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**TWO PLEISTOCENE MAMMALIAN FAUNAS**  
**FROM**  
**ALACHUA COUNTY, FLORIDA**

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## TWO PLEISTOCENE MAMMALIAN FAUNAS FROM ALACHUA COUNTY, FLORIDA

ROBERT S. BADER<sup>1</sup>

One of the most varied and abundant faunas of Pleistocene vertebrates is found on the peninsula of Florida. This fauna has been studied in the past chiefly by Leidy, Sellards, Hay, and Simpson. However, little has been added in published form to our knowledge of Pleistocene mammals since the work of Simpson in the early 1930's. Vertebrate paleontological activity in the state is greater now than it has been for many years, and it is to be hoped that it will continue unabated for many years to come. Activation of the fossil vertebrate collection at the University of Florida has been an important step in the revitalization of this field of study in the state.

Two assemblages of mammals from new Pleistocene localities have been recently studied by the author; a preliminary report is presented here.

### ARREDONDO

Solution channels, pits, and sinkholes in the Ocala Limestone are among the most dominant of the topographic features in north-central Florida. These depressions have been receiving freshwater sediments, at least periodically, since the Lower Miocene. Although the stratigraphic sequence may vary considerably, even in closely adjacent basins, the general outlines of the Pleistocene sequence in the area embracing Marion, Alachua, and Levy Counties emerge with some clarity. The most superficial deposit is commonly a porous, brownish-red clayey sand—possibly representing a marine terrace—almost completely barren. It lies unconformably on an orange and blue sandy clay, which is frequently very fossiliferous. The clay is interrupted locally by a band of nearly pure, white or pink, quartz sand, which is generally a few inches thick and barren. The clay lies unconformably on the Ocala Limestone. In many places the clay is absent, in which case the contact is between the red sand and the underlying Ocala.

A rather extensive collection of Pleistocene vertebrates has been made in fissures and channels in the Ocala Limestone near Arredondo, approximately four miles southwest of Gainesville, Alachua County,

<sup>1</sup>The work reported on here was performed while the author was serving as curator in vertebrate paleontology, University of Florida Collections, and as Assistant Professor of Biological Sciences, University of Florida, Gainesville. Currently he is Assistant Professor of Zoology, University of Illinois, Urbana. Manuscript received 20 August 1956.—Ed.

on State Highway 24. The Levy County Lime Rock Corporation has excavated two large pits in the area, exposing the depressions laterally. The pits are in SE¼ sec. 22, T. 10 S., R. 19 E., 4.2 miles from the intersection of U.S. Highway 441 and State Highway 24 in southwest Gainesville. Pit I is just north of Highway 24; Pit II is a few hundred yards south of the first and south of the highway and the tracks of the Seaboard Airline Railroad. The most important single locality, particularly for the larger mammals, is a nearly vertical fissure extending at least 15 feet below the surface in the center of the north face of Pit I. The lower part of the exposed portion of the fissure was filled with the highly fossiliferous orange and blue clay described above. Eroded boulders of the Ocala Limestone were common in the clay filling, which was bounded below by an unfossiliferous quartz sand. This fissure is referred to as locality "B" by Auffenberg (MS). A detailed account of the stratigraphy of the area is given by Brodkorb (in press). The fossiliferous clay is his Stratum No. 2. The following mammalian species have been identified, 41 percent of which are extinct:<sup>2</sup>

#### Marsupialia

*Didelphis marsupialis*

#### Insectivora

*Scalopus aquaticus*

*Blarina* cf. *B. brevicauda*

#### Chiroptera

*Myotis* cf. *M. austroriparius*

#### Rodentia

*Sciurus* cf. *S. carolinensis*

*Geomys pinetis*

*Peromyscus* sp.

*Neotoma floridana*

*Pitymys pinetorum*

†*Synaptomys australis*

*Neofiber alleni*

#### Lagomorpha

*Sylvilagus* sp.

#### Carnivora

*Euarctos* sp.

†*Aenocyon ayersi*

#### Edentata

†*Dasypus bellus*

#### Proboscidea

†*Mammut americanum*

#### Perissodactyla

†*Tapirus veroensis*

†*Equus* sp.

#### Artiodactyla

†*Mylohyus* cf. *M. gidleyi*

†*Tanupolama mirifica*

†*Tanupolama* cf. *T. americana*

*Odocoileus virginianus*

<sup>2</sup>Some of the extant species are in the collection of James H. Gut, Sanford, Florida, and were identified by him.

In addition to the mammals the area has yielded a large number of amphibian, reptilian, and avian species. The birds have been studied by Brodkorb (in press), the herpetofauna by Auffenberg (MS.). Most of the mammalian remains at Arredondo—and also at Hornsby Springs, as discussed later—do not add appreciably to our knowledge of the several species and are simply recorded here. The more important finds are discussed below.

*Mylohyus* cf. *M. gidleyi* Simpson

The most complete remains of an individual mammal at Arredondo are those of a peccary found in Pit II. The articulated skeleton was discovered in the orange and blue clay near the northwest corner of the pit. A veneer of indurated quartz sand covered many of the bones and also served to hold the pedal elements in place. The specimen, a young adult, was discovered and collected by Pierce Brodkorb. The upper dentition includes the left incisors, right and left canines, and the entire cheek dentition with the exception of the right  $P_3$ . Only small fragments of the anterior dorsal part of the skull were found. The lower jaw is completely preserved; however, the left  $P_2$  and three incisors are missing from the dentition. Almost the entire postcranial skeleton is present including the carpals, tarsals, metapodials, and most of the phalanges.

The specimen (Florida Geological Survey V-5691) can be assigned unequivocally to *Mylohyus*, but its specific reference within that genus is less certain. As regards the size relationship with reasonably similar species, it falls within the acceptable range of *M. exortivus*, *M. pennsylvanius*, and *M. browni*, being slightly larger than the first and smaller than the latter two. However, it is separable from *M. exortivus* and *M. pennsylvanius* on the basis of markedly different proportions throughout most of the dental series and on the character of the  $P_2$ . It resembles the latter in the development of the  $M_3$ . *M. browni* is characterized by an extremely long snout, the diastema between the lower canine and the cheek teeth measuring 89 mm. in the type. The diastema in FGS V-5691 is 69 mm. in length. There are other differences, including the nature of the  $M_3$ .

