BLANCAN MAMMALS FROM HAILE XVA, ALACHUA COUNTY, FLORIDA

By

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ABBREVIATIONS

Abbreviations of institutions and collections used throughout this work are as follows:

AMNH: American Museum of Natural History

U.C.M.P.: University of California Museum of Paleontology

UF: University of Florida Collections

UK: University of Kansas

H.C.T.: University of Houston Collection

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Major Department: Zoology

The Haile XVA fauna is the first Gulf Coastal Plain Blancan fauna to be described. Among the mammals, which are represented by 8 orders, 17 families, and 18 genera, are two edentates which are new to the North American fauna. *Glossotherium chapadmalensis* (Kraglievich), a small South American ground sloth species, is reported from North America for the first time. This species was previously known from the Chapadmalalan (early Pleistocene) fauna of Argentina. It is proposed that this form may be ancestral to both *G. harlani* (Owen) and *G. robustus* (Owen). *Kraglievichia paranensis* (Kraglievich), a giant, extinct armadillo previously known only from Miocene and Pliocene deposits of South America, is reported for the first time in North America. The Haile XVA specimen is described as a new subspecies. *Dasypus bellus* (Simpson), a smaller extinct armadillo, is reported for the first time in the Blancan, making its earliest occurrence anywhere.

A brief review of the Subfamily Chlamytheriinae is presented, and it is suggested that *Plaina* (Castellanos) is a synonym of *Kraglievichia* (Castellanos) and that *Hoffstetteria* (Castellanos) is a synonym of *Chlamytherium* (Lund). Chlamytheres are shown to have been present in North America continuously since the re-establishment of the late Cenozoic land bridge between North and South America, and it is proposed that the Pleistocene evolution of these forms occurred simultaneously on both continents.

The Old World Flying squirrel *Petauria* is reported for the first time in the New World. It was previously known only from early Pleistocene deposits of Bavaria.

Several of the Haile XVA taxa are closely allied with South American Plio-Pleistocene forms, which further strengthens the previously established correlation between the Chapadmalalan stage of South America and the Blancan stage of North America.

The abundance of aquatic non-mammalian vertebrates indicates that the environment of deposition was probably an open stream. The mammalian members of the terrestrial community include the tropical or subtropical indicators *Kraglievichia* and *Dasypus*. Forest indicators include *Mylohyus*, *Castor*, *Petauria*, and *Glossotherium*. The zoogeography of the more exotic forms is discussed.

INTRODUCTION

Florida has long been famous for its Pleistocene fossil vertebrate deposits. Most of these sites have yielded faunas representing the later stages of the Pleistocene. Classical examples of these are Vero, Indian River County (Sellards, 1917; Hay, 1917; 1928; Wiegel, 1962), Melbourne, Brevard County (see Ray, 1957, for numerous references), and Seminole Field, Pinellas County (Simpson, 1930) which are all of late Rancholabrean age. Among the slightly earlier Rancholabrean faunas are Haile VIIIA, Alachua County, and Bradenton, Manatee County (Robertson, in press).

An Irvingtonian site, Coleman IIA, Sumter County, has recently been described by Martin (in press). To date, this is the earliest Florida Pleistocene fauna to be fully described. Another excellent Irvingtonian fauna, Inglis IA, Citrus County, is presently being described by Mr. Jean Klein, a graduate student in geology at the University of Florida.

The Santa Fe I locality, Gilchrist County, has long been considered to be of Blancan age, but the fauna is as yet undescribed except for the description of Titanis, a giant, flightless bird (Brodkorb, 1963). A faunal list for this locality is provided by Webb (in press a). Other Florida deposits which are considered to be of Blancan age, but which have not been studied, are Santa Fe IV and Santa Fe VIII, Gilchrist County.

Correlation of Florida Pleistocene deposits is difficult at best, because of their mode of deposition. The two most common types of Florida Pleistocene fossil vertebrate deposits are filled sinkholes in limestone and river bottom deposits. The various fissure fillings have trapped sediments representing many stages of the Pleistocene, and adjacent sinkholes may contain faunas which vary greatly in age. River bottom deposits are usually heterochronous accumulations of bones which have eroded out of fossiliferous strata and settled at low energy areas of the stream. This lack of orderly stratigraphic sequences for most of the Florida fossil vertebrate deposits necessitates the use of faunal correlation.

Usually, a reasonably accurate age assignment can be made based upon the presence or absence of certain genera and species. The presence of *Bison*, for example, indicates a Rancholabrean age (Savage, 1951). Further refinement of the age could be made by determining the species of *Bison* present. The presence of *B. latifrons* would represent early

Rancholabrean, *B. antiquus* late Rancholabrean, and *B. bison* sub-Recent or Recent (Robertson, in press).

In addition to faunal correlation, the effects of sea level changes due to Pleistocene glaciation may be employed as an aid to dating Florida Pleistocene deposits. Glacial eustatic fluctuations of sea level have caused "terraces" or "abandoned shore lines" which are dominant geomorphic features of the Florida landscape (Cooke, 1945, MacNeil, 1949; White, 1958; Alt and Brooks, 1965). The location of a deposit relative to these structures can be quite helpful in age determination. If, for example, a coastal terrestrial deposit is presently lying at or below sea level, then it must represent a time when sea level was as low or lower than it is now. This would be an indication that the deposit was laid down during glacial times, as these were the times of low sea level. Once this is determined, faunal elements will indicate which glacial stage is represented.

Inland deposits of higher elevations present a problem in that they could have been deposited during either a glacial or interglacial stage. If, however, it can be shown that a particular inland deposit was coastal at its time of deposition, then it must represent an interglacial stage, when sea level was high. As a rule it is difficult to ascertain whether or not a terrestrial fauna represents inland or near-shore conditions. Auffenberg (1958), however, has been able to do this for certain deposits. Working with fossil Terrapene carolina, he has shown that particular intergradient populations of this species reflect near-shore conditions. If members of these intergradient populations are present in an inland deposit of higher elevation, the deposit probably represents an interglacial stage. Evidence for near-shore conditions is not always this conclusive, however, and sometimes one is forced to rely upon more tenuous means.

Of particular interest among the Florida fossil vertebrate deposits are those near the settlement of Haile, Alachua County, conveniently located only 15 miles from the University of Florida campus. In a radius of only a mile are clustered numerous vertebrate localities, traditionally designated by roman numerals in the University of Florida vertebrate paleontology collections. Most of the Haile localities have produced fossils of Rancholabrean age. Notable exceptions to this are localities V and VI which are considered to be Pliocene (Auffenberg, 1955) and locality XVA which is regarded as Blancan. The fossil vertebrate assemblage recovered from the Haile XVA locality constitutes the subject for this dissertation.

The Haile XVA locality is situated on the property of

Parker Brothers' Limestone Products, Inc., near Haile, R17E, T9S, S25, Alachua County, Florida. It was discovered in 1964 by Mr. Phillip Kinsey of Jacksonville Beach, Florida, who has long been a friend of, and a contributor to, the Florida State Museum. Mr. Kinsey did extensive collecting at Haile XVA, and, upon recognizing it as an unusual locality, brought it to the attention of the museum staff. Further excavations were carried out in the same year by Dr. S David Webb, Mr. Robert Allen, and the present author, with the support of NSF Grant GB 3862. The resulting collections, in addition to the large quantity of bones so generously donated by Mr. Kinsey, are now housed in the University of Florida Collections.

In addition to the mammalian fauna described in this report, the locality has also contributed extensive fish and reptile faunas. A fair amount of amphibian and avian remains is also present. Among the reptiles are the type and abundant material of Chrysemys platymarginata (Weaver and Robertson, 1967).

GEOLOGY

The Haile XVA deposit, lying at an elevation of about 90 feet above sea level, is a filled sinkhole in the Ocala (Eocene) Limestone. The deposit extends approximately 30 feet along its east-west axis; its north-south dimension is narrower and irregular in width.

Underlying the fossil-bearing matrix is a layer of dark brown, unfossiliferous hardpan which begins at a depth of approximately 20 feet and extends to a depth of at least six feet from its upper margin (Figure 1).

The fossil-bearing matrix extends from about five to 20 feet below present ground level, and consists of two units: an upper layer of heavy, greenish clay; and an underlying layer of coarse, poorly sorted, gravelly sandstone, containing lenses of clay. Where these two units merge, an alternation of clay and sand lenses occurs. The lowermost massive sand is the most productive part of the fossiliferous sequence. It contains much calcareous cement and calcareous cemented concretions. Many of the larger bones were encrusted with cemented sand and gravel. The

Figure 1

Geologic Section at Haile XVA

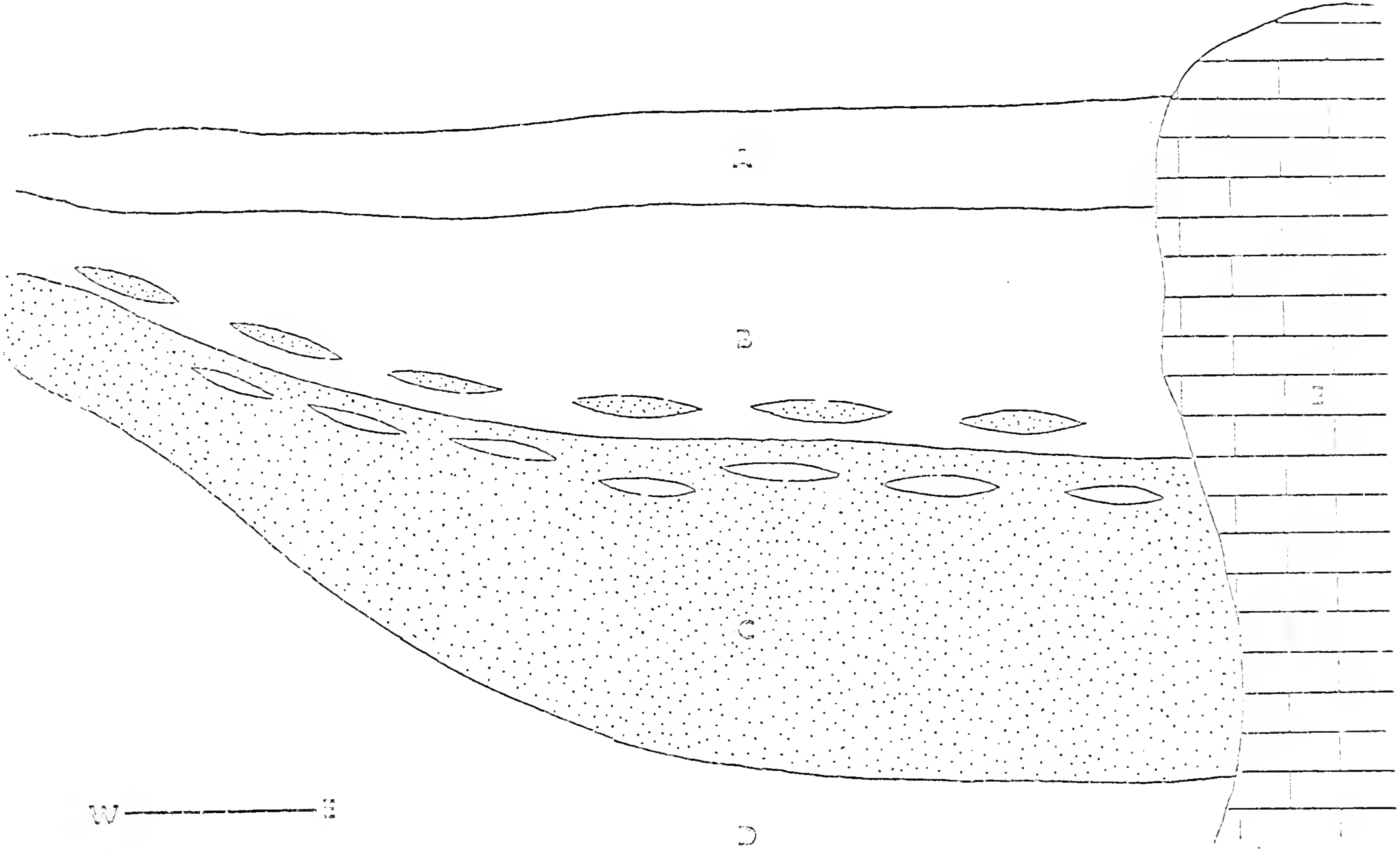
A. Sandstone alternating with gray clay

B. Heavy greenish clay

C. Coarse, poorly sorted, gravelly sandstone

D. Dark brown hardpan

E. Ocala Limestone (Eocene)


A
B
C
D
E
W
E

sandstone and clay were shown to be essentially contemporaneous by the occurrence of fossils which extended from the sandstone up into the clay.

Overlying the fossiliferous sand and clay sequence is a layer of thin, brown sandstone alternating with gray clay. This layer is unfossiliferous.

Since the original collections were made, mining activities have scattered the remaining matrix over a wide area. On a recent trip, for example, a tooth of Glossotherium belonging to the associated skeleton taken from the original deposit in 1964 was found on one of the adjacent piles of matrix. The site is presently covered by several feet of sand washed in from the overhanging limestone ledge. There is little, if any, of the matrix remaining in the original site.

SYSTEMATIC PALEONTOLOGY

There are 20 taxa representing a minimum number of 34 individuals in the Haile XVA fauna (Table 1). These are considered on the following pages.

Order Insectivora

Family Soricidae

Cryptotis parva Say

Material: UF 17466, right mandible with M_1-M_3.

This specimen is morphologically indistinguishable from specimens of C. parva from the Irvingtonian Coleman IIA and from recent specimens. The Haile XVA specimen is slightly larger than the previously mentioned specimens (Table 2), but not significantly so. The only other Blancan record of Cryptotis is the Rexroad fauna (Hibbard, 1937, 1941), Meade County, Texas.

Family Talpidae

Scalopus aquaticus Linnaeus 1758

Material: UF 17466, 2 left M^2; UF 17465, right humerus.

A comparison of the three Haile XVA specimens with corresponding modern S. aquaticus from the southeastern

Table 1

Mammalian Faunal List and Minimum Number of Individuals

Cryptotis parva	1
Scalopus aquaticus	2
Glossotherium chapadmalensis	1
Graglievichia paranensis	3
Dasypus bellus	1
Sylvilagus sp.	3
Petauria sp.	1
Castor canadensis	1
Sigmodon medius	2
Canidae	2
Pteronura sp.	1
Smilodon gracilis	1
Gomphotheriidae	1
Nannippus phlegon	2
Plesippus simplicidens	2
Equus (*Asinus*) sp.	2
Tapirus sp.	1
Mylohyus floridanus	1
Hemiauchenia cf *macrocephala*	1
Odocoileus virginianus	5

Table 2

Measurements (in mm) of the Lower Dentition and Mandible of UF 17466 and Other Fossil and Recent *Cryptotis parva*

$\bar{X}$ = mean; O. R. = observed range; number of specimens in parenthesis

	US 17466	*C. parva** (20)		*C. parva** (fossil)	
		$\bar{X}$	O. R.	$\bar{X}$	O. R.
Condyloid to mental foramen	6.8	6.1	5.9-6.7	6.6	5.1-7.0 (8)
Condyloid to M_1	6.7	6.9	6.7-7.4	7.1	6.8-7.6 (8)
Condyloid to M_2	5.3	5.7	5.5-6.0	5.8	5.5-6.1 (8)
M_1-M_2	2.8	2.6	2.4-2.7	2.7	2.5-2.9 (8)
M_1-M_3	4.0	3.4	3.3-3.6	3.6	3.5-3.6 (2)
M_2-M_3	2.5	2.2	2.1-2.4	2.3	2.2-2.3 (2)

---

*measurements after Martin (in press)

United States reveals no significant differences in size or morphology.

Scalopus is also present in the Blancan Rexroad fauna of southwest Kansas (Hibbard, 1941). The only other mole from the Rexroad fauna is *Hesperoscalops*, which is based upon a partial lower dentition. A direct comparison could not be made with this genus as only upper teeth are known from Haile XVA. As Hibbard (1941) points out, however, mole humeri of various genera can be distinguished from one another, so it would be illogical to assume that a *Scalopus*-like humerus would belong to another genus. Because of this, and since *Scalopus* is known from other Blancan and Irvingtonian deposits, it seems reasonable to ascribe this material to the living species.

Order Edentata

Family Mylodontidae

Glossotherium chapadmalensis Kraglievich 1925

Material: UF 10922, partial skeleton

There is no doubt that the Haile XVA specimen represents one individual as there is no duplication of elements, and the left and right elements agree very closely in all measurements. Parts of this specimen were collected by several people over a number of years, but the bulk of the specimen was taken from the sand layer of the fossiliferous sequence and was semi-articulated.

In the following discussion, terminology regarding sloth dentitions will be based upon that used by Hirschfeld and Webb (1968): the first tooth (upper and lower) will be referred to as the caniniform; all the rest of the teeth will be referred to as molariform. No homologies are implied.

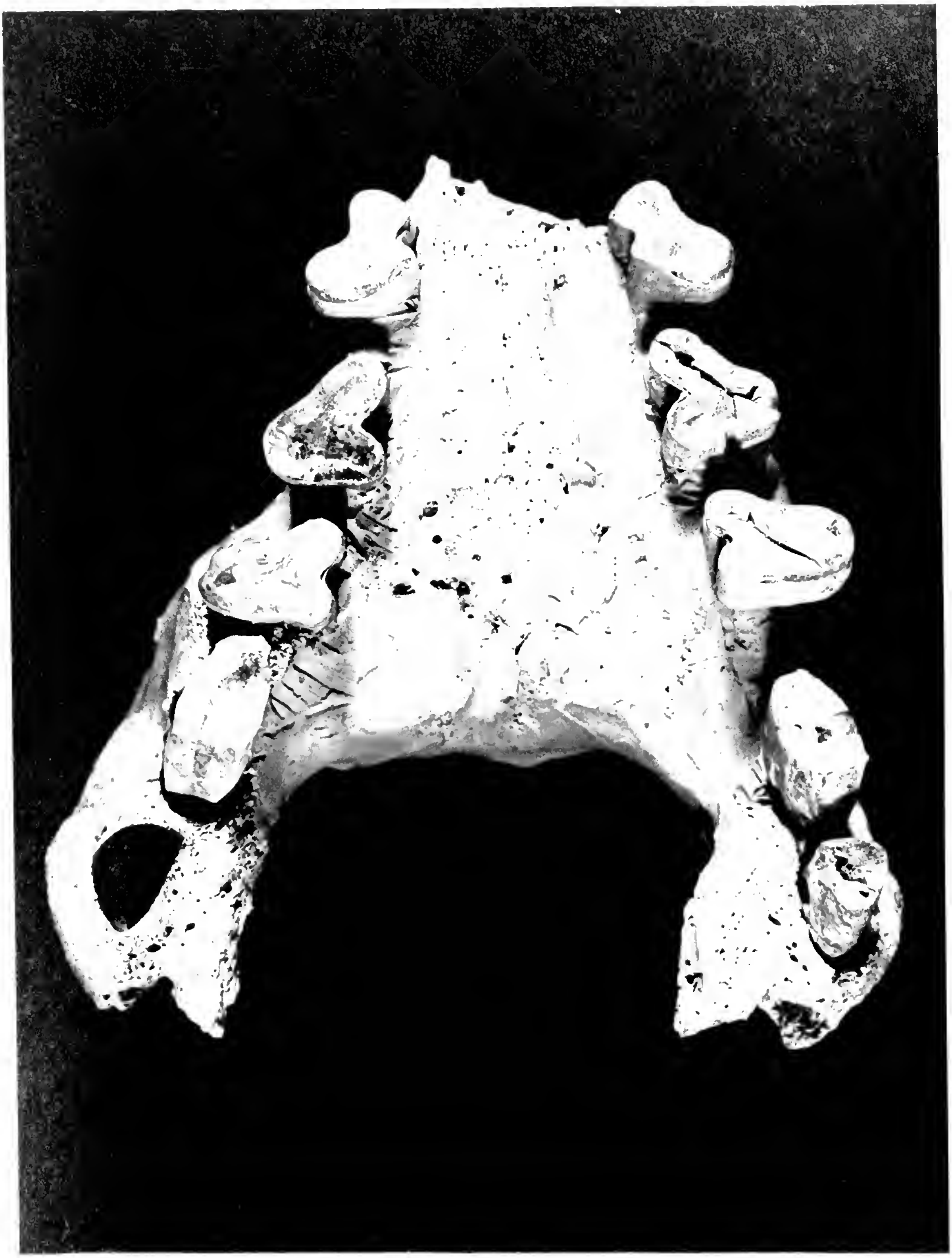
Upper dentition: The upper dentition of the Haile XVA specimen (Figure 2) is complete except for the left upper caniniform. The caniniform is triangular in cross-section and well developed. As in the Argentine specimen of G. chapadmalensis, this stoutness of the caniniform is reflected by the expansion of the anterior portion of the maxilla. The anterior portion of the maxilla is very much reduced in G. harlani, which tends to have a reduced or lost caniniform.

