PLEISTOCENE MAMMALS FROM LADDS, BARTOW COUNTY, GEORGIA

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The present contribution is a status report on mammalian remains identified thus far from late Pleistocene fissure fillings at Ladds, near Cartersville, Bartow County, Georgia. The exact location and nature of the deposit, and history and organization of the project have been discussed elsewhere, and need not be repeated here (Ray, 1965; Lipps and Ray, 1967).

All measurements are in millimeters. Measurements of paired structures, where given for one side only, are in every case for the left side wherever the option existed, as for measurements of the dentition of modern specimens presented for comparative purposes. The following abbreviations are used for institutions for which the name is not indicated in full in the text:

AMNH, American Museum of Natural History, New York
ANSP, Academy of Natural Sciences of Philadelphia
CM, Carnegie Museum, Pittsburgh
LACM, Los Angeles County Museum
TMM, Texas Memorial Museum, Austin
UF, University of Florida Collections, Gainesville
UMMP, University of Michigan Museum of Paleontology, Ann Arbor
USNM, United States National Museum, Washington

Modern specimens denoted by USNM numbers are catalogued in the Division of Mammals; fossils, in the Division of Vertebrate Paleontology.

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FAUNAL LIST

Marsupialia
Didelphis marsupialis Linnaeus, Opossum
Insectivora
Sorex cinereus Kerr, Masked Shrew
Sorex fumeus Miller, Smoky Shrew
Blarina brevicauda (Say), Short-tailed Shrew
Scalopus aquaticus (Linnaeus), Eastern Mole
Chiroptera
Myotis cf. *lucifugus* (Le Conte), cf. Little Brown Myotis

Myotis cf. grisescens A. H. Howell, cf. Gray Myotis
Pipistrellus cf. *subflavus* (F. Cuvier), cf. Eastern Pipistrelle
Eptesicus cf. *grandis* (Brown), Big Brown Bat
Edentata
Megalonyx sp. indet., Ground Sloth
Dasypus bellus (Simpson), Beautiful Armadillo
Lagomorpha
Sylvilagus transitionalis (Bangs), New England Cottontail
Rodentia
Tamias aristus Ray, Noblest Chipmunk
Tamias striatus (Linnaeus), Eastern Chipmunk
Marmota monax (Linnaeus), Woodchuck
Castor canadensis Kuhl, Beaver
Oryzomys palustris (Harlan), Marsh Rice Rat
Peromyscus cf. *maniculatus* (Wagner), cf. Deer Mouse
Peromyscus cf. *leucopus* (Rafinesque), cf. Whitefooted Mouse
Peromyscus, new species, Guilday and Handley, in press. Extinct Mouse
Sigmodon hispidus Say and Ord, Hispid Cotton Rat
Neotoma floridana (Ord), Eastern Wood Rat
Pitymys pinetorum (Le Conte), Pine Vole
Neofiber alleni True, Round-tailed Muskrat
Ondatra zibethicus (Linnaeus), Muskrat
Synaptomys cooperi Baird, Southern Bog Lemming
Zapus hudsonius (Zimmermann), Meadow Jumping Mouse
Carnivora
Canis cf. *lupus* Linnaeus, cf. Gray Wolf
Urocyon cinereoargenteus (Schreber), Gray Fox
Ursus (Euarctos) americanus Pallas, Black Bear
Tremarctos floridanus (Gidley), North American Spectacled Bear
Procyon lotor (Linnaeus), Raccoon
Martes pennanti (Erxleben), Fisher
Mustela cf. *frenata* Lichtenstein, cf. Long-tailed Weasel
Spilogale putorius (Linnaeus), Spotted Skunk
Mephitis mephitis (Schreber), Striped Skunk
Conepatus leuconotus (Lichtenstein), Eastern Hognosed Skunk
Lutra canadensis (Schreber), River Otter
Panthera (Jaguarius) onca augusta (Leidy), Jaguar
Felis (Puma) cf. *inexpectata* (Cope), cf. Puma
Felis (?Herpailurus), sp. indet., ?Jaguarundi
Felis (Lynx) rufus Schreber, Bobcat
Perissodactyla
Tapirus cf. *veroensis* Sellards, cf. Vero Tapir
Equus, sp. indet., Horse
Artiodactyla
Mylohyus nasutus (Leidy), Long-nosed Peccary
Platygonus compressus Le Conte, Le Conte's Peccary
Odocoileus virginianus (Zimmermann), White-tailed Deer
One or more unidentified large selenodont artiodactyls

DISCUSSION

At least 48 species of mammals are known thus far in the Ladds assemblage. Of these, perhaps 25% are extinct, including *Eptesicus* cf. *grandis, Megalonyx,* sp. indet., *Dasypus bellus, Tamias aristus, Peromyscus,* new species, *Tremarctos floridanus, Felis* cf. *inexpectata, F. (?Herpailurus),* sp. indet., *Tapirus* cf. *veroensis, Equus,* sp. indet., *Mylohyus nasutus, Platygonus compressus,* and the one or more unidentified artiodactyls. Two of these, *Eptesicus grandis* and *Felis inexpectata,* probably will prove to be no more than extinct subspecies of *E. fuscus* and *F. concolor,* respectively. *Panthera onca augusta* is already so regarded by most authors. The "extinction" of *Tamias aristus* could well be by transformation into *T. striatus* through phyletic speciation, if *T. aristus* does not in fact prove to be merely a giant extinct subspecies of *T. striatus.* On the other hand, the material representing *Pipistrellus* may include a taxonomically distinct form. Thus it is valid to state that approximately ¼ of the species of mammals from Ladds are extinct.

As noted by Ray (1965, p. 1017) and Lipps and Ray (1967), the physical situation at Ladds unfortunately affords every opportunity for faunal mixing, and the apparent ecological incompatibility of the species of mammals present strongly suggests the same.

Forms of more or less clear northern affinities include *Sorex cinereus, S. fumeus, Sylvilagus transitionalis, Synaptomys cooperi,* and *Martes pennanti.* None of these are known to occur in the immediate vicinity of Ladds today, but neither are they strongly indicative of northern habitat. Some species, such as *Blarina brevicauda,* which occur today at and far south of Ladds, are represented by samples including individuals much larger than those occurring so far south at present. All of the suggestively northern forms would be consistent with a depression of altitudinal ecological zones which would permit extension of their range into the vicinity of Ladds, but none strongly demands such an interpretation. In fact, *Synaptomys cooperi* might imply quite the opposite. Although the southern limit for the species today is in North Carolina just north of the Georgia border, the coincidence of the unusually large size of the form from Ladds, the southward increase in size in the modern form, and the presence of the still larger, probably conspecific, *S. australis* in the Pleistocene of Florida, suggests southerly ecological affinities. *Tamias aristus* may stand in the same relationship to *T. striatus* as does *Synaptomys australis* to *S. cooperi,* for *T. striatus* shows a negative Bergmann's response also.

Species now occurring or having their closest relatives only to the south of Ladds are *Dasypus bellus, Neofiber alleni, Tremarctos floridanus, Conepatus leuconotus, Panthera onca, Felis (?Herpailurus),* sp. indet., and *Tapirus* cf. *veroensis. Dasypus, Tremarctos, Conepatus,* and *Felis (Herpailurus)* have always been southerly in their North American distribution, and probably do imply southerly habitats. *Dasypus bellus* probably was physiologically excluded from regions of prolonged freezing weather (Slaughter, 1961). It is however known from deposits in West Virginia, Tennessee and Missouri, north of Ladds (Guilday and McCrady, 1966). *Neofiber, Panthera,* and *Tapirus* were widespread in North America during the Pleistocene, and, if they have any paleoclimatic implication, it is a complex one.

Although it is difficult to imagine such seemingly ecologically disparate animals as *Dasypus bellus* and *Martes pennanti* as members of the same fauna, the possibility should not be excluded out of hand. A growing body of evidence indicates the impropriety of rigidly interpreting Pleistocene communities in terms of present ones (Hibbard, 1960). It is already abundantly clear that whole faunas did not respond as a unit to climatic change. Differing climatic regimens with, for example, varying combinations of seasonal distribution of precipitation and annual extremes of temperature affected the ranges of species in differing ways, as yet poorly understood. The factual record of past community associations must of course be compiled from unit faunas, from which it will then be possible to interpret possibly heterochronic assemblages such as that from Ladds.

ANNOTATED LIST

Didelphis marsupialis Linnaeus

Opossum

Material: left P^4 (USNM 23314); left upper molar, left P_4, and left and right lower molars.

Remarks: The surprising rarity of Opossum remains in the collection may reflect true rarity in the fauna of the time.

Sorex cinereus Kerr

Masked Shrew

Material: rostral portion of skull lacking braincase (USNM 24500); left maxillary fragment with P^4-M^2; one partial right (USNM 23383) and three partial left mandibular rami.

Remarks: Only the partial skull is certainly distinguishable from *S. longirostris.* The rostral portion of the skull of *S. cinereus* may be separated from that of *S. longirostris* by its slenderness, and greater convexity in the transverse plane along with its relatively larger third, and smaller fifth, unicuspid teeth. It is possible that some or all of the five remaining fragments listed above pertain to *S. longirostris,* rather than to *S. cinereus.* Measurements are presented in Table 1.

Sorex cinereus seems not to have been recorded as yet from Georgia, although known from North Carolina within a few miles of northeastern Georgia.

