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THE PLASTER JACKET
Florida Paleontological Society, Inc.
Florida State Museum
University of Florida
Gainesville FL 32611

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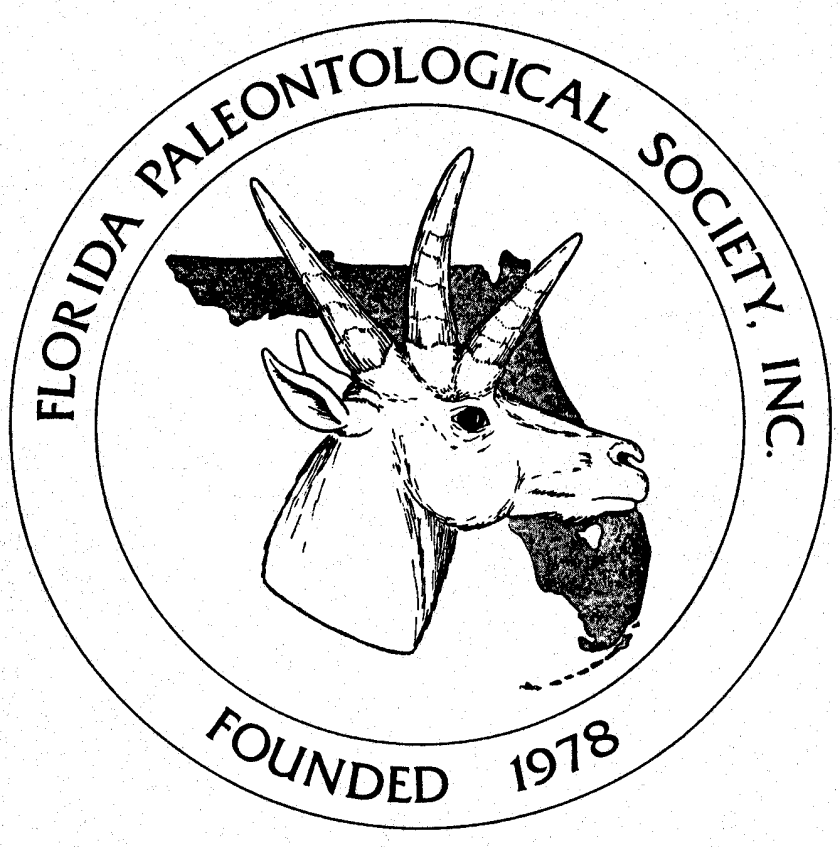
THE PLASTER JACKET

NUMBER 36 JANUARY 1981



A Publication of the
Florida Paleontological Society, Inc.
Florida State Museum, University of Florida
Gainesville, Florida 32611

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Official News

NEW MEMBERS ENCOURAGED

This issue of *The Plaster Jacket* is being mailed once more to the full list of original free subscribers. The reason is to encourage all persons with a real interest in Florida paleontology to join the FPS and thereby subscribe to future issues of *The Plaster Jacket*. See back cover for subscription and membership information.

Membership renewal notices were also recently mailed out to remind 1980 members to send in dues for 1981. As of 1 March 1981, the membership list will be pared down to include only members in good standing. If you have not already done so, please renew your FPS membership. Encourage a friend or two also.

SPRING MEETING IN JACKSONVILLE

On Saturday, May 16, 1981, members and guests of the FPS are invited to an all-day FPS meeting at Jacksonville University. The host committee of Jesse S. Robertson, Clifford J. Jeremiah, and Guy Selander have planned an exciting and informative program. The morning lecture session will include a talk by Dr. David Webb on *Recent Advances in Florida Paleontology*. The afternoon will feature a tour of Dr. Clifford Jeremiah's casting and molding workshop. Anyone wishing to participate either with a lecture or with a fossil display should request time or space as soon as possible by contacting:

Dr. Jesse S. Robertson
Dept. of Biology, Box 146
Jacksonville University
Jacksonville, Florida 32211
(904) 744-3950 ext. 382 or 383.