The first upper molariform tooth is large and oval in cross-section. As in G. harlani and G. robustus it is the longest anteroposteriorly of all the upper teeth, but is relatively narrow in transverse diameter. Due to the very well-developed lower caniniform which in part occludes with this tooth, the anterior oblique wear surface is much more accentuated than in G. harlani. In several specimens of

Figure 2

Glossotherium chapadmalensis Upper Dentition

X 1.13 (linear)



G. robustus observed, this tooth was worn off smoothly just above the alveolus. A very short diastema separates the caniniform from the first molariform tooth in the Haile XV specimen.

The second upper molariform tooth of UF 10922 is triangular in cross-section, with the base of the triangle placed lingually. The anteroposterior distance is less than the transverse diameter in this species, while the opposite is true in G. harlani. Of the two specimens of G. robustus for which measurements are provided, one agrees with G. chapadmalensis while the other is nearly equal in both diameters. The third upper molariform tooth of UF 10922 is similar in shape to the second and agrees morphologically with the corresponding teeth in both G. harlani and G. robustus. The fourth molariform tooth is relatively small compared to the Argentine specimen of G. chapadmalensis although the shape is the same.

The palate is very much constricted in the area of the last upper teeth and very much expanded at the anterior end of the maxilla. Both of these characters are more extreme in UF 10922 than in the Chapadmalalan specimen, or in specimens of G. harlani and G. robustus.

Lower dentition: The lower caniniform of UF 10922 (Figures 3, 4) is very well developed and directed labially.

Figure 3

Glossotherium chapadmalensis Right Mandible, Lateral View

X 0.82 (linear)

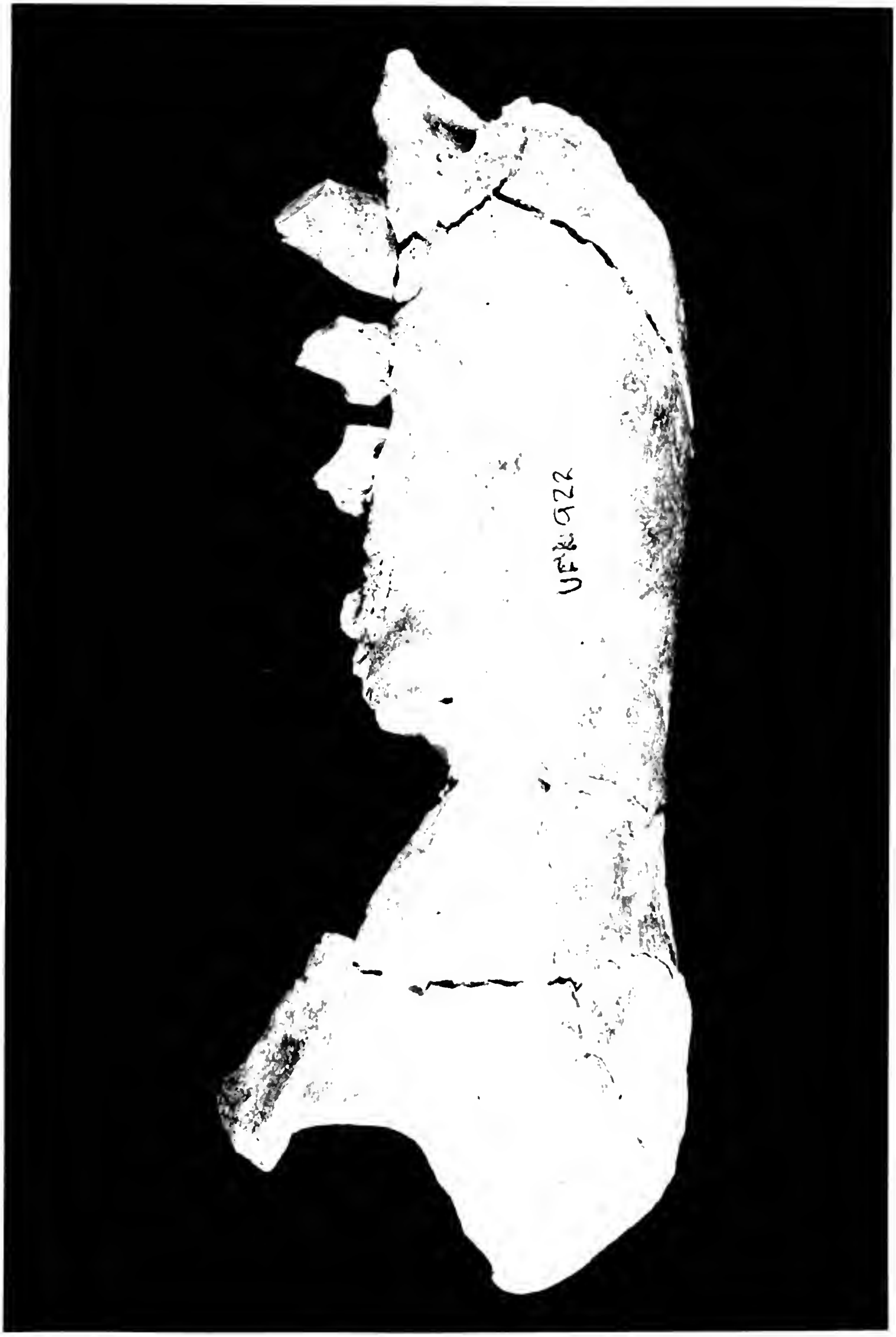

UF 8922

Figure 4

Glossotherium chapadmalensis Right Mandible, Occlusal View

X 0.82 (linear)

This tooth is relatively slightly larger than the corresponding tooth in the South American specimen of G. chapadmalensis. The tooth is pointed when viewed laterally due to the dual occlusion with the upper caniniform and the first molariform tooth.

The first lower molariform tooth is also relatively robust. It is somewhat triangular in cross-section and protrudes fairly high above the alveolus. This tooth is also turned slightly to the outside and closely resembles the lower caniniform.

The second molariform tooth is rectangular and is turned lingually, so that its long axis does not parallel the tooth row. Stock (1925), in discussing this tooth, used the long axis as the anteroposterior length while Kraglievich (1928) used the shorter axis of the tooth for this measurement. For comparison, Kraglievich's method of measuring is used here for the Haile XVA specimen and Stock's method for measuring G. robustus. It was necessary to reverse the measurements of G. robustus provided by Kraglievich (1928) so they would be consistent with the other material considered. Thus, the seemingly great difference in the measurements of the second molariform teeth is actually an expression of the fact that the orientation of the teeth is different in the species and does not indicate gross morphological differences in the teeth.

The third lower molariform tooth is of a slightly different shape in *G. chapadmalensis*. The two main columns are separated by a thin bridge, while in *G. harlani* and *G. robustus* this bridge is thicker.

Mandible: Unfortunately, the mandibular symphysis is not preserved in the Haile XVA specimen. The portion of the mandible present agrees in morphology with the other two species. Measurements of the upper and lower dentitions are presented in Table 3.

Cranial material: The remainder of the Haile XVA cranial material consists of part of the occipital bone and portions of the left and right periotic bones. The occipital fragment contains the left condyle and a portion of the otic region. The hypoglossal canal, jugular foramen, and auditory meatus show no observable differences from those of *G. harlani* and *G. robustus*. A portion of the left squamosal is attached to the occipital. Part of the right squamosal is present including the zygomatic process.

Vertebrae: The atlas of UF 10922 is well preserved. According to Stock (1925) this element differs in *G. harlani* and *G. robustus*. The posterior portion of the lateral process does not extend as far forward in *G. harlani*. The location of the dorsal foramina also varies: In *G. harlani* they are quite far apart while in *G. robustus* they are

Table 3

Measurements (in mm) of the Upper and Lower Dentitions of Three Species of *Glossotherium*

	G. chapad-malensis Haile XVA	*G. chapad-malensis* Argentina[1]	*G. harlani* California[2]	*G. robustus* Argentina[3]
Upper Dentition				
Anteroposterior length, tooth 1	14.7	14.0	17.9	17.9
Transverse length, tooth 1	10.6	10.5	16.0	18.2
Anteroposterior length, tooth 2	22.4	22.0	33.3	22.3
Transverse length, tooth 2	12.0	15.0	17.4	16.7
Anteroposterior length, tooth 3	15.6	20.5	27.1	22.8
Transverse length, tooth 3	22.4	2.40	23.0	23.0
Anteroposterior length, tooth 4	17.9	15.0	22.6	20.3
Transverse length, tooth 4	20.5	24.0	23.8	22.4
Anteroposterior length, tooth 5	21.4	24.0	24.3	23.3
Transverse length, tooth 5	13.6	18.0	19.4	19.2
Lower Dentition				
Anteroposterior length, tooth 1	20.5	14.5	21.4	20.4
Transverse length, tooth 1	12.4	10.5	16.0	15.0
Anteroposterior length, tooth 2	18.7	18.0	28.3	23.8
Transverse length, tooth 2	14.5	22.0	22.5	22.8
Anteroposterior length, tooth 3	14.5	14.0	28.8	25.0
Transverse length, tooth 3	20.5	25.0	18.2	19.0
Anteroposterior length, tooth 4	40.3	43.0	51.9	50.2
Transverse length, tooth 4	17.6	18.0	23.8	20.2

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[1] measurements after Kraglievich (1925)

[2] measurements after Stock (1925)

[3] measurements after Owen (1842)

close together. UF 10922 definitely agrees with *G. harlani* in the expression of these two characters.

The remainder of the vertebrae preserved are, for the most part, in poor condition, and as a result their positions in the vertebral column could not be determined accurately.

Front limbs: Neither scapula of UF 10922 is present. The right humerus is present. Neither radius is preserved, although both ulnae are present. The left ulna is so poorly preserved that it could not be removed from the plaster jacket in which it was collected.

Several bones of the manus are present in the Haile XVA material. The cuneiform appears to be somewhat different in *G. chapadmalensis* than in *G. harlani*. This element in UF 10922, when viewed from the palmer aspect, is square in appearance as opposed to being rectangular in the figure of *G. harlani* provided by Stock (1925, Figure 72d). These differences are reflected by the measurements of this element in Table 4. In UF 10922, the proximal-distal distance is greater than the distance across the ulnar articular surface while the opposite is true for 39 specimens measured by Stock. The cuneiform appears to be a deeper element in *G. chapadmalensis* than in *G. harlani*. The remainder of the elements of the manus preserved in the Haile XVA specimen

Table 4

Limb Measurements (in mm) of *Glossotherium chapadmalensis* and *Glossotherium harlani*

	G. chapadmalensis UF 10922, Haile XVA left	 right	*G. harlani** Rancho La Brea
Humerus			
Greatest anteroposterior distance of head	70.0	70.0	123.8
Greatest width of shaft at deltoid ridge	----	71.3	122.6
Width of distal articular surface	----	86.0	133.2
Ulna			
Greatest length	285	----	395.9
Width of distal articular surface	34	----	55.0
Femur			
Total length	355	----	546.4
Transverse diameter of head	79.3	----	127.8
Least width of shaft	99.5	----	164.6
Greatest width across distal tuberosities	140	----	234.8
Width of distal condyles	111	----	188.5
Width of intercondyloid space	27.1	----	47
Width of inner condyle	47.2	47.2	88.7
Vertical extent of inner condyle	67	69.8	120
Tibia			
Total length	181	176	247.3
Greatest width, proximal end	114	----	185.2
Greatest width, distal end	90	88	142.5
Anteroposterior distance, distal end	64.8	66.6	101.9
Fibula			
Total length	183	----	263
Width, proximal end	50.5	----	103.6
Width, distal end	39.5	----	73.5

*After Stock (1925). The measurements represent the mean of large samples. The number of specimens varied from element to element and in some cases was not given.

are the left scaphoid, right pisiform, left metacarpal III, and left phalanx II, digit III.

Hind Limbs: The pelvis is missing in UF 10922. The left femur is complete while the right is badly fragmented. Both tibiae, and the left fibula are well preserved.

Several elements of the pes are present. These are the right calcaneum, right astragalus, left and right metatarsal III, left and right phalanx II, digit III, and an ungual phalanx, digit III.

A comparison of the limb elements of the Haile XVA specimen with those of *G. harlani* from various Rancholabrean deposits of Florida and with the figures of *G. harlani* provided by Stock (1925) and figures of *G. robustus* (Owen, 1842) shows, for the most part, no great morphological differences. All three of these species appear to be very similar postcranially. Comparative measurements of UF 10922 and Stock's (1925) Rancholabrean material show the Haile XVA material to be significantly smaller (Tables 4, 5). *Glossotherium robustus* is larger, about the size of *G. harlani*.

Discussion: There has been much confusion concerning the taxonomy of the genera *Mylodon* and *Glossotherium*. Kraglievich (1928) has presented a thorough review of the literature. He concludes that *Mylodon darwinii* is the geno-

Table 5

Measurements (in mm) of the Bones of the Manus and Pes of *Glossotherium chapadmalensis* From Haile XVA and *Glossotherium harlani*

	G. chapadmalensis		*G. harlani**
	left	right	
scaphoid			
Greatest distance across articular surface	46.2	-----	75.3 (39)**
cuneiform			
Greatest distance across dorsal surface from inner side to outer	42.1	-----	68.5 (42)
Greatest proximal-distal distance	34.3	-----	50.5
Distance across articular surface for ulna	31.2	-----	61.3
pisiform			
Greatest length	-----	25.3	55.6 (22)
Greatest depth	-----	18.9	36.4
Greatest width	-----	20.9	34.7
Metacarpal III			
Greatest length	71.7	-----	103.1 (30)
Width, proximal end	51.9	-----	75.2
Width, distal end	30.5	-----	50.9
Depth, proximal end	42.0	-----	66.0
Phalanx II, digit III			
Length	40.5	-----	48.9 (42)
Depth, inner condyle	23.5	-----	39.9
Width, proximal end	26.2	-----	47.9
Calcaneum			
Greatest width, anterior end	-----	57.4	91.8 (21)
Greatest depth	-----	83.4	125.4
Astragalus			
Anteroposterior diameter	-----	76.1	140.2 (41)
Metatarsal IV			
Length	84.3	-----	119.3 (29)
Width, proximal end	41.2	41.5	60.7
Depth, proximal end	34.3	37.1	45.5
Width, distal end	38.5	-----	50.1
Depth, distal end	35.3	-----	43.5

Table 5 (continued)

	G. chapadmalensis		G. harlani*
	left	right	
Phalanx II, digit III			
Length	30.2	31.0	35.4 (32)
Depth, inner condyle	20.4	21.5	21.8
Width, proximal end	22.6	22.5	35.1
Ungual phalanx, digit III			
Length	104.4		174.1
Proximal-distal distance of ungual base	41.0		73.5
Width, proximal end	32.4		55.0

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*measurements after Stock (1925)

**number in parentheses refers to the sample size from which the mean (the numbers in the right-hand column) was calculated type of *Mylodon*, and that what Owen (1840) described as *Mylodon robustus* more correctly belongs to a distinct genus, *Glossotherium*. However, Kraglievich retains *Paramylodon* (Brown, 1903) as a valid genus even though Stock (1925) showed that the type of *Paramylodon* merely represented a variation of what was then called *Mylodon harlani*. Simpson (1945) argues that if the North and South American forms (late Pleistocene) are not generically distinct, then they all belong to the genus *Glossotherium*. This view is followed here. Hoffstetter (1952) retains *Paramylodon* as a subgenus of *Glossotherium*, recognized by its tendency to lose the upper caniniform tooth, and because of their narrow muzzles and long skulls.

The partial, associated skeleton from Haile XVA is clearly a member of the Subfamily Mylodontinae as indicated by the single astragalar facet for articulation with the calcaneum. Following the above system of classification, it is a member of the genus *Glossotherium*. This specimen so closely resembles *Eumylodon* (*Glossotherium*) *chapadmalensis* that it is here ascribed to that species. *Glossotherium chapadmalensis* is an early Pleistocene ground sloth from the Chapadmalal fauna of Argentina and is here reported from North America for the first time. It is a small species which appears to be very closely related to both *G. harlani* and *G. robustus*, differing from these two forms in the nature of the anterior dentition and in overall size. It agrees with these two species in the morphology of most of the postcranial elements with the possible exception of some of the bones of the manus and pes.

As this species is known from the early Pleistocene of Argentina and Florida it is thus temporally, geographically, and morphologically, a plausible ancestor of both *G. harlani* and *G. robustus*.

Family Dasypodidae

Kraglievichia paranensis new subspecies

Holotype: UF 10902, partial skeleton collected by P. E. Kinsey, S. D. Webb, R. R. Allen, and J. S. Robertson in 1964.

Type Locality and Horizon: Haile XVA, R17E, T95, S25, Alachua County, Florida, Blancan.

Subspecific Diagnosis: A member of the species *Kraglievichia paranensis* on the basis of all major morphological characteristics. Differs from the only other subspecies, represented by the South American members of the species, in that the fourth tooth is reniform rather than peg-like and is not turned lingually, but is nearly parallel with the tooth row.

Referred Material: UF 10902, partial skull and jaws, and associated skeleton, Haile XVA (holotype), UF 17474, right ulna, also from Haile XVA; UF 10432, right humerus, Sante Fe I; UF 9354, right humerus, Santa Fe I; UF 10449, left ulna, Santa Fe I; UF 10830, right radius, Santa Fe I; UF 16371, left metatarsal IV, Waccasassa River; UF 17475, right metatarsal IV, Santa Fe II; UF 17472, right metatarsal III, Santa Fe II; UF 17476, right femur, Haile XIII; UF 17568, and UF 17569, right naviculars, Haile XVA.

