

FOSSIL MAMMALS OF FLORIDA



FLORIDA GEOLOGICAL SURVEY

• S.J. OLSEN •

STATE OF FLORIDA
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FOSSIL MAMMALS OF FLORIDA

By
Stanley J. Olsen

Tallahassee, Florida
1959
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STATE OF FLORIDA
STATE BOARD OF CONSERVATION
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FOSSIL MAMMALS OF FLORIDA

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INTRODUCTION

In 1928 Dr. G. G. Simpson's account of "The Extinct Land Mammals of Florida" was published as a part of the Twentieth Annual Report of the Florida Geological Survey. This report has *proven to be one of the most popular and widely circulated* of all the publications issued by the Florida Geological Survey. Due to the tremendous demand, over the past three decades, this report has gone out of print. However, recent requests and inquiries pertaining to this type of account have indicated that a publication similar to Simpson's is now required to fill this growing need for information concerning Florida's first inhabitants.

To simply reprint Simpson's excellent original work would not be enough as many new localities and their vertebrate forms have been discovered and described subsequent to his research and these must be included if an up-to-date account is to be compiled. Several of Florida's classic vertebrate localities (i. e., Thomas Farm Miocene quarry and Itchtucknee River Pleistocene deposit) have been discovered and recorded in detail during the time that has elapsed since the Twentieth Annual Report was first circulated.

In order that this may be regarded as a wholly new work, all of the illustrations have been designed and executed for this paper in original form. These excellent and accurately detailed drawings are the productions of Andrew Janson, Scientific Artist for the Florida Geological Survey, and in some cases situations for these drawings were taken from the published illustrations of Charles Knight and Robert B.

Horsefall, artists whose works need no further comment. Full credit for the original layouts is here acknowledged to these two master artists of North America's past prehistoric life. The detailed faunal lists are due to the careful work of Clayton Ray of Harvard University's Museum of Comparative Zoology.

To give a complete bibliography or to refer to all publications that give detailed citations of Florida fossils is not the purpose of this account. Those readers who require material of this nature are referred to the more complete bibliography contained in Florida Geological Survey Special Publication No. 3, "A List, Bibliography and Index of the Fossil Vertebrates of Florida."

The occurrences of fossil vertebrates in Florida are so numerous and scattered that it has never been possible for one worker to study or even examine all of the known materials. Under these circumstances, the published identifications are undoubtedly less comparable than if they were all made by one student; however, they have been accepted (with some changes in nomenclature) except where personal knowledge or unpublished notes has permitted a few corrections. The classification used by Simpson¹ is generally accepted by students of past mammalian life and has been the basis for the classification used throughout this summary. I also wish to acknowledge and give credit to Dr. G. G. Simpson for those portions of his writings that are used in this report.

The great difficulty in the deciphering of these faunas is inherent in the geologic conditions which prevail in Florida. None of the fully exposed sections as seen in the western United States, where the faunal sequence is frequently so clearly displayed, occur in the low-lying peninsular State. The fossils have usually been found in mining, dredging, realigning roadcuts or other operations which disturb the

¹Simpson, G. G., 1945, The Principles of Classification and a Classification of Mammals: Am. Mus. Nat. History Bull., v. 85, p. 1-350.

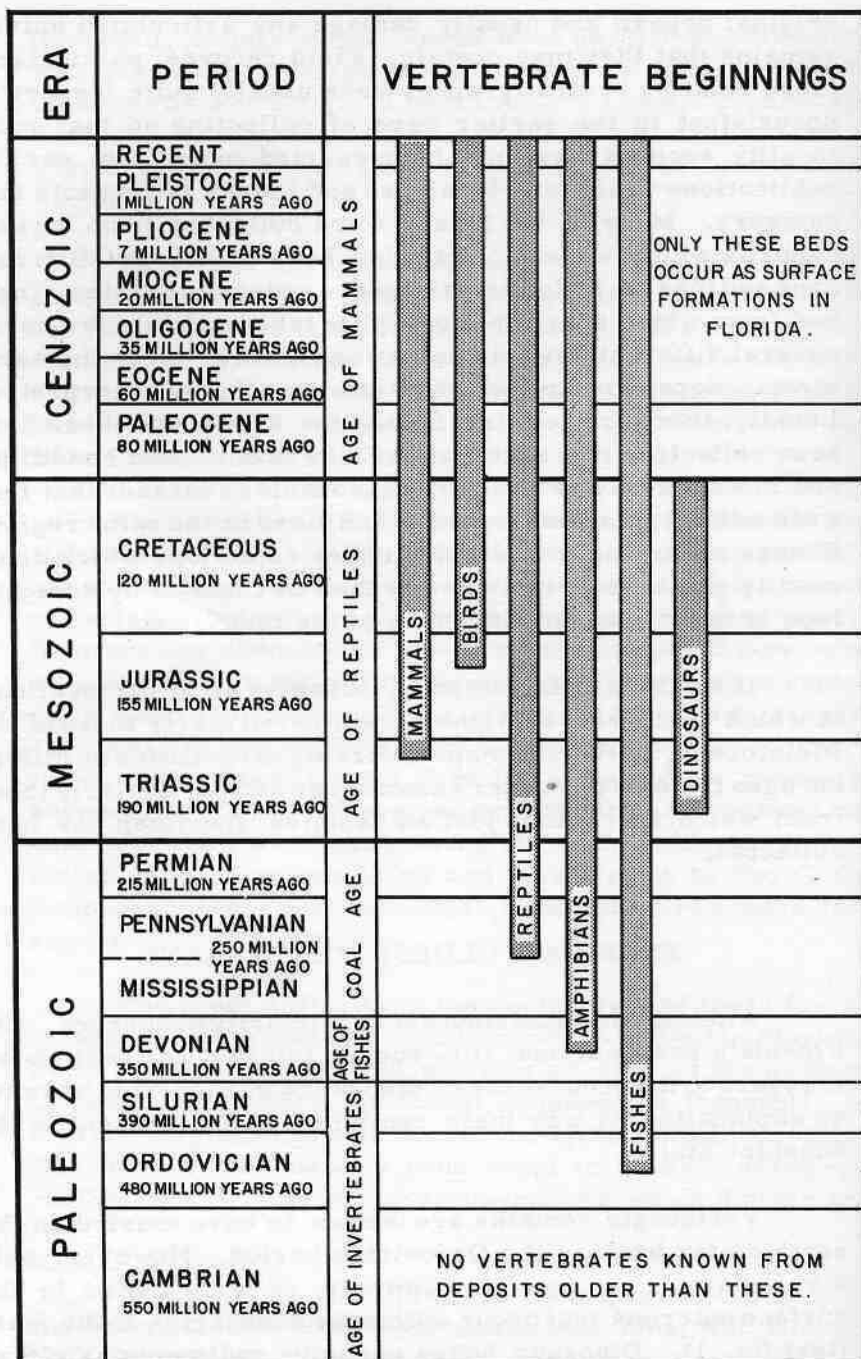
original deposit and usually damage any articulated animal remains that they may contain. Field records, particularly those relating to stratigraphy, were usually quite inexact or nonexistent in the earlier days of collecting so that some locality records have not been carried over from earlier publications which cite localities and faunas falling into this category. Many of the fossils were collected from stream deposits which were from eroded beds of several different ages and these mingled remains were redeposited into a single bed from which the collections were taken and in a few cases several different age determinations were given to the same strata, depending on which fauna was being interpreted. Luckily, there are good test faunas now known and these have been collected from areas where they occur under conditions and in such a way as to afford reasonable assurance that they were actually contemporaneous and lived in the same region. Faunas occurring or collected under conditions which could readily give rise to mixture can then be checked by comparison of their species with those of the test faunas.

It would be nearly impossible to give all of the localities in which vertebrate remains occur, particularly those of the Pleistocene, so that the maps referring to localities of different ages list only the better known areas and particularly those from which more than just an isolated specimen has been collected.

FLORIDA'S OLDEST VERTEBRATE

Although this contribution is primarily concerned with Florida's past mammal life, enough interest has been shown in regard to the occurrence of dinosaurs in Florida to warrant an explanation of why their remains are not present in the Sunshine State.

Vertebrate remains are known to have existed on the earth as far back as the Ordovician period. However, only the Cenozoic, or Age of Mammals, is represented in the surface outcrops that occur within the boundaries of the State (text fig. 1). Dinosaur bones occur in sediments as old as the Triassic period, but these interesting reptiles became extinct at the close of the Cretaceous, some 80 million years



Text figure 1. Geologic periods.

ago. In order to come in contact with beds of an age that might produce dinosaur bones, it is necessary in Florida to drill down through the earth's crust to a depth of several thousand feet (pl. I). The closest surface outcrop to Florida, of Cretaceous age, from which dinosaurs have been recovered, is from near Selma, Alabama, and Tupelo, Mississippi. This area is about 100 air miles from the North Florida border.

Florida's oldest vertebrate was recovered during the summer of 1955 by the Amerada Petroleum Corporation, during the course of drilling operations near Lake Okechobee. A well core, containing a partial skeleton of an aquatic turtle was brought up from a depth of 9,210 feet from the Glen Rose formation of the early Cretaceous. The exploration hole just happened to be in a position to penetrate the spot in which the remains of a fossil turtle were embedded. It is possible, but not very probable, that dinosaur remains, teeth or partial vertebrae, could be recovered from Cretaceous beds in Florida under similar conditions.

FOSSILIZATION AND THE STUDY OF FOSSILS

How Fossils Are Formed

In very simple words, a fossil is anything of organic origin which has been preserved in the earth's crust by natural causes. (Organisms which have been buried in the earth during historic times are usually not included in this category.) Some strata, as coal or limestone, are made up wholly of fossils, but are popularly termed "rocks" rather than fossils. Fossils are found in various states of preservation, from those such as the Mammoth of Siberia, which retains most of the original flesh, skin, hair and bones, to mere tracks which retain no part of the animal itself. Some fossils have been turned to stone, or petrified; many others are preserved without any change other than the loss of soft tissues. Except under the most unusual conditions, as in the natural cold storage of the far north, or preservation in amber (fossil gum), the soft tissues decay leaving only the bones, teeth and hard parts behind to fossilize.

Plate I. Why there are no dinosaurs in Florida.

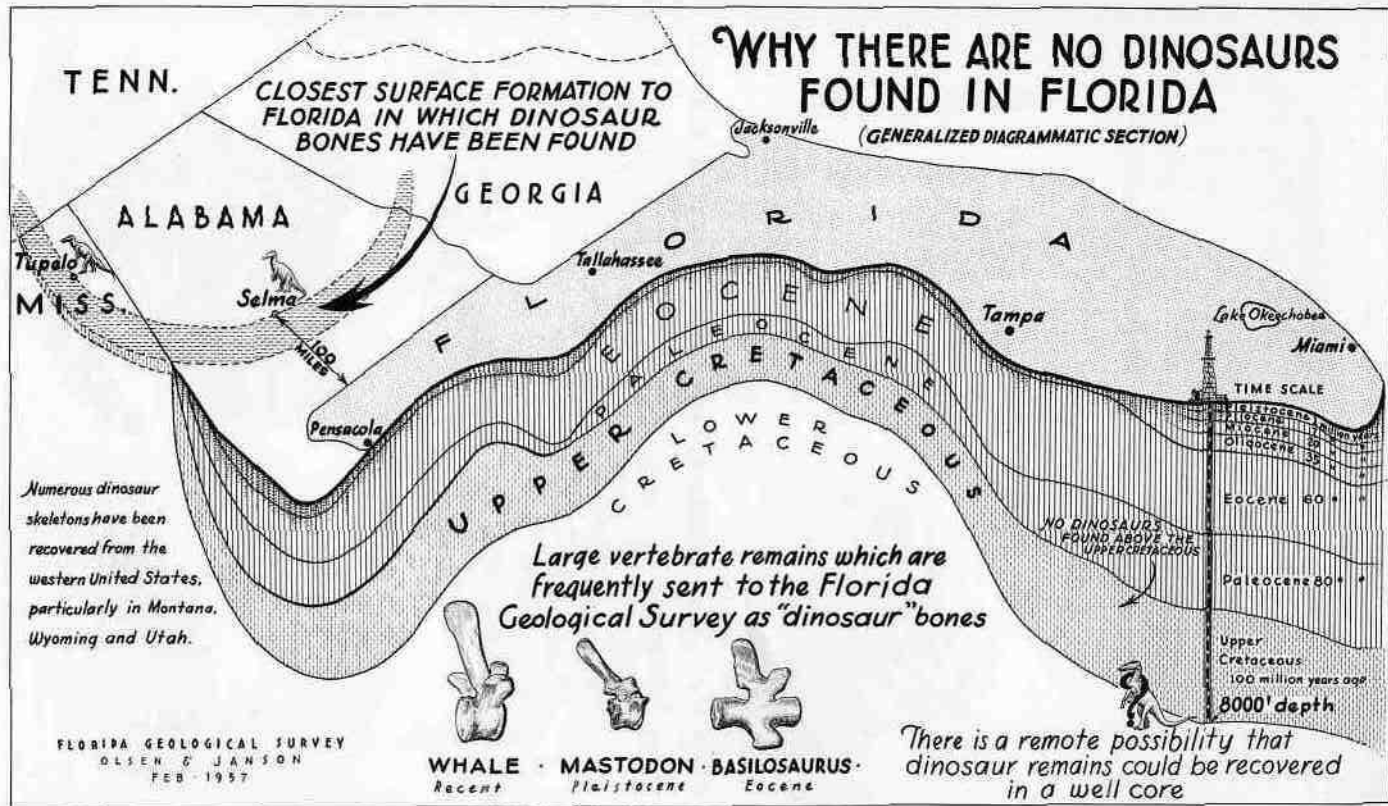


Plate II. Common vertebrate fossils found in Florida.

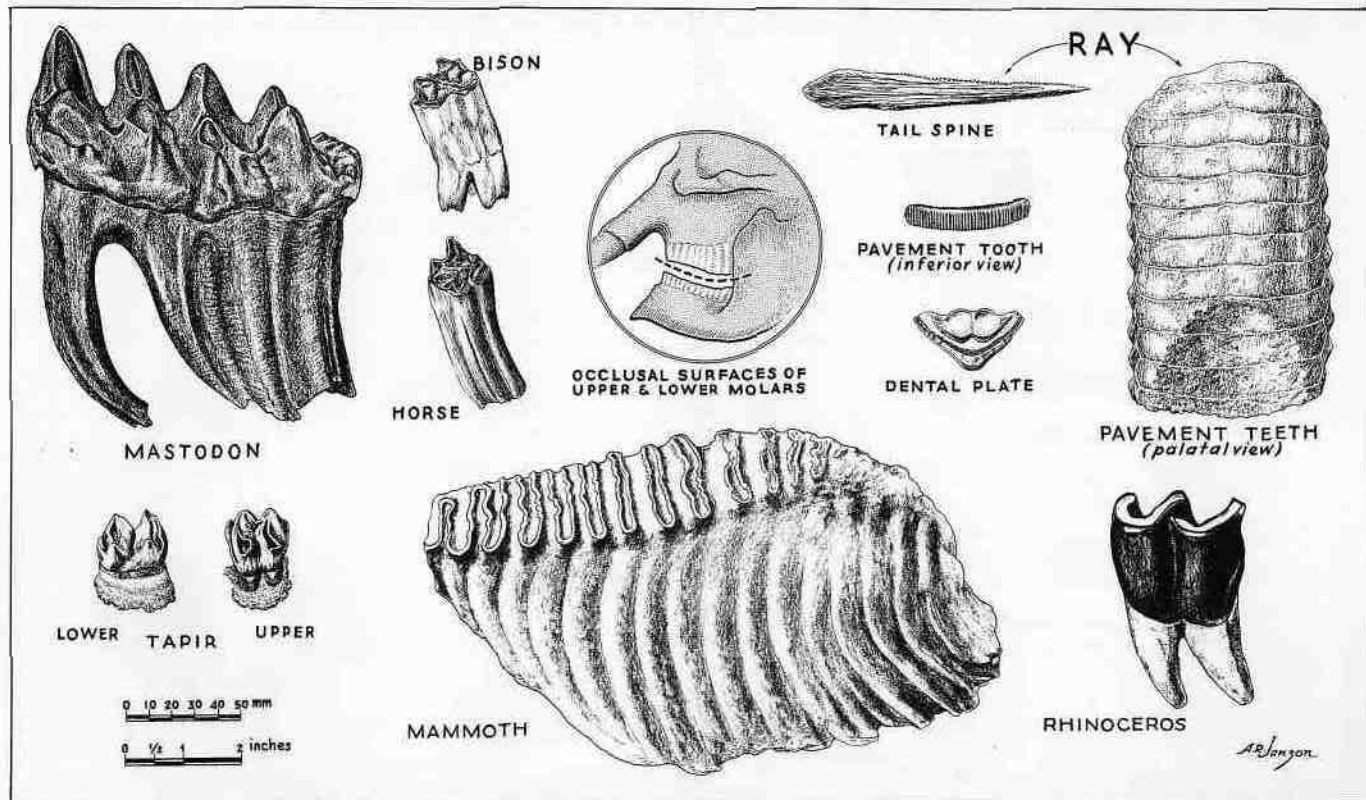
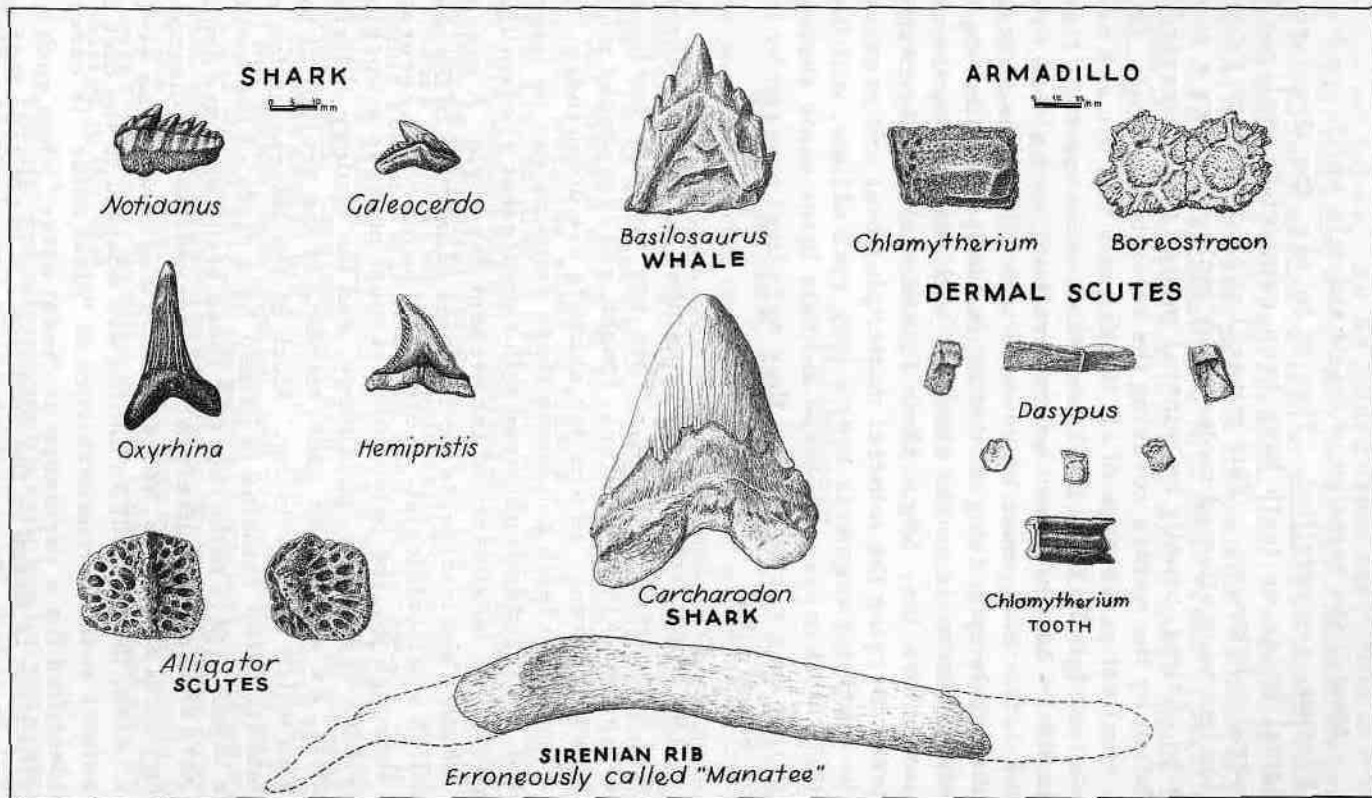


