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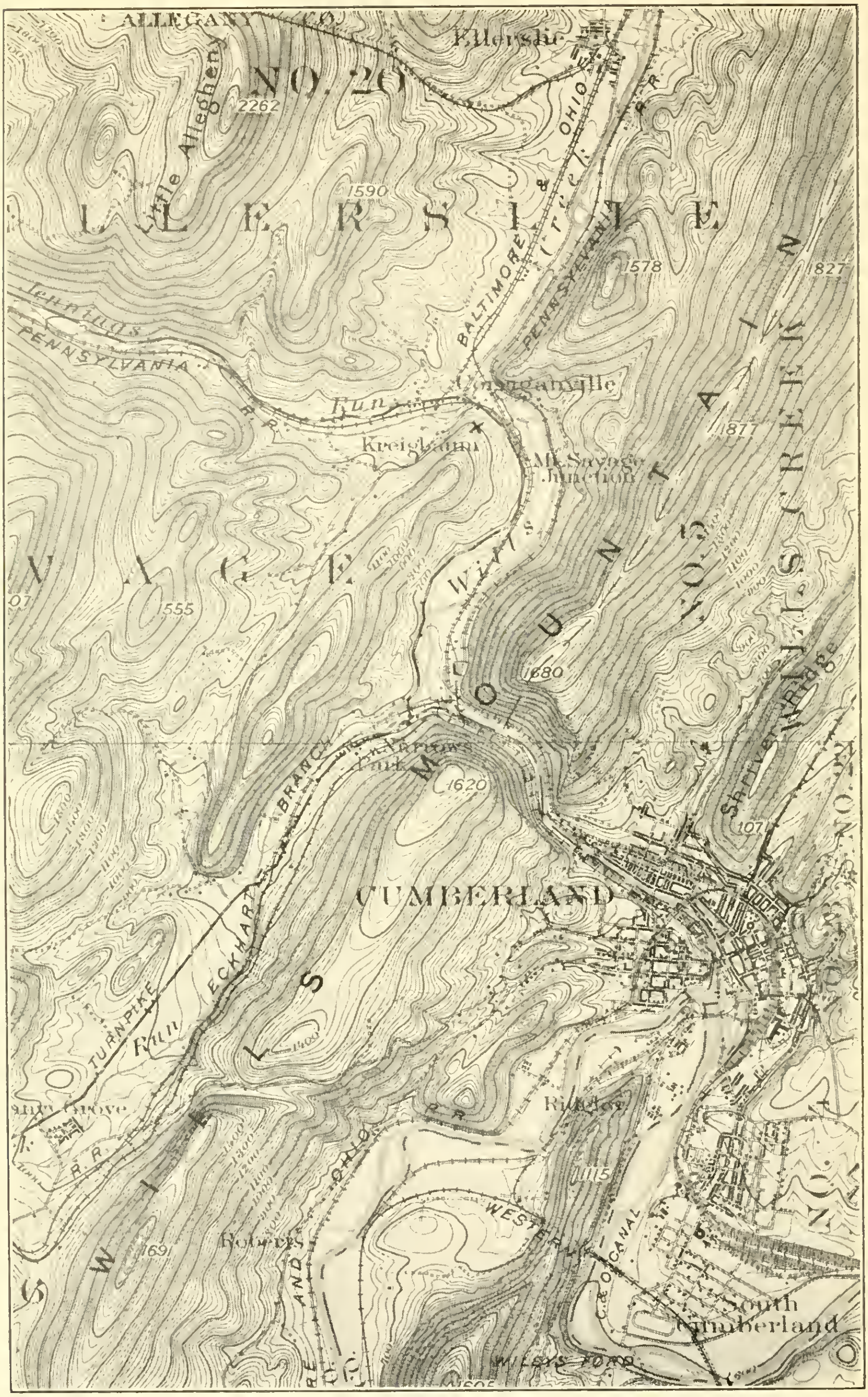


Topographic map showing location of Cumberland Cave and its relation to the physiography. The cave is indicated (X) on north end of spur just south of Corriganville, Md. Map is taken from U. S. Geological Survey Frostburg Quadrangle. Scale, 1/62500, or about 1 mile to the inch. Contour interval, 20 feet.

SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM
BULLETIN 171

# THE PLEISTOCENE VERTEBRATE FAUNA FROM CUMBERLAND CAVE MARYLAND

BY
JAMES W. GIDLEY AND C. LEWIS GAZIN

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1938

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## ADVERTISEMENT

The scientific publications of the National Museum include two series, known, respectively, as *Proceedings* and *Bulletin*.

The *Proceedings* series, begun in 1878, is intended primarily as a medium for the publication of original papers, based on the collections of the National Museum, that set forth newly acquired facts in biology, anthropology, and geology, with descriptions of new forms and revisions of limited groups. Copies of each paper, in pamphlet form, are distributed as published to libraries and scientific organizations and to specialists and others interested in the different subjects.

The dates at which these separate papers are published are recorded in the table of contents of each of the volumes.

The *Bulletin* series, the first of which was issued in 1875, consists of separate publications comprising monographs of large zoological groups and other general systematic treatises (occasionally in several volumes), faunal works, reports of expeditions, catalogs of type specimens and special collections, and other material of similar nature. The majority of the volumes are octavo in size, but a quarto size has been adopted in a few instances in which large plates were regarded as indispensable. In the *Bulletin* series appear volumes under the heading *Contributions from the United States National Herbarium*, in octavo form, published by the National Museum since 1902, which contain papers relating to the botanical collections of the Museum.

The present volume forms No. 171 of the *Bulletin* series.

Alexander Wetmore,
*Assistant Secretary, Smithsonian Institution.*

Washington, D. C., *January 25, 1938.*



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# THE PLEISTOCENE VERTEBRATE FAUNA FROM CUMBERLAND CAVE, MARYLAND

By James W. Gidley and C. Lewis Gazin

## INTRODUCTION

Limestone caverns have played a major role in preserving a record of the Pleistocene life in the eastern region of North America. Except for the remarkable deposits in Florida, our knowledge of the composition of Pleistocene mammalian faunas from this region has been limited largely to occasional and fortunate cave finds. This mode of accumulation rivals that of the tar pits in presenting a broad cross section of the land life belonging to the geologic period immediately preceding the present.

Caves are abundant in the limestone areas of the Appalachian and Mississippi Valley regions, but very little systematic exploration has been done with a view toward obtaining representative collections of Pleistocene mammals. Strong impetus for exploratory work has come from the field of archeological research, and many of the important paleontological finds were made during the investigations for the remains of man. The search for saltpeter has also led to the examination of many caves, but in this work the importance of fossil remains found has undoubtedly been overlooked in the majority of instances.

Cumberland Cave was first found by workmen in excavating for a railroad cut near Cumberland, Md. Considerable fossil material was destroyed by steam shovel and dynamite before the significance of the find was known, but the abundant material subsequently obtained includes a remarkable variety of mammalian forms, many of which are represented by unusually well preserved remains.

The junior author is greatly indebted to C. W. Gilmore, curator of vertebrate paleontology at the National Museum, for advice and criticism during the preparation of this report, and to Dr. J. B. Reeside, Jr., and Dr. W. C. Alden, of the United States Geological Survey, for a better understanding of the geologic and physiographic relations of the cave. Acknowledgment is also made of the courtesy extended by G. S. Miller, Jr., Dr. Remington Kellogg, and staff of the division of mammals in the National Museum and Dr. H. H. T. Jackson, E. A. Goldman, and A. H. Howell, of the United States Biological Survey, in giving generously of their time and advice and

in permitting unreserved use of the collections of recent mammals. Dr. Walter Granger, of the American Museum of Natural History, and Dr. C. L. Camp and R. A. Stirton, of the University of California, have aided greatly in loaning type material from their cave collections. The drawings included with the text were made by Sydney Prentice and Rudolf Weber.

## HISTORY OF INVESTIGATION

The attention of the United States National Museum was directed to the occurrence in 1912 by Raymond Armbruster, of Cumberland, Md., and by George Roeder, of Swetnan, Va. Investigation of the occurrence was undertaken by Dr. J. W. Gidley, and quarrying operations in the cave were conducted by him at intervals during the years 1912 to 1915. For a part of this time he was assisted in the excavation work by Mr. Armbruster. The exploration work carried on at the cave is interestingly described in three popular papers published in "Explorations and Field-Work of the Smithsonian Institution" for the years 1913, 1914, and 1915.

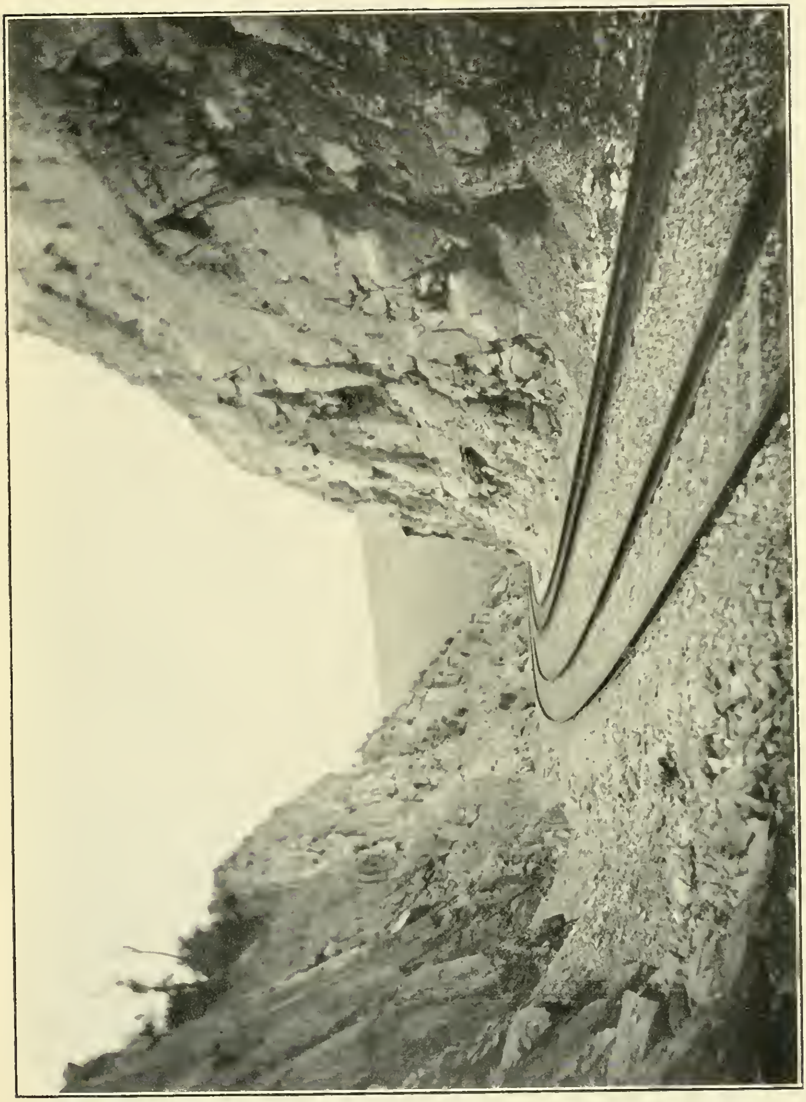
Early results of Gidley's study of the fauna were published in two short papers that appeared in 1913. These included a description of an "eland" (1913a) (see also Gazin, 1933), and new species of wolf and black bear (1913b). In later papers Gidley (1920a, 1920b) gave a general account of the occurrence and described the peccary remains taken from the cave. Dr. Alexander Wetmore (1927) reported the remains of a ruffed grouse included in the collection.

Since the death of Dr. Gidley in 1931 it has become the junior author's privilege to continue the investigation of the Cumberland Cave fauna, completing the manuscript and describing those portions of the fauna that had not been studied. In 1933 a revised list of the forms encountered in the investigation was published (Gidley and Gazin, 1933) together with descriptions of the remaining new forms in the fauna.

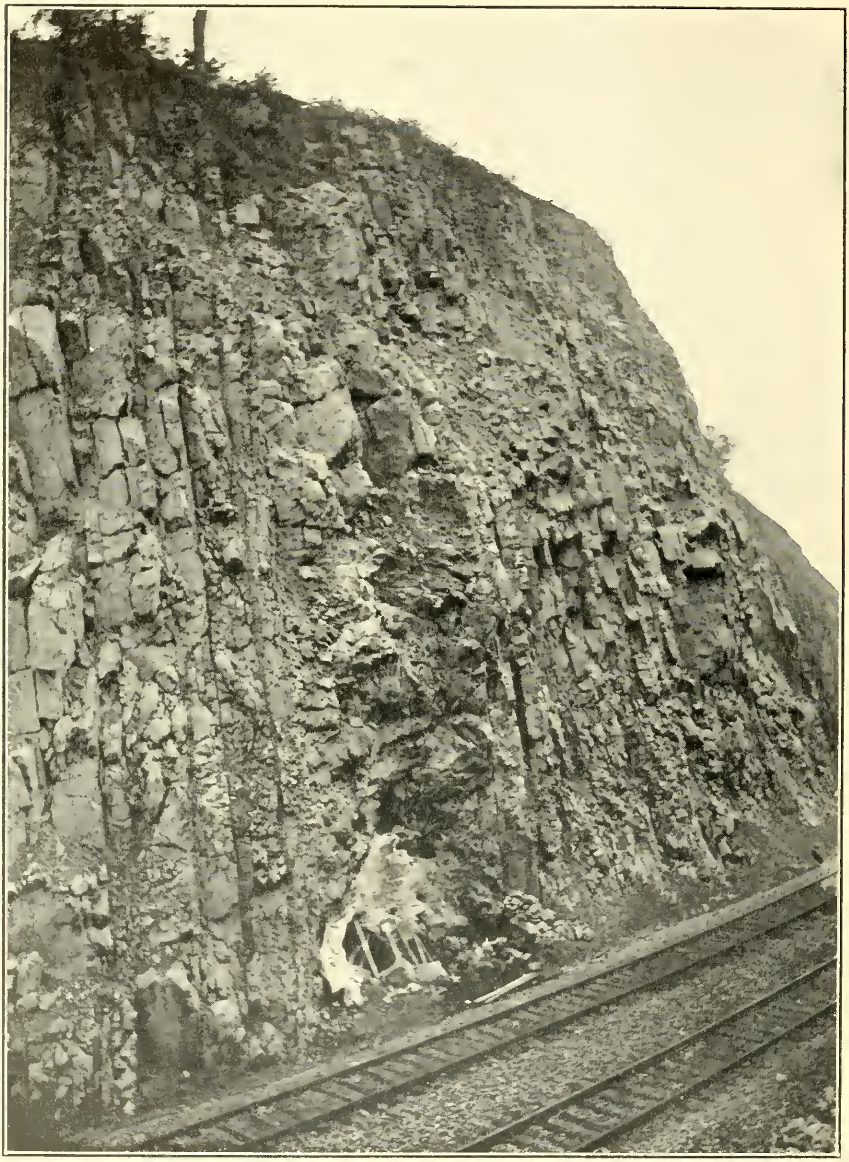
## LOCATION OF CUMBERLAND CAVE

Cumberland Cave is located in Allegany County, western Maryland, about 4 miles northwest of Cumberland (see pl. 1). It is situated in a cut made by the Western Maryland Railroad through the north end of a ridge just south of Corriganville, near where Jennings Run joins Wills Creek. Its location as determined from the topography shown on the Frostburg quadrangle, U. S. Geological Survey, is at about latitude 39°41½′ N. and longitude 78°47¼′ W.

The cave is exposed in the cut at the base of an escarpment of Devonian limestone about 75 feet high. Dr. J. B. Reeside, Jr., of the United States Geological Survey, informs the writer that the



Cut made by Western Maryland Railroad Co., which uncovered the Cumberland Cave deposit.



View from opposite side of railroad cut showing fossil deposit at bottom, near track, and traces of ancient opening at top of cliff. Photographed in 1913 by Raymond Armbruster.

limestone at this point belongs to the Keyser member of the Helderberg formation, and is about 50 feet stratigraphically below the base of the Oriskany. The limestone is structurally a part of the steeply dipping west flank of the Wills Mountain anticline. In the vicinity of the cave the strata are standing nearly vertical, a fact that probably aided greatly in the penetration of surface waters.

## ACCUMULATION AND PRESERVATION OF MATERIAL

The following account of the conditions encountered at the cave is taken from Gidley's preliminary report (1913b, pp. 94–95) on the occurrence:

> In making the railway cut, several small chambers at higher levels than the one containing the bones were encountered, and before the work of excavation began there was said to have been an opening to the surface on the crest of the hill directly above the middle of the present roadbed. This opening so nearly overhead probably at one time served as a trap through which were introduced the animals whose remains are now in the deposits of the bone cavern. There are other openings along the line of outcrop of the ledge, one of them at about the same level with the bone-bearing deposits, appearing at the north end of the ridge where it slopes abruptly down into the Wills Creek Valley. These openings may or may not have communicated at one time with the caverns intersected by the railroad cut, but probably had nothing to do with the accumulation of material in the latter.
>
> From Brown's [1908, p. 163] account of the Conard Fissure, it would seem that the conditions governing the accumulation of material in the Cumberland Cave were quite similar. The bones for the most part are much broken, yet show no signs of being water worn. They are found scattered fairly uniformly throughout the entire mass of unstratified accumulations which consist entirely of cave clays and breccias, unevenly hardened and more or less cemented together by stalactitic materials. There is an almost entire absence of admixture of sand or gravel, or in fact anything that would suggest the possible aid of stream currents in sorting or placing the material during the process of accumulation.

## RELATIONSHIP OF CAVE TO PHYSIOGRAPHY

Five geographic provinces are recognized in Maryland (Fenneman, 1930): Coastal Plain, Piedmont Plateau, Blue Ridge, Valley and Ridge Province, and Appalachian Plateau. The region about Cumberland Cave belongs physiographically in the western part of the middle section of the Valley and Ridge Province.

Physiographic studies of western Maryland and vicinity (Abbe, 1900; Clark and Mathews, 1906; Stose and Swartz, 1912; Stose and Miser, 1922) show that several surfaces, representing periods of cessation of downward stream-cutting, have been developed. Remnants of the various upland surfaces recognized are commonly represented by sets of ridge tops having accordant levels. More recent stages in the process of stream erosion are seen in the different gravel-strewed terraces.

Perhaps the oldest surface recognized, which has been referred to the Schooley Plain, includes the higher portions of the Allegheny Mountain section of the Appalachian Plateaus. A somewhat lower level may be represented by the crest of Wills Mountain (see pl. 1) just east of Cumberland Cave and having an elevation varying from 1,400 feet to 1,800 feet. A still lower surface is believed to be indicated by the crest of Shriver Ridge just north of the town of Cumberland and by a spur of Knobly Mountain to the south of the town. W. B. Clark and E. B. Mathews (1906, p. 89) correlated these ridge crests with the Harrisburg surface, and Cleveland Abbe, Jr. (1900, p. 52), considered them as representing a surface which he called the Shenandoah Plain. The ridges have an elevation of about 1,100 feet near the Potomac River, and if the surface represented were extended up Wills Creek Valley at the present stream gradient it would have an elevation of about 1,200 feet at Cumberland Cave. It may be represented, as suggested by Clark and Mathews, by the ridge west of Wills Mountain, in which Cumberland Cave is located. This ridge crest varies in elevation from about 1,040 feet near the cave to about 1,300 feet farther south. The elevation of the cave deposit, as determined by O. P. Hay (1923) is 837 feet. Assuming practically no gradient for the surface between Cumberland and Cumberland Cave, we have a minimum difference of nearly 300 feet between the elevation of the cave and that of the surface.

During later stream history (Abbe, 1900) two important terraces were developed in the vicinity of Cumberland at elevations of about 800 feet and 650–700 feet. The higher of these may have had an elevation of about 900 feet on the spur in which the cave is located. This is probably very close to the elevation at which the cave mouth was located. The lower terrace may have been 750–800 feet in elevation near the cave. This level appears to be slightly lower than the cave deposit. It seems evident that the fossil material did not accumulate until cutting by Wills Creek had at least reached the stage represented by the higher terrace, and probably at a somewhat later date when the drainage system had dissected this surface.

## CUMBERLAND CAVE FAUNA

The classified list that follows includes all the Pleistocene vertebrate fauna identified from the Cumberland Cave and herein treated:

LORICATA:
- Crocodylid.

SERPENTES:
- Ophidian remains.

GALLIFORMES:
- Tetraonidae:
  - *Bonasa umbellus* (Linnaeus).

INSECTIVORA:
- Soricidae:
  - *Sorex* sp.
  - *Blarina brevicauda* (Say).

CHIROPTERA:
- Vespertilionidae:
  - †*Eptesicus* cf. *grandis* (Brown).
  - †*Corynorhinus alleganiensis* Gidley and Gazin.

CARNIVORA:
- Canidae:
  - †*Canis armbrusteri* Gidley.
  - †*Canis* cf. *priscolatrans* Cope.
- Ursidae:
  - †*Euarctos vitabilis* (Gidley).
  - ‡*Arctodus haplodon* (Cope).
- Mustelidae:
  - †*Martes parapennanti* Gidley and Gazin.
  - *Mustela* cf. *vison* Schreber.
  - †*Gulo gidleyi* Hall.
  - †*Lutra parvicuspis* Gidley and Gazin.
  - ‡*Brachyprotoma pristina* Brown.
  - †*Spilogale marylandensis* Gidley and Gazin.
  - †*Taxidea marylandica* Gidley and Gazin.
- Felidae:
  - †*Felis* cf. *inexpectata* (Cope).
  - †*Felis* near *atrox* Leidy.

RODENTIA:
- Sciuridae:
  - *Marmota monax* (Linnaeus).
  - *Citellus* cf. *tridecemlineatus* (Mitchill).
  - *Tamias* cf. *striatus* (Linnaeus).
  - †*Sciurus tenuidens* Hay.
  - *Glaucomys* sp.
- Geomyidae:
  - ‡*Plesiothomomys potomacensis* Gidley and Gazin.

RODENTIA (Cont.):
- Castoridae:
  - *Castor canadensis* Kuhl.
- Cricetidae:
  - *Peromyscus* cf. *leucopus* (Rafinesque).
  - †*Neotoma magister* Baird.
  - ‡*Parahodomys spelaeus* Gidley and Gazin.
  - *Synaptomys* cf. *cooperi* Baird.
  - *Synaptomys* (*Mictomys*) sp.
  - †*Microtus* (or *Pitymys*?) cf. *involutus* (Cope).
  - †*Ondatra* cf. *annectens* (Brown).
- Zapodidae:
  - *Zapus* sp.
  - *Napaeozapus* cf. *insignis* (Miller).
- Erethizontidae:
  - *Erethizon* cf. *dorsatum* (Linnaeus).

LAGOMORPHA:
- Ochotonidae:
  - *Ochotona* sp.
- Leporidae:
  - *Lepus* cf. *americanus* Erxleben.

PROBOSCIDEA:
- Mastodontidae:
  - ‡*Mammut* cf. *americanum* (Kerr).

PERISSODACTYLA:
- Equidae:
  - †*Equus* sp.
- Tapiridae:
  - †*Tapirus* sp.

ARTIODACTYLA:
- Tayassuidae:
  - ‡*Platygonus cumberlandensis* Gidley.
  - ‡*Platygonus vetus*(?) Leidy.
  - ‡*Mylohyus exortivus* Gidley.
  - ‡*Mylohyus* cf. *pennsylvanicus* (Leidy).
- Cervidae:
  - *Cervus* sp.
  - *Odocoileus* cf. *virginianus* (Boddaert).
- Bovidae:
  - ‡*Euceratherium*(?) *americanum* (Gidley).

† Extinct species. ‡ Extinct genera.

## ENVIRONMENT OF THE FAUNA

Evidence of the environmental conditions that prevailed in the region of the cave during the time in which the fossil material accumulated might reasonably be expected from a consideration of the various forms present in the fauna. Many of the species recognized are closely related to living forms, and it seems probable that their habits were not greatly different from those of living representatives.

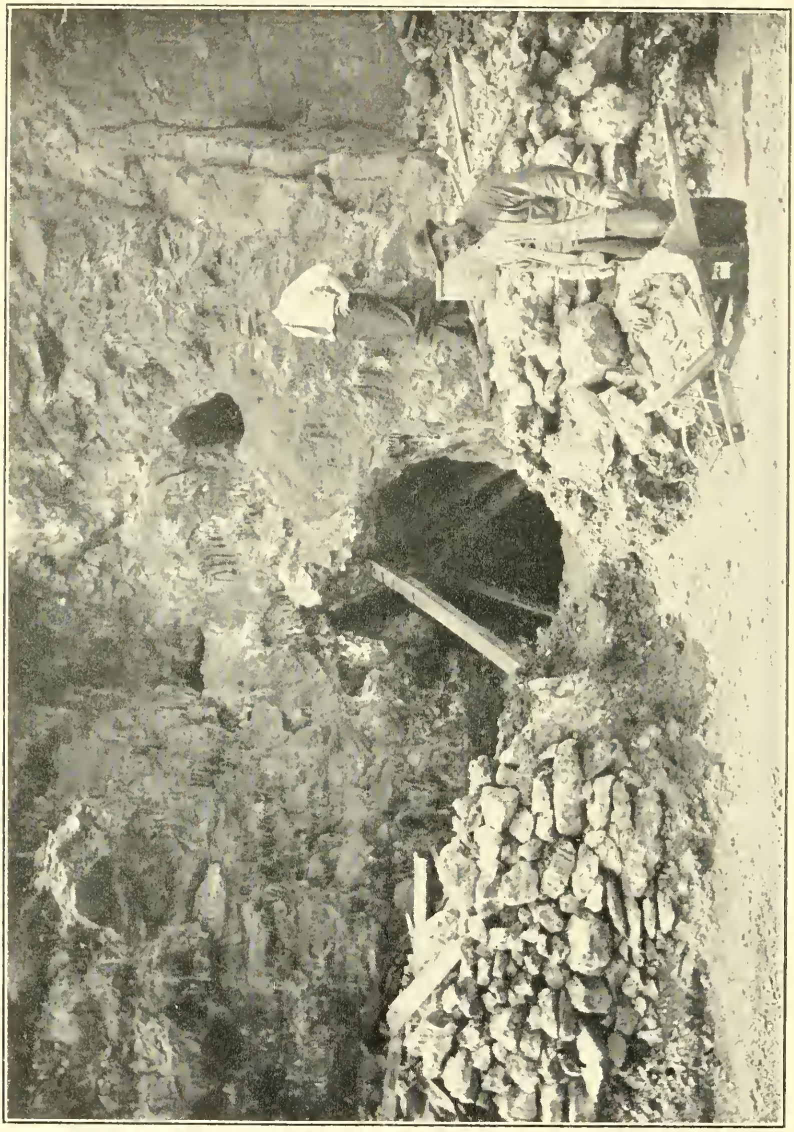
The fauna from the cave includes a peculiar assemblage of animals. Many of the species are comparable to forms now living in the vicinity of the cave, but others are distinctly northern, or Boreal, in their affinities and some are related to species peculiar to the southern, or Lower Austral, region. The fauna now living in this part of Maryland is composed principally of species representative of the Carolinian or Upper Austral region and of the Alleghenian division of the Transition Zone (Merriam, 1900, p. 292).

The wolverine, *Gulo*, and lemmings of the group *Mictomys* are distinctly northern in range, and it seems highly improbable that they were contemporaneous in the same region with a crocodylid and a tapir. Such an association might be plausible with sufficient topographic relief, but from a consideration of the physiographic history it seems evident that during the time in which the cave deposit accumulated relief was not greater than at present, as streams may not have cut so deeply below the old upland surfaces. A more probable explanation of the apparent association is that the fauna is not entirely contemporaneous and that the entombment extended over a period of time sufficient to allow important climatic changes to take place. The cave may have received material during a portion of a glacial and of an interglacial stage. Gidley (1920a) contended that the forms were contemporaneous in the same region, postulating greater relief, but the physiographic evidence does not seem to justify his reasoning.

Included among the forms that may well have been associated with wolverine and lemming mice in the colder fauna are the long-tailed shrew, fisher, mink, red squirrel, muskrat, porcupine, jumping mice, pika, hare, and elk; although in present distribution several of these extend well into the southern region. Suggesting warmer climatic conditions are bats and peccaries, in addition to crocodylid and tapir. Among those forms whose most closely related living representatives are now found much farther west are coyote, badger, pika, a pumalike cat, and a pocket gopher that resembles *Thomomys* more closely than it does *Geomys*.

The fauna as a whole is strongly indicative of a wooded region with no lack of moisture. The floristic condition is suggested particularly well by the spermophiles and jumping mice, and the plentiful supply

Near view of part of excavation made in fossil deposit, Dr. Gidley standing at opening. Photographed in 1913 by Raymond Armbruster.



Opening to excavation made in fossil deposit. Upper figure is Dr. Gidley. Photographed in 1914 by Raymond Armbruster.

of water is evident from the presence of fisher, mink, otter, beaver, bog-lemmings, and muskrat, as well as of the crocodylid. The greater part of the fauna is not unsuited to humid conditions and an abundance of vegetation. However, the horse, coyote, badger, and hare are suggestive of a more open terrane, perhaps bordering a wooded area. It should be noted, moreover, that coyotes and perhaps badgers are commoner in arid regions.

## AGE AND RELATIONSHIPS OF THE FAUNA

A Pleistocene age seems clearly indicated by the assemblage, but a more critical recognition of the stage represented in the absence of stratigraphic evidence is not entirely satisfactory. Our knowledge of the sequence of mammalian forms during Pleistocene time is very incomplete, and it is only through direct correlation of fossil occurrences with known glacial and interglacial deposits that the succession of faunas can be determined. The appearance of new migrants and the extinction of old types appear as valuable criteria in recognizing various stages, but in any case the absence of forms can never be regarded as more than negative evidence.

The number of extinct forms recognized in the fauna and the difficulties encountered in identifying as modern several of the species so classified do not favor a very late stage at Cumberland Cave. Many typical Pleistocene forms, however, as saber-toothed cats, sloth, camel, elephant, and extinct species of bison and musk-ox, are not included in the assemblage. Here again the absence of types is not positive evidence. It is a noteworthy fact that remains of animals larger than a black bear are exceedingly scarce in the collection, probably owing to the mode of accumulation and possibly in part to regional environment.

Gidley (1913b, p. 95) regarded the assemblage as pre-Wisconsin in age and possibly as old as that from Port Kennedy (Cope, 1899) in Pennsylvania. A comparison of the Cumberland Cave faunal list with that of the Port Kennedy fauna, and with the list of mammals from the Conard Fissure in Arkansas (Brown, 1908), follows.

| Cumberland Cave | Port Kennedy | Conard Fissure |
|---|---|---|
| | *Scalopus* sp. | *Scalopus aquaticus* |
| *Sorex* sp. | | *Sorex personatus* |
| | | *Sorex personatus fossidens* |
| | | *Sorex obscurus* |
| | | *Sorex fumeus* |
| | | *Microsorex minutus* |
| *Blarina brevicauda* | *Blarina simplicidens* | *Blarina brevicauda ozarkensis* |
| *Eptesicus* cf. *grandis* | | *Eptesicus grandis* |
| | *Myotis*(?) sp.[1] | *Myotis subulatus*(?) |
| *Corynorhinus alleganiensis* | | |
| *Canis armbrusteri* | *Canis dirus*(?) | *Canis occidentalis*(?) |
| *Canis* cf. *priscolatrans* | *Canis priscolatrans* | |
| | *Vulpes latidentatus* | *Vulpes fulva*(?) |
| | *Urocyon cinereoargenteus* | *Urocyon*(?) sp. |
| | | *Procyon lotor* |
| *Euarctos vitabilis* | *Euarctos americanus* | *Euarctos americanus* |
| *Arctodus haplodon* | *Arctodus haplodon* | |
| *Martes parapennanti* | *Martes diluviana* | *Martes pennanti* |
| *Mustela* cf. *vison* | | *Mustela vison* |
| | | *Mustela cicognanii angustidens* |
| | | *Mustela gracilis* |
| *Gulo gidleyi* | *Gulo gidleyi* | |
| *Lutra parvicuspis* | *Lutra rhoadsii* | |
| *Brachyprotoma pristina* | *Brachyprotoma obtusata* | *Brachyprotoma pristina* |
| | (?)*Mephitis nigra* | *Mephitis mesomelas newtonensis* |
| *Spilogale marylandensis* | | *Spilogale interrupta*(?) |
| | *Osmotherium spelaeum* | |
| | *Pelycictis lobulatus* | |
| *Taxidea marylandica* | *Taxidea taxus* | |
| | *Smilodontopsis gracilis* | *Smilodontopsis troglodytes* |
| | *Smilodontopsis mercerii* | *Smilodontopsis conardi* |
| *Felis* cf. *inexpectata* | *Felis inexpectata* | *Felis couguar* |
| *Felis* near *atrox* | *Felis eyra* | *Felis longicrus* |
| | *Lynx calcaratus* | *Lynx compressus* |
| | | *Lynx rufus*(?) |
| *Marmota monax* | | *Marmota monax* |
| *Citellus* cf. *tridecemlineatus* | | *Citellus tridecemlineatus*(?) |
| *Tamias* cf. *striatus* | | *Tamias nasutus* |
| *Sciurus tenuidens* | *Sciurus calycinus* | *Sciurus hudsonicus* |
| *Glaucomys* sp. | | |
| *Plesiothomomys potomacensis* | | *Geomys parvidens* |
| *Castor canadensis* | *Castor canadensis* | *Castor canadensis* |
| | | *Reithrodontomys simplicidens* |
| *Peromyscus* cf. *leucopus* | *Peromyscus leucopus*(?)[1] | *Peromyscus* sp. |
| *Neotoma magister* | | *Neotoma ozarkensis* |
| *Parahodomys spelaeus* | | |
| *Synaptomys* cf. *cooperi* | | |
| *Synaptomys* (*Mictomys*) sp. | | |
| | *Anaptogonia hiatidens* | |
| | *Sycium cloacinum* | |
| | *Microtus diluvianus* | *Microtus ochrogaster* |
| | *Microtus speothen* | |
| | *Microtus* (or *Pitymys*?) *dideltus* | |
| *Microtus* (or *Pitymys*?) cf. *involutus* | *Microtus* (or *Pitymys*?) *involutus* | |
| *Ondatra* cf. *annectens* | | *Ondatra annectens* |
| *Zapus* sp. | *Zapus hudsonius*(?) | |
| *Napaeozapus* cf. *insignis* | | |
| *Erethizon* cf. *dorsatum* | *Erethizon dorsatum*(?) | *Erethizon dorsatum* |
| *Lepus* cf. *americanus* | | *Lepus americanus*(?) |
| | | *Lepus giganteus* |
| | *Sylvilagus floridanus* | *Sylvilagus floridanus*(?) |
| *Ochotona* sp. | *Ochotona*(?) *palatina* | |
| *Mammut* cf. *americanum* | *Mammut americanum* | |

[1] According to O. P. Hay (1923, p. 312).

| Cumberland Cave—Con. | Port Kennedy—Con. | Conard Fissure—Con. |
|---|---|---|
| *Equus* sp. | *Equus complicatus* [1] | *Equus scotti*(?) |
| | *Equus pectinatus* [1] | |
| *Tapirus* sp. | *Tapirus haysii* | |
| *Platygonus cumberlandensis* | *Platygonus*(?) *tetragonus* | |
| *Platygonus vetus*(?) | | |
| *Mylohyus exortivus* | *Mylohyus nasutus* | *Mylohyus browni* |
| *Mylohyus* cf. *pennsylvanicus* | *Mylohyus pennsylvanicus* | *Mylohyus* sp. indet. |
| | | *Mylohyus* sp. indet. |
| | *Teleoplernus orientalis* | |
| *Cervus* sp. | | *Cervus canadensis*(?) |
| | *Odocoileus laevicornis* | *Odocoileus hemionus*(?) |
| *Odocoileus* cf. *virginianus* | *Odocoileus virginianus* | *Odocoileus virginianus*(?) |
| | *Bison* sp.[1] | |
| *Euceratherium* (?) *americanum* | | |
| | | *Symbos australis* |
| | *Megalonyx loxodon* | |
| | *Megalonyx wheatleyi* | |
| | *Megalonyx tortulus* | |
| | *Megalonyx scalper* | |
| | *Mylodon harlani*(?) | |

The Cumberland Cave fauna exceeds that of other caves in number of mammalian genera recorded but includes a slightly smaller number of species than recognized in either the Port Kennedy or Conard Fissure occurrence. Of the 41 genera listed from Cumberland Cave 8 are extinct, and of 46 species about 28 are believed to represent extinct forms. Thirteen of the 39 genera and about 37 of the 51 species in the Port Kennedy fauna as listed are extinct. This suggests a somewhat greater antiquity for the Pennsylvania assemblage. Thirty-eight genera are recorded from the Conard Fissure, and of this number 4 are extinct, and about 19 of the 50 species are extinct. The Conard Fissure fauna may be appreciably younger than either of the other two, although O. P. Hay (1923, p. 14) believed that the Arkansas occurrence antedated Cumberland Cave. Saber-toothed cats were found in both Port Kennedy and Conard Fissure deposits and not in Cumberland Cave, but tapir, mastodon, and *Arctodus* included in the Cumberland Cave and Port Kennedy occurrences are absent from Conard Fissure. It seems odd that sloth remains were not found in either Conard Fissure or Cumberland Cave. Megalonichid material is frequently encountered in caves, and species of this group of sloths probably lived until near the close of Pleistocene time.