Sorex fumeus Miller

Smoky Shrew

Material: partial left mandibular ramus with M_1 only (USNM 24593); posterior portion of left ramus with M_2-M_3 (USNM 24595); essentially complete right ramus (USNM 24594).

Remarks: Characters used by Guilday (1962, p. 96) to separate mandibles of *Sorex fumeus* from those of *S. arcticus* were

found to be reliable. These include, in *S. fumeus* and in the fossi shallow protoconid-hypoconid valley in M_1, absence of po mandibular foramen in most specimens (including the fossil more slender dentary and incisor, and larger M_1. Measureme are presented in Table 1.

S. fumeus has been recorded living only as far south as e treme northeastern Georgia (Golley, 1962, fig. 15).

TABLE 1

Some measurements of *Sorex* from Ladds. Measurements USNM 24594 are very slightly too large as the specimen w recovered in two pieces and imperfectly repaired.

	Sorex cinereus			*Sorex fume*	
	USNM 24500	USNM 23383	USNM 24648	USNM 24594	US 24
Palatal length	6.42				
Crown length of upper toothrow	6.53				
Crown length, first unicuspid—M^3	5.75				
Crown length, P^4-M^3	3.82				
Crown length, M^1-M^3	2.70				
Total length, mandibular ramus				10.50	
Crown length, C_1-M_3		4.45		5.22	
Crown length, P_4-M_3		3.94		4.54	
Crown length, M_1-M_3		3.27		3.69	
Crown length, M_1		1.29	1.29	1.47	1.

Blarina brevicauda (Say)
Short-tailed Shrew

Material: 10 rostral portions of skulls (including USN 23384); 6 maxillary fragments; some 25 mandibular rami, most fragmentary and incomplete (including USNM 23385); miscellaneous isolated teeth and skeletal parts.

Remarks: As shown in Table 2, the Ladds material is rathe heterogeneous in size, but includes individuals much larger tha those living in the vicinity today. The sample as a whole com pares favorably in size to that from White Sulphur Spring West Virginia. *Blarina* today exhibits a positive Bergmann response. Thus a fossil sample exhibiting large size in compar son to that of the modern population in the area is suggestive o more northerly conditions.

Scalopus aquaticus (Linnaeus)
Eastern Mole

Material: left lower molar (USNM 23386); three isolate upper molars; left mandibular fragment with M_2-M_3 (USN 24596); left and right humerus; left radius.

Myotis cf. *lucifugus* (Le Conte)
cf. Little Brown Myotis

Material: eight rostral fragments (including USNM 2460 and 24603); 12 mandibular rami (including USNM 24604).

Remarks: Although the material compares favorably with modern *M. lucifugus*, identification as that species is not war-

TABLE 2

Blarina brevicauda from Ladds compared in size to some modern samples.

	N	$\bar{X}$	OR
Rostral breadth			
Ardell, Cullman County, Alabama	8	2.81	2.59 - 3.11
Pisgah Forest, Transylvania County, North Carolina	10	3.14	2.84 - 3.36
White Sulphur Springs, Greenbriar County, West Virginia	10	3.19	2.83 - 3.48
Ladds, Bartow County, Georgia	6	3.42	2.97 - 3.81
Maxillary breadth			
Ardell	8	6.63	6.42 - 6.83
Pisgah Forest	10	7.53	7.20 - 8.00
White Sulphur Springs	10	7.66	7.20 - 8.02
Ladds	5	7.76	6.60 - 8.51
Interorbital breadth			
Ardell	7	5.10	4.96 - 5.21
Pisgah Forest	10	5.66	5.36 - 6.00
White Sulphur Springs	10	5.63	5.35 - 5.91
Ladds	4	5.67	5.13 - 5.98
Length upper tooth row, I^1-M^3			
Ardell	8	8.56	7.78 - 8.96
Pisgah Forest	10	10.28	9.65 - 10.73
White Sulphur Springs	10	10.40	9.66 - 10.76
Ladds	3	10.78	10.30 - 11.12
Length upper tooth row, P^4-M^3			
Ardell	8	5.23	5.07 - 5.42
Pisgah Forest	10	5.98	5.62 - 6.14
White Sulphur Springs	10	6.10	5.69 - 6.40
Ladds	6	6.03	5.42 - 6.39
Total length, mandibular ramus			
Ardell	8	12.29	11.4 - 12.7
Pisgah Forest	10	14.56	14.0 - 14.9
White Sulphur Springs	10	14.79	13.8 - 15.4
Ladds	3	14.41	12.0* - 16.1
Length lower tooth row, C_1-M_3			
Ardell	8	5.67	5.42 - 5.83
Pisgah Forest	10	6.37	6.05 - 6.55
White Sulphur Springs	10	6.52	6.09 - 6.87
Ladds	8	6.28	5.74 - 7.00
Length lower tooth row, P_4-M_3			
Ardell	8	5.15	4.89 - 5.28
Pisgah Forest	10	5.78	5.47 - 5.98
White Sulphur Springs	10	5.85	5.48 - 6.19
Ladds	10	5.72	5.14 - 6.24
Length lower tooth row, M_1-M_3			
Ardell	8	4.31	4.12 - 4.45
Pisgah Forest	10	4.88	4.67 - 5.07
White Sulphur Springs	10	4.93	4.68 - 5.16
Ladds	12	4.95	4.39 - 5.57
Length M_1			
Ardell	8	1.71	1.65 - 1.78
Pisgah Forest	10	1.98	1.83 - 2.08
White Sulphur Springs	10	1.99	1.89 - 2.10
Ladds	26	2.01	1.68 - 2.34

*old individual with worn I_3.

ranted in view of the similarity in size and form of skull and jaws in *M. lucifugus, M. sodalis* and *M. austroriparius.*

Myotis cf. *grisescens* A. H. Howell
cf. Gray Myotis

Material: partial skull lacking basicranium (USNM 24[illegible]09); partial skull lacking much of occiput (USNM 24600); 64 rostral fragments; 52 mandibular rami (including USNM 24601).

Remarks: The specimens have been compared with all North American *Myotis,* and resemble *M. grisescens* most closely. Certain discrepancies however leave the specific identification in doubt. The two fossil crania have the sagittal crest less well developed (in fact the feature is a low ridge bounded by clearly demarcated parasagittal lines) than in modern *M. grisescens.* The elongate longitudinally oriented depression on the dorsal surface of the rostrum is more strongly developed in the fossils than is usual in *M. grisescens.* The two anterior premolars and, less conspicuously, the canines are larger in both upper and lower jaws in the fossils than in modern *M. grisescens,* without however resulting in greater total length of tooth row.

Myotis cf. *grisescens* is the commonest mammal in the fossil deposit, and will undoubtedly be represented by many additional specimens as processing of incompletely studied chiropteran remains continues. Referral of lower jaws of *Myotis* to *M.* cf. *grisescens* is based on their close conformity in size to modern *M. grisescens* and on relative abundance of fossil cranial remains.

Pipistrellus cf. *subflavus* (F. Cuvier)
cf. Eastern Pipistrelle

Material: 15 rostral fragments (including USNM 2460[illegible]); 18 mandibular rami, mostly fragmentary (including USNM 24606).

Remarks: Although some of the fossil specimens can be matched in size and form among modern *P. subflavus,* most of the fossils are considerably larger and differ from modern specimens in having much more robust dentition with both upper and lower incisors, canines, and premolars set in much closer order. Further study, preferably on the basis of more nearly complete specimens, is needed to determine the significance of the observed differences from modern *P. subflavus.*

Eptesicus cf. *grandis* (Brown)
Big Brown Bat

Material: 12 maxillary fragments, including one with premaxilla and all teeth except inner incisor (USNM 24597); 32 mandibular rami, mostly fragmentary, including one with all teeth excepting anterior premolar (USNM 24598).

Remarks: The specimens can be matched among modern *Eptesicus fuscus* as well as among specimens from Cumberland Cave, Maryland referred to *E. grandis.* However, in general, the fossils seem to be slightly more robust in proportions than are modern *E. fuscus,* but the differences are minute and overlap is great. The status of *E. grandis* is currently under study by Dr. John E. Guilday.

Megalonyx, sp. indet.
Ground Sloth

Material: neural spine and portion of neural arch of anterior (first?) thoracic vertebra (Shorter College Collection); two partially ankylosed anterior thoracic vertebrae, highly fragmentary and lacking much of neural arch of first and much of centrum of second (USNM 24590); highly fragmented left radius, lacking proximal extremity (USNM 24591).

Remarks: The three partial vertebrae compare closely in size and form with figures of anterior thoracic vertebrae of *Megalonyx jeffersonii* in Stock (1925, pl. 18), excepting in the more greatly expanded dorsal extremities of the neural spines in the Ladds specimens. The two associated specimens (USNM 24590) are ankylosed in the dorsal ⅓ of their neural spines. The partial radius (USNM 24591) closely resembles the one illustrated as *M. jeffersonii* by Leidy (1855, pl. 9, figs. 5, 6; pl. 10, fig. 1).

Dasypus bellus (Simpson)
Beautiful Armadillo

Material: proximal portion of left femur lacking distal extremity, much of shaft medial to third trochanter, and much of greater and lesser trochanters (USNM 23315); ungual phalanx (USNM 24497); some 25 dermal armor scutes (including USNM 24592), mostly fragmentary, representing most sections of the carapace.

Remarks: The partial femur compares closely in both size and form to one from Haile VIIIA, Florida, UF 3350, lacking only the third trochanter. The dermal scutes have been compared with numerous specimens from Florida, and no differences in size and morphology were discovered.