Description: The discovery of the Haile XVA skeleton, as well as isolated postcranial material from several other sites in Florida, affords an excellent opportunity to expand the description of this species. Heretofore, postcranial material of this species has been scarce.

The following description is based for the most part on the Haile XVA specimen. In some cases material from the other localities is used if corresponding elements are lacking in the Haile XVA material.

Comparisons are made with North American specimens of Chlamytherium, as well as with descriptions and figures (particularly Winge, 1915) of South American chlamytheres.

Cranium: The nasals (Figure 5b) of UF 10902 compare favorably in size and morphology with the South American specimen of K. paranensis described by Castellanos (1927). They differ, however, in the presence of tiny protuberances

Figure 5

Kraglivichia paranensis Cranial Material

A. Right premaxillary

B. Nasal

C. Palletal portion of maxillary

D. Zygoma, ventral view

E. Zygoma, laterial view

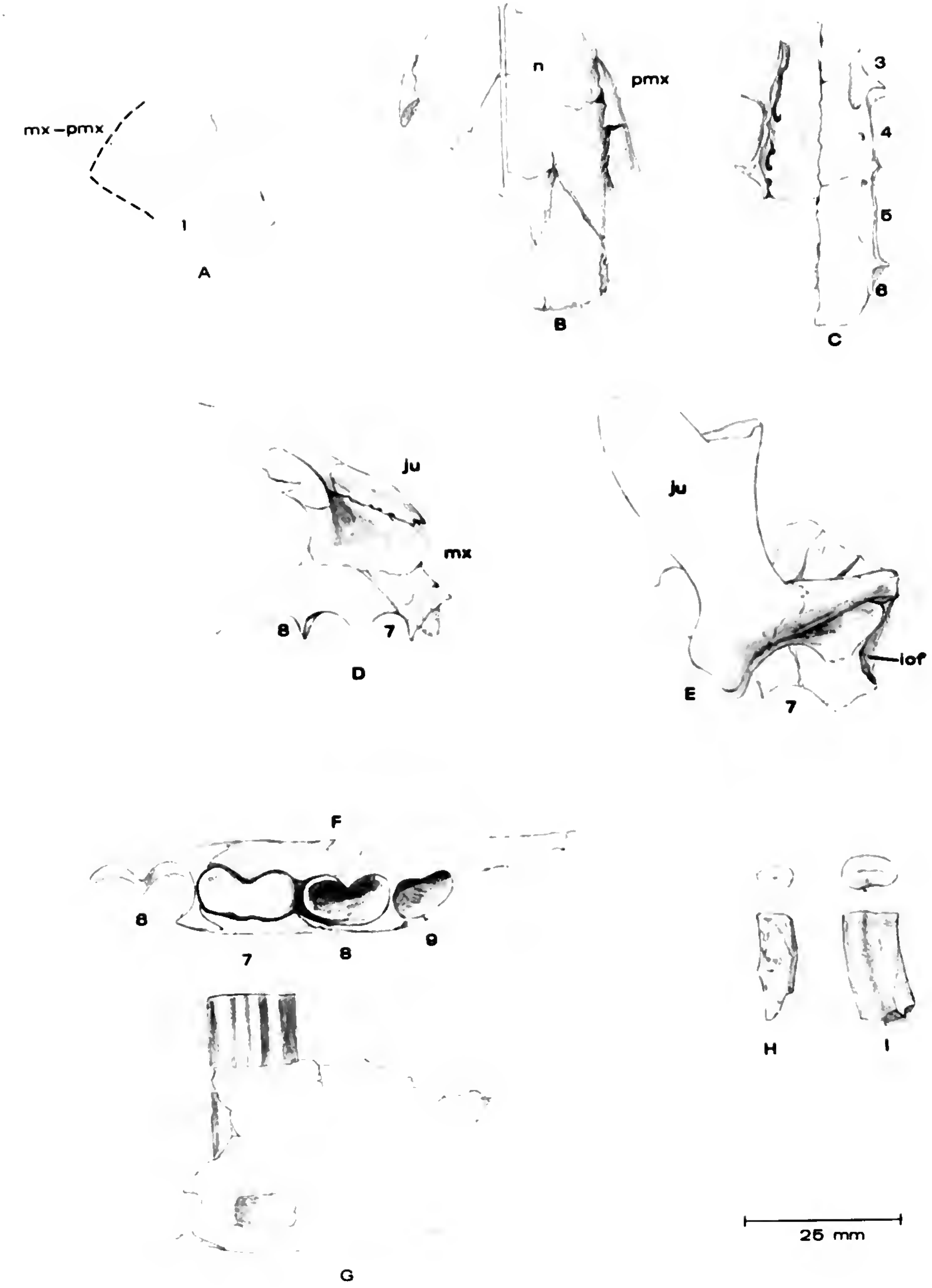
F. Right mandible, occlusal view

G. Right mandible, lateral view

H. First lower tooth

I. Fourth lower tooth

Abbreviations: iof, infraorbital foramen; ju, jugal; mx, maxillary; mx-px, maxillary-premaxillary suture; pmx, premaxillary; n, nasals; numbers refer to tooth sequence.


mx –pmx
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25 mm

on the anterior ends of the nasals near the medial surface. These structures are not present on any of the other *Chlamytherium* or *Kraglievichia* specimens or figures studied. Only the anterior halves of the nasals are present in UF 10902, as the skull had been eroded away, and only parts of it were recovered.

The premaxillary (Figure 5a) contains only one alveolus. The premaxillary-maxillary suture forms the posterior border of the first alveolus, as is the case in *Chlamytherium*. In *Holmesina* (=*Chlamytherium*), one of the distinguishing features was supposedly the presence of one tooth in the premaxillary. Two teeth were supposedly present in the premaxillary of *Chlamytherium*. The neotype of "*Holmesina*" (AMNH 26856, Simpson, 1930) as well as UF 889 (*C. septentrionalis* from Hornsby Springs, Bader, 1957) illustrates this condition. James (1957) states that in his specimen of *C. septentrionalis* (H.C.T. 4) there appears to be a suture both before and after the second tooth. A *Chlamytherium* skull collected in South America by Dr. Gordon Edmund, Royal Ontario Museum, has only one tooth in the premaxillary (Edmund, personal communication). Thus, even if this character should be found in some skull not now known, it would not serve to separate the North and South American forms.

The major features of the maxillary compare favorably with those in Chlamytherium. The infraorbital foramen (Figure 5e) is located directly above the sixth tooth in both genera. The anterior palatal foramina (Figure 5c) are located between the posterior edges of the fourth teeth in the Haile XVA specimen, while their position is somewhat variable in Chlamytherium. The maxillary process of the zygomatic arch is directly above the seventh tooth in both genera.

Only a portion of the zygomatic arch is present in UF 10902 (Figure 5d, e). The zygomatic process of the maxillary turns posteriorly and downward as it leaves the skull. The anterior portion of the jugal, which borders the zygomatic process laterally, then turns upward and expands posteriorly to accept the aquamosal process. A well-developed suture present at the posterior end of the jugal indicates that in Kraglievichia, as in Chlamytherium, the zygomatic arch is complete. The base of the zygomatic process of the maxillary is expanded by sinuses, as in Chlamytherium.

Upper dentition: There are nine upper and nine lower teeth in each jaw of Kraglievichia. One upper tooth is located in the premaxillary. Because the incisors of most mammals occur in the premaxillary, it is tempting to refer to the first tooth in *Kraglievichia* as an incisor. However, the terminology "tooth one" through "tooth nine" is continued in this report.

A conspicuous difference between the Haile XVA specimen and previously described specimens of *Kraglievichia* and *Chlamytherium* is seen in the nature of the anterior upper dentition. In the South American specimens of *Kraglievichia*, the first four teeth are oval in cross-section rather than reniform and have their long axes turned lingually. In *Chlamytherium*, the first three teeth show this condition, but the fourth is usually bilobate and parallel with the rest of the tooth row. This character is considered to be important in the evolution of the chlamytheres (Castellanos, 1937; Simpson, 1930). It is obvious, however, that this trait is variable. In James' (1957) specimen the first four teeth are oval, but the fourth tooth is parallel with the rest of the tooth row, rather than being canted lingually. The peg-like nature of the fourth tooth may represent a primitive condition, assuming *Kraglievichia* is the ancestor of *Chlamytherium*. *Vassallia*, another even more primitive chlamythere, with its first five teeth being peg-like and canted lingually, also shows this evolutionary trend. Castellanos (1937) sees the evolution of chlamythere teeth progressing from the back of the tooth row to the front, with the teeth tending to become bilobate and the tooth rows becoming parallel. The Haile XVA specimen appears to be intermediate between Kraglievichia and Chlamytherium in this character. The fourth alveolus shows that this tooth was moderately bilobate and nearly parallel with the posterior teeth. That this could represent individual variation should not be overlooked, especially when one considers the limited number of Kraglievichia specimens known; but when all the chlamythere specimens known are considered, the trend toward bilobate and parallel teeth seems evident. Cranial and upper dentition measurements are provided in Table 6.

Mandible and lower dentition: Partial left and right mandibles are preserved in UF 10902. In the right mandible (Figures 5f, g) the seventh tooth is complete while the eighth is broken off below the level of the alveolus. Alveoli for the sixth and ninth teeth are present. The fragmentary nature of the two jaws makes them difficult to compare in detail. The major differences between the mandibles of Kraglievichia and Chlamytherium, according to previous workers, are in the shape and orientation of the anterior teeth. Unfortunately, this portion is lacking in both mandibles of UF 10902. There appear to be no differences in the posterior portion of the mandibles except for

Table 6

Cranial and Dental Measurements (in mm) of *Kraglievichia* and *Chlamytherium*

	Kraglievichia UF 10902 Haile XVA	*Kraglievichia* Argentina[1]	*Chlamytherium* AMNH 2686 Florida	*Chlamytherium* UF 889 Florida
Cranium				
Width of nasals at anterior border of premaxillary	25.9	27.6	----	39.0
Width of palate at center of tooth 4	15.0	17.4	28.0[2]	29.6
Anteroposterior length, tooth 4	12.3	12.6	----	16.7
Anteroposterior length, tooth 5	15.4	12.7	23.7	20.5
Anteroposterior length, tooth 7	16.4	15.0	22.6	23.6
Width, tooth 1	6.8	6.5	7.6	----
Mandible				
Distance, top of ninth alveolus to bottom of jaw	37.8	32.8	60.2	51.4
Length, tooth 1	5.4	----	----	----
Width, tooth 1	3.7	----	----	----
Length, tooth 3	8.2	----	12.3	----
Width, tooth 3	5.2	----	6.9	----
Length, tooth 6 (alveolar)	16.0	14.8	25.1	25.1
Length, tooth 7	14.3	13.9	23.3	22.1
Width, tooth 7	7.1	----	11.2	9.2
Width, tooth 8 (alveolar, anterior lobe)	11.9	----	10.5	10.0
Width, tooth 9	10.3	----	13.8	----
Width, tooth 9	5.5	----	7.8	----

[1] measurements after Castellanos (1927)

[2] estimated

size. Measurements of the lower dentition are provided in Table 6.

Vertebrae: The vertebral material from the Haile XVA skeleton consists of seven thoracic, five lumbar, and four caudal vertebrae. Five of the thoracic vertebrae are cemented together in the proper sequence by a coarse, large grained sandstone. Comparisons of these specimens with the vertebrae of an excellent *Chlamytherium* skeleton from Branford IA, Suwannee County (Rancholabrean), show no significant morphological differences except for size.

Front limbs: In discussion of the major limb elements, a comparison is also made with *Dasypus*. *Kraglievichia* is approximately the same size as Rancholabrean specimens of *Dasypus bellus*, a large extinct Pleistocene armadillo. Conceivably, limb bones of the two could be confused.

The right humerus of UF 10902 is well preserved except for the idstal end (Figure 6a, b). The humerus of *Kraglievichia* is greatly expanded laterally (as seen in the specimens from Santa Fe I). The supracondylar foramen is relatively larger than in *Dasypus*. The articular surface for the radius is concave in *Kraglievichia*, whereas it has a slight convexity in *Dasypus*. The supinator ridge is relatively narrower in *Kraglievichia*, and the deltoid ridge is wider. The proximal end of the humerus is similar in the

Figure 6

Kraglievichia paranensis Front Limb Elements

A. Right humerus, medial view

B. Right humerus, anterior view

C. Left ulna, medial view

D. Left ulna, anterior view

E. Left radius, posterior view

F. Left radius, anterior view

X 0.60 (linear)


A

B


C


D


E


F

two genera. Comparison between *Kraglievichia* and *Chlamytherium* shows no distinct differences in this element except for size.

There are three ulnae from the Haile XVA site. Two of these specimens appear to be from the same individual as they are similarly preserved, are of opposite sides, and agree very closely in measurements (Table 7). The ulna of *Kraglievichia* (Figure 6c, d) is laterally flattened and possesses a long olecranon process. The articular facets for the radius and medial condyle of the humerus are a single structure in this form, while in *Dasypus* they are partially divided. Another striking difference is a lateral groove which runs the entire length of the ulna in *Dasypus*, but which terminates at the upper border of the semilunar notch in *Kraglievichia*. Size appears to be the only difference between the ulnae of *Kraglievichia* and *Chlamytherium*.

As in *Dasypus*, the distal end of the radius is massive compared to the proximal end although it is less flattened in *Kraglievichia* (Figure 6e, f). The proximal portion of the shaft is relatively thicker and less curved in *Kraglievichia*. Comparison with *Chlamytherium* shows only a size difference.

The left metacarpal II is preserved with the Haile XVA skeleton. In general shape and proportion it agrees with

Table 7

Measurements (in mm) of Limb Elements of *Kraglievichia paranensis*, UF 10902, Haile XVA

	Left	Right
Humerus		
Lateral width, proximal end	-----	36.7
Anteroposterior width, proximal end	----	36.8
Greatest anteroposterior diameter of shaft	---	25.5
Lateral width of shaft at same location	-----	18.2
Distance from proximal end to top of entepicondylar foramen	-----	100.5
Ulna		
Total length	129.0	----
Lateral width, proximal end	17.2	----
Lateral width, distal end	16.1	----
Lateral width at semilunar notch	25.5	25.7
Anteroposterior width at semilunar notch	29.4	30.5
Radius		
Total length	89.2	87.2
Lateral width, proximal end	22.6	22.3
Anteroposterior width, proximal end	11.7	11.4
Lateral width, distal end	23.0	22.3
Anteroposterior width, distal end	17.4	16.5
Metacarpal II		
Total length	32.8	-----
Width, proximal end	10.9	-----
Depth, proximal end	14.5	-----
Width, distal end	10.5	-----
Depth, distal end	11.2	----
Metacarpal III		
Total length	34.4	36.3
Width, proximal end	13.8	14.5
Depth, proximal end	12.8	13.0
Width, distal end	12.6	13.4
Depth, distal end	10.5	11.0
Ungual Phalanx, Digit V		
Total length	----	29.1
Width, proximal end	----	11.4
Depth, proximal end	----	10.3

Table 7 (continued)

	Left	Right
Femur		
Total length	----	193.5
Lateral width, proximal end	----	66.9
Anteroposterior thickness of greater trochanter	----	41.7
Lateral width of shaft at third trochanter	----	41.3
Anteroposterior thickness of shaft at same point	----	23.7
Greatest lateral width of articular facets	----	48.4
Greatest anteroposterior width, distal end	----	51.5
Tibia and Fibula		
Total length	----	121.0
Lateral width, distal end	----	46.7
Anteroposterior width, distal end	----	25.1
Calcaneum		
Total length	----	63.5
Width of articular facets for astragalus	----	28.0
Depth of facet for cuboid	----	12.2
Width of facet for cuboid	----	11.5
Navicular		
Greatest lateral width	----	39.5
Greatest anteroposterior distance	----	23.3
Greatest depth	----	22.5
Metatarsal II		
Total length	33.2	32.8
Width, proximal end	12.2	12.5
Depth, proximal end	13.8	14.3
Width, distal end (articular surface)	13.2	13.7
Depth, distal end (articular surface)	11.3	10.2
Metatarsal III		
Total length	36.5	34.5
Width, proximal end	15.0	14.9
Depth, proximal end	14.7	14.4
Width, distal end (articular surface)	13.2	12.3
Depth, distal end (articular surface)	11.3	11.5
Ungual Phalanx, Digit V		
Total length	----	24.6
Width, proximal end	----	17.6
Depth, proximal end	----	10.7

the same element of Chlamytherium. The facet for articulation with the trapezoid, however, is quite different. When viewed laterally, this facet is a smooth curve in Chlamytherium, while in Kraglievichia it forms a sharp, V-shaped indention. The facet for articulation with the magnum is oblong in Chlamytherium, while it is round in Kraglievichia. The facet for articulation with the trapezoid is wider dorsally in Chlamytherium. This extra width gives the facet for metacarpal III a different shape. In Chlamytherium it bulges out proximally to form a quarter diameter for the facet which articulates with the trapezoid. It appears that less of the trapezoid articulates with metacarpal III in Kraglievichia.

Left and right metacarpals III are preserved in UF 10902. In this element the facet for articulation with metacarpal II and the trapezoid shows a relatively greater association with the trapezoid than with the adjacent metacarpal. The facet for the magnum in both Chlamytherium and Kraglievichia is convex dorsally and concave ventrally. In Kraglievichia the greater portion of the facet is convex, while the opposite is true in Chlamytherium. The ventral portion of this facet, when viewed from the ventral aspect, is parallel in a line at right angles to the long axis of the bone in Chlamytherium while in Kraglievichia it is oblique.

Hind limbs: The femur (Figure 7a, b) and the tibia and

Figure 7

Kraglievichia paranensis Hind Limb Elements

A. Right femur, anterior view

B. Right femur, lateral view

C. Right tibia and fibula, anterior view

D. Right tibia and fibula, lateral view

X 0.60 (linear)

A

B

C

D

fibula (Figure 7c, d) show no morphological differences from those of *Chlamytherium* except for size.

The calcaneum of *Kraglievichia* is relatively less expanded at the distal end, and is a relatively less robust element than that of *Chlamytherium* (Figure 8). The facets for articulation with the astragalus are quite different. In *Kraglievichia* the facets are connected, forming a double facet, while in *Chlamytherium* they are separated by a central valley. The relative proportions of the two facets also differ. In *Chlamytherium*, the lateral facet is much larger than the medial facet, while in *Kraglievichia* they are more nearly the same size.

The navicular of *Kraglievichia* shows no appreciable differences from that of *Chlamytherium*. A comparison of the three right naviculars from Haile XVA with one another shows only a slight variation in the relative shapes and sizes of the facets for articulation with the cuneiforms.