This spring FPS meeting will begin at 9 AM in the Biology Building on the Jacksonville University Campus. You approach the Jacksonville University campus from I-95 South by driving north on University Boulevard.

APPLY NOW FOR JUNE FIELD CAMP

The field camp committee is proceeding with plans for the 1981 program at Thomas Farm. An application form appears in the center of this issue. Each person interested in attending either of the one-week sessions should complete the form and return it, together with a deposit, by March 15. Applications will be considered in the order of their receipt. The total cost to each FPS volunteer will be $200, excluding transportation; with the full amount due by May 1. Application deposits will be refunded if, for any reason, the application cannot be accepted, or if a written request for refund is received by the committee by May 1. The committee reserves the absolute right to accept or reject any applications.

Two sessions, each lasting one week, are scheduled: June 14-20; and June 21-27. Each session will be limited to 15 FPS volunteers, 2 graduate students from the University of Florida to assist and direct field work, and 2 of the staff from the Florida State Museum (Dave Webb, Bruce MacFadden, and Howard Converse serving on a rotating basis).

The emphasis of the sessions will be on field excavation and recognition and preservation of fossils. There will be evening talks and discussions directed to the fossil fauna and the geology of Florida. With a good ratio of staff to volunteers there should be adequate opportunity for communication. This is a Middle Miocene concentration; and Parahippus three-toed horses will predominate, with 70 other species possible.

Tents and cots will be provided for all participants (two persons to a tent); and meals will be provided at the camp. Thomas Farm is somewhat isolated and living conditions will be basic. There will be some running water, and electricity will be available for group use on a limited basis. Notwithstanding these amenities, this should be considered a primitive campground. All persons will be expected to provide their own sleeping bags and personal effects - the latter to include, but not limited to soap, towels, sunburn lotion, insect repellant, etc.

(a comprehensive list of necessities and suggestions will be sent to each participant).

As was discussed at the November FPS meeting, the committee has made a few arbitrary decisions. All participants must be at least 16 years old; no motor homes, campers, trailers, or other wheeled living quarters will be permitted at the dig. Also, if any members of the professional staff at the dig (all of whom are members of this committee) finds it necessary, for cause, he may require the removal of any participant.

The administrative arrangements for the field camp are somewhat complex, mainly because they necessarily involve the Florida State Museum as well as the Florida Paleontological Society. The Thomas Farm Site and surrounding land belong to the University of Florida and the camp will be sponsored by the Florida State Museum, a part of the University, with support from the *Florida Paleontological Society, Inc.* Participants in the field camp will become members of the Museum Associates, Inc., and will receive liability insurance while involved in FSM work, the FSM Newsletter, a 10 per cent discount at the FSM Collector's Shop, and all other benefits of Museum Associate membership.

After reciting all of these negatives, it must be admitted that we think we are putting together a program that, while intense, will combine work, fun, and education with a package that will be rewarding and beneficial to all.

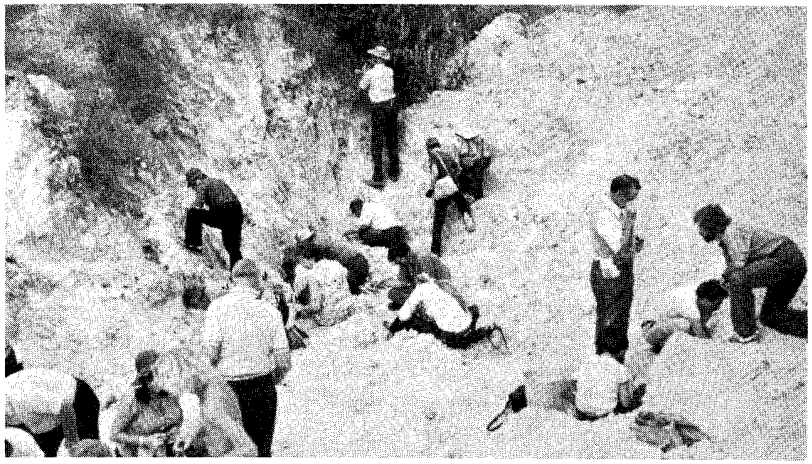
For those desiring it, 3 hours of course credit can be provided through UF's Continuing Education Division. Checking the appropriate box on your application will result in your receiving the necessary information for enrolling.

