

man a more rapid evolution than that of other almost equally complex mammals? Nearly all of the existing species of mammals are survivals from the Pleistocene. The essential difference between the Pleistocene and the Recent faunas is one of quantity rather than kind. Many species became extinct during or at the close of the Pleistocene, but few new species or subspecies originated during that time. One would therefore expect to find that the Pleistocene progenitors of the modern man are indistinguishable from ourselves. Other contemporary races of primitive man that are now extinct represent collateral lines and are not our ancestors.

The presence of man in America, assuming that he originated in the old world, is no more difficult to explain than the presence here during by-gone ages of camels, horses, elephants, rhinoceroses, and other genera that are now restricted to Africa or Asia.

PALEONTOLOGY.—*Characteristic mammals of the Early Pleistocene.*¹

OLIVER P. HAY, Washington, D. C.

For the writer the Pleistocene is the equivalent of the Ice Age. We may say that it began when the first ice sheet, the Nebraskan, had pushed southward to about the 55th degree of latitude. It had perhaps even then begun to disturb the ancient drainage systems. It ended when the Wisconsin glacier had retreated to the same latitude, opening up the main river systems of our times. Within that interval there had occurred momentous changes in the physiography of our continent, in its climates, and in its highest forms of animal life.

I wish to discuss especially the composition of the mammalian life of the Pleistocene and some of the changes which it underwent.

The kinds of mammals that existed on our continent during the late Pliocene are not sufficiently well known. We know, however, that there were present a few edentates, various carnivores of dog-like and cat-like forms, mastodons, tapirs, horses (possibly not yet *Equus*), peccaries, camels, and antelope-like hoofed animals. After the close of the Pliocene no doubt some of those mammals, somewhat modified, lived on into the Pleistocene. We are sure that a few of the edentates did so; also some of the tapirs, peccaries, camels, and some of the early horses.

About the beginning of the Pleistocene a passage was opened up

¹ Received July 20, 1928.

between Asia and North America. Over this many kinds of Old World mammals entered our continent. Elephants of perhaps several species, new mastodons, bison, musk-oxen, deer, moose, wolves, tigers, possibly horses and camels, descendants of former migrants from this country into Asia, pressed in and spread over the land. About the same time, perhaps a little earlier, a highway was established between South America and North America and our land was invaded by the strange fauna of the southern continent. The most conspicuous of these animals belonged to the order of Edentates, and consisted of huge ground-sloths, armadillos, and glyptodons. More than a dozen genera of these edentates have been described; and they varied in size from that of the existing Texan armadillo to that of an elephant. Our early Pleistocene mammalian fauna was, therefore, a product of three continents and it was a fauna probably more abundant in numbers and more diverse in species than any other known.

About the genera and species of mammals which existed in our country during the first glacial stage we know little or nothing, I mean little that is derived from actually discovered remains. We can only judge as to their general nature from those which preceded them and those which followed them.

I shall now attempt to show that certain important elements of the mammals I have mentioned existed in our country in what is believed to be the first interglacial stage.

Along the Missouri River, from the northwestern corner of the State of Missouri to the mouth of Sioux River and along this to the northwestern corner of Iowa, at many localities, have been discovered deposits, gravels and sands, intercalated between the first (Nebraskan) and the second (Kansan) drifts. These gravels and sands are known as Aftonian deposits. In these have been discovered a considerable number of fossil mammals. In one gravel pit near the town of Missouri Valley, 18 species have been reported. Of these, 90 percent are extinct. They represent eight families and twelve genera. There are two species of ground-sloths (*Megalonyx* and *Myiodon*), three species of elephants, one or two of mastodons, four species of horses, at least one species of camel, a moose, a bison, a musk-ox, a goat, the existing bear, and a beaver.

In this one pit, therefore, have been found representatives of 8 families of mammals, *Megatheriidae* (ground-sloths), *Castoridae* (beavers), *Elephantidae* (elephants), *Equidae* (horses), *Camelidae* (camels), *Cervidae* (deer), *Bovidae* (oxen), and *Ursidae* (bears).

Near Akron, Plymouth County, were found two teeth of *Stegomastodon mirificus* in Aftonian deposits. In a deposit of the same stage, at Mapleton, Harrison County, was found a fine tooth of *Elephas imperator*. At Afton, Iowa, were collected foot bones and a tooth of *Hipparion*. At Rockport in northwestern Missouri, in the Aftonian sands and gravels, were found a foot-bone of a horse, a tooth of a camel, and a molar tooth of *Hipparion*.