The specimen is provisionally referred to *M. gidleyi*, described by Simpson (1929a) from Seminole Field, Florida. It is approximately 10 percent larger than the type of *M. gidleyi*, a not uncommon relationship between members of the same species. The inferior molar proportions and the character of the  $P_2$  are quite similar in the two—the type of *M. gidleyi* consists of the inferior dentition only. The

accessory cusps are better developed than in *M. gidleyi*, and while cingula are nearly absent internally and externally, as in the Seminole Field form, they are developed along the anterior and posterior margins of the cheek teeth. The heel of the  $M_3$  consists of two subequal cusps arranged in tandem and a much smaller cuspule wedged externally between the more anterior of the two and the hypoconid. The heel of the  $M_3$  of the Seminole Field type possesses an anteroexternal and posteroexternal cusp and a small posteroexternal cuspule. The two differ to some extent in this trait which has usually been considered to be of taxonomic importance. However, this appears to be an extremely variable character in *Mylohyus*, as is frequently the case with the terminal members of a dental series, and has probably been over-emphasized in taxonomic studies of the genus.

The larger median upper incisor is separated from the smaller lateral incisor by a diastema of 3 mm. The inferior canines are bounded by three planes, not four as in the type of *M. tetragonus*. The superior

TABLE 1  
DENTAL DIMENSIONS OF THE ARREDONDO PECCARY, FGS V-5691

	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>	M <sub>1</sub>	M <sub>2</sub>	M <sub>3</sub>	TCS
L	9.3	11.6	13.6	15.0	15.7	15.8	80.5
AW	7.5	10.3	12.4	13.7	14.6	12.5	—
PW	6.6	10.3	12.0	12.7	13.2	9.8	—
	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>	M <sub>1</sub>	M <sub>2</sub>	M <sub>3</sub>	TCS
L	9.3	11.7	13.4	14.9	15.6	19.8	84.6
AW	5.0	8.7	12.0	13.7	14.0	12.7	—
PW	5.2	8.4	11.2	12.1	13.1	10.9	—

Mandible length (from the posterior border of the alveolus of the median incisor to the condyle) .....	244
Diastema length (between the canine and the P <sub>2</sub> ) .....	69
Symphysis width (minimum) .....	20
Ramus height (the vertical distance between the dorsal border of the coronoid process and the ventral border of the ramus) .....	86
Mandible height (the vertical distance between the dorsal and ventral mandibular borders at the protoconid of the M <sub>1</sub> ) .....	36

L is length; AW, anterior width; PW, posterior width; and TCS, total check series. All measurements are in millimeters.

and inferior dentitions are shown in figure 1; the dimensions are given in table 1.

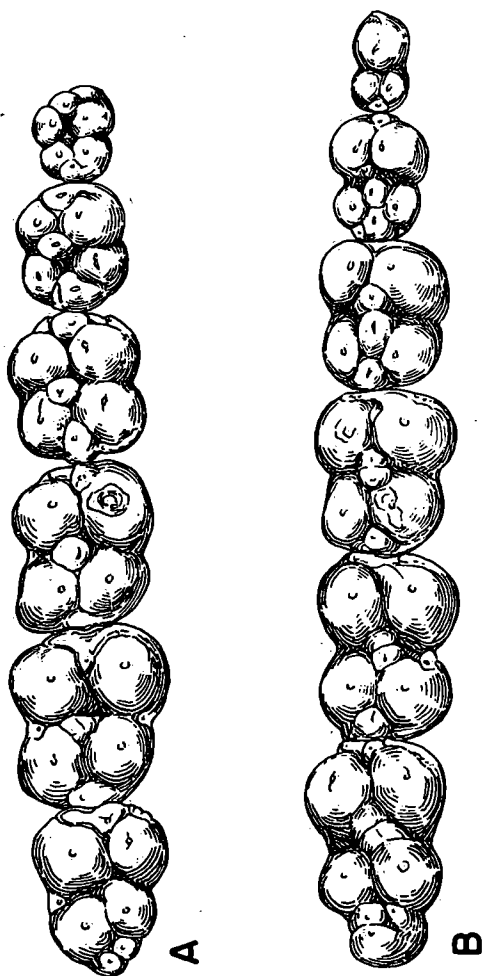
The classification of peccaries has been based largely on the size and shape of the dental cusps, both of which are extremely variable as pointed out by Brown (1908). The proportions of the cheek teeth also appear to vary considerably more than in most living or extinct mammals. Five species of *Mylohyus* have been recognized in Florida from rather fragmentary remains, a number which would probably be reduced if more extensive material were available.

A detailed comparison of the postcranial skeleton with *Platygonus* and the living peccaries must await the acquisition of adequate comparative material. The manus and pes are similar to those figured by Brown (1908). The pes includes metatarsal II, which is much smaller than metacarpal II, and the proximal phalanx. There is no evidence of metatarsal V.

### *Tanupolama* Stock

A considerable amount of camel material was collected at fissure "B" in Pit I. Tapir and horse teeth as well as a nearly complete skeleton of *Alligator mississippiensis* were found in the same depression. The camel dentitions include a right maxilla with  $P^4-M^3$ , associated right and left  $M^{1-3}$ , associated left  $M^{2-3}$ , an incomplete left mandible with  $P_3-M_3$  (fig. 2), associated left  $M_{2-3}$ , the symphyseal region of a mandible with  $I_{1-3}$  and the canines of both sides, and several isolated teeth. A large fragment of a skull roof including the inner rims of the orbits is present. The postcranial elements include two cervical vertebrae, the proximal end of a humerus, a tibia, metatarsals, and several phalanges.