Regarding the metatarsal II, the facet for articulation with the mesocuneiform is relatively narrower ventrally in *Kraglievichia* than in *Chlamytherium*. In *Chlamytherium* the medial border of metatarsal II forms an unbroken line, while in *Kraglievichia* there is an indentation at the proximal end to accept the proximal end of metatarsal I. There must have been a corresponding bulge in the proximal end of

Figure 8

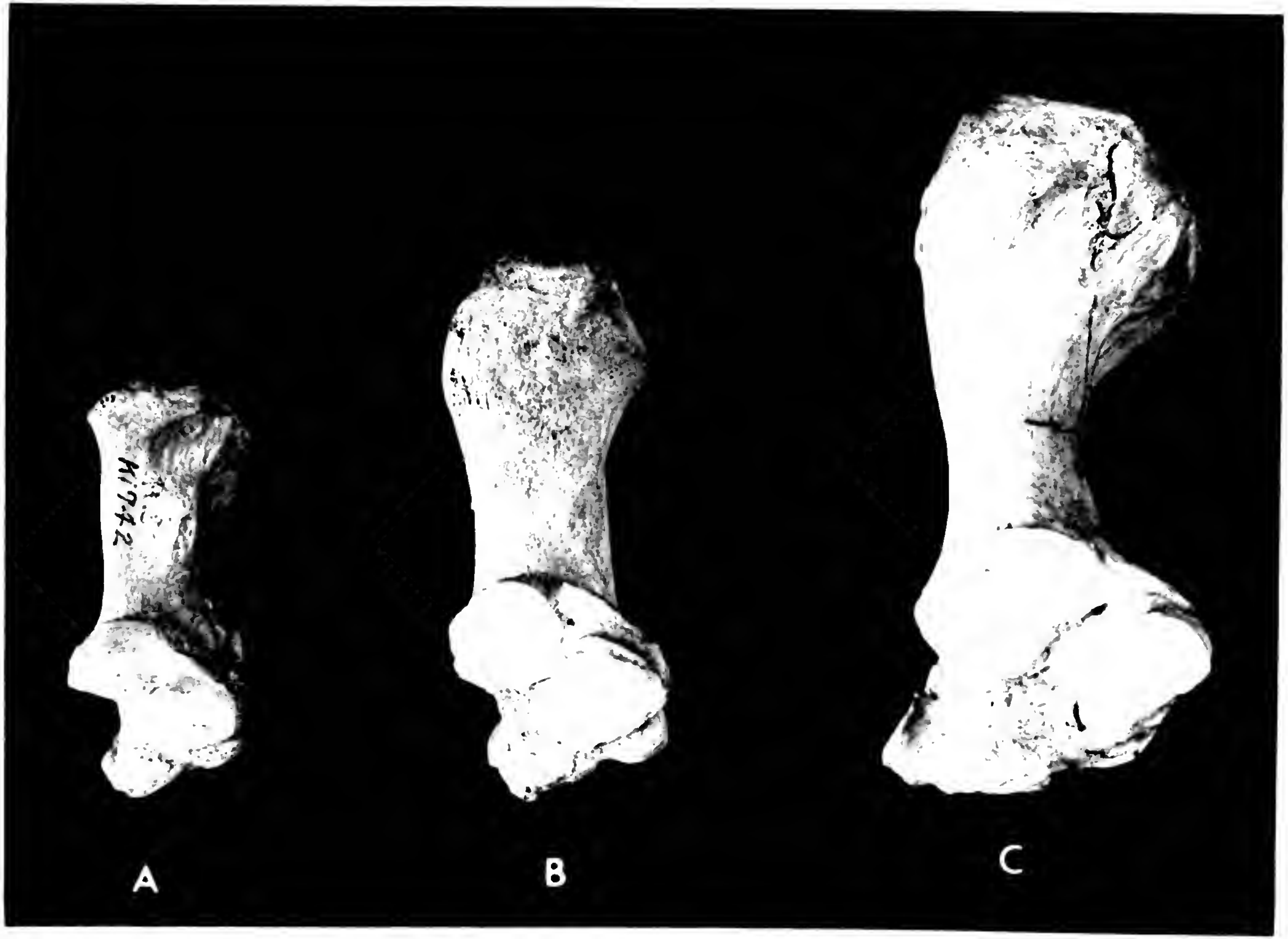
Kraglievichia and *Chlamytherium* Calcanea

A. *Kraglievichia paranensis* right
calcaneum, Haile XV

B. ?*Kraglievichia* sp. right calcaneum,
Inglis IA

C. *Chlamytherium septentrionalis* right
calcaneum, Branford IA

All approx. natural size


Ki742
A
B
C

metatarsal I of *Kraglievichia*; no such feature occurs in metatarsal I of *Chlamytherium*.

When viewed laterally, the proximal articular surface of metatarsal III appears rounded in *Kraglievichia* while in *Chlamytherium* it forms a straight line, perpendicular to the long axis of the element. Due to the rounding of the proximal end of this element in *Kraglievichia*, the articular surface can be seen when the element is viewed from above; this is not the case for *Chlamytherium*. This would appear to permit more dorsoventral movement of the toes of *Kraglievichia*.

Regarding metatarsal IV, the facets for articulation with metatarsal III and the cuboid are a single structure in *Kraglievichia*, while they are two separate structures in *Chlamytherium*.

Two ungual phalanges of UF 10902, both from digit V, have been recovered from Haile XVA. One is rather narrow and pointed, and the other is blunt and broad. Apparently the ungual phalanges of the front feet were pointed, while those of the hind feet were blunt. The same is true in *Chlamytherium*. Measurements of limb elements of other examples of *Kraglievichia* from various Florida localities are presented in Table 8.

Table 8

Measurements (in mm) of Limb Elements of *Kraglievichia paranensis* From Various Florida Localities

	UF 10432 (right) Santa Fe I	UF 9354 (right) Santa Fe I
Humerus		
Greatest anteroposterior diameter of shaft	28.8	-----
Lateral width of shaft at same point	19.5	-----
Lateral width, distal end	60.2	54.2
Greatest width of distal articular surface	37.8	36.8
Ulna	UF 10449 (left) Sante Fe I	UF 17474 (right) Haile XVA
Total length	116.5	-----
Lateral width, proximal end	17.6	-----
Lateral width, distal end	10.4	-----
Lateral width at semilunar notch	20.5	25.1
Anteroposterior width at semilunar notch	23.4	31.8
Radius		UF 10830 (right) Sante Fe I
Total length		105.2
Transverse width, proximal end		24.5
Anteroposterior width, proximal end		13.3
Transverse width, distal end		23.1
Anteroposterior width, distal end		20.6
Femur		UF 17476 (left) Haile XII B
Lateral width, proximal end		55.3
Anteroposterior width, proximal end		34.2
Lateral width of shaft at third trochanter		38.8
Anteroposterior width of shaft at same point		16.5
Calcaneum		UF 17473 (left) Santa Fe II
Total length		64.1
Width of articular facets for astragalus		24.5
Depth of facet for cuboid		14.9
Width of facet for cuboid		10.6

Table 8 (continued)

Navicular	UF 17568 (right) Haile XVA	UF 17569 (right) Haile XVA
Greatest lateral width	37.3	33.6
Greatest anteroposterior distance	22.6	18.3
Greatest depth	30.6	26.6
Metatarsal II		UF (left) Haile XV
Total length		30.8
Width, proximal end		11.3
Depth, proximal end		13.6
Width, distal end (articular surface)		12.3
Depth, distal end (articular surface)		10.2
Metatarsal III		UF 17472 (right) Santa Fe II
Total length		34.2
Width, proximal end		16.5
Depth, proximal end		15.2
Width, distal end (articular surface)		13.5
Depth, distal end (articular surface)		11.4
Metatarsal IV		UF 17475 (right) Santa Fe II
Total length		29.5
Width, proximal end		11.2
Depth, proximal end		12.2
Width, distal end (articular surface)		15.1
Depth, distal end (articular surface)		10.5

Review of the chlamytheriinae

Since the genus *Kraglievichia* is reported here for the first time in North America, this seems to be an appropriate place for a review of this group on both continents. The nomenclatural history of the various chlamythere genera will first be discussed in the order of their introduction into the literature. This will be followed by a brief review of each genus, in geological order, beginning with the oldest form.

The first remains of a chlamythere were discovered in a Brazilian cave deposit in 1836 by Peter Wilhelm Lund and described by him as *Chlamytherium humboldtii* (Lund, 1838). In his early works Lund referred to this genus as *Chlamytherium*, but later (beginning in about 1840) he began to call the genus *Chlamydotherium* without giving any reason (Castellanos, 1927). Later authors used the name *Chlamydotherium*, apparently not realizing that this name, in the meantime, had been given to a genus of glyptodonts by Bronn (1838). In 1875 Ameghino proposed the name *Pampatherium* for this genus, recognizing that the name *Chlamydotherium* was occupied by the glyptodont genus. He later abandoned this name when he realized that Lund had previously named the genus *Chlamytherium*. Paula Couto (1956) has argued that *Pampatherium* is a valid name, as Lund meant to call it *Chlamydotherium*.

The first North American record of Chlamytherium was reported by Leidy (1889a) when he designated the species Glyptodon septentrionale. In the same year Leidy, in another work (1889b), referred these specimens to the South American species C. humboldtii. Sellards (1915) believed that the North and South American forms represented different species and revived Leidy's original trivial name septentrionale.

In 1902 Ameghino described Machlydotherium from the Eocene of Patagonia.

Castellanos (1927) named two new genera of chlamytheres: Vassallia, based on an edentulous mandible and several dermal plates; and Kraglievichia, based upon two skulls, a mandible, and a small amount of postcranial material. The genotypic species of Vassallia was originally Chlamytherium minutum (Moreno and Mercerat, 1891). Kraglievichia was erected to include C. paranensis, C. intermedia (Ameghino, 1887), and C. subintermedius (Rovereto, 1914). The trivial name paranensis was retained.

Simpson (1930) established the genus Holmesina while studying excellent material of septentrionalis from the Seminole Field in western peninsular Florida. Subsequent authors have tended to refer to the North American forms as Holmesina and to the South American forms as Chlamytherium.

Castellanos later (1937) named *Plaina*, based upon the type of *C. intermedius* which he had earlier placed in *Kraglievichia*. The reason for the establishment of this new genus was his interpretation of the lineage of the chlamytheres. He believed that there should be a form intermediate in size between *Kraglievichia* and *Chlamytherium*. Since *C. intermedius* is larger than the other material referred to *Kraglievichia*, he saw it as representing this intermediate form.

The genus *Hoffstetteria* of Castellanos (1957) was based upon a skull collected in Ecuador. This skull had previously been described as *C. occidentalis* by Hoffstetter (1952).

Each of the chlamythere genera will now be briefly reviewed in geologic order beginning with the oldest, *Machlydotherium*. This form is known from the Eocene of Patagonia and its relationship to the later chlamytheres is not known (Simpson, 1945). Chlamytheres are not known from the Oligocene.

Vassallia precedes *Kraglievichia* temporally as it is known from the La Venta fauna of Miocene age in Colombia. The author has examined a skull from this locality (U.C.M.P. 40401) which definitely represents *Vassallia*. This identification is based upon its small size, and the nature of the anterior dentition, in which the first five teeth are peg-like and rotated lingually. Vassillia has also been reported from Auracanean deposits (Castellanos, 1946) so it appears that this genus did range into the Pliocene.

Porta (1962) has reported Kraglievichia from the La Venta fauna in Colombia, but this record was based only upon dermal plates which could just as well represent Vassallia. Other Miocene records of Kraglievichia have been reported as some previous works considered this to be the age of the Auracanean deposits; however, more recent interpretations of South American stratigraphy (Patterson and Pasqual, 1968) demonstrate the Auracanean to be Pliocene rather than Miocene. Therefore, it appears that Kraglievichia was restricted to the Pliocene in South America.

Castellanos (1927) has reported morphological differences between Vassallia and Kraglievichia. In Vassallia the first five teeth tend to be peg-like and rotated lingually while only the first four teeth of Kraglievichia show this condition. Just how variable this characteristic is cannot be ascertained presently because of the lack of comparative material known for these genera. Vassallia is also significantly smaller than Kraglievichia. It is suspected here (as Castellanos has suggested) that Vassallia is the ancestor of Kraglievichia.

Regarding Plaina, which is based on three isolated dermal plates, Castellanos (1927) was probably correct in his first judgment when he placed this material in the genus *Kraglievichia*. He considered these plates to be intermediate in size and sculpturing between *Kraglievichia* and *Chlamytherium*. They seem, however, to fall within the size range expected for the older armadillo genus. Furthermore, it seems quite difficult to interpret slight variation in plate rugosity as being generically significant. It is therefore proposed here that *Plaina* is a synonym of *Kraglievichia*.

The genus *Hoffstetteria* (Castellanos, 1957) is based upon supposed differences in the shape and measurements of the teeth. The deviations, however, are clearly attributable to individual variation. *Hoffstetteria* is here considered to be a synonym of *Chlamytherium*.

In Simpson's (1930) description of *Holmesina*, he listed a number of characters in which this new genus differed from *Chlamytherium*. However, James (1957) has shown that the characters pointed out by Simpson are not sufficient to separate the North and South American forms generically, and that *Holmesina* is a synonym of *Chlamytherium*. This report strengthens James' views on this issue. Simpson (1930) has also argued that if *Holmesina* is not valid, then all the South American forms should be placed in the genus *Chlamy-*

therium as they are no more different from each other than Chlamytherium is from Holmesina. There may be some justification for doing just this. In this report, however, new characters of Kraglievichia, different from Chlamytherium, have been pointed out which, together with what previous workers have considered generic characters, justify retaining Kraglievichia as a valid genus.

The genera of chlamytheres, then, recognized in this report are Machlydotherium (Eocene), Vassallia (Miocene and Pliocene, South America), Kraglievichia (Pliocene, South America and early Pleistocene, North America), and Chlamytherium (Pleistocene, North and South America).

Evolution of the chlamytheres

The principle morphological trend in Chlamythere evolution since the Miocene was an increase in size. Vassallia was the smallest form in the known chlamythere lineage, followed by Kraglievichia which was slightly larger. An examination of the two femora in Figure 9 shows the great size difference between Kraglievichia and Chlamytherium. The intermediate steps in this size increase are illustrated in Figure 10, which shows dermal plates from deposits representing various stages of the Pleistocene. The Blancan Haile XVA plates are the smallest, followed by those from the Irvingtonian Inglis IA site. Slightly larger still are the plates from

Figure 9

Kraglievichia and Chlamytherium Femora

A. Chlamytherium septentrionalis right femur
Branford IA

B. Kraglievichia paranensis right femur,
Haile XVA

X 0.60 (linear)

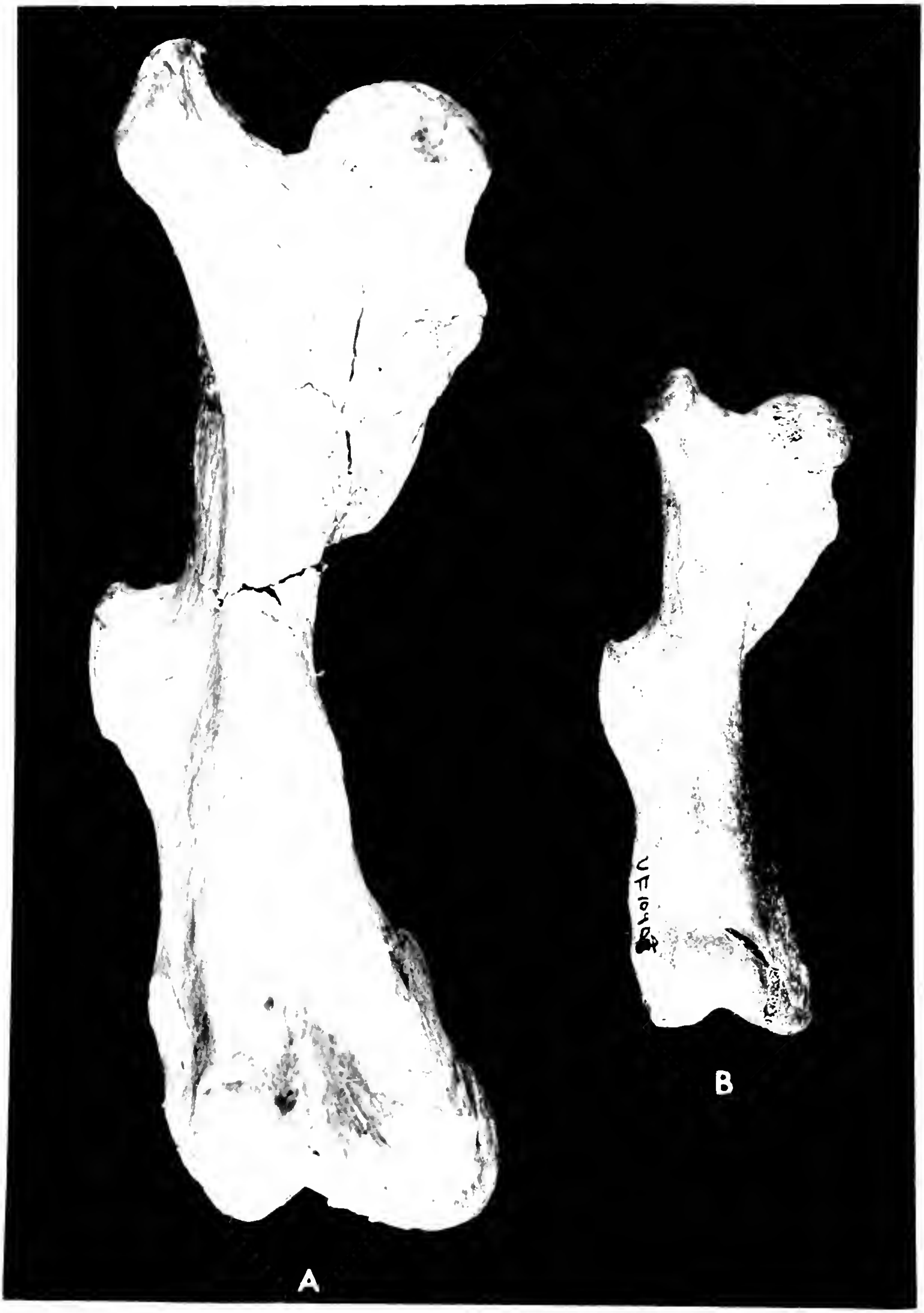

A
B

Figure 10

Kraglievichia and *Chlamytherium* Dermal Plates

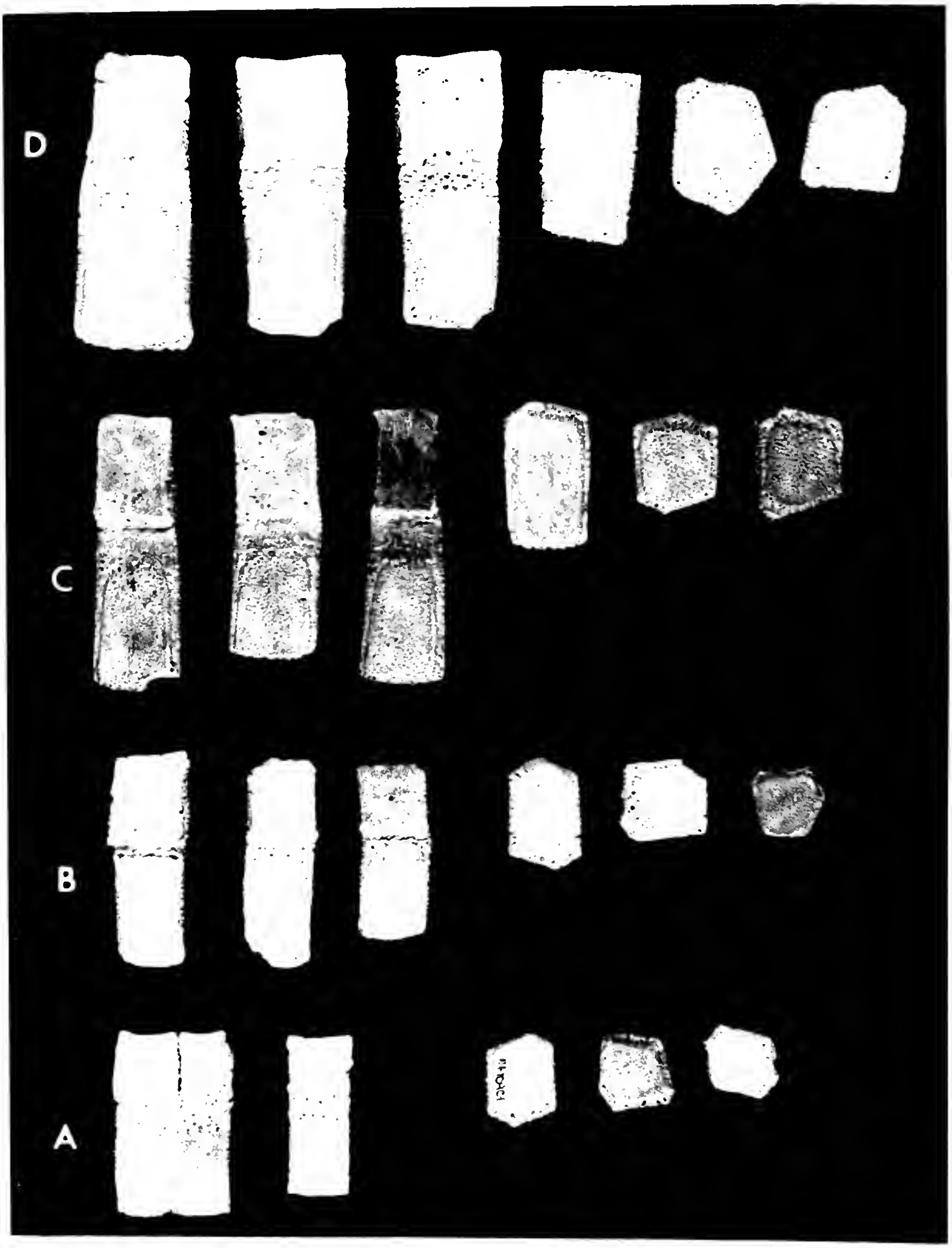
A. *Kraglievichia paranesis*, Haile XVA, Blancan