FIFTH ANNUAL PALEONTOLOGICAL MEETING

The 5th Annual Paleontological Meeting was held at the University of Florida on 11 October 1980. The scientific talks in the morning were followed by the 3rd Annual

Business Meeting of the FPS. The new President, Ben Waller, was installed (Figure 1A). After lunch, two groups of 40 members each took a bus excursion to the Devil's Milhopper and to the fabulous late Miocene Love Bone Bed (Figure 1B).

Ben Waller, new FPS President, with Hexameryx horns at left, symbol of his office.



FPS Love Bone Bed Field Trip led by Bruce MacFadden (lower right).

MINUTES OF THIRD ANNUAL BUSINESS MEETING

11 October 1980

The meeting was called to order by President David Webb at 11:10 AM. He welcomed the group back to Gainesville.

Reports were given, starting with the President's Report. Dr. Webb reported that all is going very well for so young a society. Its major accomplishments have been and will be these annual meetings and publishing the *Plaster Jacket*. The new experiments this year will be a field camp and a spring meeting. The Board of Directors were introduced. It was noted that Harold Majors has moved out of the State and finds himself unable to serve in this capacity any longer. Dr. Webb displayed the FPS logo as decided at the previous meeting. He noted that the FPS honorary member, Dr. G.G. Simpson had recently visited Florida and seemed rather pleased with the progress of paleontology in Florida (including the FPS). He announced that the Society of Vertebrate Paleontology will be holding it's annual meeting in Gainesville in November. And he reported that Roy Burgess had resigned as Club Historian. Roy received thanks for a job very well done.

Howard Converse presented the Secretary-Treasurer's Report. Currently the FPS has 298 members with 26 states represented. The bank balance is $1024.21. Expenses for the year included $496.00 for *Plaster Jacket* publication; $315.00 for bus rental (field trip); $35.38 for soft drinks (field trip); $39.90 for traveling expenses delivering *Plaster Jacket* to the printer; $10.00 to the Secretary of State. These expenses totalled $896.28.

Dr. MacFadden gave the Editor's Report. Three *Plaster Jackets* were published this past year. We would like to publish quarterly. Appropriate manuscripts are solicited from the members or non-members. There is still a shortage of back issues and these will be printed as time allows. A statement (ADDRESS CORRECTION REQUESTED) will be printed on the back cover of each issue of the *Plaster Jacket* to help keep our mailing list accurate.

comment from the floor suggested that an address list of FPS members be printed annually, which the Editor accepted.

Dr. Webb announced that the Society will hold a Spring meeting in Jacksonville. The meeting committee consists of Dr. Robertson (chairman); Dr. Selander; and Dr. Jeremiah. A date will be announced in the February issue of the *Plaster Jacket*.

Mr. Ed Brown reported on the Summer Field Camp Program. He stated that the results of a poll of the members favored a one-week camp. The dates have been set for the weeks immediately after most schools are out: June 14th for the first camp and June 21st for the second camp. There will be a limit of 15 persons per camp. All will live at the site in tents. Bathrooms will be portable. Minimum age is 16 years. University Continuing Education credits will be offered. Discussion followed. Ben Waller suggested that a manual of techniques be provided. It was decided that trailers and campers would not be allowed.

The By-Laws Committee Report was presented by Ray Robinson. The committee of Selander/Robinson reviewed questions presented at the last meeting. The committee's suggested changes to the By-Laws were read but it was noted that they must be published and then be voted upon at a future meeting. Written comments may be sent to the Secretary-Treasurer.