Most of the teeth agree well with those of *Tanupolama mirifica*, described by Simpson (1929a) from Seminole Field. The associated  $M^{1-3}$  of both sides (UF 1579) are somewhat larger than the others in their elongate dimensions but are otherwise similar. One of the isolated teeth (UF 1582), a left  $P_4$ , is almost identical in size and character to that figured by Simpson (1929a:597) and tentatively referred by him to *Tanupolama americana*. Two complete metatarsals, perhaps belonging to the same individual, have a length/width ratio of 10.5, compared to 7.6 reported by Simpson (1929a) for *T. mirifica*, and 14.5 for *T. stevensi* (Stock, 1928). The association of camelid remains at Arredondo parallels that at Seminole Field in a striking fashion, i.e., the occurrence of several teeth referable to *T. mirifica*, a  $P_4$  close to that of *T. americana*, and metatarsals stouter than those known in





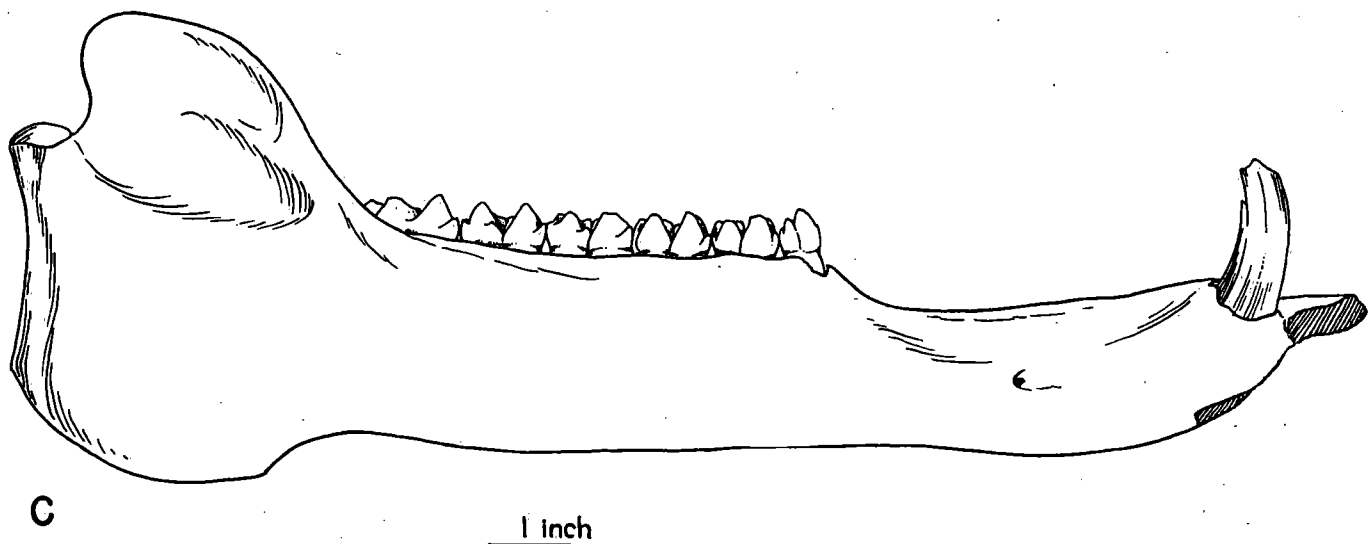


Figure 1.—Occlusal view of (A) the left upper cheek teeth and (B) the right lower cheek teeth of *Mylohyus* cf. *M. gidleyi*, and (C) a lateral view of the right mandible of the same individual (FGS V-5691).

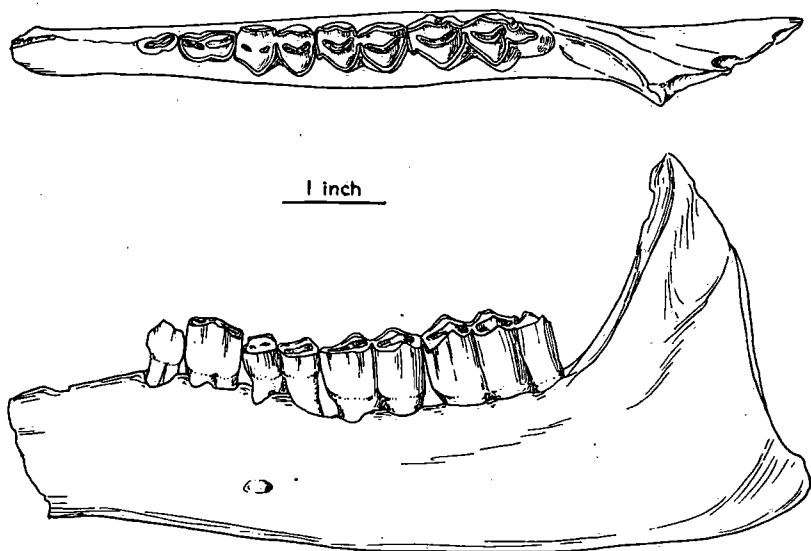


Figure 2.—Occlusal and lateral views of the left inferior dentition of *Tanupolama mirifica* (UF 1093) from Arredondo. The  $P_3$  is present in the known representatives of *Tanupolama mirifica* but variable in the genotypic species, *T. stevensi*.

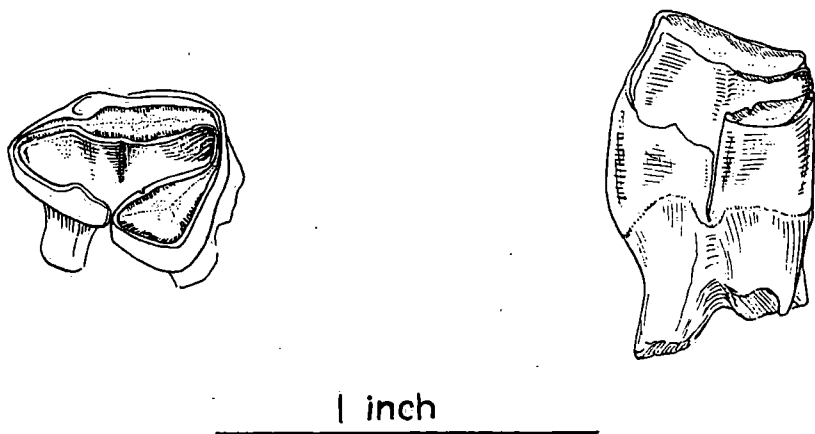


Figure 3.—Crown and medial views of the left  $P_3$  of *Tanupolama mirifica* (MCZ 17816) from Melbourne, Florida.

