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MIOCENE RODENTS FROM THE THOMAS FARM LOCAL FAUNA, FLORIDA

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No. 11 — *Miocene Rodents from the Thomas Farm Local Fauna, Florida*

By Craig C. Black[1]

During the last several years a considerable number of rodent specimens have been recovered from the early Miocene Hawthorn formation at the Thomas Farm locality, Gilchrist County, Florida. For the most part only isolated teeth have been found but sufficient numbers of these are now available to increase considerably our knowledge of this rodent assemblage.

Rodents from the Florida Miocene south of the town of Midway were first described by Wood (1932). At that time he described *Proheteromys floridanus* and *P. magnus*. In 1935 this material was reviewed by Wood but no new specimens were then available to supplement his earlier work. In 1947, he described additional specimens of both species from Thomas Farm and also recorded the presence of a cricetid at this locality as well as the presence of *Mesogaulus* in the Miocene at Midway, Florida. *Mesogaulus* was represented by a single premolar, Florida State Geological Survey No. V-5422, which has since been lost. The presence of a cricetid was indicated by several fragmentary limb bones and a number of incisors.

The present collection includes two isolated cricetid molars, several *Proheteromys magnus* teeth, a large number of *Proheteromys floridanus* teeth (which, for the first time, make possible a complete description of the dentition of this species), four squirrel teeth, and one prosciurine M^3. The last two forms are new to the fauna. Unfortunately, no new mylagaulid material has been found.

I would like to thank Mr. Stanley J. Olsen and the Florida Geological Survey for the loan of the types of *Proheteromys floridanus* and *P. magnus* as well as many additional specimens, Dr. Clayton E. Ray of the University of Florida for the loan of material in his care, and Dr. A. S. Romer for the loan of specimens in the collections of the Museum of Comparative Zoology, Harvard University. The illustrations are by Mr. Richard Lang and were made possible by a grant from the Gulf Oil Corporation. All measurements are in millimeters.

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The following abbreviations are used throughout:

F.S.G.S., Florida State Geological Survey; K.U., University of Kansas, Museum of Natural History; M.C.Z., Museum of Comparative Zoology, Harvard University; U.F., University of Florida; a-p, anteroposterior; tr., transverse.

Order RODENTIA

Family PARAMYIDAE

Subfamily Prosciurinae

Prosciurus? sp.

Figure 1

Material. F.S.G.S. V-5952, a right M^3.

Description. Although the enamel on this tooth has been damaged, the crown pattern is still clear. The tooth is broadly triangular with the protocone filling the lingual margin. The anterior cingulum is broad and rises to a well-developed parastyle. The protoloph is complete with some indication of a protoconule but the presence of this cusp cannot be determined with certainty. There are indications of several ridges running down the anterior and posterior slopes of the protoloph. A well-defined metaloph is present passing obliquely from the protocone to the postero-buccal corner. The metaloph is lower than the protoloph and is partially constricted on both sides of the large metaconule. A short mesoloph lies between the protoloph and metaloph and passes internally to fuse with the metaloph at the base of the metaconule.

Discussion. This specimen is referred to the Prosciurinae because of the complex ridging developed behind the protoloph. The development of a metaloph and/or a mesoloph on M^3 is seen in some members of the Sciuridae particularly in *Cynomys* and to a lesser degree in some species of the subgenus *Citellus*. However, in both these cases this pattern appears to be a late Cenozoic development, no Tertiary North American sciurids being known which show this pattern. The presence on M^3 of a metaloph, well-developed metaconule, and mesoloph are common features of *Prosciurus,* however, and tend to ally the Florida specimen with that genus. *Prosciurus* is a rather common element of many Oligocene faunas in western North America but it had not been reported from the Miocene until recently. The genus

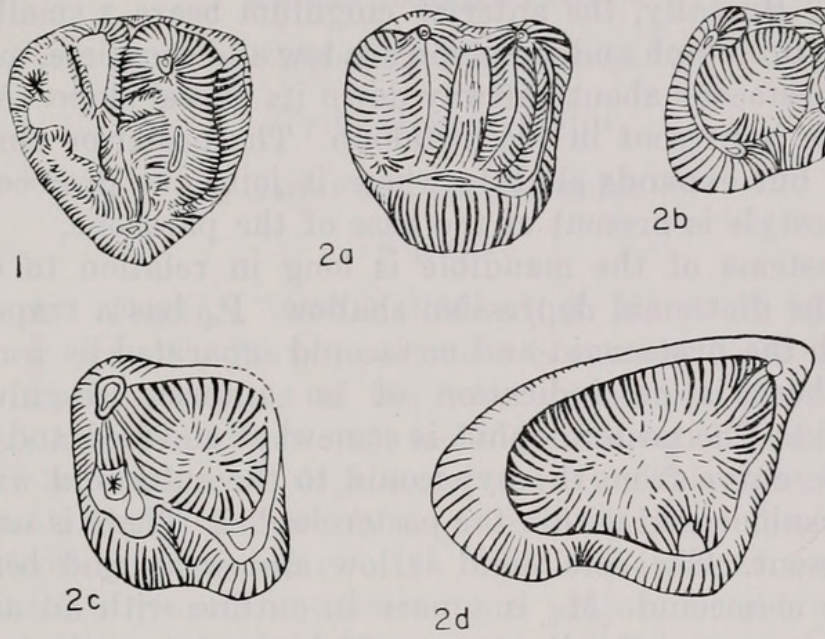

FIG. 1. *Prosciurus?* sp. F.S.G.S. V-5952, RM^3, x10. Figure 2. *Tamias* sp. 2a. F.S.G.S. V-6021, $LM^{1 or 2}$, x15. 2b. F.S.G.S. V-6020, RP_4, x15. 2c. U.F. No. 3873, LM_1, x15. 2d. F.S.G.S. V-5951, RM_3, x20.