Sylvilagus transitionalis (Bangs)
New England Cottontail

Material: fragments of a single skull, including both maxillae and right frontal (USNM 23387); three mandibular fragments, and miscellaneous isolated teeth and fragmentary skeletal parts.

Remarks: Only the partial skull is specifically identifiable. The supraorbital region of the frontal is sufficiently well preserved to reveal the obsolete anterior supraorbital process and the slender, free posterior supraorbital process separated from the adjacent cranial wall by a narrow slit. These features are characteristic of *S. transitionalis* and distinguish it from all other eastern rabbits.

The New England Cottontail has been recorded living in Georgia only from Young Harris and Brasstown Bald in Towns County, but is known also from Ardell, Cullman County, and Erin, Clay County, Alabama. It is conceivable that it occurs in Bartow County, or has within historic time.

Tamias aristus Ray
Noblest Chipmunk

FIGURE 1.

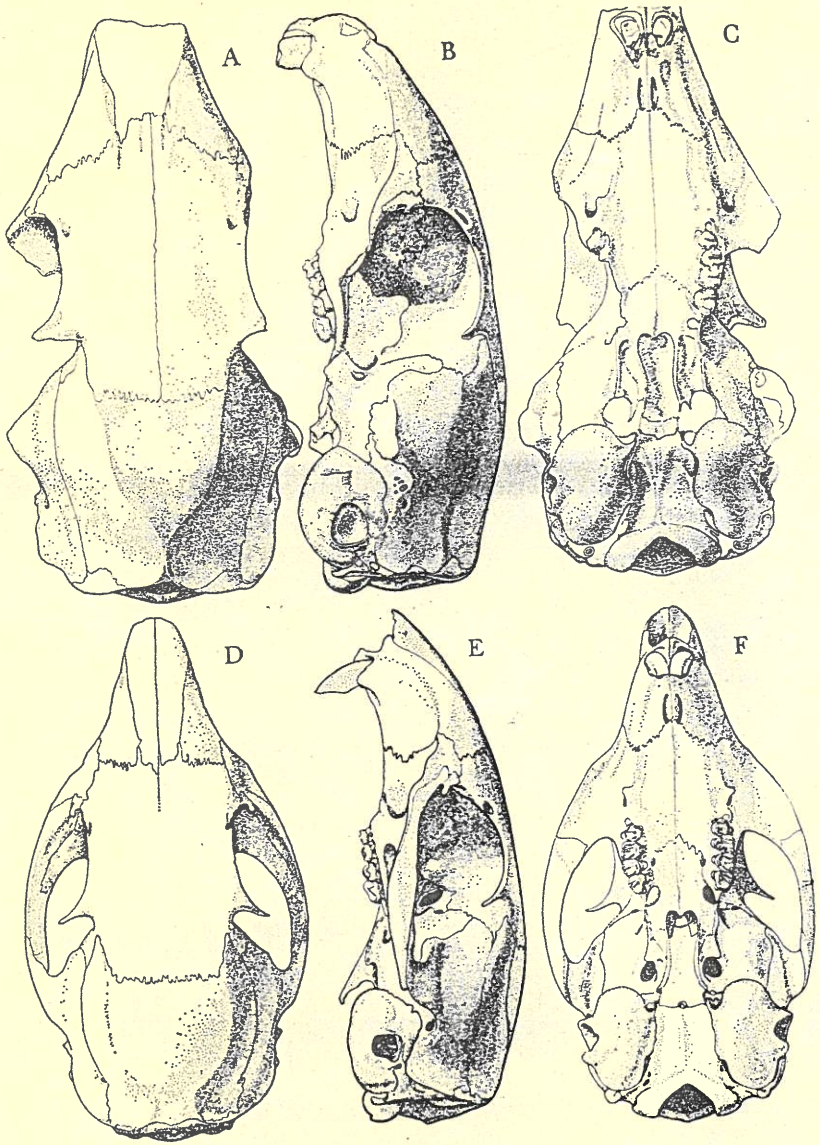


FIGURE 1.

Skulls of chipmunks, genus *Tamias*, X1.5. A-C, *Tamias aristus*, type, USNM 23320, Pleistocene, Ladds assemblage, Bartow County, Georgia; A, dorsal view; B, lateral view; C, ventral view. D-F, *Tamias striatus pipilans*, USNM 284859, Recent, one mile north of Cornor, West Feliciana Parish, Louisiana; D, dorsal view; E, lateral view, F, ventral view.

Material: skull (USNM 23320, the type); left mandibular ramus (USNM 23321); 12 isolated cheek teeth, one toothless right mandibular fragment.

Remarks: This species has been discussed in detail and compared to *T. striatus* by Ray (1965). Only a few isolated teeth and a mandibular fragment, all tentatively referred, have been added since that writing.

Tamias striatus (Linnaeus)
Eastern Chipmunk

Material: four maxillary fragments; one right frontal; 15 fragmentary mandibular rami (including USNM 23319 and 24608); some 50 isolated cheek teeth.

Remarks: With the exception of USNM 24608, all mandibular fragments fall well within the observed range in size of modern *T. striatus*. The alveolar length P_4-M_3 of USNM 24608 is 7.6, whereas in four other mandibular rami from Ladds this dimension is 6.5, 6.7, 6.9, and 7.0(?), respectively. Considering the upward bias in alveolar measurements in specimens lacking P_4 or M_3 and the close approach in size by the largest modern *T. striatus* (cf. Ray, 1965, table 2), USNM 24608 may be referred to the living species.

A prehistoric (5550 ± 70 B.P.) record of *T. striatus* based on a left lower incisor from Scarborough Bluffs, Toronto, Ontario, published by Churcher and Karrow (1963), should be added to the list of localities of Ray (1965, pp. 1017-1018).

Marmota monax Linnaeus
Woodchuck

Material: four cranial fragments, including one palate with incisors, left P^3-M^3, and right M^1-M^3 (USNM 23323); six partial mandibular rami (including USNM 23129); 38 isolated cheek teeth, numerous fragments of incisors, and miscellaneous postcranial material.

Castor canadensis Kuhl
Beaver

Material: isolated left P^4 (USNM 24607); isolated right M^3 (USNM 24609); fragment of enamel band of left lower incisor.

Oryzomys palustris (Harlan)
Marsh Rice Rat

Material: incomplete right mandibular ramus with M_1-M_3 (USNM 23388).

Peromyscus cf. *maniculatus* (Wagner)
cf. Deer Mouse

Material: palate with left M^1-M^2 and right M^1-M^3 (USNM 24613); six fragmentary maxillae; 19 mandibular rami (including USNM 24614).

Remarks: See under *Peromyscus* cf. *leucopus*.

Peromyscus cf. *leucopus* (Rafinesque)
cf. White-footed Mouse

Material: five maxillae (including USNM 24615); 14 mandibular rami (including USNM 24616); five isolated M_1s.

Remarks: Material from Ladds representing mice of the genus *Peromyscus* can be separated into three homogeneous groups on the basis of size (Table 3). The smallest specimens are comparable in size to modern *P. maniculatus* from the southeastern

TABLE 3

Comparison of length of molar series in three groups of *Peromyscus* from Ladds.

	N	$\bar{X}$	OR
Peromyscus cf. *maniculatus*			
Crown length, M^1-M^3	4	3.30	3.14-3.42
Crown length, M_1-M_3	5	3.38	3.21-3.49
Peromyscus cf. *leucopus*			
Crown length, M^1-M^3	2	3.64	3.57-3.71
Crown length, M_1-M_3	4	3.81	3.71-3.96
Peromyscus, new species			
Crown length, M_1-M_3	1	4.92	4.92

United States, the intermediate to *P. leucopus* (and *P. gossypinus*), and the largest to a new species from Cumberland Cave being described by Guilday and Handley (in press). This large form is readily distinguished from any living species in the eastern United States, and is discussed separately below. The smaller forms are however more difficult.

As pointed out by Hall and Kelson (1959, p. 628) and others, *P. leucopus* is generally larger than *P. maniculatus* where the two occur together, and *P. gossypinus* slightly larger than either. Size alone is of course not a very persuasive character in identification of Pleistocene mammals, as change in size (generally increase, but in some cases decrease) as compared to living populations is so frequently observed. Furthermore, accessory tooth structures have been shown to be extremely variable (Hooper, 1957; Bader, 1959). However, accessory tooth structures may be used in some instances with proper caution. For example, Hooper (1957, pp. 22-25) found them more frequently and more strongly developed in the M_1 and M_2 of *P. leucopus* than of *P. maniculatus;* Bader (1959, p. 601) found them still more frequently developed in *P. gossypinus,* but did not present data on expressivity in *P. gossypinus.* Undoubtedly correlated with these traits is the broad, open appearance of the major fold in M_1 and M_2 of *P. maniculatus,* and its narrow, compressed appearance in *P. leucopus* and *P. gossypinus.* Accessory structures show strong penetrance and expressivity in the sample designated *Peromyscus* cf. *leucopus* and weaker penetrance and expressivity in the series designated *P.* cf. *maniculatus.*

Guilday and Handley (in press) have noted differences in the anteroconid between *P. leucopus* and *P. maniculatus;* that of *P. leucopus* being more symmetrically developed on either side of the anterior median fold, and that of *P. maniculatus* less symmetrically developed, with the labial portion somewhat suppressed. This feature corroborates the separation made among the fossils first on the basis of size, and supported on the basis of accessory structures.