*Tanupolama*, more closely approaching those of *Camelops*. This second occurrence of *Tanupolama* teeth and robust metatarsals lends support to the hypothesis that animals with teeth as similar as *T. mirifica* and

*T. stevensi* possessed metatarsals that differed considerably in dimensions and proportions, although the matter must remain conjectural until a more positive association is found. It should also be noted that the Arredondo metatarsals resemble those from California more closely than do those from Seminole Field. The  $P_4$  (UF 1582) differs considerably from the known homologues in *T. mirifica* and it is tentatively referred to *T. americana*. It is possible that this tooth may belong with some of the larger molars; however, none are certainly assignable to that species at the present time. Dental statistics of a series of teeth available from Melbourne, Paynes Prairie, Ichatucknee Springs, and Hornsby Springs, as well as Seminole Field and Arredondo are presented in table 2. The upper teeth appear to be more variable than is usual for mammalian species, insofar as conclusions can be drawn from this limited sample. Almost certainly the sample is not completely contemporaneous, the variation including a vertical as well as a horizontal component. The dental dimensions reported by Stock (1928) for *T. stevensi* were also rather variable.

After the discovery of an upper dentition of *T. mirifica* from Ichatucknee Springs which included a  $P^3$  with a complete inner lobe, Simpson (1932) questioned whether the Florida species should be included within the genus *Tanupolama*. This tooth is not represented in the Arredondo material; however, a  $P^3$  in the Harvard collection (MCZ 17816), obtained by C. P. Singleton in 1928 from Melbourne, sheds some additional light on the problem. The tooth (fig. 3) is similar in size and shape to those known in *T. mirifica*, but its inner crescent is incomplete. A thin lamina, forming the anterior third of the inner crescent, is separated from a well-developed posterior lobe by an exceedingly narrow vertical cleft which extends essentially to the enamel base. Fusion across this cleft would result in a tooth of the type known in *T. mirifica*. Furthermore, since the presence of several of the teeth is highly variable in the genus as defined by Stock (1928)—there may be a disparity of eight in the entire dentition—the exclusion of the Florida forms because of the development of the inner lobe of the  $P^3$  would seem to be unjustified, particularly since this condition appears to be variable in the species.

#### HORNSBY SPRINGS

A collection of fossil vertebrates has been obtained from Hornsby Springs, which is located in the northwestern part of Alachua County. The Springs is in the SW  $\frac{1}{4}$  sec. 27, T. 7 S., R. 17 E., 1.8 miles north and 0.9 miles east of the town of High Springs. The spring run empties,

TABLE 2

DENTAL STATISTICS OF *Tanupolama mirifica* FROM SEVERAL LOCALITIES IN  
PENINSULAR FLORIDA (SEE TEXT)

	Sample size	Observed range	Mean	Standard deviation	Coefficient of variation
P <sup>3</sup> L	3	13.4-14.5	14.07	—	—
P <sup>3</sup> W	4	11.2-12.3	11.88	—	—
P <sup>4</sup> L	4	14.6-18.3	16.50	—	—
P <sup>4</sup> W	4	15.6-16.7	15.98	—	—
M <sup>1</sup> L	6	19.3-25.6	21.75 ± .94	2.30 ± .66	10.57 ± 3.05
M <sup>1</sup> AW	6	18.2-23.3	20.52 ± .70	1.72 ± .50	8.38 ± 2.42
M <sup>1</sup> PW	6	18.5-22.3	20.08 ± .64	1.57 ± .45	7.82 ± 2.26
M <sup>2</sup> L	10	23.7-29.4	25.92 ± .59	1.85 ± .41	7.14 ± 1.60
M <sup>2</sup> AW	9	20.0-23.1	21.76 ± .40	1.20 ± .28	5.51 ± 1.30
M <sup>2</sup> PW	10	18.5-21.5	20.17 ± .46	1.00 ± .22	4.96 ± 1.11
M <sup>3</sup> L	8	22.3-27.4	25.64 ± .65	1.85 ± .46	7.22 ± 1.81
M <sup>3</sup> AW	8	19.6-22.6	21.65 ± .41	1.17 ± .29	5.40 ± 1.35
M <sup>3</sup> PW	8	16.1-19.5	18.31 ± .39	1.09 ± .27	5.95 ± 1.49
P <sub>3</sub> L	1	—	10.3	—	—
P <sub>3</sub> W	1	—	4.8	—	—
P <sub>4</sub> L	4	14.0-16.9	15.28	—	—
P <sub>4</sub> W	4	8.9- 9.7	9.15	—	—
M <sub>1</sub> L	4	19.8-22.5	21.10	—	—
M <sub>1</sub> AW	4	12.7-14.3	13.78	—	—
M <sub>1</sub> PW	4	13.4-15.0	14.43	—	—
M <sub>2</sub> L	8	23.7-27.3	25.75 ± .47	1.32 ± .33	5.13 ± 1.28
M <sub>2</sub> AW	8	14.3-16.4	15.63 ± .25	0.72 ± .18	4.61 ± 1.15
M <sub>2</sub> PW	8	14.3-16.4	15.43 ± .21	0.59 ± .15	3.82 ± 0.96
M <sub>3</sub> L	4	31.8-36.0	33.15	—	—
M <sub>3</sub> AW	4	14.5-15.8	15.13	—	—
M <sub>3</sub> PW	4	14.0-15.5	14.63	—	—

L is length; W, width; AW, anterior width; and PW, posterior width. All measurements are in millimeters.

after a short distance, into the Santa Fe River. Vertebrate material has been obtained from the bed of the run as well as from the spring bottom, but principally from the latter. A narrow opening in one side of the limestone depression opens into a large cavernous room known to extent at least 100 feet from the opening. Several of the most important finds, including the tapir and giant armadillo material described below, have been made in the muck on the floor of this cavern. The spring, approximately 60 feet deep, issues from the Ocala Lime-

stone. Contemporaneity of specimens found in the spring is, of course, impossible to determine. The species list, however, contains no form which has been found in the pre-Pleistocene deposits of Florida. Eight of the ten species became extinct in North America in pre-Columbian times. The following mammalian species have been identified:

## Rodentia

*Neofiber alleni*

## Carnivora

†*Aenocyon ayersi* (fig. 6)

## Edentata

†*Paramylodon harlani*

†*Holmesina septentrionalis*

## Proboscidea

†*Mammut americanum*

†*Mammuthus* sp.

## Perissodactyla

†*Tapirus veroensis*

†*Equus* sp.