If the Port Kennedy occurrence is considered as early Pleistocene, that of Cumberland Cave may well be near middle Pleistocene in age. However, the particular stage or stages represented remains undetermined.

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[1] According to O. P. Hay (1923, p. 312).

## SYSTEMATIC DESCRIPTION OF VERTEBRATE FAUNA

### Order LORICATA

#### Crocodylid

A single reptile tooth in the Cumberland Cave collection was recognized by C. W. Gilmore as belonging to a crocodile or an alligator. The importance of this tooth is seen in its occurrence farther north than the present limits of this group, suggesting a more equable climate than at present.

### Order SERPENTES

#### Ophidian remains

Several small vertebrae in the collection were identified by Gilmore as snake. There is no certain evidence in the material that more than one form is represented.

### Order GALLIFORMES

#### Family TETRAONIDAE

##### BONASA UMBELLUS (Linnaeus)

A bird bone (U.S.N.M. no. 11690) in the collection was identified by Dr. Wetmore (1927) as the distal portion of a left humerus belonging to a ruffed grouse.

### Order INSECTIVORA

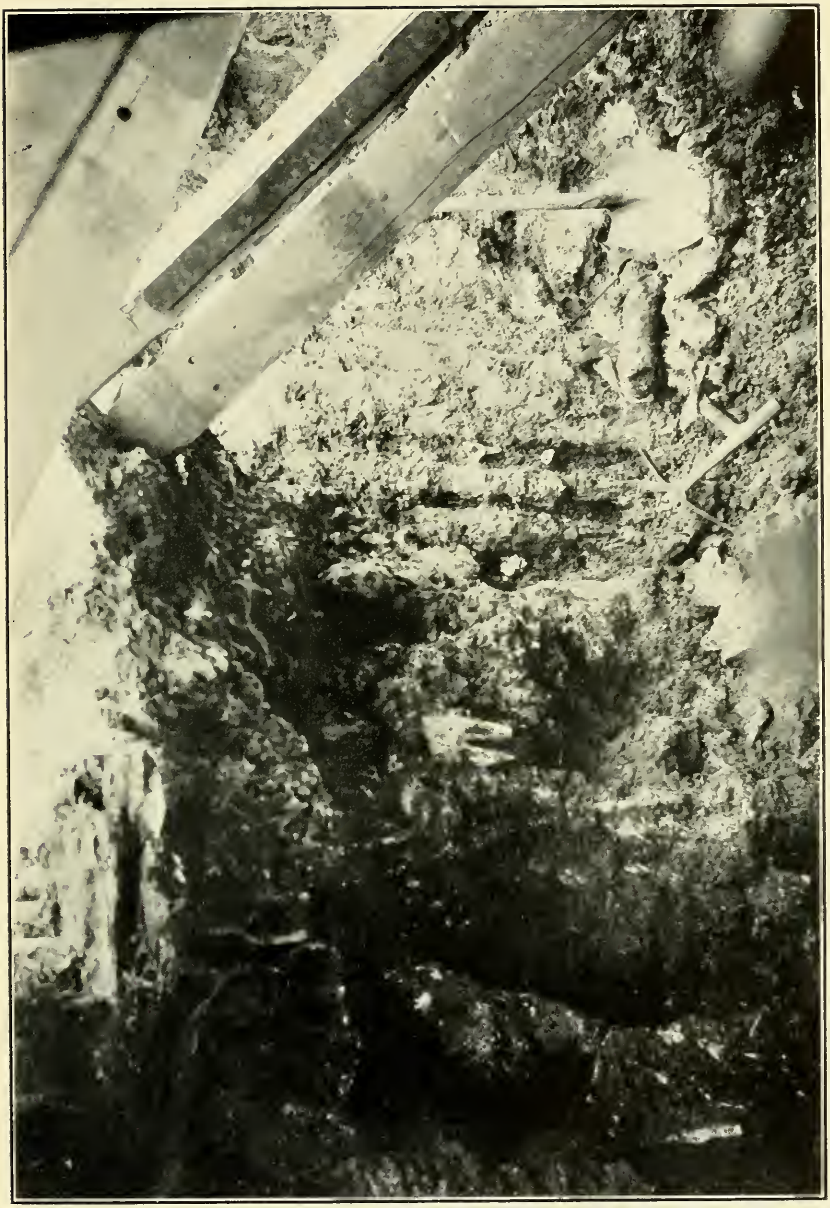
#### Family SORICIDAE

##### SOREX species

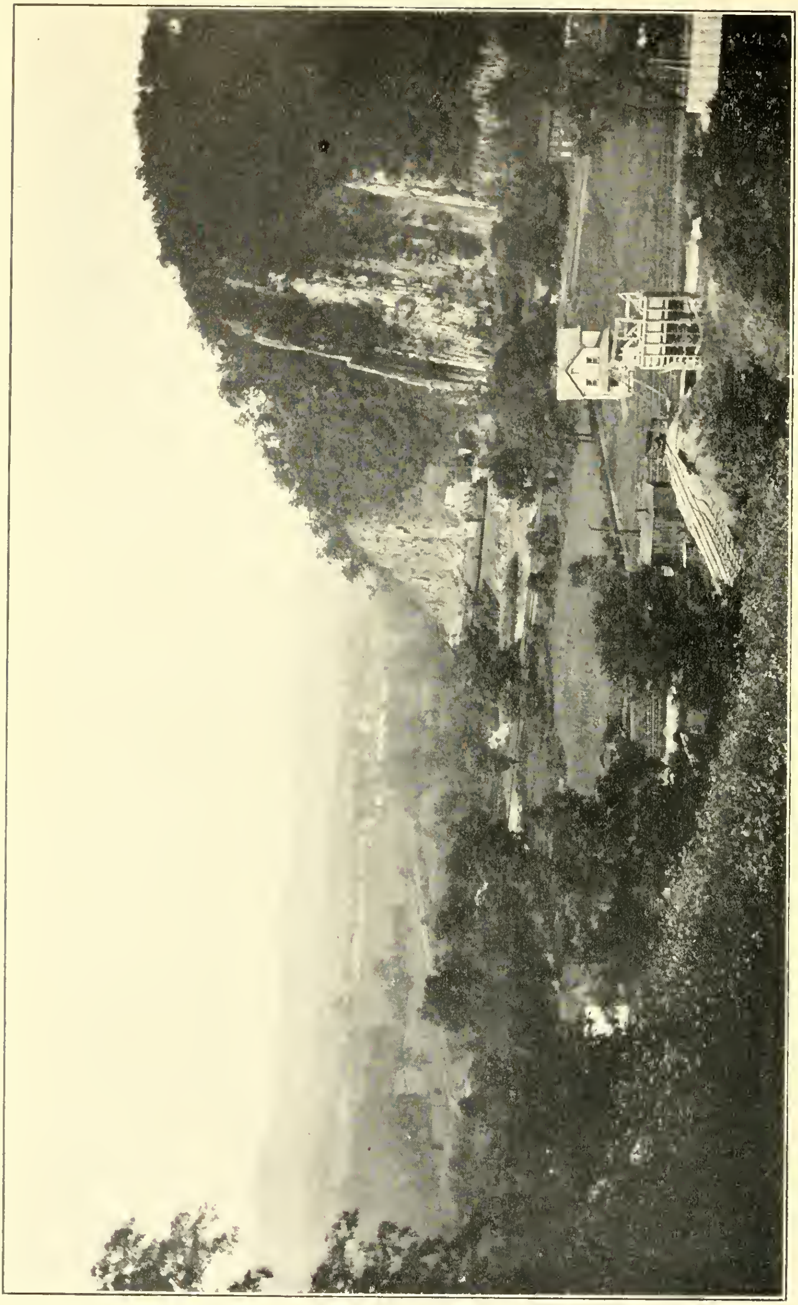
A single maxillary fragment (U.S.N.M. no. 12468) including three teeth, apparently $P^4$, $M^1$, and $M^2$, was kindly identified by Dr. H. H. T. Jackson as belonging to the long-tailed shrew, *Sorex*. The specimen is too fragmentary to permit specific recognition, but no differences could be cited to distinguish it from the living species *Sorex cinereus*, which inhabits the region of the cave today.

##### BLARINA BREVICAUDA (Say)

Representing the short-tailed shrew are one rostral portion of a skull with the greater part of the dentition, two maxillary fragments with teeth, and eight lower jaws. The fossil material indicates a size somewhat greater than the average in Recent specimens and in several characters resembles the form described by Brown from the Conard Fissure as *Blarina b. ozarkensis* (Brown, 1908, pp. 170–171, pl. 15). The heel on the last lower molar is reduced as in the Arkansas form but not more so than in some modern individuals of *B. brevicauda*. The presence of this heel clearly separates the Cumberland form



Small portion of cave interior photographed from near opening, showing bones sticking in clay and stalactitic material.



View from spur in which cave is located looking north across Wills Creek Valley. The limestone strata exposed in right background are the same as those on the south side of the valley where the cave deposit occurs.

from *B. simplicidens* Cope (1899, pp. 219–220). The longitudinal profile of the lower border of the mandible varies in the series of jaws from a smooth curve, as in the Conard Fissure specimen figured by Brown, to a margin distinctly angulate below $M_3$. The variation, however, does not appear to be greater than in living *Blarina brevicauda*, although modern specimens show a greater tendency toward a sharper angulation below $M_3$. Furthermore, there is an average difference in the form of the large lower incisor, which in the fossil shrew is less turned upward at the point than is usual in living species. As noticed by Brown, the crowns of the teeth show pigment as in more recent specimens.

## Order CHIROPTERA

### Family VESPERTILIONIDAE

#### EPTESICUS cf. GRANDIS (Brown)[2]

The large vespertilionid *Eptesicus* is represented in the collection by 13 skull portions and 55 mandibular rami. About half the lower jaw specimens are exceptionally well preserved, and one pair of rami was associated with a nearly complete skull.

The two best-preserved Cumberland Cave skulls (U.S.N.M. nos. 12432 and 12433) are distinctly larger than the living bat *Eptesicus fuscus*, in which respect they resemble *E. f. grandis* from the Conard Fissure. Brown considered his form a subspecies of *E. fuscus*, but the characters outlined by him suggest that the form might well deserve full specific rank. Furthermore, if the Cumberland Cave form is conspecific with the Arkansas Pleistocene type, as seems evident, additional characters are to be seen in the crania of the better-preserved skulls from Maryland.

As in *E. grandis*, the Cumberland Cave form shows the following differences from *E. fuscus*: Skull larger, ridges and depressions on the dorsal surface of rostrum usually more pronounced, width of zygoma greater, teeth somewhat larger than average, depth of masseteric fossa slightly greater, condyle on mandible relatively larger, antero-internal basal cusp on $P_4$ better developed, and mandible of greater relative depth. Additional characters not determinable in the Conard Fissure material but present in the Cumberland specimens include a wider brain case, greater separation of the occipital condyles, and slightly larger bullae. The only difference observed between the specimens from the two localities is that the upper canine in the Maryland form is slightly smaller. However, the number of specimens in which this tooth is preserved is very limited in both collections, and the canine in recent individuals shows a noticeable variation in size.

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[2] Brown, 1908, pp. 174–175, pl. 15.

TABLE 1.—*Measurements (in millimeters) of skulls and mandibles of* Eptesicus grandis *and* E. fuscus

| Measurement | *Eptesicus* cf. *grandis* | *Eptesicus grandis* | *Eptesicus fuscus* [1] |
|---|---|---|---|
| | *U.S.N.M. no. 12432* | *A.M.N.H. no. 11795 (type)* | *U.S.N.M. no. 255580 (Div. Mamm.)* |
| Distance from anterior surface of canine to occipital condyle | 18.4 | ---------- | 18.2 |
| Width of postorbital constriction | 4.3 | 4.3 | 4.6 |
| Width of brain case | 9.4 | ---------- | 8.5 |
| Distance across occipital condyles | 6.4 | ---------- | 5.8 |
| Distance across zygomatic arches | 13.5 | ---------- | 12.9 |
| | *U.S.N.M. no. 12433* | | |
| Length of upper dentition, $P^4$ to $M^3$ | 6.1 | [2] 6.1 | 5.9 |
| | *U.S.N.M. no. 12447* | | |
| Length of lower jaw from $I_1$ to condyle | 15.2 | 15.2 | 15.0 |
| Length of lower dentition from C to $M_3$ | 8.3 | 8.3 | 8.2 |

[1] Specimen of greater than average size.
[2] Approximate.

### CORYNORHINUS ALLEGANIENSIS Gidley and Gazin [3]

FIGURE 1

*Type.*—Skull, U.S.N.M. no. 12412, with incomplete dentition and lacking bullae and zygomatic arches.

*Specific characters.*—Skull close in size to that of *C. rafinesquii.* Frontal region not so highly inflated above dorsal plane of rostrum. Median depression in the dorsal surface of muzzle not so deep. Depth of posterior portion of skull from occipital condyles to top of interparietal less. Occipital condyles slightly farther forward. Temporal ridges do not unite posteriorly in a median ridge.

*Material.*—Representing *Corynorhinus alleganiensis* are 5 skull portions and 29 lower jaw fragments. The most complete specimen is the type, which is well preserved and clearly shows the proportions of the rostrum and cranium (fig. 1*a* and *b*). However, the dentition is not entire and the specimen lacks the zygomatic arches and tympanic bullae. U.S.N.M. no 12413 is an incomplete rostral portion including all the cheek teeth posterior to the canine in the right maxillary (fig. 1*c*) and three cheek teeth in the left. A fragmentary third skull, U.S.N.M. no 12415, consists of the left portion of the rostrum with the teeth, $P^4$ to $M^3$, and a part of the frontal region. The two remaining skull portions consist only of maxillary fragments and teeth. The majority of mandibles are remarkably well preserved and include a greater part of the dentition (see fig. 1*d*), although only two specimens retain the incisors.

*Description.*—The skull of *Corynorhinus alleganiensis* is about the size of that in the living species *C. macrotis* and *C. rafinesquii.* However, several characters are observed that clearly separate it from the

[3] Gidley and Gazin, 1933, pp. 345–347, fig. 1.

nearest living forms. The most important of these are concerned with the less inflated condition of the brain case and appear not to be due to crushing. The frontal region in *C. alleganiensis* does not project so markedly above the dorsal plane of the rostrum; consequently the dorsal profile from the nasal opening to the top of the frontals more nearly approaches a straight line. Also, the median pit or depression in the dorsal surface of the rostrum is not so deep as in *C. rafinesquii* and is not separated from the anterior nasal notch by so conspicuous a ridge. The height of the posterior portion of the cranium as measured from the occipital condyles to the top of the interparietal is noticeably less in the fossil. Furthermore, the condyles are slightly farther forward in position as indicated by the distance between the preserved condyle on the left side and the glenoid fossa. This suggests that the bullae, though not preserved in the fossil, may have been of smaller anteroposterior diameter or possibly not so well separated from the condyles. The temporal ridges at the anterodorsal margins of the temporal fossae are distinct and converge backward but instead of uniting to form a sagittal crest continue posteriorly a short distance as nearly parallel ridges. This character was also clearly observed in a second, more incomplete skull portion of *C. alleganiensis* (no. 12415). In all specimens of *C. macrotis* and *C. rafinesquii* examined these lateral ridges unite posteriorly to form a short median ridge. Furthermore, these ridges in *C. alleganiensis* are somewhat better defined anteriorly than in modern forms and at the termination of each is the very slightest suggestion of a postorbital process.

*Corynorhinus phyllotis* Allen (1916, pp. 352–353) from the region of San Luis Potosi in Mexico, though defined as having a flattened brain case, is apparently a larger and broader-skulled type than *C. alleganiensis*. The rostrum of *C. phyllotis* is described as more depressed and having a more marked median excavation than other living species of *Corynorhinus*. Furthermore, the audital bullae are even larger than in the more northern species.

No important or consistent differences were observed between the dentition of *C. alleganiensis* and that of the living forms of *Corynorhinus*. Also, the lower jaws are apparently not distinguishable from those of modern forms. Although the dental formula for the lower jaw of *Corynorhinus* is the same as in *Myotis*, not one of the many specimens from Cumberland Cave was found to represent the latter genus. It is probable that Gidley had reference to this *Corynorhinus* lower jaw material when he included *Myotis* in his faunal list of 1913. The mandible of *Corynorhinus* has a relatively shorter premolar series and longer molar series than does that of *Myotis*.

The presence of *Corynorhinus* in the fauna is of particular interest inasmuch as it is the first record of the genus from the Pleistocene and it adds a new and interesting species to this group of bats. Furthermore, its occurrence in western Maryland is apparently somewhat outside the recorded distribution (Allen, 1916, pp. 338, 349–350) of the living species. The range of *C. macrotis* extends northward into North Carolina, and the species has been recorded from the Dismal Swamp of Virginia. *C. rafinesquii* is known in southwestern Virginia, Kentucky, and southern Indiana, as well as farther west.

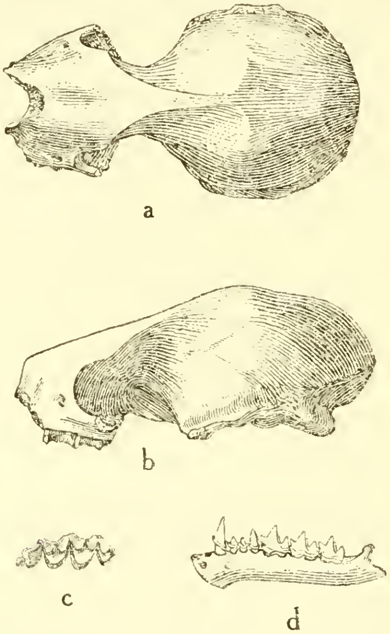



Figure 1.—*Corynorhinus alleganiensis* Gidley and Gazin: *a*, Skull, type specimen (U.S.N.M. no. 12412), dorsal view; *b*, same, lateral view; *c*, upper dentition, paratype (U.S.N.M. no. 12413), occlusal view; *d*, left ramus of mandible, paratype (U.S.N.M. no. 12414), lateral view. × 3. Cumberland Cave Pleistocene, Maryland.

Table 2.—*Measurements (in millimeters) of skulls and mandibles of* Corynorhinus alleganiensis *and* C. rafinesquii pallescens

| Measurement | *Corynorhinus alleganiensis* | *Corynorhinus rafinesquii pallescens* |
|---|---|---|
| | *U.S.N.M. no. 12412 (type)* | *U.S.N.M. no. 213367 (Biol. Surv.)* |
| Length of skull from anterior margin of canine alveolus to supraoccipital | 15.75 | 15.9 |
| Width of postorbital constriction | 3.8 | 3.75 |
| Depth of posterior portion of skull from inferior margin of occipital condyles to top of interparietal | 5.25 | 6.3 |
| Distance from postglenoid process to posterior margin of occipital condyle | 5.65 | 6.4 |
| | *U.S.N.M. no. 12413* | |
| Length of upper premolar–molar series | 4.4 | 4.5 |
| | *U.S.N.M. no. 12414* | |
| Length of lower dentition from C to $M_3$, inclusive | 5.9 | 5.8 |

# Order CARNIVORA

## Family CANIDAE

### CANIS ARMBRUSTERI Gidley [4]

FIGURES 2–10

The type of this species is a portion of a left lower jaw, U.S.N.M. no. 7662, containing teeth, $P_4$ to $M_2$, and the alveolus for $M_3$ (fig. 6*a* and *b*). Two paratypes were designated: A portion of a right lower jaw with teeth, $P_2$ to $M_1$, U.S.N.M. no. 7661 (fig. 7*a* and *b*), and portions of the right and left lower jaws of another individual, U.S.N.M. no. 7482, containing teeth, which include carnassials of both sides and $M_2$ and the posterior half of $P_4$ of the left side.

The material in the National Museum representing this species consists of a number of well-preserved specimens (figs. 2–10), including nine skull portions of which five are more than half complete. There are also 17 lower jaws and jaw portions, one nearly complete fore limb and foot, and several unassociated limb bones and vertebrae. Most of this material was collected after Gidley published his description of this form.

The chief characters given by Gidley to distinguish *Canis armbrusteri* are as follows:

> Size slightly less than that of *C. occidentalis*, as that species has been defined by Miller [1912, p. 2], but tooth characters indicate an animal quite distinct from any of the true wolves. Its principal differences are seen in the greater relative depth of jaw, smaller canine, more simple $p_2$ and $p_3$, the presence of a posterior basal tubercle on $p_4$, and in the relatively larger heel of the carnassial. The paraconid also is less expanded at base, with more perpendicular anterior face. The metaconid is larger and higher placed, while the protoconid is less broad and full, as seen from the inner side. The carnassials as a whole suggest those of a jackal, fox, or coyote rather than those of a wolf. * * *

In the newer material is a portion of a lower jaw associated with a broken and crushed skull, U.S.N.M. no. 11881, in which most of the cheek teeth are preserved. The very close resemblance of the lower teeth in this specimen (fig. 8) with the corresponding ones of the type make its reference to *C. armbrusteri* logical. However, the depth of the ramus in no. 11881 is not so great. By comparison with no. 11881, other skull portions in the collection are referred to this species.

Considerable individual variation exists in the series of canid specimens, sufficient to suggest the recognition of more than one distinct species were only the extremes represented. However, the degree of variation, particularly in size and proportions of skull and teeth, is not greater than that which was observed in a series of 35 Recent canid skulls in the collections of the Biological Survey from Gila National Forest in New Mexico.

[4] Gidley, 1913b, pp. 98–102.

The skull of *Canis armbrusteri* as indicated by specimens no. 11886 (fig. 2*a* and *b*), no. 11883 (fig. 3*a*, *b*, and *c*), and no. 11885 (fig. 4*a*, *b*, and *c*) approximates in size that of *Canis occidentalis.* The rostrum is slender, but the frontals are relatively broad and heavy. The sagittal crest, though variable, is more prominent in no. 11886 and no. 11883 than in old individuals of *C. occidentalis.* In no. 11886 the inion projects backward to a marked degree, but not nearly so much as in the Rancho La Brea wolves.

The superior first three premolars are comparatively simple and slender. The anterointernal portion of the posterior root of $P^2$ and $P^3$ does not project lingually so much as in *C. occidentalis.* The upper carnassial and molar teeth are relatively large and massive.

TABLE 3.—*Measurements (in millimeters) of skulls and superior dentition of* Canis armbrusteri

| Measurement | U.S. N.M. no. 11886 | U.S. N.M. no. 11881 | U.S. N.M. no. 11883 | U.S. N.M. no. 11885 | U.S. N.M. no. 11887 | U.S. N.M. no. 7994 |
|---|---|---|---|---|---|---|
| *Skull* | | | | | | |
| Length from anterior end of premaxillary to condyles | [1] 270 | | | 240 | | |
| Length from anterior end of premaxillary to posterior nasal opening | 140 | | [1] 130 | 130 | | |
| Length from glenoid fossae to condyles | 55 | | | 53.5 | 47 | 45.5 |
| Distance from line between postorbital processes to inion | 135 | | | [1] 120 | [1] 105 | 100 |
| Width of muzzle in front of infraorbital foramina | [1] 51 | | [1] 47 | [1] 45 | | 44.2 |
| Least width between superior borders of orbits | [1] 56 | | 52.6 | 44.7 | 44.1 | 42 |
| Width across postorbital processes of frontals | [1] 67.7 | [1] 57 | [1] 67 | 61.5 | 58.9 | 59.6 |
| Greatest width across zygomatic arches | [1] 160 | | [1] 150 | [1] 130 | | |
| Width of palate between alveoli of $M^1$ | [1] 44.1 | | [1] 44.5 | 39 | 38.6 | 36.5 |
| *Superior dentition* | | | | | | |
| Length of cheek-tooth series, $P^1$ to $M^2$, inclusive | [1] 101 | [1] 101.5 | 96 | 96.5 | | |
| C, anteroposterior diameter at base of enamel | | | 13.3 | | | |
| C, transverse diameter at base of enamel | | | 9.3 | | | |
| $P^1$, anteroposterior diameter | | | 8.4 | 8.6 | | |
| $P^1$, greatest transverse diameter | | | 5.5 | 4.5 | | |
| $P^2$, anteroposterior diameter | | 14.4 | | | | |
| $P^2$, greatest transverse diameter | | 5.8 | | | | |
| $P^3$, anteroposterior diameter | | 17.4 | [1] 18 | | [1] 17.5 | |
| $P^3$, greatest transverse diameter | | 6.9 | 7 | | | |
| $P^4$, anteroposterior diameter | 27.7 | 28.8 | 28.3 | 28.1 | [1] 29.4 | 26.7 |
| $P^4$, greatest transverse diameter including protocone | 14.9 | 14.5 | 13.6 | 14.5 | [1] 13.2 | 12.9 |
| $P^4$, transverse diameter across paracone | 11.5 | 12 | 11.9 | 12 | 11.9 | 11.5 |
| $M^1$, anteroposterior diameter parallel to outer wall | 18.1 | 18 | 18.2 | 18 | 19.1 | 17.2 |
| $M^1$, transverse diameter perpendicular to outer wall | 21.8 | 22.5 | 22.7 | 21.7 | 23.4 | 20.9 |
| $M^1$, greatest transverse diameter | 24.4 | 25.4 | 24.9 | 24.5 | 25.5 | 23.4 |
| $M^2$, anteroposterior diameter | 10.3 | 10.3 | 9.5 | | 10.4 | 8.3 |
| $M^2$, greatest transverse diameter | 15.7 | 15 | 15.7 | | 17.5 | 14.2 |

[1] Approximate.

Two isolated upper molars of *Canis armbrusteri* were described recently by Bryan Patterson (1932). He noted the large size of these teeth and the relatively large $M^2$ as compared with $M^1$. The Field Museum $M^1$ possesses a well-developed hypocone, as do several of the National Museum specimens, but, as anticipated by Patterson, this character is variable and in some dentitions where the heel of $M^1$ is narrower the hypocone is not so prominent. However, the reduction of the hypocone in these cases does not reach the stage common in *C. dirus* of Rancho La Brea.

TABLE 4.—*Measurements (in millimeters) of mandible and inferior dentition of* Canis armbrusteri

| Measurement | U.S.N.M. no. 7662 (type) | U.S.N.M. no. 11881 | U.S.N.M. no. 8168 | U.S.N.M. no. 8169 | U.S.N.M. no. 11887 | U.S.N.M. no. 8172 |
|---|---|---|---|---|---|---|
| *Mandible* | | | | | | |
| Depth of jaw below anterior part of $P_3$ | -------- | 27 | 27 | -------- | 25.5 | 21.4 |
| Depth of jaw below heel of $M_1$ | 36.3 | 32.6 | 31 | 31.3 | 29 | [1] 25 |
| Thickness of jaw below heel of $M_1$ | 16.3 | 15.7 | 15.6 | 15 | 14.6 | 12.9 |
| *Inferior dentition* | | | | | | |
| Length of tooth series from anterior margin of canine alveolus to posterior margin of $M_3$ | -------- | [2] 127 | [1] 130 | -------- | -------- | [1] 106 |
| C, anteroposterior diameter at base of enamel | -------- | [1] 16.5 | [1] 14 | -------- | -------- | [1] 12 |
| C, transverse diameter at base of enamel | -------- | [1] 11.3 | 10 | -------- | -------- | [1] 8 |
| $P_1$, anteroposterior diameter | -------- | 7 | 6.6 | -------- | -------- | -------- |
| $P_1$, greatest transverse diameter | -------- | 5.2 | 4.8 | -------- | -------- | -------- |
| $P_2$, anteroposterior diameter | -------- | -------- | 13.8 | -------- | 13.9 | 12.4 |
| $P_2$, greatest transverse diameter | -------- | -------- | 6.4 | -------- | 5.4 | 5.6 |
| $P_3$, anteroposterior diameter | -------- | 15.4 | 15.8 | 16 | 14.6 | 13.4 |
| $P_3$, greatest transverse diameter | -------- | 6.7 | 6.9 | 7.1 | -------- | 5.8 |
| $P_4$, anteroposterior diameter | 17.9 | 17.7 | 17.8 | [1] 18 | 18.3 | 16 |
| $P_4$, greatest transverse diameter | 9.1 | 9.2 | 8.8 | [1] 9.5 | 9.6 | 7.7 |
| $M_1$, anteroposterior diameter | 31 | 31 | [1] 31 | [1] 29.4 | -------- | 27.9 |
| $M_1$, greatest transverse width of trigonid | 12.5 | 13.2 | 12.1 | 12.2 | -------- | 10.6 |
| $M_1$, greatest transverse width of talonid | 12.5 | 12.9 | [1] 11.9 | [1] 12.1 | [1] 12.7 | -------- |
| $M_2$, anteroposterior diameter | 13.6 | 13.3 | [1] 13.5 | 13.5 | [1] 13 | 12.4 |
| $M_2$, greatest transverse diameter | 10.4 | 9.8 | [1] 9.9 | [1] 10 | 10.2 | 8.8 |
| $M_3$, anteroposterior diameter | -------- | -------- | -------- | 7.2 | 6.5 | -------- |
| $M_3$, greatest transverse diameter | -------- | -------- | -------- | 5.6 | [1] 5.8 | -------- |

[1] Approximate.

*C.* (*Aenocyon*) *dirus* is distinctly more robust than *C. armbrusteri*. The specimens from Rancho La Brea have a much wider rostrum and the carnassial teeth are more powerfully built. The larger limb bones in the Cumberland Cave collection, presumably referable to *C. armbrusteri*, are equally as long but slenderer than corresponding elements of various individuals of the Brea wolf in the National Museum collections.

The coyotelike characters in the dentition of *C. armbrusteri* pointed out by Gidley do not necessarily require that this form be grouped with the coyotes in the subgenus *Lyciscus* or *Thos* but emphasize the specific separation of *C. armbrusteri* from the living wolves of North


FIGURE 2.—*Canis armbrusteri* Gidley, skull (U.S.N.M. no. 11886): *a*, Lateral view; *b*, ventral view of left half of palate. Two-thirds natural size. Cumberland Cave Pleistocene, Maryland.


FIGURE 3.—*Canis armbrusteri* Gidley, skull and lower carnassial (U.S.N.M. no. 11883): *a*, Lateral view of skull; *b*, ventral view of left half of palate; *c*, lateral and occlusal views of lower carnassial. Two-thirds natural size. Cumberland Cave Pleistocene, Maryland.