Plate III. Common vertebrate fossils found in Florida.



Most of the remains of fossil animals which are found in Florida, are petrified. That is to say, the structure of original bones or teeth have been completely replaced by mineral substances. This mineral replacement or substitution has been effected molecule by molecule, over a great period of time, usually by mineral matter that is carried in solution by the waters covering the entombed animal. Only the smallest percentage of all the animals that die are ever fossilized (pl. II, III). Ideal conditions must exist for these animals to be preserved or mineralized as we find them today. The body must be covered with silt or sand almost immediately upon dying so that rapid decay or scattering by predatory animals or the elements will not destroy the remains before they begin their fossilization. Percolating waters, carrying the mineral matter plus heat and pressure of the overlying segments over a long span of time, will then do their work to preserve these animals in the same skeletal form that they exhibited when they were first covered by the flood-borne silts.

The important thing to remember is that vertebrate fossils truly represent life. They are not just dry bones but are animals that ate, drank, fought, and reproduced much in the same manner as similar animals are doing today. By the form of the teeth and bones these remains can be interpreted, analyzed and compared with animals that are familiar to all of us as inhabitants of the present day world. A person who studies and interprets the remains of animals of the past is called a paleontologist. In order that he may do an accurate and thorough job, the paleontologist must possess a working knowledge of anatomy, physiology, and the ecology of living animals, as well as an understanding of the geology of the area in which he is working. Much of the interpretation of vertebrate fossil remains is gained by a study of the teeth. This is due in part to the fact that these structures are dense and hard and are more likely to be preserved than are the more spongy parts of the ribs, vertebrae and long bones of the skeleton. Also, the teeth of an animal are adapted to the diet of the animal so that a true herbivore or "plant eater" is rarely misidentified for a carnivore or "meat eater" when such an identification is based on the dentition. It is not true that an entire animal can be reconstructed from a single bone. It is true that a pretty fair knowledge of an animal's form, and

hence his habits, can be gained from very little in the way of actual remains, but almost never is an animal's skeleton restored for museum exhibition unless the skeletal remains of the animal are well represented. Usually when an individual animal has the missing parts of its skeleton restored in plaster, the measurements and form of these restored parts were taken from another individual in which these bones were completely known.

The age of the various strata, in which animal remains are found, can be interpreted from evidence based on the rate at which radioactive minerals undergo chemical changes that can be detected and measured as to the amount of change that has taken place since these minerals became a part of the strata which is being dated (pl. 4).

Paleontology

Why devote time, energy and money to a science that is as far removed from our everyday world as is the study of fossils? In these days of great world-shaking events, why concern ourselves with the remains of animals of another age? These are questions commonly asked a paleontologist. In our modern world of economic problems and threats of atomic war, the study of fossils seems distantly removed from the realities of everyday life, and it is true that much of paleontology has little bearing on direct economy. Paleontology is a cultural science, one of the few "pure" fields of science today which is not primarily concerned with an economic return. Man does not read the newspaper or history texts, or visit a museum of art or a national park, for economic gain. Emerson has said, "Man loves to wonder, and that is the seed of his science." We have arisen to the heights of our mental development, and proportionally to our status in this world, through the human characteristic of wanting to know something about everything. We wish to know something of the past, partly for pure pleasure, and partly for an increased understanding of life today as based on life as it existed in the past.

The study of microscopic fossils has led to an interpretation of the layers of the earth's crust that is of the most

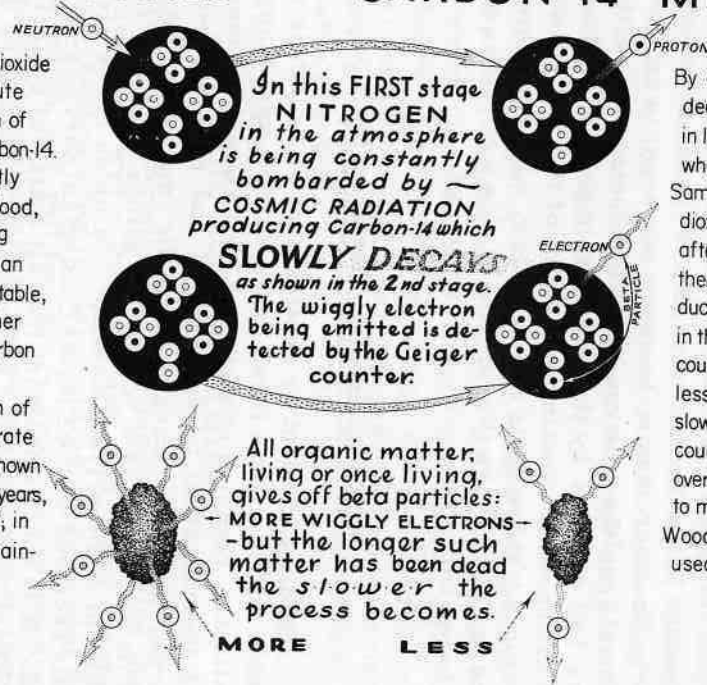
Plate IV. Dating fossils by carbon 14 method.

HOW OLD ?

DATING FOSSILS ~ CARBON-14 METHOD

All plants, as they absorb carbon dioxide from the air, take in with it minute quantities of a radioactive form of carbon known to scientists as Carbon-14. Since all animals depend directly or indirectly on plants for their food, it follows that every living thing contains Carbon-14. But when an organism, whether animal or vegetable, dies, it normally takes in no further carbon. Instead, its radioactive carbon begins to decay.

In dead organisms the proportion of Carbon-14 decreases at a fixed rate which does not vary under any known physical conditions. After 5,568 years, half the Carbon-14 content is lost; in the next 5,568 years half the remainder disappears, and so on.



By comparing the amount left in any dead organic matter with the amount in living matter, scientists can estimate when the organism died.

Samples are first burned to form carbon-dioxide gas. In one method, the gas, after further chemical treatment, is then treated with magnesium to produce pure carbon. Finally the carbon, in the form of a paste, is fed to a Geiger counter. The older the sample is, the less Carbon-14 it contains and the slower is the pulse of the Geiger counter. Carbon-14 content in material over 50 thousand years is too small to measure.

Wood, bone, horn and shell have been used in dating.

vital economic importance to the petroleum industry. Without the help of these minute organisms, or index fossils, the bulk of oil prospecting would revert to "blind guessing" rather than to the well organized interpretation of the geologic structures as we know it today. In some cases, vertebrate and plant fossils can be used for guides or index fossils and give us a clue to the age of the sediments that contain them. If, for example, a formation were found in which the remains of a flowering plant were preserved, this formation would not be older than the Cretaceous as these plants have their beginnings in the Cretaceous. If, in these same beds identifiable dinosaur bones, however scrappy, were found the sediments could not be younger than Cretaceous as the dinosaurs had died out by the end of this period. Likewise, if beds are known to contain the remains of the early dawn horse "Eohippus," these beds can be dated, with complete confidence, as Eocene, as the remains of this well known mammal are found only in deposits of Eocene age.

Collecting and Identification

Hardly a roadcut or realignment of a ditch is made in Florida without some fossil being turned up. Many of the fossils are common enough and well known, but many more need identification by a qualified and experienced person in order that a specimen of scientific importance may not be lost or set aside as a "curio" to gather dust in a forgotten corner of some private dwelling. Samples of fossils will be gladly received by the Florida Geological Survey and reported upon. It is most important that all material collected, if it is to have any scientific importance, should have accurate locality data accompanying it so that adequate comparisons with faunas of a similar age can be undertaken. Attention to inquiries and general correspondence is an important part of the duties of the paleontologist, and affords a means through which the Survey may, in many ways, be of service to the citizens of the State.

The State Legislative Act of the General Assembly of 1907 (Chapter 5681, Section 4) empowered and directed the Florida Geological Survey to collect and display Florida's

fossil plant and animal remains. To fulfill this objective, the Survey continues to enrich its collections with material secured by Survey collection and by gifts from its friends. To adequately display and care for these treasures, a suitable building is needed and it is hoped that this need will be fulfilled in the near future.

It cannot be stressed too strongly that anyone contemplating collecting fossils within the State should first secure permission from the owners of the land on which any prospecting is to be done. The days of unchallenged roaming are at an end and in most cases permission for collecting will be granted by the owners if the courtesy of requesting this permission is extended to them.

Although most quarries are fenced and posted, there is the personal danger of entering, without permission, an area in which blasting is going on. Abandoned water-filled quarry holes offer a hazard to any small children or non-swimmers who may be in a party engaged in prospecting areas of this sort and adequate precautions should be taken to avoid preventable accidents.

THE AGE OF MAMMALS

Although mammals had their beginning during the Age of Reptiles they were insignificant, rat-sized creatures, hardly noticeable among the large ruling reptiles that dominated the earth 150 million years ago. These beady-eyed ancestors of all mammals to follow may have contributed in a small way to the downfall of the dinosaurs by robbing their nests and destroying the eggs. Insignificant as he was in the Cretaceous, the mammal was already better adapted for an active life on this planet than was his neighbor, the dinosaur. The mammal, due to his physiological mechanism, could maintain a nearly constant body temperature and thereby remain active regardless of the weather conditions - not so with the reptile. The activity of this cold blooded animal is regulated by the outside weather conditions and temperature. If the weather is too cold, he is sluggish or even completely inactive; if the weather is too hot, he simulates a form of

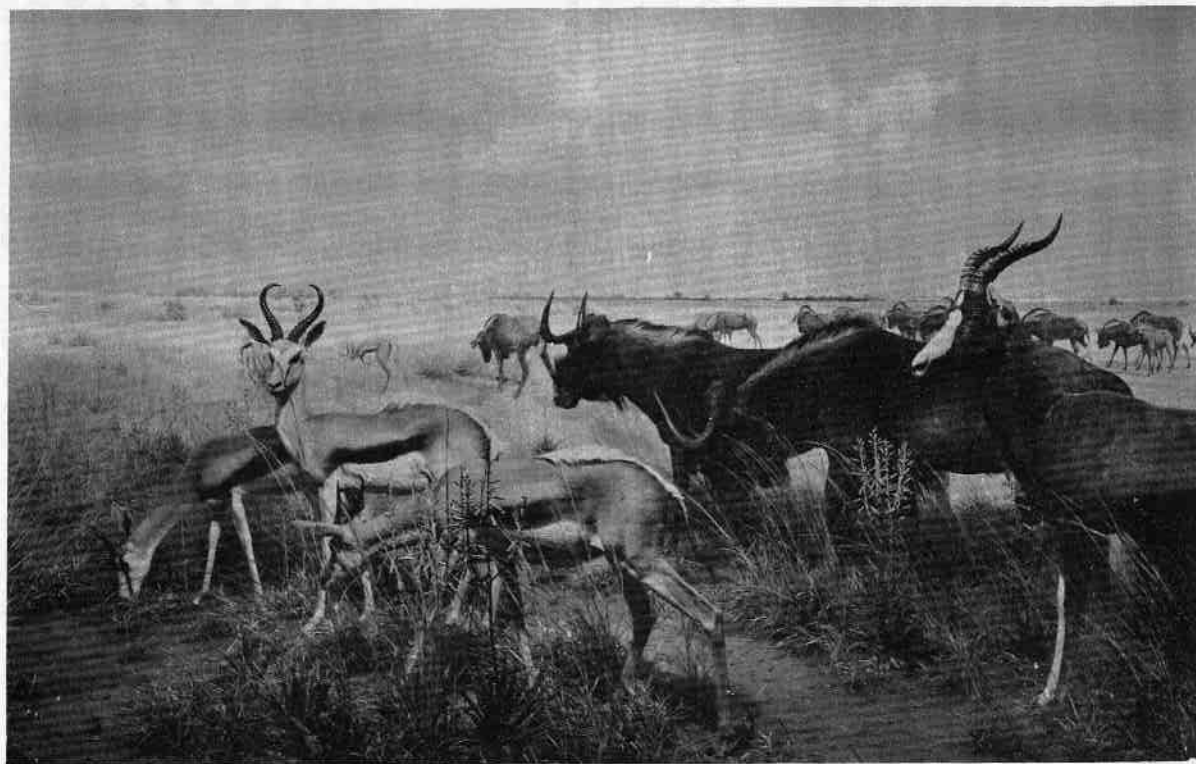


Photo: American Museum Natural History

Text figure 2. African big game herd, similar to herds of animals occurring in Florida during the Pleistocene.

sunstroke and may even die. The mammal in all respects was capable of a faster, more continuous mode of existence.