Thus, aside from the new large form of Guilday and Handley, it seems clear that at least two species of *Peromyscus* are present as fossils at Ladds, even though their identity remains uncertain. The sample of *P.* cf. *leucopus* remains particularly in question, as I have been unable to separate *P. leucopus* from its close relative, *P. gossypinus,* on the basis of dentition.

Peromyscus, new species, Guilday and Handley

Extinct Mouse

Material: seven partial mandibular rami (including USNM 24649); eight isolated M_1s (including USNM 24650); one isolated M_2; one isolated M_3.

Remarks: Through the kindness of Dr. John E. Guilday, it has been possible to examine a portion of the hypodigm on which the new species of *Peromyscus* is founded, and to read the manuscript of the type description (Guilday and Handley, in press) prior to publication. This has made intelligible the otherwise puzzling material from Ladds.

Further discussion of the material is inappropriate at this time. Suffice to say that the characters of the teeth and jaws of the Ladds specimens, including size (Table 4), are closely compatible with those of the new species from Maryland.

TABLE 4

Data on size for specimens from Ladds referred to *Peromyscus,* new species (Guilday and Handley, in press). The lower extreme of the observed range for each dimension is in all cases based on deeply worn teeth.

	N	$\bar{X}$	OR
Crown length, M_1-M_3	1	4.92	4.92
Crown length, M_1	10	2.21	2.02-2.37
Crown width, M_1	10	1.47	1.33-1.60
Crown length, M_2	2	1.64	1.55-1.72
Crown width, M_2	2	1.36	1.25-1.47
Crown length, M_3	3	1.48	1.44-1.55
Crown width, M_3	3	1.23	1.11-1.32

Sigmodon hispidus Say and Ord

Hispid Cotton Rat

Material: three left mandibular rami (including USNM 23389).

Remarks: One of the three specimens appears to be modern and intrusive into the deposit.

Neotoma floridana (Ord)

Eastern Wood Rat

Material: one palate with left and right M^1-M^3 (USNM 24612); two maxillary fragments; 12 mandibular rami, mostly fragmentary (including USNM 23390); 133 isolated molars.

Remarks: No features were found in the broad ontogenetic series represented among the fossil teeth by which they could be distinguished from those of the living *N. floridana.*

Pitymys pinetorum (Le Conte)
Pine Vole

Material: incomplete palate with left and right M^1-M^3 (USNM 24620); palate with right M^1; four maxillary fragments; 25 mandibular rami, mostly fragmentary (including USNM 24[illegible]7); some 170 isolated molars.

Remarks: Most of the specimens are slightly larger than modern individuals from localities near to or south of Ladds.

Neofiber alleni True
Round-tailed Muskrat

Material: fragment of right mandibular ramus with M_1 (USNM 24611).

Remarks: *Neofiber* is today limited to Florida and extreme southeastern Georgia, but during Pleistocene time ranged as far as Texas, Kansas, and Pennsylvania.

Ondatra zibethicus (Linnaeus)
Muskrat

Material: right M^2 (USNM 23391); incomplete right M_1 (USNM 24610).

Remarks: The M^2 represents a rather small individual. The M_1 is broken both anteriorly and posteriorly and is somewhat eroded, making further study of its characters in relation to other Pleistocene Muskrat remains unfeasible.

Synaptomys cooperi Baird
Southern Bog Lemming

Material: left mandibular ramus with M_1-M_3 (USNM 24617); fragmentary left mandibular ramus with M_3; 25 isolated molars (including USNM 24618 and 24619).

Remarks: The Southern Bog Lemming is represented by two size groups, probably reflecting different time planes in the deposit. Most of the specimens fall well within the size limits of modern samples from the southeasterly portion of the range. Two specimens only, a left mandibular ramus, USNM 24617, and an isolated M_1 (USNM 24618), represent a population of much larger animals, equaled in size among living forms only by the large *S. c. paludis* of Meade County, Kansas. The occlusal length, M_1-M_3 of USNM 24617 is 7.15, as compared to a range of 6.9-7.5, average 7.15, for 8 specimens of *S. c. paludis* (see Hibbard and Rinker, 1942, p. 29). The specimen is perhaps suggestive of a clinal link toward the still larger *S. australis* of the Pleistocene of Florida (and Kansas?), which has been suspected to be merely a large, extinct subspecies of *S. cooperi*.

The Southern Bog Lemming has not been collected from life in Georgia, but reaches its southernmost known limit at Highlands, Macon County, North Carolina, about four miles north of the northeastern corner of Georgia. The relict occurrence of the species in Meade County, Kansas, its presence in Pleistocene localities in Texas and northeastern Mexico (Patton, 1963), and the probability that *S. australis* will prove to be conspecific, clearly indicate that *S. cooperi* must have been present in suitable habitats throughout Georgia during the Pleistocene.

Zapus hudsonius (Zimmermann)
Meadow Jumping Mouse

Material: left mandibular ramus with M_1-M_2 (USNM 24477), right ramus with M_1-M_3 (USNM 24476); left M_1 (USNM 24478).

Remarks: All three specimens may be assigned to the living species, *Z. hudsonius*, on the basis of detailed similarity to modern specimens and of characters noted by Klingener (1963).

Canis cf. *lupus* Linnaeus
cf. Gray Wolf

Material: left M^1 (USNM 23698).

Remarks: Although a single M^1 is inadequate for specific identification of a large Pleistocene wolf-like canid, this tooth is, in proportions and arrangement of cusps, distinctly like that of *Canis lupus* and distinctly unlike that of *C. armbrusteri* from Cumberland Cave, Maryland (Gidley and Gazin, 1938, p. 17), particularly as regards development of the hypocone and the relative breadth of the tooth. The dimensions of USNM 23698 are: length (across paracone and metacone), 17.7; breadth, 21.0. The tooth is much larger than that of any *Canis niger*, and is in fact comparable in size only to large individuals of *C. lupus*. It seems also to be inseparable from some specimens of *Canis dirus*, and is here assigned only very tentatively to *C. lupus*.

Urocyon cinereoargenteus (Schreber)
Gray Fox

Material: left M_2 (USNM 23392), and questionably identified fragment of right mandibular ramus, lacking teeth.

Remarks: The M_2 of *Urocyon* may be distinguished from that of *Vulpes* by its strongly developed labial cingulum adjacent to the protoconid and its high, discrete entoconid.

Ursus (Euarctos) americanus Pallas
Black Bear

Material: palate with right C^1 and right and left P^4-M^2 (USNM 24482); fragmentary right mandibular ramus with P_4-M_3 (USNM 24481); partial left mandibular ramus with M_2, M_3 and fragment of M_1 (Shorter College Collection); partial right ramus with M_1 and fragment of P_4 (USNM 24484); fragment of maxilla with M^1 and M^2, with probably associated isolated left M^2 (USNM 24483); numerous fragmentary cranial parts, isolated teeth, and postcranial elements, mostly highly fragmentary.

Remarks: The Black Bear is by far the commonest large mammal represented at Ladds. Specimens compare well with modern individuals of the species.

Tremarctos floridanus (Gidley)
North American Spectacled Bear

Material: fragment of left mandibular ramus with M_1-M_3 (USNM 24485).

Remarks: The incomplete bony ramus has been extensively gnawed by rodents, but the anterior margin of the highly characteristic premasseteric fossa is preserved, clearly placing the specimen in the arctothere group. In all available dental dimensions (Table 5) the specimen falls near the middle of the

observed range for specimens assigned by Kurtén (1966, table 1) to *Tremarctos floridanus*.

TABLE 5

Dimensions of the lower molars of the arctothere from Ladds compared to those of *Tremarctos floridanus*, the latter after Kurtén (1966, table 1).

	USNM 24485	Tremarctos floridanus OR
M_1 length	22.4	20.2-23.8
anterior width	8.6	8.1-9.8
posterior width	10.3	9.6-11.8
M_2 length	21.7	19.0-24.0
anterior width	12.8	11.8-14.6
posterior width	13.3	11.6-14.5
M_3 length	17.0	14.6-18.5
width	12.5	11.[illegible]-13.9

Procyon lotor (Linnaeus)
Raccoon

Material: fragment of left mandibular ramus lacking teeth (USNM 23696); right P_4 (USNM 24486).

Remarks: The two specimens provied sufficient basis only for inclusion of the Raccoon in the fauna.

Martes pennanti (Erxleben)
Fisher

Material: fragment of left maxilla with P^4 (USNM 23697); sectorial blade and posterior root of right P^4 (USNM 24487); right M^1 (USNM 24488); left M_1 in fragment of jaw (USNM 24489).

Remarks: Ladds is considerably south of the proven historic southern limits of the Fisher (Hall and Kelson, 1959, p. 903), but as Barkalow (1961) has pointed out there is ample hearsay evidence of its more southerly occurrence in modern times as well as definite archeological records at the Law's Site, Marshall County, northeastern Alabama, and at the Etowah Site, Bartow County, Georgia (adjacent to Ladds). Although presence in archeological sites is not certain evidence that the Fisher lived in the immediate vicinity at the time, presence in the Pleistocene deposits at Ladds does indicate definite local occurrence.

Mustela cf. *frenata* Lichtenstein
cf. Long-tailed Weasel

Material: left P^4 (USNM 24490); fragment of right maxilla with P^4 (USNM 24491), left DM^3 lacking protocone (USNM 23393).