## Artiodactyla

†*Tanupolama mirifica*

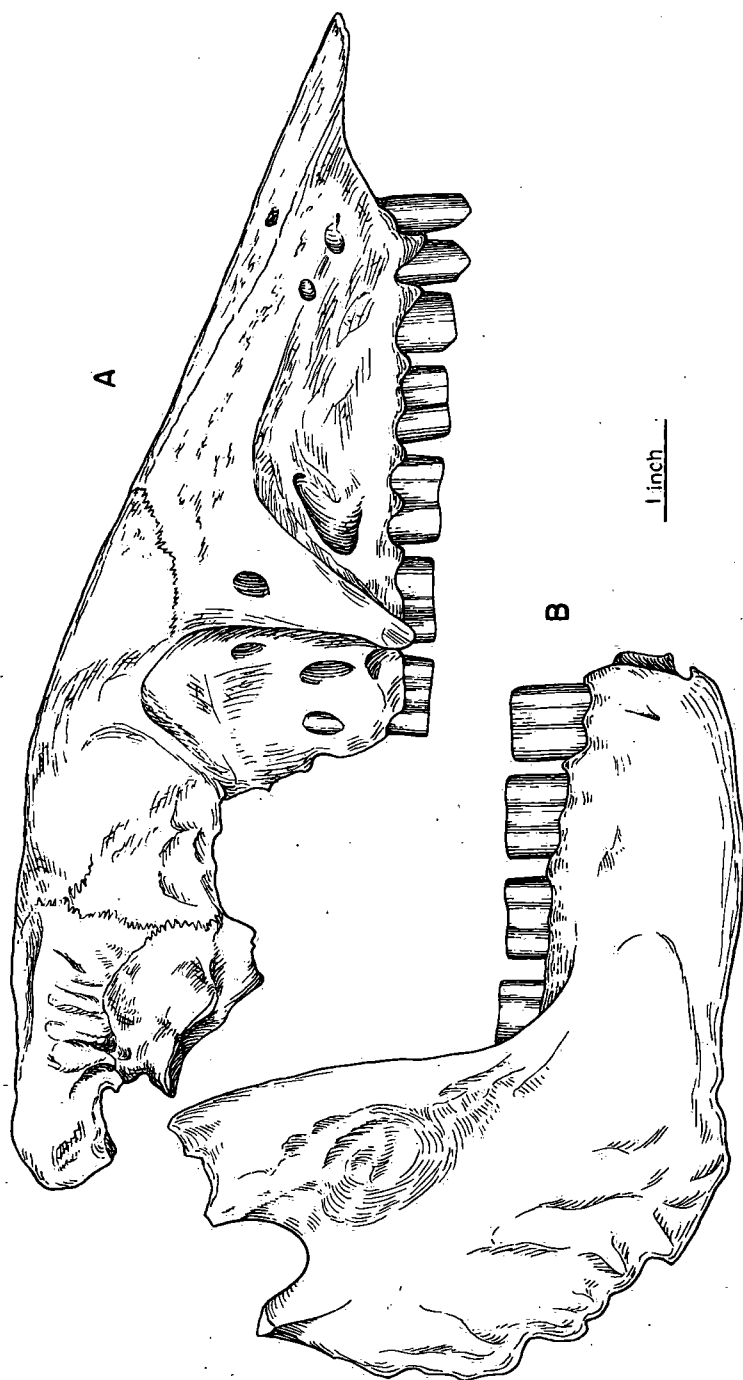
*Odocoileus virginianus*

*Holmesina septentrionalis* (Leidy)

The most welcome find at Hornsby Springs is the partial skull and associated mandible (UF 890) of the giant armadillo, *Holmesina septentrionalis* (figs. 4 and 5). The only skull material previously reported in this genus from Florida is that by Simpson (1930)—a right premaxilla and associated left maxilla from Manatee County.

The skull is lacking principally the premaxillae, the zygomatic arches, the occipital region, and the entire ventral region posterior to the eighth tooth. Teeth two through eight are present on both sides (the third on the left side is broken) and, in addition, the anterior walls of the ninth alveoli are preserved. The bilobate fifth, sixth, seventh, and eighth teeth are almost identical to those described by Simpson (1930). The fourth has a single groove internally; the groove is but slightly developed on the external surface which is nearly flat except for the rounded terminal parts. The third is unevenly convex externally; a faint groove is present internally. The second is biconvex in cross section and incisiform in appearance. In the second, third, and fourth teeth the distal end of the posterior margin has been obliquely truncated by occlusion with the mandibular teeth. In the second and third the axis of the tooth forms an acute angle with the long axis of the skull, more markedly so in the former. There is a progressive size increase from the second through the sixth tooth.

