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ABSTRACT

The Mauvilla local fauna, Mobile County, Alabama, contains 15 mammalian taxa, of which 12 are either new or have not previously been reported from this locality. Most abundant are three equids, *Cormohipparion emsliei*, *Neohipparion eurystyle*, and *Protohippus gidleyi*, a new species of protoceratid artiodactyl, *Synthetoceras davisorum*, and a large species of peccary, *Prosthennops* cf. *serus*. *Synthetoceras davisorum* is distinguished from *Synthetoceras tricornatus* by its distinctly smaller size and several dental characters including absence of a parastyle on the P4. Other notable members of the fauna include a large borophagine canid, the rhinoceroses *Teleoceras* and *Aphelops*, the artiodactyls *Pleiolama* and *Pediomeryx*, and the long-snouted dolphin *Pomatodelphis*. Biochronologic analysis of the mammals indicates a late early Hemphillian age (6.8 to 7.3 Ma) for the fauna, about 2 myr younger than previously reported. The mammalian component of the Mauvilla local fauna more resembles late early Hemphillian assemblages from central Florida than those from northern Texas and the Great Plains.

Key Words: Hemphillian; Alabama; biochronology; Mammalia; *Synthetoceras*; Equidae

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INTRODUCTION

During the Hemphillian Land Mammal Age (late Mi-
ocene and earliest Pliocene), increased aridity and sea-
sonality profoundly altered North America's large mam-
mal fauna. The Clarendonian Chronofauna (Webb 1969),
a very species-rich assemblage of camelids,
gomphotheres, tridactyl equids, and other ungulates domi-
nated the continent from about 16 to 6.8 Ma (Webb 1969;
Janis et al. 2000). This assemblage included many
browsers and mixed-feeders, and only a few true graz-
ers. It was replaced during the Hemphillian by a much
less diverse array of ungulates with a far greater pro-
portion of grazers, most notably antilocaprids and very
hypsodont equids (Hulbert 1993a; Webb et al. 1995).
The effective end of the Clarendonian Chronofauna
occurred about 6.8 Ma when 20 to 25 mammalian gen-
era became extinct and there was major turnover within
many ungulate lineages (Webb 1984a; Tedford et al. 1987;
Alroy 1992; Hulbert 1993a; Janis et al. 2000). This ex-
tinction event at 6.8 Ma separates the late early (Hh2)
and late (Hh3) subages of the Hemphillian (Tedford et
al. 2004). The uneven geographic distribution of verte-
brate fossil localities of this age hinders detailed investi-
gation into the causes and timing of the transition. Only
in the Great Plains, from the Texas panhandle north to
Nebraska, is there a sufficient number of well studied
sites with the needed chronologic distribution to ad-
equately document the abrupt faunal change from the
early to the late Hemphillian (Fig. 1). In other regions,
while there may be one or a few important faunas that
provide some information, the chronologic and geo-
graphic density of vertebrate-sites is much less. Such is
the case in the Gulf Coastal Plain, where Hemphillian
faunas are well known only from central peninsular
Florida. Thus the discovery of a late Miocene verte-
brate locality in coastal Alabama provided a welcome
addition towards understanding mammalian evolution and
biogeography during the Hemphillian.

In the fall of 1966, James E. Davis, Jr. found a
partial skull of a fossil mammal in a swimming hole in
Chickasaw Creek, near the town of Mauvilla, in south-
ern Alabama (Fig. 1). Mr. Davis and his father then
searched the creek banks and found several more bones
and teeth. They took the collection to G. M. Lamb at
the University of South Alabama. Lamb sent the fossils
to the National Museum of Natural History where they
were identified by F. C. Whitmore as Hemphillian mam-
mals (the first such record from Alabama). Whitmore
visited the site with J. E. Davis, Sr. and Lamb in No-
vember, 1967. More fossils were collected from the
creek bank, including a nearly complete mandible of the
extinct dolphin *Pomatodelphis*. Whitmore supervised
a large-scale excavation of the site in November and
December of 1981 that produced over 400 vertebrate
specimens (Fig. 2). Specimens collected after
Whitmore's excavations are housed in the Auburn Uni-
versity Museum of Paleontology, and some of these
formed the basis of a report on the equid *Protohippus*
by MacFadden and Dobie (1998).

Although the fauna has never been thoroughly stud-
ied until now, its existence, general age, and implications
for regional stratigraphy and geochronology were first
discussed by Isphording and Lamb (1971), and later by
Isphording and Flowers (1983) and Tedford and Hunter
(1984). The latter coined the designation "Mobile local
fauna" for this fossil assemblage, but we use Mauvilla
local fauna for its formal name. This is because "Mo-
bile" is already in use as the name of a formal
lithostratigraphic unit in southern Alabama, the Mobile
Clay (Isphording 1977; Isphording & Flowers 1983), a
middle Miocene marine unit which is unrelated to the
vertebrate fauna. Also, Mauvilla is the name of a small
town located only 1.5 km from the fossil site, and is thus
more apropos than "Mobile" which is the name of a
county, a more distant large city, a river, and a bay.

The first publication dealing with the Mauvilla lo-
cal fauna was Isphoding and Lamb (1971), in which the
site was designated the "Chickasabogue Creek local-
ity." Seven mammalian taxa were listed, based on iden-
tifications provided by Whitmore. The first direct refer-
ence in the scientific literature to a specimen from the
Mauvilla local fauna was by Patton and Taylor
(1971:194), who referred a specimen to the protoceratid
Synthetoceras. Their use of "Chickasaw Creek" to
designate the locality was followed by Savage and Russell
(1983).

The purpose of the present study is to thoroughly
document the mammals of the Mauvilla local fauna in

Figure 1. Map of the eastern and central United States showing the geographic distribution of major Hemphillian vertebrate faunas. The Mauvilla local fauna, located in southern Alabama, is the only known early Hemphillian locality between central Florida and the Texas panhandle. Circles (●), Hh1 faunas; squares (■), Hh2 faunas; up-triangle (▲), Hh3 faunas; down-triangle (▼), Hh4 faunas; diamond (◆), late Hemphillian fauna, exact age uncertain.

the USNM collection (Table 1), and to determine the age of the fauna as precisely as possible. Direct comparisons were made with similar-aged specimens, particularly those from Florida. An unexpected result was the recognition that the Mauvilla protoceratid is specifically distinct from *Synthetoceras tricornatus* Stirton 1932 (contra Patton & Taylor 1971). The preliminary identifications of most of taxa from Mauvilla listed in published accounts (e.g., Isphording & Lamb 1971; Thurmond & Jones 1981; Tedford & Hunter 1984) proved to be incorrect, or are here revised to follow current scientific nomenclature. In this study we use the geologic time scale of Berggren et al. (1995), the calibration of North American Land Mammal Ages as revised by Woodburne and Swisher (1995), and the chro-

nology of Hemphillian vertebrate sites by Webb and Hulbert (1986), Tedford et al. (1987, 2004), and Morgan (1993, 1994).

ABBREVIATIONS

Institutional.—AMNH, American Museum of Natural History, New York; AUMP, Auburn University Museum of Paleontology, Alabama; MCZ, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts; UF, Florida Museum of Natural History, Gainesville; UM, University of Michigan Museum of Paleontology, Ann Arbor; UNSM, University of Nebraska State Museum, Lincoln; and USNM, National Museum of Natural History, Smithsonian Institution, Washington, D.C.

Other Abbreviations.—Cl, Clarendonian Land Mammal Age, which is subdivided into three parts, Cl1, Cl2, and Cl3, as defined by Tedford et al. (2004:216-217); Hh, Hemphillian Land Mammal Age, which is subdivided into four parts, Hh1, Hh2, Hh3, and Hh4, as defined by Tedford et al. (2004:217-219) (early Hh = Hh1 + Hh2; late Hh = Hh3 + Hh4); LF, Local Fauna; M or m, molar, with uppercase indicating an upper tooth and lowercase a lower, and with tooth position indicated by a number (e.g., M3 is an upper third molar); Ma, Meganna, millions of years before present; myr, millions of years (duration); N, sample size; P or p, premolar, with uppercase indicating an upper tooth and lowercase a lower, and with tooth position indicated by a number (e.g., p4 is a lower fourth molar); s, sample standard deviation; x, sample mean.

GEOLOGIC SETTING

The vertebrate fossils of the Mauvilla LF (Table 1) were derived from a 60-cm-thick interval located within a series of alternating beds of clay and sand (Unit 2 in the stratigraphic section of Isphording & Lamb 1971:fig. 1).

Individually, the dark gray clay beds were about 10 cm thick, the discontinuous sand beds about 2 to 3 cm thick. Most of the bones lay on top of a clay bed within a sandy layer. Several fossil tree logs ranging from 0.3 to almost 1 m in diameter were also present through this interval, and the densest concentrations of vertebrate remains lay close against the western sides of the logs in association with many small pieces of fossil wood. All of the mammalian remains in the USNM collection are disarticulated and unassociated elements, although some complete or nearly complete turtle carapaces were found and the AUMP collection contains a partial associated skeleton of an equid (MacFadden & Dobie 1998). Many of the elements show signs of preburial weathering, but relatively little indication of water wear. The depositional setting is interpreted to be a deltaic floodplain (Isphording & Lamb 1971), with deposition occurring during flooding. Fossils of freshwater turtles, especially the trionychid *Apalone*, and fish are abundantly represented. Screen washing of sediment from the fossiliferous layers failed to recover any small terrestrial vertebrates. This is probably the result of hydrodynamic

Figure 2. Field excavations in 1981 at the Mauvilla locality, Mobile County, Alabama. Chickasaw Creek is to the right of the picture. The two persons kneeling on the left are excavating the fossiliferous horizon.

Table 1. Mammals of the Mauvilla local fauna, early Hemphillian (late Miocene) of southern Alabama, in the USNM collection. Taxa not previously reported from the fauna are indicated by asterisks (*).

CARNIVORA	PERISSODACTYLA
Canidae	Equidae
Epicyon cf. *haydeni**	*Neohipparion eurystyle**
	Nannippus aztecus*
ARTIODACTYLA	*Cormohipparion emsliei**
Tayassuidae	*Protohippus gidleyi*
Prosthennops cf. *serus**	Tapiridae
Camelidae	*Tapirus* sp.*
Pleiolama cf. *vera**	Rhinocerotidae
Protoceratidae	*Teleoceras fossiger* or *Teleoceras hicksi*
Synthetoceras davisorum sp. nov.*	*Aphelops mutilus**
Gelocidae	
cf. *Pseudoceras* sp.*	PROBOSCIDEA
Palaeomerycidae	Gomphotheriidae
Pediomeryx sp.*	gen. & sp. indet.*
CETE	
Platanistidae	
Pomatodelphis inaequalis	

sorting; the current at the time of deposition was evidently sufficient to transport smaller skeletal remains downstream from the Mauvilla locality.

The Mauvilla LF has received some attention as a means of providing a maximum age for the Citronelle Formation (Isphording & Lamb 1971; Isphording & Flowers 1983; MacFadden & Dobie 1998). The clay and sand beds producing the Mauvilla LF unconformably underlie the Citronelle Formation (Isphording & Flowers 1983). A generally coarser grained formation, the Ecor Rouge Sand, of late Miocene age more often underlies the Citronelle in Mobile, Washington, and Baldwin counties of southern Alabama (Isphording & Flowers 1983). The sediments that produced the Mauvilla LF can either be considered an unusually clay-rich facies of the Ecor Rouge Sand or a lateral equivalent of that unit.

SYSTEMATIC PALEONTOLOGY
Class MAMMALIA Linnaeus 1758
Order CARNIVORA Bowdich 1821
Family CANIDAE Fischer de Waldheim 1817
Subfamily BOROPHAGINAE Simpson 1945
Genus *EPICYON* Leidy 1858
Epicyon cf. *haydeni* Leidy 1858

Referred Specimens.—USNM 347758, radius; 347668, proximal phalanx.

Measurements.—Radius: greatest length, about 261 mm; proximal transverse width, about 31 mm; midshaft transverse width, 23.2 mm; midshaft antero-posterior breadth, 17.4 mm. The phalanx is 47.8 mm long, with a proximal width of 20.0 mm and a distal width of 16.3 mm.