is now known from the basal Miocene of South Dakota (Macdonald, pers. com.), and also from the early Miocene in Wyoming (Black, 1960). It is somewhat surprising, therefore, to find this genus in the later part of the early Miocene of Florida. The presence of *Prosciurus* in Florida at a later date than it is known to occur in the Great Plains lends support to the suggestion made by Wood (1947) in regard to the mylagaulid tooth, that Florida may have been isolated from the main center of evolution of these families and acted as a refugium for the more primitive forms.

Measurements

	a-p	tr.
RM^3	2.85	2.85

Family SCIURIDAE

TAMIAS sp.

Figure 2

Material. U.F. No. 3873, partial mandible with LM_1 ; F.S.G.S. V-5951, RM_3 ; V-6021, $LM^{1 or 2}$; V-6020, RP_4.

Description. The upper molar is unworn and shows a high, somewhat compressed protocone. The anterior cingulum is broad and joins the protocone at its base, well below the level of the

protoloph. Buccally, the anterior cingulum bears a small parastyle. The protoloph and metaloph are low and complete, merging with the protocone about halfway down its buccal slope. A small metaconule is present in the metaloph. The posterior cingulum is narrow but expands slightly where it joins the protocone. A small mesostyle is present at the base of the paracone.

The diastema of the mandible is long in relation to overall size and the diastemal depression shallow. P_4 has a trapezoidal shape with the protoconid and metaconid separated by a narrow notch. There is no indication of an anterior cingulum or anteroconid. The posterolophid is somewhat elevated and passes in a gentle curve from the hypoconid to the entoconid with the entoconid submerged within the posterolophid. There is no mesostylid present. The ectolophid is low and weak and bears no trace of a mesoconid. M_1 is square in outline with an angular entoconid corner. A small anteroconid is present on the anterior cingulum. The metalophid is complete and the small trigonid basin completely enclosed. The posterolophid is low. The entoconid is submerged in the posterolophid. The ectolophid is low and weak and the buccal valley is shallow. No mesostylid is present. The M_3 is extremely elongate, more so than in any other sciurid and it is quite possible that this is not a chipmunk M_3 and should not be associated with the other material described here. However, the tooth bears no resemblance to that of the prosciurines and on the basis of size alone it is here tentatively referred to *Tamias*. Most of the enamel on the tooth is missing and the crown pattern obliterated.

Discussion. These specimens, with the possible exception of the M_3, are scarcely separable from the isolated chipmunk teeth known from the Miocene of the Great Plains. Although they are somewhat smaller, the compressed high protocone, partially elevated posterolophid, and entoconid submerged within the posterolophid are characters which agree closely with those of the South Dakota and Wyoming Miocene chipmunks.

Measurements

	a-p	tr.
LM $^{1 \text{ or } 2}$	1.3	1.5
RP_4	1.1	1.0-1.2
LM_1	1.2	1.2-1.2
RM_3	1.8	1.4-1.3

Family CRICETIDAE

Subfamily CRICETINAE

Tribe Hesperomyini

Genus and species indet.

Figure 3

Material. F.S.G.S. V-6019, RM^1; U.F. No. 3940, RM_1.

Description. The first upper molar is mesodont with prominent lophs. About one-third of the anterior portion of the tooth is missing; however, the overall tooth outline can be reconstructed (Figure 3a) with some degree of accuracy. This anterior section was constricted transversely as is indicated by the narrowing of the tooth just posterior to the break. The presence or absence of a shallow reentrant between the protocone and anteroloph cannot be ascertained in this specimen. The rest of the tooth shows three transverse, obliquely oriented lophs and two transverse valleys both extending almost the complete width of the occlusal surface. The anterior loph passes anterobuccally from the protocone and probably connected the protocone and the anteroloph. The second loph parallels the first and connects the hypocone and paracone while the third loph passes from the posterior cingulum to the metacone. The anterior valley is composed of two segments and with further wear would be interrupted at the center of the tooth resulting in the formation of a deep lingual valley between the paracone and anteroloph. The latter valley would rapidly disappear with further wear. The second transverse valley arises between the paracone and metacone and passes internally to the midline of the tooth where it bends posteriorly and ends near the posterior border at the base of the hypocone. The occlusal surface of M^1 is terraced with the buccal cusps elevated and the lingual cusps flattened.