B. ?*Kraglievichia* sp., Inglis IA, Early Irvingtonian

C. *Chlamytherium septentrionalis*, Coleman IIA, late Irvingtonian

D. *Chlamytherium septentrionalis*, Branford IA, Rancholabrean

X 0.40 (linear)


D
C
B
A

the later Irvingtonian Coleman IIA site, and the largest plates of all are those from the Rancholabrean Branford IA locality.

A trend from peg-like to bilobate teeth, and from oblique to parallel tooth row axes was previously noted. Both of these trends seem to have extended from the rear of the dentition toward the front, as the number of bilobate and parallel teeth increases from *Vassallia* through *Chlamytherium*.

Concerning the geography of chlamythere evolution, it is apparent that these forms originated in South America as all pre-Pleistocene records of this group are restricted to that continent.

The earliest known Chlamythere is the Eocene *Machlydotherium*, and no chlamytheres are known from the Oligocene. *Vassallia* is present in Miocene deposits of South America, and both *Vassallia* and *Kraglievichia* were present in the South American Pliocene. *Kraglievichia* is known from North American early Pleistocene deposits, but its presence in South America during the Pleistocene is questionable. *Chlamytherium* is known from the Pleistocene of North and South America.

It has generally been believed that the evolution of the chlamytheres has been strictly a South American phenomenon, with only the end product, Chlamytherium, migrating to North America during Rancholabrean time. The evidence supporting this hypothesis is, briefly, that all pre-Rancholabrean records of chlamytheres have been from South America, and all genera of chlamytheres except Chlamytherium seemed to have been restricted to South America. The study of the Haile XVA fauna, and other pre-Rancholabrean sites of Florida, has yielded conclusive evidence warranting modification of this theory.

Apparently Kraglievichia migrated to North America shortly after the establishment of the late Cenozoic land bridge between the two continents. This is substantiated by its presence in the Haile XVA and other Blancan faunas of Florida.

Three hypotheses can be offered regarding the zoogeography of the evolutionary transition from Kraglievichia to Chlamytherium. The first hypothesis, already discussed, is that the evolution of Chlamytherium took place in South America and this genus then moved into North America in Rancholabrean times. This intepretation has already been shown to be in error.

The second hypothesis suggests that Kraglievichia moved into North America during the latest Pliocene and became extinct in South America. This would make the evolution of

Chlamytherium strictly a North American event. According to this hypothesis, Chlamytherium, a North American form, then reinvaded South America in the later Pleistocene. This would account for the apparent lack of chlamytheres in the early Pleistocene of South America.

The apparent lack of chlamytheres from the Argentinian Chapadmalalan fauna should be briefly discussed here. A dermal plate has been questionably attributed to this fauna (Kraglievich, 1934); however, the specimen was from a locality near the major deposit and its horizon is actually unknown. Because of their unusually high number of bony plates available for preservation, if the chlamytheres were present at all in the fauna, they should be well represented. It is possible that their absence from the fauna is ecologically determined. The early Pleistocene Chapadmalal fauna represents a temperate part of the continent, whereas the chlamytheres may have been restricted to the more tropical parts of the continent. The lack of early Pleistocene deposits in tropical South America hampers a definite establishment of the presence or absence of these forms on that continent at that time.

The third hypothesis to be considered is that the distribution of chlamytheres has been continuous on both continents throughout the Pleistocene, and the evolution of

Chlamytherium from Kraglievichia occurred simultaneously in North and South America. That is the hypothesis favored here.

Dasypus bellus Simpson 1929

Material: UF 16698, left nasal, right maxilla and mandible, right astragalus, 51 isolated dermal plates.

The preceding material probably represents one individual as the maxillary and mandible articulate nicely and all the material (with the exception of some of the plates) was found closely associated. Comparisons are made here with other specimens of D. bellus and with its closest living relative, D. novemcinctus. The only other known D. bellus material containing teeth is from Crankshaft Pit, Missouri (UK 15544, Oesch, 1967). Postcranial comparisons are made with material from a number of sites of various ages in Florida.

The nasal bone is represented by only the anterior portion and is larger than, but morphologically similar to, that of D. novemcinctus.

In discussing the dentition, teeth will be designated as follows: T^1 will refer to the first upper tooth, T^2 the second upper tooth, and so forth. The same procedure will be used in referring to the lower teeth.

The maxillary is fragmented and contains only T^3 – T^6. Except for size, the lateral portion of this specimen compares favorably with the corresponding portion of the Crankshaft Pit specimen. The first three teeth of UF 16698 were probably transversely flattened as this is the nature of T^3. The remaining upper teeth were probably round and peg-like as this is the condition in T^4 - T^6. The Crankshaft Pit skull is from a juvenile individual, and T^1 has not completely erupted. In this specimen the first tooth is transversely flattened, but all the rest are round and peg-like. In *D. novemcinctus* the first three teeth tend to be somewhat laterally flattened, but not as much as in the Haile XVA specimen of *D. bellus*. That tooth number and structure is variable in *Dasypus* has been pointed out by Talmage and Buchanan (1954), as well as by others. In four *D. novemcinctus* skulls examined, the total number of teeth varied from seven to nine.

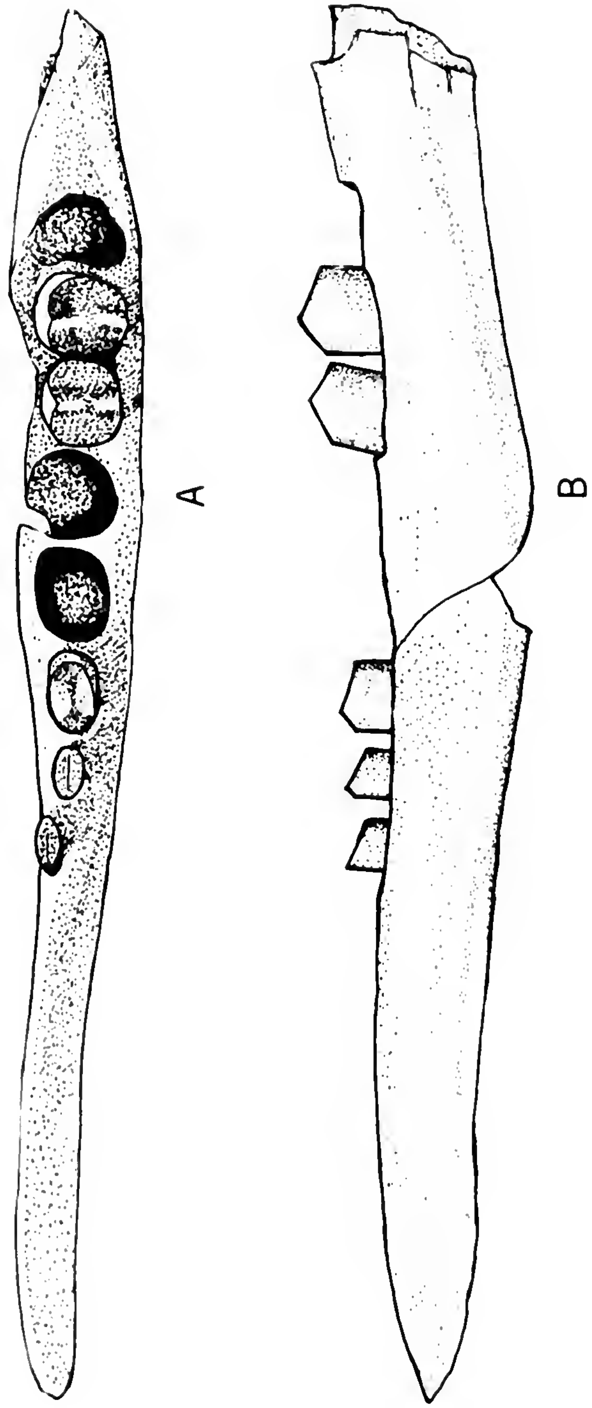
The mandible of UF 16698 (Figure 11) is lacking the proximal end. The number, shape, and location of the mental foramina are highly variable in this genus. In both known *D. bellus* mandibles there are two foramina, one large and one small. In UF 16698, the larger of the two foramina occurs between T_2 and T_3. The smaller of the two foramina is located 38 mm anterior to T_1. In UK 15544, the larger foramen is anterior to the smaller and is located directly beneath T_2. The smaller is located beneath T_3. In *D.*

Figure 11

Dasypus bellus Mandible

UF 16698, Haile XVA

X 2.26 (linear)


A
B

novemcinctus, the number of mental foramina varies from one to four. The symphysis of the Haile XVA specimen is weak, which is characteristic of the genus.

The mandible of UF 16698 lacks T_4 - T_5. T_1 - T_3 are laterally flattened but T_6 and T_7 are round. This differs from the lower dentition of UK 15544 in which all the teeth are round.

Except for smaller size and a tendency toward flattening of the anterior teeth, the mandibles and dentition of the Haile XVA specimen differ little from other Dasypus material. Dental measurements are provided in Table 9.

Differences in the astragalus of the Haile XVA D. bellus and other specimens of D. bellus from various Florida Pleistocene sites and Recent specimens of D. novemcinctus are insignificant except for size. A comparison of the astragali of Dasypus from various stages of the Pleistocene reveals a size trend similar to that of the chlamytheres, with one exception (Figure 12). The size of Dasypus increased from Blancan through Rancholabrean time, then decreased in Recent times when it is represented by D. novemcinctus.

The dermal plates of UF 16698 do not differ from any other specimens of Dasypus except for size. Martin (in press) has measured samples of plates from several Florida

Table 9

Dental Measurements (in mm) of *Dasypus bellus*

	UF 16698 Haile XVA Florida	UK 15544 Crankshaft Pit Missouri	
		left	right
Maxillary			
Total distance, teeth 3-6	19.9	23.8[1]	23.7
Anteroposterior distance, tooth 3	3.5	4.6[1]	4.5
Transverse distance, tooth 3	2.1	4.6[1]	4.5
Anteroposterior distance, tooth 4	4.4	----	----
Transverse distance, tooth 4	3.6	----	----
Anteroposterior distance, tooth 5	4.0	----	4.1
Transverse distance, tooth 5	4.2	----	5.1
Anteroposterior distance, tooth 6	4.2	5.2[2]	4.5
Transverse distance, tooth 6	4.1	----	4.8
Mandible			
Depth of ramus at tooth 1	6.8	-----	12.4
Width of ramus at tooth 1	2.8	----	3.7
Depth of ramus at tooth 6	8.4	15.2	15.5
Width of ramus at tooth 6	4.8	8.2	7.8
Depth of ramus at tooth 8	7.2	13.5	12.2
Width of ramus at tooth 8	5.2	7.1	6.4
Length of tooth row	38.8	----	45.6
Anteroposterior distance, tooth 1	3.0	----	2.8[3]
Transverse distance, tooth 1	1.3	----	1.8[3]
Anteroposterior distance, tooth 2	3.3	2.2	2.1
Transverse distance, tooth 2	1.4	2.7	2.3
Anteroposterior distance, tooth 3	3.3	4.0	4.5
Transverse distance, tooth 3	2.2	3.2	3.2
Anteroposterior distance, tooth 4	4.8[1]	4.7	4.6
Transverse distance, tooth 4	2.8[1]	4.5	4.2
Anteroposterior distance, tooth 5	4.0[1]	4.1	4.4
Transverse distance, tooth 5	3.3[2]	4.5	4.5
Anteroposterior distance, tooth 6	4.5	4.3	4.5
Transverse distance, tooth 6	3.7	4.7	4.7
Anteroposterior distance, tooth 7	4.6	4.6	4.2
Transverse distance, tooth 7	3.5	4.7	4.6
Anteroposterior distance, tooth 8	4.1[1]	3.5	3.4
Transverse distance, tooth 8	4.2[2]	3.5	3.4

---

[1] alveolar

[2] alveolar, estimated

[3] Not completely erupted

Figure 12

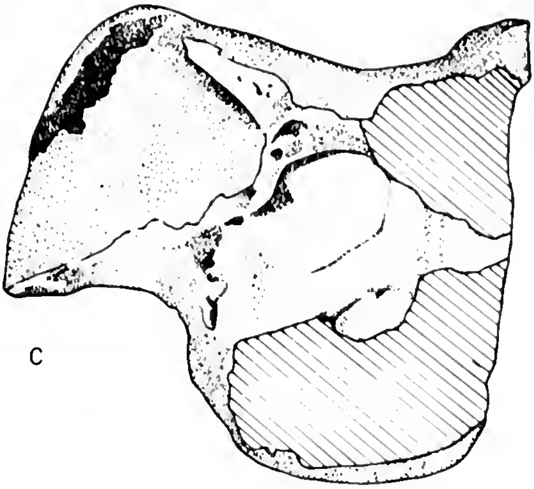
Dasypus bellus Astragali

A. UF 16698, Haile XVA, Blancan

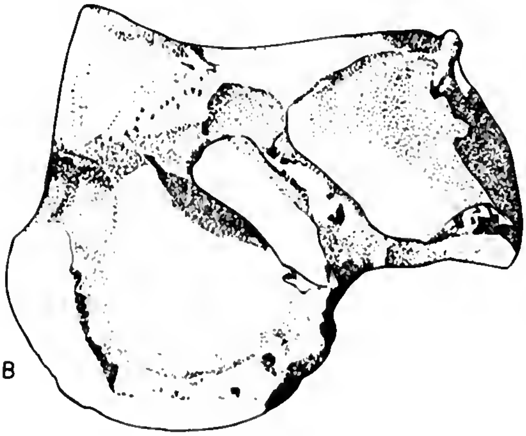
B. UF 13187, Coleman IIA, Irvingtonian

C. UF 2478, Mefford Cave, Rancholabrea

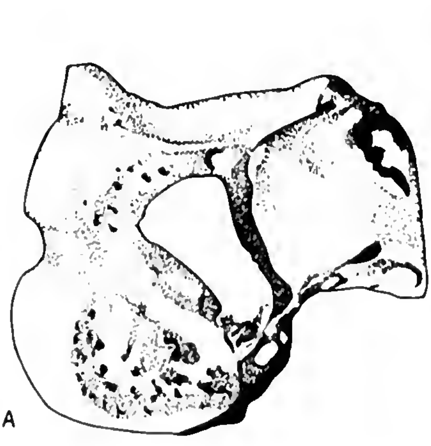
X 2.23 (linear)



C



B



A

sites and has shown little overlap in plate size between D. bellus and D. novemcinctus. His measurements indicate that the size of the plates do not follow the trends throughout the Pleistocene which are seen for other parts of the skeleton. The Coleman IIA plates are small, and overlap slightly with those of D. novemcinctus. However, this was probably due to the small sample of plates used. There are approximately 2,500 plates in a single armadillo carapace and little or no satisfactory method for determining the area of the shell from which most of them come. Therefore, size trends based on plates should involve large samples to insure accuracy.

Inasmuch as the morphological differences between the Haile XVA material and other D. bellus material are so slight, and those which were observed probably represent individual variation, this material is referred to Dasypus bellus.

Dasypus bellus has typically been considered a southern North American species of Rancholabrean age. Martin's (in press) description of the Coleman IIA fauna, however, extended the temporal range of the species back to Irvingtonian time. This report extends this species still further back, into the Blancan, and is thus the earliest known record.

There is a question as to the relationship between D.

bellus and D. novemcinctus. These animals are clearly more related to each other than to any of the other armadillos (Auffenberg, 1957). The question arises as to whether D. novemcinctus was derived from D. bellus or existed allopatrically with D. bellus during the Pleistocene, replacing it during the last few thousand years.

Considering the former possibility first, it would have taken quite rapid selection for smaller size to develop D. novemcinctus from D. bellus. In Miller's Cave (Patton, 1963), a date of ca 8,000 BP is given for the Travertine stratum bearing D. bellus remains, and a date of ca 3,000 BP for the Brown Clay deposits containing D. novemcinctus. According to Patton (personal communication), even if the D. novemcinctus is a Recent intrusive (which he doesn't believe to be the case), the difference between 8,000 BP and 3,000 BP, or 8,000 BP and 1,000 BP is not that great--it is still rapid evolution, but possible, particularly if the only change is size.

Concerning the second hypothesis, if D. novemcinctus existed somewhere else during the Pleistocene and replaced D. bellus very late, it should be known from some Central or South American Pleistocene deposit. To date, however, D. novemcinctus has no fossil record except for Miller's Cave, but the fossil record in tropical America is extremely poor.

That D. bellus is not known from pre-Rancholabrean deposits outside Florida is puzzling. Slaughter (1961) lists two conditions which he feels were necessary for the occurrence of this species: winters could have been no more severe than those of North Central Texas today; and rainfall probably had to be more than 20 inches per year. That temperature and rainfall could have restricted D. bellus to Florida during the entire Pleistocene is possible, but it seems more likely that the known distribution of this species is a reflection of a lack, outside of Florida, of Gulf Coastal Plains sites of the proper age.