Discussion.—The radius is morphologically similar to but much larger than radii of *Epicyon saevus* in the UF collection from the Cl3 Love Site of Florida. It is also significantly larger than radii of Coffee Ranch *Borophagus secundus* (= *Osteoborus cyonoides*, following Wang et al. 1999), which have lengths of 160 to 165 mm (Matthew & Stirton 1930; Dalquest 1969). USNM 347758 is very similar in morphology, proportions, and length to UF 24010, a canid radius collected at Nichols Mine, Polk County, Florida (length of UF 24010 is ca. 268 mm). UF 24010 was found along with a premolar (UF 24009) that was referred to the large borophagine *Epicyon haydeni* by Wang et al. (1999) and other elements of the Hh1 Four Corners Fauna (Hulbert et al. 2003). Munthe (1989) referred a much longer radius to *E. haydeni* (AMNH 67667), with a length of 303 mm and a proximal width of 33 mm. While this difference in length of about 15 percent would seem to preclude referral of UF 24010 and USNM 347758 to *E. haydeni*, Wang et al. (1999:278) reported intraspecific variation in limb bone length in borophagines as great as 28 percent. The phalanx USNM 347668 is of similar size and morphology to those illustrated for *E. haydeni* by Wang et al. (1999). The large Mauvilla borophagine is tentatively referred to *E. haydeni*, but a more definite referral would require a more complete sample including cheek teeth.

Order ARTIODACTYLA Owen 1848
Family TAYASSUIDAE Palmer 1897
Genus *PROSTHENNOPS* Gidley 1904
Prosthennops cf. *serus* (Cope 1878)

Referred Specimens.—USNM 340942, P4; 330996, 330979, 347773, 347672, lower canines; 341699, fragmentary dentary with dp4-m2; 341456, dp4; 330984, m3; 173631, partial lower molar; 340979, incisor; 341152, fused metatarsals 3 and 4.

Description.—USNM 34092 is heavily worn, with a nearly square, submolariform crown bearing four main cusps. It is 12.2 mm long and 12.1 mm wide. The cingulum is very weak. The lower molars consist of four low, rounded cusps plus a smaller, posterior hypoconulid. There are also small accessory cuspules emanating from the hypoconid, metaconid, and protoconid. The heel of the m3 consists of five cusps of

varying sizes. The m1 of USNM 341699 is about 16 mm long and 10.9 mm wide. USNM 330984 is 24.1 mm long and 13.2 mm wide. The fused metatarsals are long and slender. The third metatarsal has a maximum length of 119.2 mm while the fourth metatarsal is 120.1 mm long. The combined proximal articular width of USNM 341152 is 28.4 mm.

Discussion—The fragmentary Mauvilla tayassuid sample does not contain adequate specimens to make a definitive comparison, but the teeth most resemble those of *Prosthennops serus* of the early Hemphillian, especially the submolariform P4. However, the metatarsals are considerably longer and more gracile than those of UNSM 76071 (Schultz & Martin 1975:fig. 4Q), a specimen referred to *Prosthennops graffhami*. Wright (1998) apparently regarded *P. graffhami* as a junior synonym of *P. serus*.

Family CAMELIDAE Gray 1821
Tribe LAMINI Webb 1974
Genus *PLEIOLAMA* Webb and Meachen 2004
Pleiolama cf. *vera* (Matthew 1909)

Referred Specimens.—USNM 347689, caniniform tooth; 341706, 347785, radio-ulnae; 347922, metacarpal; 340966, 347747, tibiae; 173646, astragalus; 171050, 347677, proximal phalanges.

Description—The limb elements are very long and slender. The greatest lengths of the radii are about 438 mm for USNM 341706 and 452 mm for USNM 347785, while the complete tibia (USNM 347747) is 461 mm long. Other tibial measurements are shown in Table 2. The metacarpal is from a juvenile and missing the distal epiphyses; its length as preserved is 346 mm, proximal width is 42.2 mm.

Discussion—These specimens belong to a medium-sized, long-legged camelid. They are much too small to come from one of the Hemphillian giant camelids, such as *Megatylopus*, *Megacamelus*, or *Aepycamelus* (Harrison 1985). Limb elements of *Alforjas* are stouter than those of the Mauvilla camelid (Harrison 1979; Dalquest 1980). Since publication of Webb (1974), small- to medium-sized, long-legged, lamine camelids have been placed in the genus *Hemiauchenia* (e.g., Honey et al. 1998). More recently, Webb and Meachen (2004) named the genus *Pleiolama* for some Clarendonian and Hemphillian lamines formerly placed in *Hemiauchenia*, including "*Hemiauchenia*" *vera*. *Pleiolama* has long limb elements similar to those of *Hemiauchenia*; the two are distinguished by cranial and dental features (Webb & Meachen 2004).

The Mauvilla camelid specimens are larger than

Table 2. Measurements (in mm) of tibiae of the camelid *Pleiolama* cf. *vera* from the Mauvilla local fauna, Alabama compared to those of camelids from the Love Site and Palmetto Fauna of Florida. An "a" before a value indicates an approximation because of breakage or waterwear.

Specimen/Sample	Greatest Length	Max. Distal Width	Distal A-P Depth	Locality & Taxon
USNM 347747	461	54.8	38.4	Mauvilla *Pleiolama* cf. *vera*
USNM 340966	—	a61	40.2	Mauvilla *Pleiolama* cf. *vera*
UF 103708	439	59.4	40.3	Palmetto *Pleiolama vera*
UF 177204	460	61.8	41.8	Palmetto *Pleiolama vera*
UF 212548	435	56.2	36.0	Palmetto *Pleiolama vera*
Mean		62.1 (7)	41.5 (8)	Palmetto *Pleiolama vera*
Observed Range		56.2-67.9	36.0-45.1	Palmetto *Pleiolama vera*
Mean	—	48.9 (7)	33.2 (6)	Love *Hemiauchenia minima*
Observed Range	—	47.0-50.3	32.0-34.0	Love *Hemiauchenia minima*
Mean	498 (1)	73.3 (7)	49.9 (7)	Love *Procamelus grandis*
Observed Range	—	66.3-77.2	47.0-53.2	Love *Procamelus grandis*

the late Clarendonian-early Hemphillian *Hemiauchenia minima* and smaller than *Procamelus grandis* from Florida (Table 2). They fall within the range of variation observed in the *Pleiolama vera* sample from the Hh4 Palmetto Fauna (Webb et al. in press), and are therefore tentatively referred to that species. Most records of *P. vera* are Hh3 or Hh4 (Webb 1974; Dalquest 1980; Honey et al. 1998), but the species is known from some Hh2 faunas, such as the Minimum Quarry of Kansas (Thomasson et al. 1990; Honey et al. 1998). Recovery of dentitions or complete metapodials are needed to confirm the identification of the Mauvilla camelid.

Family PROTOCERATIDAE Marsh 1891
Subfamily SYNTHETOCERATINAE Frick 1937
Genus *SYNTHETOCERAS* Stirton 1932
Synthetoceras davisorum n. sp.

Synthetoceras tricornatus Stirton, Patton & Taylor 1971:194 (in part); Prothero 1998a:436 (in part).
Synthetoceras cf. *tricornatus* Stirton, Whitmore in Isphording & Lamb 1971:778; Thurmond & Jones 1981:189; Tedford & Hunter 1984:144.
Synthetoceras sp., Whitmore in Isphording & Flowers 1983:72 and fig. 11 (in part).

Holotype.—USNM 25687, a partial rostrum with left P3-M3 (Fig. 3A-B).

Type locality.—Mauvilla local fauna, west bank of Chickasaw Creek, 1.5 km NE of Mauvilla, Mobile County, Alabama. Sec. 27, T. 2 S., R. 2 W., USGS Kushla 7.5' Quadrangle.

Horizon and Age.—From interbedded clay and sand layers of the Ecor Rouge Formation or its lateral equivalent, about 2 m below the unconformity with the Citronelle Formation. Age is Hh2, about 6.8 to 7.3 Ma (late Miocene).

Distribution.—Presently known only from the type locality.

Etymology.—For James E. Davis, Sr. and James E. Davis, Jr.; in recognition of their discovery of the Mauvilla LF, their donation of specimens, and their assistance during its excavation.

Referred Specimens.—USNM 341620, distal portion of rostral horn; 347669, distal portion of frontal(?) horn; 340723, 341600, M1s; 171047, 330974, 341565, M2s; 331000, 341564, M3s; 340723, 341624, partial upper molars; 330961, 330966, dentaries; 171071, dp4; 173638, m1; 340933, distal humerus; 347679, proximal metacarpal(?); 341572, proximal femur; 341589, 341707, tibiae; 347766, astragalus; 341020, calcaneum; 341153, cuboid; 340957, 341631, 347673, 347764 metatarsal 3s; 341579, 347674, metatarsal 4s; 347693, distal phalanx.

Diagnosis.—Linear skeletal and dental dimensions 12 to 15 percent smaller than average-sized individuals of *Synthetoceras tricornatus*. Also differs from *S. tricornatus* by lack of P4 parastyle; taller lingual ac-
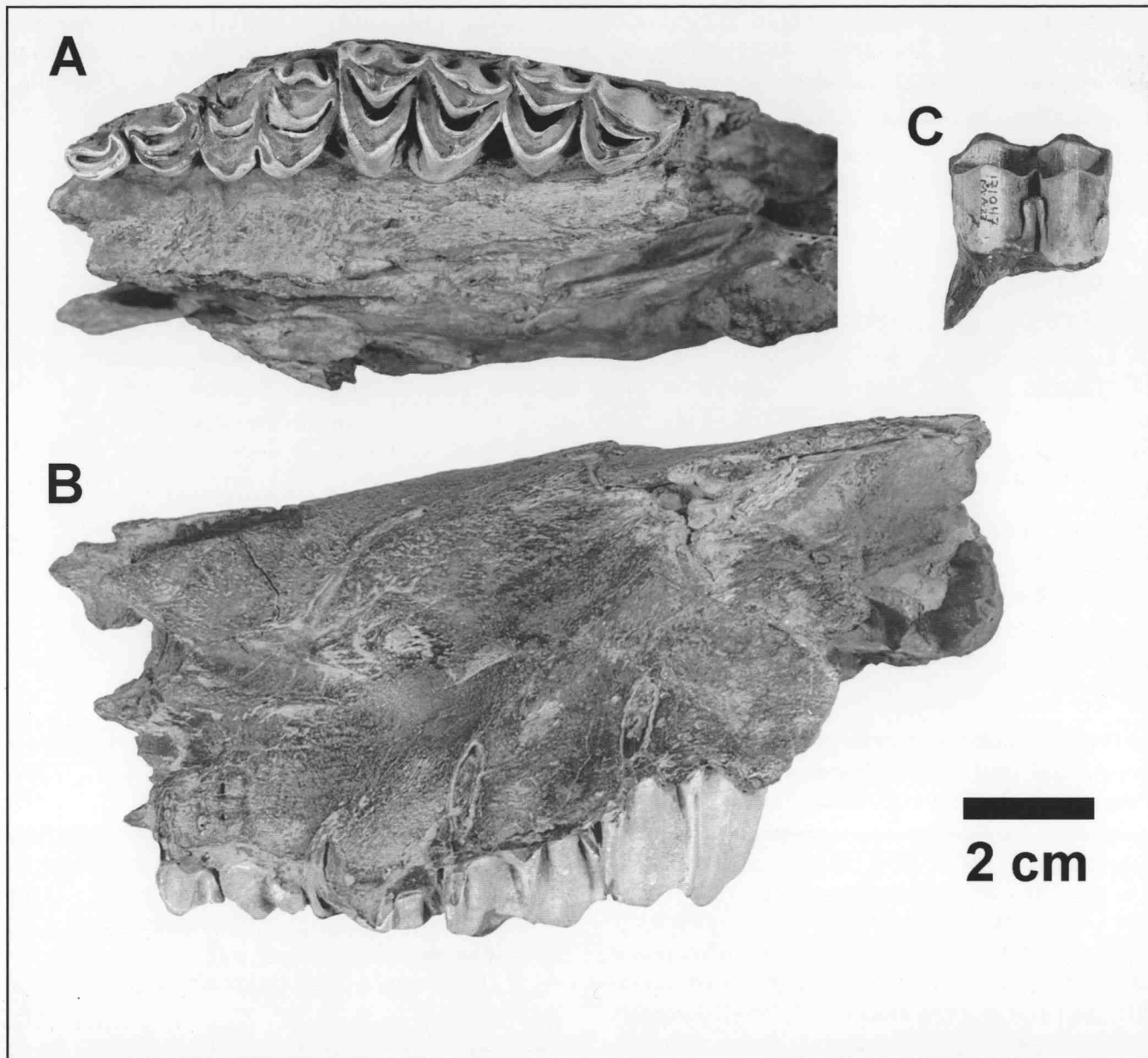
Figure 3. *Sythetoceras davisorum* sp. nov. from the late Miocene of Alabama. A-B, USNM 25687, holotype rostrum with left P3-M3 in A, occlusal view; and B, left lateral view. C, USNM 171047, M2, lingual view. Scale bar = 20 mm.

cessory cuspule on upper molars; and absence of rostral tubercle dorsal to infraorbital foramen. Differs from *Kyptoceras amatorum* in smaller size, lower crowned teeth, and more gracile limb elements.