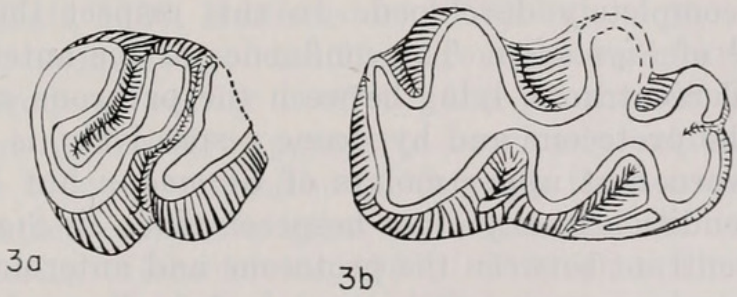

FIG. 3. Hesperomyines, genus and species indet. 3a. F.S.G.S. V-6019, RM^1, x20. 3b. U.F. No. 3940, RM_1, x20.

The enamel is partially chipped and the metaconid is broken on M_1. The tooth is somewhat lower crowned and the cusps more prominent than in the upper molar. The anterolophid is weakly bilobed and connects with the metalophid along the midline of the tooth. The four major cusps are slightly offset with the metaconid and entoconid lying forward of the protoconid and hypoconid. The anterior protoconid arm passes obliquely across the tooth to the metaconid. There is also a broad connection with the entoconid through the posterior protoconid arm. The anterior hypoconid arm parallels that of the protoconid passing anteriorly to the entoconid. The anterior reentrant between the anterolophid and protoconid is partially closed by a crest passing from the anterolophid towards the base of the protoconid. The posterior buccal and lingual reentrants are of nearly the same size and depth and both turn anteriorly as they pass toward the midline of the tooth. The anterior lingual reentrant is shallow and narrow and is directed posteriorly. The four major cusps are approximately equal in size, with the entoconid and probably the metaconid elevated above the protoconid and hypoconid. The posterior cingulum is short and narrows to a thin ledge behind the entoconid.

Discussion. These teeth clearly demonstrate the presence of hesperomyine cricetids in the Thomas Farm fauna. The absence of a mesoloph and mesolophid on the two molars might be taken to indicate a relationship with the phyllotine or sigmodont hesperomyines rather than with the *Peromyscus-Oryzomys* group (Hershkovitz, 1955). However, Hooper (1957) has shown that, in *Peromyscus* at least, these two structures are variable both inter- and intraspecifically. As regards the two Florida molars one, M^1, does seem to resemble those of the sigmodont cricetids in most characters while the other, M_1, appears to be that of a *Peromyscus*-like form.

The first upper molar is higher crowned than M_1 and the lophs are more completely developed. In this respect the tooth resembles M^1 of *Sigmodon*. The confluence of the anterior buccal and lingual reentrants, lying between the paracone and anteroloph and the protocone and hypocone respectively, is duplicated in the unworn first upper molars of *Sigmodon* but I have not seen this condition in any other hesperomyine. In *Sigmodon* the anterior reentrant between the protocone and anteroloph is deep and the anterior margin of the protoloph is directed across the crown almost at a right angle to the long axis of the tooth. In

F.S.G.S. V-6019, however, what is preserved of the lingual margin of the protoloph is directed antero-buccally. Thus, if an anterior reentrant were present, it would not pass directly across the tooth as it does in *Sigmodon*. The terraced crown of the Florida specimen is not found in *Sigmodon* but is seen in the more bunodont and brachyodont dentition of *Hesperomys*. However, in other details of crown pattern M^1 bears little resemblance to that of *Hesperomys*, and its closest affinities seem to be with *Sigmodon*.

The first lower molar is more bunodont and somewhat lower crowned than the upper molar and in this respect more closely resembles that of *Peromyscus* and *Hesperomys* than that of *Sigmodon*. The bilobed anteroloph seen in U.F. No. 3940 is present to a slight degree in *Hesperomys* and is well developed in *Perymyscus* but absent in *Sigmodon*. The principal cusps do not appear to be as prominent as are those of *Peromyscus, Oryzomys,* and *Onychomys,* although this may be partially due to the extreme state of wear, nor are they as completely incorporated into transverse lophs as they are in *Sigmodon* or *Phyllotis*. The terraced occlusal surface seen on the M^1 from Thomas Farm is not as pronounced on the lower molar but is present to a slight degree. The shallow depth and the direction of the reentrants correspond to the condition in *Peromyscus, Hesperomys,* and to a less extent in *Reithrodontomys* but differ from that in *Sigmodon* and *Phyllotis*. The shallow reentrant between the posterior cingulum and the entoconid corresponds to the condition in *Peromyscus* and *Oryzomys*. In general, the lower molar resembles that of *Peromyscus* and possibly *Hesperomys* more closely than any other hesperomyine.

Both of these teeth indicate the presence of hesperomyine rodents at Thomas Farm. One of the teeth is more highly specialized than any others yet reported from the Miocene or early Pliocene. *Peromyscus* has been reported from the late Miocene (Hall, 1930, Hoffmeister, 1959) but, to the best of my knowledge, no member of the Hesperomyini has previously been reported from an earlier horizon. One of the Florida species, represented by the M^1, appears to be closely related to cotton rats which today are distributed through the southern portion of North America and the grass and scrubland area of northern South America (Hershkovitz, 1955). The other Florida species would appear to be most closely allied to the more generalized hesperomyines of the genus *Peromyscus*.