Near the present post-town of Peters, Sheridan County, in northwestern Nebraska, near Niobrara River, in a deposit of sand lying between 50 and 100 feet above the little tributary of the river, were collected many years ago about 20 species of mammals. Of these at least 70 percent are extinct. The fossils represented 13 families and 16 genera. These include two genera of ground-sloths, two dogs, an extinct genus of bears (*Arctotherium*), a prairie dog and a musk-rat, a field mouse, two elephants, one of them *Elephas imperator*, an extinct genus of peccaries, three species of camels, two species of prong-horn antelopes, one possibly the existing species, the other the extinct *Capromeryx furcifer*. The bed of sand containing these fossils is about 12 feet thick and overlies late Tertiary deposits. Since the bed was laid down, Niobrara River has cut its valley nearly 100 feet deeper.

I ask you now to consider Pleistocene fossil mammals which have been found in the canyon of Tula Creek, Briscoe and Swisher Counties, Texas. During probably the early part of the Pleistocene, by a quickening of a stream, approximately 100 feet of deposits were removed from the Miocene. Then came a change either in a reduced slope of the country or in a smaller amount of water or both, and deposition recommenced. There was laid down first about 30 feet of coarse sand, over this 15 feet of bluish clay, then again coarse sand, and finally 25 feet of fine white sand. This variation in the materials implies changes in climate and of elevation, and consequently this deposition of 90 feet of sand and clay required a long time. Then occurred a more momentous change in affairs. The region must have been considerably elevated as also the country west of it, for extensive cutting began. This continued until a broad valley had been eroded through all of that 90 feet of Pleistocene materials, then through the Miocene and down into the Triassic clay below. That canyon so cut is, less than 10 miles farther down, 400 or 500 feet deep. We can not doubt that those deposits belong to an early stage of the Pleistocene.

Now in the first coarse sand laid down and in the last stratum of fine sand have been found numerous specimens of Pleistocene mammals.

About 20 species have been collected. These include a ground-sloth (*Myiodon*), a glyptodon, two elephants, one being *Elephas imperator*, from four to six species of horses, a peccary, four species of camels and two species of dogs. All of the species collected are now extinct.

I ask you now to consider a fourth important locality, one whose geology certifies to the age of the fossils discovered.

Frederick, Tillman County, is in southwestern Oklahoma, about 12 miles north of Red River. From the town there runs northward for about ten miles a prominent ridge, and this near the town stands about 100 feet above the adjacent country. In one side of this ridge a sand and gravel pit has been opened and is being extensively operated. The ridge is found to be a filled-up and abandoned river bed, probably that of the ancient North Fork of Red River. The filling consists of, first, a stratum a foot or two thick, of broken rocks and gravel cemented by carbonate of lime, forming a mass of considerable hardness. Above this is a rather hard sandstone of about the same thickness. This is overlain by some ten to fifteen feet of compact sand and gravel; while above all comes about three feet of a red clay. The whole rests on a red clay of Permian age. At present the North Fork runs about ten miles west of Frederick and at a level of 200 or more feet lower down.

Now principally in the lowest cemented layer, but to some extent in the compact sand, have been discovered numerous fossil bones of mammals. Since they were buried there the river valley was filled and choked up, the river diverted into other channels, and the immediate region has been eroded away more than 100 feet, while further west probably more than 200 feet. It will be understood at once that a very long time must have been required to accomplish that work. Inasmuch as the animals found there are in general the same as those found in the three other localities mentioned it is concluded that the time of their burial was during the first interglacial stage. The fossils collected consist of a megalonyx, a myiodon, a mastodon, a glyptodon, three or four horses, a large tapir, a large and a small camel, a peccary, an elephant more primitive than *E. imperator*, two other elephants, a mastodon which appears to belong to the long-jawed genus *Gomphotherium*. All of the species are extinct.

Collecting together then the animals found in the western Iowa localities (1), that on Niobrara River (2), that in Tula Canyon (3), Texas, and that at Frederick (4), Oklahoma, we have the following list:

Megalonyx jeffersonii	1, 2, 4	Symbos cavifrons	1
Myiodon harlani	1, 2, 3, 4	Aftonius calvini	1
Glyptodon petaliferus	3, 4	Bison sp. indet.	1
Equus complicatus	1, 3, 4	Elephas haroldcooki	4
E. niobrarensis	1, 2	E. imperator	1, 2, 3
E. laurentius	1	E. columbi	1, 2, 3, 4
E. scotti	3	E. boreus	1, 4
E. excelsus	1, 2, 3	E. primigenius ?	4
E. calobatus	3	Mammut americanum	1
E. tau ?	3	M. progenium	1
E. semiplicatus	3	Stegomastodon mirificus	1
Tapirus haysii	4	Gomphotherium sp. nov.	4
Platygonus compressus	3	Castor canadensis	1
P. sp. indet.	2, 4	Castoroides ohioensis ?	2
Camelops huerfanensis ?	3	Microtus sp. indet.	2
C. vitakerianus	2	Ondatra nebrascensis	2
C. macrocephalus	3	Thomomys sp. indet.	2
C. kansanus	2	Cynomys ludovicianus	2
C. hesternus	3	Lepus sp.	4
C. niobrarensis	4	Ursus americanus	1
Lama sp. nov.	4	Arctotherium sp. indet.	2
Camelus americanus	2	Ænocyon dirus	3
Eschatus conidens	3	Canis occidentalis ?	2
Alces shimeki	1	C. texanus	3
Capromeryx furcifer	2	C. latrans	2
Antilocapra americana ?	2	Smilodon nebrascensis	2

In this list there are included more than 50 species which appear to have lived during the first interglacial stage. I do not see how this conclusion can be escaped. Most of those of the list represent mammals which are to be found in deposits all over the Great Plains into Texas and Mexico and many of them are found in Florida and South Carolina. When white men discovered this continent the great majority (80 percent) of the animals here listed no longer existed.

Now the question arises: Did all of these animals that are now extinct, and many others not here mentioned, live on until near or into the Recent epoch and then suddenly disappear, or did the extinctions occur at various times during the first interglacial stage and since that time?

What can we learn about the longevity of mammalian genera and species on comparing them with genera and species of mollusks? Several genera of mollusks have persisted ever since the Jurassic; many more from the Cretaceous. The oldest living genus of mammals is, I think, *Didelphis*, the opossum, and this comes down to us from only the Eocene. Following Matthew's list² we find that of

² Bull. U. S. Geol. Surv. No. 361.

90 Miocene genera only 11 now exist (12 percent); of species none. With few exceptions the Miocene species do not continue from one formation to the next. In a geological sense, therefore, mammalian genera and species are short-lived. This being true I hold that it is improbable that all of the species of the list presented lived until the close of the Pleistocene. In that first interglacial stage there were thrown together three incongruous faunas, and it was inevitable that in the struggle for existence some would succumb. This would have happened even if the physical environment were favorable, but with the changes resulting from three or four glacial stages and two or three interglacial stages extinctions would be multiplied.

The fact that the collections from the older Pleistocene deposits show a much higher percentage of extinct forms than from known later ones is evidence that the extinctions occurred at all times. Had all the first interglacial species lived until the end of the Pleistocene, collections from all of the stages would show approximately the same percentage of extinct species.

The history of the Pleistocene animals of Europe shows that the older deposits contain a higher proportion of non-existing species, the majority or all of the earliest deposits being extinct.

Out of the list which has been presented I select the following species as being a part of those of which we find no traces after the close of the first interglacial stage, or at least, after the Kansan glacial stage.

Glyptodon petaliferus	<i>C. vitakerianus</i>
<i>Equus niobrarensis</i>	<i>C. macrocephalus</i>
<i>E. laurentius</i>	<i>C. kansanus</i>
<i>E. excelsus</i>	<i>Eschatius conidens</i>
<i>E. semiplicatus</i>	<i>Camelus americanus</i>
<i>E. calobatus</i>	<i>Elephas haroldcooki</i>
<i>Camelops huerfanensis</i>	<i>E. imperator</i>
<i>C. hesternus</i>	<i>Smilodon nebrascensis</i>
<i>C. niobrarensis</i>	

To these I add the following because they have been found associated with those of the number just given and are evidently of the same geological age.

<i>Smilodon floridanus</i>	<i>Megatherium mirabile</i>
<i>Neochœrus pinckneyi</i>	<i>Chlamytherium septentrionale</i>
<i>Stegomastodon mirificus</i>	

Here are listed 22 species of large and important animals of which the writer affirms that they have not been found at any locality the

geology of which can be determined as being later than the first interglacial or the second glacial stages. In support of my position I present the following five sources of evidence.