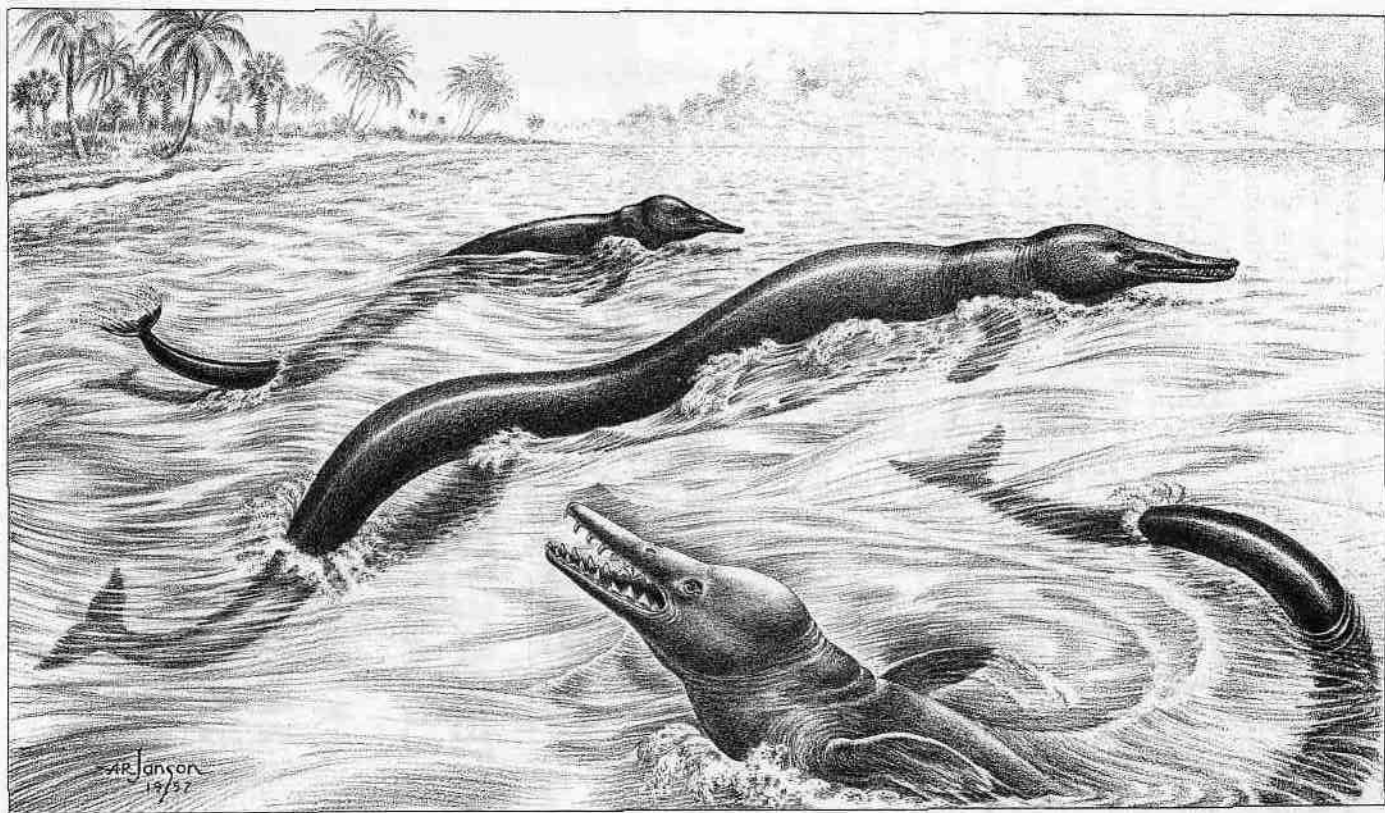
This changeover of mammalian dominance did not take place at once, but was a gradual change over millions of years and by Eocene time the mammals were here to stay. By Miocene time, the many groups of mammals had adapted themselves to nearly all environments from an existence in water to the airborne travel of the bats. During the Pleistocene much of Florida must have represented the great Serengetti Game Plains of East Africa during the late 1800's, with vast herds of browsing and grazing herbivores congregating around water holes to be preyed upon by the many carnivores that existed at that time (text fig. 2).

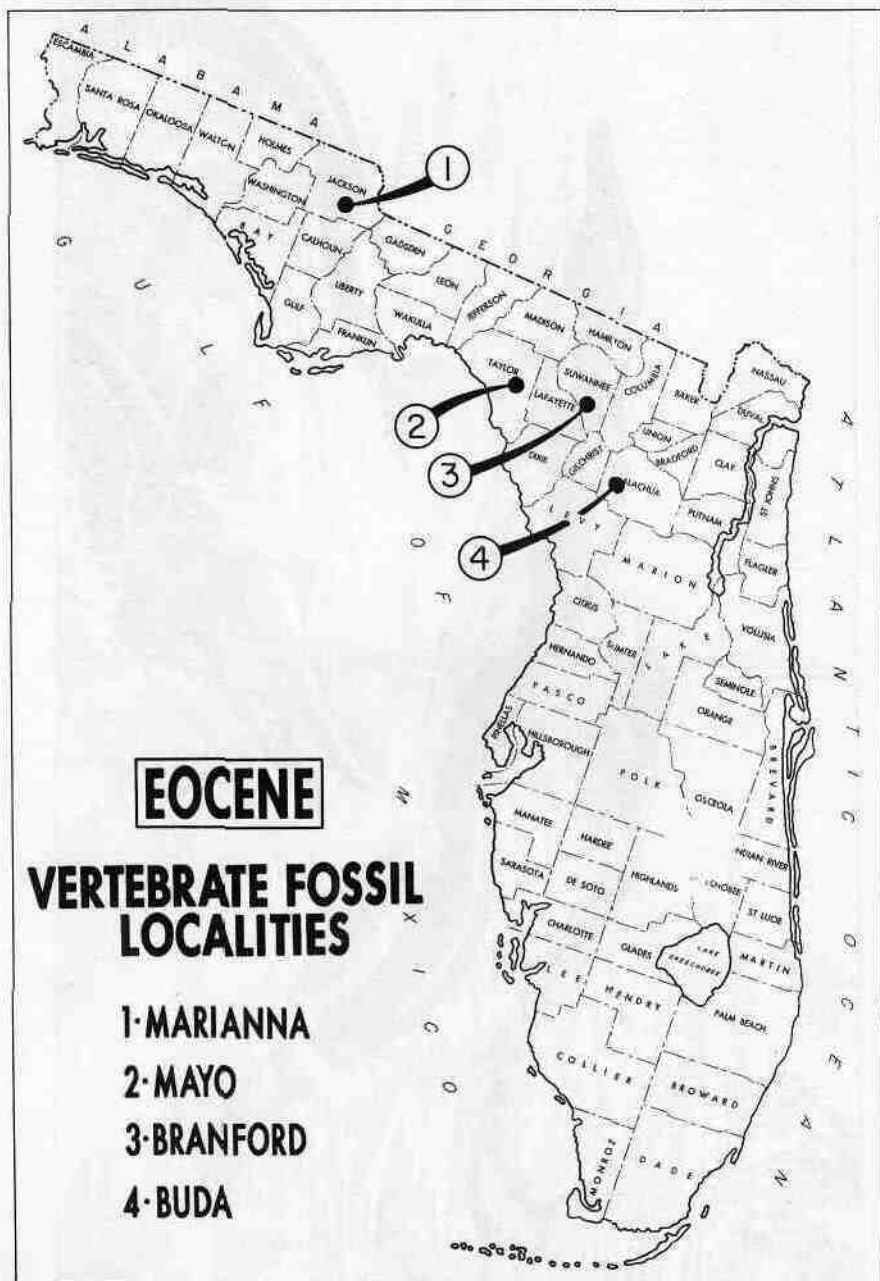
With all of us familiar with the many mammals that exist today (including man), it is difficult to visualize a world devoid of these animals as it was in the early days of the Age of Reptiles. Probably the most apparent difference would have been the quietness of this "silent world" lacking the mammal and bird noises which we take for granted, unless these early reptiles were capable of making bellowing sounds similar to those of the Florida alligator.

Eocene

The limestone of the Crystal River formation has preserved the remains of the extinct whalelike form of Basilosaurus or Zeuglodon in several widely scattered localities throughout the northern portion of the State. This marine mammal attained a length of over 40 feet and had a body form that was well adapted to speed and maneuverability in water (pl. V). The true whales are found in the later marine deposits and their remains are common finds in the Pleistocene deposits of the southern peninsula that are worked by draglines for their roadbed material.

The vertebrae of Basilosaurus differ noticeably from those of other large mammals in that they are proportionally much longer when compared to the diameter of the centrum which may exceed a measurement of eight inches (pl. I).





Text figure 3. Map of Eocene localities.

These vertebrae are usually a blue-black in color when found, and stand out against the white or cream colored matrix of the entombing limestone. The premolars and molars are characteristically serrate-edged along the margin of the cutting surface and are readily distinguished from the teeth of the large Tertiary shark Carcharodon (pl. III). The incisors and canines are simple, recurved, cone-shaped structures which have a single pointed root to secure them in the socket or alveolus of the jaws.

Remains of this large mammal have been found in various limestone quarries throughout the State and in particular in the Buda pit of The Williston Shell Rock Company near Buda, Alachua County, and from a pit of the Dell Mine near Mayo, Lafayette County. Remains are also known from the quarry of the Suwannee Lime Rock Company near Branford, Suwannee County (text fig. 3).

EPOCH	NORTH AMERICAN PROVINCIAL STAGES	FLORIDA EQUIVALENT
		OCALA FAUNA
EOCENE	DUCHESNEAN	
	HINTON	
	BRIDGERIAN	
	WASATCHIAN	

Text figure 4. Age correlation chart of Florida Eocene with that of North American provincial stages.

The Eocene beds of Florida are all of marine origin and none of the interesting terrestrial or land mammals as found in Wyoming and the adjacent areas have been reported as occurring within the boundaries of Florida.

Eocene Faunal List

Cetacea: Whales and porpoises

Basilosauridae: Archaic whales

Basilosaurus: Harlan 1834, sp. indet.

Basilosaurus cetoides (Owen) 1845

Oligocene

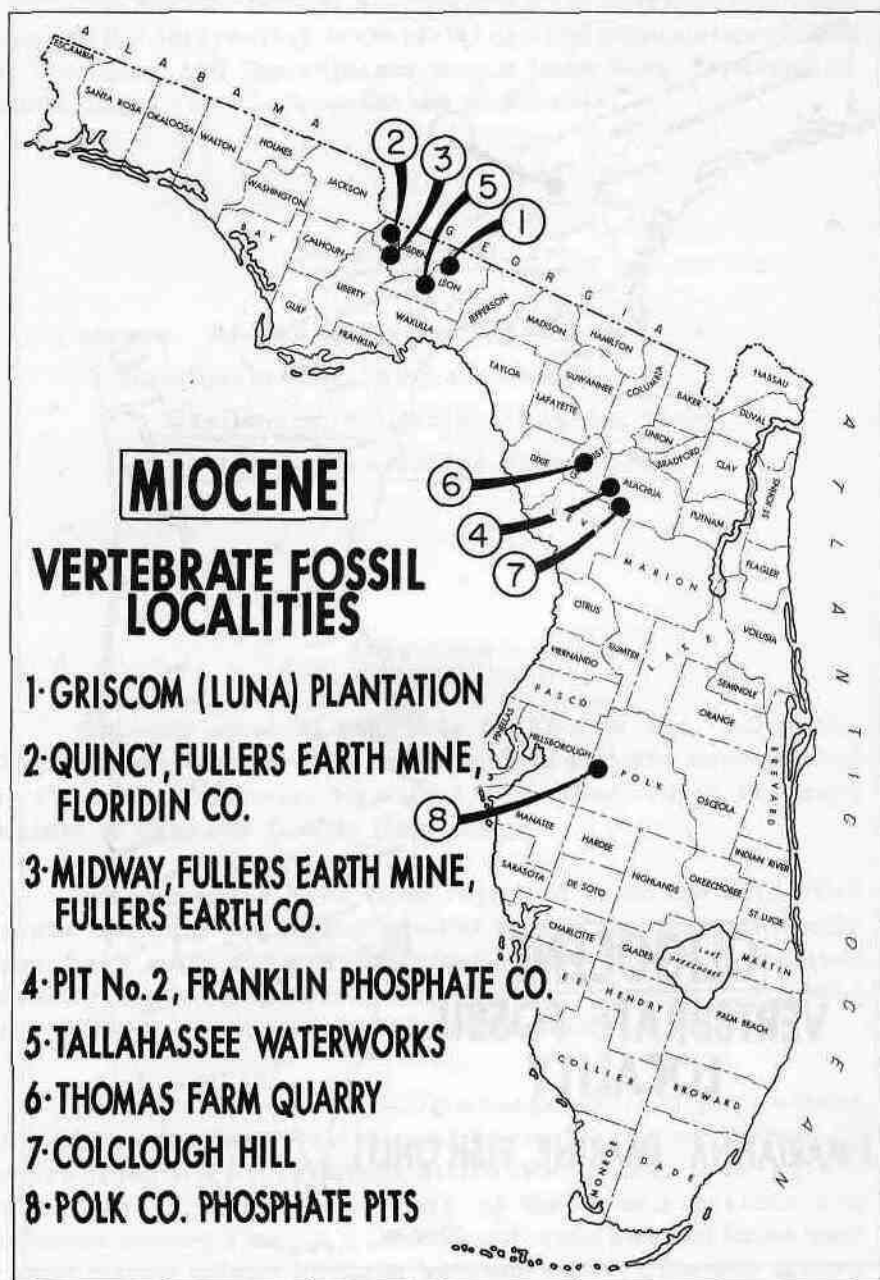
As with most of the beds of Eocene age, all of the Oligocene deposits are of marine origin and are represented by the cream colored Marianna limestone which outcrops mainly in Jackson County (text fig. 5).

No mammals have been reported from the Oligocene strata and only one or two teleost fish of the snapper family have been collected and described. However, this isolated locality is recorded here in the hope that additional prospecting in this area may turn up mammalian remains.

Both the Eocene and Oligocene deposits of the western United States have vast faunal assemblages of mammals whose scientific descriptions fill many volumes. It is regrettable that terrestrial deposits of these two periods are unknown among Florida's surface outcrops and that important comparisons cannot be made between eastern Eocene faunas and those of the west as they are with the vertebrate fossils of the Miocene, Pliocene and Pleistocene periods.



Text figure 5. Map of Oligocene locality.



Text figure 6. Map of Miocene localities

Miocene

The Tertiary deposits of the western United States have yielded a remarkably complete story of the history of land mammals throughout the entire extent of the Age of Mammals. Although the Pleistocene, and the last phase of the Tertiary, are well represented in the eastern United States and a few marine deposits of Miocene age are known, only one early terrestrial deposit of any consequence is present in the known sedimentary rocks east of the Mississippi River. The reason for this lack of a fossil record, in this part of North America, is due to the early Tertiary sediments being dominantly marine in nature and hence containing no land mammals. The one exception to this barren record lies in north central Florida. This deposit, the richest bone bed of Miocene age in eastern North America, is located in Gilchrist County in a most unpromising-appearing setting of low, sandy flatwoods having none of the "usual" surface outcrops visible with which vertebrate fossils are associated. The circumstances that led to the discovery, purchase and development of the now famous Thomas Farm quarry are worthy of relating here in some detail.

In September 1931, Mr. J. Clarence Simpson, of the Florida Geological Survey, was investigating a reported Indian graveyard that had turned up while plowing through a depression in an abandoned field of the old Raeford Thomas Farm located between Bell and Ft. White. Mr. Clarence Simpson determined correctly that these bones were not of human origin but represented, instead, the remains of the small three-toed horse *Parahippus* and were similar to those obtained from the fuller's earth pit at Midway, Florida, in Gadsden County. A small collection of fragments from those that littered the surface of the shallow depression which marked the original site, were sent back to the Geological Survey office in Tallahassee. The Survey Director at that time, Dr. Herman Gunter, forwarded these scraps to Dr. G. G. Simpson at the American Museum of Natural History in New York City. Dr. Simpson, a recognized authority on fossil mammals, of course recognized the scientific importance of this find and urged that more material be collected if possible.

Dr. Gunter secured permission to excavate and several more trips were made to the farm by personnel of the Florida Geological Survey between 1931 and 1932. A published account of the first material obtained at this dig was released by the Florida Survey in 1932 (Simpson, G. G., Miocene Land Mammals from Florida, Florida Geol. Survey Bull. 10, 58 p.).

In 1939, Dr. Thomas Barbour, Director of the Museum of Comparative Zoology at Harvard College, made one of his frequent trips to the Sunshine State to obtain fossils for the Harvard Museum and stopped for a visit at the office of the Florida Geological Survey. During the course of his stay in Tallahassee, Barbour had occasion to examine the fossils that had been obtained from the newly-opened deposits at the Thomas Farm.

The result of this visit was a desire, on Barbour's part, to purchase the forty acres of land that contained the fossil quarry so that it would be protected for future scientific excavations. Dr. Gunter located the owners, a loan and trust company in Georgia, and undertook the initial negotiations for the purchase of the desired land. The property was purchased and deeded over to the present owner, the University of Florida, with the verbal understanding that Harvard University and the Florida Geological Survey would also enjoy the privilege of collecting fossils from the Thomas Farm quarry, for scientific study or display. The Florida Geological Survey has received the cooperation of both universities in its endeavor to obtain a series of vertebrates from this locality for the state collections that are housed in the Survey's present quarters in the State capitol at Tallahassee.