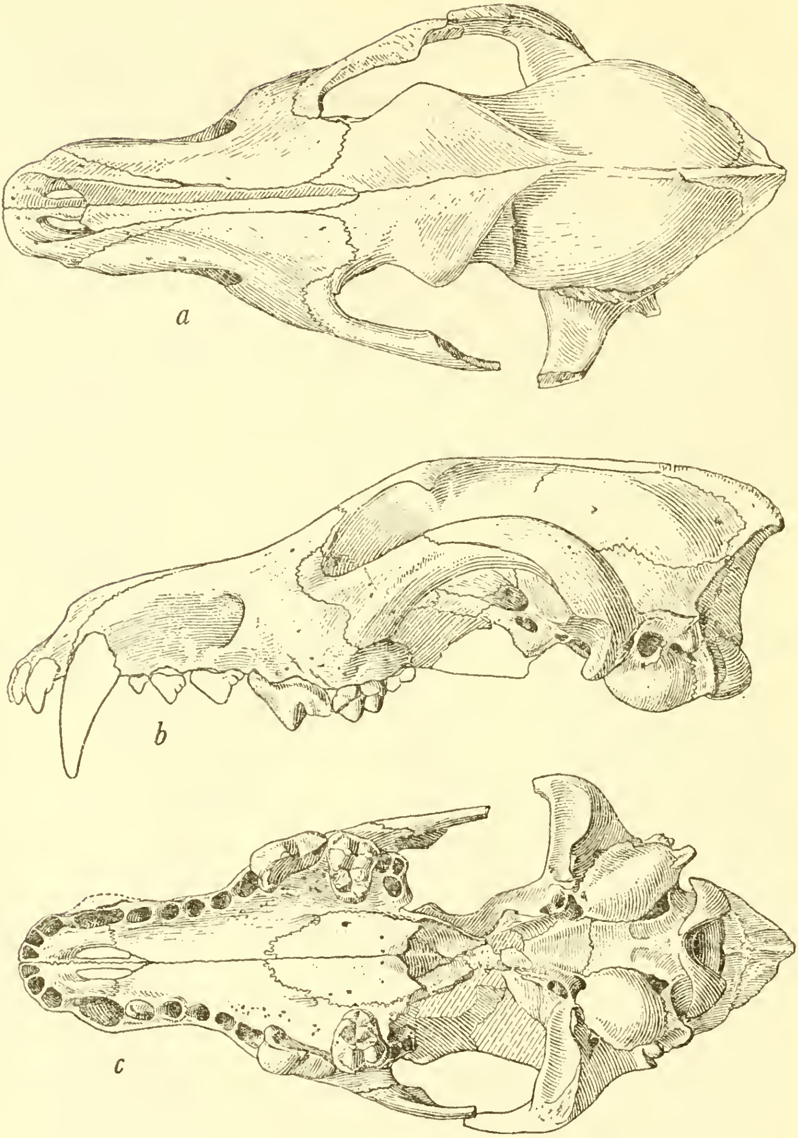



FIGURE 4.—*Canis armbrusteri* Gidley, skull (U.S.N.M. no. 11885): *a*, Dorsal view; *b*, lateral view; *c*, ventral view. Two-fifths natural size. Cumberland Cave Pleistocene, Maryland.

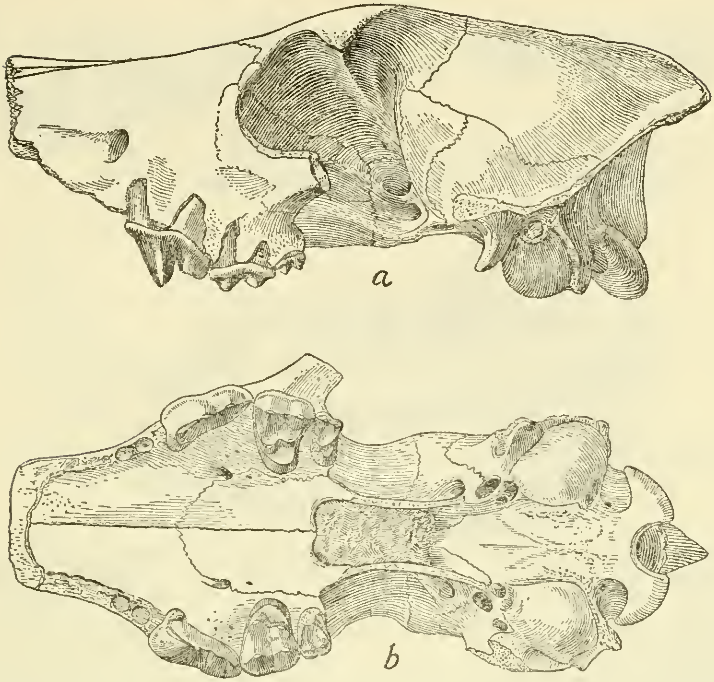



FIGURE 5.—*Canis armbrusteri* Gidley, skull (U.S.N.M. no. 7994): *a*, Lateral view; *b*, ventral view. One-half natural size. Cumberland Cave Pleistocene, Maryland.

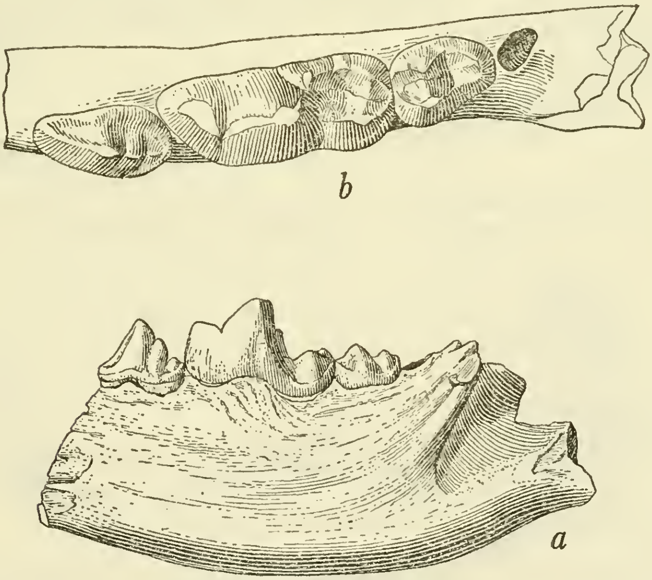



FIGURE 6.—*Canis armbrusteri* Gidley, left ramus of mandible, type specimen (U.S.N.M. no. 7662): *a*, Lateral view, two-thirds natural size; *b*, occlusal view, natural size. Cumberland Cave Pleistocene, Maryland.

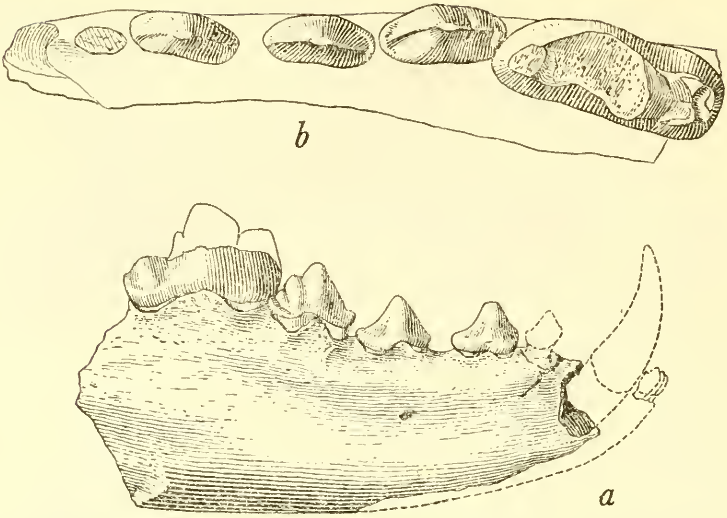



FIGURE 7.—*Canis armbrusteri* Gidley, right ramus of mandible, paratype (U.S.N.M. no. 7661): *a*, Lateral view, two-thirds natural size; *b*, occlusal view, natural size. Cumberland Cave Pleistocene, Maryland.

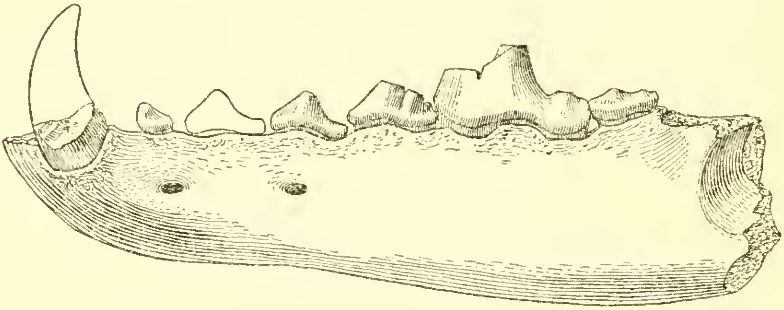


FIGURE 8.—*Canis armbrusteri* Gidley: Left ramus of mandible (U.S.N.M. no. 11881), lateral view. Two-thirds natural size. Cumberland Cave Pleistocene, Maryland.

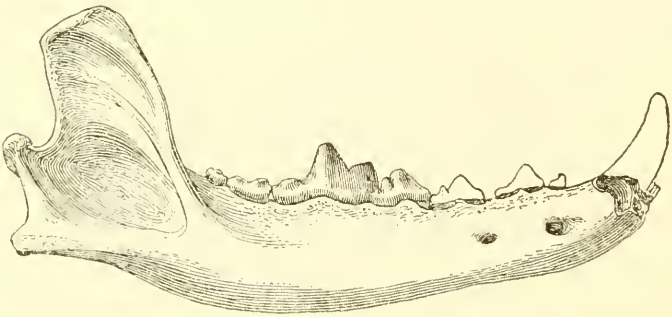


FIGURE 9.—*Canis armbrusteri* Gidley: Right ramus of mandible (U.S.N.M. no. 11882), lateral view. One-half natural size. Cumberland Cave Pleistocene, Maryland.

America. In proportions of the skull and lower jaw the fossil form is distinctly more wolflike than *C. rufus* (=*C. frustror*), which also shows points of resemblance to the coyotes.

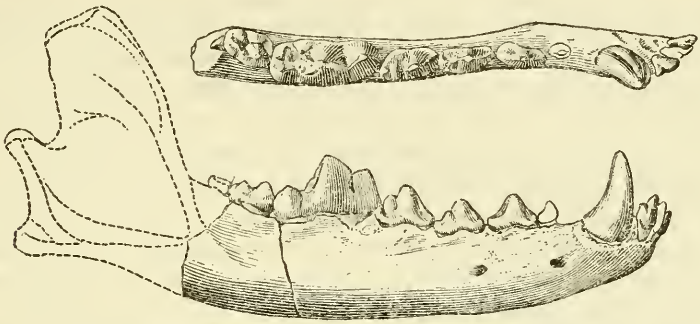


FIGURE 10.—*Canis armbrusteri* Gidley: Right ramus of mandible (U.S.N.M. no. 8172), lateral and occlusal views. One-half natural size. Cumberland Cave Pleistocene, Maryland.

**CANIS cf. PRISCOLATRANS Cope**

A skull fragment with part of $P^3$ and $P^4$ of the right side and the root portions of $M^1$ and $M^2$ on the left shows the presence in the fauna of a coyote near *Canis latrans*. The anterior portion and right side of the muzzle are incomplete, but the cranium and left zygoma are well preserved. The skull is very close in size to that of *C. latrans* but is slightly more robust, particularly in the region of the frontals. The small, very slender, sharp-cusped character of $P^3$ and the fragment of $P^4$ further substantiates reference of the form to the coyote group. Direct comparison with *C. priscolatrans* from the Port Kennedy deposit in Pennsylvania or with *C. riviveronis* Hay from Florida is not satisfactory, because of the different nature of the materials. The reference of the Cumberland Cave form to *C. priscolatrans* is based on the somewhat more robust character of the Maryland form as compared with living coyotes.

Measurements of the skull fragment (U.S.N.M. no. 7660) are as follows: Distance from line between postorbital processes of frontals to inion, 88 mm; least width between anterior margins of orbits, 33.2; width across postorbital processes of frontals, 51 mm; greatest width across zygomatic arches, 110 mm (last three measurements approximate).

## Family URSIDAE

**EUARCTOS VITABILIS (Gidley)**

FIGURES 11–14; PLATE 8

The Cumberland Cave collection includes an unusually large amount of well-preserved bear material. There are skull portions of at least 25 individuals. Four of the skulls are nearly complete (figs. 12–14), and nine more are represented by rostral portions including most of the teeth on both sides. The remainder consists of maxillary fragments with teeth. About 35 individuals are indicated by lower jaws. Six specimens include both rami and most of the teeth. A large portion of the separate jaws are well preserved and have nearly all the teeth. In two cases jaws and skull were associated.

A composite skeleton (see pl. 8) has been mounted from the better-preserved remains and placed on exhibition at the National Museum. This mount is composed of parts belonging to at least six individuals, but a small portion of the skeleton was necessarily restored. The scapulae, left ulna, fibulae, ribs, sternum, and some of the vertebrae were not represented in the collection. The composite skeleton has received the catalog number 10304, and is composed of the following catalog portions: Skull, no. 8188; mandible, no. 10302; three posterior dorsal and three anterior lumbar vertebrae, no. 10303; left radius, no. 8126; parts of both hind limbs and right hind foot, no. 8179; and complete left hind foot, no. 10301.

*Ursus* (*Euarctos*) *vitabilis* was described by Gidley (1913b, pp. 96–97) from a nearly complete pair of lower jaws (fig. 11*a* and *b*), U.S.N.M. no. 7665. The description is as follows:

> About the size of *U.* (*Euarctos*) *americanus*, but differs from that species in (1) comparatively larger canines; (2) wider space between the anterior cheek-teeth, combined with a less wide branching of the horizontal rami in general; (3) a relatively larger symphysis, which is more sharply constricted and more flattened latterly behind the canines; and (4) longer diastema between canines and cheek-teeth.

Most of the ursid material in the collection was obtained since the above description was published. A restudy of the group with this added material at hand has brought to light new characters and has furnished further information on the constancy or variability of others. In view of these conclusions it has seemed advisable to redescribe the species on the basis of characters shown by the type, U.S.N.M. no. 7665, supplemented by a series of skull portions and lower jaws.

*Specific characters.*—Size equaling that of the living black bear, *Euarctos americanus* (Pallas). Upper and lower cheek teeth relatively narrow. $P^4$ large and well developed, with prominent protocone. $M^2$ large and usually does not narrow so abruptly posterior to the metacone as does the corresponding tooth of *E. americanus*. Anterior lower premolars more commonly present and better developed than in *E. americanus*. $P_4$ well developed.

All the *Euarctos* material in the collection is referred to *E. vitabilis*, which indicates considerable variation in size for this species. Several jaws in the collection compare favorably with those of small individuals of *E. americanus* or with the glacial bear, *E. emmonsii*. The largest specimen of *E. vitabilis*, a skull, U.S.N.M. no. 12247, equals in size large specimens of *E. luteolus* from Louisiana.

The skull of *E. vitabilis* is not so robust as that of *Ursus horribilis*, nor is the muzzle so elongate. In the relative proportions of the skull and lower jaw the Cumberland Cave form compares favorably with living black bears of North America. The shape as well as the size of the fossil skulls varies somewhat, but no important or consistent differences can be cited to establish a division within the fossil collection, or to distinguish them from Recent forms on the osseous parts alone.

In the dentition *E. vitabilis* shows points of resemblance to both *E. americanus* and *E. luteolus*, but in some characters it seems clearly distinguished from them. *E. luteolus* possesses teeth averaging somewhat greater size than does *E. americanus*. Also, in *E. luteolus* the cheek teeth appear relatively wider and $P^4$ is better developed. The upper and lower teeth of *E. vitabilis* are relatively much narrower than in *E. luteolus* and average somewhat narrower than comparable teeth in *E. americanus*. Upper and lower canines in the fossil form are usually large as in *E. luteolus*.

$P^4$ in *E. vitabilis* is noticeably well developed, with a prominent internal cusp placed opposite the notch between paracone and metacone. This tooth is much larger than in *E. americanus*, and in several fossil specimens it is appreciably larger than in *E. luteolus*. The corresponding tooth in *U. horribilis* is in turn very much larger than in *E. vitabilis*, and in the grizzly the protocone is accompanied by several accessory cuspules.

$M^1$, other than being relatively somewhat narrower, differs little from this tooth in *E. americanus*. $M^2$ is an elongate tooth that does not usually taper so abruptly posterior to the metacone as is common in *E. americanus;* however, this tooth does not reach the development and proportions seen in *U. horribilis*.

The anterior lower premolars are more commonly present in *E. vitabilis* than in *E. americanus* and *E. luteolus* and are usually better developed. $P^4$ averages larger than in the living black bears, but it is not nearly so large as in *U. horribilis*, nor does it show the sulcate heel, which characterizes this tooth in the grizzly.

$M^1$ is a narrow tooth having a trigonid cuspate as in the ursids not trenchant as in the tremarctine forms. The succeeding molars are also narrow but otherwise resemble corresponding teeth in Recent black bears.

A large amount of limb and foot material of *Euarctos vitabilis* is included in the collection. The various elements for the most part were unassociated. A noticeable variation in size is seen and no consistent differences were observed which would serve to distinguish the fossil from the living bear.

The skull of *E. vitabilis* differs from that of *Ursus procerus* Miller (1899) from the Pleistocene of Ohio in having a less concave dorsal surface of the rostrum and most noticeably in the smaller size of the teeth.

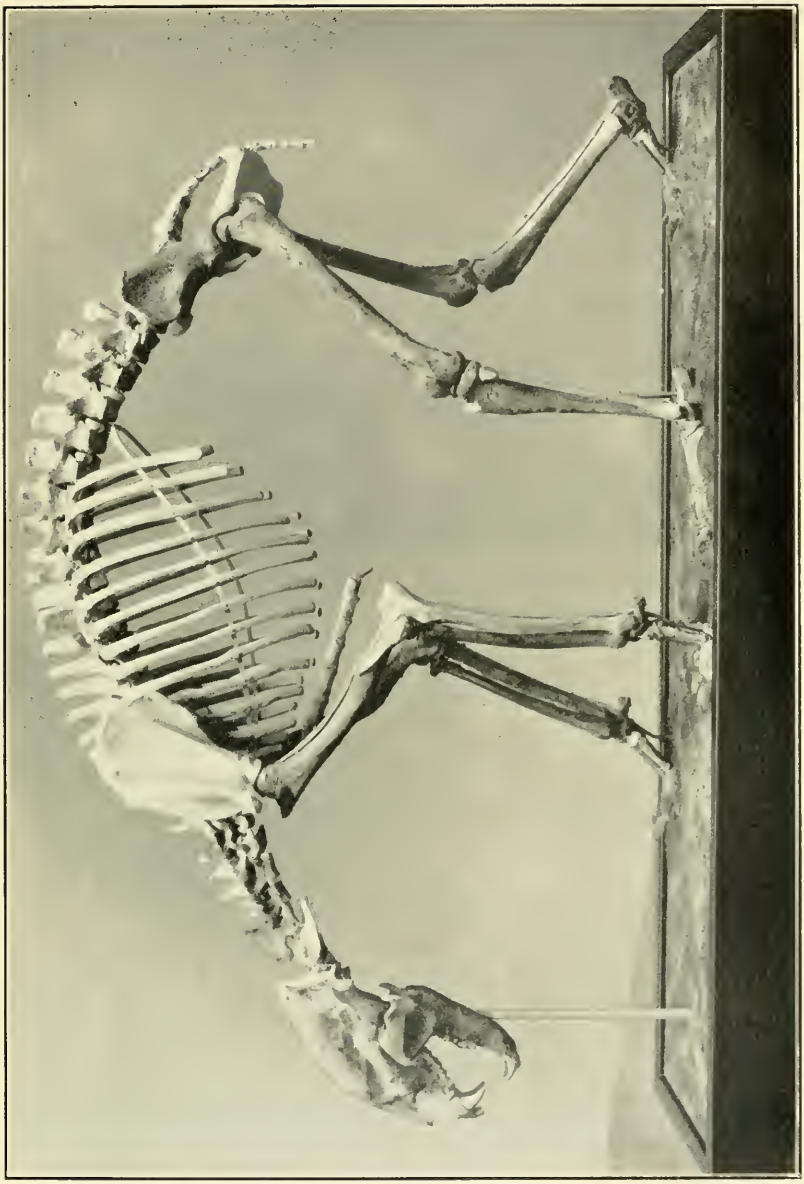
*E. vitabilis* is also distinct from *U. amplidens* Leidy (1856) in having lower teeth of much smaller size.

Upper teeth from the Conard Fissure referred by Brown (1908, pp. 183–184) to *Ursus americanus* may represent *Euarctos vitabilis.* The characters of the upper dentition cited by Brown are also seen in the Cumberland Cave bear, as the development of $P^4$, the narrowness of $M^1$, and the character of the heel of $M^2$. In the past most finds of Pleistocene black bear have been referred to the living species *Euarctos* or *Ursus americanus*, and it seems probable that with a very limited amount of material it would be difficult to recognize as distinct a species approaching the living form so closely as does *E. vitabilis*.

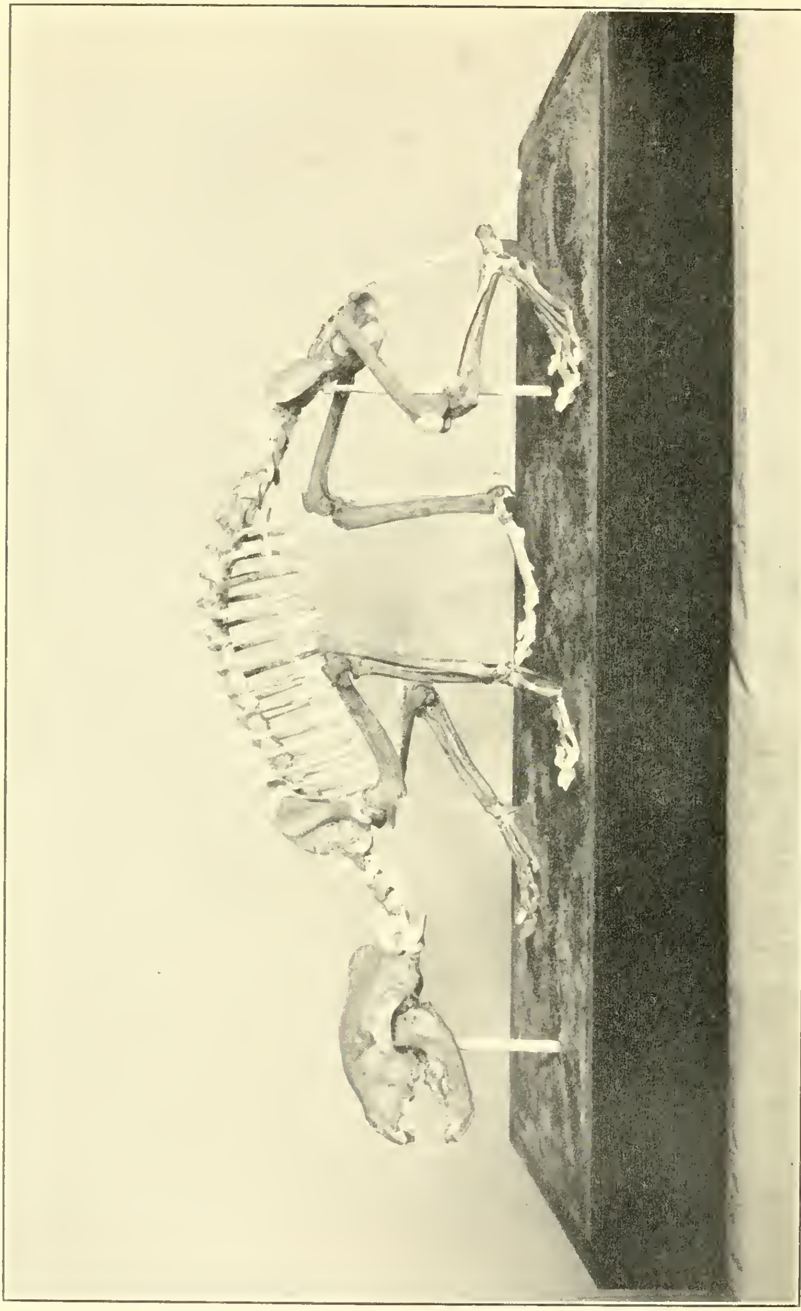
TABLE 5.—*Measurements (in millimeters) of skull and superior dentition of three species of* Euarctos

| Measurement | *Euarctos vitabilis* | | | *Euarctos americanus* | *Euarctos luteolus* |
|---|---|---|---|---|---|
| | U.S.N.M. no. 8181 | U.S.N.M. no. 12247 | U.S.N.M. no. 8143 | U.S.N.M. no. 35388 | U.S.N.M. no. 132546 |
| *Skull* | | | | | |
| Length from anterior end of premaxillaries to posterior end of condyles | 284 | | | 284 | 304 |
| Distance from line between posterior surfaces of glenoid fossae to posterior end of condyles | 91 | | | 96 | 101 |
| Distance between anterior margin of orbit and anterior end of premaxillary | 105 | [1] 120 | 112 | 103 | 108 |
| Distance from line between postorbital processes of frontals to inion | 170 | | | 168 | 184 |
| Greatest width across muzzle from outer walls of canine alveoli | [1] 62 | 74.4 | [1] 64 | 62 | 64.8 |
| Least width between anterior margins of orbits | 74 | [1] 83 | | 75 | 71 |
| Greatest width across postorbital processes | 102 | 108 | | 105 | 101.5 |
| Greatest width across zygomatic arches | 172 | | | 180 | 186 |
| Width of palate between alveoli of $M^2$ | 47 | [1] 45 | 45.5 | 50 | 47.2 |
| *Superior dentition* | | | | | |
| Length of tooth row from anterior margin of C alveolus to posterior surface of $M^2$ | [1] 103 | [1] 118 | [1] 110 | 103 | 107 |
| Length of tooth row $P^4$ to $M^2$, inclusive | 58 | 64 | 62 | 54.2 | 59.5 |
| C, anteroposterior diameter at alveolus | [1] 20 | [1] 25 | [1] 21.5 | 20.6 | 20.2 |
| C, greatest transverse diameter at alveolus | 11.6 | 15 | 13 | 12 | 12.7 |
| $P^4$, anteroposterior diameter | 13.2 | 13.8 | 13.7 | 11.5 | 12.1 |
| $P^4$, greatest transverse diameter | 9.4 | 10 | 11.3 | 8.2 | 9.2 |
| $M^1$, anteroposterior diameter | 19.3 | 19.3 | 21 | 17.2 | 19 |
| $M^1$, greatest transverse diameter | 13.2 | 14.4 | 14.6 | 13.2 | 15 |
| $M^2$, anteroposterior diameter | 27.7 | 31.1 | 27.3 | 26.6 | 29 |
| $M^2$, greatest transverse diameter | 15.2 | 17.1 | 15.8 | 15.7 | 17 |

[1] Approximate.



Mounted skeleton (composite) of bear (*Euarctos vitabilis* Gidley) from Cumberland Cave. Exhibited in U. S. National Museum.



Mounted skeleton of wolverine (*Gulo gidleyi* Hall) from Cumberland Cave. Exhibited in U. S. National Museum.

TABLE 6.—*Measurements (in millimeters) of mandible and inferior dentition of three species of* Euarctos

| Measurement | *Euarctos vitabilis* | | | *Euarctos americanus* | *Euarctos luteolus* |
|---|---|---|---|---|---|
| | U.S.N. M. no. 7665 (type) | U.S.N. M. no. 8141 | U.S.N. M. no. 8143 | U.S.N.M. no. 35388 | U.S.N.M. no. 132546 |
| *Mandible* | | | | | |
| Length of mandible from anterior end to posterior surface of condyle | -------- | [1] 197 | [1] 195 | [1] 193 | 210 |
| Depth of jaw below $M_1$ | 41.3 | 41 | 38 | 36.6 | 40 |
| Thickness of jaw below $M_1$ | -------- | 16 | 14.6 | 15.5 | 17.3 |
| Least width across both rami at constriction posterior to canines | 36 | 41 | -------- | 35 | 37.4 |
| *Inferior dentition* | | | | | |
| Distance from anterior margin of canine alveolus to posterior surface of $M_3$ | 117 | 121 | 115 | 118.5 | 123.4 |
| Length of tooth row, $P_4$ to $M_3$, inclusive | [1] 62 | 67 | 66.5 | 61 | 69.2 |
| Diastema between canine alveolus and $P_4$ | [1] 36.8 | 33.3 | 31 | 36.4 | 32.8 |
| C, anteroposterior diameter at alveolus | [1] 18.1 | [1] 20 | [1] 19 | [1] 20 | [1] 20.5 |
| C, transverse diameter at alveolus | [1] 12 | 12.8 | 11 | 11.6 | 11.9 |
| $P_4$, anteroposterior diameter | [1] 11 | 10.9 | 9.9 | 9.5 | 9.8 |
| $P_4$, greatest transverse diameter | -------- | 5.7 | 5.8 | 5.0 | 5.7 |
| $M_1$, anteroposterior diameter | 17.8 | 20.5 | 19.6 | 18.6 | 20.5 |
| $M_1$, transverse diameter of trigonid | 6.9 | 8.3 | 7.3 | 7.9 | 8.6 |
| $M_1$, transverse diameter of talonid | 8.3 | 9.4 | 8.4 | 9.3 | 10.7 |
| $M_2$, anteroposterior diameter | 17.7 | 20.8 | 20.5 | 19.5 | 22.5 |
| $M_2$, greatest transverse diameter | 11.4 | 12.1 | 11.7 | 11.8 | 14.5 |
| $M_3$, anteroposterior diameter | 15.1 | 15.1 | 17.7 | 13.8 | 17.6 |
| $M_3$, greatest transverse diameter | 11.9 | 12 | 12.4 | 11.5 | 13.8 |

[1] Approximate.

### ARCTODUS HAPLODON (Cope)

A crushed right lower jaw, with the third incisor, canine, and second molar, and an isolated second molar from the left side of the same mandible, U.S.N.M. no. 8005, show the presence of a rather large tremarctine bear in the cave fauna. Several limb bones and parts of fore and hind feet, greatly exceeding in size those of a black bear and apparently belonging to one individual, are also believed to be those of Cope's eastern cave bear.

The lower jaw from Cumberland Cave has been badly distorted by crushing but appears to be slightly deeper than the jaw figured by Cope (1899, pl. 19, fig. 2) from the Port Kennedy bone deposit. Although the posterior part of the ramus, U.S.N.M. no. 8005, is not preserved, the configuration of the jaw below $M_2$ suggests that the antemasseteric pit probably extended forward nearly to a point below the posterior margin of $M_2$. In *Ursus* the anterior margin of the masseteric fossa is not so far forward.

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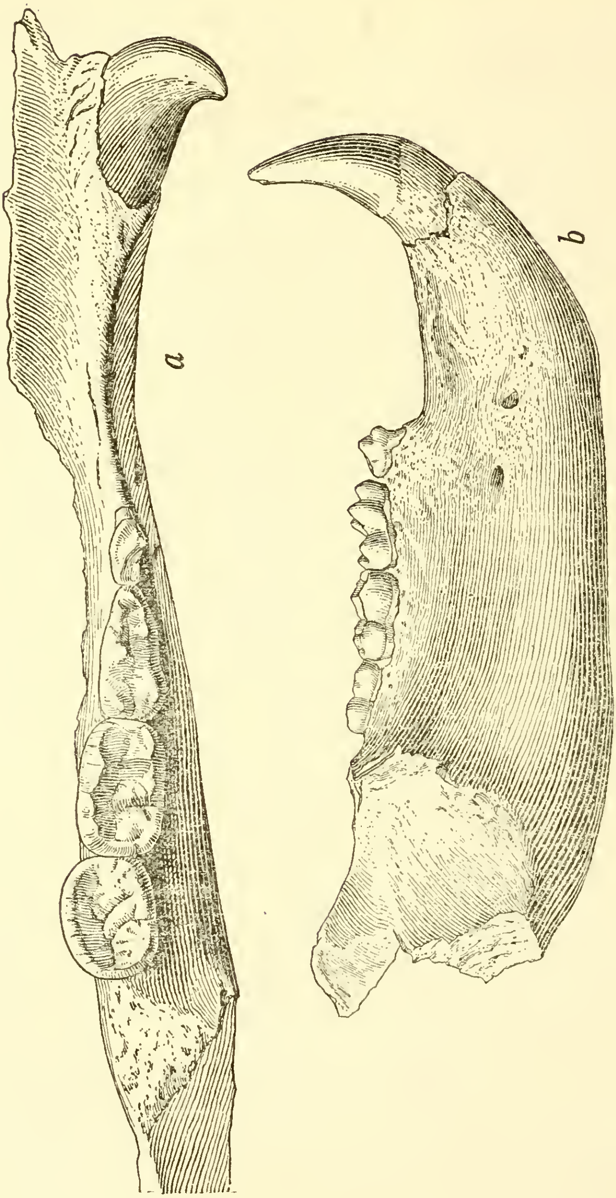



FIGURE 11.—*Euarctos vitabilis* (Gidley), right ramus of mandible, type specimen (U.S.N.M. no. 7665): *a*, Occlusal view, natural size; *b*, lateral view, two-thirds natural size. Cumberland Cave Pleistocene, Maryland.