Order Lagomorpha

Family Leporidae

Sylvilagus sp. Gray 1967

Material: UF 17561, 2 M^3, UF 17562, M_3; UF 17563, lumbar vertebra; UF 17564, 3 innominates; UF 17565, 2 femora; UF 17566, 1 tibia; UF 17567, 2 metatarsals.

Hypolagus and Sylvilagus are two smaller lagomorphs common in North American Blancan deposits. Unfortunately, the generic diagnosis provided for Hypolagus by Dawson (1958) does not include discussion of either M^3 of M_3, which are the only teeth preserved in the Haile XVA fauna. A comparison of the innominates from Haile XVA with the descriptions and figures of these elements of Hypolagus in Dawson (1958) shows the Haile specimens possess a less elevated illial crest, a condition considered to be more advanced. All the rest of the Haile XVA material also agrees in size and morphology with Sylvilagus.

Unfortunately, a lack of diagnostic elements prevents a species determination. Two living species are present throughout Florida: S. palustris and S. floridanus. The present range of the genus is throughout North America, with two species being present in South America: S. floridanus and S. brasielensis (Hall and Kelson, 1959).

Previous Blancan records of Sylvilagus include the Curtis Ranch fauna (Gazin, 1942) and the Broadwater fauna (Barbour and Schultz, 1937). Numerous Irvingtonian and Rancholabrean occurrences of this genus are recorded throughout North America.

Order Rodentia

Family Sciuridae

Petauria sp. Dehm 1962

Material: UF 12353, partial right mandible with M_3.

By Miocene time flying squirrels had diversified into two groups (James, 1963). One of these groups has complicated cheek tooth loph patterns. This is due to the presence of "protolophules and metalophules, and especially metalophules that extend from the metaloph posteriorly to the posterior cingulum, dividing the posterior valley into two, and sometimes three or more smaller valleys." (James, 1963) This complicated toothed group contains several living genera including Petaurista, Belomys, Trogopterus, and Sciuropterus, as well as the fossil genera Pliopetaurista (Kretzoi, 1959), Petauria (Dehm, 1962), and Pliosciuropterus (Sulimski, 1964).

The second group has simpler loph patterns in its cheek teeth. This group is represented by the living genera Hylopetes, Aeromys, Eoglaucomys, Glaucomys, and others, and by the extinct genus Pliopetes (Sulimski, 1964) and several extinct species referred to Sciuropterus.

Formerly, fossil species referred to Sciuropterus included both simple and complex toothed types. Hugueney and Mein (1966), however, have placed the complex toothed fossil species of Sciuropterus in the genus Pliopetaurista based on Deperet's (1897) S. pliocenica. The result is that all fossil species remaining in the genus Sciuropterus in both the New and the Old World have simple teeth, while the living species which are restricted to the Old World have complicated teeth. This curious arrangement leaves some doubt as to the evolutionary unity of the fossil and recent species referred to Sciuropterus.

The Haile XVA specimen (Figures 13 and 14) marks the first occurrence in the New World of a member of the group

Figure 13

Petauria sp. Right Mandible

UF 12353, Haile XVA

X 7 (linear)

Figure 14

Petauria sp. Right M_3

UF 12353, Haile XVA


4 mm

with complicated teeth. It is clearly more closely related to *Petaurista* than any of the other living genera.

The Haile XVA specimen (UF 12353) differs from *Pliopetaurista* in that its M_3 is oval in shape as opposed to being pointed at the posterior end. The metastylid in UF 12353 is only moderately developed as opposed to being well developed in *Pliopetaurista*, and the postflexid is not as well developed in the Haile XVA specimen.

UF 12353 differs from the M_3 of *Pliosciuropterus* in its shape, which is narrow and tapers toward the posterior end, as opposed to being oval in the Haile XVA specimen. The mesoconid is only moderately developed inthe Haile XVA specimen while in *Pliosciruopterus* it is so well developed that it forms a labial spur. The postflexid is also well developed in *Pliosciuropterus*.

UF 12353 is clearly more allied with *Petauria* than any of the fossil genera. On the other hand, one striking difference separates these forms: the mesoconid is completely absent in *Petauria*, but it is moderately well developed in the Haile XVA form (Figure 13 and 14).

The Haile XVA specimen shares one important characteristic with *Petaurista* that does not occur in *Petauria*, namely the presence of a mesoconid. On the other hand it shares the following characteristics with *Petauria* which do not occur in Petaurista: the grinding surface of the talonid is less complex; and the metastylid is moderately developed as opposed to the metaconid-metastylid chaos (McKenna, 1962). Finally, it shares the following characteristics with both Petaurista and Petauria: the grinding surface of the trigonid is complex, with extra lophids and fossettids; the postflexid is poorly developed; the M_3 is oval in shape; and the entoconid is connected to the hypoconid through the hypolophid.

Since the Haile XVA specimen shares characters with both Petaurista and Petauria, assignment to a genus is difficult. Whether the lack of a mesoconid is more important than the presence of extra fossettids and lophids on the talonid would probably be a disputed point among students of rodent evolution. However, Petauria is known from only one dentition, and the variations which may have existed are not known. Petaurista, being extant, has been studied in greater detail and its variations have been taken into account. Thus characters known to be peculiar to Petaurists are more reliable than those in the diagnosis of Petauria. The simple grinding surface of the talonid (not observed in a very large sample of Petaurista) becomes a more important character with regard to the Haile XVA specimen than the presence of the mesoconid, which may have occurred in *Petauria*. Following this line of reasoning, it seems more appropriate to refer the Haile XVA specimen to *Petauria*.

The only specimen of *Petauria* previously known is from Bavaria, in the Region of Eichstatt. The deposit was a fissure filling of red loamy sand in the Solenhofn Limestone. The filling has been ascribed to the "older Pleistocene" by Dehm (1962).

It is almost certain that the populations of flying squirrels of Florida and Bavaria during the early Pleistocene were reproductively isolated; thus the Haile XVA specimen isnot assigned to the type species, *P. helleri*. It also seems pointless at this time to describe a new species based upon this single specimen, as even the generic characters are difficult to ascertain with this limited amount of material. Until more material is available, it seems more prudent to refer to the Haile XVA specimen as *Petauria* sp.

Family Castoridae

Castor canadensis Linnaeus 1758

Material: UF 17480, left femur.

This element, lacking the proximal end, represents a young individual. It shows no morphological differences from the living species. A comparison of measurements

(Table 10) with examples of young, Recent C. canadensis shows no significant size differences. Other Blancan records of Castor are the San Joaquin locality (Kellogg, 1911; Stirton, 1935) and the Hagerman fauna.

Family Cricetidae

Sigmodon medius Gidley 1922

Material: UF 12335, left M^1; UF 12341, right M^1; UF 12337, left M^2; UF 12339, UF 12340, right M^3, UF 12334, UF 12338, left M_1; UF 12336, left M_2; UF 12342, right M^1 and M_3 (both unworn).

This species characteristically possesses only two or three roots on the M_1. If accessory roots are present, they are centrally located and are very small, peg-like structures. The labial root is always better developed than the lingual. The two specimens from Haile XVA, UF 12338, agree with the above features.

Sigmodon medius is nearly identical morphologically with a closely allied species, Sigmodon minor. According to Martin (in press), the only difference between the two species, other than size, is that the re-entrant folds are deeper and narrower in S. minor than in S. medius. This character is more obvious in teeth with little wear and since the essential Haile XVA specimens show significant wear, size alone must be relied upon for the separation of

Table 10

Measurements (in mm) of the Femora of Fossil and Recent *Castor canadensis*

	C. canadensis UF 17489 Haile XVA	*C. canadensis* Recent		
		N	$\bar{X}$	O.R.
Width, distal end	38.7	6	36.6	34.1-38.4
Anteroposterior depth, distal end	29.2	6	29.7	28.5-32.5
Width, external condyle	13.5	5	14.0	12.2-15.5
Width, internal condyle	12.5	5	12.1	11.6-12.5
Width of shaft at third trochanter	25.2	6	29.1	27.0-30.5
Anteroposterior diameter of shaft at third trochanter	13.9	6	11.5	10.2-13.5

these two species. *Sigmodon medius* is significantly larger than *S. minor*. The larger measurements of the Haile XVA material (Table 11) indicate that it belongs to *S. medius*.

Two subspecies of *S. medius* (*S. m. medius* and *S. m. hibbardi*) have been described, based entirely upon size difference. The small sample of material from Haile XVA, however, prevents the statistical treatment necessary to determine the subspecies designation.

Sigmodon medius is known only from Blancan deposits of North America. These include the Benson fauna, the Vallecito-Fish Creek sequence (Downs and White, 1968), the Red Light Local Fauna (Akerston, 1970), the Hudspeth fauna (Strain, 1966) and the Broadwater fauna.

Order Carnivora

Family Canidae Gray 1821

Material: UF 17492 and UF 17493, 2 tibiae.

The presence in the fauna of two poorly preserved tibiae probably represents the Family Canidae. They are about the size of a fox, but positive identification is not possible as only the badly worn proximal ends are preserved.

Family Mustelidae

of *Pteronura* Gray 1837

Material: UF 17487, humerus; UF 17491, right meta-

Table 11

Dental Measurements (in mm) of *Sigmodon medius* and *Sigmodon minor**

Length M_1	2	2.25	2.18-2.32	45	1.89	1.72-2.19
Width M_1	2	1.24	1.23-1.25	48	1.31	1.17-1.48
Length M_2	1	1.49	----------	49	1.40	1.22-1.62
Width M_2	1	1.53	----------	46	1.36	1.20-1.50

*re-calculated from Martin (1970)

tarsal II; UF 17490, right metatarsal III; UF 17494, medial phalanx.

The humerus (Figure 15) is lacking the proximal end and the distal end has a pathologic abnormality. The element is very porous in the region of the olecranon fossa and on the lateral and medial edges of the distal end. The abnormal growth of bone on the medial side of the distal end has resulted in a downward extension of this portion of the humerus to a greater degree than is usual. This growth (and possibly a similar abnormality in the ulna) has caused a shift in the articular contact between the humerus and the ulna. The result of this shift in articular bearing pressure was a "planing off" of a portion of the distal articular surface.

Disregarding the abnormalities of the element, it corresponds very closely morphologically with both Lutra and Pteronura. A possible difference between these two genera, other than size, may exist in the shape of the entepicondylar foramen. In Pteronura the foramen is nearly round, while in Lutra it is elongate. The Haile XVA specimen more closely agrees with Pteronura. A length/width ratio of the measurements of the foramen shows the following results: Haile XVA specimen 1.3; Pteronura 1.4; and Lutra 2.2. It should be pointed out, however, that this character is likely to

Figure 15

Pteronura humerus

UF 17487, Haile XVA

X 1.85 (linear)

be highly variable, as one of the specimens of _Lutra_ studied completely lacked this foramen.

In size the Haile XVA specimen also agrees more closely with _Pteronura_. The majority of the measurements of this specimen agree with the measurements of three _Pteronura_ specimens and were exclusive of the range of measurements of seven _Lutra_ specimens (Table 12). Nonetheless, the relatively small samples gives cause for some reservations, and thus the Haile XVA specimen is only tentatively referred to _Pteronura_.

Family Felidae

Smilodon gracilis Cope 1880

Material: UF 17496, right tibia (distal end) and right astragalus; UF 17498, right metacarpal II.

This material represents a medium-sized cat and is probably from one individual since the tibia and astragalus articulate well, all the material is similarly preserved, and all the elements were found together.

The material is referred to the genus _Smilodon_ on the basis of two characters presented by Merriam and Stock (1932). First is the presence of the astragalar foramen. Second, the medial facet for the calcaneum and the facet for the navicular are merged.

The Haile XVA sabercat was very small, being similar

Table 12

Measurements (in mm) of the Humerus of Fossil and Recent *Pteronura* and Recent *Lutra*

	UF 17487 *Pteronura* Haile XVA	*P. brasiliensis* Recent			*Lutra canadensis* Recent		
		N.	$\bar{X}$	O.R.	N.	$\bar{X}$	O.R.
Greatest width, distal end	33.0	3	36.3	33.5-40.1	7	25.1	24.1-27.2
Greatest width, distal condyle (measured from anterior side)	21.0	3	23.3	21.5-26.5	7	15.1	11.8-17.3
Length of entepicondylar foramen	5.5	3	5.9	5.4- 6.5	6	4.4	3.7- 4.7
Width of entepicondylar foramen	4.1	3	4.2	4.0- 4.4	6	2.0	1.5- 2.3
Greatest anteroposterior thickness of shaft	17.4	3	16.1	14.7-18.5	7	13.1	11.3-14.3
Transverse width at same location	10.2	3	10.2	9.5-11.4	7	7.9	7.5- 8.8
Greatest anteroposterior thickness of distal condyle	11.3	3	14.0	10.7-16.2	7	11.2	10.2-12.4

in size to *Smilodon gracilis*. A comparison of the measurements of the astragalus from Haile XVA with those of the astragalus of *S. gracilis* from Port Kennedy Bone Bed (Cope, 1899) shows a close correlation in size (Table 13). Inasmuch as *S. gracilis* is the only small species of *Smilodon* in North America, the Haile XVA specimen probably represents this species.

Two species of small sabercats are known from South America. *Smilodon cruciens* is known only from a single mandible (Ameghino, 1904). *Smilodontodon riggi* (Kraglievich, 1948) is present in the Chapadmalal Fauna and is known only from postcranial material. This form is slightly larger than the Haile XVA form. The astragalus is preserved in this specimen but it is in poor condition, and the critical characters of the facets cannot be verified from the figures. While other species are shared by the Chapadmalal fauna and the Haile XVA fauna, it does not follow that the two cats are necessarily allied. The Haile XVA astragalus so closely resembles *Smilodon* that if it is the same as the Chapadmalalan form then the Chapadmalalan form must be synonymized with *Smilodon*.

Order Proboscides

Family Gomphotheriidae Cabrera 1929

Material: UF 17464, a small portion of a molar and two small pieces of ivory.

Table 13

Measurements (in mm) of the Astragali of Smilodon gracilis From Haile XVA and Port Kennedy*

	Haile XVA UF 17496	Port Kennedy
Length	41.6	48
Width	45.2	38
Width of trochlea	28.7	27
Vertical diameter of head	18.7	17
Transverse diameter of head	26.6	25
External elevation of trochlea	21.1	22

---

*measurements after Cope (1899)

The complicated nature of the tooth clearly indicates that this specimen belonged to a gomphotheriid. Further identification is not possible because of the small amount of material available.

Order Perissodactyla

Family Equidae

Nannippus phlegon Cope 1892

Material: UF 17484, and UF 17485, both upper cheek teeth; UF 17547, metapodial; UF 17548, proximal phalanx; UF 17549, four ungual phalanges.

The relatively unworn cheek tooth indicates this form was strongly hypsodont. The other tooth (Figure 16) and the postcranial material agree in all respects with the typical Blancan species, *N. phlegon*. Measurements are provided in Table 14.

Plesippus simplicidens

Material: UF 10909, partial skull; UF 17556, partial maxilla with deciduous molariform tooth; UF 10894, 15 cervical vertebrae; UF 10877, 37 thoracic vertebrae; UF 10895, 13 lumbar vertebrae; UF 10896, 2 sacral vertebrae, UF 10898, 3 humeri (2 left, 1 right); UF 10919, 1 right radius; UF 10910, 2 left pelves: UF 10911, 4 femora (2 left, 2 right); UF 10915, 2 right metatarsals; UF 10921, 9 splints; UF 10916, 4 cuboids (2 left, 2 right); UF 10917, 3 calcanea;

Figure 16

Nannippus phlegon Upper Molar

UF 17484 Haile XVA

X 4.4 (linear)

Table 14

Measurements (in mm) of <u>Nannippus phlegon</u> Cranial and Post-cranial Material From Haile XVA

Upper cheek tooth	UF 17484	UF 17485	
Anteroposterior distance	17.5	19.6	
Transverse distance	20.4	-------	
Crown height	- ---	51.0	
Metapodial			
Transverse width, distal end	25.7		
Anteroposterior width, distal end	24.0		
Proximal Phalanx			
Width, proximal end	24.4		
Width, distal end	20.6		
Ungual Phalanx	UF 17549a	UF 17549b	UF 17549c
Total length	43.4	43.6	43.1
Width, distal articular surface	22.7	23.9	22.8

UF 10920, 2 astragali; UF 10917, 4 proximal phalanges; UF 10913, 4 distal sesamoids; UF 10914, 7 ungual phalanges.

The Haile XVA skull (UF 10909) is in poor condition, and not enough of the fragments are present to allow complete re-construction. Both left and right dentition, however, are complete (Figure 17) and a portion of the premaxillary has been rebuilt. A small portion of the occipital region is preserved but the rest of the skull consists of isolated fragments.

The skull is referred to the genus _Plesippus_ on the basis of the well developed P^1, the poorly developed parastyles and metastyles, the dilation of the fossettes, and the more rounded nature of the protocones.

In dental morphology, UF 10909 resembles both _Plesippus shoshonensis_ and _Plesippus simplicidens_. Gazin (1936) states that the ranges of measurements of these two species overlap though _P. simplicidens_ tends to be smaller. The Haile XVA material (Table 15) is smaller than any of the individuals measured by Gazin (1936). It is, however, about the size of the specimen of _P. simplicidens_ described by Hibbard (1941) from the Blancan Rexroad fauna of Kansas. The postcranial material is also small (Table 16), and falls within the range of measurements for _P. simplicidens_ provided by Gazin (1936).

Figure 17

Plesippus simplicidens Upper Dentition

UF 10909, Haile XVA

(slightly less than natural size)

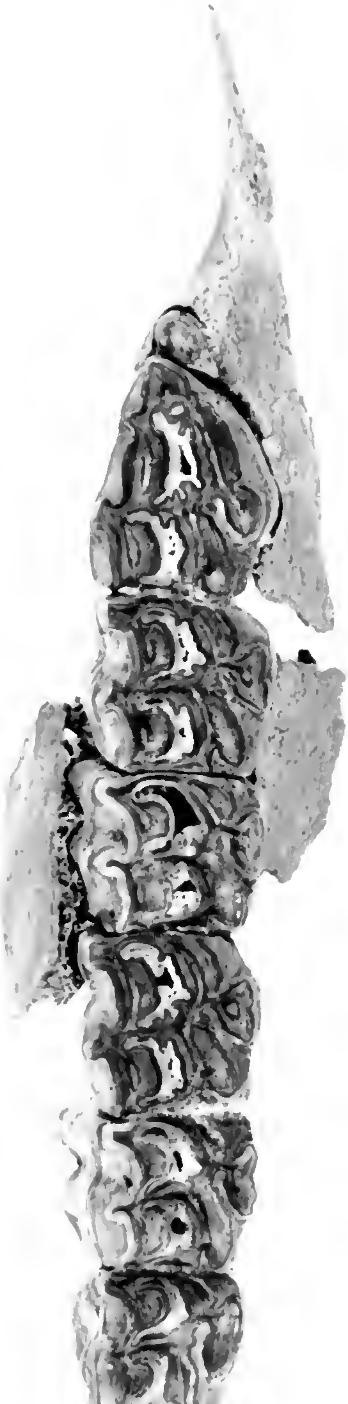


Table 15

Measurements (in mm) of the Upper Dentition of *Plesippus simplicidens* From Haile XVA

	Left	Right
Length of tooth row*	158	155
Length, P_1	----	12.2
Width, P_1	----	6.4
Length, P_2	32.9	32.8
Width, P_2	24.7	24.6
Length, P_3	24.1	24.0
Width, P_3	26.2	25.2
Length, P_4	23.3	21.9
Width, P_4	24.8	24.3
Length, M_1	22.3	23.8
Width, M_1	23.8	25.5
Length, M_2	22.0	22.4
Width, M_2	22.6	23.9
Length, M_3	28.8	33.2
Width, M_3	23.0	35.3

All measurements were taken at the grinding surface; width measurements do not include cement.