Remarks: The fourth premolars match those of *M. frenata* very well morphologically, and are comparable in size to those of females from the southeast. For example, the length of the crown (measured over the paracone and metacone parallel to the labial border) is 4.4 in each of the fossils and in a female *M. frenata* from Fort Payne, Alabama (USNM 171559), as compared to 5.1 in a male from Canton, Georgia (USNM 212033).

The DM^3 is slightly smaller than those of two females of *M. frenata* from Brownsville, Texas (USNM 45899 and 58574), but undoubtedly falls within the range for the species. All three specimens are referable to *M. rixosa*, but all could be assigned as well to *M. frenata* on the basis of size and are assigned with question to *M. frenata* on geographic grounds.

Spilogale putorius (Linnaeus)
Spotted Skunk

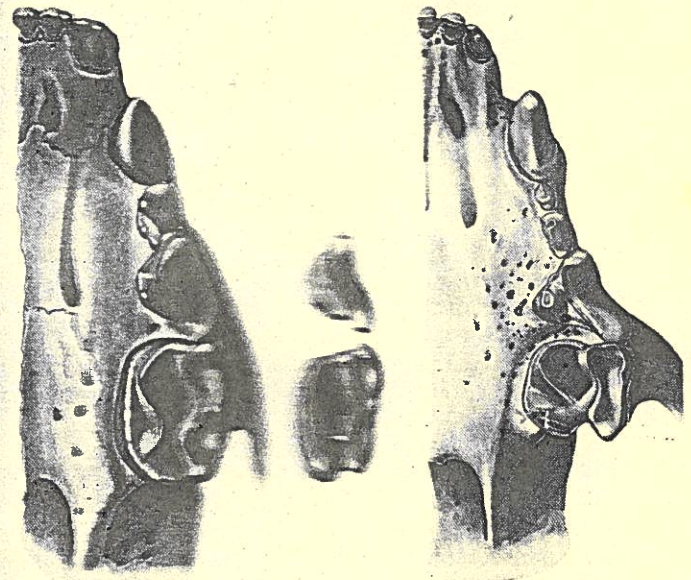
Material: right [illegible]

Remarks: The specimen compares favorably with the same tooth in modern specimens of Spotted Skunk from the southeastern United States.

Mephitis mephitis (Schreber)
Striped Skunk

Material: anterior portion of left mandibular ramus, broken immediately posterior to M_1, with P_4 and M_1 present and well preserved (USNM 24492); fragment of a right P^4 lacking the protocone and roots, otherwise complete.

Remarks: The mandibular fragment is referred to *Mephitis* rather than to *Conepatus* on all characters noted by Ray, et al. (1963). The dimensions of the crown of



Partial upper [illegible] in palatal aspect, X2. B, isolated fossil tooth, *Conepatus leuconotus*; P^4, above, USNM 23683, M^1, below, USNM [illegible] (A) Recent *Conepatus leuconotus*, USNM [illegible], and (C) Recent *Mephitis mephitis*, USNM [illegible]

M_1 are: length 9.9, width 4.4, and length of trigonid 5.5.

Conepatus leuconotus (Lichtenstein)
Eastern Hog-nosed Skunk
FIGURE 2B

Material: isolated left P^1 (USNM 23683); isolated le... M^1 (USNM 23684).

Remarks: The criteria by which *Conepatus* may be distinguished from *Mephitis* on the basis of P^1 and M^1 have been discussed at length by Ray, et al. (1963, pp. 383-388) and by Churcher and van Zyll de Jong (1965, pp. 7, 13). The specimens from Ladds in every respect more closely resemble *Conepatus* (fig. 2), and on the basis of large size are assigned to *C. leuconotus* rather than to *C. mesoleucus*. The fossil M^1 is somewhat atypical of *Conepatus* in that the crest extending posteriorly from the protocone curves labially to the metacone, thus forming a closed basin among the three principal cusps. Although this configuration does occur in modern *Conepatus*, the more usual condition is that in which the crest extends posteriorly to the posterolingual margin of the tooth, with a deep valley lying between the crest and the metacone (fig. 2A).

Ladds is the third locality for Hog-nosed Skunk in the southeastern United States. It has been reported previously from two localities in north central Florida by Ray, et al. (1963), and Churcher and van Zyll de Jong (1965) have noted an additional specimen from one of these sites. Hog-nosed Skunks today occur no closer than southeastern Texas, more than 500 miles from Ladds.

Lutra canadensis (Schreber)
River Otter

Material: right P^1 (USNM 23316); fragment of left mandibular ramus with P_3-M_1 (USNM 24492).

Remarks: Two individuals are represented, a rather small one by P^1 and a rather large one by the jaw. Both, however, can be matched among modern southeastern specimens.

Panthera (Jaguarius) onca augusta (Leidy)
Jaguar
FIGURE 3

Material: associated skull and jaws, the skull in particular highly fragmented and incomplete (USNM 23486); left DM_3 crown only (USNM 23687); immature right humerus lacking proximal epiphysis (USNM 23688); left upper canine (Shorter College Collection).

Remarks: These remains probably represent at least three individuals, as the isolated canine and the humerus represent one if not two individuals in addition to the two represented by the skull with jaws and the DM_3. The battered skull was found in a crevice among limestone boulders apparently deposited in the collapse of the ancient cave ceiling.

Comparison of USNM 23486 with all fossil Jaguar material in the U. S. National Museum, including the types of *Panthera onca augusta* and *Felis veronis*, and with a cast (provided by

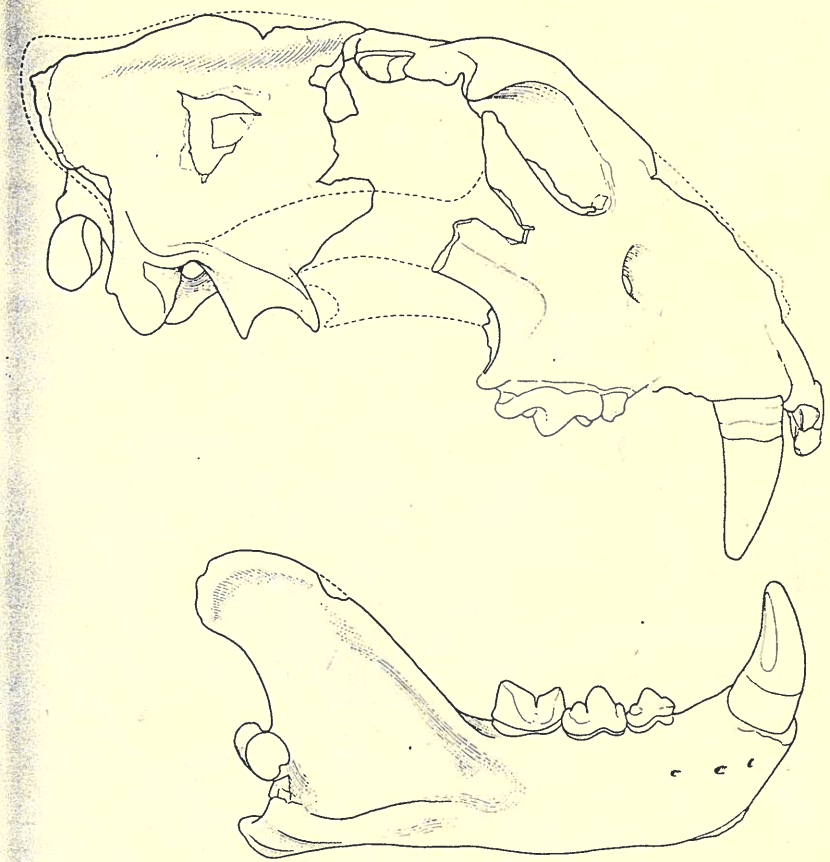


FIGURE 3.

Skull and mandible of USNM 23486, *Panthera onca augusta*, in right lateral aspect. Auditory region, condyloid fossa, condyle, and angular process reversed from left side. X.4.

Dr. John E. Guilday) of the skull and jaws of the specimen reported by Parmalee (1961) from Little Airplane Cave near Chattanooga, indicates that the specimen from Ladds is referable to *P. o. augusta*. Kurtén (1965, tables 2-6) has published measurements for many of the relevant specimens of North American fossil Jaguars, and Slaughter (1966, p. 484) has provided additional measurements for the material from Laubach Cave (Core Hole Cave of Kurtén), Texas. Comparison of measurements of USNM 23486 (Table 6) with those given by Kurtén confirms that this specimen does indeed represent *P. o. augusta*.

The left DM_3 apparently is too large for *Felis concolor*, as is the humerus. The DM_3 is slightly shorter than either specimen measured by Kurtén (his table 4); it compares well with the DM_3 of a modern Jaguar, *P. o. milleri*, USNM 270363, from Brazil. The humerus compares closely with that of a specimen from Little

TABLE 6

Some measurements of remains of large cats from Ladds and Edisto Beach.