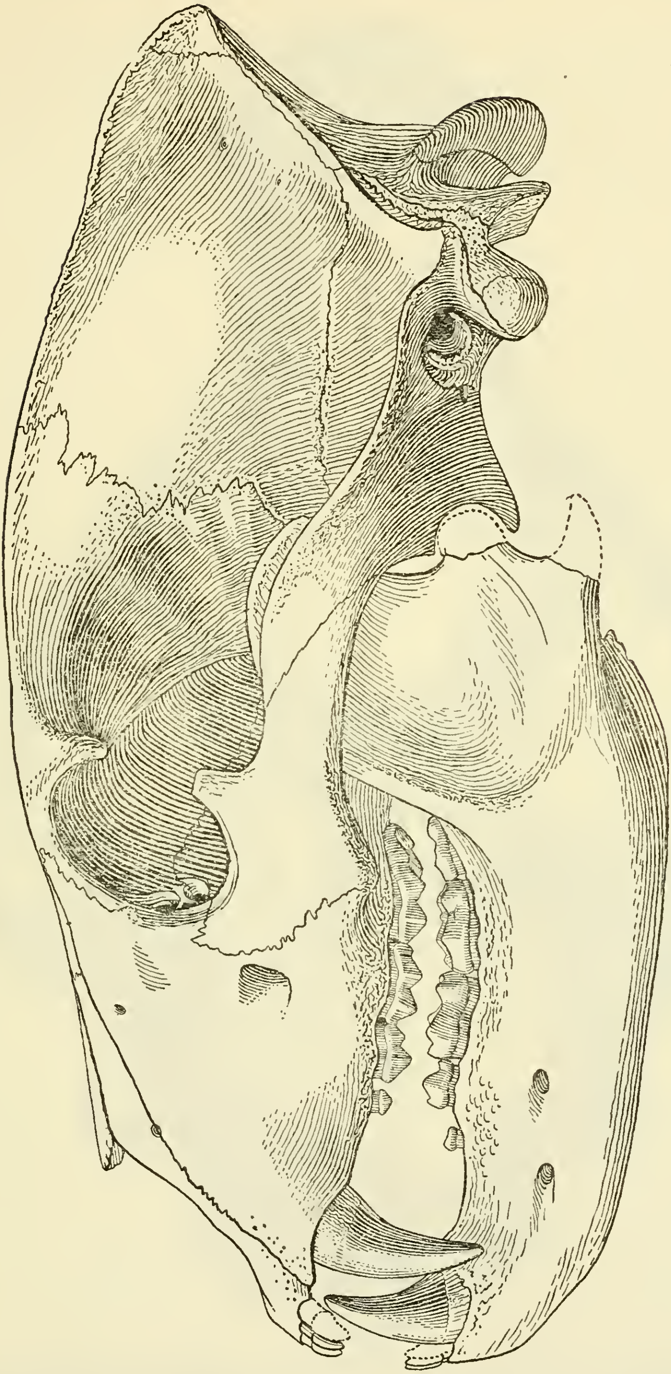


FIGURE 12.—*Euarctos vitabilis* (Gidley): Skull (U.S.N.M. no. 8181) and mandible (U.S.N.M. no. 8141), lateral view, three-fifths natural size. Cumberland Cave Pleistocene, Maryland.

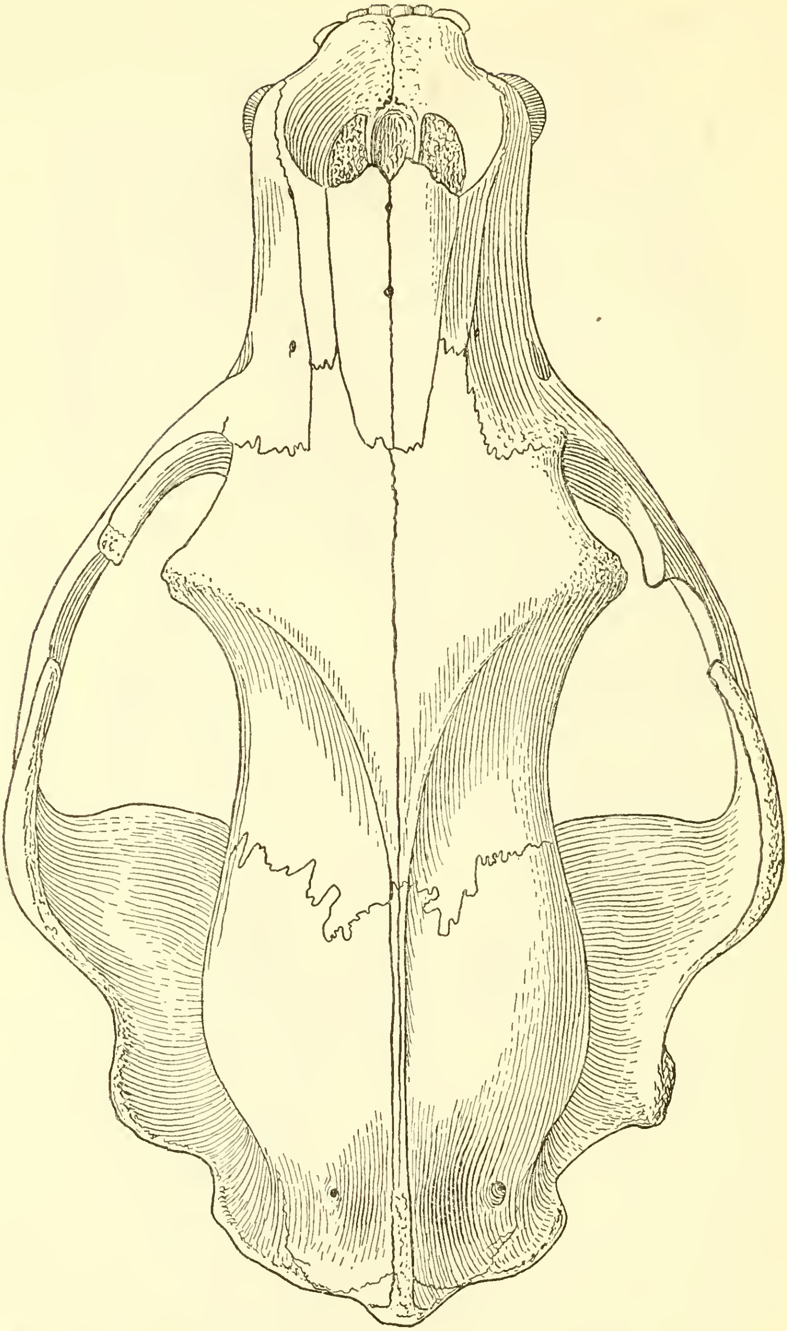


FIGURE 13.—*Euarctos vitabilis* (Gidley): Skull (U.S.N.M. no. 8181), dorsal view, three-fifths natural size.

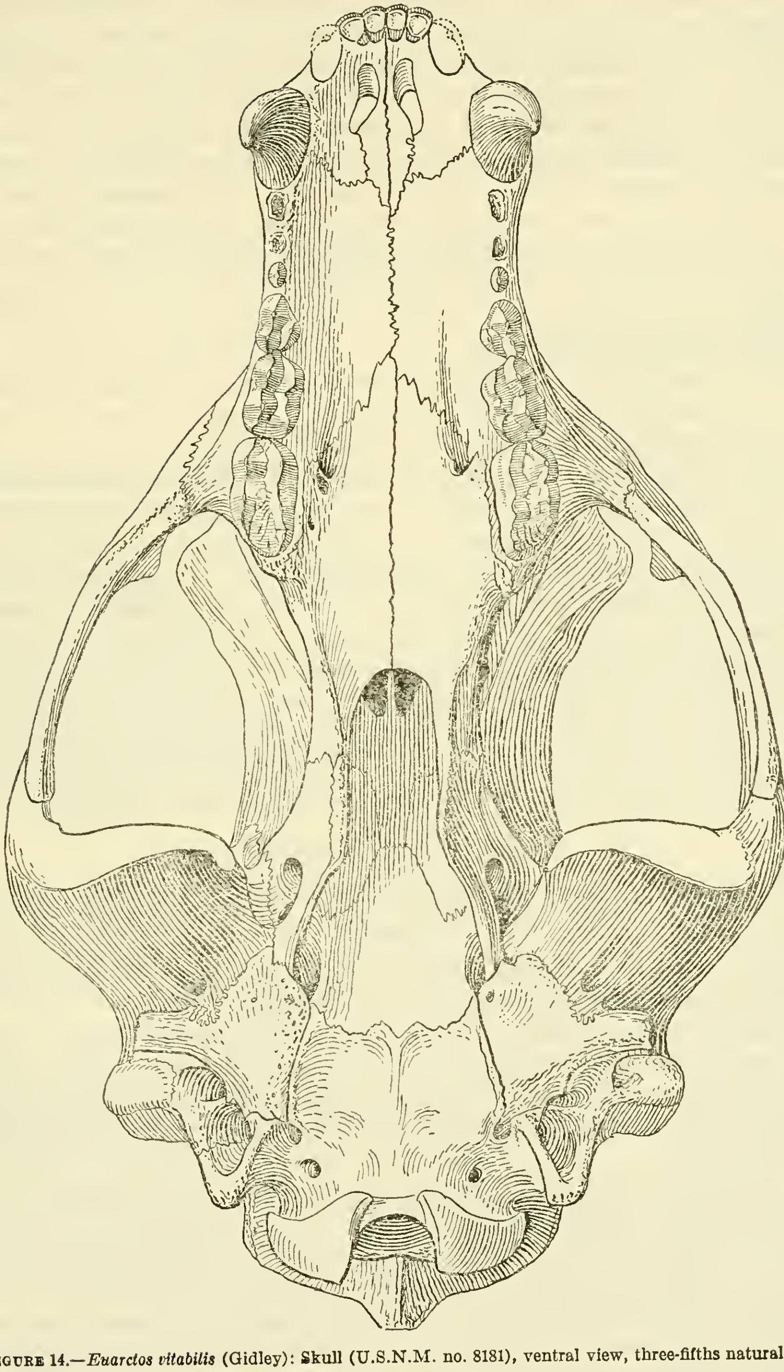


**Figure 14.**—*Euarctos vitabilis* (Gidley): Skull (U.S.N.M. no. 8181), ventral view, three-fifths natural size.

The canine and second molar are nearly identical in size with these teeth in the Port Kennedy jaw. $M_2$ has an occlusal surface as that in Cope's specimen, but not so tuberculate as in *Arctodus pristinus* Leidy; however, the external surface is deflected as in Leidy's specimen (Leidy, 1860, pl. 23, figs. 3, 4). *Arctodus floridanus* Gidley (1928) is a distinctly smaller species approaching closely the living *Tremarctos inornatus* Gervais. The second molar from Cumberland Cave is noticeably narrower than in the western forms of *Tremarctotherium.*

The Frankstown Cave form, referred by Peterson (1926) to *Arctotherium haplodon*, compares closely in size with the lower jaw from Port Kennedy. $M_2$ in our specimen is similar to that in the Carnegie Museum specimen and shows only a small difference in the outline of the external surface. In the general appearance of this tooth the Cumberland Cave form is perhaps closer to the Port Kennedy form than is the figured specimen from Frankstown Cave.

The astragalus of the partial skeleton, U.S.N.M. no. 8180, referred to *Arctodus haplodon* corresponds very closely to the dimensions given by Cope for the Port Kennedy *A. haplodon*, but the third metatarsal is distinctly smaller than that measured by Cope. It seems probable that the difference is to be accounted for by size variation between individuals in the Port Kennedy fauna. The foot bones of the Cumberland Cave specimen are noticeably small compared to *Tremarctotherium simum* (Cope), according to dimensions given by Merriam and Stock (1925), although the tibia has nearly the proportions of that in the Potter Creek Cave form. *T. californicum* (J. C. Merriam) from Rancho La Brea is very much larger (Merriam and Stock, 1925).

## Family MUSTELIDAE

### MARTES PARAPENNANTI Gidley and Gazin[5]

FIGURE 15

*Type.*—Anterior portion of male skull (fig. 15*a*), U.S.N.M. no. 8010, carrying most of the cheek teeth of the left side.

*Material.*—In addition to the type there are 10 specimens in the collection, consisting of lower jaws and skull fragments with teeth. One pair of maxillaries, U.S.N.M. no. 12336, with nearly all the cheek teeth on both sides, has a fragmentary right ramus of the mandible associated.

*Specific characters.*—Size intermediate between *Martes pennanti* and *M. americana.* Skull construction, as far as can be determined, nearly as in *M. pennanti.* Upper carnassial relatively shorter than in *M. pennanti* with protocone more forward in position as in *M. americana.* Upper carnassial with uncovered and well-developed external median rootlet as observed in *M. pennanti.* $M^1$ relatively short anteroposteriorly with metacone and cingulum posteroexternal to metacone

[5] Gidley and Gazin, 1933, pp. 347–349, fig. 2.

somewhat reduced. External roots of $M^1$ not so distinctly separated as in *M. pennanti*. $M_1$ with metaconid much reduced. Mandible with low but anteroposteriorly elongate coronoid process. Masseteric fossa deeply impressed. Coronoid process with two well-defined fossae, one on its external upper half, the other on its inner base. The modifications of the coronoid region are more pronounced than in living species.

TABLE 7.—*Measurements (in millimeters) of skull and mandible of* Martes parapennanti

| Measurement | U.S.N.M. no. 8010 (type) | U.S.N.M. no. 11877 (male) | U.S.N.M. no. 11878 (female) |
|---|---|---|---|
| *Skull* | | | |
| Width across postorbital processes | [1] 28 | | |
| Least width between superior borders of orbits | [1] 24 | | |
| Width between outer surfaces of $M^1$ | [1] 32 | | |
| *Superior dentition* | | | |
| Length of cheek-tooth row, $P^1$ to $M^1$, inclusive | 30.5 | | |
| $P^2$, anteroposterior diameter | 5.4 | | |
| $P^2$, greatest transverse diameter | 2.5 | | |
| $P^3$, anteroposterior diameter | 6.6 | | |
| $P^3$, greatest transverse diameter | 3 | | |
| $P^4$, anteroposterior diameter | 10.2 | | |
| $P^4$, transverse width across anterior part including protocone | 6 | | |
| $P^4$, transverse width across metacone | 3.9 | | |
| $M^1$, anteroposterior diameter of outer lobe | 5 | | |
| $M^1$, anteroposterior diameter of inner lobe | 6 | | |
| $M^1$, greatest transverse diameter | 9.5 | | |
| *Mandible* | | | |
| Length of lower jaw from anterior surface of canine at cingulum to middle of posterior surface of condyle | | 68.5 | |
| Distance between posterior surface of $M_1$ and posterior margin of coronoid above condyle | | 28 | |
| Height of coronoid above base of angle | | 31.1 | |
| Depth of jaw below heel of $M_1$ on external side | | 12.6 | 9.2 |
| *Inferior dentition* | | | |
| Length of tooth series, C to $M_1$ inclusive | | 40.8 | [1] 36.5 |
| $P_1$, anteroposterior diameter | | | |
| $P_2$, anteroposterior diameter | | 5 | 2.8 |
| $P_2$, greatest transverse diameter | | 2.6 | 2.1 |
| $P_3$, anteroposterior diameter | | 6.4 | 5.4 |
| $P_3$, greatest transverse diameter | | 2.8 | 2.3 |
| $P_4$, anteroposterior diameter | | 7.9 | 6.4 |
| $P_4$, greatest transverse diameter | | 3.3 | 2.6 |
| $M_1$, anteroposterior diameter | | 12.7 | [1] 10.5 |
| $M_1$, transverse width of trigonid | | 4.6 | 3.6 |
| $M_1$, transverse width of talonid | | 4.7 | |

[1] Approximate.

In *Martes americana* and *M. caurina* the upper carnassial is relatively short, as it is in *M. parapennanti*, but $P^4$ in these living forms lacks the external median rootlet characteristic of the fishers. $M^1$ also is relatively short anteroposteriorly in the martens and the metacone is reduced, more so than in *M. parapennanti*.

The condyle of the lower jaw in *M. parapennanti* is relatively narrow transversely and shallower than in the living species examined. A glenoid portion preserved with one of the specimens, U.S.N.M. no. 11959, shows a correspondingly narrow glenoid fossa and the postglenoid process curves well forward along its inner border to form an interlocking joint as in *Gulo*. In the living species of martens this joint is perfectly hinged but is not completely interlocking.

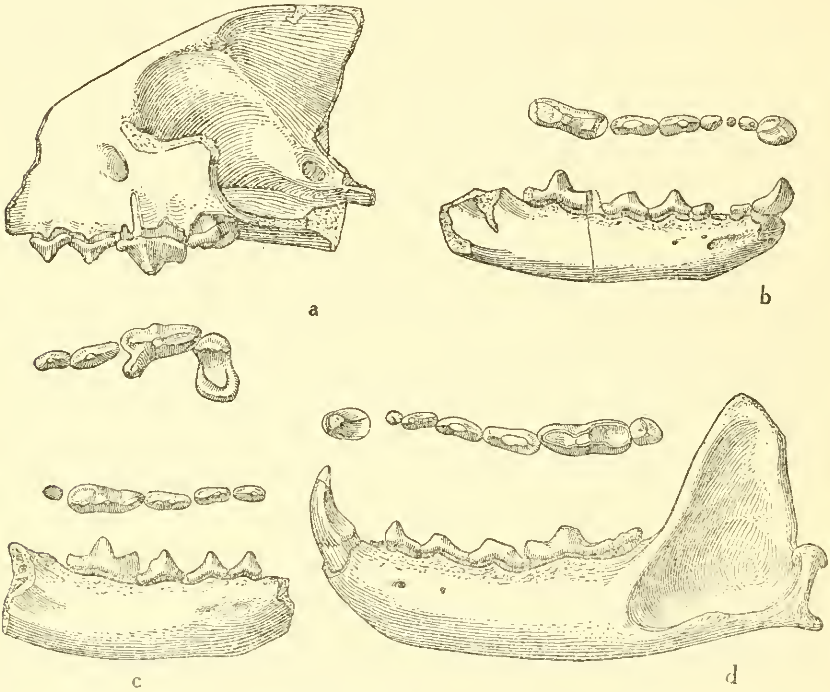



FIGURE 15.—*Martes parapennanti* Gidley and Gazin: *a*, Anterior portion of male skull, type specimen (U.S.N.M. no. 8010), lateral view with occlusal view of dentition; *b*, right ramus of female mandible, paratype (U.S.N.M. no. 11878), lateral and occlusal views; *c*, right ramus of female mandible (U.S.N.M. no. 11876), lateral and occlusal views; *d*, left ramus of male mandible, paratype (U.S.N.M. no. 11877), lateral and occlusal views. Natural size. Cumberland Cave Pleistocene, Maryland.

*Martes diluviana* (Cope, 1899) from the Port Kennedy deposit in Pennsylvania has a much shallower jaw, as indicated in the two figured specimens, than male specimens of *M. parapennanti* with teeth of comparable size. The depth of the jaw is near that of a female *M. parapennanti* with teeth considerably larger. Moreover, the metaconid of the lower carnassial is apparently better developed in *M. diluviana*. This is noticeable when comparisons are made with U.S.N.M. no. 12352 from Cumberland Cave, which has relatively unworn teeth. There is but a very slight development of the metaconid on $M_1$, and this specimen though exhibiting a youthful dentition has a relatively much deeper ramus than in either of the youthful specimens figured by Cope. Dr. E. R. Hall (1936), however, regards these differences as of only age significance.

The modifications of the upper facial region in the Cumberland Cave form resemble those seen in *M. nigripes*, but in the latter species the postorbital processes are more prominently developed and the convergence backward to the postorbital constriction is more extreme. The dental characters throughout are decidedly more like those of *M. vison.* In *M. nigripes* the protocone of the upper carnassial and the protocone shelf of $M^1$ are more reduced, and the heel of the lower carnassial is very narrow, with the talonid basin entirely lacking.

### MUSTELA cf. VISON Schreber

FIGURES 16–18

Included in the mustelid material from Cumberland Cave are six skull portions and an equal number of lower jaws belonging to mink (see figs. 16–18). The fossil material closely resembles the form *M. vison mink* living in Maryland at the present time. A number of differences were observed between the fossil and modern forms, but the magnitude or importance of these differences is not greater than that of the distinctions seen to exist between several of the subspecies currently recognized.

TABLE 8.—*Measurements (in millimeters) of skull, mandible, and dentition of* Mustela vison

| Measurement | *Mustela* cf. *vison* U.S.N.M. no. 8156 | *Mustela v. vison* U.S.N.M. no. 2242 (Biol. Surv.) | *Mustela v. mink* U.S.N.M. no. 241192 (Biol. Surv.) |
|---|---|---|---|
| *Skull and superior dentition* | | | |
| Distance anterior end of nasals to line between postorbital processes | 17.7 | 15 | 16.8 |
| Width between orbits | 14.5 | 14 | 14.7 |
| Width at postorbital processes | 16.8 | 16 | 16.3 |
| Width across outer margins of canine alveoli | 13.8 | 12.5 | 13.6 |
| Length of upper tooth series, anterior margin of canine alveolus to posterior surface of carnassial | 19 | 17.4 | 18.4 |
| $P^4$, anteroposterior diameter along outer wall | 7.4 | 6.7 | 7.5 |
| $P^4$, transverse diameter including protocone | 4.7 | 3.8 | 4.4 |
| $P^4$, transverse diameter posterior to protocone | 2.6 | 2.2 | 2.4 |
| *Mandible and inferior dentition* | | | |
| Depth of lower jaw below trigonid of $M_1$ | 6.5 | 6 | 6.7 |
| Distance from apex of coronoid to base of angle | 17.7 | 17 | 18.4 |
| $M_1$, anteroposterior diameter | 8 | 7.5 | 8.2 |
| $M_1$, transverse diameter of trigonid over anterior root | 2.5 | 2.4 | 2.5 |
| $M_1$, greatest transverse diameter | 3 | 3.1 | 3.2 |
| $M_1$, transverse diameter of talonid | 2.8 | 2.9 | 3 |

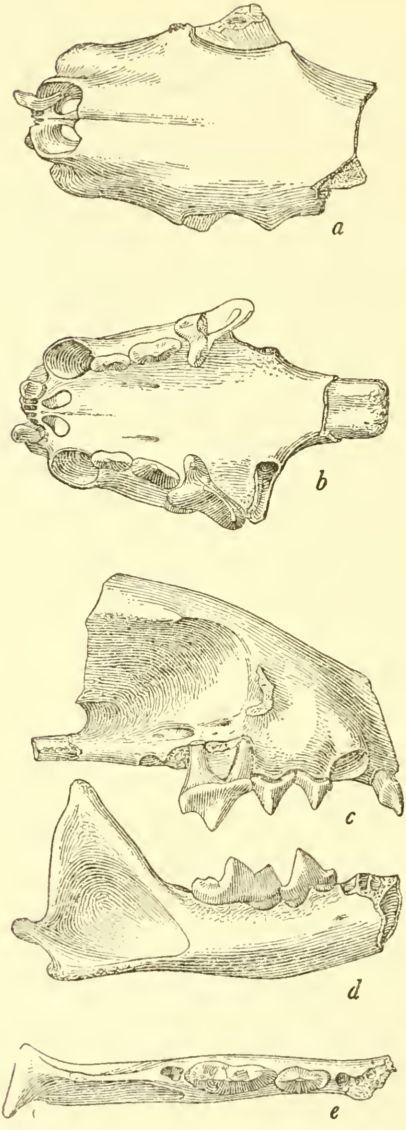



FIGURE 16.—*Mustela* cf. *vison* Schreber, anterior portion of skull and right ramus of male mandible (U.S.N.M. no. 8156): *a*, dorsal view of skull; *b*, ventral view of skull; *c*, lateral view of skull; *d*, lateral view of mandible; *e*, occlusal view of interior dentition. × 1½. Cumberland Cave Pleistocene, Maryland.

In size the fossil form is close to *M. vison mink.* A comparison with this subspecies shows the muzzle of the fossil skulls to be relatively broad posteriorly with a slightly elongate face. Viewed from above the lateral lines of the postorbital constricted portion of the

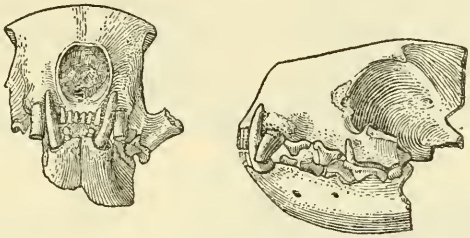


FIGURE 17.—*Mustela* cf. *vison* Schreber: Anterior portion of skull and mandible (U.S.N.M. no. 11880), anterior and lateral views. Natural size. Cumberland Cave Pleistocene, Maryland.

skull (fig. 16*b*) converge posteriorly, perhaps more so than in the Alaskan form, *M. vison ingens.* The upper dentition is essentially like that in *M. vison mink,* although the upper carnassial of U.S.N.M. no. 8156 (male) (fig. 16*c*), is somewhat broader posteriorly than in the living mink. The lower jaw (fig. 16*d* and *e*) is less robust than in

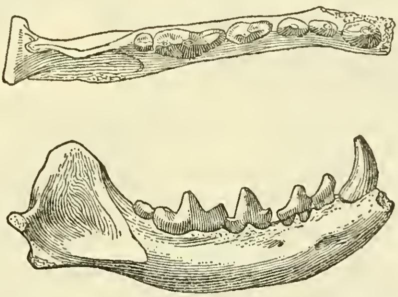


FIGURE 18.—*Mustela* cf. *vison* Schreber: Right ramus of female mandible (U.S.N.M. no. 8212), lateral and occlusal views. ×1½. Cumberland Cave Pleistocene, Maryland.

*M. vison mink,* but the lower teeth, with the exception of $M^1$, are not different. The heel and middle portion of the lower carnassial are narrower in the fossil jaws, and the hypoconid appears to be more medially placed. The relative breadth of this tooth does not vary greatly within subspecies, but between such forms as *M. v. vison* and *M. v. ingens* the proportions differ appreciably. Incidentally, the junior author does not follow the procedure adopted by Dr. E. R. Hall (1936, pp. 114–115) in referring the fossil material to the living subspecies, *M. vison mink,* occupying the Maryland region today.

### GULO GIDLEYI Hall [6]

FIGURES 19, 20; PLATE 9

The normal habitat of the wolverine today is the far north, and in the Eastern United States it has not been known to range farther south than northern New York. This animal is represented in the Cumberland Cave collection by several specimens including an unusually well preserved skeleton.

The wolverine skeleton, U.S.N.M. no. 8175, has been mounted and is on exhibition in the hall of fossil vertebrates at the National Museum

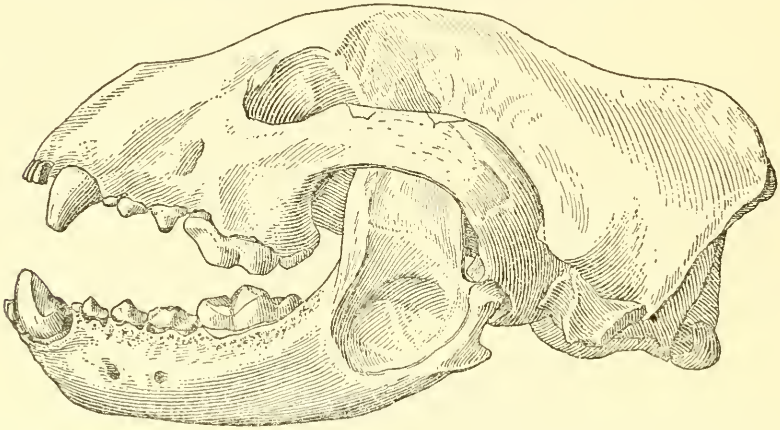


FIGURE 19.—*Gulo gidleyi* Hall: Skull and mandible (U.S.N.M. no. 8175), lateral view. Two-thirds natural size. Cumberland Cave Pleistocene, Maryland.

(see pl. 9). The skull and mandible belonging to this specimen are nearly complete and most of the teeth are intact. The ribs and the anterior portion of the vertebral column are largely restored, and the sacrum and most of the caudal vertebrae were not preserved but the lumbar and posterior dorsal vertebrae are in good condition. The right scapula is only half complete but has been restored from the one on the left side which has very little missing. The fore limbs and right fore foot are entire. Several carpals, phalanges, and claws of the left manus were not preserved but have been modeled from those on the right. Of the pelvic girdle only the tip of the left ilium and the symphysial portion of both ischia are restored. The hind limbs are complete except for the fibular and one patella. The left pes includes most of the elements and served to model the right hind foot, which had only the astragalus, cuboid, and third metatarsal preserved.

In proportions of the skull a noticeable degree of variation is seen between specimens in the cave collection. The skull (figs. 19, 20) belonging to the preserved skeleton, U.S.N.M. no. 8175, is characterized by a broad frontal region and well-expanded zygomatic arches; moreover, the posterior narial passage is noticeably constricted, and

[6] Hall, 1936, pp. 83-86.

the pterygoids approach each other somewhat more than in the living species. However, skull U.S.N.M. no. 8176, the type as designated by Hall, in the cave collection, is not so broad through the muzzle, and the posterior narial aperture is not different from that in an average

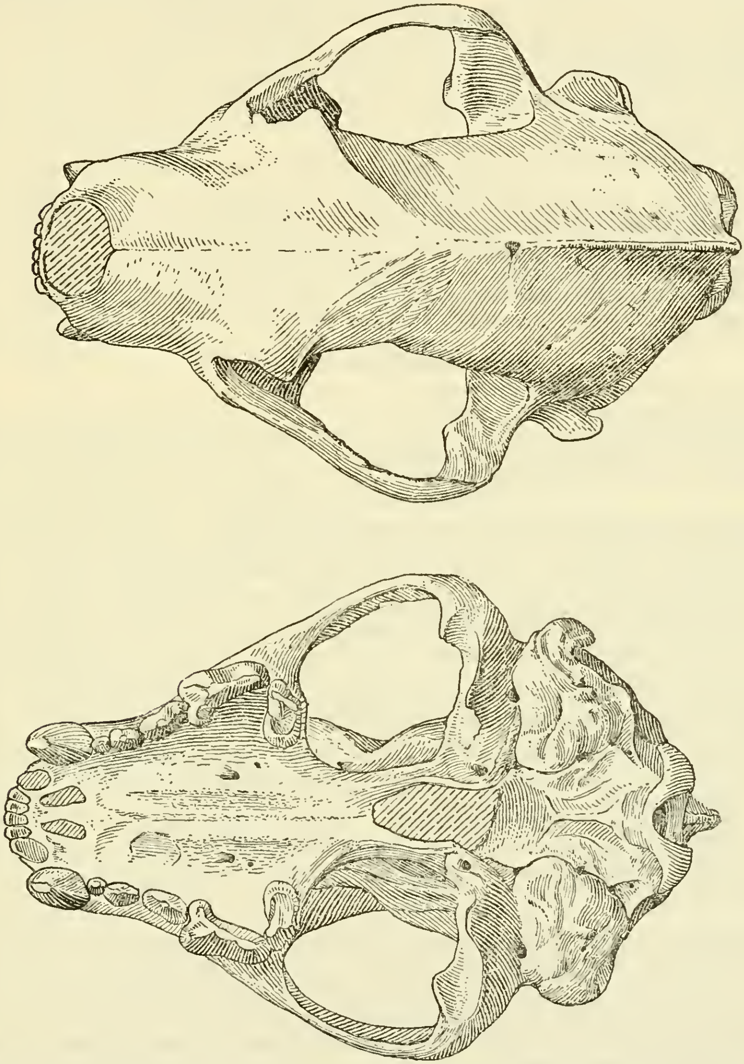


FIGURE 20.—*Gulo gidleyi* Hall: Skull (U.S.N.M. no. 8175), dorsal and ventral view. Two-thirds natural size.

modern specimen of *Gulo luscus*. The occipital condyles in no. 8175 are close together, and the foramen magnum is correspondingly small. Unfortunately the occipital region is missing in other skull portions from Cumberland Cave, but the distance between the condyles in living specimens of *G. luscus* varies sufficiently to include the condition seen in no. 8175.

TABLE 9.—*Measurements (in millimeters) of skeleton of* Gulo gidleyi

| Measurement | U.S.N.M. no. 8175 |
|---|---|
| *Skull* | |
| Total length of skull from anterior end of premaxillaries to occipital condyles | 136 |
| Width at mastoids | 77.6 |
| Width across zygomatic arches | 98.8 |
| Width of muzzle at canines | 37.5 |
| Width of muzzle at infraorbital foramen | 41 |
| Width between orbits | 43.3 |
| Width across postorbital processes | 50.6 |
| Width at postorbital constriction | 37.2 |
| *Superior dentition* | |
| Length of upper tooth series, canine to $M^1$, inclusive | 53.5 |
| $P^4$, anteroposterior diameter | 18.9 |
| $P^4$, transverse diameter including protocone | 11 |
| $P^4$, transverse diameter (greatest) posterior to protocone | 7.3 |
| $M^1$, anteroposterior diameter of external portion | 7 |
| $M^1$, anteroposterior diameter of internal portion | 7.1 |
| $M^1$, transverse diameter | 12.5 |
| *Mandible and inferior dentition* | |
| Depth of lower jaw below trigonid of carnassial | 19.5 |
| Length of lower tooth series, canine to $M_2$, inclusive | 60.5 |
| $M_1$, anteroposterior diameter | 19.5 |
| $M_1$, greatest transverse diameter of anterior portion | 8.4 |
| $M_1$, greatest transverse diameter of posterior portion | 7.7 |
| *Anterior limb* | |
| Greatest length of scapula from coracoid process to suprascapular border | [1] 91 |
| Greatest width of articulating end of scapula measured across glenoid cavity | 26.5 |
| Distance from inner border of glenoid cavity of scapula to outer surface of acromion | 26.2 |
| Greatest length of humerus | 128 |
| Greatest transverse diameter of proximal extremity of humerus | 27.2 |
| Greatest anteroposterior diameter of proximal extremity of humerus | 29.3 |
| Greatest width of distal extremity of humerus | 34.6 |
| Greatest length of ulna | 129 |
| Greatest transverse width across sigmoid cavity of ulna | 15.3 |
| Distance from distal margin of sigmoid cavity to distal end of ulna | 104 |
| Greatest length of radius | 107 |
| Long diameter of proximal end of radius | 15.8 |
| Greatest width of distal end of radius | 20 |
| Length of first metacarpal | 25.9 |
| Length of second metacarpal | 35.9 |
| Length of third metacarpal | 44.5 |
| Length of fourth metacarpal | 42.8 |
| Length of fifth metacarpal | 37 |
| *Posterior limb* | |
| Length from anterior end of ilium to posterior border of ischium | 112 |
| Width of ilium | 30 |
| Width of ischium measured from ischial tuberosity to posterior end of ischial symphysis | 45 |
| Diameter of acetabulum measured at right angles to long axis of internal notch | 18.5 |
| Length of femur from top of head to distal margin of inner condyle | 134 |
| Width of proximal end of femur from inner surface of head to outer surface of greater trochanter | 34.4 |
| Anteroposterior diameter of head of femur | 16.4 |
| Width of distal end of femur across condyles | 30 |
| Greatest length of tibia measured parallel to long axis | 133 |
| Greatest anteroposterior diameter of proximal end of tibia | 27.8 |
| Greatest width of proximal end of tibia | 29.4 |
| Greatest transverse width of distal end of tibia measured perpendicular to long axis of shaft | 21 |
| Length of first metatarsal | 34.4 |
| Length of second metatarsal | [1] 44.6 |
| Length of third metatarsal | 52.5 |
| Length of fourth metatarsal | 54.2 |
| Length of fifth metatarsal | 51.5 |

[1] Approximate.