Measurements

	a-p	tr.
M^1	1.4 approx.	1.3
M_1	2.1	0.8-1.1-1.2

Family HETEROMYIDAE

Proheteromys floridanus Wood

Figure 4

Proheteromys floridanus Wood, 1932: 45; 1935:166; 1947:489.

Type. F.S.G.S. V-5329, jaw fragment with LP_4-M_1.

Hypodigm. P^4-F.S.G.S. V-6012, V-6015, V-6026, V-6031, V-6034, M.C.Z. Nos. 8480, 8482, U.F. Nos. 3872, 3941, 4061, 4062, 4075, 4076; $M^{1 or 2}$-F.S.G.S. V-5330, V-5331, V-6000, V-6002, V-6003, V-6004, V-6005, V-6016, M.C.Z. Nos. 8452, 8454, 8458, 8466, 8467, 8468, 8469, 8470, 8471, 8472, 8474, 8475, 8483, U.F. Nos. 3867, 4057, 4058, 4060, 4064, 4074, 4079, M.C.Z. Nos. 7134, 7139; M^3-F.S.G.S. V-6001, V-6017, V-6028, V-6029, U.F. Nos. 4067, 4078, 4080; RdP_4-M.C.Z. No. 8450; LdP_4-M.C.Z. No. 8478; P_4-F.S.G.S. V-6014, V-6027, M.C.Z. Nos. 7137, 8450, 8457, 8470, 8478, 8485, U.F. Nos. 3871, 4077; $M_{1 or 2}$ F.S.G.S. V-5334, V-6006, V-6007, V-6008, V-6009, V-6010, V-6011, V-6013, V-6035, M.C.Z. Nos. 7136, 8449, 8451, 8453, 8456, 8459, 8462, 8463, 8464, 8473, 8477, 8479, 8481, U.F. Nos. 4059, 4063, 4065, 4066, 4068, 4069; M_3-F.S.G.S. V-6030, V-6032, V-6033, M.C.Z. Nos. 8448, 8455, 8460, 8461, 8465, 8484, U.F. Nos. 3869, 4070, 4071.

Emended diagnosis. Smaller than *Proheteromys sulculus, P. matthewi,* and *P. thorpei;* cheek teeth bilophodont with cusps not as prominent as in *Mookomys;* P^4 with single cusp on protoloph, three cusps on metaloph; central valley in $M^{1 or 2}$ closed lingually by fusion of styles; P_4 generally with low median crest connecting metalophid and hypolophid but crest not as prominent as in perognathines; P_4 without anteroconid but generally with accessory hypoconulids.

Description. The fourth upper premolars all show a single cusp on the protoloph, the protoconid, and a three cusped metaloph, composed of the metacone, hypocone, and entostyle. The protocone lies well below the level of the metacone and hypocone in all specimens and is only weakly connected to the metaloph