*not including P_1

Table 16

Measurements (in mm) of *Plesippus simplicidens* Postcranial Material From Haile XVA

	N	$\bar{X}$	O.R.
Humerus			
Transverse width, distal condyle	3	70.1	69.7-70.5
Anteroposterior width, distal end	3	80.7	77.0-84.0
Radius			
Total length	1	316.0	----------
Anteroposterior width, proximal end	1	77.6	----------
Transverse width, proximal end	1	36.3	----------
Anteroposterior width, distal condyle	1	37.4	----------
Transverse width, distal condyle	1	57.9	----------
Femura			
Total Length	1	368.5	----------
Transverse width, proximal end	1	114.0	----------
Anteroposterior width, proximal end	1	88.5	----------
Transverse width, distal condyle	4	87.2	84.6-89.7
Anteroposterior width, distal end	4	116.8	114.0-118.0
Metatarsal			
Anteroposterior width, proximal end	2	41.2	39.6-42.8
Transverse width, proximal end	2	48.5	48.2-48.8
Calcaneum			
Total length	3	107.7	103.0-110.0
Lateral width	3	42.0	43.2-46.5
Astragalus			
Total length	2	58.0	57.0-58.9
Laterial width	2	58.8	57.7-59.8
Proximal Phalanx			
Total length	3	73.5	76.5-81.2
Width, proximal articular surface	2	43.7	42.8-44.5
Width, distal end	4	36.1	33.7-38.5

Table 16 (continued)

	N	$\bar{X}$	O.R.
Medial Phalanx			
Total length	6	45.5	44.1-47.4
Width, proximal articular surface	6	40.7	39.1-43.2
Width distal end	6	40.9	38.8-42.8
Ungual Phalanx			
Total length	6	54.4	50.6-58.8
Width, proximal articular surface	6	38.5	34.1-43.3

Equus (*Asinus*) sp.

Material: UF 17750, upper cheek tooth; UF 17483, lower molar; UF 17482, M_3; UF 17551, left humerus; UF 17552, astragalus; UF 17553, proximal phalanx; UF 17554, medial phalanx; UF 17555, ungual phalanx.

The three teeth listed above do not agree morphologically with those of *Plesippus*. Regarding the upper tooth, the fossettes are much more complicated than in *Plesippus*. The lower teeth are also quite distinct from those of *Plesippus* figured by Gazin (1936), Hibbard (1941), and McGrew (1944). In all the lower teeth figured by the above authors, the median valley enters the commissure. This is not the case with the Haile XVA specimens. In these, the median valley approaches the commissure but does not enter it. In this respect, the Haile XVA specimens resemble *Equus fraternus*, a Pleistocene ass.

Several postcranial elements in the Haile XVA fauna also suggest the presence of an ass. These are much smaller than specimens attributed to *P. simplicidens*. Hibbard (1956) has reported the presence of an ass in the Meade County fauna, in Meade County, Kansas. The referred specimen was a medial phalanx. The Haile XVA medial phalanx agrees very closely with regard to size (Table 17).

Table 17

Measurements (in mm) of _Equus_ (_Asinus_) sp. Cranial and Post-cranial Material From Haile XVA

Upper Cheek Tooth		
Anteroposterior distance		25.4
Transverse distance		23.4
M_3	UF 17482a	UF 17482b
Anteroposterior distance	----	28.7
Transverse distance	11.2	10.7
Humerus		
Total length		255.0
Transverse width, anterior end		88*
Lateral width, distal condyles		68.1
Anteroposterior width, distal condyles		46.9
Astragalus		
Total length		50.4
Greatest width		50.0
Proximal Phalanx		
Total length		60.6
Width, proximal end		34.8
Width, distal end		30.5
Medial Phalanx		
Total length		40.0
Width, proximal articular surface		38.1
Width, distal end		34.8
Ungual Phalanx		
Total length		45.7
Width, proximal articular surface		33.1

---

*estimated

Family Tapiridae

Tapirus sp. Brisson 1762

Material: UF 17468, partial crown of a cheek tooth.

Since only one genus of Tapirs is known from post-Hemphillian deposits of North America, it seems reasonable to ascribe this specimen to *Tapirus*. The material only serves to record the presence of this genus in the fauna. The only other Blancan record of this genus is the Santa Fe I fauna (Webb, in press a).

Order Artiodactyla

Family Tayassuidae

Mylohyus floridanus Kinsey (in press)

Material: UF 18002, left and right mandibular rami and upper left canine (holotype).

This species has recently been described by Kinsey (in press) based upon the material from Haile XVA. It represents one of the few Blancan records for this genus. The material is figured (Figures 18 and 19) and the diagnosis is included here in order to complete the study of the fauna. Measurements of the holotype are presented in Table 18.

> Close to *Mylohyus nasutus* in size and elongation of the snout. Larger and more robust than *Mylohyus fossilis* and lacking extreme constriction of the symphysis diagnostic of that species (Lundelius, 1960). Pre- and Post-canine diastema longer than in other species of *Mylohyus*. Symphysis much more slender than in Prosthenops. Coronoid process triangular with straight, not convex, anterior margin.

Figure 18

Mylohyus floridanus Mandibular Ramus

UF 18002, Haile XVA

X .89 (linear)

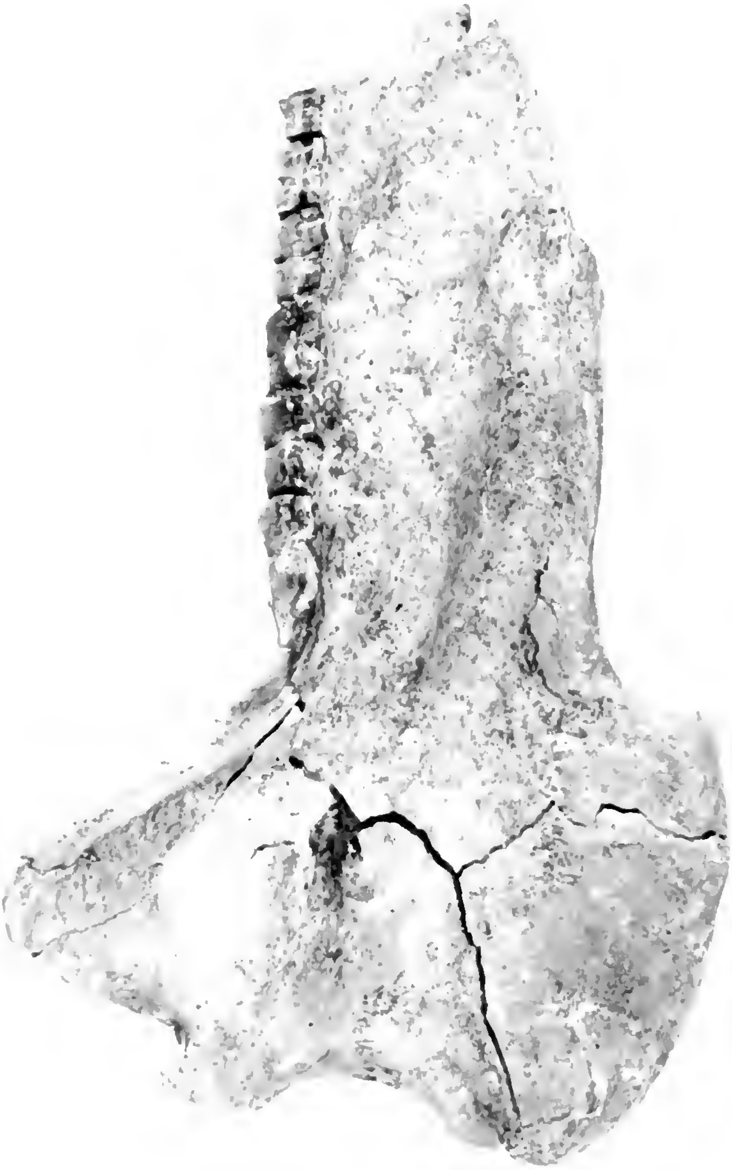


Figure 19

Mylohyus floridanus Mandibular Symphysis

UF 18002, Haile XVA

X .89 (linear)

Table 18

Measurements (in mm) of the Dentition of *Mylohyus floridanus**

	Left	Right
Length, upper canine	15.1	----
Width, upper canine	11.1	----
Length, lower canine	14.0	----
Width, lower canine	10.6	----
Length, P_2	8.5	----
Anterior width, P_2	4.9	----
Posterior width, P_2	5.1	----
Length, P_3	12.0	----
Anterior width, P_3	9.0	----
Posterior width, P_3	9.1	----
Length, P_4	13.0	----
Anterior width, P_4	10.6	----
Posterior width, P_4	12.6	----
Length, M_1	13.2	13.5
Anterior width, M_1	12.6	12.8
Posterior width, M_1	12.8	12.7
Length, M_2	15.2	15.5
Anterior width, M_2	14.0	14.1
Posterior width, M_2	13.9	14.1
Length, M_3	21.1	21.0
Anterior width, M_3	13.1	13.1
Posterior width, M_3	11.8	11.9
Length, premolars	33.1	----
Length, molars	49.9	50.3
Length, molar-premolar series	83.0	----
Post-canine diastema	80.0	----
Pre-canine diastema	14.0	13.0
Depth of jaw at M_1	41.2	41.0
Thickness of jaw at M_1	21.2	21.1
Width, jaw at canines	41.2	----
Width between canine alveoli	17.6	----
Least width, symphysis	26.4	----
Length, articular condyles to anterior end of symphysis	273.0	----

---

*measurements after Kinsey (in press)

> Total length of the P_2-M_3 series less than in other *Mylohyus*, both absolutely and relative to the overall length of the jaw. M_1 and M_2 relatively shorter than in other *Mylohyus* except *M. exoticus* (USNM 8876). Anteroposterior diameter of $\bar{C}$ greater than in all other *Mylohyus*, both absolutely and relative to the cheek teeth series. Width of $\bar{C}$ greater relative to width of P_2 and M_1 than in other *Mylohyus*. (Kinsey, in press)

It is interesting that *Mylohyus* does not occur in the other Blancan faunas of Florida. Such a large fauna as Santa Fe I, for example, should contain some remains of this genus if it were present in the area in any great numbers. That it was scarce in Florida in pre-Rancholabrean time is suggested by the Coleman IIA fauna in which *Platygonus* outnumbers *Mylohyus* eleven to one. *Platygonus* is present in the Santa Fe I fauna. The occurrence of different peccary genera in the Haile XVA and Santa Fe I faunas may suggest an ecological difference between the two. This possibility will be discussed in the paleoecology section.

Family Camelidae

Hemiauchenia cf *macrocephala* Cope 1893

Material: UF 10900, partial skull; UF 10894, 2 cervical vertebrae; UF 10899, phalanges (3 medial, 1 ungual).

The Haile XVA skull (UF 10900) consists of the palate with upper dentition (Figure 20) and part of the cranium. The cranial fragment includes parts of the parietal, left squamosal, left exoccipital, and supraoccipital. This por-

Figure 20

Hemiauchenia cf *macrocephala* Upper Dentition

UF 10900, Haile XVA

X .93 (linear)

tion of the skull, particularly the external auditory meatus and the subsquamosal foramina, agrees very closely with the type material for Tanupolama figured by Stock (1928). The Haile XVA specimen represents a juvenile individual. The left DP^2 is present as are the left and right DP^3 and DP^4. Left and right P^3 and P^4 are present but unerupted. The complete right molar series is present while the left is represented by only M^1.

The Haile XVA specimen is a small llama referrable to what most authors have called Tanupolama which is now partly included in Hemiauchenia in a recent revision (Webb, in press b). In this revision (Webb, in press b) three North American species are recognized: H. blancoensis, H. seymourensis, and H. macrocephala. Hemiauchenia blancoensis is large and has a relatively narrow P_4. Hemiauchenia seymourensis is about as large as H. blancoensis and differs from it in the nature of the P4 (Hibbard and Dalquest, 1962). Hemiauchenia macrocephala is the smallest of the North American species and has a relatively wider P_4. The Haile XVA specimen lacks the P_4, but the specimen is quite small (Table 19) and tentative species allocation is based on size.

The occurrence of H. macrecephala in the Haile XVA fauna marks its earliest record anywhere. That this species has a long continuous history in Florida is indicated by its

Table 19

Measurements (in mm) of the Upper Dentition of *Hemiauchenia* cf *macrocephala* From Haile XVA

	Left	Right
Length, DP^2	10.8	----
Width, DP^2	5.8	----
Length, DP^3	19.7	19.2
Anterior width, DP^3	11.5[1]	12.4
Posterior width, DP^3	----	17.3
Length, DP^4	19.6	18.8
Anterior width, DP^4	17.7	17.8
Posterior width, DP^4	19.2	19.1
Length, P^3	----	16.5[2]
Width, P^3	----	9.9
Length, P^4	----	18.8[2]
Width, P^4	----	15.2
Length, M^1	26.2	25.7
Anterior width, M^1	20.2	21.2
Posterior width, M^1	19.8	20.4
Length, M^2	----	22.7
Anterior width, M^2	----	21.2
Posterior width, M^2	----	19.7
Length, M^3	----	26.6
Anterior width, M^3	----	14.2
Posterior width, M^3	----	19.1
Length of deciduous premolar series	50.1	----
Length of molar series	----	75.0
Length of tooth row functional at time of demise	125[1]	
Length of permanent tooth row	110[1]	
Palatal width at DP^3	34.5	
Palatal width at DP^4	37.5	
Palatal width at M^1	47.5	

---

[1] estimated

[2] unerupted

presence in the Irvingtonian Inglis IA fauna (Webb, in press a). Hemiauchenia blancoensis occurs in the Santa Fe I fauna (Webb, in press b) possibly indicating ecological differences.

This genus was widespread in the Blancan, being present in most North American faunas of this age. It also occurred in the Argentinian Chapadmalalan Fauna (Kraglievichia, 1946).

Family Cervidae

Odocoileus virginianus Zimmerman

Material: UF 10885, 6 partial upper dentitions; UF 17481, right mandible with P_2, DP_4, M_2, M_3; UF 17478, left P_4, UF 17477, right M_3; UF 10883, 19 cervical vertebrae; UF 10889, 25 thoracic vertebrae; UF 10884, 35 lumbar vertebrae; UF 10891, 3 left humeri; UF 10893, right humerus; UF 17479, 3 metacarpals (2 left, 1 right); UF 10887, metatarsal; UF 17480, left astragalus; UF 10886, 3 podials; UF 10888, 15 phalanges.

The genus Odocoileus is recognized in many of the Blancan faunas of North America. In most cases, however, the material has been scarce and species allocation has not been possible.

The definitions of closely related species (and genera) of deer are very similar, and the taxonomic problem is compounded by the large amount of individual variation in these forms. The nature of the P_4 is considered important in deer taxonomy at the generic or subgeneric level; unfortunately, this tooth is also the most variable. In Simpson's (1928) discussion of Blastocerus extraneous, he pointed out that specimens of Odocoileus studied approached Blastocerus in character, and some Recent Blastocerus material diverged from his specimen toward Odocoileus. The subgenus Procoileus (Frick, 1937) is based primarily on the characters of the P_4.

An examination of a large sample of Odocoileus teeth from the Santa Fe I fauna showed individual variation approaching the characters of Blastocerus, Procoileus, and even Craniocerus. A similar, though not as drastic, example of individual variation observed in a sample of Odocoileus teeth from several later Pleistocene and Recent sites in Florida. It appears as though P_4 morphology is not reliable for taxonomic studies.

One P_4 is preserved in the Haile XVA material. Only the labial portion of the tooth is preserved, and it shows little wear. The portion present, however, compares favorably with most specimens of O. virginianus observed.

The shape and relative size of antlers are other characters used in deer taxonomy (Frick, 1937). Unfortunately, no antler material is present in Haile XVA.

Size also has been a criterion for species determination of fossil deer. The Haile XVA deer are relatively small. This is not considered taxonomically significant, however, as a size comparison of certain postcranial elements from various stages of the Pleistocene (Table 20) shows random size fluctuations. Evidently, Odocoileus exhibits no such size trend throughout the Pleistocene as was shown for the edentates. The size variations seen are probably a reflection of ecological conditions. Harlow and Jones (1965) show that the size of Recent deer fluctuates significantly from habitat to habitat within the state of Florida.

Finally, an element by element comparison of the Haile XVA deer material with specimens of O. virginianus from other Florida Pleistocene sites, and with Recent specimens, shows no conspicuous differences. It is considered then, that the Haile XVA cervid represents Odocoileus virginianus.

Table 20

Measurements (in mm) of Postcranial Elements of *Odocoileus virginianus* from Several Florida Pleistocene Localities

	Haile XVA			Coleman IIA			Reddick I		
	N.	$\overline{X}$	O.R.	N.	$\overline{X}$	O.R.	N.	$\overline{X}$	O.R.
Humerus									
Lateral width, distal condyles	3	31.0	30.6-31.4	2	28.4	26.2030.6	1	28.4	---------
Metacarpal									
Lateral width, proximal end	3	23.5	22.7-24.8	2	27.4	26.6-28.2	1	22.2	---------
Anteroposterior width, proximal end	3	16.7	16.4-17.1	2	20.3	20.2-20.5	1	18.1	---------
Metatarsal									
Lateral width, proximal end	1	23.2	---------	2	22.4	21.5-23.3	1	20.8	---------
Anteroposterior width, proximal end	1	23.7	---------	2	24.8	22.9-26.6	1	23.2	---------

	Inglis IA			Coleman IIA			Reddick I		
	N.	$\overline{X}$	O.R.	N.	$\overline{X}$	O.R.	N.	$\overline{X}$	O.R.
First Phalanx									
Length	7	41.0	37.7-43.2	10	43.5	39.4-48.9	-	----	---------
Width, proximal end	7	13.4	12.2-13.9	10	13.3	11.6-15.2	-	----	---------
Humerus									
Lateral width, distal condyles	4	32.9	31.3-34.4	7	30.4	28.2-33.2	3	29.6	28.6-31.2
Metacarpal									
Lateral width, proximal end	1	29.6	---------	1	24.3	---------	2	27.0	27.6-26.4
Anteroposterior width, proximal end	1	20.7	---------	1	23.8	---------	2	19.5	19.1-20.0

Metatarsal									
Lateral width, proximal end	3	25.2	24.6-25.5	7	23.6	22.5-24.8	1	23.1	---------
Anteroposterior width, proximal end	3	26.5	26.0-27.4	7	25.2	23.6-35.8	1	21.9	---------
First Phalanx									
Length	1	46.6	---------	7	43.4	40.3-44.4	4	42.5	40.6-44.4
Width, proximal end	1	15.4	---------	7	13.0	12.2-13.8	4	14.7	14.3-15.5

	Devil's Den			Itchetucknee River		
	N.	$\overline{X}$	O.R.	N.	$\overline{X}$	O.R.
Humerus						
Lateral width, distal condyles	8	35.0	33.5-36.7	7	31.4	28.6-34.0
Metacarpal						
Lateral width, proximal end	12	28.1	27.0-30.2	11	27.2	23.7-29.6
Anteroposterior width, proximal end	12	20.3	18.5-21.3	11	18.4	17.1-21.5
Metatarsal						
Lateral width, proximal end	11	25.5	24.3-26.9	14	25.6	21.0-26.7
Anteroposterior width, proximal end	11	26.9	25.7-27.8	14	25.7	22.5-29.6
First Pahlanx						
Length	--	----	---------	14	41.5	36.1-45.8
Width, proximal end	--	----	---------	14	12.7	11.5-13.8

AGE AND CORRELATION

Workers such as Schultz (1938), Wilson (1938), McGrew (1944), and others have long recognized that the Blancan faunas of North America can be identified by the presence and absence of certain mammalian genera. McGrew (1944) summarized these as follows:

> (1) the absence of typically Pliocene genera; (2) the presence of characteristically middle and late Pleistocene genera; (3) the presence of certain genera that survived from the Hemphillian but which did not outlive the Blancan; (4) the presence of certain genera that were limited to the Blancan; and (5) the absence of certain genera that did not make their appearance until after the close of the Blancan.