Description.—The holotype, USNM 25687, includes most of the left maxilla as well as portions of the left palatine, right maxilla, right and left nasals, and right and left frontals (Fig. 3A-B). The right side has been deformed by compaction. The nasal and frontal sinuses are filled with dense ironstone. The crowns of the cheek teeth are rounded and the paracones on the M1 and M2

are broken suggesting the specimen experienced fluvial transport prior to burial. The holotype represents a mature adult, with a fully erupted and moderately worn M3 and a heavily worn M1. Although the maxilla is broken just anterior to the P3, there is no trace of alveoli for a P2 and that tooth was probably absent. In ventral view, the palatine ends anteriorly at a point level with the M3 protocone.

On the lateral side of the rostrum, the infraorbital foramen is located dorsal to the anterior edge of the P4, about 14 mm above the alveolar border of the maxilla

(Fig. 3B). It is oval, 7.1 mm tall and 6.3 mm deep. Dorsal to the infraorbital foramen is a thickened, rugose ridge about 5.5 mm wide dorsoventrally. There is a prominent tubercle or knob in this region in other synthetoceratines, but it was either located more anteriorly in *Synthetoceras davisorum* (and not preserved on USNM 25687), or was absent altogether and represented by the just described ridge. Dorsal to the ridge is a deep sulcus or groove about 5 mm wide. A narrower (ca. 2 mm), more shallow groove runs posterodorsally from the deeper sulcus back onto the dorsal surface of the cranium, terminating at the supraorbital foramen on the frontal.

The largest preserved portion of the horn (USNM 341620) is about 161 mm long and only slightly curved in lateral view. It is too straight to be an orbital horn, and it also lacks the knobs or prominences found on the anterolateral edge of protoceratid orbital horns. Its slenderness means that it is from the 'prong' or distal fork of the rostral horn. It is oval in cross-section and tapers gradually from a maximum area of 18.9 by 22.8 mm to about 14 by 16 mm. The surface of USNM 341620 is covered by deep grooves for carrying blood vessels and nerves.

The two dentaries are slender and shallow; their depth taken on the labial side between m1 and m2 is 40.9 and 42.1 mm for USNM 330966 and 330961, respectively. Although the symphysis of USNM 330966 is not well preserved, only four relatively small alveoli for anterior teeth are present for the three incisors and the canine (implying that an anteriorly located, caniniform p1 was not present). A p2 is absent on both specimens. The diastema is long, about as long as the cheektooth row, although breakage prevents precise measurement. The preserved portion of the ascending ramus bears only a very shallow masseteric fossa.

Upper cheek teeth of *Synthetoceras davisorum* are generally similar to those of *Synthetoceras tricornatus* (Fig. 3A; Table 3). P3 consists of a single main labial cusp with a strong lingual cingulum, a large, anteriorly projecting posterolabial style (a "metastyle"), and a slightly developed anterolabial style. P4 is wider than P3, with two well formed selenes surrounding a fossette. There is a prominent posterolabial metastyle that curves to project anteriorly, but no trace of an anterolabial parastyle. The molars are mesodont, with unworn crown height slightly exceeding that of the roots. A slightly worn M2, USNM 341565, has a crown height of about 27 mm measured at the metacone, while an unworn M1, USNM 341600, is 25.5 mm tall. Upper molars have strong labial styles and ribs and a tall lingual accessory cusp between the protocone and hypocone

(Fig. 3C). The unworn height of this accessory cusp varies between 9 and 12.5 mm. A cingulum is variably developed on the lingual half of the anterior side of the crown. It is well developed on USNM 171047, 330974, 341600 and the M2 of 25687, but is very weak to absent on USNM 331000, 340723, 341564, and 341565.

The p4 of USNM 330961 has strong posterolabial and anterolingual flexids, a pronounced labial stylid, and two enclosed posterior fossettids. The metaconid lacks any trace of an anterior extension. The m1 of USNM 330961 has almost been obliterated by wear, which has removed all significant morphologic features. Lingual stylids are present on the m2 and m3, but are generally weak; of these the parastylid is strongest. The molars of USNM 330966 lack accessory labial tubercles between the protoconids and hypoconids, but a small tubercle is present on the m2 of USNM 330961.

Postcranial elements of *Synthetoceras davisorum* are generally very similar to those of *Synthetoceras tricornatus* except for their smaller size (Table 4). The third and fourth metatarsals are unfused, relatively short, and have complete distal keels (Fig. 4A).

Discussion.—There are only three occurrences of Hemphillian protoceratids other than the Mauvilla sample. Two are from Florida: *Synthetoceras tricornatus* from the Hh1 McGehee Farm Site (Patton & Taylor 1971) and *Kyptoceras amatorum* from the Hh4 Palmetto Fauna (Webb 1981; Webb et al. in press). *K. amatorum* is also present in the Hh4 Yorktown Formation of eastern North Carolina (Eshelman & Whitmore in press). *S. tricornatus* is best known from the Clarendonian of Texas, with the largest sample originating from MacAdams Quarry, and it was formerly the only recognized species in the genus *Synthetoceras* (Stirton 1932; Patton & Taylor 1971; Prothero 1998a). No protoceratids are known from the numerous early Hemphillian sites of the Great Plains, and the family apparently became locally extinct in that region during the Clarendonian (Webb 1981; Webb et al. 1995, 2003; Prothero 1998a). The family is also not recorded at any of the Hh2 sites from Florida (Moss Acres, Withlacoochee River Sites 4A, 4X, and 5E, Manatee Fauna). Mauvilla is thus the lone Hh2 record of a protoceratid and the youngest record of the genus.

USNM 25687 was originally identified by Whitmore as *Synthetoceras* cf. *tricornatus* in a faunal list sent to G. M. Lamb (letter from FCW, 6 September 1970). This list was published by Isphording and Lamb (1971). The presence of a synthetoceratine protoceratid in the Mauvilla LF was also noted by Patton and Taylor (1971), but without detailed description or discussion. They merely stated that there was "close similarity between

Table 3. Measurements (in mm) of the teeth of *Synthetoceras davisorum* sp. nov. from the Mauvilla local fauna, Mobile County, Alabama. Tooth length was taken at the base of the crown in the middle of the tooth, excluding the styles; anterior width on upper teeth was taken at the base of the crown from the protocone to the rib of the paracone; posterior width on upper teeth was similarly taken from the hypocone to the rib of the metacone. Widths on P3 and P4 exclude the metastyle. An "a" before a value indicates an approximation because of breakage or waterwear.

	Tooth	Length	Anterior Width	Posterior Width
Upper Teeth				
USNM 25687	P3	11.6	6.5	—
USNM 25687	P4	13.5	11.4	—
USNM 25687	M1	a20	—	19.9
USNM 25687	M2	a24	21.7	20.9
USNM 340723	M1	21.8	19.9	20.5
USNM 341600	M1	19.5	18.5	19.2
USNM 171047	M2	24.0	22.0	21.1
USNM 330974	M2	24.6	22.9	22.6
USNM 341565	M2	22.9	20.6	21.3
USNM 331000	M3	24.4	a21	a19
USNM 341564	M3	22.1	19.3	17.0
USNM 25687 M1-M3 Length		a76		
USNM 25687 P3-M3 Length		95.9		
Lower Teeth				
USNM 330961	p4	13.4	—	7.4
USNM 330961	m1	17.8	—	—
USNM 330961	m2	21.8	14.5	15.1
USNM 330961	m3	—	14.7	15.0
USNM 330966	m2	23.0	13.6	15.0

the Mobile specimen referred to *S. tricornatus* [i.e., USNM 25687] and those from the McGehee fauna of Florida" (Patton & Taylor 1971:208). Webb (1981) confirmed that the McGehee protoceratid was conspecific with *S. tricornatus* from Texas, but only mentioned the Mauvilla sample indirectly when he stated that the geographic range of the Synthetoceratini included Alabama. The presence of a species of *Synthetoceras* near *S. tricornatus* in the Mauvilla LF was later noted in a number of studies (e.g., Thurmond & Jones 1981; Tedford & Hunter 1984).

The Mauvilla protoceratid sample now includes many more specimens than were available to Whitmore when he made the original determination or to Patton and Taylor (1971), and at that time *Kyptoceras amatorum* had not been described. Our new comparisons reveal greater similarity of the Mauvilla protoceratid

with *Synthetoceras tricornatus* than with *K. amatorum*, although some differences were found. The primary differences between *Synthetoceras* and *Kyptoceras* are in the size, shape, and orientation of the rostral and frontal horns (Webb 1981), character states that can not be observed in the Mauvilla sample. *Synthetoceras davisorum* differs from *K. amatorum* (and resembles *S. tricornatus*) in having more slender metapodials and much less hypsodont cheek teeth. The shape and greater depth of the cuboid facet on the fourth metatarsal of *K. amatorum* also distinguishes it from *S. tricornatus* and *S. davisorum*. The only feature in which *S. davisorum* resembles *K. amatorum* more than it does *S. tricornatus* is the reduced anterolingual cingulum on the upper molars. However, while they are completely absent in *K. amatorum* (Webb 1981), their development is variable in *S. davisorum*.

The dentitions of *Synthetoceras davisorum* and *Synthetoceras tricornatus* are morphologically similar, including loss of the P2 and p1-p2. The absence of the parastyle on the P4 in the former is the most notable difference (Fig. 3A). This structure is consistently present in *S. tricornatus*. The apparent lack of a lateral rostral tubercle dorsal to the infraorbital foramen in *S. davisorum* is significant, as this peculiar structure is found in that location in all other synthetoceratines (Patton & Taylor 1971). The lower diastema length is greater than the cheek tooth length in *S. tricornatus* while the two are about equal in *S. davisorum*. The size of *S. tricornatus* specimens from the McGehee Farm Site are well within the observed range of the Clarendon Fauna sample, and larger than corresponding elements of *S. davisorum* (Table 4). Therefore, the small size of the Mauvilla protoceratid can not simply be explained by clinal geographic variation, as was apparently the case in several Miocene equid lineages in which Gulf Coastal Plain specimens were significantly smaller than conspecific populations from the Great Plains (Webb & Hulbert 1986; Hulbert 1988c). Instead the decrease apparently marks a reversal of a long term trend within the Synthetoceratinae for increasing size (Patton & Taylor 1971:fig. 7). It is interesting that a mid-Hemphillian size decrease is also observed in the other North American lineage of multi-horned artiodactyls, the Dromomerycinae (Webb 1983).

Family GELOCIDAE Schlosser 1886
Genus *PSEUDOCERAS* Frick 1937
cf. *Pseudoceras* sp.

Referred Specimen.—USNM 341582, astragalus.
Description.—An astragalus from a very small ruminant artiodactyl: distal articular width, 10.3 mm; length from medial condyle to navicular facet, 17.0 mm.
Discussion.—USNM 341582 is smaller than average-sized astragali from a large sample of an undescribed gelocid from the Hh2 Withlacoochee River 4A Site of Florida (Webb 1984b; Becker 1985), but falls within the observed size range of this population. Other early Hemphillian records of gelocids, usually referred to the genus *Pseudoceras*, include specimens from the Cambridge Fauna, Potter Quarry, and Feltz Ranch of Nebraska, the Box T LF of Texas, and the Gracias Fauna of Honduras (Breyer 1981; Webb and Perrigo 1984; Tedford et al. 1987).