	USNM 23486, skull and jaws left	right	Shorter College Collection, left C^1	Charleston Museum, right P^4	USNM 23687, left DM_3	USNM 23688, right humerus	USNM 23689, left P_4
I^2, maximum anteroposterior dimension of crown	8.7	—					
I^3, same	11.7	—					
C^1, maximum anteroposterior diameter (root)	24.2	24.0	25.5				
C^1, maximum transverse diameter (root)	19.8	18.5	20.2				
P^4, length	33.4	33.6		31.3			
P^4, width	16.1+	—		16.1			
M^1, length	4.6	4.7					
M^1, width	10.0	10.1					
C^1-P^4, inclusive	93.0	91.9					
Occipital condylar width	52.5						
Condylobasal length (estimated)	264						
Postglenoid length (estimated)	65						
Length of mandibular ramus	190+	—					
Depth below anterior end of P_4	39.4	39.6					
Depth immediately posterior to M_1	41.6	41.1					
Thickness posterior to M_1	19.2	18.7					
C_1-M_1, inclusive	103.6	103.4					
P_3-M_1, inclusive	59.8	60.2					
C_1, maximum anteroposterior diameter (root)	23.2	23.0					
C_1, maximum transverse diameter (root)	16.2	15.5					
P_3, length	16.8	16.6					
P_3, width	8.2	—					
P_4, length	22.4	22.1					18.9
P_4, width	—	11.1					9.4
M_1, length	—	24.0					
M_1, width	12.2	12.2					
DM_3, length					11.7		
DM_3, width					5.5		
Humerus							
Length						224+	
Shaft, transverse						24.1	
Distal, transverse						[illegible]1+	
Distal, minimum anteroposterior						[illegible].3	

Salt River Cave, Tennessee, USNM 18262, and its measurements with those of three specimens from Florida (Kurtén, table 7). The isolated upper canine is virtually identical to that of USNM 23486.

Hibbard, et al. (1965, fig. 8) have mapped many of the fossil occurrences of *Panthera onca* in the United States and Kurtén (1965, pp. 223-225) has added several localities in Florida. The species is well known from abundant records in Tennessee and Florida, but the present record seems to be the first for Georgia.

It may be noted in passing that there is in the Charleston Museum an isolated right P^4 referable to *P. o. augusta* (Table 6). The specimen was collected in 1966 by Mr. Gerard Case at Edisto Beach, South Carolina. To my knowledge this is the first noted occurrence of the species in South Carolina, and is placed on record here through the courtesy of Mr. E. Milby Burton, Director of the Charleston Museum.

Felis (Puma) cf. *inexpectata* (Cope)

cf. Puma

Material: left P_4 (USNM 23689); two ungual phalanges (USNM 23318).

Remarks: The lower fourth premolar is smaller (Table 6) than that of any North American fossil Jaguar known to me, and is somewhat larger than that of *Felis inexpectata* (see Simpson, 1941, p. 15). However, adequate samples of fossil Pumas have yet to be accumulated. In the meantime USNM 23689 may tentatively be referred to *Felis inexpectata.* It may be noted in passing that the specimen is almost exactly the size of the P_4 in a jaw from Cita Canyon referred to *Felis studeri* by Savage (1960, p. 328). Savage's discussion of fossil and modern Pumas and Jaguars, including *Panthera palaeoonca* Meade, is extremely useful for its insights into the general problem, but in the absence of compelling morphological evidence, the Blancan age material from Texas described or discussed by him is not relevant in detail to the late Pleistocene material from Georgia.

The two ungual phalanges can be matched closely in modern skeletons of *F. concolor,* but are also close to those of modern Jaguar, and thus are not certainly identifiable.

The specific name *F. inexpectata* is retained for the time being because fossil Puma material is inadequate to provide the basis for revision. It seems almost certain that *F. inexpectata,* if determinable, will prove to be a synomyn of the living *F. concolor.* The name may have some utility in the future as a chronological subspecies, when adequate material is available.

Felis (?Herpailurus), sp. indet.

?Jaguarundi

FIGURE 4

Material: fragmentary left mandibular ramus with P_3-M_1, lacking angular and condylar processes and much of coronoid process, as well as anterior extremity of horizontal ramus (USNM 24479).

Remarks: This specimen has been compared with all modern

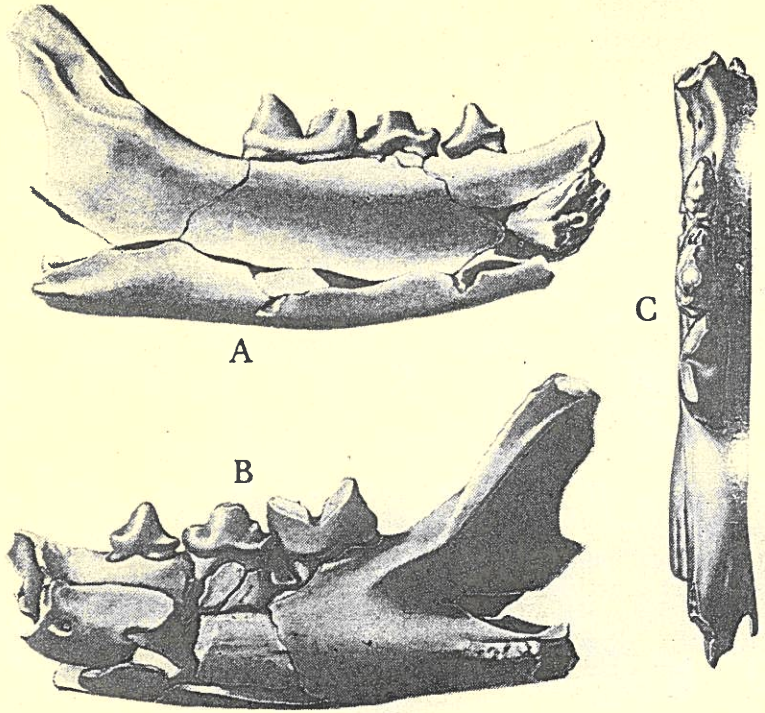


FIGURE 4.

Partial left mandibular ramus of USNM 24479, *Felis (?Herpailurus)*, sp. indet., in lingual (A), labial (B), and occlusal (C) aspect. X1.5.

species of small cats in the collection of the U. S. National Museum and does not fit satisfactorily within any. On geographic grounds, *Felis (Lynx) rufus* is the most probable form to which the fossil might be referred, but it cannot be matched by any specimen within the extensive series of modern *F. rufus*. In dental dimensions USNM 24479 is near the extreme lower limit in size for *F. rufus*. Yet the bony ramus is more robustly constructed than in even much larger individuals of *F. rufus*, being relatively deeper and broader. Specimens of *F. rufus* comparable in dental dimensions have a more lightly constructed mandible; specimens comparable in mandibular construction have much larger dentition (Table 7). The great breadth of the fossil ramus is especially striking on the dorsal surface immediately posterior to M_1 (fig. 4C) and also on the ventral surface below the coronoid fossa. The anterodorsal margin of the coronoid fossa is bounded by a thick wall of bone, not a thin lamina as in *F. rufus*. The sharp crest bounding the deep coronoid fossa anterodorsally is distinct from the anterior margin of the coronoid process, and curves posteriorly dorsally. The anterior margin of the coronoid process ascends much more steeply than in *F. rufus*.

TABLE 7

Measurements of lower dentition and mandible in some fossil and Recent specimens of small felids.

	Fossil			*Lynx rufus*, Recent				
Length from posterior alveolar border of C_1 to posterior alveolar border of M_1	(31)	37.0	29.4	32.3	31.9	35.6	37.5	36.7
Alveolar length P_3-M_1	21.0	20.6	21.2	26.7	21.6	27.0	29.5	28.7
Crown length P_3-M_1	23.4	28.7	23.9	26.2	23.7	26.0	28.4	28.2
Alveolar length P_4-M_1	18.0	21.1	17.2	19.0	17.3	19.2	21.3	21.3
Crown length P_4-M_1	17.5	20.7	17.2	19.0	17.2	18.4	21.1	20.4
Crown length P_3	(6.0)	7.7	6.2	6.8	6.2	7.0	7.3	7.7
Crown breadth P_3	3.1	3.9	3.3	4.0	3.5	4.2	4.1	4.3
Crown length P_4	8.5	9.8	8.2	9.7	7.8	8.4	10.1	9.6
Crown breadth P_4	3.9	4.7	3.6	4.9	4.2	4.8	5.1	5.0
Crown length M_1	9.8	11.7	9.5	10.3	10.0	10.6	12.2	11.8
Crown breadth M_1	4.4	5.2	4.1	5.1	4.7	5.3	5.4	5.3
Depth of ramus on lingual surface at midpoint of P_3	13.7	—	12.1	13.3	13.2	14.2	15.8	15.6
Breadth of ramus at same point	5.9	—	5.1	5.6	5.7	5.7	6.5	6.6
Depth of ramus on lingual surface at midpoint of P_4	14.5	—	12.5	13.4	13.4	14.9	15.5	15.7
Breadth of ramus at same point	6.5	—	5.4	6.2	5.6	6.2	6.4	7.4
Depth of ramus on lingual surface at midpoint of M_1	14.5	—	11.8	13.0	13.3	14.6	14.2	15.9
Breadth of ramus at same point	6.4	—	5.8	5.8	5.9	6.2	6.4	7.6
	USNM 24479, Ladds	USNM 23317, Ladds	UF 9254, Merritt's Island, Florida	USNM 234052, sex unknown, Chokoloskee, Florida	USNM 250521, female, Beachton, Georgia	USNM 276084, male, Piedmont Refuge, Georgia	USNM 276429, male, Noxubee Refuge, Mississippi	USNM 286567, sex unknown, Dooly County, Georgia

It may be noted that in immature *F. rufus* as in other cats (as well as in many other mammals), the bony ramus is much more robust, but that in maturity, the bony ramus is relatively and even absolutely more slender. The Ladds specimen is fully mature with M_1 considerably worn. Robustness also increases with increasing individual size in *F. rufus*. Thus one would not expect a specimen near the minimum size in dental dimensions to be near the maximum size and robustness in bone dimensions.