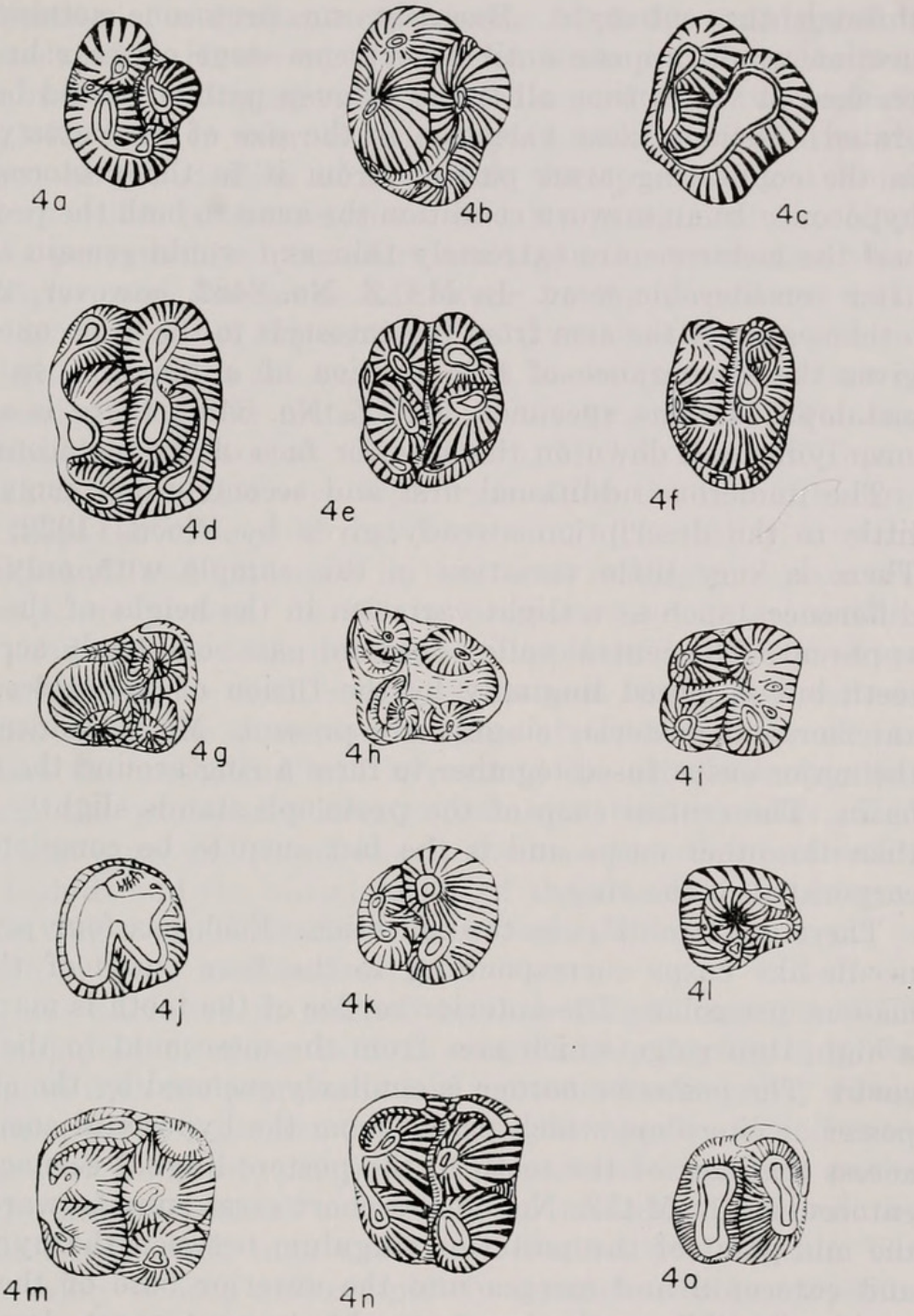

FIG. 4. *Proheteromys floridanus*, all approximately x20. 4a. F.S.G.S. V-6031, RP^4. 4b. F.S.G.S. V-6015, RP^4. 4c. F.S.G.S. V-6026, RP^4. 4d. F.S.G.S. V-6016, $RM^{1 or 2}$. 4e. M.C.Z. No. 8470, $LM^{1 or 2}$. 4f. F.S.G.S. V-6028, LM^3. 4g. M.C.Z. No. 8450, RdP_4. 4h. M.C.Z. No. 8478, LdP_4. 4i. F.S.G.S. V-6014, RP_4. 4j. U.F. No. 3871, LP_4. 4k. M.C.Z. No. 7137, RP_4. 4l. M.C.Z. No. 8485, LP_4. 4m. M.C.Z. No. 8481, $RM_{1 or 2}$. 4n. M.C.Z. No. 8473, $RM_{1 or 2}$. 4o. M.C.Z. No. 8484, LM_3.

through the entostyle. Buccally, no protocone-metaloph connection would appear until an extreme stage of wear had been reached at which time all traces of cusp pattern would be obliterated. There is some variation in the size of the entostyle and in the connecting arms passing from it to the protocone and hypocone. In an unworn condition the arms to both the protocone and the metacone are extremely thin and would remain so even after considerable wear. In M.C.Z. No. 8482, however, there is a thickening of the arm from the entostyle to the hypocone which gives the appearance of the addition of a fourth cusp to the metaloph. In one specimen, M.C.Z. No. 8480, there is a small cusp lying well down on the anterior face of the metaconid.

The numerous additional first and second upper molars add little to the description already given by Wood (1932, 1935). There is very little variation in this sample with only minor differences, such as a slight variation in the height of the styles, apparent. The central valley does not pass completely across the teeth but is closed lingually by the fusion of the styles. Both anterior and posterior cingula are present. M^3 is reduced with the major cusps fused together to form a ring around the central basin. The central cusp of the protoloph stands slightly higher than the other cusps and is the last cusp to be completely incorporated in the ring.

There are two dP_4s in the collection. Each has four principal needle-like cusps corresponding to the four cusps of the permanent premolar. The anterior border of the tooth is marked by a high, thin ridge which arcs from the mesoconid to the protoconid. The posterior border is similarly enclosed by the elevated posterior cingulum which passes from the hypoconid completely across the back of the tooth to the postero-lingual corner of the entoconid. On M.C.Z. No. 8478 a short crest runs forward from the mid-point of the posterior cingulum between the hypoconid and entoconid and merges into the anterior base of the hypoconid. On this tooth there are also present short, low crests running from the protoconid to the base of the entoconid and from there to the base of the hypoconid. These crests are entirely absent on M.C.Z. No. 8450.