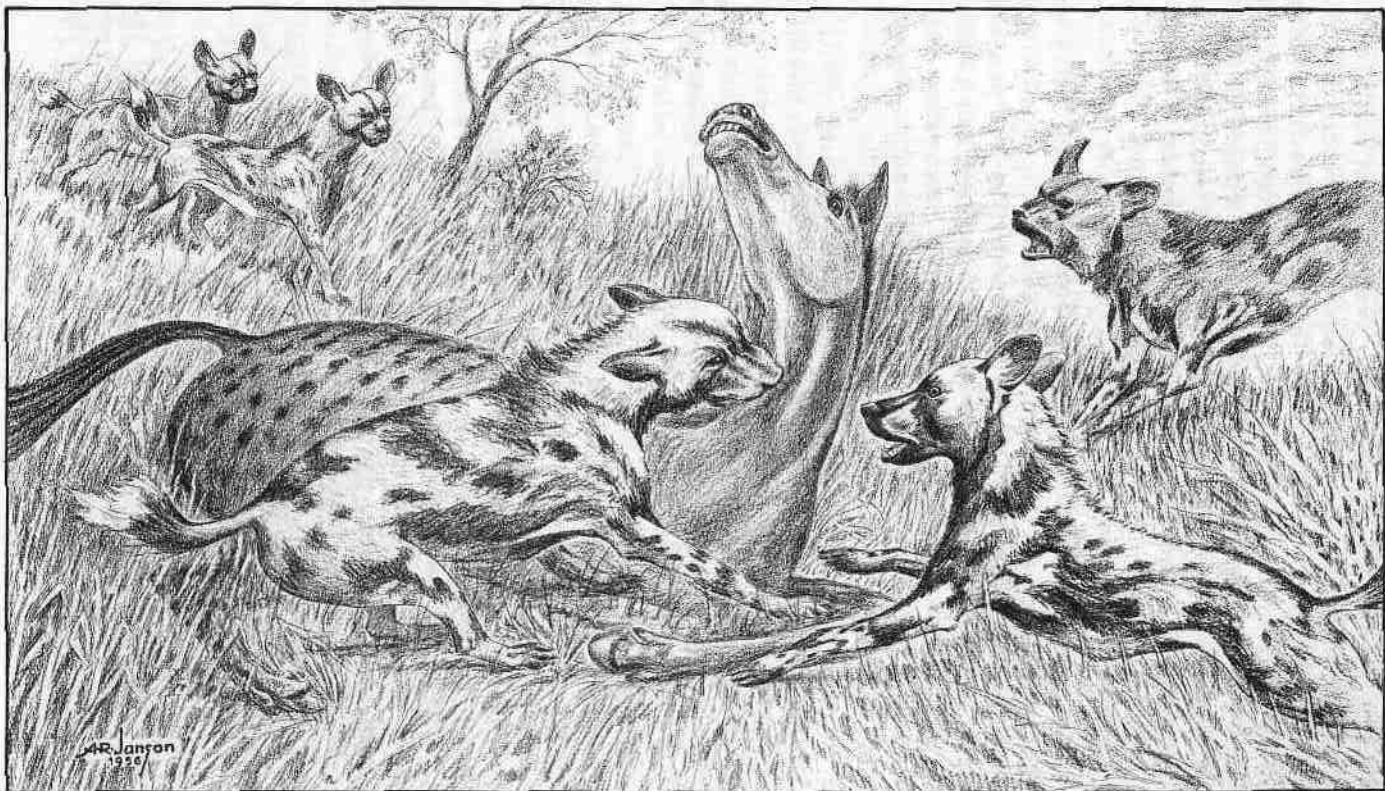
The nature of this locality, as it appeared in Miocene time, has not been solved to the satisfaction of all concerned. Indications point to a partially filled sinkhole or to a cavern or rock shelter having considerable depth, located perhaps at the edge of a stream. That a cavern of some sort was present is attested to by the numerous bat remains that are found in the rubble of a boulder bar or breakdown of a long collapsed cave roof. That this cavity was at times water fed is indicated by the various amphibian, aquatic turtle and

alligator remains that are present in the sediments. However, no reliable or identifiable fish bones have turned up in the nearly three decades of digging since the quarry was first discovered. Another indication that this deposit was stream fed at one time or another, while the animals were being entombed, is substantiated by the waterworn scraps of bone and by the evidence that no articulated or individually associated skeletons have been found. Instead, it is not unusual to find five or six horse skulls nesting together or half a dozen or so femora, of the same side of the animals represented, lying in close contact. Although quite a few complete skeletons are known of the small horse Parahippus (pl. VI), the different elements composing these complete skeletons may represent several individuals rather than belonging to one animal as is usually the case in most vertebrate fossil quarries from which complete mammal skeletons are known.

Among the animals, represented in the known collections from this site, are the remains of the large bear-like carnivore Amphicyon, which rivaled the Kodiak bear in bulk and in having a similar battery of powerful teeth. Also present are the smaller coyote-sized dogs Cynodesmus and Tomarctus (pl. VI), as well as a badger Leptarctus and a small skunk Miomustela. A few long-snouted camels known as Floridatragulus as well as the small dik-dik sized artiodactyl Blastomeryx were also dwellers of the Thomas Farm area in Miocene time. The remains of two different sized hornless rhinoceros have occasionally turned up in the excavations.

One of the interesting things concerning this Florida locality, as compared with those of similar age found in the western United States (text fig. 7), is the total lack of the remains of either felids or Oreodonts. Both of these groups of animals are well represented in similar quarries throughout the western United States and the latter animals are so numerous in some areas that certain layers that contain their bones have been dubbed "Oreodon beds" by the paleontologists that work these beds. No positive statements can be made, based on our present knowledge of these forms, as to why they would occur in great abundance in one area and be totally absent in another.

Plate VI. Miocene horse Parahippus and dog-like carnivore Tomarctus.



The present limits of the excavation, that contain the most productive collecting area, measures approximately 30 by 60 feet and reaches a depth of 15 feet below the surrounding terrain. Test borings made by the Florida Geological Survey indicate that the bone-bearing beds extend to a depth of about 30 feet below the present bottom of the pit and become barren of bone about 100 feet out from the present center of operations.

This quarry has actively been worked by one party or another from each of the three institutions concerned since 1941. Dr. A. S. Romer of Harvard University, and present Director of the Museum of Comparative Zoology, has postulated that the pit would not be completely excavated until approximately 2000 man-years of labor had been expended.

It must be stressed that anyone contemplating visiting the Thomas Farm quarry will have to have written permission from the head of the Biology Department of the University of Florida. This precaution is to prevent uncontrolled wandering over the bone deposit, which would destroy scientific material that could not be replaced.

The Griscom Plantation, or Luna Plantation, as it is generally known today, is located about 15 miles north of Tallahassee in Leon County. This plantation is the site of an early Miocene vertebrate locality that was accidentally discovered in 1916 during the course of digging a shaft for a water well. This shaft, having a diameter of six or eight feet, was dug to a depth of 50 feet before it had to be abandoned due to encountering poisonous gases. The workmen had struck a bone-bearing layer, just before the pit was vacated, which has produced the types of the Miocene horse Parahippus leonensis and the dog-like Cynodesmus iamonensis. The well was completed by the use of a mobile drill rig and the larger hand dug opening was filled in around the well casing, no additional bone fragments being collected. This bone-bearing layer does not outcrop on the surface in the vicinity of the plantation and, since the original well is now in the landscaped area of the plantation headquarters, it is improbable in the

foreseeable future that additional material will be collected from this locality. All of the animals obtained from this well, with the exception of the carnivore Temnocyon, are also known from the Thomas Farm quarry. This last named form has been recorded from a small bone-bearing pocket situated in Pit No. 2 of the Franklin Phosphate Company's mine near Newberry in Alachua County. This pit is now abandoned and a good deal of the exposures are covered with redeposited surface soil or vegetation so that the possibilities of getting good additional material from this locality are poor indeed.

As in the case of the Griscom Plantation, the digging of a pump pit by the Tallahassee water works was responsible for some very tantalizing fragments of the Miocene rhinoceros Aphelops and a camel Nothokemus. These meager scraps were collected in 1930 and here again, as in the Griscom Plantation locality, the bone-bearing layer is no longer available for further exploration.

The most recent locality of Miocene age to come to light was exposed by a road cut through Colclough Hill, south of Gainesville in Alachua County. This layer, judging by the fauna, was laid down as a marine or brackish water deposit. The animals from this layer have been identified as the small Miocene horse Parahippus blackbergi, a squirrel-like rodent and numerous shark and ray teeth. Although this site will most surely never be developed as a quarry, enough material has been collected as surface scrap to warrant future investigation, particularly after heavy rains.

Only two good Miocene localities have been reported from the Florida panhandle. Both of these are located in Gadsden County and were located in the fuller's earth mines of this area. The first of these localities, at Quincy, produced Florida's first identifiable material of the Miocene horse Merychippus. From the second locality, at Midway, were recorded scraps of Parahippus and Nothokemus as well as Merychippus. Both of these sites are now in abandoned water-filled pits. The surrounding country is covered by brush so that little hope is held for any additional fossils being

obtained from the original locations.

The fossil beds of Polk County will be discussed in some detail in the following section on the Pliocene beds of the Bone Valley, but a note is in order in this section pointing out that vertebrate remains, found only in the Miocene in other parts of the western hemisphere, have been taken up from the Bone Valley deposits.

These "true" Miocene forms are the badger Leptarctus, the tapir Tapiravus, and the cetacean Hoplocetus.

EPOCH	NORTH AMERICAN PROVINCIAL STAGES	FLORIDA EQUIVALENT
		BONE VALLEY FAUNA
MIOCENE	BARSTOVIAN	FULLERS EARTH FAUNA THOMAS FARM FAUNA
	HEMINGFORDIAN	
	ARIKAREEAN	

Text figure 7. Age correlation chart of Florida Miocene with that of North American provincial stages.

Miocene Faunal List

Chiroptera: Bats

Vespertilionidae: Little brown bats, big brown bats, etc.

Suaptenos whitei Lawrence 1943

Miomyotis floridanus Lawrence 1943

Gen. et sp. indet.: Eptesicus-like
vespertilionid

Rodentia: Rodents

Mylagaulidae: Extinct family

Mesogaulus Riggs 1899, sp. nov.

Heteromyidae: Pocket mice, kangaroo rats

Proheteromys magnus A. E. Wood 1932

Proheteromys floridanus A. E. Wood 1932

Gen. et sp. indet.

Cricetidae: Native rats and mice (rice rats, cotton rats, white-footed mice, etc.)

Gen. et. sp. indet.

Cetacea: Whales and porpoises

Physeteridae: Sperm whales

Hopllocetus Gervais 1848-52

Acrodelphidae: Long-beaked porpoises

Schizodelphis bobengi Case 1934

Schizodelphis depressus G. M. Allen 1921

Pomatodelphis inaequalis G. M. Allen 1921

Delphinidae: Dolphins, killer whales, blackfish, etc.

Megalodelphis magnidens Kellogg 1944

Cetotheriidae: Whale-bone whales in part

?Isocetus Van Beneden 1880, sp. indet.

?Mesocetus Van Beneden 1880, sp. indet.

Carnivora: Carnivores

Canidae: Dogs, wolves, foxes, etc.

Cynodesmus iammonensis (Sellards) 1916

Tomarctus canavus (Simpson) 1932

Temnocyon Cope 1878, sp. indet.

Enhydrocyon spissidens (White) 1947

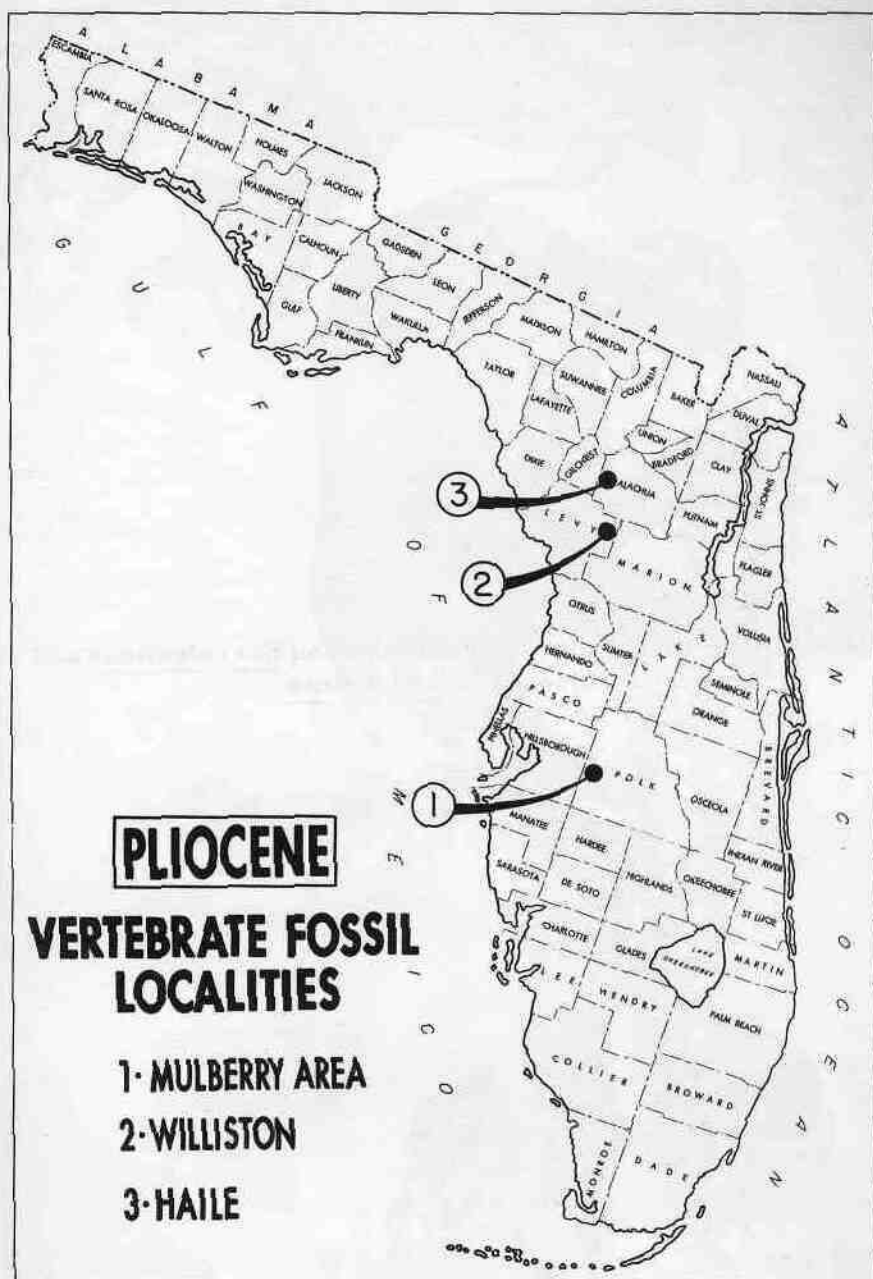
Amphicyon longiramus White 1942

Absonodaphoenus bathygenus Olsen 1958

?Aelurodon johnhenryi White 1947

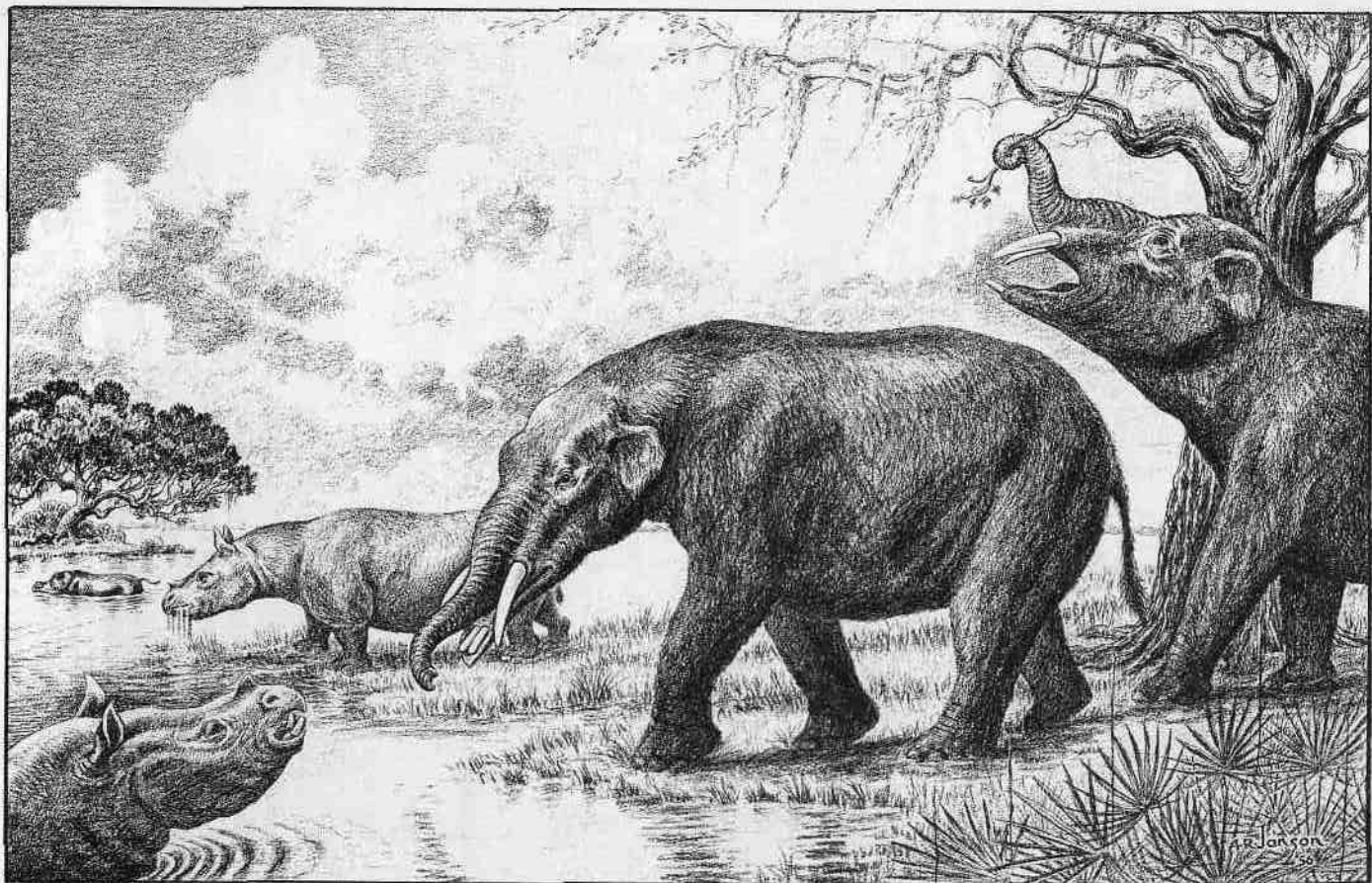
Mustelidae: Badgers, skunks, weasels, otters, etc.