The teeth average somewhat smaller than in *Gulo luscus*, as noted by Hall, although a few specimens were found in which the teeth were definitely smaller than in the fossil form. The relatively wide $P^3$ in the fossil material was matched in some recent individuals but this condition is uncommon in *Gulo luscus*.

The other bones of the skeleton, no. 8175, show but few peculiarities, the principal ones being that the anterosuperior border of the scapula is more rounded than in the living species, and the shaft of the humerus is slightly less curved.

The record of *Gulo* in the Pleistocene of North America is very incomplete, and the material for the most part has been referred to the living species, *Gulo luscus*. Several lower jaws of wolverine in the Port Kennedy occurrence, believed by Cope (1899, pp. 229–230) to be specifically identical with *Gulo luscus*, are referred to *Gulo gidleyi* by Hall.

### LUTRA PARVICUSPIS Gidley and Gazin[7]

FIGURE 21

*Type.*—Portion of a broken and crushed skull (fig. 21), U.S.N.M. no. 8213, in which the principal cheek teeth of both sides are present. $P^1$, the canines and incisors represented by their alveoli.

*Specific characters.*—Size somewhat larger than *Lutra canadensis*. Main outer cusps of $M^1$ relatively lower and less robust than in *L. canadensis*. $P^2$ and $P^3$ large with conspicuous posterointernal basin. $P^4$ triangulate, with its base relatively wide anteriorly and with its anterior border forming a right angle with the outer border of the tooth. $P^4$ long and outer wall of $M^1$ relatively short anteroposteriorly as compared with *L. canadensis*. $M^1$ with paracone and metacone subequal and both cusps with relatively narrow extension of the basal portions of their outer walls.

*Comparison.*—The Cumberland Cave specimen represents an extinct species of otter intermediate in size between *L. canadensis* of the Eastern United States and *L. felina* or *L. paraensis* of Chile and Honduras, respectively. Judged by their alveoli the canines of the Cumberland Cave specimen are relatively robust, as in the living species of Central and South America. The backward extension of the protocone shelf of the carnassial and the posterointernal shelf of the other premolars is somewhat more expanded than in *L. canadensis*. The posterior margin of the upper molar, as in some South American specimens, is not so deeply notched posterointernal to the metacone, as noted in *L. canadensis*. Perhaps the most noticeable distinction in the dentition of *L. parvicuspis* is the distinctly narrow proportions of the external cusp row of $M^1$.

Although *L. parvicuspis* is distinct from both North American and South American otters, it approaches living species of South America

[7] Gidley and Gazin, 1933, pp. 349–351, fig. 3.

in several of those characters in which it differs from northern forms. Most noticeable among these are the size of the skull and canines, the development of the upper premolars, and the somewhat smaller relative size of the molar.

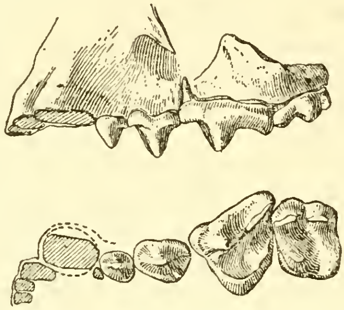


FIGURE 21.—*Lutra parvicuspis* Gidley and Gazin: Maxillary portion of skull with premolar and molar teeth, type specimen (U.S.N.M. no. 8213), lateral and occlusal views. Natural size. Cumberland Cave Pleistocene, Maryland.

A comparison of *L. parvicuspis* with *L. rhoadsii* Cope (1899, pp. 238–239) from Port Kennedy, Pa., is difficult on account of the different nature of the materials preserved. *L. rhoadsii* was based on lower jaws and a single upper molar. The dimensions given by Cope for the anteroposterior diameter of the lingual portion of $M^1$ shows this tooth to be much smaller than in *L. parvicuspis*.

TABLE 10.—*Measurements (in millimeters) of superior dentition of three species of* Lutra

| Measurement | *Lutra parvicuspis* U.S.N.M. no. 8213 (type) | *Lutra canadensis* U.S.N.M. no. 197943 (Div. Mamm.) | *Lutra felina* U.S.N.M. no. 35377 (Div. Mamm.) |
|---|---|---|---|
| Length of cheek-tooth series, $P^1$ to $M^1$, inclusive | [1] 34.5 | 30 | 33.6 |
| C, anteroposterior diameter of alveolus | [1] 7.7 | 5.5 | 7.6 |
| $P^2$, anteroposterior diameter | 5 | 5 | 5 |
| $P^2$, greatest transverse diameter | 4 | 3.3 | 4.3 |
| $P^3$, anteroposterior diameter | 7.7 | 7.5 | 8.2 |
| $P^3$, greatest transverse diameter | 5.3 | 5 | 6 |
| $P^4$, anteroposterior diameter | 12.8 | 11.5 | 14.5 |
| $P^4$, greatest transverse diameter perpendicular to outer wall | 10.2 | 9.6 | 11.5 |
| $M^1$, anteroposterior diameter across outer cusps | 8 | 8.7 | 8.3 |
| $M^1$, anteroposterior diameter across inner portion | 8.7 | 8 | 8.5 |
| $M^1$, transverse diameter across paracone and protocone | 10.5 | 11 | 11.8 |

[1] Approximate.

*Satherium piscinaria* (Leidy, 1873, pp. 230–231) from the late Pliocene or early Pleistocene of Idaho is a considerably larger form as indicated by the size of the tibia. (See also Gazin, 1934, pp. 143–149).

E. R. Hall (1936, pp. 75–77) regards *Lutra parvicuspis* as a synonym of *L. canadensis lataxina*. In examining all the material of this recent subspecies in the National Museum the junior author finds that the fossil species is probably distinct from the living form and that several of the characters cited above for the fossil type are distinctive and others are present only in unusual specimens or extreme conditions of the modern form.

**BRACHYPROTOMA PRISTINA Brown** [8]

FIGURES 22–24

Included in the musteline material from Cumberland Cave are three skull portions, one of which is nearly complete (fig. 22), and four mandibular rami representing an extinct form of skunk.

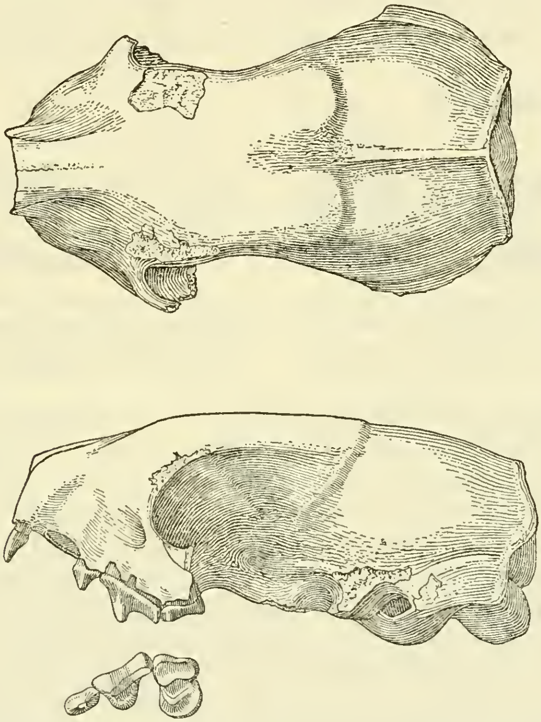


FIGURE 22.—*Brachyprotoma pristina* Brown: Skull (U.S.N.M. no. 8155), dorsal and lateral views with occlusal view of dentition. × 1½. Cumberland Cave Pleistocene, Maryland.

The skull material corresponds closely in size and other characters with the type of *Brachyprotoma pristina*, which was described by Brown from the Conard Fissure in Arkansas. Skull U.S.N.M. no. 8155 (fig. 22) is rather short and broad, more so than in the living species *Spilogale ambarvalis*. The width is most noticeable through the frontal region and is accompanied by a reduction in size of the postorbital processes. Prominent dorsolateral swellings in the vicinity of the postorbital constriction emphasize the breadth of the

[8] Brown, 1908, 176–179.

16541—38——4

skull in this region. The cranial portion is conspicuously shortened anteroposteriorly and is convex dorsally in a longitudinal profile somewhat as in the Florida *S. ambarvalis.* Some of the modern western skunks, as *S. gracilis* and *S. phenax*, have relatively flat dorsal profiles and are also more elongate than the cave specimen. Furthermore, the longitudinal profile of rostrum is slightly concave anterior to the frontals, as noted in several specimens of *S. putorius.*

The dental formula of *Brachyprotoma* is as in *Conepatus*, and the characters of the upper teeth of the Cumberland Cave specimen correspond rather closely with those of *B. pristina.* $M^1$ has a broader heel than in the type, but the difference may not be greater than can be attributed to individual variation or possibly to difference of sex.

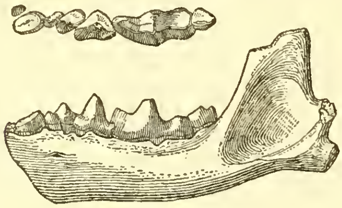


FIGURE 23.—*Brachyprotoma pristina* Brown: Left ramus of male mandible (U.S.N.M. no. 12045), lateral and occlusal views. × 1½. Cumberland Cave Pleistocene, Maryland.

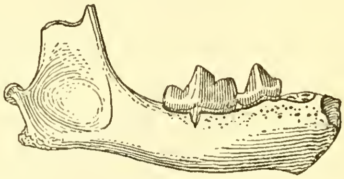


FIGURE 24.—*Brachyprotoma pristina* Brown: Right ramus of female or young male mandible (U.S.N.M. no. 8214), lateral view. × 1½. Cumberland Cave Pleistocene, Maryland.

A comparison with *Spilogale* shows $P^4$ in our specimen to be similar to that in the living species but with protocone relatively smaller and the anterior margin of the paracone slightly more backward sloping. $M^1$ is relatively short anteroposteriorly and wide transversely, and the median constriction is not nearly so pronounced as in *Spilogale.* The external cingulum of this tooth is very well developed and terminates anteriorly in a prominent cusp external to the paracone.

Of the four jaws referred to *Brachyprotoma pristina*, one (fig. 23), U.S.N.M. no. 12045, is evidently of an adult male and corresponds very closely to the lower jaws Brown recognized as belonging to *B. pristina.* Jaw no. 12046 is apparently of an adult female and corresponds favorably with the type of *B. spelaea.* The remaining two jaws (fig. 24) seem to represent relatively young males. The adult male specimen, U.S.N.M. no. 12045, is characterized by a moderately robust mandible with a rather deep, abrupt symphysis, and a well-developed masseteric fossa as compared to *Spilogale.* The premolars are crowded, overlapping, and the lower carnassial is narrow and short heeled and exhibits a weak metaconid, differing markedly in these respects from living forms. The female specimen, no. 12046, differs from the male in having a weaker mandible, particularly shallow beneath the posterior portion of $M_1$, a shallower symphysis, and a more gently sloping ascending ramus.

It seems evident from a consideration of the skeletal characters distinguishing males from females among living mustelines related to this fossil form that those characters that have been cited to separate *B. spelaea* from *B. pristina* should be considered sexual.

*B. obtusata* from Frankstown Cave in Pennsylvania, as recorded by Peterson (1926, p. 285), possibly differs from the type of that species, which is from Port Kennedy, in the size of the lower carnassial. The lower jaw illustrated by Peterson, however, does not resemble closely the specimens of *B. pristina* from Cumberland Cave. The difference is most noticeable in the greater downward projection of the symphysis, the lower position of the ventral surface of the angle, and in the differently shaped coronoid process of the Frankstown Cave jaw. If the material from Frankstown Cave should be regarded as belonging to the same species as that from Conard Fissure and Cumberland Cave, it seems preferable to refer it to *B. pristina*, since no comparisons are possible with the type of *B. obtusata*, which is lost. Cope's measurements for the latter, though possibly in error, indicate a smaller species than *B. pristina*. Moreover, there is no assurance that the Port Kennedy deposit is the same age as that at Frankstown Cave.

TABLE 11.—*Measurements (in millimeters) of skull, mandible, and dentition of* Brachyprotoma pristina

| Measurement | U.S. N.M. no. 8155 | A.M. N.H. no. 12426 (type) | A.M. N.H. no. 11722 | U.S. N.M. no. 12045 | A.M. N.H. no. 11773 | U.S. N.M. no. 12046 | A.M. N.H. no. 12399 |
|---|---|---|---|---|---|---|---|
| *Skull and superior dentition* | | | | | | | |
| Length of skull from anterior end of premaxillaries to occipital condyles | 47.4 | -------- | 46 | -------- | -------- | -------- | -------- |
| Width between orbits | [1] 18.2 | [1] 18 | -------- | -------- | -------- | -------- | -------- |
| Outside measurement across upper molars | 20.1 | 20.5 | -------- | -------- | -------- | -------- | -------- |
| Length of tooth series, $P^3$ to $M^1$, inclusive | 12.2 | -------- | 12.1 | -------- | -------- | -------- | -------- |
| $P^4$, anteroposterior diameter | 6.2 | 5.9 | 6.2 | -------- | -------- | -------- | -------- |
| $P^4$, transverse diameter including protocone | 3.9 | 3.8 | 3.9 | -------- | -------- | -------- | -------- |
| $M^1$, anteroposterior diameter of outer portion of tooth parallel to outer wall | 4 | 3.8 | 4.1 | -------- | -------- | -------- | -------- |
| $M^1$, anteroposterior diameter of heel | 3.8 | 3 | 3.3 | -------- | -------- | -------- | -------- |
| $M^1$, greatest transverse diameter | 6.3 | 5.7 | [1] 6 | -------- | -------- | -------- | -------- |
| *Mandible and inferior dentition* | | | | | | | |
| Length of lower jaw from anterior end to condyle | -------- | -------- | -------- | [1] 30 | 30.5 | -------- | 26.6 |
| Depth of lower jaw below $P_2$ | -------- | -------- | -------- | 6.8 | 6.8 | 5.9 | [1] 6 |
| Depth of lower jaw below talonid of $M_1$ | -------- | -------- | -------- | 5.1 | 5.3 | 4.1 | 4 |
| Length of premolar series | -------- | -------- | -------- | 6.3 | 6.5 | 6.3 | -------- |
| $M_1$, anteroposterior diameter | -------- | -------- | -------- | 7.3 | 7.1 | 7 | 6.8 |
| $M_1$, greatest transverse diameter | -------- | -------- | -------- | 3 | 3 | 3 | 2.7 |
| $M_1$, transverse diameter of talonid | -------- | -------- | -------- | 2.7 | 2.8 | 2.7 | 2.5 |

[1] Approximate.

**SPILOGALE MARYLANDENSIS Gidley and Gazin [9]**

FIGURE 25

*Type.*—Right ramus of mandible (fig. 25), U.S.N.M. no. 12048, with canine and $P_3$ to $M_1$ preserved.

*Specific characters.*—Mandible about the size of that in *Spilogale putorius.* Symphysis abrupt and inferior margin of mandible less convex longitudinally. Canine slender and long. Third and fourth premolars and molar slender and not overlapping. $P_3$ small. Basal portion of $P^4$ nearly oval in cross section as seen in dorsal view. Trigonid of $M_1$ relatively short and narrow. Metaconid moderately well developed but not so distinctly separated from protoconid as in

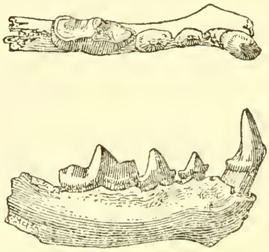


FIGURE 25.—*Spilogale marylandensis* Gidley and Gazin: Right ramus of mandible, type specimen (U.S.N.M. no. 12048), lateral and occlusal views. × 1½. Cumberland Cave Pleistocene, Maryland.

*S. putorius.* Buccal surface of talonid not offset inwardly to so great an extent as in living species.

*Comparison.*—*Spilogale marylandensis* compares favorably in size and depth of jaw with female specimens of *S. putorius.* However, the symphysis of the mandible is somewhat more abrupt than in either male or female specimens and projects downward to a noticeable extent giving the lower margin of the ramus a less convex and more irregular longitudinal profile. The premolars are narrower and even less crowded than is common in the living species. The trigonid of $M_1$ is slightly shorter and narrower than in either *S. putorius* or *S. interrupta,* and the external wall of the heel is not offset inward so abruptly from that of the trigonid as in the living species. Furthermore, the metaconid of $M_1$ is more solidly united with the protoconid; however, this cusp is not reduced as in *Brachyprotoma.*

*Spilogale marylandensis* does not differ greatly in size from *Brachyprotoma pristina* but has smaller, more slender premolars and a larger carnassial. Other characters separating the two forms are those which distinguish *Brachyprotoma* from *Spilogale,* such as the crowding or overlapping of the premolars and smaller size of heel and more reduced metaconid of the lower carnassial.

[9] Gidley and Gazin, 1933, pp. 351–352, fig. 4.

TABLE 12.—*Measurements (in millimeters) of mandible of* Spilogale marylandensis *and* S. putorius

| Measurement | *Spilogale marylandensis* U.S.N.M. no. 12048 (type) | *Spilogale putorius* U.S.N.M. no. 42892 (male) (Biol. Surv.) | *Spilogale putorius* U.S.N.M. no. 43719 (female) (Biol. Surv.) |
|---|---|---|---|
| Depth of ramus below $P_3$ | 5.5 | 6 | 5.5 |
| Depth of ramus below posterior portion of $M_1$ | 4.4 | 5 | 4.4 |
| Length of dentition, C to $M_1$, inclusive | 18.3 | 18.5 | 18.1 |
| $P_3$, anteroposterior diameter | 2.6 | 2.8 | 2.9 |
| $P_3$, greatest transverse diameter | 1.7 | 2.1 | 1.9 |
| $P_4$, anteroposterior diameter | 3.4 | 3.6 | 3.3 |
| $P_4$, greatest transverse diameter | 2.1 | 2.4 | 2.3 |
| $M_1$, anteroposterior diameter | 7.4 | 7.4 | 7.6 |
| $M_1$, anteroposterior diameter of trigonid | 4.4 | 4.7 | 4.8 |
| $M_1$, greatest transverse diameter of trigonid | 3.1 | 3.5 | 3.4 |
| $M_1$, transverse diameter of heel | 3 | 3.1 | 3.1 |

## TAXIDEA MARYLANDICA Gidley and Gazin[10]

FIGURES 26, 27

*Type.*—A complete skull and lower jaws (figs. 26, 27), an articulated series of 11 vertebrae in which all the cervicals and four dorsal are present, and the proximal half of the right humerus of one individual, U.S.N.M. no. 7990.

*Specific characters.*—Size large, about equaling the largest living race of *Taxidea taxus*. Cheek teeth relatively large. Upper carnassial with both protocone and hypocone having low regularly cone-shaped contours with circular bases; hypocone relatively large. $M^1$ complex in structure, with the five principal cusps (paracone, metacone, protocone, hypocone, and metaconule) low, regularly cone-shaped and subequal. This tooth in consequence has a flatter appearance than is usual in the living species. It is also more expanded posterointernally, so that the general outline of this tooth is not triangular, as is usual in the living species, but subquadrangular with a relatively straight posterolateral margin and a posteromedially directed lingual margin. Also, the posterior portion of the tooth is distinctly wide transversely. Lower $P_4$ is relatively long with well-developed heel, and the cusps of $M_1$ are distinctly robust.

The skull, in general appearance, is much like that of *T. taxus*, but it presents a few peculiarities that seem to distinguish it from any living species. Viewed from the side, the region above the orbit is high-arched; the occiput is relatively depressed; and the postorbital zygomatic process is relatively low. In the basicranial portion of the skull the bullae appear to be more swollen and more evenly rounded than is usual in the living species. In superior view the principal differences to be noted are the slight development of the postorbital

[10] Gidley and Gazin, 1933, pp. 352–354, figs. 5, 6.

processes of the frontals as compared with recent skulls in the same stage of maturity and especially the form and size of the nasals. These are broad in midregion so that the outer sides run nearly parallel for a considerable distance instead of converging V-shaped

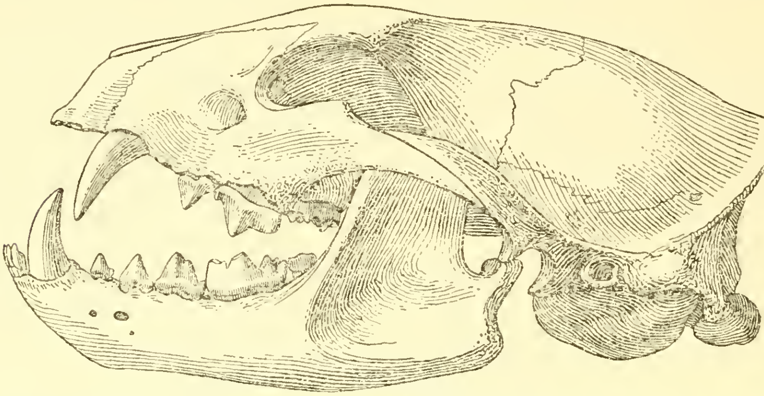


FIGURE 26.—*Taxidea marylandica* Gidley and Gazin: Skull and mandible, type specimen (U.S.N.M. no. 7990), lateral view. Three-fourths natural size. Cumberland Cave Pleistocene, Maryland.

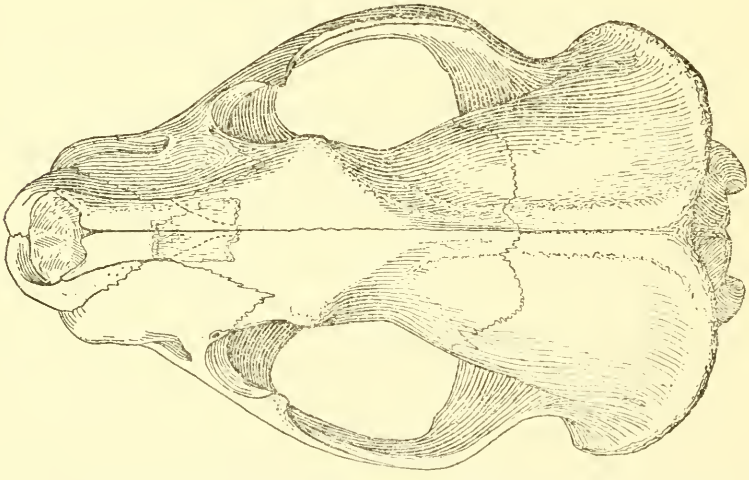


FIGURE 27.—*Taxidea marylandica* Gidley and Gazin: Skull, type specimen (U.S.N.M. no. 7990), dorsal view. Three-fourths natural size. Cumberland Cave Pleistocene, Maryland.

backward as is usual in the living species. Thus the points of the anterior extension of the frontals are very definitely farther apart than in any specimen of the living species observed.

The junior author does not regard this specimen as sufficiently typical of *Taxidea taxus taxus* to be placed in the modern species and subspecies, as does Hall (1936, pp. 79–82).

Badgers today are considered strictly western in habitat, and in this country they are now not found in any numbers east of the Mississippi River.

Badgers from the Pleistocene of North America are relatively little known. *Taxidea robusta*, described by Hay (1922, pp. 631–632) from Arizona, is known only from an ulna and part of an innominate bone. This material is not that in which one would expect to find significant characters of specific importance; hence there is little justification in referring it to a living subspecies, as does Hall (1936, pp. 82–83). The Anita, Ariz., material should have been cited as *Taxidea* sp.

A specimen of *T. taxus*, originally described by Cope (1878, p. 227) as *T. sulcata*, is recorded from the Pleistocene of Washington. Cope (1899, p. 239) also recognized the modern species in the Port Kennedy fauna.

TABLE 13.—*Measurements (in millimeters) of skull and dentition of* Taxidea marylandica *and* T. taxus

| Measurement | *Taxidea marylandica* U.S.N.M. no. 7990 (type) | *Taxidea taxus* U.S.N.M. no. 84562 (Div. Mamm.) |
|---|---|---|
| *Skull* | | |
| Total length of skull including condyles | 129.3 | 130 |
| Width across mastoids | 77 | 73.5 |
| Width across zygomatic arches | 81.2 | 78.7 |
| Width of muzzle across canines | 36.3 | 35.7 |
| Width of muzzle at infraorbital foramina | 34.2 | 34.3 |
| Width between orbits | 30 | 27.5 |
| Width across postorbital processes | 33 | 33.8 |
| Width across postorbital constriction | 30 | 30 |
| Depth of skull at bullae | 51.5 | 56.5 |
| Depth of occiput | 42.5 | 45.5 |
| Width of nasals at posterior points of premaxillaries | 10.7 | 10.7 |
| Width of nasals at anterior points of frontals | 10.7 | 6.5 |
| *Superior dentition* | | |
| $P^4$, anteroposterior diameter along outer wall | [1] 12.5 | 12.2 |
| $P^4$, transverse diameter perpendicular to outer wall | [1] 10.5 | 10.8 |
| $M^1$, greatest diameter | [1] 14 | 14 |
| $M^1$, transverse diameter perpendicular to postero-external wall | [1] 10 | 9.4 |
| *Inferior dentition* | | |
| Length of lower tooth series, C to $M_2$, inclusive | 50.5 | 52.5 |
| Length of lower cheek tooth series $P_2$ to $M_2$ | 40 | 41.2 |
| $P_4$, anteroposterior diameter | 9 | 7.9 |
| $M_1$, anteroposterior diameter | 14.3 | 15 |
| $M_1$, anteroposterior diameter of heel | 5.2 | 5.2 |

[1] Approximate.

## Family FELIDAE

### FELIS cf. INEXPECTATA (Cope)

FIGURE 28

A relatively small quantity of cat material is included in the collection. An upper carnassial and a fragmentary left mandibular ramus (fig. 28*a* and *b*), U.S.N.M. no. 11890, with $P_4$ and $M_1$ preserved are referred questionably to *Felis inexpectata* (Cope, 1899, pp. 247–249). The proportions of the upper carnassial are such that the tooth may be from the same individual as the lower jaw.[11]

Cope described *F. inexpectata* with an upper carnassial from the Port Kennedy deposit as the type. To this species he referred a lower jaw fragment with $M_1$ and part of $P_4$, some separate upper and lower teeth, foot bones, and limb fragments. The Cumberland Cave upper carnassial is slightly larger and higher crowned than the type of *F. inexpectata*, but it has its protocone noticeably reduced as in that species. However, the Port Kennedy lower jaw is much deeper and has larger teeth than the Cumberland Cave jaw portion and the notch between the paracone and protocone of the lower carnassial is deeper and more open than in $M_1$ of the latter specimen. The Port Kennedy lower jaw is out of proportion with the type upper tooth, which suggests considerable individual variation or possibly that another species is represented.

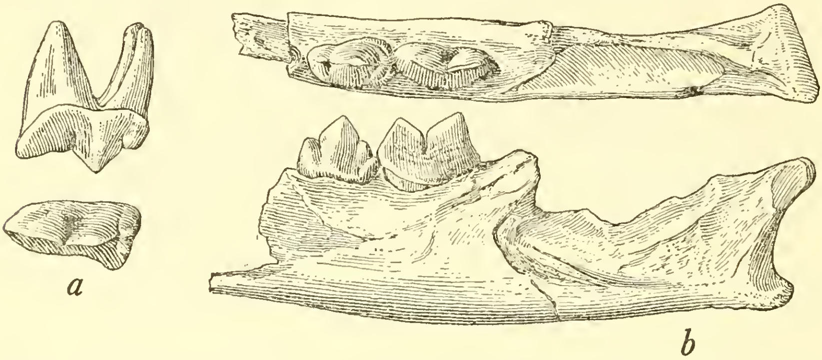


FIGURE 28.—*Felis* cf. *inexpectata* (Cope), upper carnassial and left ramus of mandible (U.S.N.M. no. 11890): *a*, Lateral and occlusal views of upper carnassial; *b*, lateral and occlusal views of mandible. Two-thirds natural size. Cumberland Cave Pleistocene, Maryland.

The Cumberland Cave upper carnassial is nearly equal in size to the type upper carnassial of *Felis longicrus* Brown (1908, p. 178). The principal differences to be noted include somewhat narrower proportions, a more backward sloping parastyle, relatively shorter anteroposterior length of paracone, and a more reduced and less forward projecting protocone than in *F. longicrus*. The $P_4$ referred by Brown to *F. longicrus* is similar to that tooth in the Cumberland Cave mandible but is distinctly larger. Brown noted the resemblance of this tooth to *F. onca* and to the $P_4$ in the jaw referred by Cope to *F. inexpectata*.

The mandible from Cumberland Cave is distinctly pumalike in character, particularly in the relative proportions of $P_4$ and $M_1$. Though smaller than an average size jaguar, it is apparently larger

[11] The specimens were associated, according to Dr. Gidley's notes.

than the living pumas. It approximates in size *F. daggetti* Merriam (1918) from the Pleistocene of Rancho La Brea but possesses noticeably slenderer teeth.

TABLE 14.—*Measurements (in millimeters) of mandible and dentition of* Felis *cf.* inexpectata

| Measurement | U.S.N.M. no. 11890 |
|---|---|
| *Superior dentition* | |
| $P^4$, greatest anteroposterior diameter | 26.6 |
| $P^4$, anteroposterior diameter of paracone between notches | 10.1 |
| $P^4$, anteroposterior diameter of metacone | 10.9 |
| $P^4$, transverse diameter including protocone | 12.2 |
| $P^4$, greatest transverse diameter posterior to protocone | 10 |
| $P^4$, height of paracone above base of cingulum externally | 13.5 |
| *Mandible* | |
| Distance between posterior margin of $M_1$ and posterior surface of condyle | 64.8 |
| Depth of lower jaw below cingulum of $M_1$ externally | 28 |
| *Inferior dentition* | |
| $P_4$, anteroposterior diameter | 17.2 |
| $P_4$, transverse diameter of anterior portion | 7.6 |
| $P_4$, greatest transverse diameter | 9.1 |
| $P_4$, height of principal cusp above base of cingulum externally | 12.5 |
| $M_1$, anteroposterior diameter | 20.9 |
| $M_1$, greatest transverse diameter at cingulum | 9.6 |
| $M_1$, length of cutting edge of paraconid | 7.5 |
| $M_1$, length of cutting edge of protoconid | 9.5 |
| $M_1$, height of paraconid above base of cingulum anteriorly | 9 |
| $M_1$, height of protoconid above base of cingulum posteriorly | 11.7 |

### FELIS near ATROX Leidy

FIGURE 29

Several feline foot bones in the collection appear to be much too large and robust to belong with the upper tooth and jaw portion referred to *Felis inexpectata* and may represent the large North American Pleistocene cat *Felis atrox* Leidy (1853). Included in this foot material are a scapholunar and second metacarpal (fig. 29*b*) representing the manus and an astragalus, calcaneum (fig. 29*a*), and the third (fig. 29*c*) and fifth (fig. 29*d*) metatarsals from the pes. There is no evidence to show that these bones are from the same individual.

These elements are much too big to belong to a large jaguar or even an unusually large puma. The proportions are comparable to those in the foot of a specimen of *Felis tigris* or *F. leo*. The scapholunar is distinctly larger than in any of the tiger or lion carpi examined and shows a relatively deeper groove for its articulation with the magnum. However, the second metacarpal, though equally as long as in these large Asiatic and African cats, is somewhat slenderer, and the proximal end does not have so large an articular facet for the trapezoid.

The Cumberland Cave astragalus and calcaneum are of about the same size as in an adult *Felis tigris*, although the posterior portion of the calcaneum is relatively short and the proximal end is noticeably heavy. The posterior dorsal surface of the calcaneum is not so sharply

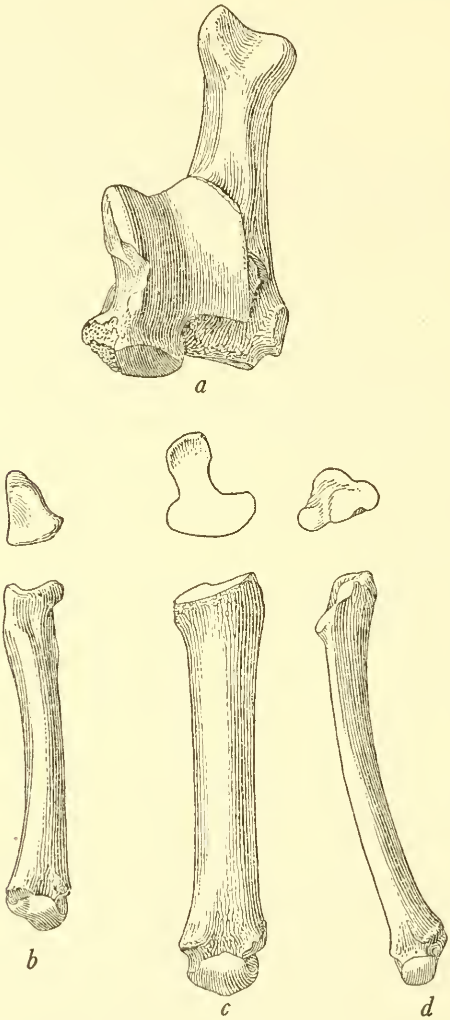


FIGURE 29.—*Felis* near *atrox* Leidy, foot bones (U.S.N.M. 12840): *a*, Astragalus and calcaneum, anterior view; *b*, second metacarpal, dorsal and proximal views; *c*, third metatarsal, dorsal and proximal views; *d*, fifth metatarsal, dorsal and proximal views. One-half natural size. Cumberland Cave Pleistocene, Maryland.

keeled as in available specimens examined of either *F. tigris* or *F. leo*. The third metatarsal is as large and robust as in specimens of *F. tigris*, but the fifth metatarsal though fully as long as in the tiger is distinctly slenderer.