1. Remains of none of these species have been found in deposits overlying either the Kansan, the Illinoian, or the Wisconsin drift sheets. Many other extinct species have been found in such deposits, ground-sloths, a horse or two, the giant beaver, various species of peccaries, elephants and mastodons. Species of the last list furnished may be found around the borders of these drift sheets; and it is for those who believe in their late existence to explain why these animals did not venture to cross the moraines. The mastodons and the elephants, *Elephas boreus* and *E. columbi*, which more than once were driven from the glaciated regions returned to their old pastures. The camels which inhabited western Iowa did not return.

2. In a fissure in northwestern Arkansas Barnum Brown collected about 50 species of mammals. These appear to have lived about the time of the Illinoian drift stage. Not one of the species of the last list presented was found there.

3. A considerable number of collections of fossil mammals have been made in the Appalachian Mountains from Lookout Mountain, in southern Tennessee, to Frankstown, Pennsylvania. At Lookout Mountain have been found a small horse, a ground-sloth and a tapir. From Winterburg, in northeastern Tennessee, there have been described 18 species of mammals, including 2 horses, a tapir, 3 deer, and *Elephas boreus*. In Wythe County, Virginia, Cope long ago collected 19 species of Pleistocene mammals, among them a megalonyx, a tapir, a horse, a peccary, a bison, and an extinct bear. From a cave in western Maryland the writer has recorded 24 species of mammals, including 2 horses, 6 peccaries, 2 deer, an elephant, probably *Elephas columbi*, and one species of saber-tooth tiger. From a fissure in limestone, near Corriganville, Maryland, Gidley collected 40 or more species of mammals, among them an extinct bear, a mastodon, a horse, a tapir, 5 species of peccaries and many small species of rodents.

Near Frankstown, Pennsylvania, 10 miles south of Altoona, in a limestone cave, were collected by the Carnegie Museum, Pittsburgh, a considerable number of fragmentary fossils, a megalonyx, a tapir, a peccary, a bison, a mastodon, 2 bears, the dog *Enocyon dirus*, a musk-ox, and a horse.

Now all of these collections made in the Appalachian ranges appear to belong somewhere about the middle of the Pleistocene, in possibly

the Yarmouth or the Sangamon interglacial stages. In none of them are there any of the forms which I regard as peculiar to the first interglacial. If these species were then living it is hardly comprehensible that they did not occupy that region. At Nashville a large camel, perhaps a species of *Camelops*, has been found, accompanied by 2 species of horses, a *Myiodon*, and a deer; but these fossils occurred in stratified deposits at a depth of 30 feet and on a level with low water in the river; so that there is no reason for believing that they are not old. The occurrence of these at that locality shows that these animals were once able to visit that region.

4. The Mississippi embayment extends from Cairo to the Gulf. On each side of the river is a deposit which has been called the Port Hudson. In this deposit at various localities have been found important fossils.

From a deposit of blue clay believed to belong to this Port Hudson, and overlain by some 50 or more feet of a later deposit, situated near Natchez, Mississippi, or possibly partly collected from the later deposit, have been described the following seventeen species of mammals:

Megalonyx jeffersonii	Symbos cavifrons
M. dissimilis	Bison latifrons ?
Myiodon harlani	Mammut americanum
Ereptodon priscus	Elephas columbi ?
Equus complicatus	Castoroides ohioensis
E. leidyi	Ursus americanus
Tapirus haysii	U. amplidens
T. terrestris	Felis atrox
Odocoileus virginianus	

In Louisiana, in this Port Hudson, have been discovered at various localities mastodons, elephants, mylodons, megalonyx, horses, and tapirs. These genera and species are such as lived during the middle portion of the Pleistocene. We have, however, no account of there having been found, either in Louisiana, or any of the states bordering on the Mississippi as far north as Cairo, any camels or any of the other extinct animals the writer named as characterizing the first interglacial deposits. They abound, however, in Texas, and again in Florida. On account of the mild climate we might expect to find in this embayment *Megatherium*, *Glyptodon*, *Elephas imperator*, various camels, capabaras and saber-tooth tigers. If they ever left their bones and teeth in this Mississippi River region the remains appear to have been swept away by the floods of that great stream or to have been buried out of sight in its later deposits.

5. There is another important deposit in which we might expect

to find descendants of the early Pleistocene animals named, if there were any such descendants. This deposit, laid down during probably two distinct stages of the early middle and late middle Pleistocene, is known as the loess, a wind-laid element. It is found as a deep deposit along the Mississippi River from Natchez to northern Wisconsin and along the Missouri River to western Iowa and beyond. In places it abounds in land shells, but it has afforded here and there a few vertebrate fossils. In a deposit of loess at Alton, Illinois, the following list of 15 species of mammals were discovered many years ago.