The fourth lower premolars show a considerable amount of variation and the new material necessitates a number of additions to the original description (Wood, 1932, 1935). The only P_4 previously described is extremely worn and as Wood has pointed out the crown pattern is obscured. In this tooth the metalophid and hypolophid surround a shallow central basin and there is

no indication of a median arm passing from the metalophid to the hypolophid. However, the central basin is not as deep as are the buccal and lingual valleys which separate the two lophids. Hence, with further wear, the metalophid and hypolophid would fuse first in the midline of the tooth thus presenting a broad X-pattern which is characteristic of later perognathines. However, the perognathine premolars are higher crowned than those of *Proheteromys floridanus* and wear to the X-pattern much earlier in the life of the tooth. The premolars in the present collection show (with one exception) a low to prominent central crest passing from the metalophid to the hypolophid. The one tooth which does not show this pattern, M.C.Z. No. 8485, has a deep central pit and a very high crest along the buccal margin which fuses the mesoconid and hypoconid. The valley between the protoconid and entoconid in this tooth is deep and no accessory cusps are present. In all the premolars, an anteroconid is absent; and there is no indication of a hypostylid. Several of the premolars have two small cusps set between the hypoconid and entoconid along the posterior margins of the teeth. In all the premolars the mesoconid and hypoconid are set closer together than are the protoconid and entoconid. One premolar, U.F. No. 3871, is worn and shows clearly the broad median connection of the lophids and the initial fusion of the mesoconid and hypoconid leaving a small, shallow pit between the buccal margin of the tooth and the median crest.

M_{1-2} are narrower in relation to their length than are M^{1-2}. The metalophid on these teeth is considerably higher than the hypolophid with the protoconid and metaconid submerged within the metalophid to a greater degree than the hypoconid and entoconid are within the hypolophid. The anterior cingulum passes from the antero-internal corner of the metaconid around the protoconid and ends in a small but distinct protostylid. The median valley is deep and completely separates the two lophids. The hypoconid and entoconid are of approximately the same size while the hypostylid is much smaller. M_3 agrees in occlusal pattern with M_{1-2} except in the development of the stylar cusps. The protostylid is reduced and the entostylid absent.

An analysis of the measurements of the teeth here assigned to *P. floridanus* is given below. The variation seen is slightly more than one might expect to find for a sample taken from a single mammalian population, but not as high as one would expect if the sample were a mixture of two species.

Statistical data on cheek teeth of *P. floridanus*

		N	O.R.	M	S	V
P^4	anteroposterior	10	.7-1.0	.81±.016	.05	6.7±1.48
	width metaloph	10	.9-1.1	1.03±.016	.05	4.9±1.09
$M^{1 or 2}$	anteroposterior	20	.7-.9	.81±.011	.05	6.2±.98
	width metaloph	20	.9-1.1	1.04±.011	.05	5.0±.79
M^3	anteroposterior	6	.6-.7	.71±.016	.04	5.6±1.60
	width metaloph	6	.7-1.0	.90±.033	.08	8.8±2.25
dP_4	anteroposterior	2		.77		
	width hypolophid	2		.70		
P_4	anteroposterior	7	.6-.7	.67±.019	.05	7.5±2.00
	width hypolophid	7	.6-.7	.70±.016	.04	5.7±1.52
$M_{1 or 2}$	anteroposterior	23	.7-1.0	.83±.010	.05	6.0±.88
	width metalophid	23	.8-1.0	.91±.010	.05	5.7±.87
M_3	anteroposterior	10	.6-.8	.73±.013	.04	5.5±1.22
	width metalophid	10	.7-1.0	.79±.016	.05	6.3±1.40

Discussion. As Galbreath (1953, p. 98) and Wilson (1960, p. 78) have pointed out, it has become increasingly difficult to fit the early Miocene species of heteromyids into the present definitions of the known genera, *Heliscomys, Mookomys,* and *Proheteromys.* As more material becomes known, there is an increasing overlap in size and occlusal pattern between species assigned to these three genera.

Galbreath (1953, pp. 63-65) has clearly demonstrated a considerable range of structural variation in the dentition of *Heliscomys vetus* from the Orellan of Colorado; and, if the Thomas Farm sample of *P. floridanus* described here is truly representative of a single species, this range of variation, particularly in the premolars, would appear to be true for the genus *Proheteromys.* Wilson (1960, pp. 75-79) found the same variation in specimens from the Martin Canyon Quarry A local fauna. Aside from several larger heteromyid specimens which he believes represent a species close to *P. magnus,* he discusses three smaller populations which he refers to *Proheteromys, Florentiamys?,* and *Mookomys.* In his discussion, he has assigned the more extreme variants in his sample to *Florentiamys?* and *Mookomys,* and the bulk of the material to *P. sulculus.* As a result, the structural variation found in *P. sulculus* is rather small compared to that in *P. floridanus.* However, if the five specimens referred to *Mookomys* sp. cf. *M. formicorum* and the single upper molar referred to *Florentiamys?* sp. were considered as variants of *P. sulculus* (a possibility which Wilson acknowledges in both cases), the variation in the Colorado species and in *P. floridanus*

would be of a similar degree and would parallel the variation seen in *Heliscomys vetus*. If these early Miocene species are as variable as the samples of *P. floridanus* and *P. sulculus* may indicate, then, it would be almost impossible to distinguish species of *Proheteromys* from those of *Mookomys*.

The other species of *Proheteromys, P. parvus* and *P. matthewi* (excepting *P. magnus* which is clearly distinct), are known from such fragmentary material that their relationship to *P. floridanus* and *P. sulculus* cannot be determined.

P. floridanus closely resembles *P. sulculus* but differs from the Colorado species in being somewhat smaller and in possessing the median arm on P_4. The new material shows that *P. floridanus* is not as heteromyine in structure as Wood (1932, 1935) believed. This fact would support Wilson's belief (1960, p. 78) that the Heteromyinae and Perognathinae are not separable in the early Miocene and that *Proheteromys* in a broad sense could be structurally ancestral to both subfamilies.