A comparison of the foot elements from Cumberland Cave with those of *Felis atrox* from Rancho La Brea figured by Merriam and

Stock (1932, figs. 74, 92, 103, 106, 126, 130) shows the scapholunar, astragalus, calcaneum, and third metatarsal to be markedly similar to the corresponding elements in the California material but nearly one-third smaller. However, their dimensions are only slightly less than those given for a small individual in each case. The second metacarpal and fifth metatarsal in addition to being smaller are relatively slenderer than in the Rancho La Brea form.

A third metacarpal in the Port Kennedy collection, referred by Cope (1899, pp. 247–249) to *F. inexpectata*, compares favorably in length with the corresponding bone of a large puma but belongs to a foot much smaller than that indicated by the second metacarpal from Cumberland Cave. A fourth metacarpal from Conard Fissure bearing the number A.M.N.H. 11787, as does the type of *F. longicrus*, is as robust as in *F. tigris* but markedly shorter, resembling that of a saber-tooth form.

TABLE 15.—*Measurements (in millimeters) of foot bones of* Felis *cf.* atrox

| Measurement | U.S.N.M. no. 12840 |
|---|---|
| Transverse width of scapholunar measured across medial portion of radial facet | 44 |
| Greatest length of second metacarpal | 94 |
| Greatest diameter of proximal end of second metacarpal | 21 |
| Greatest transverse diameter of proximal end of second metacarpal | 15.2 |
| Length of calcaneum between groove for achilles tendon and cuboid facet | 99.5 |
| Width of calcaneum across sustentacular and ectal facets | 38 |
| Length of astragalus between center of navicular facet and most remote portion of tibial facet on inner condyle | 52 |
| Greatest length of third metatarsal | 113 |
| Dorsoventral diameter of proximal end of third metatarsal | 29 |
| Transverse diameter of proximal end of third metatarsal | 24 |
| Greatest length of fifth metatarsal | 111.5 |
| Greatest diameter of proximal end of fifth metatarsal | 17.1 |

## Order RODENTIA

### Family SCIURIDAE

#### MARMOTA MONAX (Linnaeus)

In the collection from the Cumberland Cave deposit there are a number of specimens referable to a single species of woodchuck. They include seven nearly complete skulls, several lower jaws, and other bones of the skeleton. The better-preserved carry the National Museum catalog numbers 7997, 8127, 8157, 8158, and 8183.

The cheek teeth in the cave specimens average somewhat less in size and the skulls average somewhat larger compared with a large series of the living species, but in these and all other differences noted they fall well within the range of individual variation of *Marmota monax*. For this reason they are referred to the living species.

### CITELLUS cf. TRIDECEMLINEATUS (Mitchill)

A single specimen, an incomplete left ramus of a mandible, U.S.N.M. no. 12054, containing the incisor (broken at alveolus), $M_1$, and $M_2$, represents the ground squirrels in the Cumberland Cave collection. This specimen is about the size of *Citellus tridecemlineatus*, to which it is provisionally referred. The two lower cheek teeth preserved are slightly less compressed anteroposteriorly relative to their width than is common in living specimens. The absence of more complete material prohibits a satisfactory comparison with the Recent form.

### TAMIAS cf. STRIATUS (Linnaeus)

A fragmentary lower jaw, U.S.N.M. no. 12367, included in the rodent material is recognized as belonging to a chipmunk. The lower cheek teeth are present though badly worn, and the incisor is broken away at the alveolar border. The specimen is not complete posterior to the last molar. The jaw is comparable in size and proportions to that of the living species, *Tamias striatus*. No characters were observed that would serve to distinguish the fossil from the form now living in the same region.

### SCIURUS (TAMIASCIURUS) TENUIDENS Hay

Figure 30

The species *Sciurus tenuidens* was described by Dr. Hay (1920, pp. 104–105, pl. 4, fig. 20) on what he believed to be an upper incisor in a part of a skull from a cave deposit near Cavetown, Md. It was found upon removing the matrix that the specimen is a right lower jaw portion with the lower incisor. The cheek teeth were not preserved. As an inferior jaw the specimen does not possess such marked characters distinguishing it from *Sciurus hudsonicus*. The portion of the jaw preserved is rather robust, and the incisor is relatively narrow transversely and of greater anteroposterior diameter than in *S. hudsonicus*. Also, the mental foramen appears to be placed lower on the side of the ramus than in the recent specimens examined.

Sciurid material in the Cumberland Cave collection includes three skull portions and four mandibular rami. The form represented clearly belongs to the group *Tamiasciurus* but is apparently distinct from *S. hudsonicus*. The mandible is more robust and possesses a lower incisor of relatively great anteroposterior diameter and hence presumably represents the Cavetown form, *S. tenuidens*. On the basis of skull U.S.N.M. no. 8164 (fig. 30*a* and *b*) and a nearly complete left ramus of mandible U.S.N.M. no. 12050 (fig. 30*c*) from Cumberland Cave, the species is redescribed.

*Specific characters.*—Size about that of *Sciurus fremonti*, larger than the average of the *S. hudsonicus* group. Skull with notably broad frontal region and with short, deep muzzle. Viewed from the side, occiput more elevated than in the living species, giving a less convex contour to the cranium. Anterior zygomatic region widely expanded, with its outer rim strongly turned downward and extending forward well beyond the maxillary-premaxillary suture, thus giving an unusually broad surface for the attachment of the anterior portion of the masseter-lateralis. Jugal relatively deep,

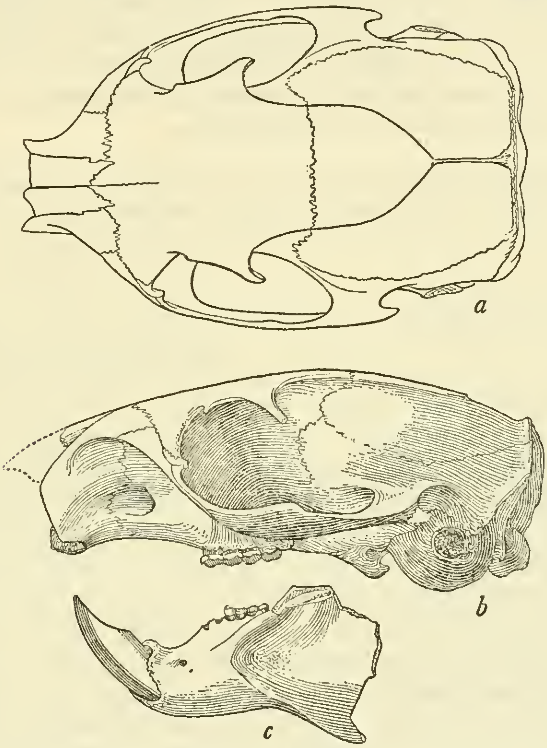



FIGURE 30.—*Sciurus* (*Tamiasciurus*) *tenuidens* Hay, skull (U.S.N.M. no. 8164), and mandible (U.S.N.M. no. 12050): *a*, Dorsal view of skull; *b*, lateral view of mandible. × 1½. Cumberland Cave Pleistocene, Maryland.

about one-fourth deeper than the average in the living species. Bullae much as in the living members of the group but more inflated backward and outward, in posterior portion, giving a decidedly flatter appearance to the posterior wall of its inner face and to the outer face directly below the external auditory meatus. External auditory meatus smaller than in living species.

Incisors more robust, with greater anteroposterior diameter than in the living species. Cheek-tooth row of equal length with that of *Sciurus fremonti*, and of *S. hudsonicus* from the Fort Yukon district, but teeth slightly narrower.

Lower jaw relatively deep, short, and massive, with broadly expanded angle. Anterior portion of masseteric fossa deeper and broader and with more robust border ridge than in specimens of equivalent maturity.

The red-squirrel material from the Conard Fissure was referred by Brown (1908, pp. 192–193) to *Sciurus hudsonicus*. Without a critical comparison of actual material it seems that the Conard Fissure material represents a species close to *Sciurus tenuidens*, although certain features, as the slightly less robust incisors, the less extreme depth of the lower jaw angle, the apparently larger external auditory meatus, and the more convex longitudinal profile of the posterior portion of the cranium ally it perhaps more nearly to the living *S. fremonti* of the Rocky Mountain region.

TABLE 16.—*Measurements (in millimeters) of skull, mandible, and dentition of* Sciurus tenuidens *and* S. hudsonicus

| Measurement | *Sciurus tenuidens* | | | *Sciurus hudsonicus* |
|---|---|---|---|---|
| | U.S.N.M. no. 9197 (type) | U.S.N.M. no. 8164 | U.S.N.M. no. 12054 | U.S.N.M. no. 151654 (Div. Mamm.) |
| Length, posterior margin of incisor alveolus to condyles | ---------- | 40.2 | ---------- | 39.5 |
| Depth of rostrum below nasofrontal suture | ---------- | 12.8 | ---------- | 12 |
| Width of skull across postorbital constriction | ---------- | 14.5 | ---------- | 13.5 |
| Length of diastema between alveolus for I and $P^4$ | ---------- | 12.4 | ---------- | 11 |
| Length of tooth series, $P^4$ to $M^3$, inclusive | ---------- | [1] 7.4 | ---------- | 7.8 |
| Transverse width of $M^2$ | ---------- | [1] 2.2 | ---------- | 2.3 |
| Depth of jaw below $P_4$ | ---------- | ---------- | 8.7 | 8.5 |
| Length of diastema between alveolus for I and alveolus for $P_4$ | 4.7 | ---------- | 4.8 | 5.4 |
| Length of tooth series from $P_4$ to $M_3$ measured at alveolar borders | [1] 8 | ---------- | [1] 8.1 | 8.2 |
| Anteroposterior diameter of lower incisor | 3.9 | ---------- | 3.5 | 3.2 |
| Transverse diameter of lower incisor | 1.3 | ---------- | 1.5 | 1.2 |
| Transverse width of $M_2$ | ---------- | ---------- | 2.2 | 2.2 |

[1] Approximate.

### GLAUCOMYS species

The flying squirrels are represented in the Cumberland Cave collection by a single specimen, a broken lower jaw, U.S.N.M. no. 7687, carrying three teeth, $P_4$ to $M_2$. This fragment of jaw indicates a species larger than *Glaucomys volans*, not quite so large as *G. yukonensis*, and about the size of *G. sabinus*. The teeth combine characters of these three living species, with features of their own that suggest the specimen may represent a new species, but without more adequate material by which to determine possible ranges of variation it is preferred not to give it a definite assignment.

The general characters noted in the Cumberland Cave specimen are as follows: Length of cheek teeth series $P_4$ to $M_2$=5.3 mm; greatest width of $M_2$=2 mm. (*G. volans* length of cheek teeth $P_4$ to $M_2$=4.2; width of $M_2$=1.6 mm.) $P_4$ relatively large, with deep talonid valley that opens obliquely outward and backward through a notch that distinctly separates the hypoconid from the outward extension of the posterior rim of the basin. Paraconid, hypostylid, and entostylid of $P_4$ well developed. Basins of the molars broad and evenly concave. Space between protoconid and hypoconid relatively wide with very distinct valleys on each side of the well developed hypostyle. Inner rim of the cheek tooth crowns interrupted by a median, sharply defined notch.

## Family GEOMYIDAE

### PLESIOTHOMOMYS POTOMACENSIS Gidley and Gazin [13]

FIGURE 31

*Type.*—Portion of left ramus of mandible (fig. 31), U.S.N.M. no. 8166, with all cheek teeth. Incisor not preserved beyond margin of alveolus.

*Generic characters.*—Anterior margin of symphysis of mandible very abrupt. Pit on lingual side and at base of ascending ramus shallow, as in *Thomomys.* Masseteric crest nearly straight and extending high on mandible anteriorly. Lower molars oval in cross section and with enamel plates on anterior and posterior surfaces.

*Specific characters.*—Size near that in average adult specimens of *Thomomys fulvus.* Mandible robust with deep symphysis. Incisor relatively wide with anterior surface smooth and rounded. Lower cheek teeth relatively narrow transversely.

The pocket-gopher material in the Cumberland Cave collection referred to this species includes four other lower jaws, one of which, U.S.N.M. no. 12049, possesses a complete lower dentition.

*Comparison.*—These specimens present several interesting characters that seem to separate them clearly from both *Thomomys* and *Geomys.* The mandibles are remarkably deep and the symphysial portion is turned upward rather abruptly, causing the nearly straight anterior margin of the symphysis to form a sharp angle with the inferior margin of the ramus. Also, the noticeably straight masseteric crest rises anteriorly at a higher angle from the lower border of the jaw than in living forms, making the distance between the anterior extremity of the masseteric crest and the ventral limit of the symphysis relatively great.

The dentition of these specimens is unique in combining characters of both *Thomomys* and *Geomys.* The incisor has its anterior surface rounded as in *Thomomys* but is relatively wide. $P_4$ has its enamel plates as in both *Thomomys* and *Geomys*, but the columns of this tooth are well rounded and the internal reentrant fold is compressed, suggesting *Geomys.* The external fold is more open. The molars are widely oval in shape, perhaps even less compressed antero-

[13] Gidley and Gazin, 1933, pp. 354–356, fig. 7.

posteriorly than is common in *Geomys*. In *Thomomys* these teeth have their lingual portion tightly compressed and their buccal surface distinctly flattened and usually grooved longitudinally. However,

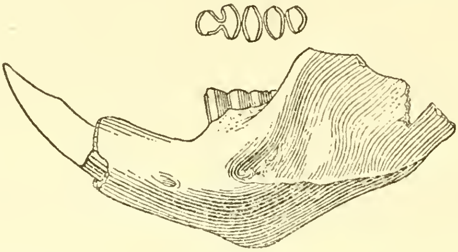


FIGURE 31.—*Plesiothomomys potomacensis* Gidley and Gazin: Left ramus of mandible, type specimen (U.S.N.M. no. 8166), lateral and occlusal views. ×2. Cumberland Cave Pleistocene, Maryland.

the molars in the fossil specimens have enamel developed on both anterior and posterior surfaces as in *Thomomys*. In *Geomys* only the posterior surface of these teeth has an enamel plate.

TABLE 17.—*Measurements (in millimeters) of mandible and dentition of* Plesiothomomys potomacensis *and* P. orientalis

| Measurement | *Plesiothomomys potomacensis* U.S.N.M. no. 8166 (type) | *Plesiothomomys potomacensis* U.S.N.M. no. 12049 | *Plesiothomomys orientalis* A.M.N.H. no. 23441 (type) |
|---|---|---|---|
| *Superior dentition* | | | |
| Length of diastema between alveoli of I and $P^4$ | ---------- | ---------- | 12 |
| Anteroposterior diameter of upper incisor | ---------- | ---------- | [1] 1.8 |
| Transverse diameter of upper incisor | ---------- | ---------- | 1.7 |
| $P^4$, anteroposterior diameter at occlusal surface | ---------- | ---------- | 2.2 |
| $P^4$, transverse diameter of anterior lobe | ---------- | ---------- | 1.6 |
| $P^4$, transverse diameter of posterior lobe | ---------- | ---------- | 1.8 |
| $M^1$, anteroposterior diameter at occlusal surface | ---------- | ---------- | 1.1 |
| $M^1$, transverse diameter | ---------- | ---------- | 1.9 |
| *Mandible and inferior dentition* | | | |
| Distance between lowest point on dorsal surface of mandible anterior to $P_4$ and ventral extremity of symphysis | 9 | 8.5 | ---------- |
| Length of diastema between I and $P_4$ | [1] 8.1 | 8.6 | ---------- |
| Length of lower cheek-tooth series measured at occlusal surface | 7 | 7.6 | ---------- |
| I, anteroposterior diameter | ---------- | 2.3 | ---------- |
| I, transverse diameter | 2.1 | 2.2 | ---------- |
| $P_4$, anteroposterior diameter at occlusal surface | 2.6 | 2.8 | ---------- |
| $P_4$, transverse diameter of anterior lobe | 1.3 | 1.4 | ---------- |
| $P_4$, transverse diameter of posterior lobe | 2 | 2.1 | ---------- |
| $M_1$, anteroposterior diameter at occlusal surface | 1.4 | 1.5 | ---------- |
| $M_1$, transverse diameter | 2 | 2.2 | ---------- |
| $M_1$, auteroposterior diameter at occlusal surface | 1.5 | 1.6 | ---------- |
| $M_2$, transverse diameter | 1.9 | 2.1 | ---------- |
| $M_3$, anteroposterior diameter at occlusal surface | 1.5 | 1.6 | ---------- |
| $M_3$, transverse diameter | 1.7 | [1] 1.9 | ---------- |

[1] Approximate.

*Thomomys orientalis* Simpson (1928, pp. 6–7) from Saber-tooth Cave in Florida, although possessing characters that ally it to *Thomomys*, apparently should be included in the genus *Plesiothomomys*. The upper incisor in the Florida specimen shows a single shallow groove placed well toward the inner margin of the enamel, as in some modern species of *Thomomys*. Also, both $P^4$ and $M^1$ have the enamel complete across the posterior surface as in the western pocket gopher. However, the columns of these teeth are oval in cross section as in *Geomys* and the reentrant folds in $P^4$ are not so widely open as they are in *Thomomys*. Another interesting character observed in the type of *P. orientalis* is that the rostrum appears to be somewhat depressed anteriorly. This may be due in part to crushing, but the portion of the palate between the cheek teeth and incisors does not seem to ascend so steeply as in living species.

*P. orientalis* is a distinctly smaller species with smaller teeth than *P. potomacensis*, corresponding more nearly in size to specimens of *Thomomys fossor*.

## Family CASTORIDAE

### CASTOR CANADENSIS Kuhl

A single left upper molar in the Cumberland Cave collection, U.S.N.M. no. 12056, may be so exactly matched in specimens of the living species *Castor canadensis* that it must for the present be referred to this species. Height of crown (apparently not much worn) 23 mm; anteroposterior length, triturating surface, 6.5 mm; actual anteroposterior diameter 6 mm, width 6.5 mm.

## Family CRICETIDAE

### PEROMYSCUS cf. LEUCOPUS (Rafinesque)

The deer mice are represented in the cave collection by eight fragmentary mandibles with incisors. Seven of the specimens have one or more cheek teeth each. A comparison of this material with jaws of *Peromyscus leucopus* from the Recent fauna of Maryland failed to reveal any characters of diagnostic importance separating the fossil from the living form. Although more complete material including skulls may show important specific differences, this is not suggested in the mandibles. Several modern species of *Peromyscus*, as *P. maniculatus* and *P. leucopus*, have remarkable geographic distribution, and it seems not at all unlikely that their geologic range through Quaternary time may have been equally extensive.

### NEOTOMA MAGISTER Baird[13]

FIGURE 32

Three wood-rat mandibles, U.S.N.M. nos. 12033 (fig. 32), 12034, and 12035, in the collection apparently represent the large *Neotoma*

[13] Baird, 1857, p. 498.

*magister*. The specimens compare favorably in size with the cotype material from Carlisle Cave, Pa., being somewhat larger and deeper jawed than in an average living specimen of *N. pennsylvanica*.[14] The Cumberland Cave specimens are characterized by a relatively long mandibular symphysis, robust incisors, and cheek teeth with postero-external reentrant folds widely U-shaped and deeply pocketed at base.

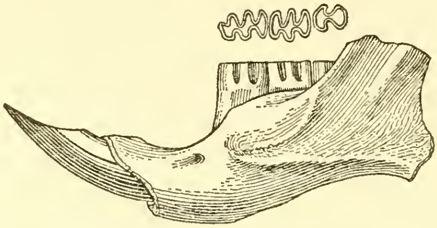


FIGURE 32.—*Neotoma magister* Baird: Left ramus of mandible (U.S.N.M. no. 12033), lateral and occlusal views. ×2. Cumberland Cave Pleistocene, Maryland.

The Cumberland form is readily distinguished from *N. floridana* by its greater size, larger incisors, and relatively longer diastema between incisor and cheek teeth.

*N. ozarkensis* Brown (1908, pp. 196–197) is apparently somewhat smaller than the Cumberland Cave wood rat, presumably nearer in size to *N. pennsylvanica*.

TABLE 18.—*Measurements (in millimeters) of mandible and inferior dentition of* Neotoma magister

| Measurement | U.S.N.M. no. 12033 | U.S.N.M. no. 12034 |
|---|---|---|
| Length of lower molar series measured at occlusal surface | 8.8 | 9.4 |
| Length of lower molar series measured along alveoli | 9.7 | 10 |
| $M_1$, anteroposterior length | 3.4 | 3.7 |
| $M_1$, transverse width | 1.9 | 2.1 |
| $M_2$, anteroposterior length | 2.8 | 3 |
| $M_2$, transverse width | 2.2 | 2.2 |
| $M_3$, anteroposterior length | 2.2 | 2.3 |
| $M_3$, transverse width | 1.9 | 1.9 |
| Depth of ramus at junction of $M_2$ and $M_3$ | 5.6 | 5.8 |

### PARAHODOMYS SPELAEUS Gidley and Gazin[15]

FIGURES 33, 34

*Type*.—Portion of the right ramus of a mandible (young individual), U.S.N.M. no. 12040 (fig. 33), with all cheek teeth and part of alveolus for incisor.

*Generic characters*.—Cheek teeth in general structure as in *Hodomys*, but with reentrant valleys, especially the external ones, shallower and

[14] The possibility of *N. pennsylvanica* Stone being a synonym of *N. magister* Baird was noted by Rhoads, 1894, pp. 213–221.

[15] Gidley and Gazin, 1933, pp. 356–357, figs. 8, 9.

directed nearly at right angles to the line of the tooth row. [They are directed more obliquely forward in *Hodomys*.] Anteroexternal valley of $M_1$ and $M_2$ very shallow and absent in $M_3$. [In *Hodomys* $M_3$ has a shallow but well-defined anterior reentrant in young specimens.] $M_3$ with a well-defined posterointernal reentrant valley. [This fold is absent in *Hodomys*.]

As seen in mandibles U.S.N.M. nos. 12037 (fig. 34) and 12041, the following additional characters appear as of generic importance:

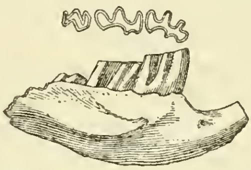


FIGURE 33.—*Parahodomys spelaeus* Gidley and Gazin: Right ramus of mandible, type specimen (U.S.N.M. no. 12040), lateral and occlusal views. × 2. Cumberland Cave Pleistocene, Maryland.

Symphysis relatively deep. Lower branch of masseteric ridge very prominent and sharply defined. Condyle relatively large and depressed so that condylar bar is directed backward to a much greater extent than in *Hodomys* and the notch between it and the coronoid process is much more widely open.

*Specific characters.*—Size about that of *Hodomys alleni*. Incisors relatively robust, causing a more prominent swelling of the lower

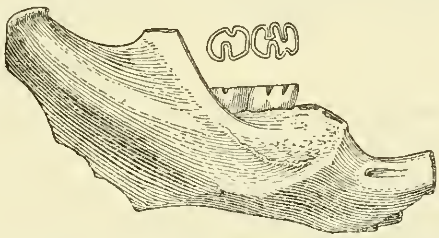


FIGURE 34.—*Parahodomys spelaeus* Gidley and Gazin: Right ramus of mandible (U.S.N.M. no. 12037), lateral and occlusal views. × 2. Cumberland Cave Pleistocene, Maryland.

border of the ramus than in *H. alleni*. Diastema between incisor and cheek teeth long. Posteroexternal reentrant folds in all molars shallow and pocketed at base, wearing at occlusal surface in wide open U-shaped pattern from summit to base of crown. Posterointernal reentrant fold well developed in $M_3$, extending somewhat below middle of crown but disappearing in old age.

The material referred to this form includes seven lower jaws in addition to the type, representing individuals in several stages of maturity.

*Comparison.*—The genus here described is known only from lower jaws but fortunately these reveal diagnostic characters that clearly distinguish it from the nearest related living genera, *Neotoma* and

*Hodomys*. Of these the most readily determinable characters are to be found in the last lower cheek tooth. In old individuals, showing well-worn teeth, this tooth, in fossil as well as in living genera, has but two reentrant angles, one on the inner, the other on the outer face of the crown. In *Neotoma* these reentrant valleys are oppositely placed and tend to divide the crown surface into two subequal areas. In *Hodomys* and *Parahodomys* the reentrants alternate, the inner being well in advance of the outer one, tending to form a more or less S-shaped enamel pattern on the triturating surface. However, the latter genera are readily distinguished from each other by the fact that in *Parahodomys* the reentrant valleys are directed almost at right angles to the longitudinal plane of the tooth row, while in *Hodomys* they slant well forward. In young individuals with slightly worn teeth, additional distinctions are apparent in that there is present a third reentrant fold in this posterior molar in all three genera, but this fold is peculiarly situated in the fossil form. In *Parahodomys* it occurs on the posterior internal lobe opposite the large external fold and extends downward to a point slightly below the middle of the crown. In *Neotoma* and *Hodomys* the third reentrant fold is on the anterior lobe of the outer side. It occurs only very near the summit of the tooth in *Neotoma*, but it extends down to about the middle of the tooth crown in *Hodomys*.

TABLE 19.—*Measurements (in millimeters) of mandible and inferior dentition of* Parahodomys spelaeus *and* Hodomys alleni

| Measurement | *Parahodomys spelaeus* | | *Hodomys alleni* |
|---|---|---|---|
| | U.S.N.M. no. 12040 (type) | U.S.N.M. no. 12037 | U.S.N.M. no. 91525 (Biol. Surv.) |
| Total length of jaw, condyle to incisor border | | 30 | 28.7 |
| Depth of symphysis | | 5.4 | 4 |
| Depth of ramus at point between $M_2$ and $M_3$ | | 7.3 | 6.5 |
| Height of condyle above level of cheek tooth row | | 7 | 10 |
| Length of cheek tooth row measured at alveolar borders | 9.5 | 9.5 | 10.8 |
| $M_1$, anteroposterior diameter | 3.2 | | 3.6 |
| $M_1$, transverse diameter | 2 | | 2.3 |
| $M_2$, anteroposterior diameter | 2.8 | 3 | 3.5 |
| $M_2$, transverse diameter | 2.1 | 2.4 | 2.5 |
| $M_3$, anteroposterior diameter | 2.4 | 2.5 | 2.9 |
| $M_3$, transverse diameter | 2 | 2 | 2.1 |

**SYNAPTOMYS cf. COOPERI Baird**

The anterior portion of a single lower jaw, U.S.N.M. no. 7774, in the Cumberland Cave collection, carrying the incisor and first molar, represents a species of *Synaptomys* that corresponds in size and is not otherwise clearly distinguishable from *S. cooperi*. In the many specimens of the living species of this genus examined the triangles of the molars are more tightly closed than in the fossil specimen. This is the only difference observed, but if it could be verified in a large number of specimens it might constitute a species distinction.

#### SYNAPTOMYS (MICTOMYS) species

The subgenus *Mictomys* is also represented in the Cumberland Cave collection by a single specimen, a broken lower jaw, U.S.N.M. no. 7773, with complete dentition. No characters were observed by which the fossil form could be distinguished from the living species, *S.* (*M.*) *borealis*. This species is currently recognized to contain all the races within the subgenus *Mictomys*. However, all the lemming mice of this group are at present Canadian and Alaskan in distribution (Howell, 1927, p. 19), extending down into northern Washington and northern New Hampshire in the United States. Although the fossil appears to demonstrate the presence of this modern boreal species in the Pleistocene of Maryland, its occurrence so far outside of the present distribution suggests that a distinct species may be represented. Additional importance is to be attached to this occurrence in furnishing the first Pleistocene record of *Mictomys* (Gidley, 1913b, p. 96).

#### MICROTUS (or PITYMYS?) cf. INVOLUTUS (Cope) [16]

FIGURE 35

The voles are very sparsely represented in the Cumberland Cave collection. Seven fragmentary specimens, one a part of a palate with the two anterior cheek teeth on the right side, the others broken mandibles, comprise the lot.

The material is clearly microtine in character but is apparently distinct from North American living species. The root portion of the lower incisor in the Cumberland Cave form passes between the lower portions of the penultimate and ultimate molars as in voles, and the cheek teeth are without roots in those specimens where this character can be observed. However, the pattern of the first lower cheek tooth is somewhat simpler than in the living pine-mice of the region. This tooth, presumably $M_1$, is characterized by a posterior loop followed forward by three closed triangles, a pair of confluent triangles opening into an anterior loop. In these characters the fossil jaw resembles *Pitymys* but unlike the form living in the same region at the present time, *P. pinetorum*, the anterior loop of $M_1$ in three of the six jaws is without reentrant angles. Two specimens have shallow reentrant angles on both inner and outer surfaces, nearly as in *P. pinetorum*, and one has a shallow groove on the antero-internal surface of the anterior loop (fig. 35). Furthermore, the posterior surfaces of the triangles in the lower cheek teeth are slightly more convex, and isolation of the triangles is not so marked as in specimens of *P. pinetorum*.

[16] Cope, 1871, pp. 89–90, fig. 16.

Also $M_3$ is somewhat more robust than is common in the Recent species.

*Microtus pennsylvanicus*, the typical microtine form living in Maryland today, exhibits a more complex pattern in the first lower tooth.

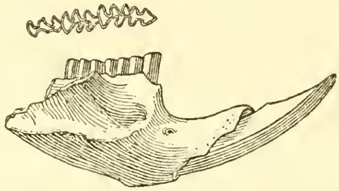


FIGURE 35.—*Microtus* (or *Pitymys*?) cf. *involutus* (Cope): Right ramus of mandible (U.S.N.M. no. 12386), lateral and occlusal views (pattern of $M_3$ taken from mandible U.S.N.M. no. 7772). × 3. Cumberland Cave Pleistocene, Maryland.

Presumably *M. pennsylvanicus* is to be regarded as possessing a more advanced type of dentition.

TABLE 20.—*Measurements (in millimeters) of dentition of* Microtus(?) *cf.* involutus *and* M. dideltus

| Measurement | *Microtus*(?) cf. *involutus* | | | | | *Microtus*(?) *dideltus* | |
|---|---|---|---|---|---|---|---|
| | U.S. N.M. no. 7686 | U.S. N.M. no. 12602 | U.S. N.M. no. 7772 | U.S. N.M. no. 12368 | A.M. N.H. no. 8699a | A.M. N.H. no. 8695 | A.M. N.H. no. 8694 (type) |
| *Superior dentition* | | | | | | | |
| I, anteroposterior diameter | 1.2 | | | | | | |
| I, transverse diameter | 1 | | | | | | |
| $M^1$, anteroposterior diameter [1] | 2.2 | | | | | 2.4 | |
| $M^1$, transverse diameter | 1.1 | | | | | 1.3 | |
| $M^2$, anteroposterior diameter | 1.6 | | | | | 1.8 | |
| $M^2$, transverse diameter | 1 | | | | | 1.2 | |
| $M^3$, anteroposterior diameter | | | | | | 1.9 | |
| $M^3$, transverse diameter | | | | | | 1.1 | |
| *Inferior dentition* | | | | | | | |
| I, anteroposterior diameter | | 1.2 | 1.2 | 1.3 | | | |
| I, transverse diameter | | 0.9 | 1 | 1 | 1 | | [2] 1.5 |
| $M_1$, anteroposterior diameter | | 2.6 | 2.5 | 2.7 | 2.5 | | 3 |
| $M_1$, transverse diameter | | 1.1 | 1 | 1 | 1 | | 1.2 |
| $M_2$, anteroposterior diameter | | 1.5 | 1.5 | 1.6 | [3] 1.5 | | |
| $M_2$, transverse diameter | | 0.9 | 0.9 | 1 | 1 | | |
| $M_3$, anteroposterior diameter | | 1.5 | 1.4 | | 1.3 | | |
| $M_3$, transverse diameter | | 0.8 | 0.7 | | 0.7 | | |
| Length of lower cheek-tooth series measured at occlusal surface | | 5.7 | 5.7 | | [3] 5.6 | | |

[1] Anteroposterior dimensions taken at occlusal surface.
[2] Dimension as given by Cope but not verified.
[3] Approximate.

The Cumberland Cave form corresponds closely in size to the type of *Microtus*? *involutus* (Cope) from the Pleistocene of Pennsylvania.

The enamel pattern of the lower cheek teeth is markedly similar in the two forms. It is important to note that the anterior triangles in the first lower cheek tooth of the type are confluent as in *Pitymys*, not as in Cope's illustration. This error in the drawing tends to exaggerate the appearance of the anterior loop, which in reality is not greatly different from that in some of our specimens. Cope noted the resemblance between his form and *P. pinetorum*, but apparently the Pleistocene form is distinct from the living species in exhibiting a slightly simpler enamel pattern.

The teeth in *Microtus*(?) *speothen* (Cope, 1871, pp. 87–88, fig. 13) and *M.*(?) *dideltus* (Cope, 1871, p. 89, fig. 15) are distinctly larger than in the Cumberland Cave form. In *M.*(?) *speothen* the enamel pattern in the first lower cheek tooth is of a different type than that in *Pitymys*. This tooth in *M.*(?) *dideltus*, while showing confluent anterior triangles as in *Pitymys*, has an anterior loop that is narrow and elongate, and the portion of the tooth posterior to the loop is relatively wide.

As noted by G. S. Miller, Jr. (1896, p. 59), the anterior lower cheek tooth of *Pitymys* is not different from that in *Pedomys*, or *Microtus ochrogaster*, living in the Mississippi Valley. Hence, reference of the Cumberland fossil to the genus *Pitymys* in the absence of satisfactory skull material cannot be made with certainty.

#### ONDATRA cf. ANNECTENS (Brown) [17]

FIGURE 36

A very small species of *Ondatra* is represented in the Cumberland Cave material by a broken mandibular ramus (fig. 36), U.S.N.M. no. 12044, containing all the teeth. In size this specimen agrees closely with the type of the Conard Fissure species, *O. annectens*, being only slightly smaller and possessing a somewhat narrower incisor. It agrees with *O. annectens* in most other important details observed and is therefore provisionally referred to this species.