The Code of Ethics Committe, represented by Ben Waller and Frank Garcia, reported on their work on an ethical code.

Steve Hartman reported that he will represent the FPS at the Society of Vertebrate Paleontology's Annual Meeting poster session.

The Nominating Committee (dr. Webb) presented the new officers for the coming year, their nominations having been published and uncontested. Officers are: Secretary/Treasurer - Howard Converse, Vice President - Steve Hartman, President-elect - Bruce MacFadden.

Ben Waller accepted the presidency for 1981 along with the Hexameryx horn plaque that symbolizes his office.

NUMBER 36 JANUARY 1981

FOSSIL WOLVES, COYOTES, AND DOGS OF FLORIDA

Annalisa Berta[1]

INTRODUCTION

Present day representatives of the genus *Canis* include four species: the grey or timber wolf, the red wolf, the coyote, and the domestic dog. Among these forms the wolf has suffered the most serious decline in numbers. Less than a century ago the grey wolf was widespread throughout North America, but today small populations survive in the United States in only four states. Approximately three million years ago, during the Pliocene and Pleistocene epochs, however, canids (especially wolves) were more numerous and diverse, being represented by no less than ten species.

[1] Annalisa Berta is a Postdoctoral Fellow in the Department of Natural Sciences, Florida State Museum, University of Florida, Gainesville, FL 32611. She received her PhD from the University of California, Berkeley, and her dissertation concerned the fossil canidae of South America.

The origins and past and present diversification of the genus *Canis* are the subjects of this paper. Primary objectives are to distinguish these species and to review their evolutionary history and geographic and stratigraphic distribution, with special reference to their occurrences in Florida.

FAMILY CANIDAE

The genus *Canis* is a member of the dog family, or Canidae, which in turn belongs to the mammalian order Carnivora. Besides wolves, coyotes, and dogs, this family includes foxes and jackals, and a total of 14 genera and 35 living species are widely distributed over nearly every continent.

Canids range in size from the 3 lb (1.5 kg) African fennec to the 175 lb (80 kg) timber wolf. Members of this family possess elongate skulls and muzzles. Characteristic of canids and carnivores in general are modifications in the dentition which enable them to effectively process meat. The long, powerful canine teeth (so named for their great enlargement in this family) are used for catching and killing prey. The cheek dentition is specialized to provide both shearing and crushing functions. The powerful tearing teeth, or carnassials, the fourth upper premolar, and the first lower molar are modified as highly efficient blades, so that on closing the jaws these blades pass over one another like scissors. The upper molars have acquired a cusp on their inner side, the protocone, and a basin, the talonid, on the lower molars which act as a mortar and pestle when the teeth occlude (Fig. 1 in *Plaster Jacket* 11, Fossil Land Carnivores of Florida by Norm Tessman).

The limbs of canids are long, slender, and modified for running. We refer to them as cursorial digitigrades, that is, able to walk on their toes.

The senses of smell and hearing are especially well developed in canids. Their hunting behavior may be solitary, or in small family groups, living off small prey, as do foxes and coyotes; or it may be gregarious with packs hunting large prey, as do wolves. Fortunately for man, canids are also very social animals and therefore susceptible to domestication.

RECENT WOLVES, COYOTES, AND DOGS

The grey wolf, *Canis lupus*, is probably the most widely distributed and most naturally successful species of *Canis* to exist. Approximately 38 subspecies are recognized. Originally, the grey wolf occurred throughout North America, Europe, and Asia, but in historic times man has nearly exterminated it. Today in the United States the grey wolf survives only in Minnesota, Wisconsin, Michigan, and Alaska (Fig. 2). Wolves are nearly extinct in western Europe surviving in small populations in Portugal, Spain, Italy, and Scandinavia. They are still widespread in the USSR and extend eastward into Mongolia, western China, Korea, Tibet, and southward into India. They are present in small numbers in southwestern Asia. The grey wolf has no particular habitat preference and may be found in tundra regions, woodlands, open plains, or the edges of desert areas from sea level to 3000 m.