Megalonyx jeffersonii	Bison sp. indet.
Equus sp. indet.	Mammut americanum
Platygonus Cumberlandensis ?	Castor canadensis
Sangamona fugitiva	Marmota monax
Cervalces roosevelti	Castoroides ohioensis
Rangifer muscatinensis ?	Geomys bursarius
Taurotragus americanus	Ursus americanus
Symbos cavifrons	

It will be observed that at least two-thirds of these fossils are of extinct species. This suggests that their time of existence was well back in the Pleistocene. Dr. Leighton, who studied³ the situation, was unable to determine with exactness the ages of the two beds of loess which overlay the bones. The lowest bed may be as old as the late Illinoian or early Sangamon stages. At any rate, none of the species regarded by the writer as belonging to the early Pleistocene are present in the collection.

The writer maintains therefore that he has demonstrated that the list of 50 species of mammals given on page 425 lived during an early stage of the Pleistocene, probably the first interglacial, or Aftonian, and that, further, he has shown that those species have not been found to have existed after that stage.

If we extend now our investigations into Florida we shall find some interesting facts.

At Arcadia many years ago about 25 species of vertebrate fossils were obtained. These consist of 15 mammals, an alligator, turtles, sea fishes, and sharks. The principal mammals are a megalonyx, *Chlamytherium septentrionale*, two species of *Glyptodon*, two horses, a tapir, a mastodon, and two elephants, one of which is *Elephas imperator*. Here we have many of the same genera and some of the same species as we have found in the four localities we have examined west of the

³ Journ. Geol. 29: 505-514.

Mississippi River. *Chlamytherium* we have not mentioned in any collection until now, but it is found in Texas associated with other early Pleistocene fossils.

A second locality furnishing similar fossils is near Vero, St. Lucie County. From a deposit about 2 feet thick have been described about 30 species of mammals besides birds and reptiles. Among the mammals are *Chlamytherium*, three species of horses, two tapirs, a camel, a bison, the mastodon, the giant capybara (*Neochærus*), a large tiger, and the floridan saber-tooth, *Smilodon*. In a sandstone of quite certainly the same geological age the skull of *Elephas imperator* was collected.

At Melbourne, Brevard County, Dr. J. W. Gidley and Dr. F. B. Loomis collected many vertebrate remains, among them *Elephas imperator*, three species of horses, one or more camels, *Chlamytherium*, and *Glyptodon*. It is wholly improbable that if these species existed during the middle and late stages of the Pleistocene, they had become so degenerate that they could not occupy the regions that I have mentioned.

The writer believes, therefore, that he is justified in maintaining that the deposits and their fossils found in the localities named and in other places in Florida and in Texas belong in the first interglacial stage. If there are yet those who believe otherwise it seems to be incumbent on them to present their reasons therefor.

PALEONTOLOGY.—*A new species of bear from the Pleistocene of Florida.* JAMES W. GIDLEY,¹ U. S. National Museum.

Two excellent papers recently published, one by Merriam and Stock², the other by Kraglievich³, have done much to lessen the confusion which for many years has existed regarding the proper classification and relationship of the Arctotheres of the Western Hemisphere. Merriam and Stock placed the group under a subfamily of the Ursidae, Tremarctinae, to include the living genus *Tremarctos*, *Arctotherium*, and, doubtfully, *Arctodus*. They recognized five described species from the Pleistocene of North America, and

¹ Published by permission of the Secretary of the Smithsonian Institution. Received August 13, 1928.

² *Relationship and structure of the short-faced bear, Arctotherium.* Contr. Paleont., Carnegie Institution of Washington, 347: 1-33, 10 plates, 1925.

³ *Los Arctoterios Norteamericanos.* Ann. Museo Nac. Hist. Nat., 34: 1-16, 1 plate, 1 text fig., 1926.



Hay, Oliver Perry. 1928. "Characteristic mammals of the early Pleistocene." *Journal of the Washington Academy of Sciences* 18, 421–430.

View This Item Online: <https://www.biodiversitylibrary.org/item/123329>

Permalink: <https://www.biodiversitylibrary.org/partpdf/101250>

Holding Institution

Smithsonian Libraries and Archives

Sponsored by

Biodiversity Heritage Library

Copyright & Reuse

Copyright Status: In copyright. Digitized with the permission of the rights holder.

Rights Holder: Washington Academy of Sciences

License: <http://creativecommons.org/licenses/by-nc-sa/4.0/>

Rights: <https://www.biodiversitylibrary.org/permissions/>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.