Table 4. Comparison of metatarsal dimensions between *Synthetoceras davisorum* sp. nov. from the Mauvilla local fauna, Mobile County, Alabama, and *Synthetoceras tricornatus* from McGehee Farm, Alachua County, Florida, and the Clarendon Fauna, Donley County, Texas. All measurements in mm. Abbreviations for measurements: PAW, proximal articular width; DAW, distal articular width; DIAK, diameter of distal keel. An "a" before a value indicates an approximation because of breakage or waterwear.

		Length	PAW	DAW	DIAK
Synthetoceras davisorum					
USNM 340957	MT 3	—	16.4	—	—
USNM 341631	MT 3	138	15.5	20.8	21.6
USNM 347764	MT 3	151	18.0	21.5	a22
USNM 347673	MT 3	137	15.9	20.4	22.1
USNM 341579	MT 4	140	16.1	20.3	20.4
USNM 347674	MT 4	144	15.8	21.5	20.3
Synthetoceras tricornatus					
UF 9512	MT 3	162	18.6	26.6	25.8
UF 9532	MT 3	157	18.4	23.8	23.8
UF 172209	MT 3	162	19.8	24.8	a24
UF 172211	MT 3	a158	—	—	—
CLARENDON[a]	MT 3	157.6			
UF 172210	MT 4	—	19.9	—	—

[a]Mean value of three specimens reported by Patton and Taylor (1971:table 1).
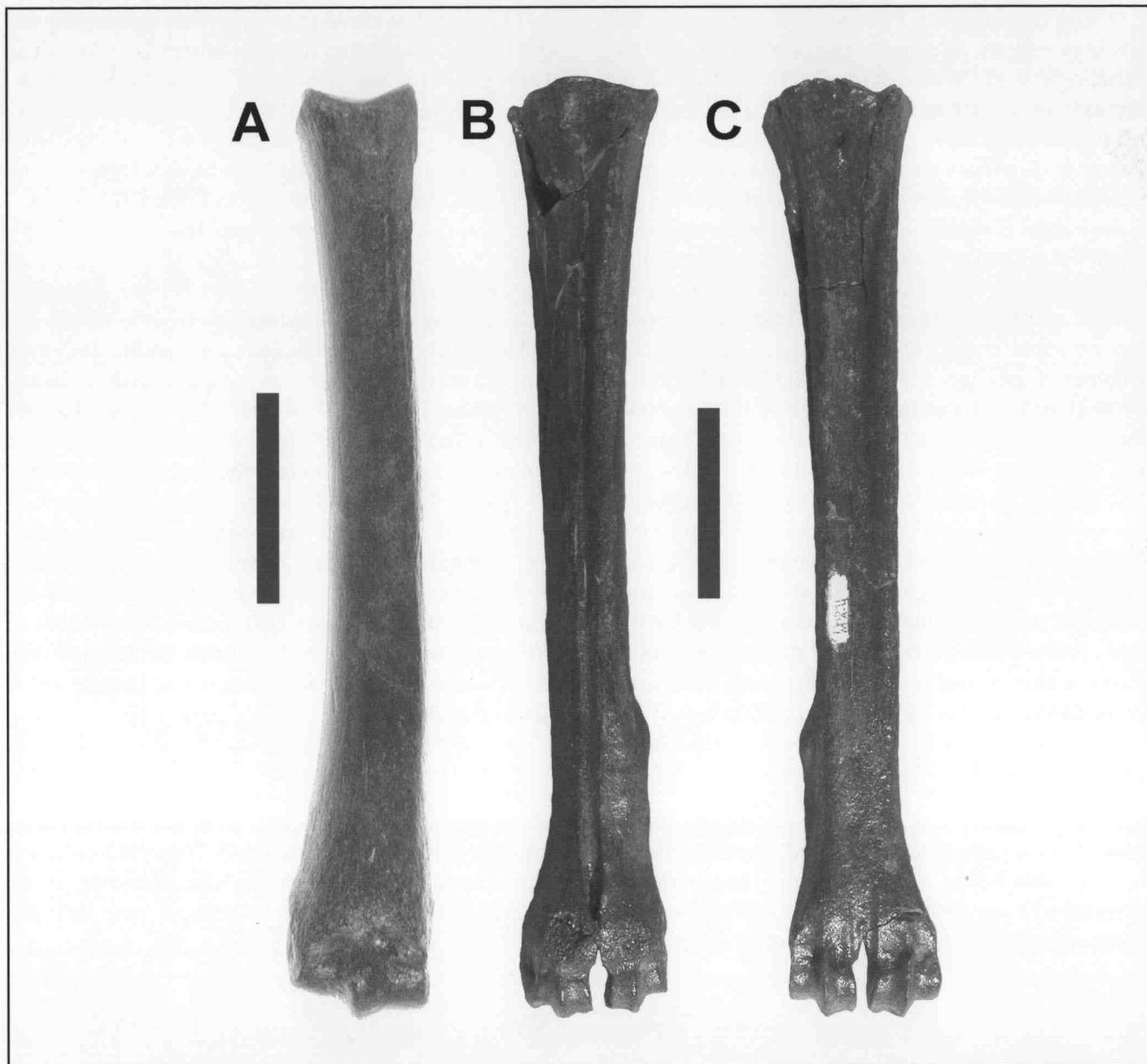
Figure 4. Artiodactyl metatarsals from the Mauvilla local fauna, late Miocene of Alabama. A. *Sythetoceras davisorum* sp. nov., USNM 347674, metatarsal 4 in anterior view. B, anterior, and C, posterior views of *Pediomeryx* sp., USNM 171041, metatarsal 3-4. Scale bars = 30 mm.

Family PALAEOMERYCIDAE Lydekker 1883
Subfamily DROMOMERYCINAE Frick 1937
Genus *PEDIOMERYX* Stirton 1936
Pediomeryx sp.

Referred Specimen.—USNM 171041, metatarsal (Fig. 4B-C).

Description.—The metatarsal gully of USNM 171041 has a bridged distal end, and the keels on the distal condyles are sharp and complete. The medial wall of the metatarsal gully is much more robust and projects anteriorly more than the lateral side. There is a small pathologic growth on the medial side of the shaft near the distal end (Fig. 4B-C). Greatest length of USNM 171041, 257.6 mm; proximal width (as preserved, breakage has lessened this dimension slightly), 41.3 mm; midshaft width, 21.4 mm; distal articular width across the condyles, 42.6 mm.

Discussion.—The morphology of the proximal articular facets, the asymmetrical, distally bridged metatarsal gully, and general dimensions of USNM 171041 match those of the dromomerycine *Pediomeryx* (including *Yumaceras*, following Webb 1983). Janis and Manning (1998) recognized four species of *Pediomeryx*, *P. hamiltoni*, *P. ruminalis*, *P. figginsi*, and *P. hemphillensis*, with a combined chronologic range of Cl3 to Hh4. The sample of metatarsals for *P. figginsi* is very limited, with only one known specimen, which has a length of 232 mm and proximal width of 47.7 (Webb 1983:table 5). These suggest a taxon with shorter but more robust limb elements than the Mauvilla *Pediomeryx*. Measurements taken on USNM 171041 fall within one standard deviation of the mean for the Love Site sample of *P. hamiltoni* for mid-shaft ($x = 20.9$, $s = 0.75$, $N = 8$) and distal width ($x = 44.3$, $s = 2.95$, $N = 3$), and within two standard deviations for proximal width ($x = 37.3$, $s = 1.97$, $N = 10$). USNM 171041 is much longer than either of the two complete Love Site *Pediomeryx* metatarsals ($x = 236.9$ mm), but both of these appear to be from relatively small individuals.

A partial skeleton (UF 97266) referred to *Pediomeryx hemphillensis* is known from the Hh2 Moss Acres Racetrack Site of Florida (Hulbert 1988a). Its metatarsals are much smaller than those of either *Pediomeryx hamiltoni* or the Mauvilla *Pediomeryx* (their greatest length is 215.5 mm; proximal width, about 33.5 mm; distal articular width, 34.7 mm). Due to the limited nature of the Mauvilla sample, the paucity of metatarsals of *Pediomeryx figginsi*, and the differences in length between the Love Site and Mauvilla metatarsals, USNM 171041 is only identified to the generic level. It is clearly distinct from *P. hemphillensis* from Moss Acres, and most similar to *P. hamiltoni*.

The metatarsal USNM 171041 was the source for the listed presence of a "cervid" in the Mauvilla LF (Whitmore in Isphording & Lamb 1971; Thurmond & Jones 1981). No fossils identifiable to the Cervidae sensu stricto are present in the USNM collection from the Mauvilla LF. The oldest North American record of a true cervid is in the Hh4 Palmetto Fauna of Florida (Tedford et al. 1987, 2004; Webb et al. in press).

Order PERISSODACTYLA Owen 1848
Family EQUIDAE Gray 1821

Discussion.—As is typical for late Miocene North American faunas, equids are represented by more specimens in the Mauvilla LF than any other ungulate family. Although their postcranial elements are common, the only equid fossils in the USNM Mauvilla collection iden-tifiable to genus and species are tooth-bearing cranial elements or isolated teeth. Four equids are recognized in the Mauvilla LF using a combination of enamel morphology, size, and degree of hypsodonty (Tables 5-6). This is actually a low number of taxa compared to Hh2 faunas from central Florida, which typically have about twice the equid species richness of Mauvilla (Hulbert 1988c). The Mauvilla LF differs from those in Florida by completely lacking very small equids, those with cheektooth row lengths less than 90 mm, such as *Nannippus morgani*, *Calippus elachistus*, or *Pseudhipparion skinneri*. Florida Hh2 faunas often have at least one, and sometimes two, of these dwarf equids (Hulbert 1988a, 1993b). Also absent at Mauvilla are large equids, those with tooth row lengths greater than 135 mm, such as *Dinohippus spectans*, *Pliohippus nobilus*, *Cormohipparion occidentale*, or *Cormohipparion plicatile*. Instead the three most common Mauvilla equid species all fall within the same general size class, each with cheektooth row lengths that range between 115 and 135 mm. That a species of *Cormohipparion* should be the most common equid in the Mauvilla LF is not particularly surprising, as this genus is abundant in almost all middle and late Miocene Gulf Coastal Plain faunas (Hulbert 1988c). On the other hand, the relatively great abundance of *Protohippus* and *Neohipparion* and the rarity of *Nannippus* are unusual for a Gulf Coastal Plain Hh site. The former two are typically rare or at least uncommon, while the latter is almost always extremely abundant. In the relative proportions of these four equid genera, Mauvilla is instead more like the Cl3 Love Site of Florida (MacFadden & Hulbert 1990).

Tribe HIPPARIONINI Quinn 1955
Genus *NEOHIPPARION* Gidley 1903
Neohipparion eurystyle (Cope 1893)

Referred Specimens.—USNM 173623, partial maxilla with P3-M2; 171046, DP3 or DP4; 330972, P3 or P4; 173640, M1; 341567, M2; 347765, M1 or M2; 340750, partial mandible with right and left dp2-m1; 340720, p3 or p4; 330978, dp3.

Description.—Upper cheek teeth (Fig. 5A; Table 5) with: elongate, isolated protocone with concave lingual margin; complex fossette plications; multiple pli caballin on premolars; and strong anteriorly hooked metastyle and posteriorly curved parastyle. Lower cheek teeth (Fig. 5B; Table 6) with: strong, persistent pli caballinid on all cheek teeth; greatly elongated metaconid-metastylid complex; broad, shallow, 'U'-shaped linguaflexid; flat labial margins of protoconid and hypo-

Table 5. Measurements of individual upper cheek teeth of equids from the Mauvilla local fauna, Mobile County, Alabama. Measurements reported in mm and taken using methods described in Hulbert (1987, 1988a). Abbreviations for measurements: APL, anteroposterior length; BAPL, anteroposterior length at base of crown; TRW, transverse width; PRL, protocone length; PRW, protocone width; MSCH, crown height measured at mesostyle. An "a" before a value indicates an approximation because of breakage or waterwear.