Proheteromys magnus Wood

Figure 5

Proheteromys magnus Wood 1932, p. 46; 1935, p. 168; 1947, p. 490.

Type. F.S.G.S. V-5332, LP^4.

Hypodigm. Type and LdP^4-F.S.G.S. V-5336; RdP^4-F.S.G.S. V-6018; RP^4-M.C.Z. No. 7138; LM^{1or2}-F.S.G.S. V-6025; LP_4-F.S.G.S. V-6024; $RM_{1\,or\,2}$-F.S.G.S. V-5333, V-6022; $LM_{1\,or\,2}$-F.S.G.S. V-6023, U.F. No. 3868, M.C.Z. No. 3694.

Emended diagnosis. Largest species of genus; P^4 with single cusp on protoloph, three cusps on metaloph and a cusp-like expansion of crest from entostyle to hypocone; central valley completely bisects the upper molars; P_4 with median crest; anteroconid present on P_4; stylids small on lower molars; posterior cingulum short but prominent on lower molars.

Description. There is one deciduous upper premolar, F.S.G.S. V-6018, in the present collection which agrees in all details with one previously described for this species (Wood, 1935). There is one cusp in the anterior row and there are three in the posterior row with the central cusp being most prominent. The deciduous tooth is slightly smaller than the permanent premolar but it is probably too large to be the dP^4 of *Proheteromys floridanus*. Wilson (1960, p. 80) has described the dP^4 of a species from the Pawnee Creek formation which he believes is related

to *P. magnus*. This tooth, KU10237, displays three rows of cusps and is somewhat larger than the permanent premolar. He suggests that the tooth considered a dP^4 of *P. magnus* by Wood (1935) is too small to be the deciduous premolar of that species. It is quite true that deciduous premolars in heteromyids are generally as large as or larger than the permanent premolars. However, F.S.G.S. V-5336 and V-6018 are probably too large to be the deciduous premolars of *P. floridanus* and there is no other species known from the Florida Miocene with which they could be associated.