The lateral aspect of the maxillo-premaxillary suture begins above



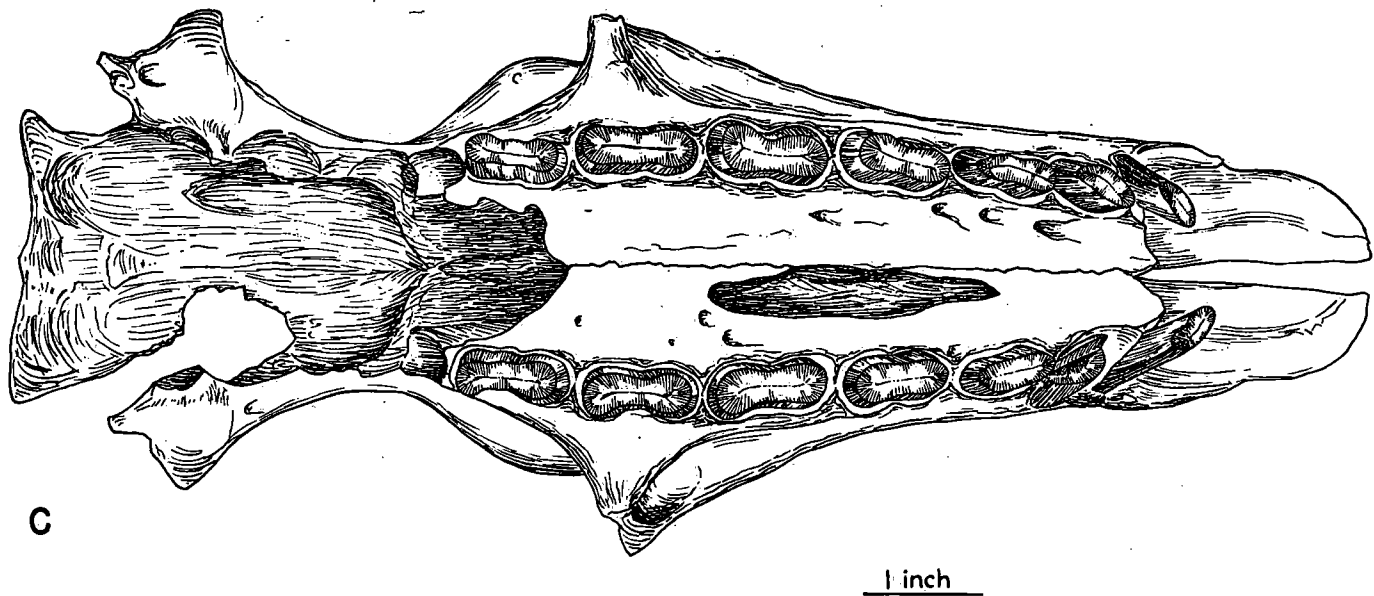
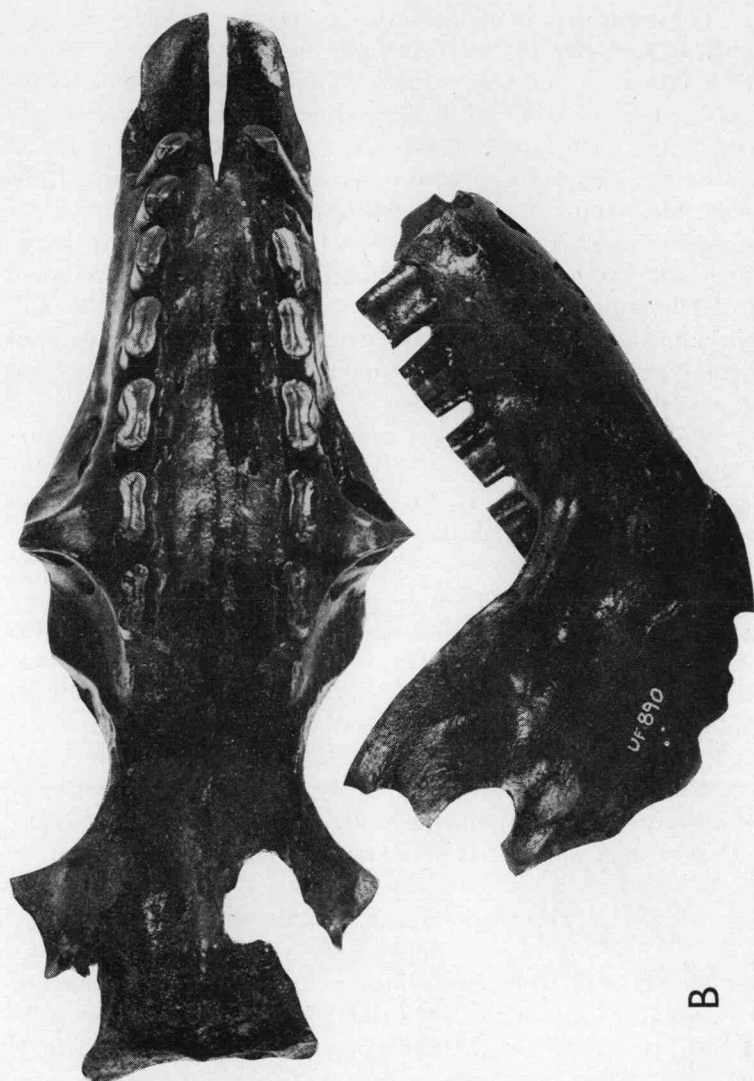


Figure 4.— (A) Lateral and (C) palatal views of the skull of *Holmesina septentrionalis* (UF 890) from Hornsby Springs. (B) Lateral view of the mandible of the same individual.







B

Figure 5.—(A) Lateral view of the skull and medial view of the mandible, and (B) palatal view of the skull and lateral view of the mandible of *Holmesina septentrionalis* (UF 890).

the middle of the second tooth and curves in an anterodorsal direction, terminating at a point slightly anterior to the position of the first tooth. The anterior wall of the second alveolus is formed by the premaxilla. The ventral part of the suture is not preserved. The zygomatic arch arises above the seventh tooth and possesses a prominent sinus as described by Simpson (1930). The infraorbital canal commences above the anterior end of the eighth and exits above the posterior end of the sixth tooth. There is no postorbital bar—present in glyptodonts, but absent in armadillos—the posterior margin of the orbit being marked by a ridge extending posteroventrally from the moderately-developed supraorbital crest. The sagittal crest is prominent; the nuchal crest has largely been obliterated by postdepositional erosion. There is a rather sharp break in the dorsal outline of the skull at a point immediately in front of the parieto-frontal suture, the dorsal surface being nearly horizontal posterior to this point while inclined at about a 45 degree angle anteriorly.

The mandible, found a few feet from the skull, probably belongs to the same individual. The preserved portion includes only the region posterior to the fourth tooth. The posterior wall of the fourth alveolus, and the fifth through the ninth teeth are present—the ninth is broken. The posterior border of the jaw angle is chipped in several places and the tip of the coronoid process is absent. The jaw and included teeth differ in no important way from those previously reported from Florida by Sellards (1915) and Simpson (1930). The canal on the inner posterior face of the ramus, present in Sellard's but absent in Simpson's material, is present here.

Various dimensions of the skull, mandible, and teeth are given in table 3. The dental dimensions are closely similar to those previously given by Sellards and Simpson, the individual here described being slightly smaller than those heretofore known from Florida.

#### *Tapirus veroensis* Sellards

The tapir material from the springs includes three well-preserved dentitions: a left maxilla with P<sup>1</sup>-M<sup>2</sup> (UF 886), a left maxilla with P<sup>1</sup>-M<sup>2</sup> (UF 885), and a palate with the alveoli of the right I<sup>1-2</sup>, right I<sup>3</sup> (broken) and P<sup>1</sup>-M<sup>2</sup> of both sides (UF 888). In the latter only a faint depression is present in the region normally occupied by the right canine alveolus; the left side is missing in this area. The specimens have a rather heavy black coating, probably of an iron compound.