	Tooth	APL	BAPL	TRW	PRL	PRW	MSCH
Neohipparion eurystyle							
USNM 171046	DP3 or DP4	26.4	22.4	—	—	—	a22.5
USNM 330972	P3 or P4	24.5	17.6	23.2	10.2	4.1	a46
USNM 173623	P3	22.9	—	21.0	8.7	4.4	a41
USNM 173623	P4	23.0	—	20.9	9.4	4.3	—
USNM 173623	M1	21.5	—	19.9	8.3	3.9	—
USNM 173623	M2	a21	—	19.0	8.9	3.8	—
USNM 341567	M2	a21.5	15.9	18.9	9.1	3.7	50.1
USNM 347765	M1 or M2	20.1	16.5	19.0	9.0	3.2	32.8
Cormohipparion emsliei							
USNM 340701	DP3 or DP4	25.2	20.8	16.0	6.1	3.4	a14
USNM 171045	P3 or P4	21.9	16.9	20.1	7.3	3.9	45.8
USNM 341566	P3 or P4	18.1	15.4	17.9	6.1	3.0	26.3
USNM 330980	M1	20.5	14.7	a18	7.1	3.9	56.4
USNM 341635	M1	17.7	—	16.5	7.1	3.4	36.1
USNM 340700	M2	22.4	a15	—	—	—	a59
Protohippus gidleyi							
USNM 340963	DP3 or DP4	27.1	22.3	20.4	7.6	4.4	17.9
USNM 330994	P2	26.6	20.7	18.8	6.2	4.3	20.2
AUMP 3454	P3	22.6	17.6	22.8	8.4	4.9	29.3
AUMP 3455	P4	22.0	17.2	23.0	9.5	4.9	33.5
USNM 347739	P3 or P4	21.1	16.3	21.1	6.7	4.5	26.3
USNM 330986	M1	21.4	16.2	22.1	9.9	4.7	52.7
USNM 341594	M1 or M2	21.1	15.6	21.2	7.2	4.3	34.9
USNM 341018	M3	20.0	—	16.8	10.4	—	50.6

conid; persistently shallow ectoflexids; and frequent isthmus plications on premolars. Deciduous lower premolars lack ectostylids (Fig. 5B).

Discussion.—Although *Neohipparion eurystyle* had a broad range in North America during the Hh3 and Hh4, it was limited to the Gulf Coastal Plain in the Hh2 (Hulbert 1987). These Hh2 specimens are morphologically intermediate in certain features between those typical of late Hh populations of *N. eurystyle* and those found in its presumed ancestor, the Cl2 to Hh1

Neohipparion trampasense (Hulbert 1987). The major differences between *N. trampasense* and *N. eurystyle* relate to heterochrony. Cheektooth enamel patterns in the two are similar in early wear-stages, but in *N. trampasense* they take on a more plesiomorphic appearance in the middle and basal portions of the crown. In *N. eurystyle*, the derived pattern is retained for nearly the entire height of the crown. The Mauvilla sample of *Neohipparion* is like those of Moss Acres and Withlacoochee River 4A (Hulbert 1987) in having enough

Table 6. Measurements of individual lower cheek teeth of equids from the Mauvilla local fauna, Mobile County, Alabama. Measurements reported in mm and taken using methods described in Hulbert (1987, 1988a). Abbreviations for measurements: apl, anteroposterior length; bapl, anteroposterior length at base of crown; atw, anterior transverse width; ptw, posterior transverse width; mml, metaconid-metastylid length; msch, crown height measured at metaconid. An "a" before a value indicates an approximation because of breakage or waterwear.

	Tooth	APL	BAPL	ATW	PTW	MML	MSCH
Neohipparion eurystyle							
USNM 340750	dp2	27.6	—	11.1	12.4	14.9	—
USNM 340750	dp3	26.2	—	12.8	12.5	17.5	—
USNM 340750	dp4	28.4	—	11.9	11.0	17.3	—
USNM 340750	m1	26.5	—	9.3	9.0	13.4	—
USNM 340750	m1	22.7	—	10.7	10.6	13.6	—[a]
USNM 330978	dp3 or dp4	a27.5	24.5	10.8	10.8	16.7	17.1
USNM 340720	p3 or p4	23.7	17.6	11.5	12.1	14.4	40.3
Nannippus aztecus							
USNM 347923	m1	16.4	—	9.1	8.9	10.0	—[b]
USNM 347923	m2	16.9	—	9.1	8.6	9.8	—[b]
USNM 347923	m3	20.3	—	8.3	7.4	9.1	—[b]
USNM 331041	m1 or m2	15.5	12.8	8.7	8.5	10.5	21.7
USNM 347774	m1 or m2	15.6	13.4	8.6	7.7	9.4	16.5
USNM 347772	m1 or m2	13.3	—	9.0	7.1	—	a6
Cormohipparion emsliei							
USNM 330986	p2	22.4	16.7	8.6	11.2	9.7	25.1
USNM 340711	m1 or m2	19.2	14.9	10.1	9.6	12.1	a36

[a]Measured 38 mm below occlusal surface at what would have been the moderate wear stage.
[b]Crown height not measurable, but tooth heavily worn.

derived features to be regarded as conspecific with *N. eurystyle*, but retaining some primitive features of *N. trampasense*. For example, the mesostyle is not strongly constricted in all of the upper cheek teeth in the Mauvilla *Neohipparion*, the protocone is relatively short in some specimens, and the ectoflexid in the lower molars is deeper in moderate to late wear-stages than in Hh3-Hh4 *N. eurystyle*.

The Mauvilla *Neohipparion* was originally assigned to the species *N. phosphorum* (Whitmore in Isphording & Lamb 1971; Thurmond & Jones 1981), which was described from the late Hemphillian of Florida. This species is now regarded as a junior synonym of *N. eurystyle* (Hulbert 1987).

Genus *NANNIPPUS* Matthew 1926
Nannippus aztecus Mooser 1968

Referred Specimens.—USNM 347923, dentary with m1-m3; 331041, 347772, 347774, m1s or m2s.

Description.—Lower molars of small size and hipparionid enamel pattern (Fig. 5C; Table 6), with rounded labial margins of the protoconids and hypoconids, deep ectoflexids that completely penetrate the isthmus (except the m3 of USNM 347923 which has a shallow ectoflexid), and large, round to oval, well separated metaconids and metastylids. All have weak to moderate protostylids, and a rudimentary or small pli caballinid is present except in heavily worn specimens.

Discussion.—These specimens are too small to represent any of the Hemphillian species of *Cormohipparion* or *Hipparion*, and too large for *Pseudhipparion skinneri* or *Nannippus morgani* (Webb & Hulbert 1986; Hulbert 1988b, 1988c, 1993b). Also the protostylids are weaker than would normally be found on molars of *Cormohipparion*. The morphology of lower molars of *Nannippus westoni* (Simpson) is similar, but they too have stronger

protostylids and are generally smaller (Hulbert 1993b). *Nannippus lenticularis* was tentatively identified from the Mauvilla LF (Whitmore in Isphording & Lamb 1971; Tedford & Hunter 1984), but primarily on the basis of the upper teeth here referred to *Cormohipparion emsliei*. The morphology of the protostylids differs from those of *N. lenticularis* in which the protostylid is most often an isolated pillar, not attached to the protoconid (Dalquest & Donovan 1973).

The size and morphology of these lower molars are most similar to those of early Hh individuals of *Nannippus* from Florida. Hulbert (1993b) referred specimens from the Moss Acres, Withlacoochee River 4A, and other Hh2 faunas to *Nannippus aztecus*. But he recognized significant differences in size, crown height, and morphology between these populations and those of *N. aztecus* found in late Hh faunas, such as the Palmetto Fauna of Florida and the Yepomera and El
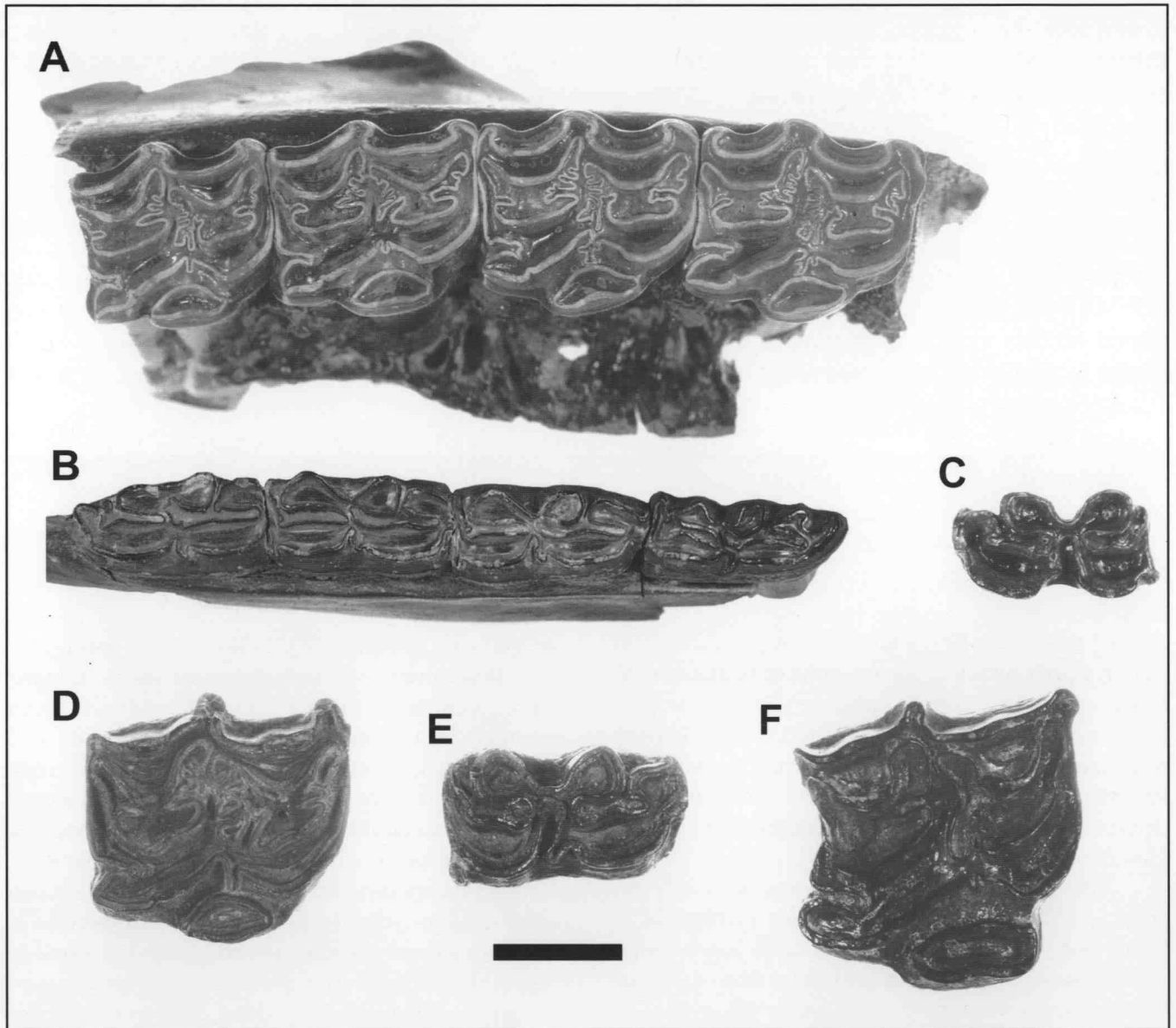

Figure 5. Cheek teeth of Equidae from the Mauvilla local fauna, late Miocene of Alabama. All in occlusal view. A-B, *Neohipparion eurystyle*; A, USNM 173623, right maxilla with P3-M2; B, USNM 340750, partial mandible with left dp2-m1. C, *Nannippus aztecus*, USNM 331041, right m1 or m2. D-E, *Cormohipparion emsliei*; D, USNM 330980, right M1; E, USNM 340711, left m1 or m2. F, *Protohippus gidleyi*, USNM 330986, right M1. Scale bar = 13.3 mm for A, 20 mm for B, and 10 mm for C-F.