- Oligobunis floridanus White 1947
? Miomustela Hall 1930, sp. indet.
Leptarctus ancipidens (White) 1941
Leptarctus progressus Simpson 1930
- Sirenia: Sea cows, manatees, and dugongs
Dugongidae: Dugongs
Hesperosiren crataegensis Simpson 1932
- Perissodactyla: Odd-toed ungulates
Equidae: Horses
Anchitherium clarencei Simpson 1932
Parahippus blackbergi (Hay) 1924
Parahippus leonensis Sellards 1916
Merychippus westoni Simpson 1930
- Tapiridae: Tapirs
? Tapiravus Marsh 1877, sp. indet.
- Rhinocerotidae: Rhinoceroses
Caenopus cf. platycephalus (Osborn and Wortman) 1894
Gen. et. sp. nov., H. E. Wood (ms.): Large rhinoceros
Diceratherium (Menoceras) Marsh 1875, sp. nov., H. E. Wood (ms.): Small rhinoceros
Diceratherium Marsh 1875 or Caenopus Cope 1880, sp. indet.
Aphelops Cope 1873, sp. indet.
- Artiodactyla: Even-toed ungulates
Entelodontidae: Extinct pig-like ungulates
Daeodon (Dinohyus) (Cope) 1879, sp. indet.
- Tayassuidae: Peccaries
Desmathyus olseni (White) 1941
- ? Oreodontidae: Extinct family
- ? Camelidae: Camels, guanacos, and vicunas
Floridatragulus dolichanthereus White 1940
Nothokemas floridanus (Simpson) 1932
Camelid cf. Miolabis tenuis Matthew 1924
- Protoceratidae: Extinct family
Synthetoceras (Prosynthetoceras) australis (White) 1940
- Cervidae: Deer
Blastomeryx (Parablastomeryx) floridanus (White) 1940
Blastomeryx cf. marshi Lull 1920
Machaeromeryx gilchristensis White 1941
? Dromomeryx cf. americanus Douglass 1903



Text figure 8. Map of Pliocene localities.

Plate VII. *Pliocene four-tusked mastodon Serridentinus* and aquatic rhinoceros *Teleoceras*.



Mio-Pliocene

Perhaps no area in Florida has caused the concern, in regard to dating the vertebrate fauna it contains, as has the Bone Valley of Polk County. The term "Bone Valley" should be used to define a geographic boundary, rather than a stratigraphic unit, as beds ranging from upper Miocene through the lower Pleistocene are known to occur in the "Bone Valley" as defined by earlier workers. These beds, in some cases, show a lithologic change but are not clearly mapable units.

Terrestrial vertebrates, known elsewhere only from the Pliocene have been recorded as occurring in the Bone Valley beds of Polk County. These animals are the bear-like carnivore Agriotherium, the huge sloth Megatherium (also recorded into the Pleistocene), the horses Hipparion, Nannipus and Neohipparion, the artiodactyls Megatylopus and Hexamerys, the sirenian Felsinotherium, and the cetaceans Kogiopsis and Balaenoptera. Animals that are present in the Pliocene and into the Miocene in other fossil areas of North America are the hyena-like Osteoborus, the proboscideans Serridentinus (pl. VII), Rhynchotherium and Mammut (this last named form continues into the Pleistocene), the rhinos Teleoceras and Aphelops (pl. VII), along with the artiodactyls Prosthenops and Procamelus.

There has been considerable confusion and even altered opinions among previous workers as to the age determinations of these beds. A report by E. W. Bishop and H. Stewart on the geology of Polk County will clarify some of these stratigraphic problems.

The vertebrate remains that were collected from the Polk County phosphate pits, during the early days of mining, were more complete than the scraps that are now recovered from the sump pits surrounding the hydraulic guns. This difference is due entirely to the method or mode of mining used today as compared with that used several decades ago. Originally, the hydraulic guns were placed in the quarries and the phosphate matrix was cut away to be processed. Thus, when a specimen was uncovered by the jet of water, it was possible to divert the stream to another area until the fossil

remains could be collected. The mining method used today consists of employing a huge dragline power shovel, having a bucket with a 25-yard capacity, bite into the phosphate layer from which the matrix is lifted and swung over a water-filled



Photo: Florida State News Bureau

Text figure 9. Phosphate mining operations using 25-yard dragline bucket and hydraulic sump pit gun.

sump pit and dumped. This material is then broken down by a manually operated hydraulic gun (text fig. 9) and the resulting mud is pumped through metal pipes to the washing plant. Obviously, only the most resistant vertebrate remains can withstand such treatment so that today's collectors, working the Bone Valley beds must be content with teeth or bone scraps rather than the more complete skulls and skeletons of yesterday's prospector. Here, again, it must be emphasized that nearly all of the fossil-collecting areas in Polk County are on private lands so that permission should be obtained before venturing into any pit, abandoned or otherwise.

The small community of Haile in Alachua County, has been the scene of some collecting activity during the last few years. Mr. J. Clarence Simpson, shortly before his death, collected some Pliocene horse teeth and bone fragments along with a few amphibian and reptile remains whose descriptions have been published in several technical papers, establishing this pocket as Pliocene in age.

EPOCH	NORTH AMERICAN PROVINCIAL STAGES	FLORIDA EQUIVALENT
PLIOCENE	HEMPHILLIAN	BONE VALLEY FAUNA
	CLARENDONIAN	
	BARSTOVIAN	
UPPER MIOCENE		

Text figure 10. Age correlation chart of Florida Pliocene with that of North American provincial stages.

One locality from which a great quantity of Pliocene vertebrates were recovered is in Levy County, northeast of Williston. This quarry known as Mixon's Bone Bed has not been worked in recent years but the following forms were identified as coming from this site during the initial stages of working this dig. The proboscidean Serridentinus, and the rhinoceros Teleoceras (pl. VII), the horse Hipparion and the Pliocene camel Procamelus. This deposit is also on private land and permission must be granted before any collecting can be done.

There are many redeposited surface finds, particularly in the peninsular part of the State from which Plio-Pleistocene forms have been collected, but as with any transitional mammal not collected from a known horizon it is nearly impossible to be sure whether they are "true" Pliocene forms or "true" Pleistocene forms.

Pliocene Faunal List

- Cetacea: Whales and porpoises
 - Platanistidae: River dolphins
 - Goniodelphis hudsoni G. M. Allen 1941
 - Physeteridae: Sperm whales
 - Kogiopsis Kellogg 1929
 - Balaenopteridae: Whale-bone whales in part
 - Balaenoptera floridana Kellogg 1944: Extinct
rorqual
- Carnivora: Carnivores
 - Canidae: Dogs, wolves, foxes, etc.
 - Osteoborus crassapineatus Olsen 1956
 - Pliogula dudleyi White 1941
 - Ursidae: Bears
 - Agriotherium schneideri Sellards 1916
- Proboscidea: Elephants, mastodonts, etc.
 - Gomphotheriidae: Serrate-toothed mastodonts

Serridentinus (Ocalientinus) floridanus

(Leidy) 1887

Serridentinus (Ocalientinus) floridanus leidii

(Frick) 1926

Serridentinus (Ocalientinus) bifolius

(Osborn) 1929

Serridentinus (Serbelodon) brewsterensis

Osborn 1926

Gomphotherium simplicidens (Osborn) 1923

Gomphotherium Burmeister 1837, sp. indet.

Rhynchotherium simpsoni Olsen 1957

Mammutidae: Mastodonts

Mammut sellardsi (Simpson) 1930

Sirenina: Sea cows, manatees, and dugongs

Dugongidae: Dugongs

Felsinotherium floridanum (Hay) 1922

Felsinotherium ossivallense Simpson 1932

Perissodactyla: Odd-toed ungulates

Equidae: Horses

Hipparion plicatile (Leidy) 1888

Neohipparion phosphorum Simpson 1930

Nannipus ingenuum (Leidy) 1886

Nannipus minor (Sellards) 1916

Rhinocerotidae: Rhinoceroses

Aphelops longipes (Leidy) 1891

Teleoceras proterus (Leidy) 1886

Artiodactyla: Even-toed ungulates

Tayassuidae: Peccaries

Prosthennops elmorei White 1942

Camelidae: Camels, guanacos, and vicunas

? Procamelus minimus (Leidy) 1887

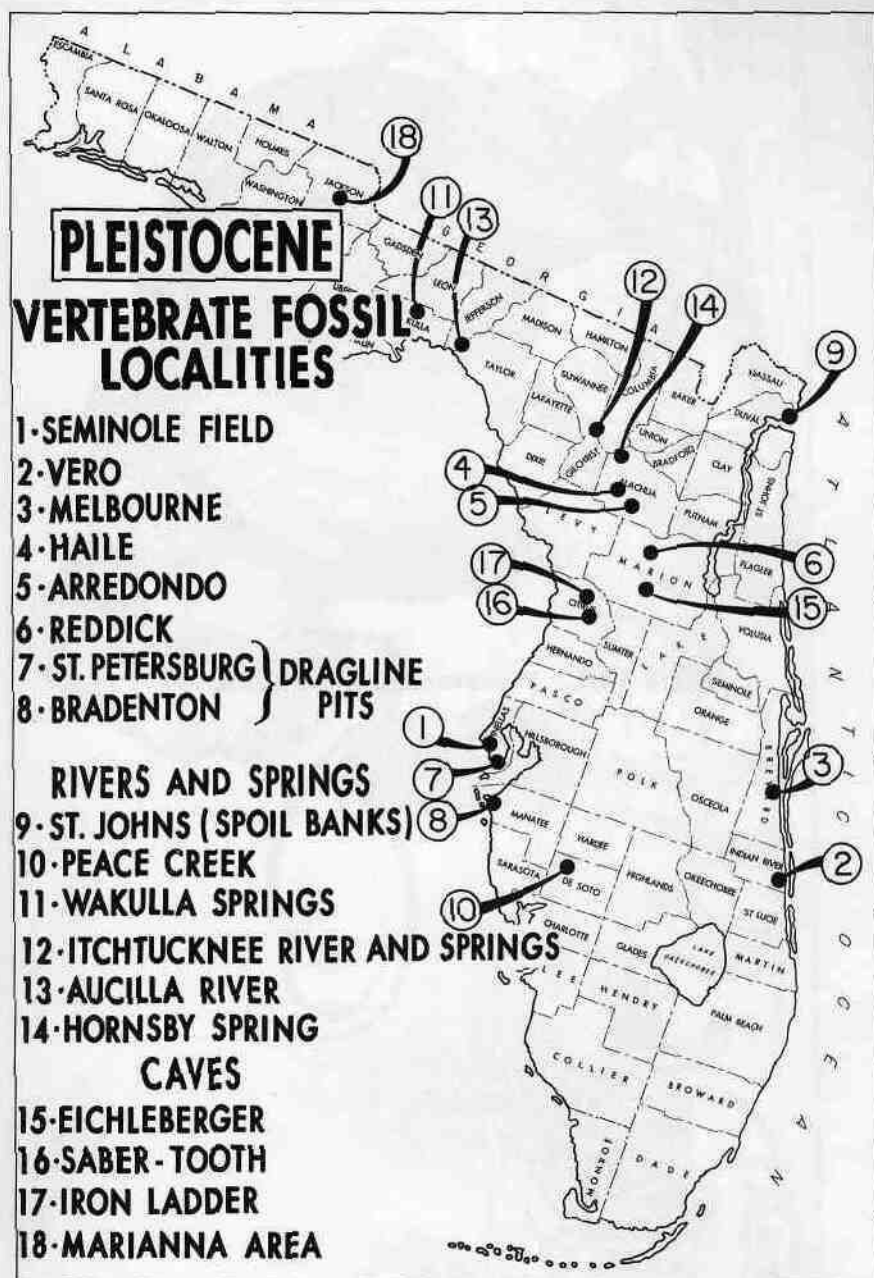
? Procamelus minor (Leidy) 1887

? Megathylopus major (Leidy) 1887

Antilocapridae: Pronghorned "antelopes"

Hexameryx elmorei White 1942

Hexameryx simpsoni White 1941



Text figure 11. Map of better known Pleistocene localities.



Plate VIII. Pleistocene mammoth.

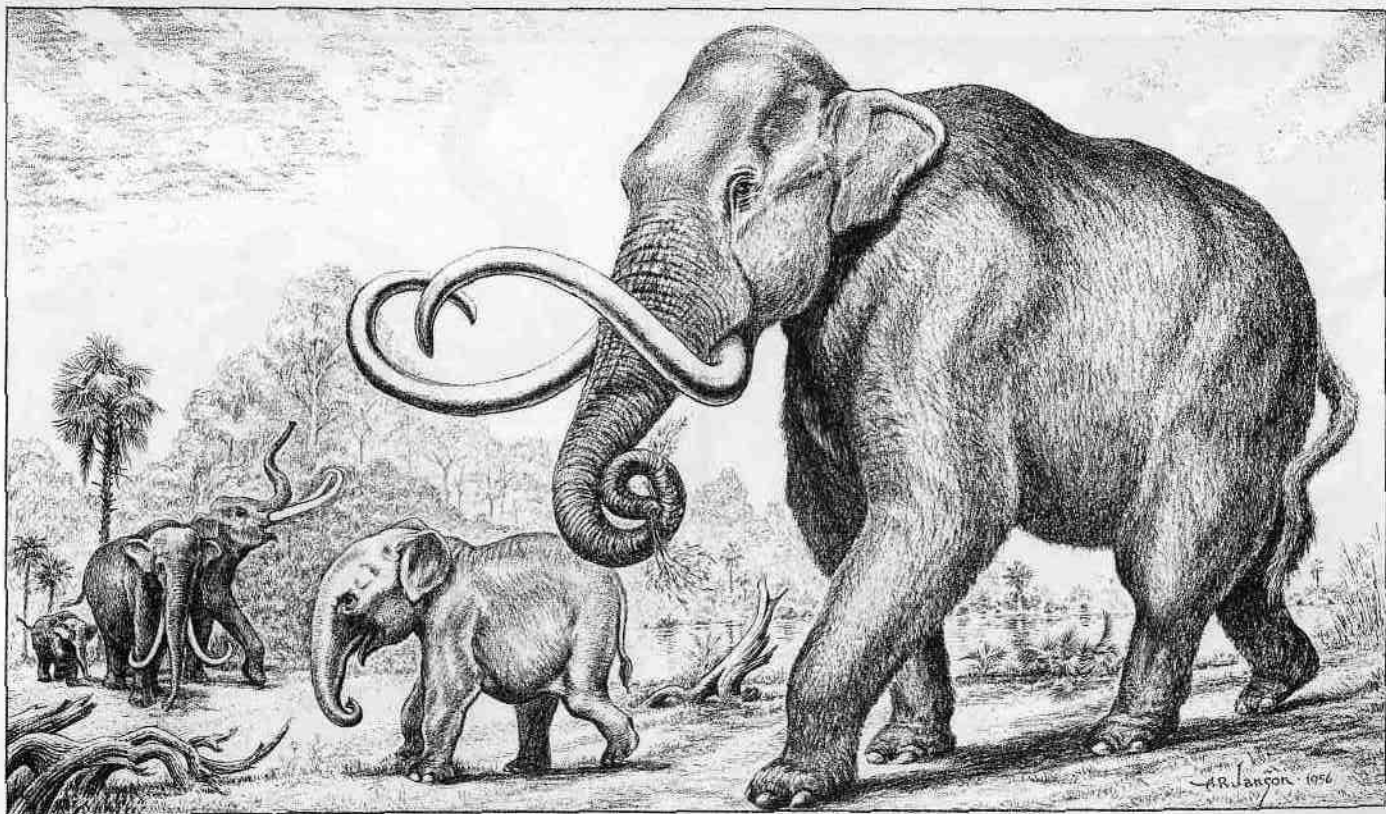




Plate IX. Pleistocene mastodon.