The three dentitions clearly belong to the species described by Sellards (1918) from Vero Beach, *Tapirus veroensis*. The dental

TABLE 3

SKULL AND DENTAL MEASUREMENTS (IN MILLIMETERS) OF *Holmesina septentrionalis* (UF890) FROM HORNSBY SPRINGS, FLORIDA

Skull measurements	
Skull length (from tip of nasals to nuchal crest) .....	305
Nasal length (at midline) .....	140
Frontal length (at midline) .....	96
Skull width (at 2nd tooth) .....	55
Skull width (at supraoccipital crests) .....	94
Palate width (between inner rims of alveoli of 7th teeth) .....	33
Dental row length (from anterior edge of 2nd to posterior edge of 8th tooth) .....	138

Lengths of upper teeth		Lengths of lower teeth	
2 .....	10.8	5 .....	19.4
3 .....	12.8	6 .....	20.8
4 .....	14.8	7 .....	21.0
5 .....	18.7	8 .....	19.7
6 .....	21.3		
7 .....	21.3		
8 .....	18.6		

dimensions and their ratios are given in table 4. All the dimensions and ratios fall either within or only slightly above the observed ranges as reported by Simpson (1945) from a Seminole Field sample. The type specimen, measured from a cast, is somewhat smaller than the Hornsby Springs forms.

The  $P^1$  is the most variable of the cheek teeth in proportions. The  $P^1$  of UF 888 is similar in outline to the type of *T. veroensis* while that of UF 886, more molariform in appearance, approaches the type of *T. copei*, although the latter is considerably larger. The cheek teeth of the type of *T. veroensis* possess a tubercle between the paracone and metacone on the outer face, and between the protocone and hypocone internally. Simpson (1945) found the outer tubercle to be almost completely absent and the inner tubercle to be extremely variable in the Seminole Field tapirs. Much the same condition occurs here, both tubercles being rather variable in expression and incidence.

Simpson<sup>2</sup> (1945) suggests that more than one species of tapir may be present in the Florida Pleistocene, an idea based primarily on certain lower cheek teeth whose dimensions fall outside the standard range of the *T. veroensis* sample from Seminole Field. Almost all the tapirs from Seminole Field, as well as the specimens (primarily

TABLE 4

DENTAL DIMENSIONS AND RATIOS OF *Tapirus veroensis* FROM HORNSBY SPRINGS, FLORIDA

LINEAR DIMENSIONS				AW			
	Sample size	Observed range	Mean		L		
P <sup>1</sup> L	3	18.0-20.7	19.63	P <sup>1</sup>	3	0.81-0.98	0.91
P <sup>1</sup> W	3	16.8-18.7	17.73	P <sup>2</sup>	3	1.04-1.09	1.07
P <sup>2</sup> L	3	19.4-21.1	20.33	P <sup>3</sup>	3	1.19-1.25	1.21
P <sup>2</sup> AW	3	21.2-22.9	21.83	P <sup>4</sup>	3	1.22-1.29	1.26
P <sup>2</sup> PW	3	22.9-25.4	24.10	M <sup>1</sup>	3	1.11-1.14	1.12
P <sup>3</sup> L	3	20.8-21.1	20.97	M <sup>2</sup>	3	1.14-1.15	1.14
P <sup>3</sup> AW	3	24.9-26.4	25.43	M <sup>3</sup>	1	—	1.15
P <sup>3</sup> PW	3	24.5-26.5	25.33				
P <sup>4</sup> L	3	21.5-22.1	21.83				
P <sup>4</sup> AW	3	26.3-28.6	27.50				
P <sup>4</sup> PW	3	25.3-27.9	26.77				
M <sup>1</sup> L	3	22.8-24.3	23.60				
M <sup>1</sup> AW	3	25.2-27.7	26.47				
M <sup>1</sup> PW	2	22.2-25.0	23.60				
M <sup>2</sup> L	3	24.8-26.8	25.73				
M <sup>2</sup> AW	3	28.2-30.8	29.43				
M <sup>2</sup> PW	3	24.4-26.7	25.60				
M <sup>3</sup> L	1	—	26.0				
M <sup>3</sup> AW	1	—	29.9				
M <sup>3</sup> PW	1	—	24.1				

AW			
		PW	
	Sample size	Observed range	Mean
P <sup>2</sup>	3	0.89-0.93	0.91
P <sup>3</sup>	3	1.00-1.04	1.01
P <sup>4</sup>	3	1.02-1.04	1.03
M <sup>1</sup>	2	1.11-1.14	1.13
M <sup>2</sup>	3	1.14-1.16	1.15
M <sup>3</sup>	1	—	1.24

L is length; W, width; AW, anterior width; and PW, posterior width. All measurements are in millimeters.

isolated teeth) obtained from various localities in north-central Florida, are definitely assignable to a single species. A statistical treatment of all teeth now available from Florida would probably increase the variation somewhat over that reported by Simpson. One of the specimens (AMNH 2311, collected near Venice, Florida), which Simpson infers may represent a different species, consists of an M<sub>2</sub> close to the mean for *T. veroensis* and an M<sub>3</sub> just within the standard range of that species. However, the coefficients of variation for the length, anterior width, and posterior width of the M<sub>3</sub> sample from Seminole Field are 3.0, 1.5, and 2.2 respectively. Coefficients for homologous variates in a large sample of *T. terrestris* are 9.1, 6.4, and 5.4. Almost certainly the Seminole Field sample reflects to a limited extent the amount of specific variation in this tooth, an inference which must be considered in comparing single specimens.

The tapirs might be expected to show a greater variability than most mammals due to their slow evolutionary rate (Bader, 1955). This is not apparent, however, in Simpson's data for either fossil or recent species.

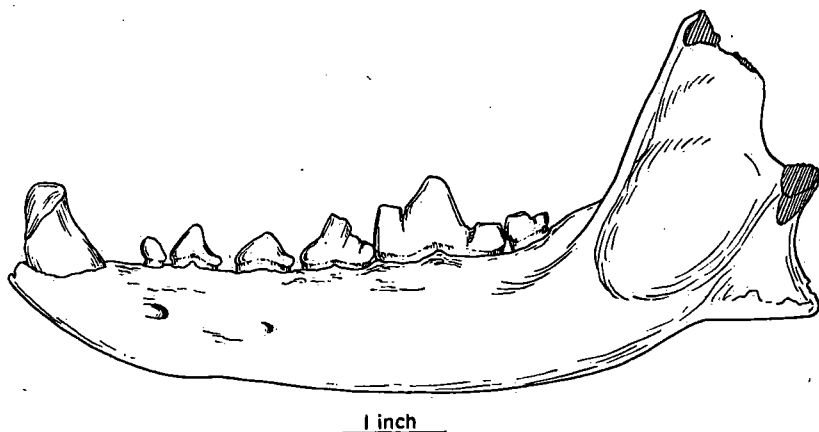


Figure 6.—Lateral view of the left mandible of *Aenocyon ayersi* (FGS V-5692) from Hornsby Springs. This is the most complete jaw reported in the species from Florida.