Ocote faunas of Mexico. For example, a weak protostylid is frequently observed on Hh2 individuals, but is generally absent or limited to the base of the crown in Hh4 specimens. More recently, an important sample of late Hh1 or early Hh2 *Nannippus* was recovered at the Tyner Farm site in Florida, including a partial skull preserving much of the preorbital region, several maxillae and mandibles, and a number of complete metapodials (Hulbert et al. 2002). On-going study of this sample will test whether early Hh populations of *Nannippus* are properly referred to *N. aztecus*, or represent a distinct species or subspecies. Until then, the Mauvilla *Nannippus* (and those from the Florida Hh2 faunas) are provisionally retained in *N. aztecus*.

Genus *CORMOHIPPARION* Skinner and MacFadden 1977
Cormohipparion emsliei Hulbert 1988

Referred Specimens.—USNM 340701, DP3 or DP4; 171045, 340721, 341566, P3s or P4s; 330980, 340700, 340722, 341635, M1s or M2s; 347685, 347686 M3s; 330981, p2; and 340711, m1 or m2.
Description.—Upper cheek teeth (Fig. 5D; Table 5) with: oval, isolated protocone usually with straight or convex lingual margin; very complex fossette plications including persistent and frequently multiple pli protoloph and pli hypostyle; multiple pli caballin common on both premolars and molars; and strong styles including a grooved parastyle in early wear-stages. Lower cheek teeth (Fig. 5E; Table 6) with: strong pli caballinid; ectoflexid shallow in premolars, deep in molars; rounded labial borders of protoconid and hypoconid; and very strong protostylid on p3-m3.
Discussion.—The combination of moderate size (Tables 5-6) and enamel pattern (Fig. 5D-E) of these specimens eliminates all equids but *Cormohipparion ingenuum* and *Cormohipparion emsliei*. The Mauvilla sample is referred to the latter because of its greater unworn molar crown height (ca. 57 to 60 mm), grooved parastyles, strong metastyles, and well developed molar pli caballinid. *C. emsliei* was originally described from Pliocene specimens (both Hh4 and Blancan) from Florida (Hulbert 1988b). Hulbert (1988c) later extended its chronologic range to the Hh2, and Manning and MacFadden (1989) reported it from Louisiana, increasing its geographic range through the central Gulf Coastal Plain. In most respects the Mauvilla specimens are identical to those from Florida and Louisiana and are confidently referred to *C. emsliei*. Two slight differences are: 1) the greater frequency of convex lingual margins on the protocone (they are straight or concave in most

Florida specimens); and 2) in the p2 (USNM 330986), the metaconid and paraconid are not connected. These two cusps are connected after a moderate amount of wear in most p2s of *C. emsliei* (and *C. ingenuum*), surrounding the metaflexid. These two differences are regarded as trivial individual variation.

Tribe PROTOHIPPINI Gidley 1907
Genus *PROTOHIPPUS* Leidy 1858
Protohippus gidleyi Hulbert 1988

Referred Specimens.—USNM 340963, DP3 or DP4; 330994, P2; 347739, P3 or P4; 330986, 341594, 347692, M1s or M2s; 341018, M3. AUMP 3464, associated dentary with p2-m3 (MacFadden & Dobie 1998:fig. 1) and thoracic vertebrae. The following specimens are probably from the same individual as AUMP3464: AUMP 3454, P3; 3455, P4; 3452, incisors, fibula, and tibia.
Description.—Upper cheek teeth (Fig. 5F; Table 5) with: elongate-oval or oval protocone which is isolated in early wear-stages and connected during middle to late wear-stages; pli caballin single, much weaker on molars than premolars and lost with heavy wear; fossettes simple with few plications, pli hypostyle absent, pli protoloph either absent or limited to very early wear-stages, in middle and late wear-stages plications usually limited to a single pli prefossette and pli postfossette; metastyle not prominent; and hypoconal groove remains open on P3-M3 until crown height is less than about 20 mm. Lower cheek teeth with: shallow ectoflexids on premolars, deep on molars; protostylids present but not prominent; molar metastylid angular, subequal to metaconid in size and the two are well separated during early wear-stages but by moderate wear-stage metastylid notably smaller than metaconid and not located as far lingually on the tooth.
Discussion.—A partial associated skeleton from the Mauvilla LF of *Protohippus gidleyi* including a nearly complete dentary and two upper premolars, was described and figured by MacFadden and Dobie (1998). The lower dentition of AUMP 3464 is a very close match for the paratype of *P. gidleyi*, UF 32173, from the Love Site, Florida (Hulbert 1988a). The USNM sample of isolated upper cheek teeth of *P. gidleyi* also closely corresponds to the topotypic Love Site population in terms of size, curvature, unworn crown height, and enamel pattern. USNM 330986, a slightly worn M1, has an isolated protocone (Fig. 5F), a feature not observed on similarly worn Cl3 or Hh1 M1s or M2s of *P. gidleyi*. However, isolated protocones in early wear-stages of upper molars are present in the Hh2 sample of *P. gidleyi*

from the Cambridge LF (Ft-40 Site) of Nebraska (Hulbert 1988a). USNM 330994 and 347739 are relatively small individuals for *P. gidleyi* (Table 5), but they are too large for members of *Calippus* (*Grammohippus*). As their enamel morphology corresponds to that of *P. gidleyi*, they are tentatively referred to that species.

Family EQUIDAE, genus and species indeterminate

Referred Specimens.—About 60 isolated postcranial skeletal elements including USNM 171042, 340569, 341692-341694, 341697 radio-ulnae; 347676, metacarpal 3; 341570, 341574, 341670, 341695, tibiae; 173653, 330965, 340950, 341187, 341568, 341668, 347684, 347756, 347757, 347759 metatarsal 3s.

Discussion.—All of the equid postcranial elements are of the appropriate size to represent the taxa identified on the basis of teeth. None are from either very small or very large equid species. All are relatively gracile. Potentially the metapodials of *Protohippus gidleyi* and the hipparionines could be discriminated, but the poor preservation of their proximal articular surfaces has effectively eliminated that possibility.

Family TAPIRIDAE Gray 1821
Genus *TAPIRUS* Brünnich 1771
Tapirus sp.

Referred Specimen.—USNM 341019, astragalus.

Discussion.—USNM 341019 is poorly preserved due to preburial weathering. Most of the articular surfaces are eroded. Enough of the specimen remains to clearly distinguish it from either equid or rhinocerotid astragali and permit its identification to family. The generic reference is based on the fact that *Tapirus* is the only known large late Miocene tapirid in North America (Colbert & Schoch 1998). USNM 341019 is slightly smaller than specimens of *Tapirus webbi* from the Love and McGehee Farm sites of Florida (Hulbert 2005), although its eroded surfaces make it appear smaller than it originally was.

Family RHINOCEROTIDAE Gray 1821
Genus *TELEOCERAS* Hatcher 1894
Teloceras fossiger (Cope 1878) or
Teleroceras hicksi Cook 1927

Referred Specimens.—USNM 330971, P2; 331001, unciform.

Description.—USNM 330971 is similar to other Hemphillian *Teleoceras* P2s in general outline (Fig. 6A), size, and configuration of the roots. Its ectoloph length

at the occlusal surface is 33.9 mm; posterior transverse width at the base of the crown is 34.7 mm. The protoloph is incomplete and does not connect with the ectoloph. The posterior process of the unciform bears a large medial projection (Fig. 6B). Maximum anterior width of USNM 331001, 57.4 mm; total length, about 73 mm.

Discussion.—*Teleoceras* unciforms with medial projections on their posterior processes first appear as a common variant in the Hh1, and became the dominantly observed state by the Hh2 (Harrison & Manning 1983). The medial projection on the posterior process of USNM 331001 is well developed, comparable in extent to those on AMNH 109393 and 109401 (Harrison & Manning 1983), but does not bear a facet for posterior articulation with the magnum. Prothero (2005) recognized two large Hh2 species of *Teleoceras*, *Teleoceras fossiger* and *Teleoceras hicksi*, and the Mauvilla specimens could belong to either of them. In both, the protoloph usually connects with the ectoloph on the P2, forming the anterior border of an enclosed fossette. The absence of this connection in USNM 330971 is more likely an unusual individual variant than a feature of great systematic value.

Genus *APHELOPS* Cope 1873
Aphelops mutilus Matthew 1924

Referred Specimens.—USNM 330975, M3; 173629, scaphoid.

Description.—The crown of USNM 330975 is well preserved and slightly worn, but its roots are broken off (Fig. 6C). It bears a strong anterior cingulum. The paracone forms a distinct convex ridge along the labial side of the crown and is separated from the smaller parastyle by a distinct groove. The antecrochet is vestigial while the well formed crochet first projects anterolingually from the metaloph, but then curves labially to connect with the crista of the ectoloph (Fig. 6C), forming a small, circular medifossette. Greatest anteroposterior length of USNM 330975 (at base of crown), 50.9 mm; greatest transverse width, 51.5 mm. UNSM 173629 is weathered and some of its articular surfaces are damaged. It is exceedingly robust.

Discussion.—Both USNM 173629 and 330975 are considerably larger than corresponding elements from the Moss Acres and Love localities, the two best late Miocene samples of *Aphelops* from the Gulf Coastal Plain. However, some specimens of a very large *Aphelops* are present in the Withlacoochee River 4A and 4X LFs, including two M3s (UF 19366 and 17396) that closely resemble the Mauvilla M3 in size and morphology. The greatest anteroposterior lengths of UF 19366 and 17396 are 51.9 and 52.1 mm, respectively;
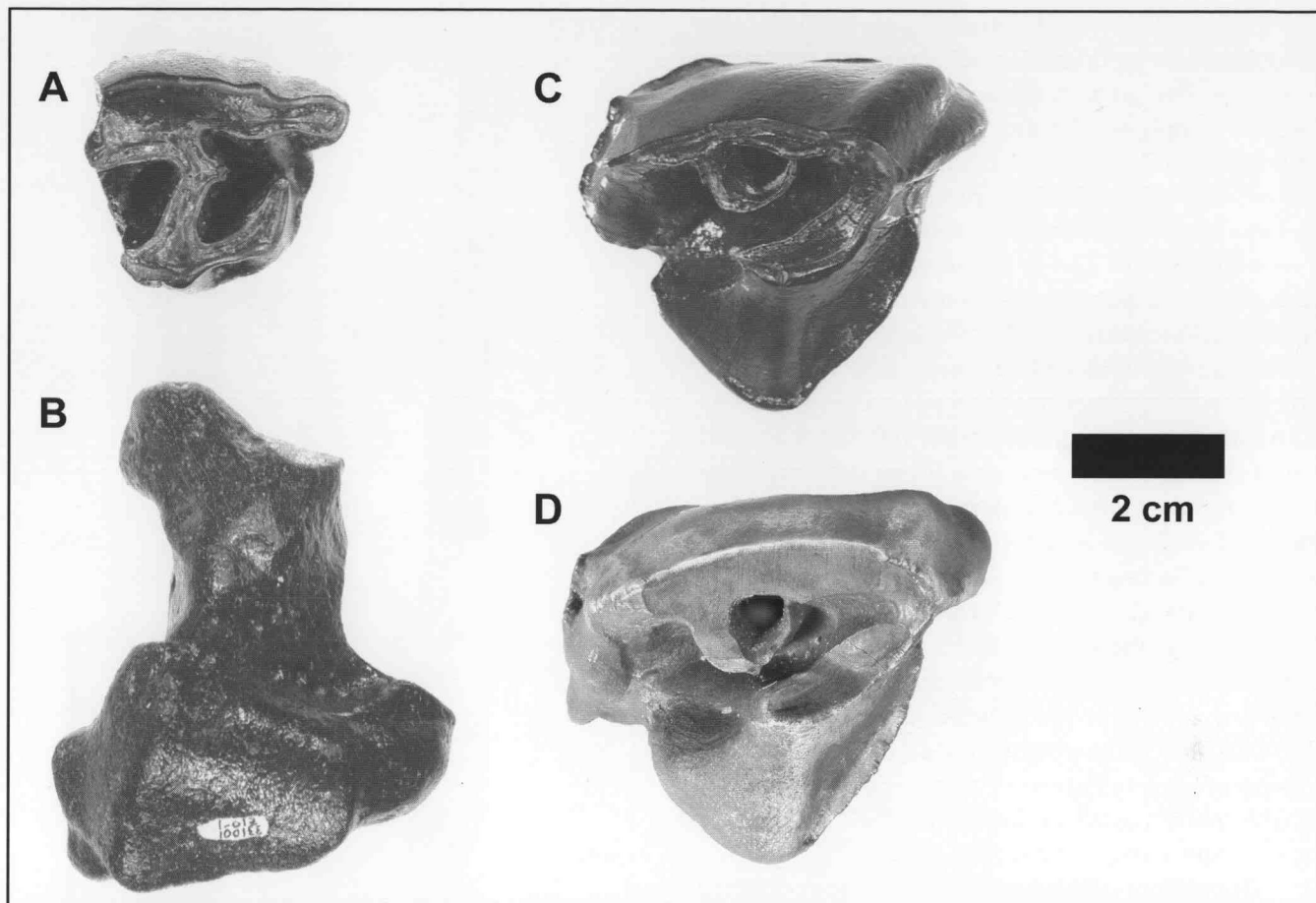
Figure 6. Rhinocerotidae from the Mauvilla local fauna, late Miocene of Alabama, and the Withlacoochee River 4A local fauna, late Miocene of Florida. A-B, *Teleoceras fossiger* or *Teleoceras hicksi* from the Mauvilla LF; A, USNM 330971, right P2 in occlusal view; B, USNM 331001, left unciform in proximal view. C, *Aphelops mutilus* from the Mauvilla LF, USNM 330975, right M3 in occlusal view. D, *Aphelops mutilus* from the Withlacoochee River 4A LF, UF 19366, right M3 in occlusal view. Scale bar = 20 mm.