In the modern Jaguarundi the bony ramus is robust relative to tooth size, the coronoid process ascends steeply, and the detailed configuration of the coronoid process and fossa is comparable to that in the fossil. However, no Jaguarundi seen by me is as large as the Ladds specimen nor as robust. However, if one were to postulate a large extinct subspecies of Jaguarundi (analogous to *Panthera onca augusta*), the increased robustness would be expected.

It seems certain now that there was in the Pleistocene of the southeastern United States a small felid probably related to, if not conspecific with, the modern Jaguarundi. In addition to the Ladds specimen there are at least three mandibular rami from Florida, which seem to pertain to this group, one from Rock Spring Run and one from Melbourne (Ray, 1964) and one from Merritt's Island, Brevard County, noted by Kurtén (1965, p. 240) and for which measurements are presented here (Table 7). None of these specimens is identifiable with complete certainty, but none are referable to *F. rufus*, and all are at least suggestive of Jaguarundi. More definitive statements must await discovery of supplementary material.

Felis (Lynx) rufus Schreber
Bobcat

Material: fragment of left mandibular ramus with P_3-M_1 (USNM 23317); three canine teeth and some half dozen fragmentary skeletal elements.

Remarks: The dental dimensions of the mandibular fragment are rather great (Table 7) for a Georgia Bobcat, but can be matched almost perfectly by USNM 286567 from Flint River, near Vienna, Dooly County, Georgia. This and the additional fragments cannot be separated from specimens of *Felis (Lynx) rufus*.

Tapirus cf. *veroensis* Sellards
cf. Vero Tapir

Material: unworn crown of right (?) M^1 (USNM 23325); two fragments apparently of a single third metapodial (USM 24493); two small fragments of cheek tooth crowns.

Remarks: The probable M^1 falls within the observed range of *T. veroensis* in its dimensions: length 22.0, anterior width 22.9, posterior width 19.6+ (posterolingual corner missing). There is nothing to distinguish the tooth from *T. tennesseae* Hay from Whitesburg, Tennessee. However, that form, if determinable at all, is almost certainly conspecific with *T. veroensis* (Simpson, 1945, p. 65).

The third metapodial, represented by fragments from the distal end and from the shaft, probably both from the same bone, may be a metacarpal. The transverse diameter of the shaft is 25, as in the third metacarpal of *T. veroensis* described by Simpson (1929, pp. 588-589).

The morphologic and taxonomic identity of the cheek tooth and the metapodial, not to mention the two tooth fragments, is so uncertain as to demonstrate no more than the presence of a tapir of unknown species at the site.

Equus, sp. indet.
Horse

Material: two partial upper cheek teeth (USNM 23324 and 24496); right M_3 (Shorter College Collection); associated right tibia (lacking proximal end), astragalus, cuboid, and metatarsal III with proximal portion of metatarsal II attached by fusion (USNM 24494).

Remarks: The dimensions of the metatarsal compare well with those of four specimens from the Slaton Quarry, Lubbock County, Texas referred to *E. conversidens* by Dalquest (1967, p. 26). Measurements of the specimen from Ladds, followed in parentheses by the observed range among the four from Slaton Quarry, are: greatest length, 263 (255-264); greatest proximal breadth, 52.4 (46.7-49.0, 3 specimens only); least medial breadth, 33.3 (31.2-32.7); greatest distal breadth, 46.7 (42.3-47.0). The proximal breadth of the Ladds specimen, apparently an old individual, is increased by strong development of the exostotic growths characteristically present near the proximal articular surface of the metapodials in horses.

The material is not adequate to justify application of a specific name, particularly in view of the notorious difficulty of identification of Pleistocene horses.

Mylohyus nasutus (Leidy)
Long-nosed Peccary
FIGURE 5

Material: fragmentary palate with left and right P^2-M^3 and probably associated fragments (USNM 23326); isolated right P^2 (USNM 24498); isolated left P^3 (USNM 23327); isolated right C_1 (USNM 23685); isolated left DM_3 (USNM 23686); left humerus, left scaphoid, right lunar, right unciform, left and right metacarpal IV, right femur, left astragalus, one proximal, three penultimate, and two ungual phalanges (USNM 23328).

Remarks: Assignment of the specimens of Long-nosed Peccary to *M. nasutus* is based primarily upon the large size of USNM 23326 (Table 8), which is the largest individual of *Mylohyus* known to me, and hence must pertain to the large, "western" population A of Lundelius (1960, p. 28), rather than to any of the small "eastern" forms (population B, or *M. fossilis*). The lower canine (USNM 23685) from Ladds is strikingly large also, whereas the three remaining teeth are not. The presence of the "western" form at Ladds, and the lack of a clear east-west geographic segregation by size (see Tables 8 and 9) casts doubt on

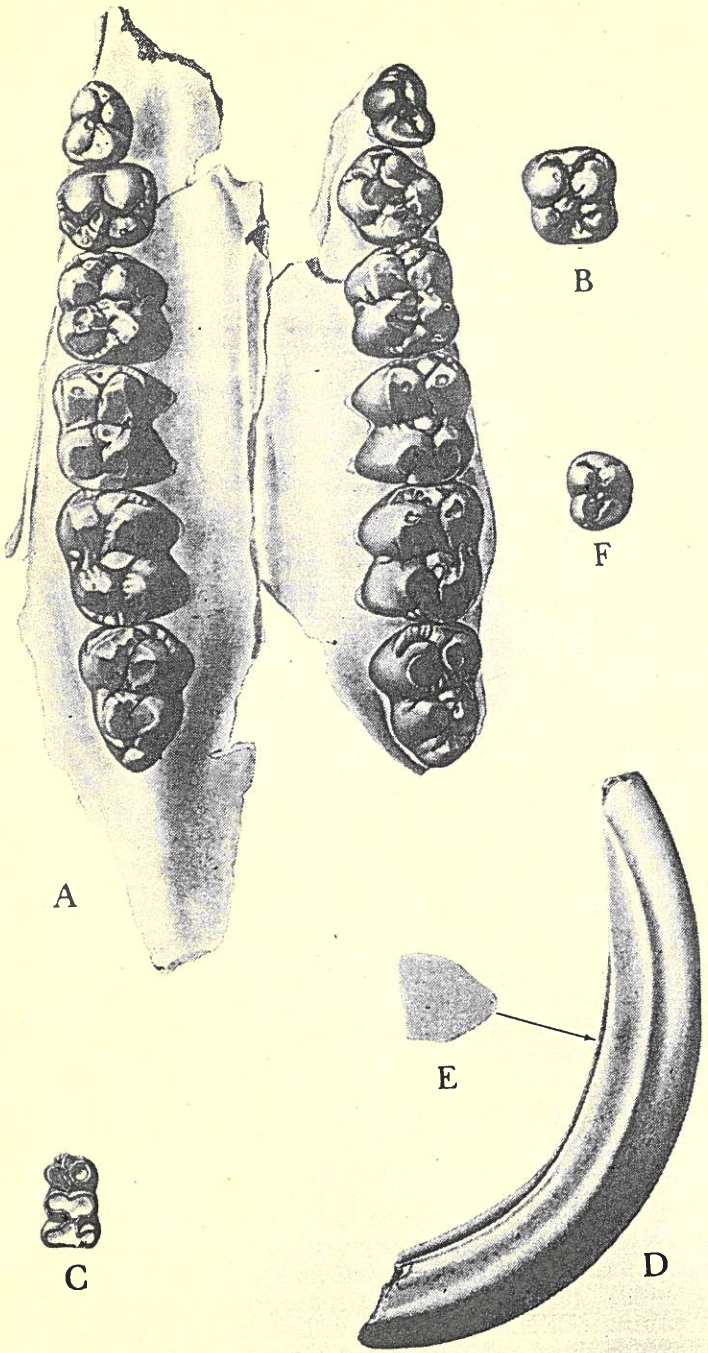


FIGURE 5.

Partial dentition of *Mylohyus nasutus*. X1.5. A, USNM 23326, fragmentary palate with left and right P²–M³ in palatal aspect; B, USNM 23327, isolated left P³ in occlusal aspect; C, USNM 23686, isolated left L[illegible], in

TABLE 8

Some measurements (mm.) of the dentition of *Mylohyus* from Ladds and elsewhere.