It was suggested by Hollister (1911, pp. 33–34) that Brown had wrongly interpreted some of the characters described. Brown considered the Conard Fissure species as "an intermediate type connecting *Fiber* (=*Ondatra*) with *Microtus* through the subgenus *Neofiber*." The type of *O. annectens* as observed by Hollister indicates "a species close to existing forms in everything except size", and he stated that the "anterior loop of first lower molar is more deeply cut by the reentrant angles than in any specimen of an existing species examined." If these anterior reentrants are to be considered within the loop, as implied by Hollister, then the number of reentrants in $M_1$ posterior to the loop on each side appears to be one less than in *O. zibethica*, approaching the condition seen in *Neofiber alleni*. In either case the

[17] Brown, 1908, p. 197.

columnar portion anterior to the fifth reentrant, counting forward along the inner side of the tooth, is not so well developed in *O. annectens* as in *O. zibethica*. Advanced wear in $M_1$ of *O. zibethica* may show this column or loop to be without reentrants although well developed.

In the description of *O. annectens* Brown called attention to the markedly reduced condition of the anteroexternal column of $M_3$. This column is not more reduced in the Cumberland Cave specimen than in certain specimens of *O. zibethica*. In *Neofiber* this column is greatly reduced.

In both the Cumberland Cave and Conard Fissure jaws the surfaces for the attachment of the masseter muscles are nearly alike but differ slightly from those of the living species of *Neofiber* and *Ondatra*.

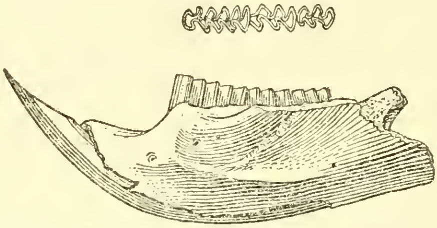


FIGURE 36.—*Ondatra* cf. *annectens* (Brown): Left ramus of mandible (U.S.N.M. no. 12044), lateral and occlusal views. × 2. Cumberland Cave Pleistocene, Maryland.

The masseteric crest in general is bulging and sharply keeled, and there is a well-defined groove marking the posterior margin of the area for attachment of the anterior masseter medialis. The distinguishing feature, however, lies in the position of this sulcus, which in *O. annectens* has its origin much farther back from the anterior end of the masseteric ridge from where it curves sharply upward, leaving a definitely wider margin between it and the anterior border of the ascending ramus. It is further noted in the Conard Fissure jaw that the shaft leading to the condyle carries a fairly well developed sulcus on its anterior face nearly as in *Ondatra zibethica*. This sulcus is incipient or absent in *Neofiber*.

TABLE 21.—*Measurements (in millimeters) of inferior dentition of* Ondatra *cf.* annectens

| Measurement | U.S.N.M. no. 12044 | A.M.N.H. no. 12424 (type) |
|---|---|---|
| Length of cheek-tooth series measured at alveolar margins | [1] 11.5 | 12 |
| Length of cheek-tooth series measured along occlusal surface | 10.5 | 10.9 |
| $M_1$, anteroposterior length at occlusal surface | 5.1 | 5.4 |
| $M_1$, transverse width | 2.1 | 2.2 |
| $M_2$, anteroposterior length at occlusal surface | 2.7 | 2.8 |
| $M_2$, transverse width | 2 | 2 |
| $M_3$, anteroposterior length at occlusal surface | 2.7 | 2.7 |
| $M_3$, transverse width | 1.6 | 1.6 |

[1] Approximate.

*O. annectens* seems to stand as a well-defined species of *Ondatra* but is presumably less advanced than the living species. *Neofiber* may be considered as still less advanced in the development of the pattern reached in $M_1$, although more advanced in degree of hypsodonty.

## Family ZAPODIDAE

### ZAPUS species

The genus *Zapus* is represented in the Cumberland Cave material by part of the right ramus of a mandible, U.S.N.M. no. 7777, carrying all the cheek teeth. This jaw represents an old individual in which the teeth are considerably worn. They nevertheless present the characters peculiar to the genus to which the specimen is referred and show certain peculiarities that prevent assigning the form to any known species. The material, however, is not sufficiently complete to warrant establishing a new species.

The tooth crowns of $M_1$ and $M_2$ are relatively shorter and the anterior main lobe of $M_1$ is relatively wide as compared with those examined of a large series of specimens of the living species.

### NAPAEOZAPUS cf. INSIGNIS (Miller)

A second lower jaw, U.S.N.M. no. 12366, of a jumping mouse in the collection is recognized as belonging to the woodland form *Napaeozapus*. This jaw fragment is from the left side and has the incisor and last two molars preserved. $M_1$ is represented by the alveoli and root portions. The jaw is distinctly larger and has larger teeth than the specimen referred to *Zapus*. Moreover, the two molar teeth show a tightly folded, complex pattern on the occlusal surface, which resembles *Napaeozapus* more closely than *Zapus*.

The fossil compares favorably in proportions with specimens of the living species, *N. insignis*, differing in having a slightly more robust incisor, which appears to be somewhat less curved than is common in the modern form. Also, the alveoli for $M_1$ suggest that this tooth may have been a little longer anteroposteriorly than in *N. insignis*.

## Family ERETHIZONTIDAE

### ERETHIZON cf. DORSATUM (Linnaeus)

FIGURE 37

The porcupine is represented in the Cumberland Cave collection by about 15 determinable specimens, including the greater part of 3 skulls and 12 broken lower jaws.

In North America, according to Miller's list of Recent mammals (Miller, 1924), there are two living species of *Erethizon* now recognized: *E. dorsatum* and *E. epixanthum*. The former comprises two subspecies and the latter five subspecies. Apparently the distinction between the two full species is based solely on color differences in the pelage. In an examination of a series of Recent skulls and jaws in the collections of the U. S. National Museum and U. S. Biological Survey, it was found that they show a wide range of individual and sex variations and that it was apparently not feasible to formulate a series of definite characters that would satisfactorily separate the two species.

The specimens from Cumberland Cave likewise show considerable variation but apparently not exceeding in any important details the limits of individual variation seen in modern specimens.

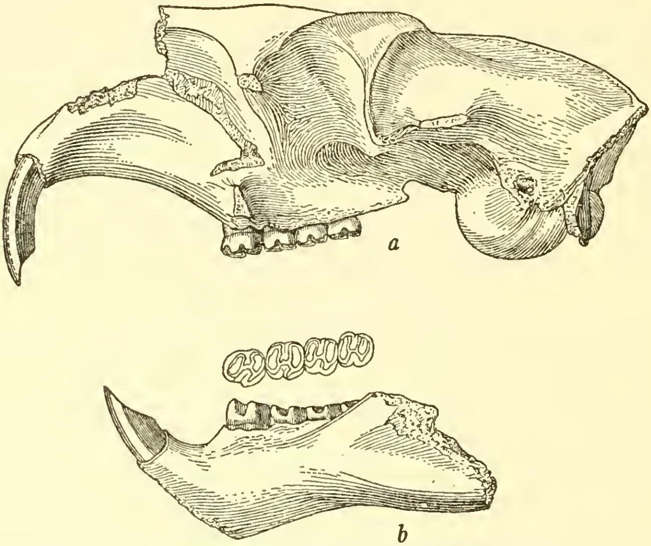



FIGURE 37.—*Erethizon* cf. *dorsatum* (Linnaeus): *a*, Skull (U.S.N.M. 7996), lateral view; *b*, mandible (U.S. N.M. no. 7672), lateral and occlusal views. Two-thirds natural size. Cumberland Cave Pleistocene, Maryland.

A remarkably large skull (fig. 37*a*), U.S.N.M. no. 7996, in the cave collection is characterized by a noticeably broad frontal region, wide palate, and particularly broad incisors. The incisors appear to be slightly wider than in the Recent specimens examined, although other proportions characterizing this skull seem to be duplicated in some of the larger of the modern specimens.

## Order LAGOMORPHA

### Family OCHOTONIDAE

#### OCHOTONA species

Six fragmentary mandibles and three maxillary portions, all carrying teeth, are recognized as belonging to a species of *Ochotona*. With this limited material no important differences can be cited separating it from the living species of North America, nor can it be assigned to any modern form with certainty.

The form corresponds favorably in size with specimens of both *O. princeps* and *O. schisticeps.* Although the dentition is closely the same as in these Recent species, the styles or columns on the inner and outer surfaces of the lower molariform teeth in a couple of the fossil mandibles are slightly closer together than is common in North American *Ochotona.* This condition sharpens or narrows somewhat the inner and outer reentrant angles.

The presence of *Ochotona* in the fauna is significant inasmuch as the North American species are found living only in the western and northwestern part of the country. The present occurrence shows the pika to have been present in the Appalachian region in Pleistocene time.

The fossil record of *Ochotona* is very scanty. A form described by Cope (1871, pp. 93–94) as *Praotherium palatinum* from the Port Kennedy deposit may possibly be *Ochotona.* The Cumberland Cave specimens, however, do not conform to the description given by Cope. The upper molariform teeth of the Maryland *Ochotona* show a pronounced external groove as in the living species and an enamel ridge divides the occlusal surface of each tooth. Furthermore, the first, second, and last teeth of the cheek series are structurally distinct from one another and from the two intermediate teeth, as in living pikas. According to Cope the four upper teeth preserved in the tooth row of *P. palatinum* are structurally alike; also, their external surfaces are not markedly grooved and the occlusal surface of each does not show a distinct median ridge.

## Family LEPORIDAE

### LEPUS cf. AMERICANUS Erxleben

Hares are well represented in the cave collection. At least 10 skull portions and 19 lower jaws are included in the material. A noticeable range in size and proportions of skulls, jaws, and teeth exists, though apparently within the limits of individual variation. No persistent characters of importance were noted distinguishing the fossil from the living hare, *L. americanus.* However, it is possible that some of the smaller, more incomplete lower jaws may represent *Sylvilagus,* but none of the skull portions shows the distinct interparietal and postorbital processes formed as in *Sylvilagus.*

# Order PROBOSCIDEA

## Family MASTODONTIDAE

### MAMMUT cf. AMERICANUM (Kerr)

A mastodon is represented in the Cumberland Cave collection by four juvenile teeth and a tibia without epiphyses. The teeth are apparently the second, third, and fourth left and the third right of the lower-jaw series.

There is nothing to distinguish these scanty remains from the typical *Mammut americanum.*

# Order PERISSODACTYLA

## Family EQUIDAE

### EQUUS species

The genus *Equus* is represented in the Cumberland Cave collection by only three teeth and three toe bones. The teeth, an upper and a lower of one individual and an upper of a second individual, are those of juveniles; they represent the milk dentition. The toe bones are two first phalanges and a metacarpal, representing adult individuals. These specimens belong to one of the large species of eastern horse, as *E. complicatus* or *E. pectinatus,* but on this incomplete material an attempt to determine the exact species represented would be no more than guess work, based on size alone.

One peculiarity of the foot bones may be mentioned. Both the metacarpal and phalanges are relatively wide for their length and depth as compared with the western species of Pleistocene horses, suggesting a species with short stocky limbs.

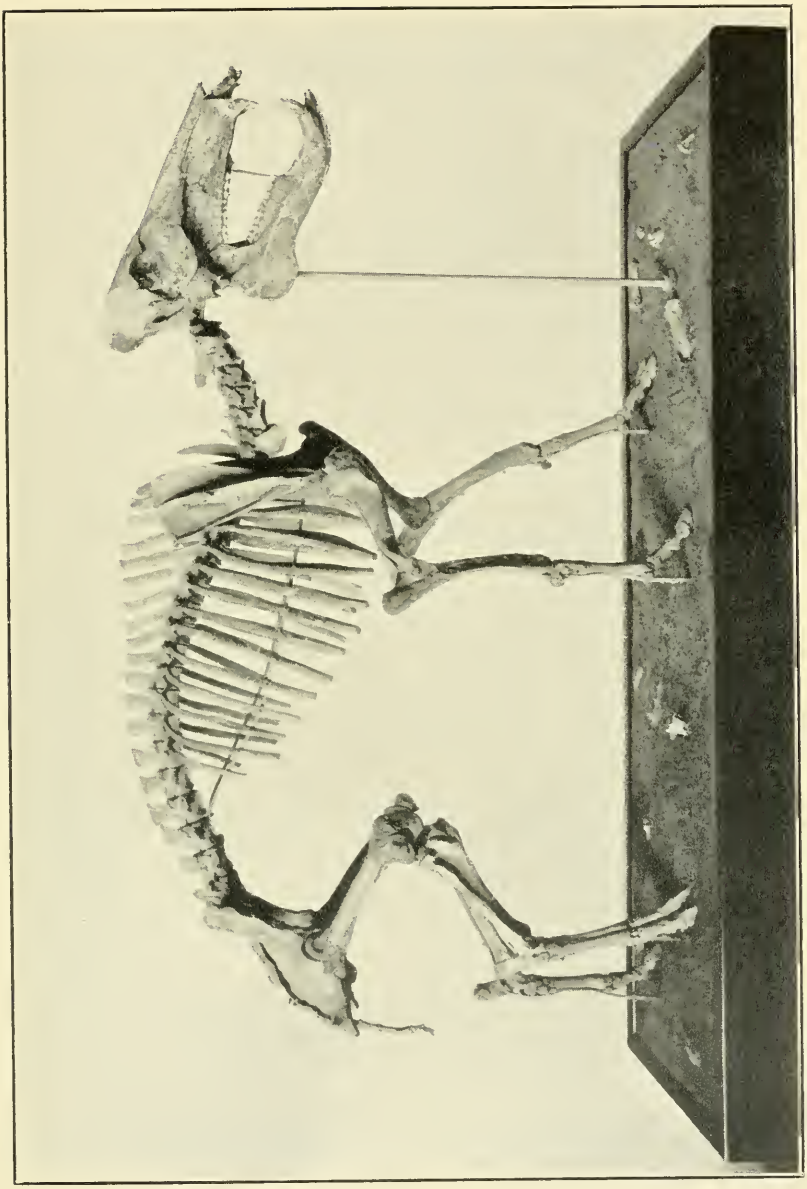
## Family TAPIRIDAE

### TAPIRUS species

Figure 38

Two last lower molars (see fig. 38) of the right side belonging to adult individuals, and a fragment of a left upper premolar of a third and much younger individual, represent the tapirs in the Cumberland Cave collection.

These teeth indicate a species somewhat larger than the living tapirs of South and Central America and the Florida Pleistocene tapir, *T. veroensis* Sellards, but not quite so large as *T. haysii* Leidy. Also they are of narrower proportions than the corresponding tooth in the Port Kennedy specimen, which has been assigned to *T. haysii.* In a study of lower teeth of a series of the living species of tapirs, the proportions



Mounted skeleton of peccary (*Platygonus cumberlandensis* Gidley) from Cumberland Cave. Exhibited in U. S. National Museum.

of length to width seem to run fairly constant; hence the extreme narrowness of the molars from the Cumberland Cave suggest they

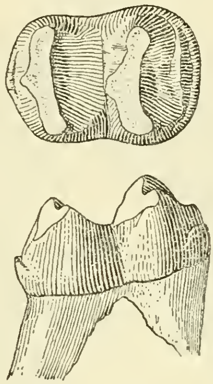


FIGURE 38.—*Tapirus* sp.: Last lower molar (U.S.N.M. no. 7667), lateral and occlusal views. Natural size. Cumberland Cave Pleistocene, Maryland.

may represent an undescribed species. But a more complete dental series is necessary to confirm such a conclusion certainly.

## Order ARTIODACTYLA

### Family TAYASSUIDAE

#### PLATYGONUS CUMBERLANDENSIS Gidley [19]

FIGURES 39–45; PLATE 10

Synonym: *Platygonus intermedius* GIDLEY.

The type of this species is a nearly complete skull (figs. 39–41), U.S.N.M. no. 8146, including all the cheek teeth but without canines or incisors, and the symphysial portion and left ramus of mandible with inferior cheek teeth and both canines. A nearly complete skeleton of an adult female, U.S.N.M. no. 8200, was designated as a paratype.

The peccary skeleton (see pl. 10) has been mounted and is on exhibition with the bear and wolverine skeletons also from the cave. The skull and mandible belonging to this specimen are slightly crushed but required no restoration. Nearly all the elements of the vertebral column are preserved; only the tips of the spines and processes needed modeling. Many of the ribs were preserved and much of the sternum. The pectoral and pelvic girdles were badly fractured and required some patching. The fore limbs and feet are complete except for the distal portion of the right ulna and one left and two right carpals, which are represented in plaster. The hind limbs are also nearly

[19] Gidley, 1920b, pp. 659–673.

entire; only the left required restoration. All the parts of the hind feet are represented, but in this case one or two elements have been substituted from the general collection.

Peccaries were one of the commonest forms found in the cave, exceeding even the black bears in quantity of material. There are 22 skulls more than half complete, 12 of which are nearly entire. Seventeen mandibles including the greater part of both rami are preserved. In addition to the skeleton described above, there is also an articulated hind foot (fig. 45) and a large number of isolated vertebrae and limb and foot bones.

The following characters were given by Gidley as distinguishing *P. cumberlandensis* from other Pleistocene species of *Platygonus:*

> A large species, nearly equalling *P. vetus* in size. Length of cheek-tooth series, type (male) 94 mm.; paratype (female), 87 mm. Differs also from *P. vetus* in having a greater relative length of the molars in animals of corresponding age, and in the possession in the upper molars of well-developed intermediary cusps and lophs, which connect at their bases the two principal cross lophs, as in *P. compressus* and *P. leptorhinus*. It differs from both these last named species in the much larger size of the skull, in which there is a relatively higher and more backwardly produced inion and a more strongly developed expansion of the zygoma, the latter being about one and one-third times the vertical diameter of the orbit in the females, and two or more times this diameter in the males.

Apparently the most distinctive features of this form are the elongate skull, the marked backward projection of the inion accompanied by a decided backward-sloping occiput, and the unusual extension of the zygoma downward and forward from the orbit. The development of the zygoma varies considerably with the age of the individual and between sexes, but it seems to have progressed farther in this species than in others as known.

A second species described by Gidley as *Platygonus intermedius* (figs. 42–44) does not appear to possess sufficiently well defined characters to justify distinct recognition. The relative sizes of teeth and skull and the length of the diastema between canine and second premolar are not persistent enough throughout the series of specimens to warrant this specific division.

A comparison of the limb and foot material of *P. cumberlandensis* with that described by Leidy (1889a) as belonging to *P. compressus* and that for *P. leptorhinus* by Williston (1894) disclosed important characters in the Cumberland Cave form. *P. cumberlandensis* possesses longer and heavier limb bones in keeping with the larger and more elongate skull in this form than in either *P. compressus* or *P. leptorhinus.* This may be noticed even in the relatively slightly built female skeleton. On the other hand, the foot bones, particularly the metacarpals and metatarsals, though usually as large and in some instances larger than in the two earlier described species, are relatively short in proportion to the limb elements. This is clearly illustrated in the proportions of the fore and hind limbs of the articulated skeleton.

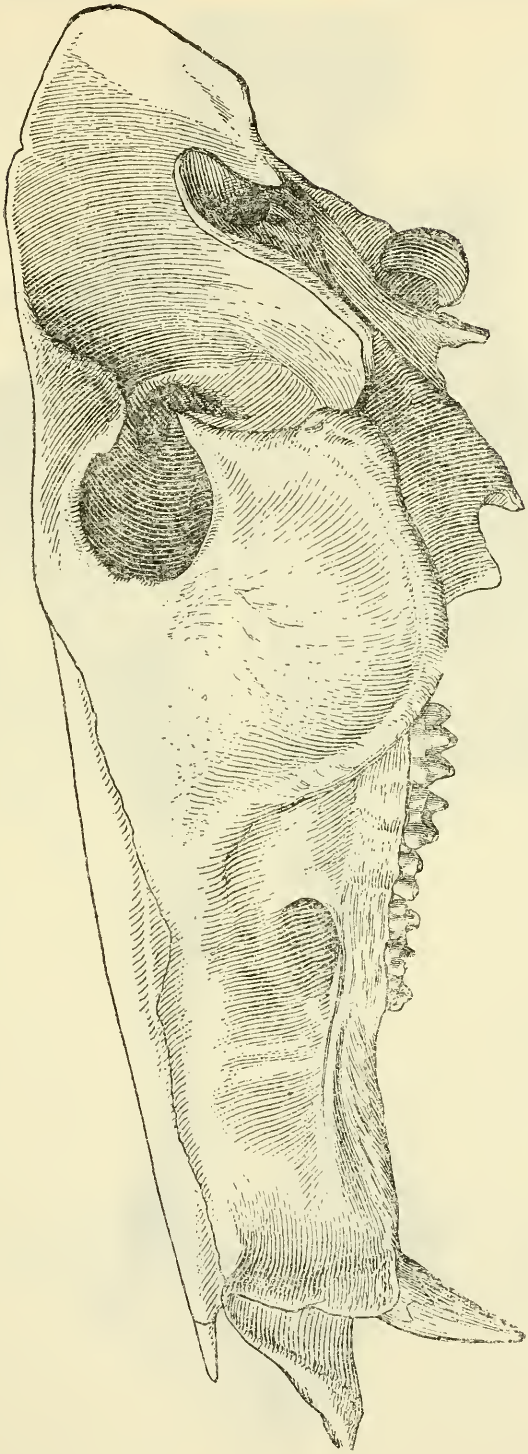


FIGURE 39.—*Platygonus cumberlandensis* Gidley: Skull, type specimen (U.S.N.M. no. 8146), lateral view. One-half natural size. Cumberland Cave Pleistocene, Maryland.

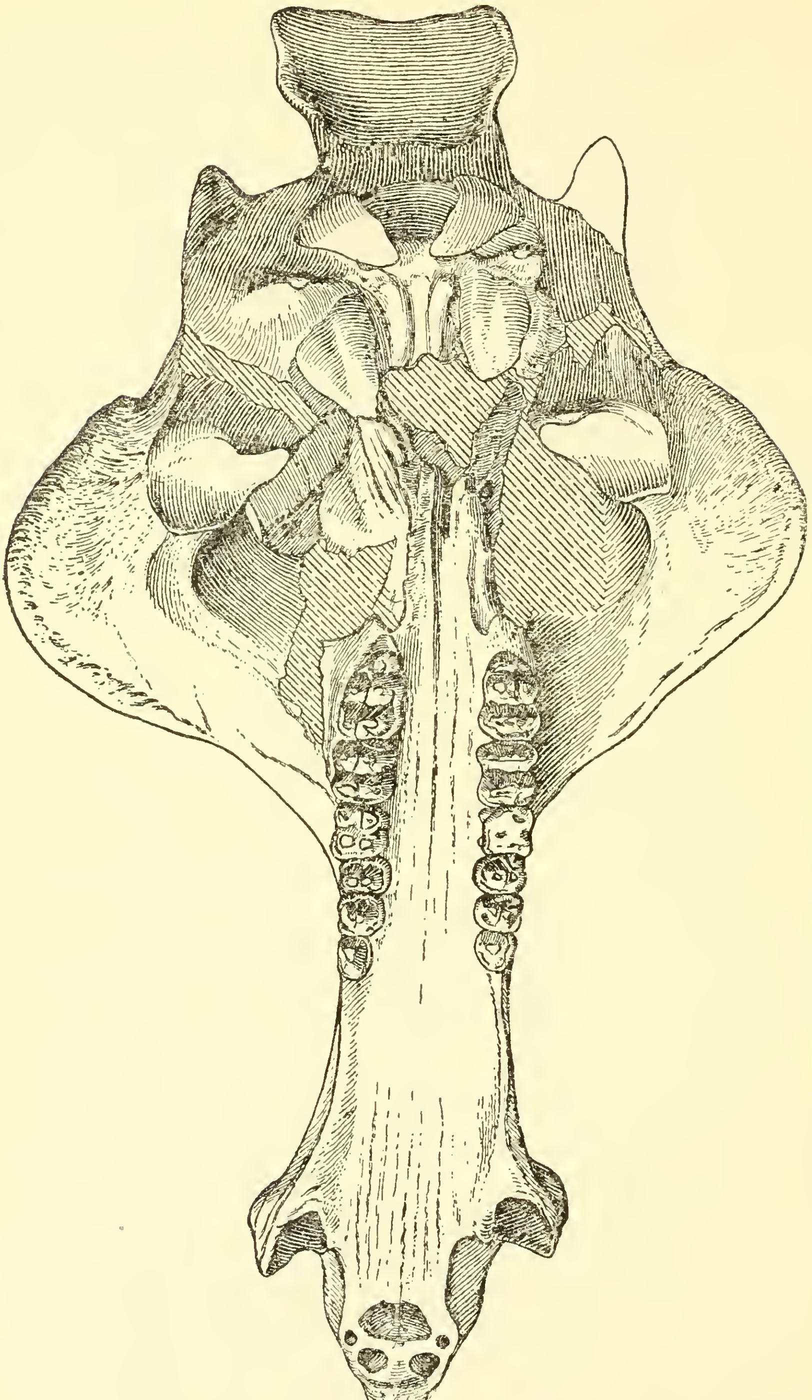


FIGURE 40.—*Platygonus cumberlandensis* Gidley: Skull, type specimen (U.S.N.M. no. 8146), ventral view. One-half natural size.

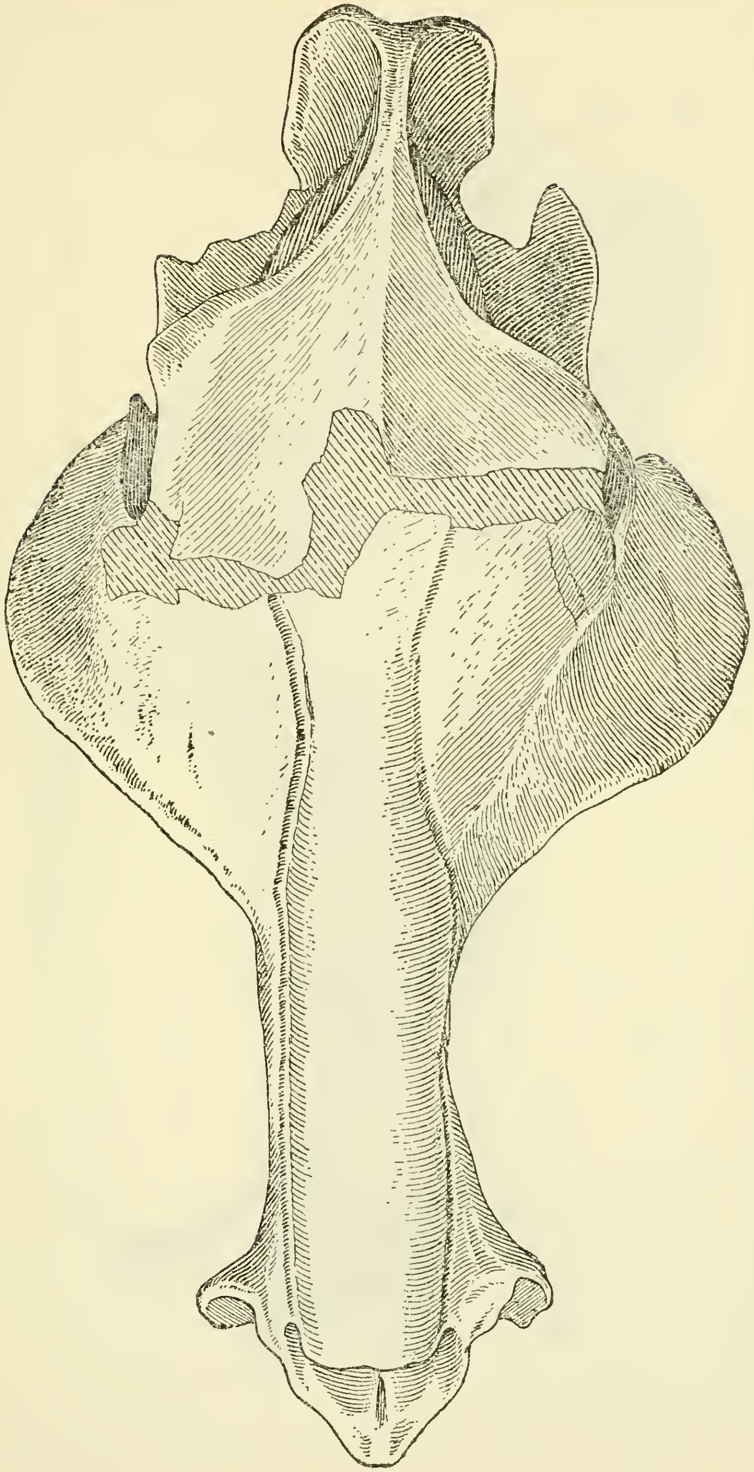


FIGURE 41.—*Platygonus cumberlandensis* Gidley: Skull, type specimen (U.S.N.M. no. 8146), dorsal view. One-half natural size.

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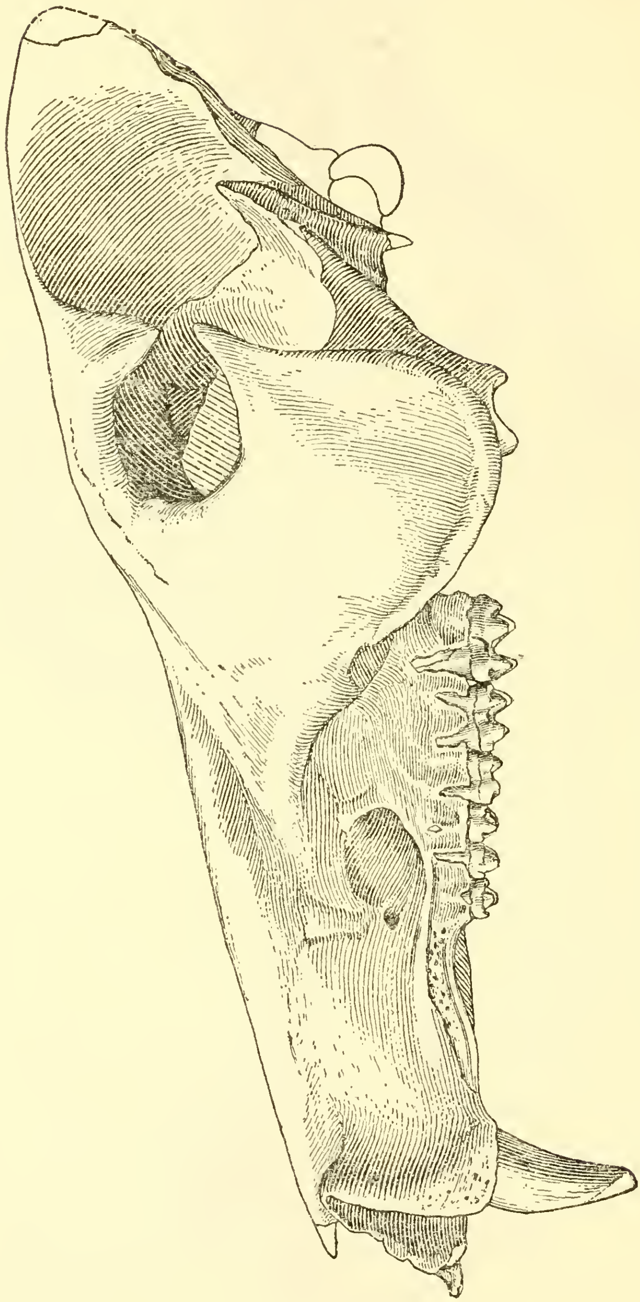

FIGURE 42.—*Platygonus cumberlandensis* Gidley: Skull, type of *P. intermedius* Gidley (U. S. N. M. no. 8148), lateral view. One-half natural size. Cumberland Cave Pleistocene, Maryland.

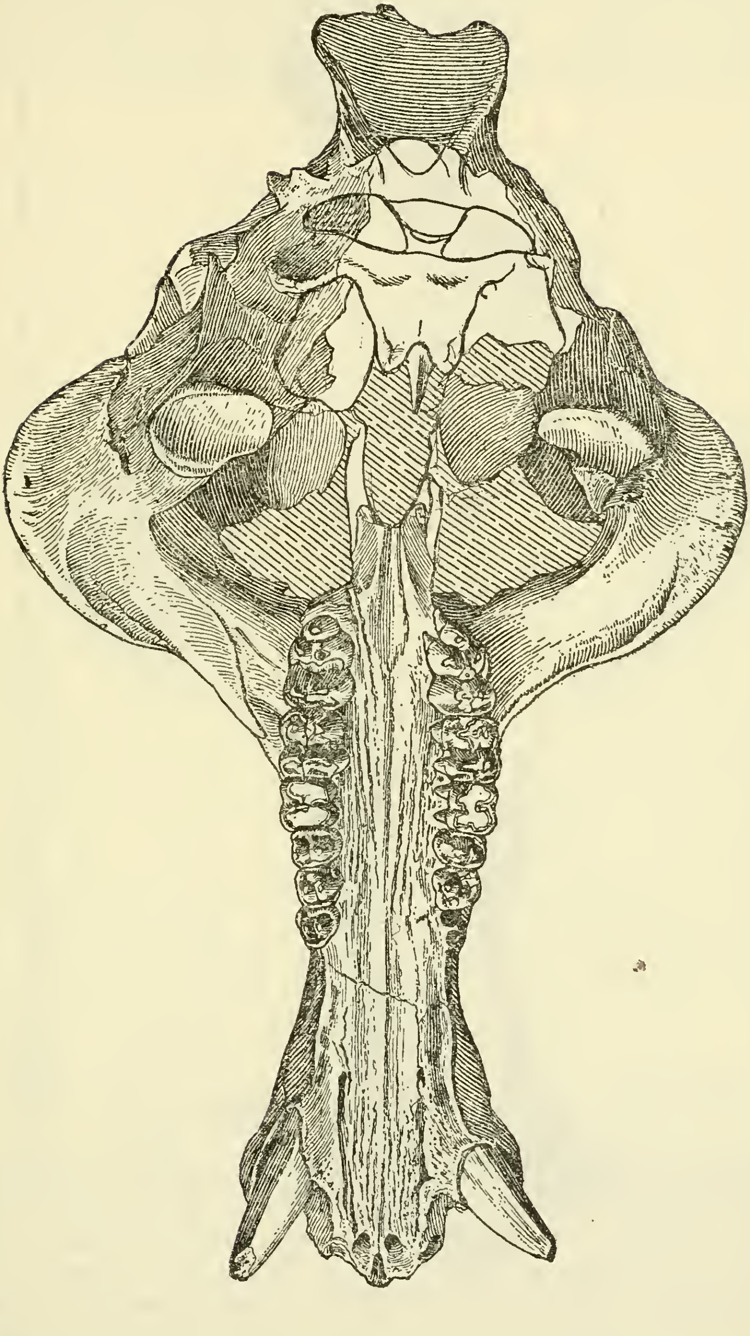

FIGURE 43.—*Platygonus cumberlandensis* Gidley: Skull, type of *P. intermedius* Gidley (U.S.N.M. no. 8148), ventral view. One-half natural size.