The red wolf, *Canis rufus*, was originally distributed throughout the southeastern United States. Presently, it is found only in extreme southeastern Texas and southern Louisiana (Fig. 3). The present known range of the red wolf lies within the coastal prairie and marsh areas, a habitat markedly different from the forested habitat found over the majority of its historic range. The red wolf is intermediate in size between the grey wolf and the coyote. Considerable debate exists concerning its taxonomic status. Numerous opinions exist, including its recognition as a proper species, a subspecies of the grey wolf, a subspecies of coyote, a cross between a coyote and a wolf, and a cross between a dog and a wolf.

Most characters used to distinguish the wolf from other canids involve size. Wolves have relatively large broad skulls and muzzles and small braincases. Their carnassial teeth are especially large. These skull and dental proportions are adaptations for eating large prey, which include caribou, sheep, muskoxen, deer, moose, and bison.

The coyote, *Canis latrans*, is the smallest species of the genus in North America. Approximately 19 subspecies are recognized. When the first settlers arrived in North America, the coyote was distributed mainly in the western half of the continent. The exact limits of its historical

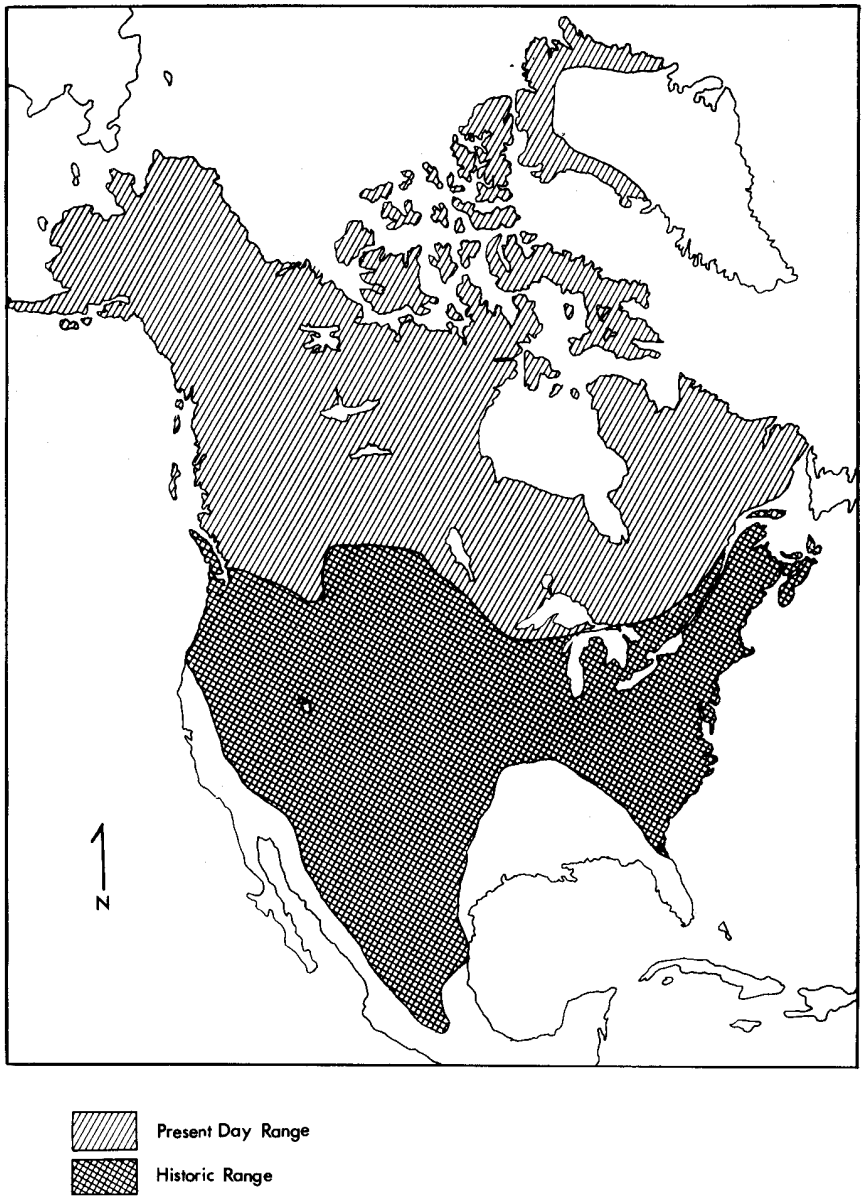


Figure 2. Historic and Present Day Distribution of the Grey Wolf, Canis lupus in North America.

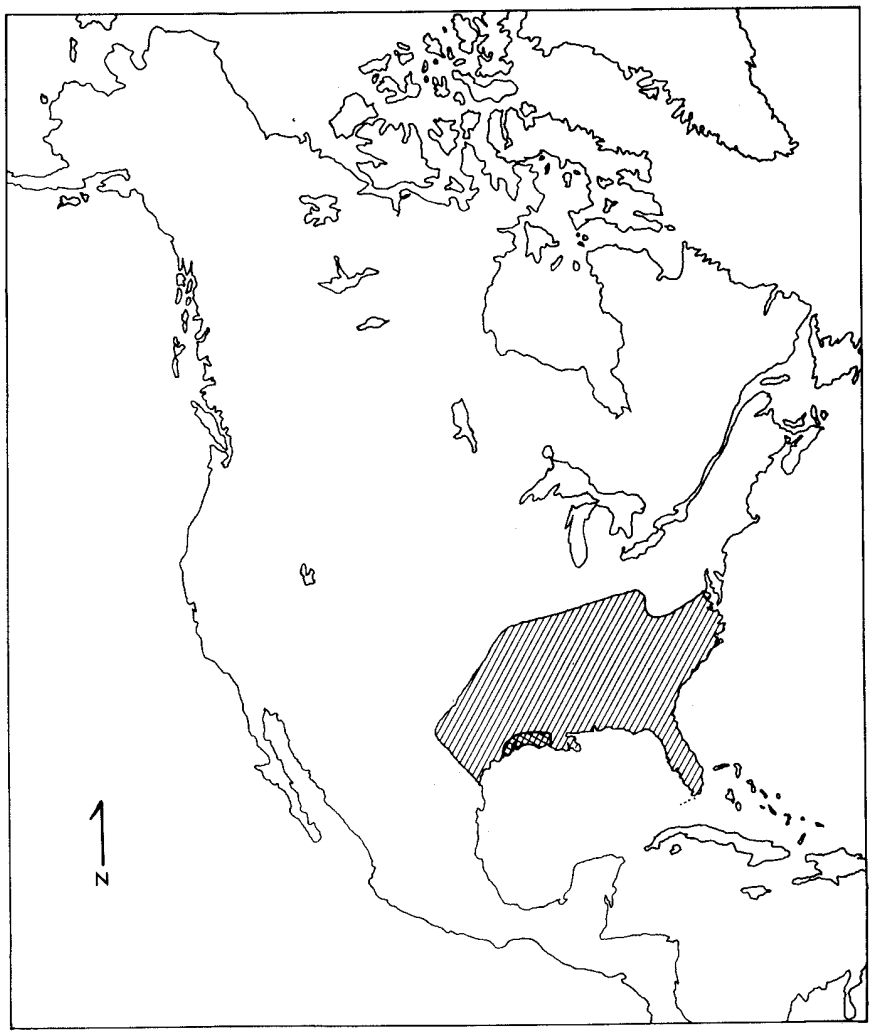


Figure 3. Historic and Present Day Distribution of the Red Wolf, Canis rufus in North America.