#### PLEISTOCENE CORRELATION

Since most of the early species lists were compilations of a probably heterochronic nature, at least lacking sufficient assurance of contemporaneity, Simpson (1929b) recognized only four faunas of the Florida Pleistocene as being of value in correlation studies. These included Vero, Melbourne, Seminole Field, and Saber-tooth Cave and were termed "test" faunas. The Reddick locality in Marion County (Gut, MS and 1939) and Arredondo could now be added to the list. The striking similarity of the well-known faunas is even more marked today than it was three decades ago when stressed by Simpson and Hay. Practically no genera and few species appear uniquely in any of these test faunas, the differences being easily accounted for by fortuitous events or by minor environmental differences. The proportion of extinct species varies from approximately 40 to 70 percent. All of the recent terrestrial mammalian genera of Florida, with the exception of *Sorex* and *Glaucômys*, are now known from the Pleistocene.

The stage or stages of the Pleistocene represented by the Florida fossils remains essentially an unsolved problem. Glacial movements, although failing to come within hundreds of miles of the state, had

as profound an effect upon Florida as on more northern regions due to oscillations in sea level. The best hope of solution of this problem, then, would seem to lie in a correlation between the fossil-bearing beds and the marine terraces. There is, however, a wide diversity of view among geologists regarding the terraces. This is expressed by MacNeil (1950) as follows: "Considerable difference of opinion therefore exists among geologists as to whether the Atlantic and Gulf terraces are of marine or subaerial origin. Moreover, there is disagreement among the principal exponents of marine origin as to how many sea levels there were and how many resultant scarps and terraces are present." With reference to the latter, Flint (1947) recognized two terraces (scarps), MacNeil (1950) and Vernon (1951) four (only three of the four are held in common), and Cooke (1945) eight. It has been generally postulated that the highest terraces are the oldest, each subsequent encroachment of the sea reaching progressively lower altitudes since shore line features would be unrecognizably eroded if subjected to a later marine inundation.

Brodkorb (in press) considers the brownish red sand at Arredondo to represent the Wicomico terrace—it is assigned to the Sangamon interglacial stage by Cooke (1945)—and allocates the underlying fossiliferous sandy clay to the Illinoian glacial stage. The correlation of the Wicomico appears to rest solely on the study of Leverett (1934), who presumably traced a gravel train in Pennsylvania, derived from Illinoian till, into sediments of the Wicomico terrace. Flint (1947) suggests that it is probable that the Illinoian valley train in this area passes beneath alluvium that is contemporaneous with the Pamlico formation. MacNeil (1950) follows Cooke's interpretation, although recognizing that no correlative evidence is available from Florida or Georgia. Flint (1942) placed the Wicomico terrace (Surry scarp) in the Sangamon but later (1947) tentatively assigned it to the Yarmouth interglacial stage. The clayey sand deposit at Arredondo is within the altitudinal limits set by both Cooke and MacNeil for the Wicomico, but it differs in color on both weathered and unweathered surfaces from the Wicomico formation as described by Cooke (1945). The question may also be raised as to whether the sand is actually of marine origin, although this is suggested by the character of the deposit itself. However, the barrenness of this stratum, a common feature of the presumed marine terraces of Florida, is difficult to reconcile with a shallow interglacial Floridian sea which would be expected to be teeming with life as it is today. This expectation is realized in the un-

questionably marine Anastasia formation. The absence of organic remains is explained by Cooke (1945) as due to the dissolving action of rain water. That a great deal of solution would occur in the porous sand is quite probable; that the total absence of fossils over a wide area can be explained by this agency seems questionable. The fossil-bearing strata below the sand contains three known boreal elements, two bird species (Brodkorb, in press) and *Synaptomys*.

The Seminole Field, Melbourne, and Vero sites are correlated with the mid-Wisconsin glacial recession (Pamlico terrace) by Cooke (1945). The Vero site is currently being studied by Robert Weigel, University of Florida. The bones at Seminole Field are found in a sand and muck of fluvatile origin and are overlain by a barren sand several feet thick at some places. The bone bed rests unconformably on a marine formation referred by Cooke (1926) to the Anastasia formation but later (1945) considered as possibly Pliocene. If the latter proves to be correct, the bone bed could conceivably represent any glacial phase of the Pleistocene, although its occurrence near the coast is indicative of a late Pleistocene age. The geological facts seem best accommodated by reference to the Wisconsin, but a somewhat earlier date cannot positively be ruled out. The mammalian faunas give little or no support to a differential age assignment of Seminole Field and Arredondo—or its almost certain temporal equivalent, Reddick (Brodkorb, 1957). Sixty-six percent of a total of 42 species are extinct at Seminole Field, compared with 41 percent of 22 species at Arredondo, and 39 percent of 48 species at Reddick. Although much of this difference may be due to nontemporal factors, the least that can be inferred from present paleontological evidence is that the Seminole Field assemblage is no more modern than the more northern faunas which occur directly below the presumed Wicomico sand.<sup>3</sup>

In short, although the evidence points to a relatively late Pleistocene age for the several faunas, a more specific, unequivocal assignment would appear premature at the present time. It is not improbable that a detailed comparison of the test faunas, with particular emphasis on the smaller and more poorly known species, would reveal consistent differences which could have chronological implications.

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<sup>3</sup>The radiocarbon age of a piece of charcoal from newly exposed canal cuts at Seminole Field was recently determined as  $2040 \pm 90$  years (Broecker, Kulp, and Tucek, 1956). This date almost certainly cannot be applied to the mammalian fauna of the site.

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## CORRIGENDUM

*Sigmodon hispidus* should be added to the list of species from Arredondo. The total number of species from this site should be 23, with 9 species, or 39 percent, extinct.

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