In the following section, each of the above criteria will be examined with regard to the Haile XVA fauna. (1) There are no typically (North American) Pliocene genera represented in Haile XVA. *Kraglievichia* is of Pliocene age in South America but is Blancan or later in North America. It should be pointed out here, however, that negative evidence, while rarely ever good, is particularly dangerous to weigh heavily in relation to the Haile XVA fauna. The small number of taxa and individuals probably indicates that the specimens collected are not a thorough sample of the fauna existing in the area at that time.

(2) There are some characteristically middle and late Pleistocene genera present in the fauna; *Odocoileus*, *Mylohyus*, *Smilodon*, and *Sigmodon* represent this element.

(3) Of the genera which survived the Hemphillian but not the Blancan, only *Nannippus* is present for certain. The presence in the fauna of a gomphotheriid may fit this category, but the lack of a definite generic allocation makes its inclusion here tenuous.

(4) There is only one representative of the genera which are totally restricted to the Blancan, the *Plesippus*. The occurrence of *Sigmodon medius* and *Nannippus phlegon* is critical, however, as these species are restricted to the Blancan.

(5) No genus appearing after the close of the Blancan is present in Haile XVA. This again is negative evidence, and the remarks previously made concerning this also apply here.

When all the mammalian faunal evidence is considered (see Table 21), particularly the presence of *Nannippus*, *Plesippus*, and *Sigmodon medius*, a Blancan age seems conclusive.

More refined correlation of the Haile XVA fauna with other North American Blancan faunas (outside of Florida) leads to difficulties resulting from geographic distance and

Table 21

Faunal Comparisons of Haile XVA and Other Blancan Localities

Haile XVA	Santa Fe IB Florida	Blanco Texas	Red Light Texas	Hudspeth Texas	Rexroad Kansas	Anita Arizona	Benson Arizona	Curtis Ranch Arizona	Sand Draw Nebraska	Broadwater Nebraska	Hagerman Idaho	Overton Nevada	Reno Nevada
Cryptotis					X								
Scalopus				X									
Glossotherium	X	X	X							X			
Dasypus	X												
Kraglievichia	X												
Sylvilagus							?	X		X			
Petauria													
Castor											X		
Sigmodon			X	X	X		X	X					
Smilodon									X	X			
Pteronura													
Tapirus	X												
Nannippus	X	X	X	X	X		X			X			
Plesippus	X	X	X	X	X	?	X	?	X	X	X	X	X
Mylohyus	X		?	X	?			X					
Odocoileus	X		?	X	?			X					
Hemiauchenia	X	X	X	?	X			X		X			

Table 21 (continued)

Haile XVA	Wichman Nevada	San Joaquin So. Calif.	Asphalto So. Calif.	Coso Mountains So. Calif.	San Timoteo So. Calif.	Bautista Creek So. Calif.	Vallicito-Fish Creek So. Calif.	Tehama No. Calif.	Pittsburg No. Calif.	Ritchie Creek No. Calif.	Lower Lake No. Calif.	Cabo Colnett Mexico	Chapadmalalan Argentina
Cryptotis													
Scalopus													
Glossotherium													X
Dasypus													
Kraglievichia													?
Sylvilagus													
Petauria													
Castor		X											
Sigmodon							X						
Smilodon													?
Pteronura													
Tapirus													
Nannippus													
Plesippus	X	X	X	X	X	X	X	X	X	X	X	?	?
Mylohyus													
Odocoileus	X				X			X			X		
Hemiauchenia				X			X				X		X

ecological differences. Most Blancan faunas are located in western North America, and no Blancan faunas outside of Florida are known from the Gulf Coastal Plain. Consequently, it is easy to see that the lack of a more detailed faunal comparison need not imply a great difference in time. The absence of Kraglievichia and Dasypus from Blancan sites elsewhere in North America is probably due to the geographic difference and not a temporal one. Conversely, a closer correlation with other Blancan faunas in Florida (for example, Santa Fe I) does not necessarily indicate precise equivalence in time. Although close similarities exist between the Haile XVA and Santa Fe I faunas, enough differences are present to indicate a difference in time. The Santa Fe I camel belongs to the typically Blancan species Hemiauchenia blancoensis while the Haile XVA form most closely resembles H. macrocephala. This possibly indicates a younger age for Haile XVA, as H. macrocephala is the typical Irvingtonian and Rancholabrean form.

There are certain forms found in the Santa Fe I fauna which one would also expect to find at Haile XVA but does not. Notable among these is the typically Blancan dog Borophagus. The absence of this form from the Haile XVA fauna probably must be attributed to sampling error. The absence of Castoroides and Hydrochoerus from Haile XVA is probably due to the same phenomenon. Other differences between the faunas of Haile XVA and Santa Fe I are most likely ecologically induced. These are discussed in the next section.

Among the best represented animals in the Haile XVA fauna are the edentates, a group of undoubted South American origin. Of the three genera at Haile XVA, only *Glossotherium* has been previously recognized in North American Blancan faunas, being present in the Blancan faunas of Texas and Nebraska (Table 21). *Dasypus* has not been found so early elsewhere in North America. *Kraglievichia* has not been recognized at all in North America, although its probable descendant *Chlamytherium* (=*Holmesina*) has been found in Irvingtonian and Rancholabrean deposits.

This record of a major influx of edentates from South America is a further indication of the Plio-Pleistocene age of Haile XVA. The small chlamythere from Haile XVA shows a remarkable resemblance to the species *Kraglievichia paranesis* from late Pliocene deposits of South America. Although no authentic Chapadmalalan (early Pleistocene) species is known, it probably lived in regions more tropical than Argentina and probably also resembled the Florida material. Florida and Argentina apparently represent the northern and southern limits of the range for this form, and it seems safe to conclude that the members occupying the middle portion of the range were similar. The close resemblance of the Haile XVA Glossotherium to that from the Chapadmalal also supports the correlation between the Haile XVA deposit and the Argentine Chapadmalalan deposits.

This Blancan influx of edentates into Florida underlines previous correlation between the Blancan stage of North America and the Chapadmalalan stage of South America. That correlation previously has been based upon the appearance of numerous Nearctic species in South America (Patterson and Pascual, 1968). Those Nearctic forms from Haile XVA which closely resemble elements of the Chapadmalalan fauna are Smilodon, Equus, and Hemiauchenia. The combination of correlative taxa of both Nearctic and Neotropical origin makes the resemblance between the Blancan fauna of Florida and the Chapadmalalan fauna of Argentina extraordinarily strong.

The presence in the Haile XVA fauna of shark vertebrae that are similar in preservation to the other vertebrates (and therefore probably not intrusive) indicates that the sea stood nearby during the time of deposition. Even though sharks are partially able to tolerate fresh water, their presence in large enough numbers to become part of the fossil fauna suggests that the sea was nearby. During the interglacial stages of the Pleistocene sea levels were high. Inland localities of higher elevation such as Haile XVA (90 feet above present sea level) which were near the sea must represent interglacial deposits. This evidence, in combination with the Blancan age of the mammalian assemblage, indicates that the Haile XVA deposit represents the Aftonian Interglacial.

PALEOECOLOGY

A complete paleoecological study of an area is not possible by examining a small sample of its vertebrates. That the Haile XVA fossil mammal assemblage is not a representative sample of the mammalian community which once lived in that region is shown by the relatively small number of individuals present and the lack of a significant variety of small mammal species.

The locality seems to represent an aquatic local situation such as a lake or a stream bed. This is indicated by the large amount of fish, amphibian, and aquatic reptile remains recovered from the site. Among the fish are three species of catfish as well as *Amia*, *Centropomus*, *Lepisosteus*, and a host of other as yet unidentified species. These forms are presently not found in sinkholes containing water, but live in open ponds or streams. The various turtles which have been collected at Haile XVA, including *Chrysemys platymarginata*, *Trionyx*, *Kinosternon*, and *Chelydra*, also indicate an aquatic local environment. The box turtle *Terrapene* is also represented in the fauna but was probably trapped in the same manner as the terrestrial mammals. The Amphibia include both anurans and urodeles, and further suggests the aquatic situation as most of these forms rarely travel far from water. Among the birds present at Haile XVA are a duck, a heron, and a grebe. A thorough study of the birds is presently being conducted by Mr. Kenneth Campbell, a graduate student in zoology at the University of Florida. Although the non-mammalian fauna has not been studied in detail, a preliminary analysis is enough to indicate sampling of an open aquatic environment of deposition. The mammals divide readily into two ecological components, a smaller group of aquatic types and a larger group of terrestrial taxa. Castor, as is well known, inhabits medium to large permanent bodies of flowing water. Pteronura inhabits streams from the Guianas to Argentina (Walker, 1960). Its surrounding habitat is probably secondary to its stream habitat as it lives in suitable rivers which flow through a variety of habitat types. These mammals, therefore, are ecologically allied with the turtles, fishes, and water birds, as primary inhabitants of the aquatic site. The other mammals lived on land adjacent to the site of deposition.

Before considering the terrestrial community, let us further consider the aquatic situation. In attempting to interpret the aquatic environment of deposition at Haile XVA, the following possible situations are considered: (1) a cave containing a pond into which animals wandered; (2) a quicksand or mud mire adjacent to a slower moving portion of a stream which trapped animals as they came to drink; (3) the spring-head of a river into which animals fell. These possibilities are discussed below:

(1) The cave pond hypothesis seems unlikely for two reasons. First, the very coarse nature of the principle fossiliferous horizons suggests more rapid transportation of sediments than would occur in a cave pond. Second, the abundance of inhabitants that prefer open moving water seems to preclude the cave pond hypothesis.

(2) A quicksand or mud trap would tend to select for larger animals as the smaller ones would be less likely to become bogged down. However, it would not be expected to a large and varied aquatic fauna, nor would it normally contain such coarse sediments as those of the Haile XVA deposit.

(3) The spring-head hypothesis appears quite appealing. It could explain the accumulation of a great number of large terrestrial animals and the relative scarcity of smaller terrestrial ones. The presence of a few dense elements of Sigmodon, Scalopus, Cryptotis, and Blarina would have to

be ascribed to fortuitous burial. The only other smaller mammals in the fauna are Castor and Pteronura, and because these are normally aquatic animals anyway, they should occur throughout the stream. All the rest of the mammals in the Haile XVA fauna are large terrestrial forms, the types one would expect to be trapped by the treacherous slopes and abrupt limestone ledges which often occur around Florida springs.

Next, we may consider the nature of the terrestrial community adjacent to the spring-head site of deposition. The terrestrial animals sampled consist of a few small mammals and a greater variety of large mammals.

The presence of wide ranging forms such as Hemiauchenia, Plesippus, Nannippus, and Smilodon and eurytopic forms such as Odocoileus, Cryptotis, Scalopus, and Sylvilagus do not reveal much about the paleoecology of the area. These forms are present in most of the North American Blancan faunas and probably ranged through many habitats.

Several taxa in the Haile XVA fauna indicate the presence of a forest community adjacent to the site of deposition. The presence of Mylohyus lends critical support to this interpretation. Lundelius (1960) reviews the evidence that strongly implicates Mylohyus as a forest dweller. He also includes Castor, Tapirus, and Glaucomys (among others) as forest forms. Both Castor and Tapirus are present in the Haile XVA fauna, and the flying squirrel Petauria (like Glaucomys) certainly indicates a forest environment. Glossotherium also presumably favored forested areas.

Dasypus and Kraglievichia were probably restricted in North America to the Gulf Coastal Plain by their need for moderate to warm temperatures and high rainfall. This is indicated by their absence from all other North American Blancan faunas. In South America, Kraglievichia seems to have been largely restricted to the northern tropical portion of the continent. These edentates suggest a tropical or subtropical climate for central Florida during the Aftonian.

In summary, the geologic and paleontologic evidence seems to indicate that the Haile XVA site lay at the springhead of a coastal stream which flowed through a tropical or subtropical forest.

ZOOGEOGRAPHY

The Haile XVA fauna is the first Gulf Coastal Plain Blancan fauna to be described. Apparently its unusual faunal assemblage compared to other Blancan faunas is a reflection of its location. All other described North American Blancan faunas probably represent upland areas which were peripheral to the subtropical corridor through which most of the South American emigrants passed.

Among the edentates, only Glossotherium was not restricted to the tropical portion of North America. This is indicated by its presence in the Blanco (Texas) and Broadwater (Nebraska) faunas. In South America this genus was probably distributed throughout the continent as the presence of G. chapadmalensis in Argentina would indicate. They were no doubt also present in the more equatorial regions of South America during Plio-Pleistocene time although fossil deposits of corresponding age in these areas have not yet been found. Throughout the later Pleistocene this genus was widespread on both continents.

In contrast to Glossotherium, Kraglievichia was apparently restricted to the tropical or subtropical portions of North America during Blancan time. Their total absence from all other North American Blancan faunas outside Florida bears this out. The presence of these forms in Pliocene deposits of Argentina suggests that this genus was able to move into more temperate climes in that continent, something that it apparently never accomplished in North America. Apparently the evolution from Kraglievichia to Chlamytherium involved, among other things, an increased tolerance to colder weather, perhaps reflected by the greater size of Chlamytherium. Chlamytherium was able, later in the Pleistocene, to disperse northwestward from the Gulf Coastal Plain and in South America it was able to spread southward throughout Argentina. It never, however, attained the widespread distribution on both continents enjoyed by Glossotherium.

The genus Dasypus seems to have been more restricted to tropical regions during the Blancan than were Glossotherium and Kraglievichia. It, too, was able to move out of the Gulf Coastal Plain later in the Pleistocene, reaching as far west as Texas and as far north as Missouri and Oklahoma. The probable mechanism allowing for tolerance to colder weather may also have been an increase in size as in Chlamytherium. Its drastic size decrease in latest Pleistocene time (assuming D. bellus is ancestral to D. novemcinctus) could account for its present southern distribution. Dasypus bellus is not known from South American fossil deposits although there is little doubt that it originated there. This is good evidence that it was totally restricted to tropical areas on that continent, where fossil sites happen to be rare.

The unusual distributional pattern of Petauria (early Pleistocene of Florida and Bavaria) indicates a wide distribution complicated tooth group of flying squirrels. Apparently this group was restricted to the eastern portion of North America while an alternate form existed as an ecological equivalent in the west. James (1963) has reported flying squirrels of the simple tooth group in deposits of western North America.

SUMMARY

The Haile XVA mammals represent a unique fauna as it samples one of the few Gulf Coastal Plain Blancan faunas, and is the only such fauna which has been extensively studied to date.

Among the important new pieces of information brought to light is the presence in North America of *Glossotherium chapadmalensis*, which was heretofore known only from Argentina. It is possible that this form gave rise to *G. robustus* in South America and *G. harlani* in North America. Apparently, *Glossotherium* was able to apread throughout North America while the other edentates represented in the Haile XVA fauna were restricted to the Gulf Coastal Plain throughout most of the Pleistocene.

The occurrence of *Kraglievichia paranensis* at Haile XVA and Santa Fe I is the first record of this genus in North America. The presence of this species and of *G. chapadmalensis* strengthens the correlation between North and South American faunas of Blancan and Chapadmalalan ages. Fairly rapidly evolving mammals in the Haile XVA fauna which are conspecific with those in the Chapadmalalan fauna and in some of the Auricanean faunas are good evidence of closely similar ages.

The earliest known occurrence of Dasypus bellus is at Haile XVA. This creature undoubtedly originated in South America although its ancestors are not known. Further discovery of northern South American fossil deposits will more than likely turn up the ancestral forms as it was probably restricted to the equatorial portions of the continent where fossil deposits are rare.

The Old World flying squirrel Petauria gives the fauna an unexpected link with the European faunas. The presence of this form reflects the Miocene or Pliocene migration of European forms to North America (Simpson, 1947). That more remains of these forms are not known is probably due to the natural scarcity of small arboreal forms in the fossil record, as well as the possible restriction of this lineage of flying squirrels to the forests of eastern North America.

The presence of Pteronura in the Haile XVA fauna marks the first record of this large aquatic otter as a fossil. The possibility that the Haile XVA form was ancestral to both Pteronura and Lutra should be considered.

The presence of Mylohyus floridanus at Haile XVA marks one of the earliest records for this genus, though its ancestor, Prosthenops, is known from the Pliocene. Platygonus occurs at Santa Fe I, suggesting a difference in ecology.

If the tentative assignment of the Haile XVA camelid to Hemiauchenia macrocephala is correct, it marks the earliest record for this species anywhere. The typical Blancan species H. blancoensis occurs at Santa Fe I suggesting a possible age difference between the two localities.

The remaining members of the Haile XVA fauna of fairly typical representatives of the North American Blancan (early Pleistocene) fauna. Such characteristic taxa as Plesippus, Nannippus phlegon, and Sigmodon medius strengthen the assignment of a Blancan age to the fauna.

The presence of sharks and brackish water fishes indicates that the sea stood near Haile during the time that Haile XVA was deposited. Presumably this stand of the sea near 90 feet represents the Aftonian interglacial level.

Although the bulk of the fauna at Haile XVA represents an aquatic stream, an adjacent terrestrial community is also well represented. Among the mammals only Pteronura and Castor represent the aquatic community. The terrestrial community includes several clear indicators of a tropical forest situation, these being Mylohyus, Petauria, and the edentates.

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BIOGRAPHICAL SKETCH

Jesse Steadman Robertson, Jr., was born in St. Augustine, Florida, on December 11, 1934. He attended public schools of New Smyrna Beach and St. Lucie County High School. He entered the United States Navy in 1952 and served for four years. In 1956 he entered Jacksonville University from which institution he was awarded a Bachelor of Science degree in biology in 1960.

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

S David Webb

S. David Webb
Associate Professor of Zoology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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This dissertation was submitted to the Dean of the College of Arts and Sciences and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

December, 1976

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