their greatest transverse widths are 50.2 and 51.0 mm. UF 19366 is the only *Aphelops* M3 in the UF collection with a curved crochet like that of USNM 330975 (Fig. 6C-D). The crochet of UF 17396 is also extensive, but it turns anteriorly after its initial anterolingual course and connects with the protoloph, not the ectoloph as in the other two M3s. Very large specimens of *Aphelops* are also known from a number of Hh2 Great Plains sites including the Box T, Wray, and Cambridge localities (Cook 1930; Tanner 1967; Schultz 1977; Prothero 2005), and this would appear to be a biochronologically useful characteristic of this interval. Prothero (2005) referred these specimens to the species *Aphelops mutilus*.

Order PROBOSCIDEA Illiger 1811
Family GOMPHOTHERIIDAE Hay 1922
Genus and species indeterminate

Referred Specimen.—USNM 330973, fragment of cheek tooth.

Description.—The only indication of a proboscidean in the Mauvilla LF consists of the enamel portion of a single cusp of a gomphothere molar.

Discussion.—The specimen is not generically diagnostic.

Order CETE Linnaeus 1758
Suborder CETACEA Brisson 1762
Parvorder ODONTOCETI Flower 1869
Family PLATANISTIDAE Gray 1846
Genus *POMATODELPHIS* Allen 1921
Pomatodelphis inaequalis Allen 1921

Referred Specimen.—USNM 25099, nearly complete, edentulous mandible.

Description.—Left dentary broken posteriorly through anterior portion of ascending ramus, right dentary broken just behind posterior end of symphysis (Fig. 7); length of symphysis, 626 mm; greatest length of dentary (as preserved), 755 mm; mandibular symphyseal region narrow, its width gradually increasing posteriorly (from 14.4 mm between the first and second alveoli, 38.4 mm at its mid-point, to 73.4 at its posterior terminus). Alveoli small and numerous, 40 present on left dentary, extending posteriorly onto the diverging dentaries as far as the base of the ascending ramus; first 10 distinctly larger than more posterior alveoli and decreasing in size from front to back; eight alveoli per 100 mm at anterior end of the tooth row, nine alveoli per 100 mm at the posterior end. Paired alveoli at anterior end face forward and each has a diameter of 9.5 mm. A row of faint pits, reflecting the bite of the upper teeth, is present on the left dorsal side of the mandible, between the alveolar row and the symphysis (Fig. 7A). This row terminates about 70 mm anterior to the posterior end of the symphysis. No pits are present on the right side of USNM 25099. The ventral surface of USNM 25099 consists of a nearly flat central portion bounded laterally by deep narrow grooves, lateral to which the sides of the mandible curve upward (Fig. 7B).

Discussion.—The holotype of the long-snouted dolphin *Pomatodelphis inaequalis* is a partial maxilla (MCZ 15750); that of its larger relative *Pomatodelphis bobengi* (UM 15117) includes a mandible, but its anterior end is missing. Therefore identification of the isolated lower jaw from Mauvilla depends on comparison with referred material (Kellogg 1959; Morgan 1994). Both of these species were described from middle Miocene specimens from central peninsular Florida, although the chronologic range of *P. inaequalis* extends into the late Miocene (Morgan 1994). Several taxa of platanistid dolphins are also known from the early to early late Miocene of Maryland and Virginia (Gottfried et al. 1994). These include at least one and possibly more species of *Zarhachis*; *P. inaequalis* may also be present.

USNM 25099 is assigned to *Pomatodelphis* because of the extremely long, dorsoventrally flattened symphyseal region, the two parallel longitudinal grooves on the ventral surface of the mandible, the 10 large alveoli at the anterior end of the tooth row followed by numerous small alveoli, and the wide, U-shaped angle between the free rami at the posterior end of the symphysis. It is distinguished from *Zarhachis* by the relative shallowness of the small alveoli and by the shape of the angle between the free rami. In *Zarhachis flagellator* (e.g., USNM 10485), this angle is smaller and the junction between the rami is sharp rather than
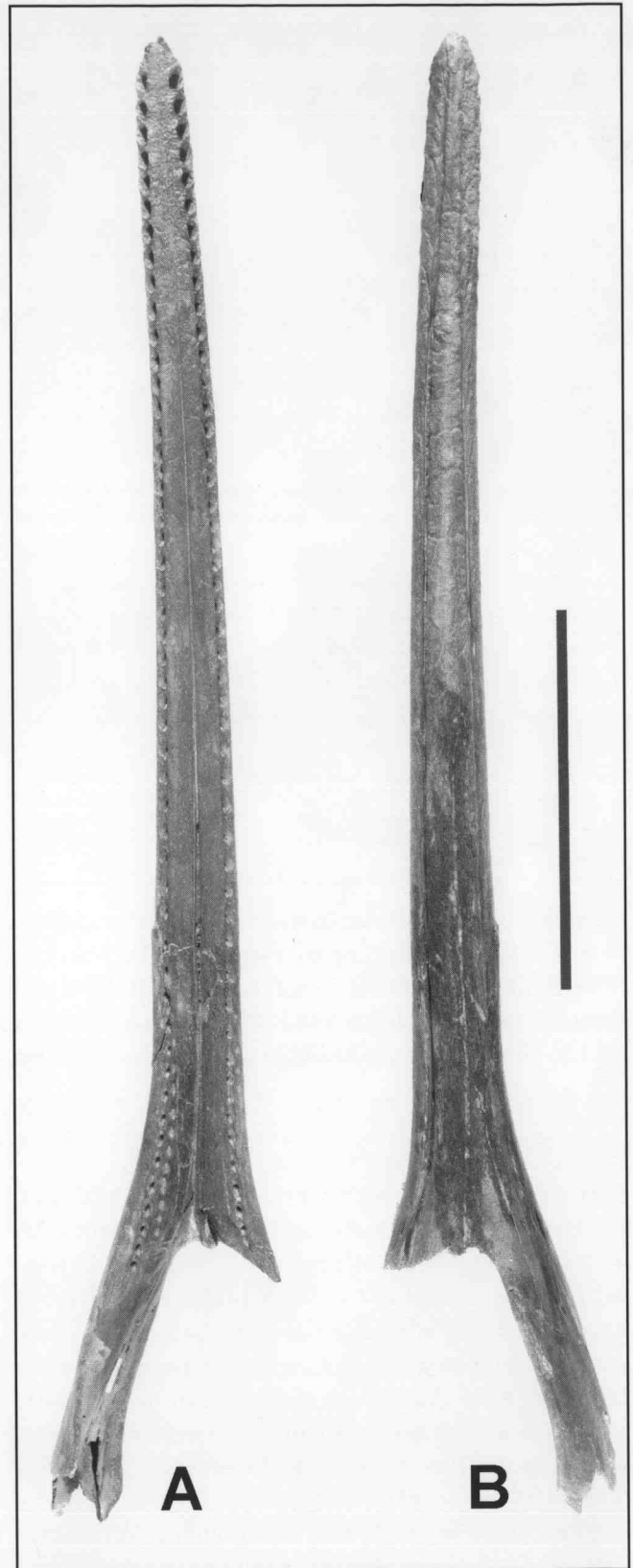

Figure 7. USNM 25099, mandible of *Pomatodelphis inequalis* from the Mauvilla local fauna, late Miocene of Alabama in (A) dorsal and (B) ventral views. Scale bar = 20 cm.

U-shaped. The reference of USNM 25099 to *P. inaequalis* rather than *P. bobengi* is based on the relative small size and close spacing of the alveoli that succeed the 10 large anterior alveoli. In *P. bobengi*, these alveoli are larger and more widely spaced (e.g., USNM 323775).

The presence of a row of faint pits or depressions medial to the tooth row on only the left dentary of USNM 25099 is similar to the condition found on other mandibles of *Pomatodelphis*. Correspondingly, on the palate of specimens referred to *P. inaequalis* there is a similar row of shallow pits medial to the upper alveoli only on the right side (Kellogg 1959; D. J. Bohaska, pers. comm.). Allen's (1921) original description of *P. inaequalis* included the only known specimen (now catalogued as UF/FGS 568) with rows of pits medial to both the left and right upper tooth rows. It appears that the bite of *Pomatodelphis* (and probably *Zarhachis*) normally involved shifting the mandible to the left relative to the palate. These tooth impressions on both the palate and mandible indicate that Allen's (1921) conclusion that the posterior teeth of *Pomatodelphis* were not functional is inaccurate.

Pomatodelphis inaequalis is the lone occurrence in the Mauvilla LF of a marine vertebrate in what is otherwise a fluvial/terrestrial setting. Whitmore in Isphording and Flowers (1983) attempted to explain this anomaly by hypothesizing that *P. inaequalis* may have been a freshwater dolphin, like the modern Amazon dolphin *Inia*. This seems unlikely to have been the dominant mode of life of this genus given its distribution in Florida, where the species is found in shallow marine and estuarine sediments along with abundant fossils of marine fish, sharks, and larger cetaceans. Fordyce and Barnes (1994) inferred a marine habitus for all fossil platanistoid odontocetes. However, the present distribution of platanistoids, in addition to rare fossil occurrences, suggest that some species of long-snouted dolphins have (or had) wide salinity tolerance, enabling them to live in an estuarine environment where salinity can vary seasonally, as it does today in Chesapeake Bay. Among modern platanistoids, *Pontoporia*, which inhabits coastal waters off eastern South America, is often encountered in waters of very low salinity due to the discharge of fresh water from the large rivers of this coast (Gaskin 1976). The present distribution of the Ganges River dolphin, *Platanista ganetica*, indicates that it may once have been saltwater tolerant, enabling it to move from one tributary to another in the Ganges River delta (J. G. Mead, pers. commun. to FCW). An indeterminate platanistoid was reported from the Pliocene Sahabi Formation of Libya, where it was associated with fos-

sils of land mammals in interbedded marine and nonmarine strata (Whitmore 1987). A skeleton of a baleen whale was also collected from the Sahabi Formation. This, in association with the platanistoid and the land mammals can be taken to indicate nearshore marine conditions.

The preferred habitat of *Pomatodelphis* was likely nearshore marine and estuarine waters, similar to the extant *Pontoporia*, but with a tolerance for low salinity that allowed excursions up streams. Such ecological plasticity could have foreshadowed the establishment of some platanistoids as fully freshwater species.