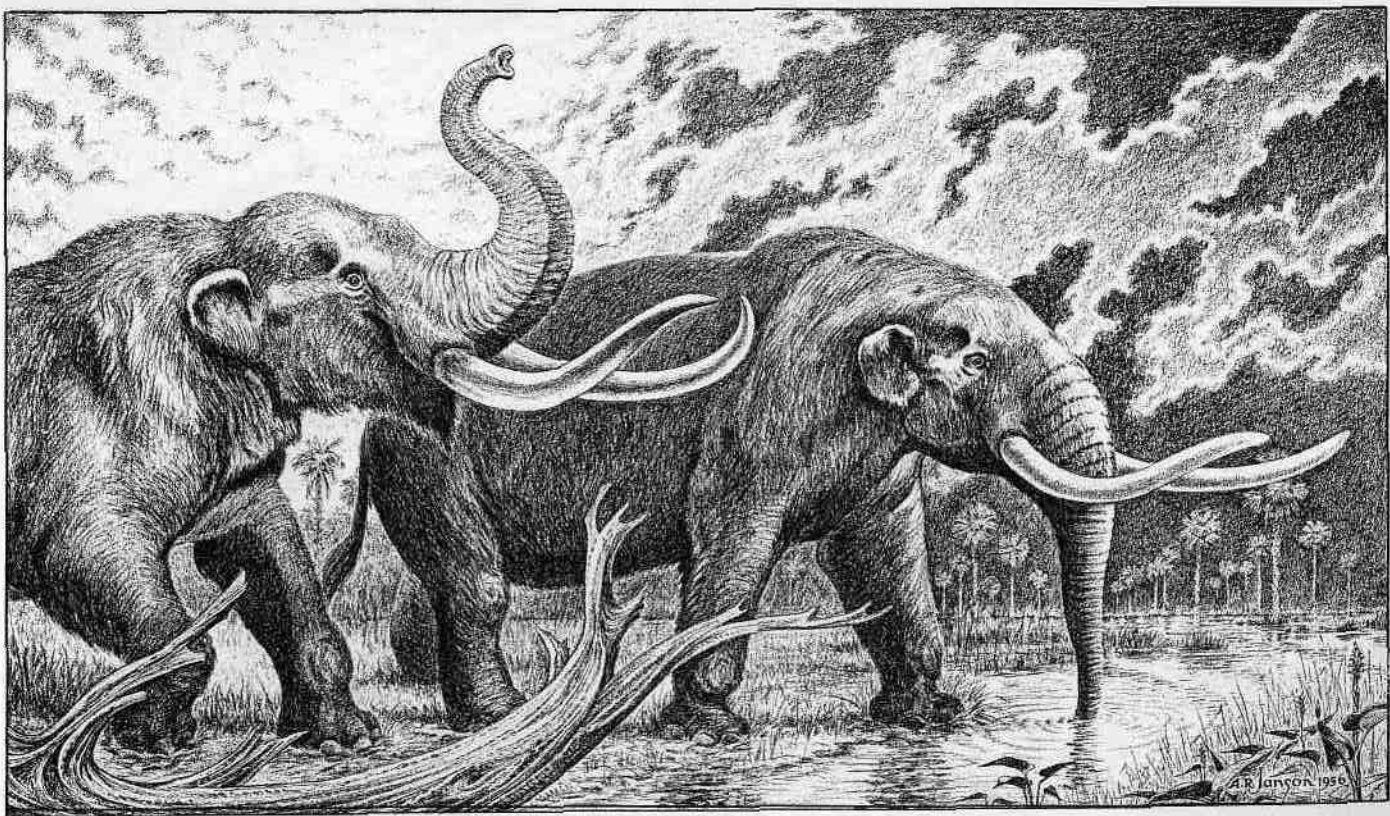
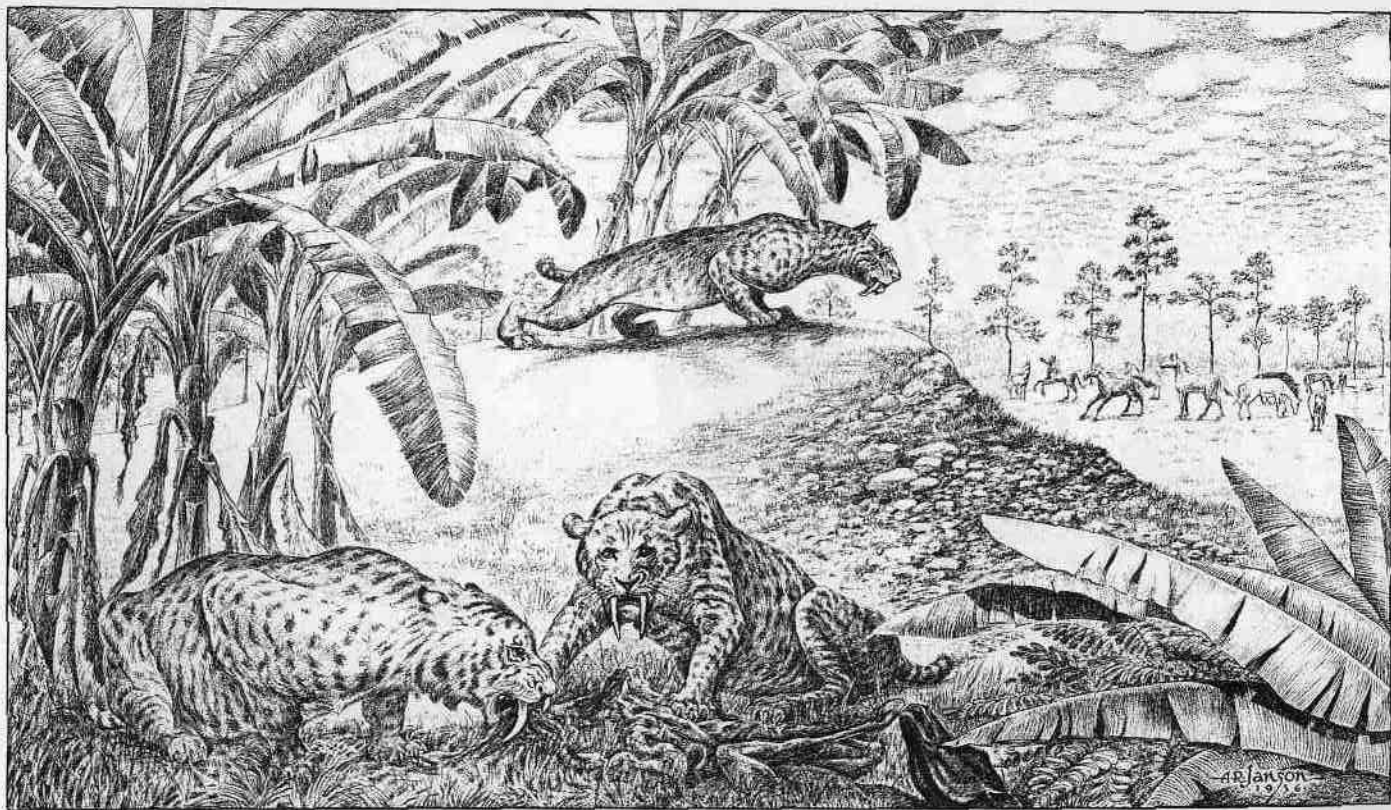


Plate X. Florida saber-tooth tiger and Pleistocene horses.



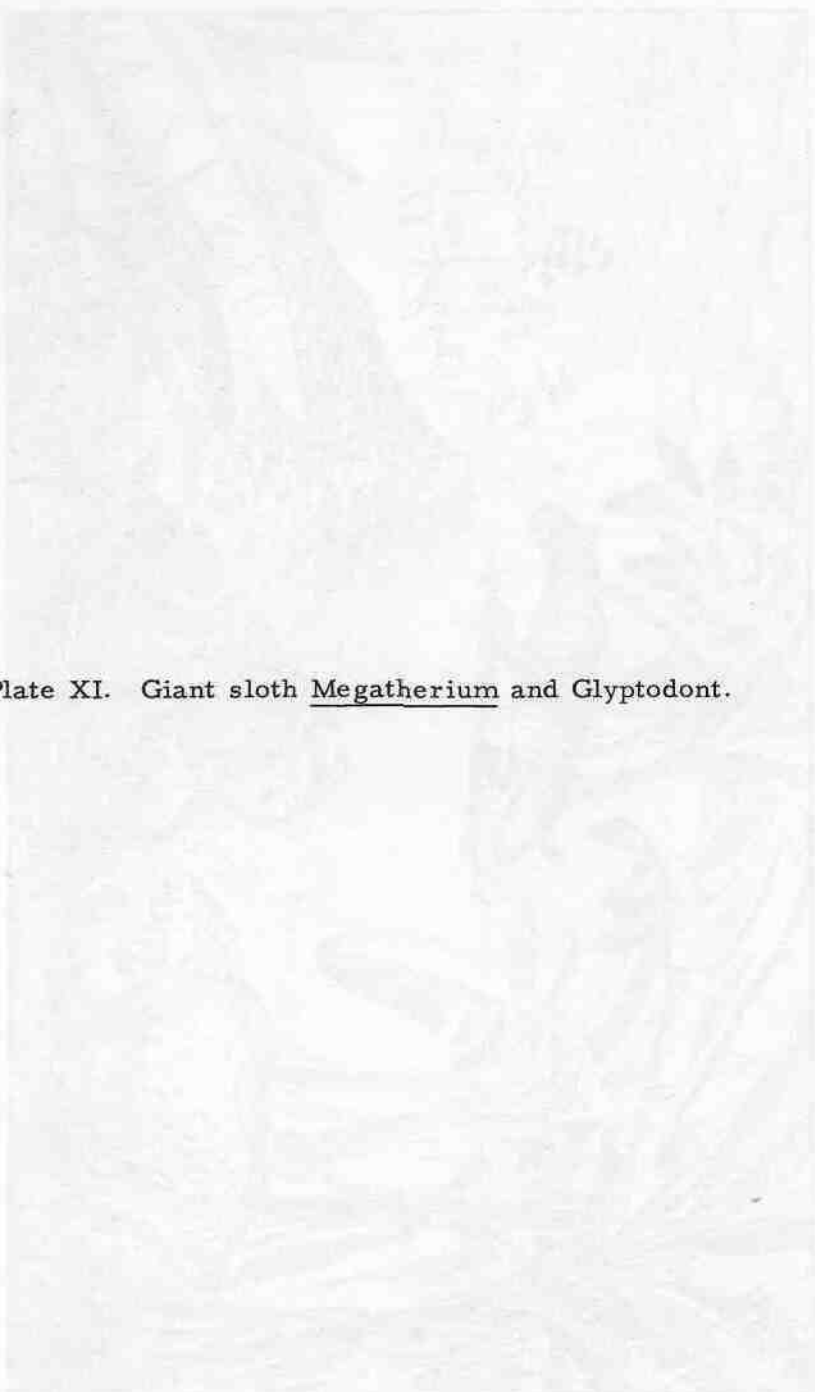


Plate XI. Giant sloth Megatherium and Glyptodont.

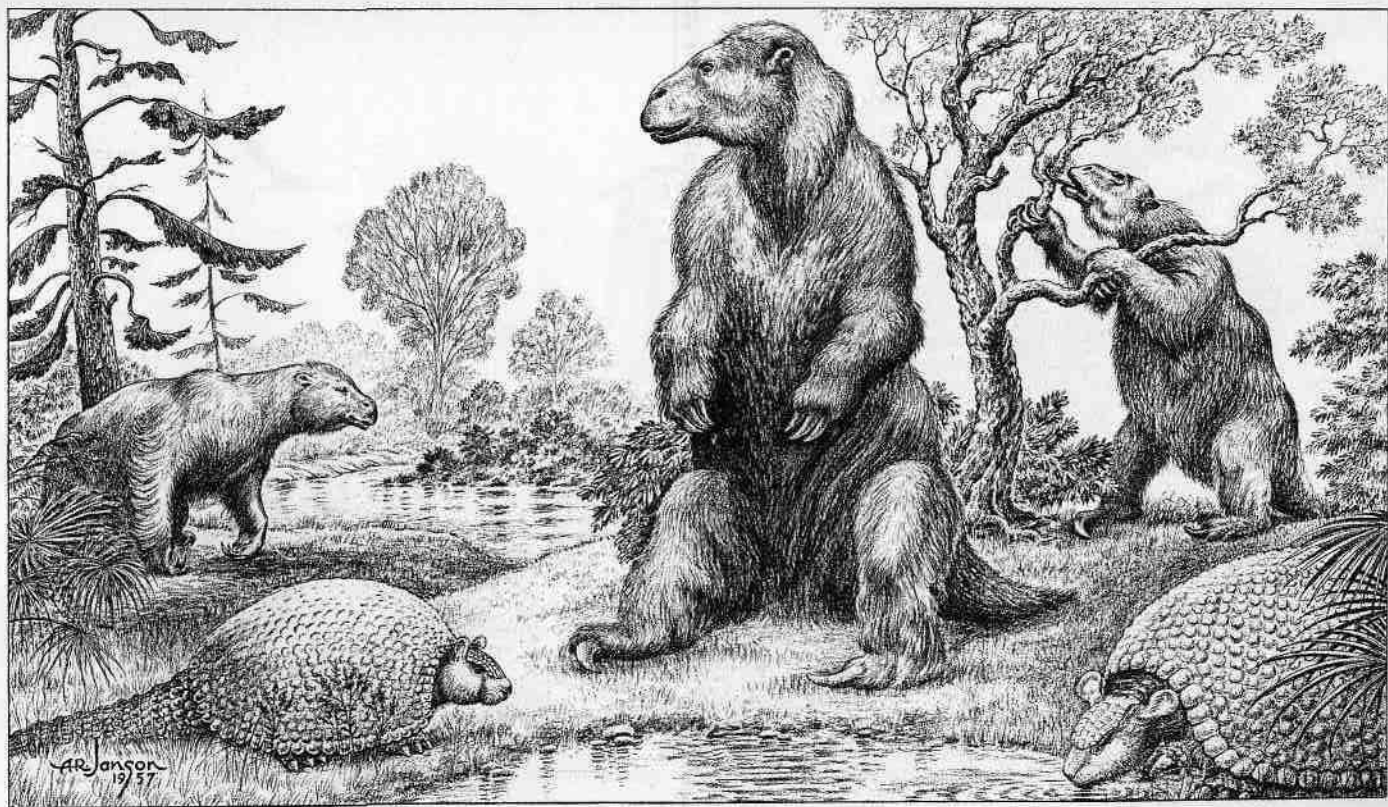
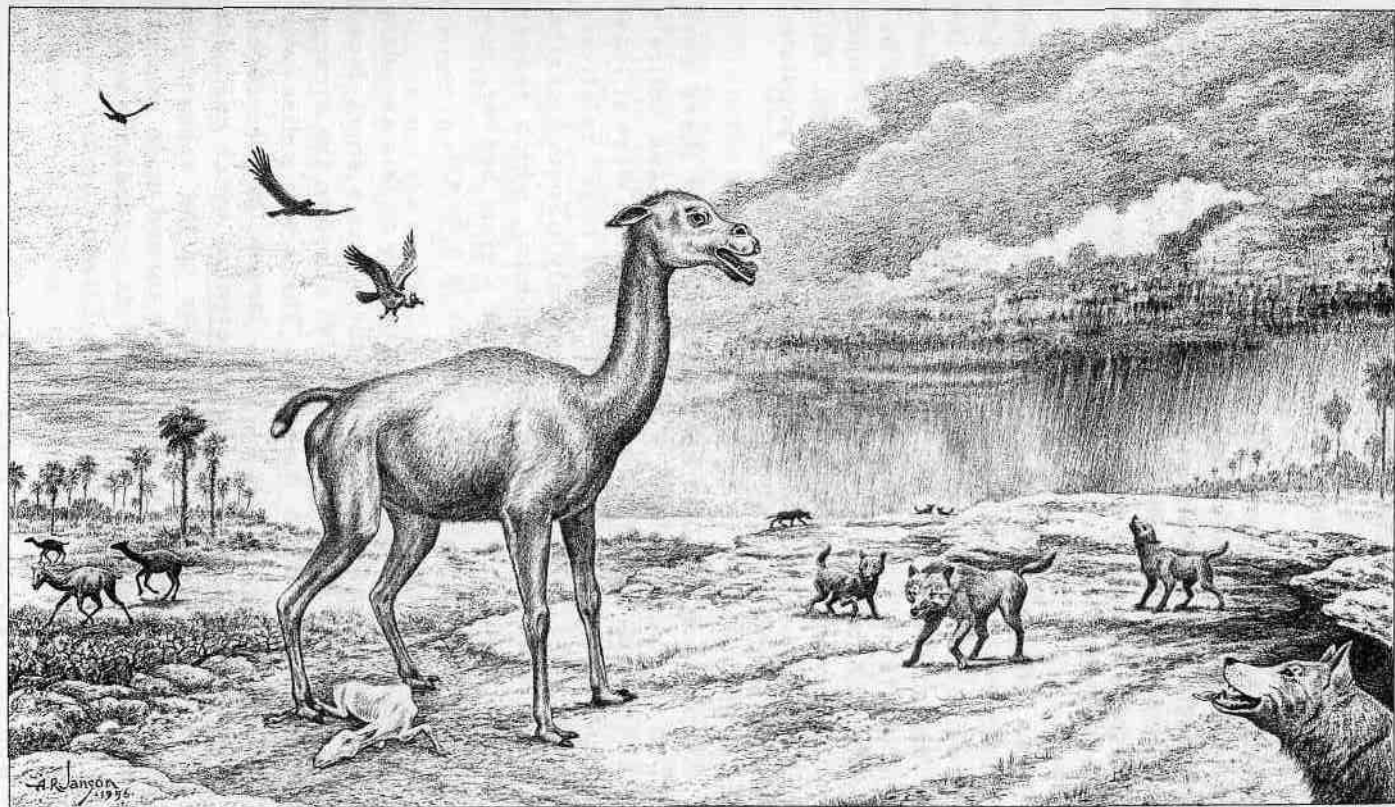


Plate XII. Pleistocene camel Tanupolama and wolf Aenocyon.