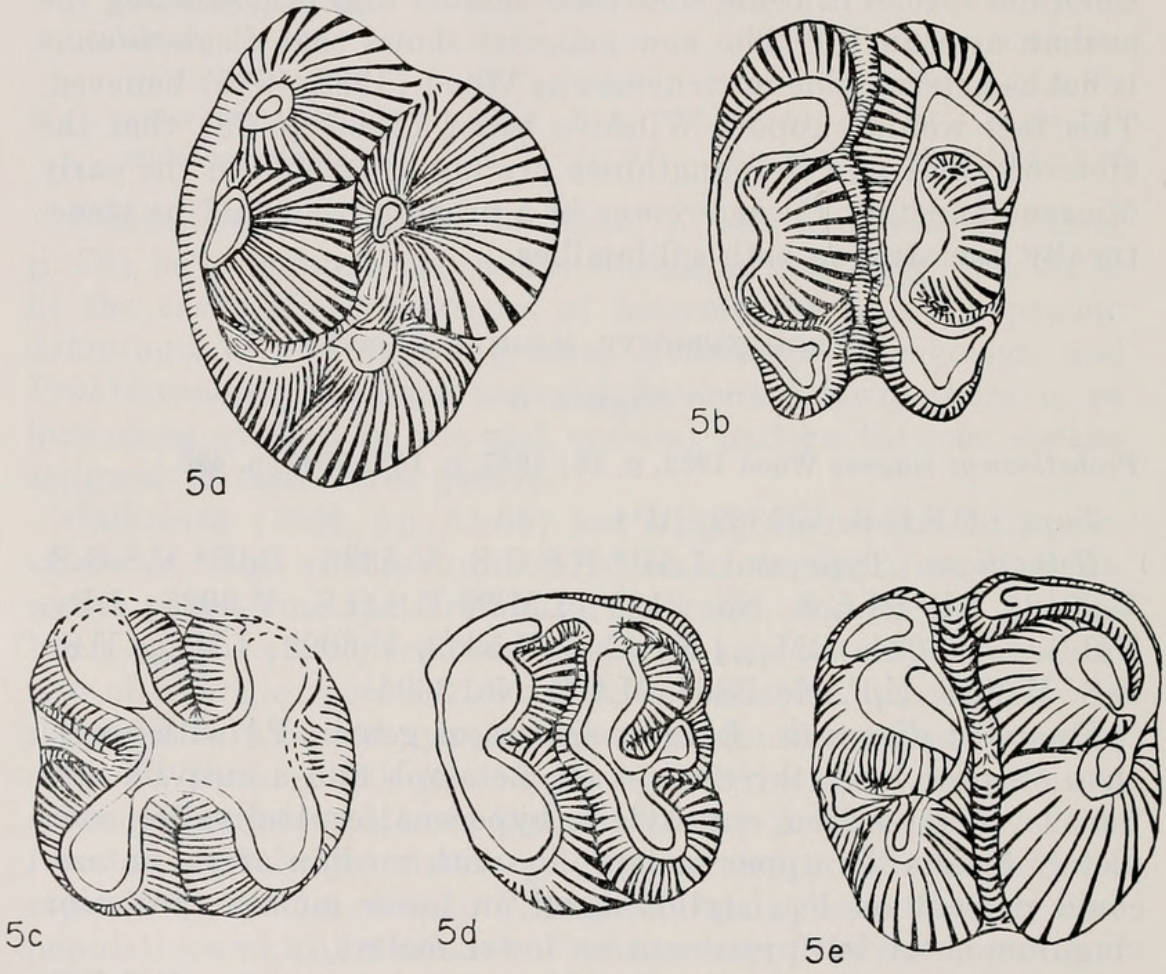

FIG. 5. *Proheteromys magnus*, all approximately x20. 5a. M.C.Z. No. 7138, RP^4. 5b. F.S.G.S. V-6025, $LM^{1 or 2}$. 5c. F.S.G.S. V-6024, LP_4. 5d. F.S.G.S. V-6022, $RM_{1 or 2}$. 5e. U.F. No. 3868, $LM_{1 or 2}$.

The anteroloph of the permanent premolar is composed of one cusp and the posterior loph of three large cusps and an expanded crest between the entostyle and the hypocone. I agree with Wilson's (1960, p. 79) interpretation of these cusps and

can state that the P^4 of *P. magnus* is not five cusped as Wood (1932, 1935) thought. The entostyle has moved forward and lies closer to the protocone than the hypocone but it is more strongly connected to the latter than to the protocone. The crest from the entostyle to the hypocone is expanded and somewhat cusplike. There is no ridge from the protocone to the base of the crown as there is in *Proheteromys* sp. cf. *P. magnus* from Colorado.

Both the anterior and posterior cingula are extremely narrow on the first and second upper molars, much more so than in *P. floridanus*. These teeth also differ from those in *P. floridanus* in that the central valleys pass completely across the crowns and are open both buccally and lingually. The cingular crests are short and narrow and converge toward the central cusps on both the anterior and posterior lophs. The central cusp of each loph is large while the buccal and lingual cusps are smaller and anteroposteriorly compressed.

There is one P_4 in the present collection but the enamel is severely damaged and missing from the tips of all the cusps and along the midline of the tooth. An attempt has been made in Figure 5c to reconstruct the probable crown pattern but the shape and position of the median crest is somewhat doubtful. Four principal cusps were certainly present together with a small anteroconid and a low, narrow ridge running from the base of the entoconid backward to the posterior edge of the tooth. The buccal and lingual valleys are both deep and buccally a high enamel wall is preserved connecting the hypoconid and mesoconid towards the midline of the crown. This enamel wall is missing at the internal end of the lingual valley but was probably present before the tooth was damaged. It would appear therefore that a broad median crest connected the anterior and posterior lophids as in *Perognathus* and *Cupidinimus*. This median lophid was probably considerably stronger than that seen in *P. floridanus*.

The additional lower first or second molars add little to the descriptions already given by Wood. The anterior and posterior lophids are completely separated for most of the crown height by a deep central valley. On both lophids the stylids are very small. There is a prominent but short posterior cingulum between the hypoconid and entoconid which fuses with the bases of these cusps and cuts off a small basin between them.

Measurements

	a-p	tr.
dP^4	1.6	1.4
P^4	1.8	2.1
$M^{1 or 2}$	1.5	1.8
P_4	1.4	1.4
$M_{1 or 2}$	1.6, 1.6, 1.4	1.6, 1.6, 1.5

Discussion. The additional material of both *P. magnus* and *P. floridanus* makes it clear that these two species, and probably the genus as presently defined, cannot be assigned to any of the three living subfamilies with any degree of accuracy. Structurally they are somewhat more advanced than the species of *Heliscomys* but there are no observable trends leading towards the specializations seen in the Heteromyinae, Perognathinae, or Dipodomyinae. This lack of specialization is perhaps more apparent in *P. floridanus* than in *P. magnus* but the latter is still inadequately known and the range of structural variation in the premolars of *P. magnus* may prove to be as great as that in *P. floridanus*. It would appear that *P. magnus* is nothing more than a large heteromyid with essentially the same molar structure as in *P. floridanus*.

Wilson (1960, p. 80) has suggested an entoptychine relationship for *P.* sp. cf. *P. magnus* and hence has implied the same possible relationship for the Florida species. The entoptychine genera *Entoptychus, Gregorymys* and *Grangerimus* are first much higher crowned than is *P. magnus* and secondly both the upper and lower premolars are much more complex than are those of *P. magnus*. The other entoptychine genus, *Pleurolicus*, has high crowned cheek teeth, but the premolars are not as complex as in the other genera of the subfamily and approach more closely the condition seen in *P. magnus* although there is still a considerable difference between the two. The species of *Pleurolicus* are for the most part older than *P. magnus*. A common Oligocene ancestry for *Pleurolicus* and *Proheteromys magnus* is possible. However, in view of the great structural similarity between *P. magnus* and *P. floridanus*, I would hesitate in placing *P. magnus* in the Entoptychinae on the basis of size alone.

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