APPLICATION

FLORIDA PALEONTOLOGICAL SOCIETY

SUMMER FIELD CAMP

1981 June

NAME_____ AGE_____

ADDRESS_____

_____

PHONE _____

NAMES OF OTHER FAMILY MEMBERS APPLYING PHONE_____

_____ AGE_____

_____ AGE_____

_____ AGE _____

SESSION PREFERRED (check one):

June 14-20_____ June 21-27_____ Either_____

I (we) desire to attend the Florida Palentological Society Summer Field Camp as indicated above. Enclosed is my (our) deposit of _____($50.00 per person listed).

_____(signed)_____date

I do desire course credit through the University of Florida Continuing Education Division.

_____(Check only if applicable)

Please return application and check made out to Florida Paleontological Society, Inc. to: (Deadline is March 15)

Howard Converse, Secretary
Florida Paleontological Society
Florida State Museum, Univ. of Florida
Gainesville, Florida 32611
(Deadline March 15, 1981)

range are not known, though it appears that this species extended as least as far east as southern Wisconsin, northwestern Indiana, western Arkansas, and central Texas. Man's near extermination of the wolf and disruption of the environment have contributed to expansion of the coyote's range, and these animals occur in many areas that were formerly inhabited by wolves. Interbreeding of coyotes and wolves has occurred in some areas, further complicating distinctions between them. Today, it ranges from Alaska as far south as Costa Rica, but is most common in desert areas (Fig. 4).

The coyote of North America is replaced in southern Europe, Africa, and Asia by jackals. In terms of food habits the coyote differs as it is more of a predator than a scavenger. Coyotes, preying as they do on small animals like jackrabbits and rodents, have smaller skull proportions, narrower muzzles, and smaller, narrower teeth than wolves.

Among the wild canids mentioned, only the wolf exhibits the social behavior that puts it in a favorable position for taming and domestication. It is most probable that the domestic dog, *Canis familiaris*, is a direct descendant of the wolf. The place of domestication was probably the northern hemisphere, which corresponds with the distribution of the wolf. It has been suggested that the most likely ancestor of the dog is the Chinese wolf, *Canis lupus chanco*, though it is probable that other species were also involved. Presumably wolves accompanied man across the Bering Straits, where they were tamed by him and eventually became the domestic dog of the American Indians.

Dogs are difficult to distinguish. Domestication has produced a great variability, and consequently no single set of characters is equally diagnostic for all breeds. Throughout the world there are several hundred distinct breeds of dog recognized. For the most part, wolf-like proportions of braincase and muzzle distinguish dogs from coyotes. Large dogs differ from wolves in having relatively smaller, narrower teeth. A further change affects the contour of the skull, the frontal sinuses of the dog are more inflated than those of the wolf and the snout slopes down more, relative to the braincase.