		Ladds				Friesenhahn Cave, Texas, after Lundelius, 1960				Sandahl Gravel Pit, Kansas, after Semken and Griggs, 1965				Haile VIIIA, Florida				Itchtucknee River, Florida				Mel-lonrue, Florida				Conard Fissure, Arkansas				Gibson County, Indiana				Hart-man's Cave, Pennsylvania				Port Kennedy Cave, Pennsylvania			
		USNM 23326, palate		USNM 24498, isolated P³		USNM 23327, isolated P³		USNM 23685, isolated C₁		USNM 23686, isolated DM₃		TMM 933-3232, skull and mandible		TMM 933-1407, partial mandible		UMMP 44763, palate				UF 3279, rostrum				UF 3567, rostrum				USNM 24587				AMNH 11812, palate				AMNH 11821, isolated teeth				ANSP 11508, *M. nasutus*, type				ANSP 26, *M. pennsylvanicus*, type				ANSP 119, *M.* sp., palate				ANSP 108, *M. tetragonus*, type				ANSP 112, *M. tetragonus*			
		left	right	right	right	left	right	right	left	left	right	right	left	left	right	right	left	left	right	right	left	left	right	right	left	left	right	right	left	left	right	right	left	left	right	right	left	left	right	right	left
P³	L	11.1	11.2	10.2						9.6	9.5			9.2	8.9			8.6	—							10.3	—																
	AW	8.6	8.8	8.9						8.4	8.6			—	—			—	—							8.5	—																
	PW	8.9	9.0	8.5						8.5	8.9			8.7	8.9			8.2	—							8.9	—																
P³	L	13.1	13.4							12.6	12.8			11.3	10.9			10.9	—							12.4	—																
	AW	11.0	11.1			11.7				11.4	11.6			10.7	10.6			10.5	—							10.9	—																
	PW	11.9	12.3			11.5				11.8	12.0			11.2	10.9			11.5	—							11.5	—																
P⁴	L	15.0	15.2			11.3				13.7	14.7			12.1	11.8			12.0	12.0							12.1	13.9																
	AW	14.2	14.3							14.4	13.1			11.9	11.6			12.1	12.2							12.1	12.1																
	PW	14.4	14.4							14.1	14.1			12.3	12.5			12.1	12.6							12.1	13.2																
M¹	L	17.0	16.6							—	—			14.1	14.1			15.1	14.8							15.4	—																
	AW	15.2	15.4							—	—			13.6	13.9			13.8	13.9							—	—																
	PW	15.0	14.9							—	—			13.5	13.6			14.2	14.3							—	—																
M²	L	18.0	17.8							16.3	16.4			14.1	—			15.2	15.0							14.4	14.4																
	AW	16.0	16.2							15.9	16.0			14.1	—			14.6	14.8							14.2	14.2																
	PW	14.9	15.4							15.1	15.0			13.8	—			14.1	14.2							14.2	14.2																
M³	L	19.3	19.3							17.4	17.7			16.3	—			17.5	17.3							17.3	17.3																
	AW	15.1	14.7							17.4	17.7			12.5	—			12.8	12.7							15.7	15.7																
	PW	11.8	11.9							14.2	13.9			10.4	—			10.7	10.7							13.6	11.8																
Total length, premolars		38.7	37.4							33.7	31.3																																
Total length, molars		53.9	53.3							48.0	48.8																																
Total length, cheek teeth		92.2	91.0							82.7	83.1																																
Width between canine alveoli		35.4*								30.3	30.3																																
C₁	L					13.5				12.0	12.2																																
	W					11.1				9.5	9.3																																
DM₃	L																																									
	AW																																									
	CW																																									
	PW	12.5								11.3																																
		6.4								6.4																																
		7.1								6.9																																
		7.8								7.4																																

the characterization of a large western and a small eastern species. It seems likely that the observed variation in *Mylohyus* could well be the result of sexual, individual, geographic, and chronologic variation within a single species.

At least most of the postcranial elements probably represent a single individual. The right lunar, unciform and metacarpal IV are definitely associated, as are the left metacarpal IV and its proximal phalanx. Other associations are less certain. The humerus, femur, and metacarpals clearly pertain to *Mylohyus* rather than *Platygonus* on the basis of their slender construction (Table 9) and on characters noted in part by Lundelius (1960). The humerus (distal half only), metacarpals, astragalus, scaphoid, lunar, and unciform are represented among the specimens referred to *Mylohyus* from the Conard Fissure in the American Museum of Natural History. All elements compare very well in morphology and size to those from Ladds.

It will be noted (fig. 5A) that USNM 23326 has both third premolars rotated far out of their normal position, that on the right by almost 90°. Similar anomalies are not uncommon among modern peccaries.

TABLE 9

Some measurements (mm.) of Postcranial elements of *Mylohyus* from Ladds (USNM) and from Friesenhahn Cave, Texas (TMM).

	USNM 23328		TMM 933-3232		TMM 953-1352	TMM 933-1850	TMM 933-1351	CM 1353
	left	right	left	right	right	right	left	left
Humerus								
Total length	215.5		216	219	210	225		
Length between articular surfaces	185.0		183	186	182	191		
Minimum width of shaft	18.3							
Distal width	44.1							
Metacarpal IV								
Length	101.0	100.5	102.7	102.7				
Proximal width	15.0	15.5	16.1	16.4				
Distal width	15.3	15.4	15.0	16.1				
Femur								
Length		218.0	220	212			194	211
Proximal width		54.8	53.8	53			56	52
Distal width		48.2	50.1	52.8			47	47
Astragalus								
Length	41.1*		43.0	42.8				
Proximal width	23.3*		21.9	22.3				
Distal width	22.8*		22.8	22.3				

*Minima, based on rodent-gnawed specimen.

Platygonus compressus Le Conte
Le Conte's Peccary

Material: isolated left M_3 (USNM 24499).

Remarks. The tooth falls near the middle of the observed range of dimensions (L 23.3, W_a 13.0, W_p 12.3) for M_3 of the large samples referred to *P. compressus* from Cherokee Cave, Missouri, and Laubach Cave, Texas (Slaughter, 1966). The specimen is exceeded in size by the M_3 in all of 11 individuals of *P. cumberlandensis* from Cumberland Cave in the U. S. National Museum.

Odocoileus virginianus (Zimmermann)
White-tailed Deer

Material: fragmentary right mandibular ramus with P_3-M_2 and fragment of P_2 (USNM 23329); plus the following specimens more or less certainly identifiable as the present species: one right DM^1; one left, one right DM^4; one left M^1; one right M^2 (?); two left DM_2 (fragments); one left (fragment), one right DM_4; one left M_1 (incomplete); one left M_3; one fragment of a right mandibular ramus lacking teeth; one immature right humerus; one partial right astragalus, much rodent-gnawed; two right cubonaviculars; one right scaphoid; one small fragment from shaft of cannonbone; one proximal phalanx.

Remarks: The material of white-tailed deer is scanty and in general poorly preserved, but is sufficient to demonstrate presence of the species in the fauna. Several teeth of selenodont artiodactyls in the fauna are doubtfully assignable to *Odocoileus virginianus* (the right M^2 (?) noted above) or definitely do not pertain to that species. The supposed M^2 compares favorably to deeply worn examples of that tooth in large individuals of *O. virginianus*, but compares equally well with M^1 in specimens referred to *Sangamona fugitiva* from San Josecito Cave, Mexico (LACM 192/8103) and Frankstown Cave, Pennsylvania (CM 11044). In addition there are two deeply worn examples of P^3 or P^4, which cannot be matched within extensive series of modern *Odocoileus;* also, one right DM^4, which resembles with some discrepancies that in LACM 192/8142 from San Josecito, and ANSP 13578 from a cave 50 miles west of Carlsbad, New Mexico, and ANSP 13591 and 13592, from Burnet Cave, New Mexico. These specimens are inadequate to form the basis for inclusion of *Sangamona* in the fauna from Ladds, in view of their deep wear, and lack of exact matching with referred comparative specimens, and impossibility of comparison with the type, USNM 8954, an isolated upper molar, not so deeply worn as the right M^1 from Ladds reported here. Furthermore, the genus *Sangamona* requires review; the type is somewhat atypical in comparison to specimens subsequently referred (mostly unpublished) to the form, and critical restudy is required. There can be no doubt, however, that a large extinct *Odocoileus*-like deer (somewhat larger than any living *Odocoileus* and much smaller than *Cervus canadensis)* was widespread and apparently rather common in the United States and Mexico during the late Pleistocene. It has been confused repeatedly with *Rangifer* as a result of similarity in size of some elements. Review of all material probably will

demonstrate that this species may be accommodated under the name *Sangamona fugitiva* Hay.

Presence of the species at Ladds would not be unexpected, as the type is from a presumably late Pleistocene deposit near Whitesburg, Hamblen County, eastern Tennessee.

Still another unsatisfactorily identified selenodont artiodactyl tooth consists (apparently) of the anterior ⅔ of a left DM_4 (USNM 23330). This specimen lacks the small labial stylid between the lobes of the tooth, so characteristic of cheek teeth in deer and present in every cervid DM_4 seen by me. In this and in detailed configuration of the crown, the tooth resembles that of *Tanupolama*, and could represent *T. parvus* Olson. However, as camelids are not otherwise represented in the assemblage, the single inconclusive fragment is not sufficient to warrant inclusion.

On the basis of specimens in hand it is possible to say only that one or more selenodont artiodactyls, in addition to *Odocoileus virginianus*, was present in the Ladds assemblage. Further collecting at the site may establish their identity.

Summary

At least 48 species of mammals are known from Ladds, of which approximately ¼ are extinct, including *Megalonyx*, sp. indet., *Dasypus bellus, Tamias aristus, Peromyscus*, new species, *Tremarctos floridanus, Tapirus* cf. *veroensis, Equus*, sp. indet., *Mylohyus nasutus*, and *Platygonus compressus*. Species of northerly affinities include *Sorex cinereus, S. fumeus, Sylvilagus transitionalis, Synaptomys cooperi*, and *Martes pennanti*. Species of southerly affinities are *Dasypus bellus, Neofiber alleni, Tremarctos floridanus, Conepatus leuconotus, Panthera onca, Felis (?Herpailurus)*, sp. indet., and *Tapirus* cf. *veroensis*. Paleoecological interpretation of the possibly heterochronic assemblage must await discovery and study of unit faunas.

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