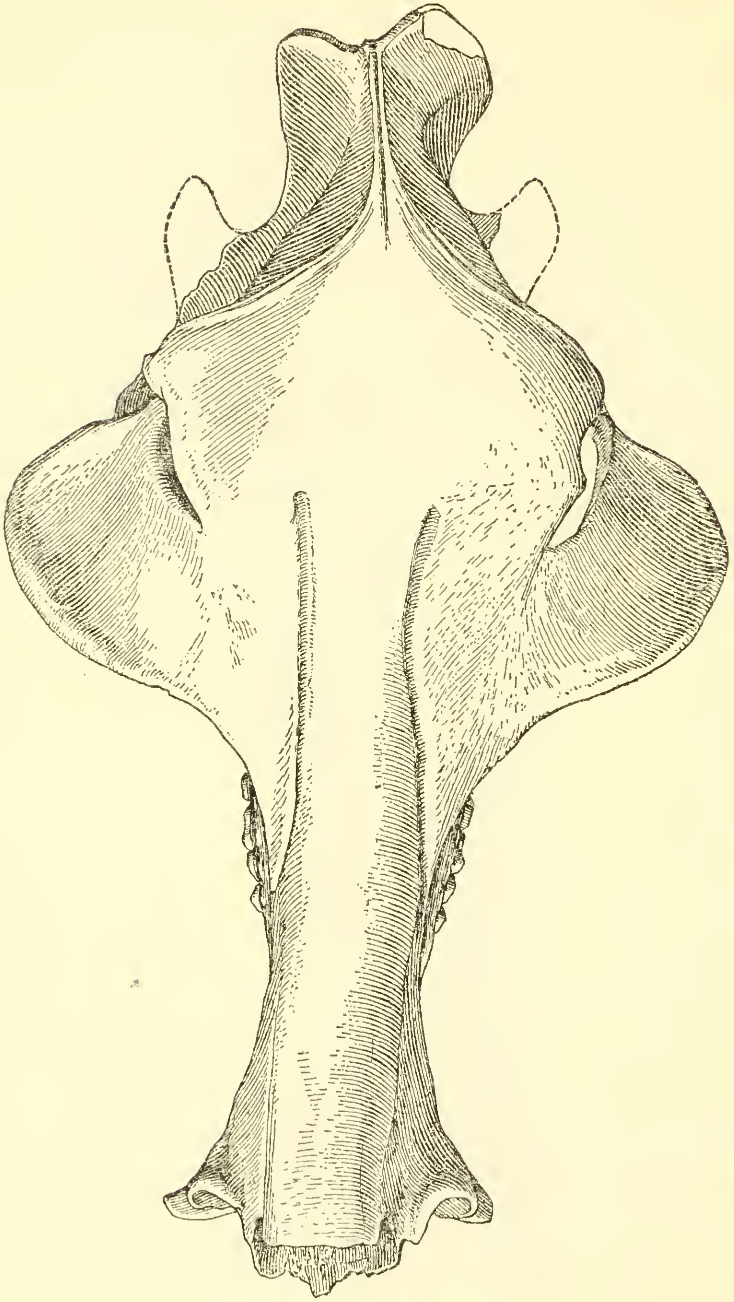

FIGURE 44.—*Platygonus cumberlandensis* Gidley: Skull, type of *P. intermedius* Gidley (U.S.N.M. no. 8148), dorsal view. One-half natural size.

*P. cumberlandensis* presents even more contrasting features when compared with living members of the Tayassuidae. In many characters of the skull the fossil form has progressed considerably beyond species of *Tayassu* and *Pecari*, most notably in size and elongation and in the exaggeration of the jugal. The dentition, however, as in

FIGURE 45.—*Platygonus cumberlandensis* Gidley: Left hind foot (U.S.N.M. no. 7690), anterior view. One-half natural size. Cumberland Cave Pleistocene, Maryland.

other species of *Platygonus* has developed along a somewhat different line, the molars being more nearly lophodont than in modern peccaries. The premolars in *Platygonus* are less progressive than in either of the living genera but approach more nearly the development in *Pecari angulatus*. More adequate descriptions of *Platygonus* as compared to other genera include those of Leidy (1889), Williston (1894), Hay (1914, pp. 212–228), Gidley (1920), and Rusconi (1930).

TABLE 22.—*Measurements (in millimeters) of skull, mandible, and dentition of* Platygonus cumberlandensis

| Measurement | U.S.N.M. no. 8146 (type) | U.S.N.M. no. 8200 (paratype) |
|---|---|---|
| *Skull* | | |
| Extreme length of skull | 420 | 382 |
| Total basal length measured from condylar notch | 360 | 320 |
| Posterior border of orbit to posterior border of inion | 125 | 92 |
| Anteroposterior diameter of orbit | [1] 40 | 38 |
| Anterior border of orbit to extreme end of premaxillary | 270 | 250 |
| Depth of skull at condyles | 140 | 135 |
| Depth of skull at glenoid fossa | [1] 130 | 125 |
| Greatest breadth of zygomatic expansion below orbit | 84 | 55 |
| Greatest width of skull across zygomae | 230 | [1] 168 |
| Width of face at middle of orbits | 135 | 114 |
| Width of face at postorbital processes | 140 | 125 |
| Width of face above infraorbital foramen | 51 | ----------- |
| Width of palate between canines | 50 | 50 |
| Width of palate just anterior to $P^2$ | 45 | 36 |
| Width of palate between second premolars | 29 | 21 |
| Width of palate between second molars | 22 | 23 |
| Distance across first pair of molars | 61 | 59 |
| Length of diastema between C and $I^3$ | 26 | 26 |
| Length of diastema behind canine | 65 | 71 |
| *Superior dentition* | | |
| Total length of upper dental series | 214 | 209 |
| Length of upper cheek tooth series | 94.5 | 86.5 |
| Length of upper premolar series | 35.2 | 34 |
| $I^1$, anteroposterior diameter | ----------- | 11 |
| $I^1$, transverse diameter | 8.7 | ----------- |
| $I^3$, anteroposterior diameter | ----------- | 8 |
| $I^2$, transverse diameter | ----------- | 6.3 |
| C, anteroposterior diameter | [1] 20 | 15 |
| C, transverse diameter | 12 | 10.4 |
| $P^2$, anteroposterior diameter | 11.7 | 11 |
| $P^2$, transverse diameter | 11.3 | 10.5 |
| $P^3$, anteroposterior diameter | 11.7 | 11 |
| $P^3$, transverse diameter | 13.5 | 13.3 |
| $P^4$, anteroposterior diameter | 11.7 | 11.6 |
| $P^4$, transverse diameter | 14.3 | 14 |
| $M^1$, anteroposterior diameter | 15.2 | 12.5 |
| $M^1$, transverse diameter | 15 | 16 |
| $M^2$, anteroposterior diameter | 19.6 | 18 |
| $M^2$, transverse diameter | 18 | 16 |
| $M^3$, anteroposterior diameter | 24.5 | 20.6 |
| $M^3$, transverse diameter | 18.2 | 17. |
| *Mandible* | | |
| Total length of lower jaw, condyle to tip of incisors | ----------- | 268 |
| Depth of lower jaw at $M_1$ | ----------- | 52 |
| Depth of jaw at coronoid process | ----------- | 115 |
| Depth of lower jaw at condyle | ----------- | 90 |
| Width between alveoli of lower canines | 20 | 22 |
| Depth of symphysis in median line | 31 | 30 |
| Depth of symphysis at mental foramen | 48 | 45 |
| Length of symphysis in front (in straight line) | 100 | 100 |
| Length of diastema between $I_2$ and C | 4 | 9 |
| Length of diastema behind canine (straight line) | [1] 76 | 75 |

[1] Approximate.

TABLE 22.—*Measurements (in millimeters) of skull, mandible, and dentition of* Platygonus cumberlandensis—Continued

| Measurement | U.S.N.M. no. 8146 (type) | U.S.N.M. no. 8200 (paratype) |
| --- | --- | --- |
| *Inferior dentition* | | |
| Total length of lower dental series | 208 | 201 |
| Length of lower cheek tooth series | 96 | 90 |
| Length of lower premolar series | 35.2 | 34 |
| $I_1$, anteroposterior diameter | ------------ | 6 |
| $I_1$, transverse diameter | ------------ | 7.2 |
| $I_2$, anteroposterior diameter | ------------ | 6.4 |
| $I_2$, transverse diameter | ------------ | 6 |
| C, anteroposterior diameter | 16.5 | 13 |
| C, transverse diameter | 13.4 | 10.5 |
| $P_2$, anteroposterior diameter | [1] 9.5 | 10 |
| $P_2$, transverse diameter | 8 | 7.5 |
| $P_3$, anteroposterior diameter | 12.8 | 11.6 |
| $P_3$, transverse diameter | 10 | 9 |
| $P_4$, anteroposterior diameter | 12.8 | 11.6 |
| $P_4$, transverse diameter | 11.7 | 11.5 |
| $M_1$, anteroposterior diameter | [1] 14 | 12.6 |
| $M_1$, transverse diameter | 13 | 11.8 |
| $M_2$, anteroposterior diameter | 20 | 18 |
| $M_2$, transverse diameter | 15.5 | 14 |
| $M_3$, anteroposterior diameter | 25.5 | 22.8 |
| $M_3$, transverse diameter | 16 | 15 |

[1] Approximate.

TABLE 23.—*Measurements (in millimeters) of skeleton of* Platygonus cumberlandensis

| Measurement | U.S.N.M. no. 8200 (paratype) |
| --- | --- |
| *Vertebrae* | |
| Length of vertebral column from atlas to distal end of sacrum | 920 |
| Length of cervical series of vertebrae | 220 |
| Length of dorsal series of vertebrae | 420 |
| Length of lumbar series of vertebrae | 130 |
| Length of sacrum | 150 |
| Greatest width of atlas | 108 |
| Width of condylar facets of atlas | 60 |
| Width of axial facets of atlas | 53 |
| Length of axis, exclusive of odontoid process | 44 |
| Height of spine of axis | 30 |
| Height of spine of first dorsal | 140 |
| Height of spine of fourth dorsal | 120 |
| Height of spine of eighth dorsal | 70 |
| Height of spine of second lumbar | 30 |
| Height of spine of last lumbar | 25 |
| Length of nine caudal vertebrae | 135 |
| *Anterior limb* | |
| Length of scapula | 220 |
| Greatest width of blade of scapula | 110 |
| Greatest width of articular face | 33 |
| Height of spine of scapula | 35 |
| Length of humerus | 220 |

Table 23.—*Measurements (in millimeters) of skeleton of* Platygonus cumberlandensis—Continued

| Measurement | U.S.N.M. no. 8290 (paratype) |
|---|---|
| *Anterior limb*—Continued | |
| Width of proximal articular face of humerus | 40 |
| Width of distal articular face of humerus | 34 |
| Anteroposterior diameter of shaft just below deltoid tubercle | 39 |
| Greatest length of ulna | 240 |
| Greatest length of radius | 170 |
| Transverse diameter of sigmoid fossa | 35 |
| Transverse diameter of distal face of radius | 41 |
| Least width of conjoined bones | 33 |
| Transverse diameter of carpus | 37 |
| Length of carpus, inside | 28 |
| Length of carpus, outside | 35 |
| Width of proximal end of metacarpals III and IV | 37 |
| Length of metacarpal III, inner side | 91 |
| Least transverse width of metacarpals III and IV | 37 |
| Length of the three phalanges of digit III | 95 |
| *Posterior limb* | |
| Greatest length of innominate bone | 270 |
| Center of acetabulum to anterior border of ilium | 140 |
| Center of acetabulum to posterior border of ischium | 135 |
| Diameter of acetabulum | 35 |
| Length of pubic symphysis | 90 |
| Longest diameter of obturator foramen | 52 |
| Greatest length of femur | 225 |
| Anteroposterior diameter of head of femur | 34 |
| Transverse diameter of head of femur | 30 |
| Transverse diameter of condyles of femur | 53 |
| Transverse diameter of trochlea of femur | 25 |
| Length of tibia, inner side | 205 |
| Width of proximal end of tibia | 54 |
| Width of distal end of tibia | 35 |
| Width of proximal end of astragalus | 26 |
| Greatest length of astragalus | 42 |
| Greatest length of calcaneum | 75 |
| Total length of tarsus | 62 |
| Width of proximal end of metatarsals | 30 |
| Width of distal end of metatarsals | 34 |
| Length of metatarsals, inner side | 97 |
| Least width of fused metatarsals | 23 |
| Total length of three phalanges of digit III | 86 |

### PLATYGONUS VETUS(?) Leidy

A single palate and maxillary portion, U.S.N.M. no. 8917, with the permanent and two deciduous premolars and the first two molars, was believed by Gidley (1920b, p. 658) to represent *Platygonus vetus*. The molars in this specimen are somewhat larger than the average in *P. cumberlandensis* and unusually wide, approaching the relative proportions seen in *P. vetus*. Although this specimen may represent an individual of *P. cumberlandensis* showing a variation of characters in the direction of *P. vetus*, its reference to the latter species is tentatively retained. It is possible that were *Platygonus vetus* better known the variation of characters within that species would be sufficiently great to include those outlined for *P. cumberlandensis*. However, in view of observed dental differences it seems preferable to regard the latter as a distinct form.

### MYLOHYUS EXORTIVUS Gidley [19]

FIGURES 46–48

The type of this species is from Cumberland Cave and consists of a nearly complete lower jaw (fig. 46), U.S.N.M. no. 8876, containing the

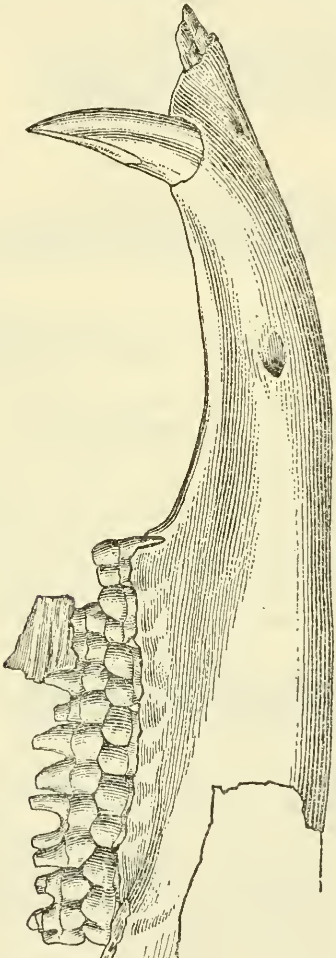

FIGURE 46.—*Mylohyus exortivus* Gidley: Right ramus of mandible and upper cheek teeth, type specimen (U.S.N.M. no. 8876), lateral view. Two-thirds natural size. Cumberland Cave Pleistocene, Maryland.

entire dentition of both rami (fig. 47*b*) and five upper teeth, $P^3$ to $M^3$, from the right side (fig. 47*a*). The original description given by Gidley is as follows:

About the size of or perhaps somewhat smaller than *M. nasutus* (Leidy), and apparently differing from that species in (1) the modifications of the canines, which seem to be relatively wider in cross-section and almost entirely lacking the

[19] Gidley, 1920b, pp. 676–678.

longitudinal ribbing so characteristic of these teeth in *M. nasutus;* (2) the form of the third upper premolar (the only tooth which can at present be directly compared) which is proportionately broader, while the secondary cuspules are much less prominent; and (3) the relative distance between the cheek-tooth rows of the opposite sides, which is much greater than in the type of Leidy's species.

A second specimen (Cat. 8160 U.S.N.M. Coll.), consisting of three milk molars and the first true molar of the right side [fig. 48], seems to belong to this species, although the first molar, which is entirely unworn, is much narrower than the corresponding tooth in the fully adult type specimen. This difference, however,

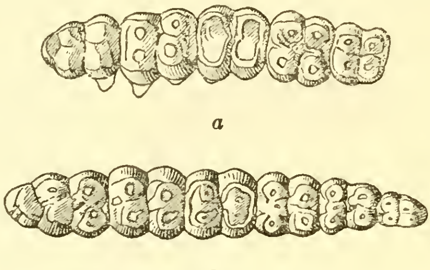

FIGURE 47.—*Mylohyus exortivus* Gidley, type specimen (U.S.N.M. no. 8876): *a*, Superior cheek teeth; *b*, inferior cheek teeth. Two-thirds natural size. Cumberland Cave Pleistocene, Maryland.

may be due to the fact that in the young specimen this tooth had not reached the stage where the roots had begun to form and is therefore so immature as not to have yet acquired its maximum width.

This specimen is especially interesting, since it affords a comparison of the milk dentition with that of the type of *M. pennsylvanicus.* The unworn condition of the deciduous teeth and the incomplete development of the first permanent molar in this species indicate a somewhat younger individual than Leidy's type. It differs from the latter in (1) the smaller size of the corresponding teeth (see table of measurements), (2) in the narrower proportions of the milk-molars, and (3)

FIGURE 48.—*Mylohyus exortivus* Gidley: Superior deciduous premolars and first permanent molar of right side (U.S.N.M. no. 8160), occlusal view. Natural size. Cumberland Cave Pleistocene, Maryland.

in the greater complication of secondary cuspules, especially in the anterior half of each of these teeth. In this last feature they show a decided advance in complexity of the milk-teeth over those of either of the living genera of peccaries. This is less pronounced in *M. pennsylvanicus* but this species also has more complex milk-molars than either *Tayassu* or *Pecari.*

A comparison of the lower jaw of the type of *M. exortivus* with illustrations of the Frankstown Cave lower jaw referred by Peterson (1926, p. 256, pl. 18) to *Mylohyus pennsylvanicus* shows the two to be very nearly the same size, but a noticeable difference is seen in the character of $P_2$. In the Frankstown Cave form $P_2$ is a simple tooth with two cusps longitudinally arranged. In *M. exortivus* the tooth is completely molariform though smaller and relatively narrower than the succeeding teeth.

*Mylohyus browni* Gidley (Gidley, 1920b, pp. 675–676; Brown, 1908, pp. 200–202, pl. 24) is a more slender and elongate jawed form than *M. exortivus*, although according to the illustrations given by Brown $P_2$ in the Conard Fissure specimen is molariform, or nearly so.

A pair of fused metatarsals in the Cumberland Cave peccary material is referred to *Mylohyus*. These bones are distinctly longer and slenderer than in *Platygonus*.

TABLE 24.—*Measurements (in millimeters) of mandible and dentition of* Mylohyus exortivus

| Measurement | U.S.N.M. no. 8876 (type) | U.S.N.M. no. 8106 |
|---|---|---|
| *Mandible* | | |
| Depth of jaw below first molar | 70 | ------------ |
| Thickness of jaw below first molar | 20 | ------------ |
| Width across both jaws below first molar | 70 | ------------ |
| Width of jaws at canines | 35 | ------------ |
| Width between canine alveoli | 15 | ------------ |
| Width of symphysis at narrowest point | 24 | ------------ |
| Vertical depth of symphysis, median line | 19.5 | ------------ |
| Length of diastema in front of canines | 11.2 | ------------ |
| Length of diastema behind canines | 71 | ------------ |
| *Superior dentition* | | |
| $P^3$, anteroposterior diameter | 10.3 | ------------ |
| $P^3$, transverse diameter | 11.8 | ------------ |
| $P^4$, anteroposterior diameter | 12.3 | ------------ |
| $P^4$, transverse diameter | 13.8 | ------------ |
| $M^1$, anteroposterior diameter | 14 | ------------ |
| $M^1$, transverse diameter | 14.5 | ------------ |
| $M^2$, anteroposterior diameter | 15 | ------------ |
| $M^2$, transverse diameter | 15 | ------------ |
| $M^3$, anteroposterior diameter | 16 | ------------ |
| $M^3$, transverse diameter | 13 | ------------ |
| *Inferior dentition* | | |
| C, anteroposterior diameter | 12.7 | ------------ |
| C, transverse diameter | 9 | ------------ |
| $P_2$, anteroposterior diameter | 10 | ------------ |
| $P_2$, transverse diameter | 6.4 | ------------ |
| $P_3$, anteroposterior diameter | 11 | ------------ |
| $P_3$, transverse diameter | 10.2 | ------------ |
| $P_4$, anteroposterior diameter | 12.5 | ------------ |
| $P_4$, transverse diameter | 13 | ------------ |
| $M_1$, anteroposterior diameter | 13.7 | ------------ |
| $M_1$, transverse diameter | 13.4 | ------------ |
| $M_2$, anteroposterior diameter | 15 | ------------ |
| $M_2$, transverse diameter | 14 | ------------ |
| $M_3$, anteroposterior diameter | 19.7 | ------------ |
| $M_3$, transverse diameter | 13.3 | ------------ |
| *Immature superior dentition* | | |
| $Dp^2$, anteroposterior diameter | ------------ | 10 |
| $Dp^2$, transverse diameter | ------------ | 7.5 |
| $Dp^3$, anteroposterior diameter | ------------ | 12.5 |
| $Dp^3$, transverse diameter | ------------ | 9 |
| $Dp^4$, anteroposterior diameter | ------------ | 12 |
| $Dp^4$, transverse diameter | ------------ | 11.5 |
| $M^1$, anteroposterior diameter | ------------ | 14 |
| $M^1$, transverse diameter | ------------ | 11.5 |

#### MYLOHYUS cf. PENNSYLVANICUS (Leidy)[10]

A jaw fragment, U.S.N.M. no. 8162, with the last two molars was referred by Gidley (1920b, p. 674) to *M. pennsylvanicus*. These two teeth are much longer and $M^2$ is actually narrower and $M^3$ relatively narrower than in *M. exortivus*. A comparison of the first permanent molars in the types of *M. exortivus* and *M. pennsylvanicus* shows the latter to have a longer and relatively narrower $M^1$, and by inference the second molars may have been similarly proportioned.

The Frankstown Cave form (Peterson, 1926, pl. 18) apparently also has relatively narrow molars as indicated by the illustrations.

The various species of *Mylohyus* recognized are known only on rather fragmentary material, and the amount of individual variation that exists in any of these species is not yet determinable.

### Family CERVIDAE

#### CERVUS species

An immature pair of fused metatarsals, apparently belonging to an elk, shows the presence of a moderately large cervid in the fauna. The cannon bone, though immature, is much too large to represent *Odocoileus* or *Eucervus*. There is at present no way of knowing whether the form *Sangamona* is represented here, inasmuch as the only described species, *S. fugitiva* Hay, has for a type an isolated tooth.

#### ODOCOILEUS cf. VIRGINIANUS (Boddaert)

Several upper and lower jaw fragments of deer are included in the collection. No characters of diagnostic importance were observed to distinguish the cave form from the living white-tailed deer, *Odocoileus virginianus*. A comparison of the fossil dentitions with those of the black-tailed deer, *O. columbianus*, shows a somewhat narrower inner wall in the upper premolars of the Pleistocene form. This anteroposterior compression of the inner lobe of the upper premolars is noticeable in the subgenus *Odocoileus*.

### Family BOVIDAE

#### EUCERATHERIUM(?) AMERICANUM (Gidley)

Figures 49, 50

An upper dentition (fig. 49) U.S.N.M. no. 7622, of a bovid type was described by Gidley (1913a) as representing a new eland, *Taurotragus americanus*. The living eland is African in distribution and belongs to a group of antilopine forms foreign to the New World. Hence, the recognition of *Taurotragus* in a North American cave deposit merits a critical reexamination of the fossil evidence.

Comparison of the Cumberland Cave dentition with that of the bovid types *Euceratherium* and *Preptoceras* was made by the junior

[10] Leidy, 1889, pp. 8–12, pl. 2, figs. 3–6.

author (Gazin, 1933). This comparison was greatly aided by additional material secured by Gidley subsequent to his report, which included a lower jaw (fig. 50*a*), U.S.N.M. no. 7993, with teeth and lower premolars (fig. 50*b*), U.S.N.M. no. 8006, belonging to another individual.

In a general way certain outstanding characters seen in the fossil dentition, as large size, hypsodonty, and proportionally large pre-

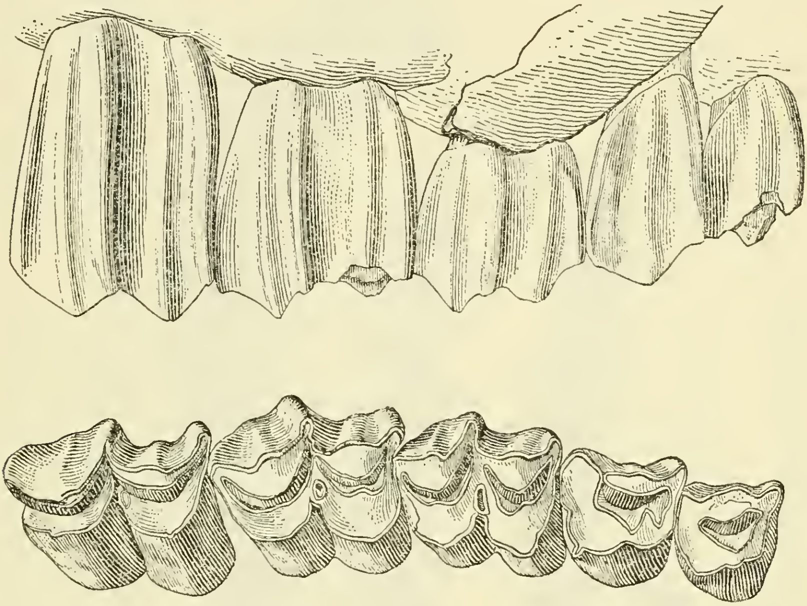

FIGURE 49.—*Euceratherium*(?) *americanum* (Gidley): Superior cheek teeth, $P^3$–$M^3$, type specimen (U.S.N.M. no. 7622), lateral and occlusal views. Three-fourths natural size. Cumberland Cave Pleistocene, Maryland.

molars, are strongly suggestive of the eland and likewise contrast it with the larger living bovids of North America. A more detailed examination, however, with particular regard for the structure of the premolars, warrants removing the fossil form from *Taurotragus*. The differences seen in the upper molars are not many and not of great importance when we consider the variability of the pattern of these teeth in bovid forms. The external styles are better developed in the fossil, as noted by Dr. O. P. Hay (1920), and these teeth are of somewhat greater size. The upper premolars are particularly robust, are apparently more hypsodont, and have a less compressed postero-external style.

In the lower molars $M_1$ is noticeably wide transversely and $M_3$ relatively narrow as compared with the modern eland; differences in the lower premolars appear to be more significant, however. The premolars are distinctly more hypsodont. The crown of $P_2$ is more complexly folded, resembling in development a $P_3$ in *Ovibos*. The second premolar in the eland though large is markedly simple. The fossil $P_3$ is particularly distinctive. The anterior portion of this tooth is broader than in the eland, and the prominent lingual fold is deeply pocketed. The extension of the inner wall encloses the fold for a

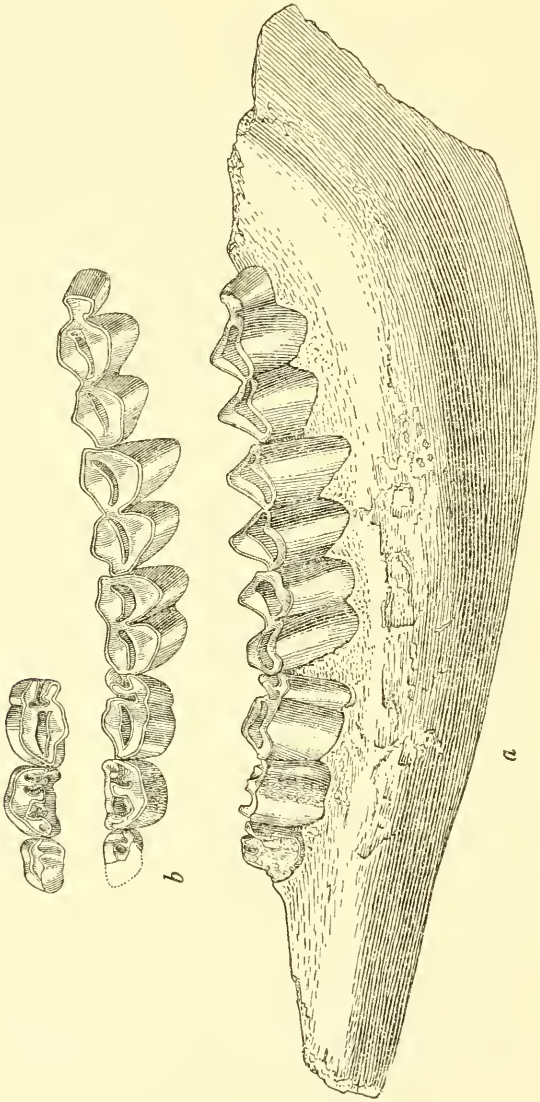


FIGURE 50.—*Euceratherium(?) americanum* (Gidley): *a*, Left ramus of mandible (U.S.N.M. no. 7993), lateral and occlusal views; *b*, right lower premolars (U.S.N.M. no. 8006), occlusal view. One-half natural size. Cumberland Cave Pleistocene, Maryland.

greater portion of the crown height. The prominent lingual fold in the third premolar of the eland is open in all specimens that were examined. The fourth premolar of the fossil jaw possesses a talonid column having a somewhat greater anteroposterior development; apparently this tooth is more nearly molariform.

TABLE 25.—*Measurements (in millimeters) of superior and inferior dentition of* Euceratherium(?) americanum

| Measurement | U.S.N.M. no. 7622 (type) | U.S.N.M. no. 7993 |
|---|---|---|
| *Superior dentition* | | |
| Length of upper tooth series, $P^3$ to $M^3$ inclusive | 141.5 | ------------ |
| Length of upper molar series, $M^1$ to $M^3$ inclusive | 101 | ------------ |
| $P^3$, greatest anteroposterior diameter | 19 | ------------ |
| $P^3$, greatest transverse diameter at occlusal surface [1] | 15.8 | ------------ |
| $P^4$, greatest anteroposterior diameter | 22.1 | ------------ |
| $P^4$, greatest transverse diameter at occlusal surface | 18 | ------------ |
| $M^1$, greatest anteroposterior diameter | 30.9 | ------------ |
| $M^1$, greatest transverse diameter at occlusal surface | 23.7 | ------------ |
| $M^2$, greatest anteroposterior diameter | 34.6 | ------------ |
| $M^2$, greatest transverse diameter at occlusal surface | 22.2 | ------------ |
| $M^3$, greatest anteroposterior diameter | 37.7 | ------------ |
| $M^3$, greatest transverse diameter at occlusal surface | 20 | ------------ |
| *Inferior dentition* | | |
| Length of lower tooth series, $P_2$ to $P_4$ inclusive | ------------ | 157 |
| Length of lower premolar series, $P_2$ to $P_4$ inclusive | ------------ | [2] 59 |
| Length of lower molar series, $M_1$ to $M_3$ inclusive | ------------ | 100 |
| $P_2$, greatest anteroposterior diameter | ------------ | [2] 15 |
| $P_2$, greatest transverse diameter at occlusal surface | ------------ | [2] 10.6 |
| $P_3$, greatest anteroposterior diameter | ------------ | 19.2 |
| $P_3$, greatest transverse diameter at occlusal surface | ------------ | 13 |
| $P_4$, greatest anteroposterior diameter | ------------ | 25 |
| $P_4$, greatest transverse diameter at occlusal surface | ------------ | 13.5 |
| $M_1$, greatest anteroposterior diameter | ------------ | 26 |
| $M_1$, greatest transverse diameter at occlusal surface | ------------ | 17.8 |
| $M_2$, greatest anteroposterior diameter | ------------ | 33.8 |
| $M_2$, greatest transverse diameter at occlusal surface | ------------ | 16.1 |
| $M_3$, greatest anteroposterior diameter | ------------ | 41.7 |
| $M_3$, greatest transverse diameter at occlusal surface | ------------ | 13.8 |

[1] Width of occlusal surface of teeth increases with wear.
[2] Approximate.

The dentition exhibited by specimens of *Euceratherium collinum* Sinclair and Furlong (1904) and *Preptoceras sinclairi* Furlong (1905)[21] though of a bovid type is of a kind clearly distinguished from that seen in the Bovinae, or even in *Ovibos* although to a less extent. The hypsodonty reached in the specimens from the Pleistocene of California is suggestive of an antilopine dentition, but the skull and horn structures they possess show them to belong to a distinct group. The development of the premolars in this western group has gone beyond that in the eland. It is further noted that those dental characters that appear most significant in distinguishing the Cumberland Cave fossil from the African eland ally it to the *Euceratherium-Preptoceras* group. Also, the marked increase in width and the shortening anteroposteriorly of the upper molars in advanced wear noted by Gidley (1913a, p. 1) for the Cumberland Cave type was observed by Sinclair and Furlong (1904, p. 416) in *Euceratherium collinum.* The

[21] See also Stock and Furlong (1927).

only outstanding difference noted is the greater size of the Maryland type as compared with the California forms. In addition, the premolars in the lower jaw, Univ. Calif. Pal. Coll. no. 8756, from Potter Creek Cave, which the junior author examined, appear to be slightly more hypsodont, and the isolation of the lingual fold in $P_3$ is more complete.

In view of the disparity in size, it is possible that were more complete material known exhibiting the skull and horn structure *Euceratherium*(?) *americanum* would be found to represent a distinct genus. On the dental structure alone, however, no important differences can be cited that would serve to distinguish this form generically from *Euceratherium* or *Preptoceras*.

Our form is referred tentatively to *Euceratherium*, as apparently the differences that separate *Preptoceras* from *Euceratherium* may not be greater than could be accounted for by individual variation. No important dental differences were seen between the two, although the teeth in the type of *Preptoceras* are slightly larger than in *Euceratherium*.

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(Principal references are given in **boldface**)

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