Pleistocene

It is only natural that the most recent fossil mammals, those of the Pleistocene, or Ice age, should be the most widely distributed in the State and the best known. The stream and swamp deposits in which their remains are preserved have not yet been so deeply buried as to be inaccessible nor, like most of the older beds, so long attacked by rivers and oceans as to have been largely eroded away and their contents lost or redeposited.

The abundance of mammals in Florida at this time was extraordinary. It can only be compared with that of the big game region of Africa (text fig. 2). Most, perhaps all, of the recent mammals or their immediate ancestors were already present but there was a host of other stranger animals besides. Mammoths (pl. X), mastodons (pl. IX), saber-tooth tigers and horses (pl. X), giant sloths and armadillos (pl. XI), as well as llama-like camels and wolves (pl. XII), populated the peninsula of Florida in great numbers.

Even among the less spectacular animals there were many that no longer inhabit Florida, or that have entirely vanished from the face of the earth. Thus there were at least two species of capybaras, so-called "water hogs" relatively large rodents of a group which now lives only in South America; there was a small rodent, the bog lemming, which ranges many miles north of Florida today, and a giant beaver, now extinct, beside which the living beaver is a dwarf.

Flesh-eaters were not lacking to prey on this abundant life. In addition to the black bear, there was a short-faced bear (Tremarctos floridanus, pl. XIV) allied to the strange spectacled bear of South America. There was a dire-wolf (Canis or Aenocyon ayersi, pl. XII), larger than the recent wolf, and a smaller coyote (Canis latrans) which has been extirpated from Florida. The remains of the saber-tooth tiger (Smilodon floridanus, pl. X) have turned up in several localities on both coasts of central Florida and the best known remains are from a sinkhole cave in Citrus County, known and recorded as Saber-Tooth Cave.

Remains of the ground sloths and the various armadillos

(pl. XI) are common finds and the bony outer scutes of the latter (pl. III) turn up in almost every locality of Pleistocene age.

One of the great mysteries of the Pleistocene concerns the horse. This animal, if we are to judge by his abundant fossilized remains, was present in great numbers on this continent from the Eocene to within some 10,000 years ago. Then, for some now unknown reason, possibly disease, or a change of climate, this noble animal died out and became extinct on this continent. In February 1519, Cortés sailed from Havana for the conquest of Mexico, and took with him 16 horses, the first to set foot on this continent since the last Ice age horse died out. Actually, 17 horses arrived on the Mexican shore, for one of the mares foaled during the journey. These horses (pl. XIII) and the other horses that came after them made and changed history. The conquest would have failed without them.

Mammoths and mastodons were so abundant that their teeth are the most commonly found fossil mammalian remains in the State (pl. II). The mastodons (pl. IX) were not true elephants and differed from the mammoth (pl. VIII) in having straighter tusks, higher cusped teeth with fewer ridges than those found in the mammoth and in having all of the cheek teeth in place simultaneously rather than having the next replacement tooth already crowding against the back face of the functional tooth as is evidenced in the mammoth and his living relative, the elephant. Although the Pleistocene is generally termed the Ice age, the ice cap did not reach as far south as Florida and the woolly mammoth was never a resident of the peninsula. The remains of the Imperial and Columbian mammoths are among the more common fossil finds in Florida today.

The fauna of Florida in the Pleistocene bore a great resemblance to the fauna of South America. Capybaras, short-faced bears, sloths, armadillos, tapirs, camels (llamas, etc.), and peccaries are all animals which we associate with the southern continent at present. This resemblance is due to two causes: some of the animals did come from South America, others originated in the North but

Plate XIII. Reintroduction of the horse into North America
by the Spaniards.



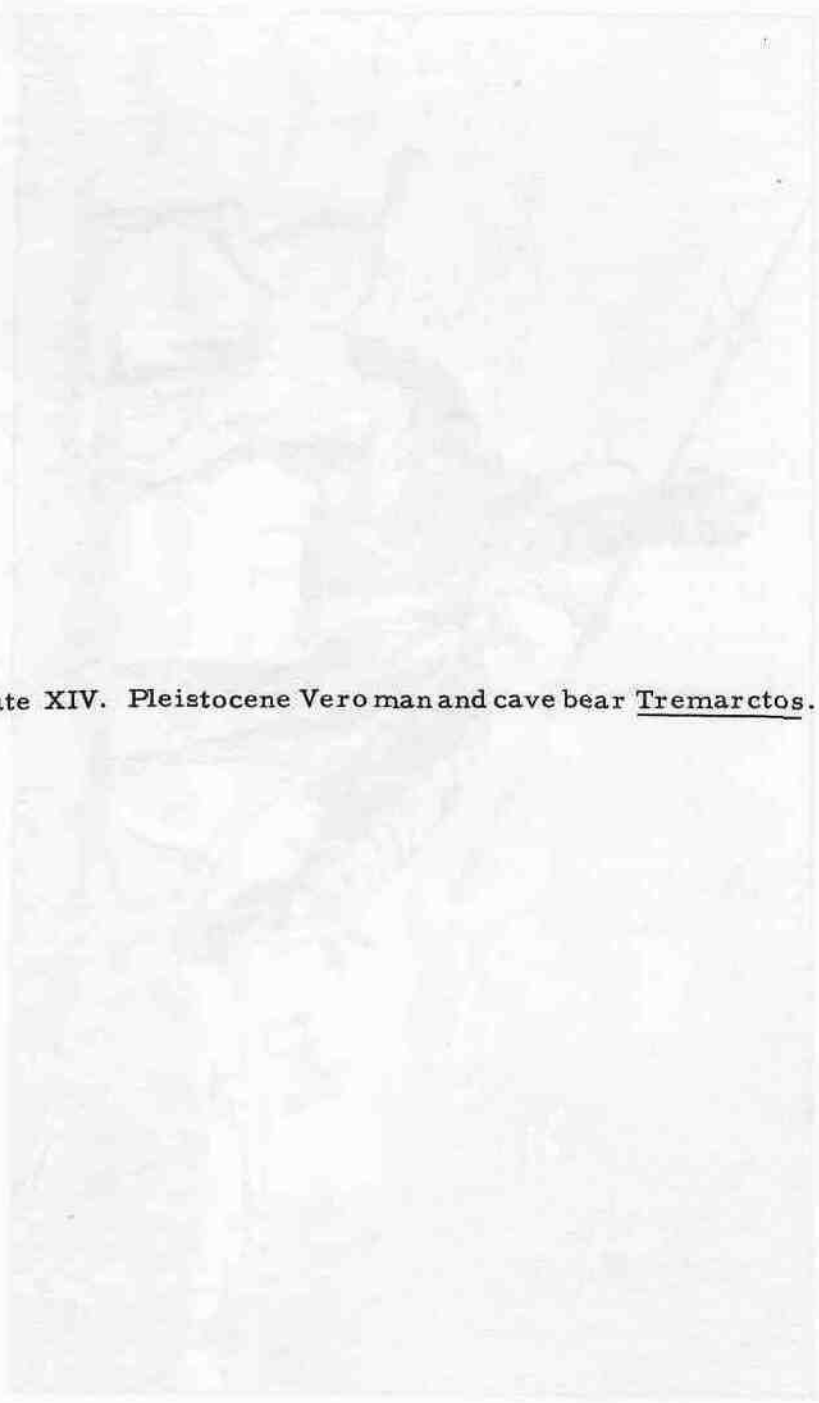
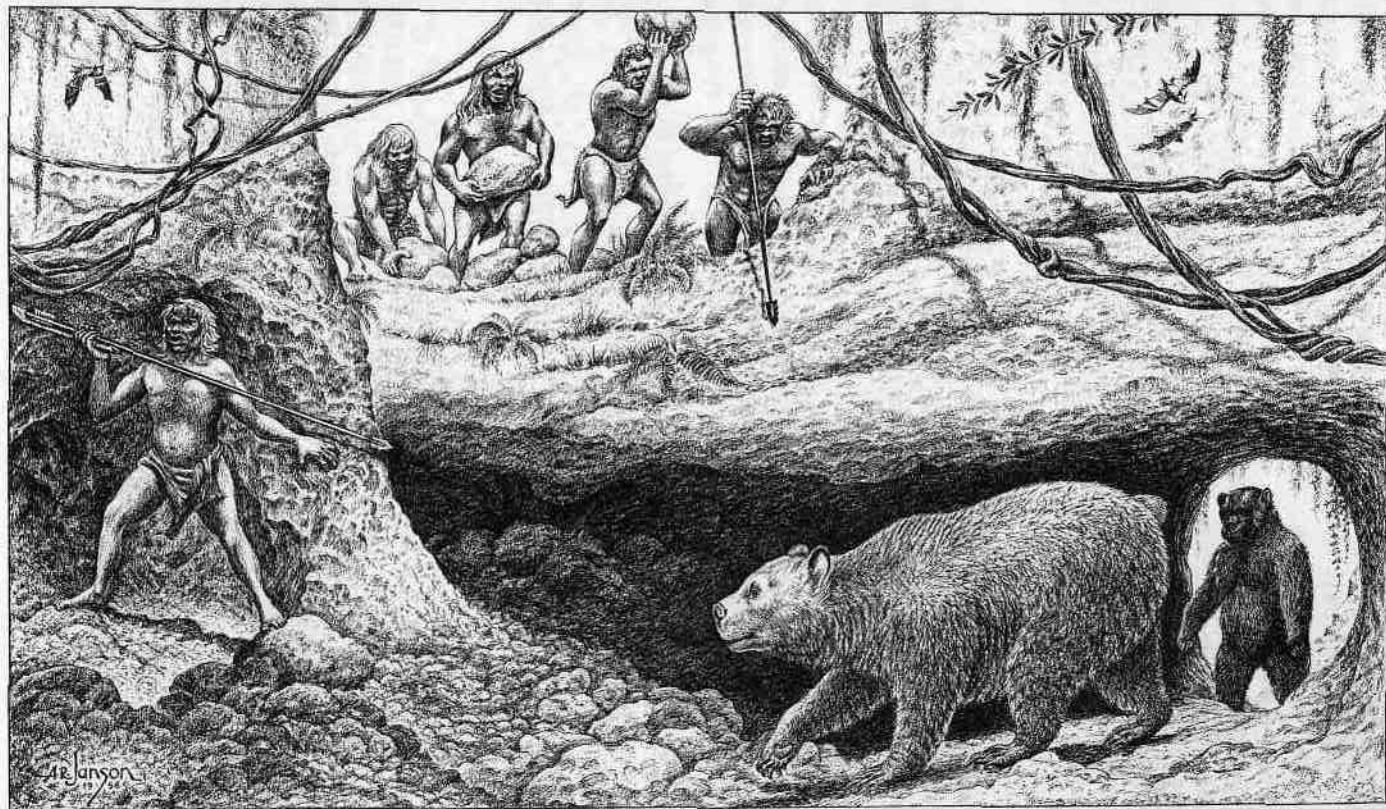


Plate XIV. Pleistocene Vero man and cave bear Tremarctos.



survive only in the South. At about the beginning of the Pliocene, South America, which for a very long time had been isolated from all other continents by the oceans, was reunited with North America. Over this new Central American land-bridge came members of groups which had been evolving in isolation in the southern continent: the capybaras, porcupines, ground sloths, armadillos and glyptodonts. The short-faced bears, tapirs, camels and peccaries, on the contrary, then entered South America for the first time (along with deer, wolves, horses, mastodons, and other animals) but survived longer in their new homes than they did in North America.

The localities that have yielded Pleistocene fossils are many and varied in nature so that only some of the better known deposits are discussed below. Chances are very good that nearly every major excavation within the State of Florida will yield up an identifiable fossil.

Seminole Field, on the outskirts of St. Petersburg has the importance of giving us one of the few radiocarbon dates for the State. This date is based on a charcoal fragment, associated with the bones of extinct animals, and placed the material as being here in a live state about 3,000 or 4,000 years ago. The collecting area that has in past years been most productive has now been destroyed by a new housing development so that fossil collecting in Seminole Field today is most limited.

On the east coast of peninsular Florida are two localities that perhaps have been the cause of more discussion among scientific personnel than has any other Pleistocene localities in the eastern United States. These localities at the Vero Canal and the Melbourne golf course were the subject of much discussion, during World War I times, due to the finding of human fragments in association with an extinct animal fauna. This area has also produced the type material of the huge Canis (or Aenocyon) ayersi as well as that of the extinct tapir Tapirus veroensis.

The small sinkhole deposits at Haile and Arredondo

have produced some fine tapir and peccary bones along with a series of "micro-vertebrates" that are unknown from other Pleistocene localities.

Anyone who has ever dug for Pleistocene vertebrates in Florida and has stopped for a brief rest, to lean back and contemplate amid the surrounding lush vegetation and warm sunshine, cannot help but wonder about the appearance of this first "winter resort" when it was inhabited by the animals that now lie buried beneath the rich soil of nearly every part of the State.

A now abandoned quarry near Reddick has been responsible for perhaps the largest collection of rodents to have ever been collected from the Pleistocene deposits of Florida. These small bones are undoubtedly due to a long abandoned owl roost and the bones are the last remnants of owl pellets that must have littered the cave floor. A nearly complete skeleton of a cave bear, some horse and camel remains and a few scraps of Smilodon have also turned up at this locality.

The deposit is no longer recognizable as a cave floor due to the limestone cave having been mined away leaving the once dark interior floor exposed to the open air and sunshine. Here again, as with so many of Florida's localities, permission must be obtained before one can collect in this area.

The many shell marl dragline pits of the St. Petersburg and Bradenton areas have been listed as good spots to obtain fragmentary remains of most of the Pleistocene animals that were present in Florida. Due to the methods of mining only the smaller bones are ever recovered in a complete condition and nothing associated or more complete can be added to the tantalizing scraps that turn up. The material is dredged up from a water-filled pit and dumped on a spoil heap from which it can be recovered. But, to get additional material from the exact spot from which a spoil bank scrap was obtained is nearly impossible.

EPOCH		NORTH AMERICAN PROVINCIAL STAGES		FLORIDA EQUIVALENT	
P L E I S T O C E N E	W I S C O N S I N	COCHRANE		F O R M A T I O N	MODERN SUBMARINE PLAIN
		MANKATO			MELBOURNE
		CARFY			SEMINOLE FIELD
		TAZEWELL			VERO BEACH
		IOWAN GLACIAL			TALBOT PENHOLLOWAY FORMATIONS WICOMICO
	SANGAMON INTERGLACIAL		EROSION INTERVAL		
	ILLINOIAN GLACIAL		SUNDERLAND FORMATION COHARIE FORMATION		
	YARMOUTH INTERGLACIAL		EROSION INTERVAL		
	KANSAN GLACIAL		BRANDYWINE FORMATION		
	AFTONIAN INTERGLACIAL		EROSION INTERVAL		
	NEBRASKAN GLACIAL				
FORT THOMPSON FORMATION (MARINE AND FRESH WATER)					

Text figure 12. Age correlation chart of Florida Pleistocene with that of North American provincial stages.

Pleistocene Faunal List

Marsupialia: Opossums only in North America

Didelphidae: Opossums

Didelphis marsupialis Linnaeus 1758:

Virginia opossum

Insectivora: Moles, shrews, hedgehogs, etc.

Talpidae: Moles

Scalopus aquaticus (Linnaeus) 1758:

Eastern mole

Soricidae: Shrews

Blarina brevicauda (Say) 1823: Short-tailed shrew

Cryptotis floridana (Merriam) 1895: Florida short-tailed shrew

Chiroptera: Bats

Vespertilionidae: Little brown bats, big brown bats, etc.

Myotis Kaup 1829, sp. indet.

Myotis cf. austroriparius (Rhoads) 1897

Molossidae: Free-tailed bats

Molossides floridanus G. M. Allen 1932:

Extinct free-tailed bat

Primates: Lemurs, monkeys, apes, man, etc.

Hominidae: Man

Homo sapiens Linnaeus 1758: Man

Edentata: Armadillos, anteaters, and sloths

Megalonychidae: Megalonychid ground sloths

Megalonyx jeffersonii (Desmarest) 1822:

Jeffersonian ground sloth

Megalonyx cf. wheatleyi Cope 1871: cf.

Wheatley's ground sloth

Megatheriidae: Megatheriid ground sloths

Megatherium hudsoni White 1941

Megatherium mirabile Leidy 1854

Mylodontidae: Mylodont ground sloths

Paramylodon harlani (Owen) 1840: Harlan's ground sloth

Thinobadistes segnis Hay 1919

Dasypodidae: Armadillos

Chlamytherium septentrionalis (Leidy) 1890:

Extinct giant "armadillo"

Dasypus bellus (Simpson) 1929: Extinct
armadillo

Glyptodontidae: Glyptodonts

Boreostracon floridanus Simpson 1929

Lagomorpha: Rabbits, hares, and pikas

Leporidae: Hares and rabbits

Sylvilagus floridanus (J. A. Allen) 1890:

Florida cottontail

Sylvilagus palustrellus Gazin 1950: Pigmy
marsh rabbit

Sylvilagus palustris (Brachman) 1837:

Marsh rabbit

Rodentia: Rodents

Sciuridae: Squirrels

Sciurus carolinensis Gmelin 1788: Gray
squirrel

Geomyidae: Pocket gophers

Plesiothomomys orientalis (Simpson) 1928:

Extinct pocket gopher

Geomys pinetis Rafinesque 1817: Pocket
gopher

Castoridae: Beavers

Castor canadensis Kuhl 1820: Beaver

Castortoides ohioensis Foster 1838: Extinct
giant beaver

Cricetidae: Native rats and mice (rice rats,
cotton rats, white-footed mice, etc.)