BIOCHRONOLOGY OF THE MAUVILLA LOCAL FAUNA

The boundaries of the North American Land Mammal Ages and their subdivisions are defined by the first occurrences of genera dispersing from Asia or South America (Tedford et al. 1987, 2004; Woodburne & Swisher 1995). However, as a practical matter, many of the defining taxa are rare and thus of limited biochronologic utility. The determination of the age of sites with a limited number of species, such as the Mauvilla LF, often must rely on concurrent range zones of common species such as camelids or equids, or the even less precise "stage of evolution" method.

Table 7 presents a comparison of the Mauvilla terrestrial mammalian fauna with those from the Hemphillian of Florida and the Great Plains. Overall, its greatest similarity is with Hh2 faunas from both Florida and the Great Plains (9 of 13 taxa shared to some degree). The Hh2 interval contains the first appearances of *Pleiolama vera*, *Neohipparion eurystyle*, *Nannippus aztecus*, *Cormohipparion emsliei*, and *Aphelops mutilus*, and the last appearances of *Epicyon haydeni* and *Protohippus gidleyi* (Hulbert 1988b, 1993a; Honey et al. 1998; Wang et al. 1999; Prothero 2005). Thus their concurrent range zone is limited to the Hh2. An Hh2 age for the Mauvilla LF is also consistent with the stage of evolution found in its samples of *Neohipparion eurystyle*, *Nannippus aztecus*, *Protohippus gidleyi*, *Teleoceras*, *Pediomeryx*, and *Prosthenops*. Tedford and Hunter (1984) originally placed the Mauvilla LF (their Mobile LF) in the Hh1, primarily on its supposed similarity to faunas of that age in Florida, such as the McGehee Farm LF. The corrected identifications of this study have greatly lessened the Mauvilla LF's similarity with Florida Hh1 faunas (Table 7), and instead support an Hh2 age.

The correlations of Florida's early Hh faunas with those from the central and western United States as presented in Tedford et al. (2004) were modified com-

Table 7. Comparison of land mammal species present in the Mauvilla LF, Alabama with those from the Hemphillian of the Great Plains (G.P.) and Florida. **XX** indicates the presence of the same species as found in the Mauvilla LF; **X** indicates the definite presence of a species only tentatively identified from the Mauvilla LF; **?** indicates the presence of a similarly tentatively identified taxon as found in the Mauvilla LF; and **–** indicates that the taxon found at Mauvilla is not present in that fauna. No Hh3 vertebrate localities are known from Florida.

Mauvilla LF	Florida Hh1[a]	Florida Hh2[b]	Florida Hh4[c]	G.P. Hh1[d]	G.P. Hh2[e]	G.P. Hh3[f]	G.P. Hh4[g]
Epicyon cf. *haydeni*	X	—	—	X	X	—	—
Prosthennops cf. *serus*	X	—	—	X	X	—	—
Pleiolama cf. *vera*	—	?	X	—	X	X	X
Synthetoceras davisorum	—	—	—	—	—	—	—
cf. *Pseudoceras* sp.	X	X	X	X	X	—	—
Pediomeryx sp.	?	—	—	?	?	—	—
Neohipparion eurystyle	—	XX	XX	—	—	XX	XX
Nannippus aztecus	—	XX	XX	—	—	XX	XX
Cormohipparion emsliei	—	XX	XX	—	—	—	—
Protohippus gidleyi	XX	XX	—	—	XX	—	—
Tapirus sp.	?	?	—	—	?	—	?
Teleoceras fossiger/hicksi	—	?	?	?	?	?	—
Aphelops mutilus	—	XX	—	—	XX	XX	XX
Total shared taxa	6	9	6	4	9	5	4

[a]Species from the McGehee Farm, Mixson's Bone Bed, Tyner Farm, and Haile 19A LFs (UF collection).
[b]Species from the Withlacoochee River sites 4A, 4X, and 5E, Moss Acres, and Manatee County Dam Site LFs (UF collection).
[c]Species from the Palmetto Fauna (Webb et al. in press).
[d]Species from the Arnett and Higgins LFs (Janis et al. 1998).
[e]Species from the Wray, Box T, Minimum Quarry, and Cambridge LFs (Janis et al. 1998).
[f]Species from the Coffee Ranch and Optima LFs (Janis et al. 1998).
[g]Species from the Buis Ranch, Christian Ranch, and Santee LFs (Janis et al. 1998).

pared to those in Tedford et al. (1987). This has consequences when making biochronologic comparisons with early Hh faunas in the rest of the Gulf Coastal Plain, such as the Mauvilla LF. Tedford et al. (1987) used the first appearance of the mylodont sloth *Thinobadistes* as one of the defining events for the beginning of the Hh, but in Tedford et al. (2004) it was instead regarded as one the events that defined the beginning of the Hh2 interval, about 1.5 myr after the start of the Hh. The ages of the McGehee Farm and Mixson's Bone Bed LFs are depicted as straddling the Hh1-Hh2 boundary on the correlation chart in Tedford et al. (2004:fig. 6.2), although by definition they should be completely within the Hh2 interval as they contain one of its defining taxa, *Thinobadistes*. In the corresponding chart in Tedford

et al. (1987:fig. 6.2), these two faunas are shown entirely within the Hh1 interval, much closer to the Cl-Hh boundary (the age of this boundary, ca. 9 Ma, is the same in the two charts). Tedford et al. (2004) do not provide an explicit reason for this change in the interpretation of the time of first appearance by *Thinobadistes* and the revised ages of these two Florida faunas. However, a possible reason is found in this statement, "Immigrant taxa whose first appearances in North America have been established *in the Great Plains* can be used to distinguish four phases of the Hemphillian" (Tedford et al. 2004:218, italics added). The oldest record of *Thinobadistes* in the Great Plains is the Hh2 Box T LF of northern Texas (Webb 1989). However, the species of *Thinobadistes* present at Box T is *T. wetzeli*,

which is a more derived species than the one found at the McGehee Farm and Mixson's sites, *Thinobadistes segnis*. Furthermore, *T. wetzeli* also occurs in Florida Hh2 faunas (Withlacoochee River sites 4A and 4X, Webb 1989), faunas which are clearly younger than McGehee Farm or Mixson's.

There are several lines of evidence that the age of McGehee Farm and Mixson's Bone Bed is very early Hh (= Hh1) as designated by Tedford et al. (1987), and not Hh2 as listed by Tedford et al. (2004). Of the eight immigrant taxa listed by Tedford et al. (2004) as defining the Hh2, McGehee Farm and Mixson's lack all except for *Thinobadistes*. Of the 16 additional 'characterizing taxa' of the Hh2 listed by Tedford et al. (2004), all except for the gomphothere *Amebelodon* are absent in these two Florida faunas. In several instances, the species present at these two Florida faunas in a particular genus is more primitive than the one Tedford et al. (2004) listed as 'characterizing' the Hh2. For example, McGehee Farm and Mixson's have *Aphelops malacorhinus* instead of *Aphelops mutilus*. The case of *Amebelodon* is similar to that of *Thinobadistes*, as the species present at the Florida sites, *Amebelodon floridanus*, is much smaller and dentally more primitive than *Amebelodon fricki* or *Amebelodon britti* from the Hh2 interval. Within the sequence of Florida Neogene faunas, McGehee Farm and Mixson's are much more similar to the Cl3 Love Bone Bed LF than they are with Hh2 faunas such as Moss Acres, Withlacoochee River 4A, or Manatee County Dam. Of 18 ungulate species present at McGehee Farm, 13 of the same species are present in the Love LF, while only three are shared with Moss Acres and Withlacoochee River 4A and 4X. The Tedford et al. (2004) chronology of Florida Hh faunas squeezes the McGehee Farm and Mixson's LFs into the very short Hh2 interval with the very different Withlacoochee River and Manatee County Dam LFs. This would require very rapid turnover in many lineages and very rapid evolution in others. The recently discovered Tyner Farm LF (Hulbert et al. 2002) contains a mammalian fauna intermediate in composition and stage of evolution between those of McGehee Farm and Mixson's on one hand, and those of Moss Acres, the Withlacoochee River sites, and Manatee County Dam on the other. While not definitive proof, this suggests a somewhat more gradual (although still relatively rapid) transition which would require a significant interval of geologic time between the two sets of Florida early Hh faunas, ca. 0.25-0.75 myr. With the general absence of radiometric or other numeric dating methods, the correlation of most of Florida's terrestrial Neogene faunas with those of the mid-continent will never be precise.

But current evidence favors an Hh1 age for the McGehee Farm, Mixson's Bone Bed, and similar faunas from Florida, such as Haile 19A, as provided by Tedford et al. (1987), and not the Hh2 age proposed by Tedford et al. (2004).

BIOGEOGRAPHY

The Mauvilla LF is one of the few Hh sites in the eastern United States outside of Florida (Fig. 1), and the only one whose age has been established as Hh2. As such it provides a rare glimpse into the degree of provinciality present in North American mammals in the latest Miocene. As indicated in Table 7, overall fauna resemblance between the Mauvilla LF and Hh2 faunas from Florida is of similar magnitude to that between Mauvilla and Great Plains Hh2 faunas. However, of the six terrestrial taxa from Mauvilla that can be confidently identified to the species level, five are shared with Florida Hh2 faunas (*Neohipparion eurystyle*, *Nannippus aztecus*, *Cormohipparion emsliei*, *Protohippus gidleyi*, and *Aphelops mutilus*), while only two are shared with Great Plains Hh2 faunas (*P. gidleyi* and *A. mutilus*). The Mauvilla LF differs from Great Plains Hh2 faunas in its abundance of hipparionine equids, and absence of antilocaprids and monodactyl equids such as *Astrohippus*, *Dinohippus*, and *Pliohippus*. The presence of a synthetocerine protoceratid is unique to Gulf Coastal Plain Hh faunas, as that clade became extinct in the Great Plains by the end of the Clarendonian (Webb et al. 1995). *Cormohipparion emsliei* also appears to be a Gulf Coastal Plain endemic (Hulbert 1988a; Manning & MacFadden 1989; Webb et al. 1995). Of the taxa shared between Mauvilla and the Great Plains Hh2 faunas to the exclusion of those from Florida Hh2 faunas, all three are known from Hh1 faunas in Florida: *Epicyon haydeni* is present at McGehee Farm and Haile 19A; *Prosthenops serus* is present at Tyner Farm; and a species of *Pediomeryx* (*Yumaceras*) is present at all three of these Florida sites. Significant absences of taxa at Mauvilla compared to contemporaneous sites in Florida are dwarf equids such as *Calippus elachistus* and *Nannippus morgani* (although these tend to be rare and their absence is possibly due to taphonomic factors, as noted above), the ground sloths *Thinobadistes* and *Pliometanastes*, the small llama *Hemiauchenia minima*, and the giraffe camel *Aepycamelus*. It will be interesting if further collecting in the central and western Gulf Coastal Plain produces these taxa in early Hh faunas.

CONCLUSIONS

The mammalian component of the Mauvilla LF from southern Alabama is described in detail for the first time.

It is the only late Miocene vertebrate fauna located between those of central Florida and northern Texas. Fifteen taxa of mammals were identified. With few exceptions, all of the mammalian fossils recovered belong to one of the ungulate orders (Artiodactyla, Perissodactyla, Proboscidea, or Cete). Five species make up the vast majority of identifiable recovered specimens: *Synthetoceras davisorum* new species; *Prosthennops* cf. *serus*; *Neohipparion eurystyle*; *Cormohipparion emsliei*; and *Protohippus gidleyi*. The age of the fauna is late early Hemphillian (Hh2).

At the species level, the Mauvilla LF more closely resembles those from Florida than those from the Great Plains, although there are also similarities with the latter. Of greatest importance is the high diversity of tridactyl hipparionine and protohippine equids in contrast to monodactyl equines such as *Dinohippus* or *Astrohippus*. The rarity of *Nannippus* at Mauvilla and the absence of other small equids, such as *Calippus* or *Pseudhipparion*, likely resulted from the site's taphonomic bias against small-sized terrestrial taxa. *Synthetoceras davisorum* is the youngest record of the genus *Synthetoceras*. It shares none of the derived features of the youngest protoceratid, *Kyptoceras*. This supports Webb's (1981) phylogenetic hypothesis that *Kyptoceras* is more closely related to early Miocene *Syndyoceras* than it is *Synthetoceras*.

ACKNOWLEDGMENTS

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