Oryzomys palustris (Harlan) 1837: Rice rat

Reithrodontomys humulis (Audubon and

Bachman) 1841: Harvest mouse

Peromyscus floridanus (Chapman) 1889:

Florida white-footed mouse

Peromyscus gossypinus (LeConte) 1853:

Cotton mouse

Sigmodon hispidus Say and Ord 1825:

Cotton rat

Neotoma floridana (Ord) 1818: Wood rat

Synaptomys (Synaptomys) australis Simpson
1928: Extinct bog lemming

Ondatra zibethicus (Linnaeus) 1766: Muskrat

Ondatra zibethicus floridanus Lawrence

1942: Extinct subspecies of muskrat

Neofiber alleni True 1884: Florida water
rat or round-tailed muskrat

Pitymys pinetorum (Le Conte) 1830: Pine
mouse

Erethizontidae: New world porcupines

Erethizon dorsatum (Linnaeus) 1758: North
American porcupine

Hydrochoeridae: Capybaras

Neochoerus pickneyi (Hay) 1923: Extinct
giant capybara

Hydrochoerus holmesi Simpson 1928:
Extinct capybara

Cetacea: Whales and porpoises

Cetacea indet.

Delphinidae: Dolphins, killer whales, blackfish,
etc.

Globicephala ?baereckeii Sellards 1916:
Extinct blackfish

?Balaenopteridae: Whale-bone whales in part
?Balaenoptera Lacépède 1804, sp. indet.:
?Rorqual

Carnivora: Carnivores

Canidae: Dogs, wolves, foxes, etc.

Aenocyon ayersi (Sellards) 1916

Canis latrans Say 1823: Coyote

Canis cf. lupus Linnaeus 1758: Wolf

Vulpes ?palmaria Hay 1917: Extinct (?) red
fox

Urocyon cinereoargenteus (Schreber) 1775:
Gray fox

Urocyon seminolensis Simpson 1929:
Extinct gray fox

Ursidae: Bears

?Tremarctos floridanus (Gidley) 1928:
Extinct spectacled (?) bear

Ursus americanus Pallas 1780: Black bear

Ursus Linnaeus 1758, sp. nov.?: "True"

Ursus (not black bear)

Procyonidae: Raccoons

Procyon lotor (Linnaeus) 1758: Raccoon

Procyon nanus Simpson 1929: Extinct
raccoon

Mustelidae: Badgers, skunks, weasels, otters,
etc.

Mustela frenata Lichtenstein 1831: Bridled weasel

Mephitis mephitis (Schreber) 1776: Striped skunk

Spilogale ambarvalis Bangs 1898: Little spotted skunk

Lutra canadensis (Schreber) 1776: River otter

Felidae: Cats

Felis (Lynx) rufus Schreber 1777: Bobcat

Felis (Noctifelis or Herpailurus) Severtzov 1858, sp. indet.: Margay or jaguarundi-type cat

Felis (Puma) ?inexpectata (Cope) 1896:

Extinct (?) puma

Panthera (Jaguaris) ?augusta (Leidy) 1872:

Extinct (?) species of jaguar

Smilodon floridanus (Leidy) 1889: Florida saber-tooth cat

Phocidae: True or "earless" seals

Monachus tropicalis (Gray) 1850: West Indian monk seal

Proboscidea: Elephants, mastodonts, etc.

Mammutidae: Mastodonts

Mammut americanum (Kerr) 1792: American mastodon

Elephantidae: Elephants

Mammuthus (Parelephas) columbi (Falconer) 1857: Columbian mammoth

Mammuthus (Parelephas) floridanus (Osborn) 1929: Florida mammoth

Mammuthus (Archidiskodon) imperator (Leidy) 1859: Imperial mammoth

Sirenia: Sea cows, manatees, and dugongs

Trichechidae: Manatees

Trichechus Linnaeus 1758, sp. indet.: Manatee

Perissodactyla: Odd-toed ungulates

Equidae: Horses

Equus Linnaeus 1758, sp. indet.: Horses

Tapiridae: Tapirs

Tapirus veroensis Sellards 1918: Florida tapir

Tapirus Brisson 1762, sp. indet.: Large tapir

Artiodactyla: Even-toed ungulates

Tayassuidae: Peccaries

Mylohyus gidleyi Simpson 1929: Extinct peccary

Platygonus LeConte 1848, sp. indet.: Extinct peccary

?Tayassu Fischer 1814, sp. indet.

Camelidae: Camels, guanacos, and vicunas

Camelidae indet., cf. Camelops Leidy 1854

Camelidae indet., cf. Tanupolama americana (Wortman) 1898

Tanupolama mirifica Simpson 1929: Extinct camel

Cervidae: Deer

?Cervus Linnaeus 1758, sp. indet.:

Medium-sized cervid

Odocoileus virginianus (Boddaert) 1784: Virginia deer

Bovidae: Bison, cattle, sheep, goats, etc.

Bison latifrons (Harlan) 1825: Extinct bison

Bison H. Smith 1827, sp. indet.

Pleistocene or Recent

The final chapter in the history of the animal life of Florida, that of transition from Pleistocene to Recent times, is a disastrous one, as it has been almost everywhere. The present fauna of the State, although it possesses some unique inhabitants, is only a poor and colorless remnant of what it once supported. Half, or perhaps even two-thirds, of the Pleistocene mammals are now extinct and those of their companions which still survive are not only relatively few in numbers but are also generally the smaller and less striking forms. The rabbits, squirrels, rats, mice, some of the carnivores, and one of the deer, have survived, but the many sloths, horses, tapirs, camels, mastodons, mammoths and many others no longer exist. It is not possible to assign a definite cause to this decimation, but if present conjectures as to the antiquity of man prove to be correct, it will seem quite probable that the destruction of animal life by man, still

going on, started with his victory over some of the Pleistocene mammals, a victory for which one must now feel some regret.

But what of man? Was he associated with some of the great extinct animals as he was in Europe? If so, does this indicate the great antiquity of man on this continent or the recent extinction of these mammals? These are questions which have long been asked and which can not be fully answered even now. At several places in Florida, especially Vero and Melbourne, human bones and the products of human hands have been found in apparent association with the extinct animals mentioned above (pl. XIV).

If further discoveries confirm these and if they can eventually survive the severe scientific criticism to which they are now properly being subjected, it will appear that man has been in Florida for some thousands of years and the first arrivals in this region disputed the ground with mammoths, mastodons and the other great beasts of the glacial epoch. This evidence will have to be in a form beyond reproach, such as a mastodon vertebra with an arrow point embedded in the bone, and the bone growing around the point. Association alone is not sufficient proof of man's antiquity in Florida.

Most of the localities termed "Pleistocene-Recent" are to be found as spring or stream deposits or as floor deposits of caves. Almost every spring or river bed has produced some bone scraps that can be identified as belonging to animals that lived during Pleistocene times. Springs and stream beds also contain a generous admixture of Recent as well as Pleistocene material so that care must be exercised in determining to which of these epochs the bones belong. Also some of the animals recorded as living during Pleistocene times, have only recently disappeared from Florida scenes. This fauna includes the great auk, the beaver, flat-tailed muskrat, bog lemming, bison, spectacled bear, jaguar and a few others. Just where to draw the line between Pleistocene and Recent is a matter of taste rather than of fact and a few people believe that we are still living in the Pleistocene.

Since the invention of the self-contained diving apparatus (text fig. 13) many underwater localities have yielded up their secrets to the modern prospector who can now enter

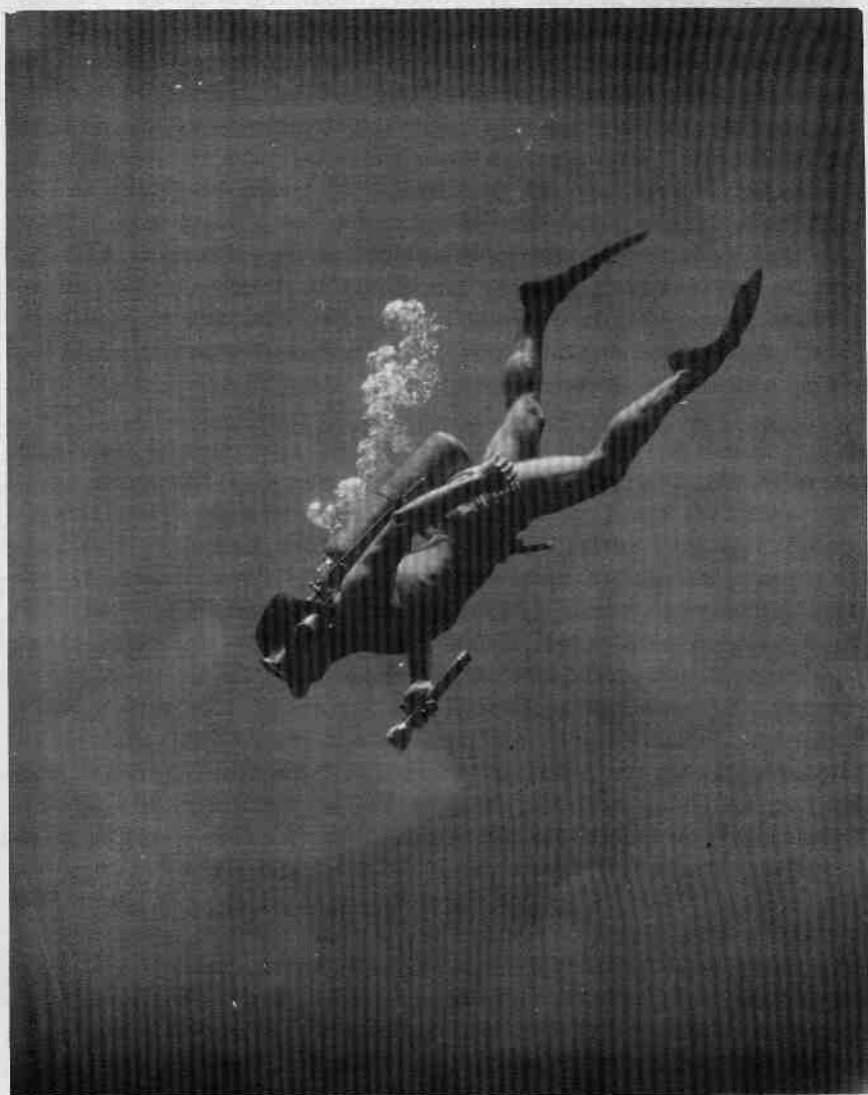


Photo: W. Jenkins

Text figure 13. Aqua lung prospecting and collecting.

the element of the fish and the frog in order to continue his search for fossil bones. However, too much emphasis cannot be placed on the danger of improperly using the self-contained diving apparatus. All persons wishing to indulge in this fast-growing sport should be checked out by an expert before attempting to dive in Florida's swifter rivers or deeper springheads. Close attention should be paid to the decompression charts and to the time that must be spent at the different depths during the ascension from a deep dive. That the last cautionary comments are not idle pessimism is borne out by the recorded diving accidents that have occurred in recent years. Many of these accidents were due to careless handling of good equipment which, in itself, was not directly responsible for these accidents.

Some of the more attractive water covered deposits are the St. Johns River in the Jacksonville-Mayport area (although the spoil banks above the river's edge are the most productive collecting), the Peace Creek area from which many of Florida's first described fossils were obtained, and the Itchtucknee River. This last named river is perhaps the best general collecting in the State. Located as a natural boundary between Columbia and Suwannee counties in north central Florida, this river flows for about five miles from its main spring to where it joins the Santa Fe River. Good material has been obtained from the Blue Hole (termed Jug Spring by later collectors) just below the main spring and also from the clay flats of the Mill Pond area which begins a mile downstream from the main boil. The best method of collecting in the mill pond area is by the use of a steel rod or probe which is shoved into the clay, just beneath the water. If a bone is struck, it is felt through the metal rod and can then be gently excavated, the swift running water carrying away the excavated mud. Many of the fragile muskrat skulls and antlered deer skulls were obtained by Mr. Clarence Simpson in this way. Most rivers in Florida have pockets in the limestone bottoms which are natural collecting traps so that good specimens can be obtained from among the residue that has collected over the years. This residue also includes present day animals along with the soft drink bottles and beer cans so thoughtfully deposited by the fishermen. Wakulla Spring, near Tallahassee, is the locality from which a nearly complete mastodon skeleton was obtained by the Florida

Geological Survey. This area has also produced many archaic weapon points and some early pottery. No proof of man's association with the early mammals found here has been put forth. Recent dives by the Florida State University students (text fig. 13) have been successful in penetrating the spring shaft for a distance of over 1,100 feet and a vertical depth of 250 feet.

Much of this distance is littered with bones of long extinct animals, many of them proboscideans. The reason for this abundance of vertebrate material is yet to be explained.

Caves, the realm of the speleologist or "spelunker" offer another field of fossil collecting that has barely been touched. Many of the limestone caves, situated in the central peninsula and the western panhandle, have been worked with some degree of success by bone hunters who prefer this medium to the hot sunny quarries that one usually associates with vertebrate paleontology. Although many of these caves have been explored, few have been excavated to the degree of that found in Saber-Tooth Cave in Citrus County. Eichleberger Cave, south of Ocala, penetrates the limestone for hundreds of feet, yet the best collecting area was discovered beneath the cave floor just inside the main entrance. There the remains of Canis ayersi were recovered along with some fragments of horse and camel. Also present were the remains of rodents, rabbits and a few peccary teeth.

Iron Ladder Cave north of Saber-Tooth Cave, was named for the metal windmill ladder that gives access to the underground crypt through a hole in the cave ceiling. The bone-bearing layer was the most lucrative just below the 60-foot high opening in the ceiling. This accumulation of bones was undoubtedly due to the animals falling through the hole and being killed on impact on the rocks below. One human skeleton, probably Indian, is known from this bone pile, below one of nature's natural traps. One can but wonder how this early hunter met his death.

The Florida Panhandle, particularly the Marianna area, is honeycombed with caves and it is safe to state that

the best fossil cave localities are yet to be discovered in Florida.

Perhaps Florida is the only state in which vertebrate fossils can be collected within easy access to cool shade and clear running spring water, and one in which a successful field trip can be conducted within a few hours drive rather than a trip of several days, which has been the experience of the majority of collectors setting forth from Eastern States to obtain a collection of Tertiary vertebrates.

DIRECTIONS TO VERTEBRATE FOSSIL LOCALITIES

Eocene

Mayo - Dell mine of the Williston Shell Rock Company NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 32, T. 4 S., R. 11 E., Lafayette County (inquire at mine office for permission to enter). Reached from U. S. Highway 27 at Mayo.

Miocene

Thomas Farm - NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 20, T. 7 S., R. 15 E., Gilchrist County (written permission is needed from head of Biology Department, University of Florida, Gainesville). Reached from State Highway 49. Quarry at east of road, between Santa Fe River Bridge and town of Bell.

Polk County Phosphate Pits - Pits of American Agricultural Chemical Company at Pierce and Brewster. Spoil banks of many abandoned pits contain vertebrate remains of Miocene age. (Permission needed to enter property - inquire at company office in Pierce.)

Pliocene

Haile - Limestone quarry, SW $\frac{1}{4}$ sec. 24, R. 17 E., T. 9 S., Alachua County. Haile can be reached by going east from Newberry on State Highway 235. Quarry lies to the south of Haile.

Pleistocene

Vero - Spoil banks of the drainage canal one-half mile north of Vero and starting approximately 500 feet west of bridge of U. S. Highway 1. Permission needed to excavate on canal banks.

Reddick - Mine of Dixie Lime Products Corporation, one mile southeast of Reddick, southwest corner NW $\frac{1}{4}$ sec. 14, T. 13 S., R. 21 E., Marion County. Permission needed to enter area.

St. Petersburg and Bradenton - Localities in this area are subject to such rapid change that it would be nearly useless to list the current collecting sites. However, many dragline operations, such as are underway for constructing yacht basins or housing sites (island or lagoon sites) are well worth visiting in order to prospect over the dredged fill for vertebrate remains. Permission should be obtained from owners or contractors before entering construction areas.

Itchtucknee River - This stream forms the northeast boundary of Suwannee County and the northwest boundary of Columbia County. Better collecting areas of this river are located in main stream bed between bridge for U. S. Highway 27 and main spring. Property owned by Loncala Phosphate Company of Ocala, Florida. Permission needed to collect.

Aucilla River - River bed south of bridge on U. S. Highway 98 to the Gulf. Deeper holes in limestone stream bottom are better collecting basins. This stream forms the boundary between Jefferson and Taylor counties.

Saber-Tooth Cave - Approximately $1\frac{1}{2}$ miles northwest of Lecanto, Citrus County, on the property of Mr. Austin Allen. Turnoff to property $1\frac{1}{2}$ miles west of Lecanto on State Highway 44. Permission needed to visit this sinkhole cave.

Iron Ladder Cave - Approximately $2\frac{1}{2}$ miles northwest of Lecanto, Citrus County. Cave on property of Mr. Gene Maynard. Turnoff to property $1\frac{1}{2}$ miles west of Lecanto on State Highway 44. Permission needed to visit this cave.