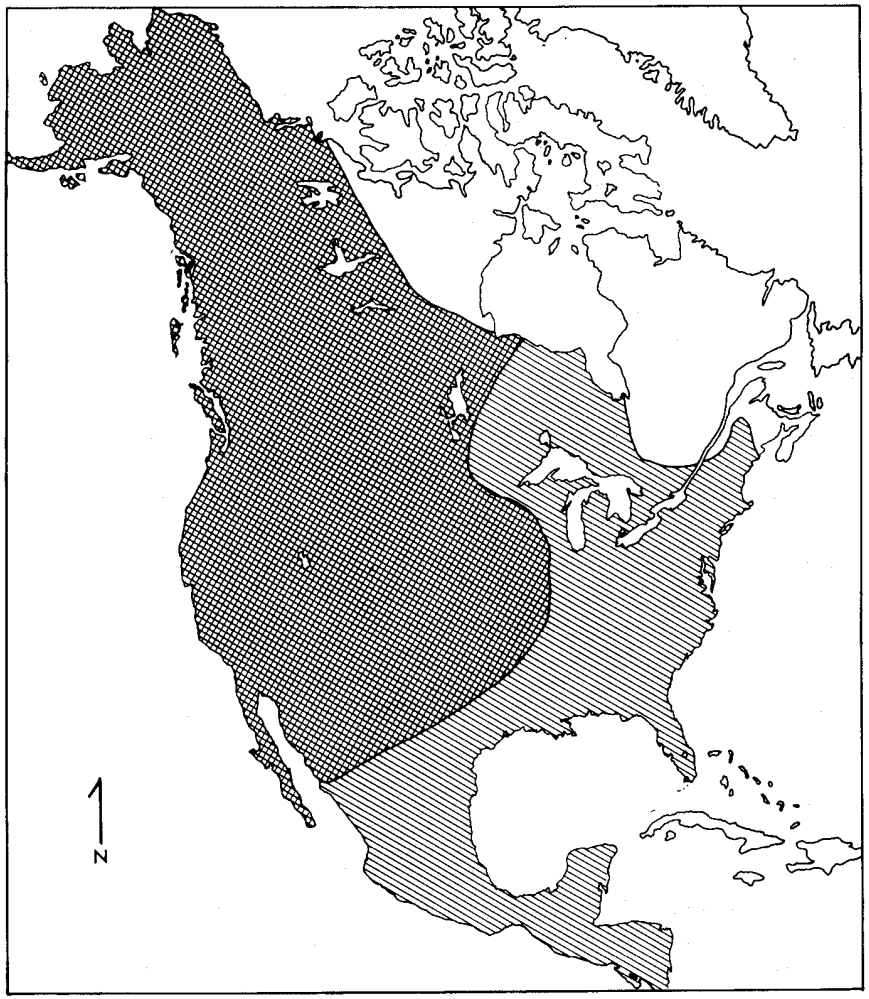


Figure 4. Historic and Present Day Distribution of the Coyote, Canis latrans in North America.

EVOLUTIONARY HISTORY

The oldest record of the Family Canidae is from late Eocene deposits in North America. One of the most primitive canids is *Hesperocyon* from the Oligocene White River Group of the Great Plains. This generalized canid had a weasel-like skeleton with an elongate body, short legs, and a dentition equipped with both cutting carnassials and crushing molars. (For comparisons of canids with other Carnivora see *Plaster Jacket* Number 11).

Insofar as the fossil record indicates, the chief center of evolution and dispersal of the Canidae was in the northern world, Holarctica. Two phylogenetic groups or lineages are recognized as far back as the late Miocene (Clarendonian): (1) a fox-like (vulpine) group, and (2) a wolf-like (canine) group. From the Miocene to the present on this continent, canids have successfully invaded a variety of different niches. They entered Eurasia in the Pliocene and both lineages underwent a small scale radiation only to invade North America again in the late Pliocene. It is at this time that the genus *Canis* first appears in the New World. Canids entered South America later in the Pleistocene as part of the "Great American" faunal interchange between continents. Once in South America they rapidly diversified into 6 or 7 genera and 10 species. They occupy habitats ranging from the plateaus and mountains of the Andes to grasslands and tropical rainforests of Brazil and Venezuela. Entering Africa during this same time interval, canids underwent a minor adaptive radiation which produced the Cape Hunting Dog, a large scavenger, the jackal, an intermediate-sized scavenger, and the fennec and bat-eared fox, both small predators.

FOSSIL WOLVES, COYOTES, AND DOGS OF FLORIDA

The earliest member of the genus *Canis* recorded from Florida faunas is *Canis lepophagus*, the probable ancestor of the living coyote, *Canis latrans*. It differs mainly in possessing a larger, broader skull and deeper jaws. *C. lepophagus* is recorded from Santa Fe River IB, of late Blancan age (Fig. 5). Undisputed remains referred to *C. latrans* have been recorded from the following late

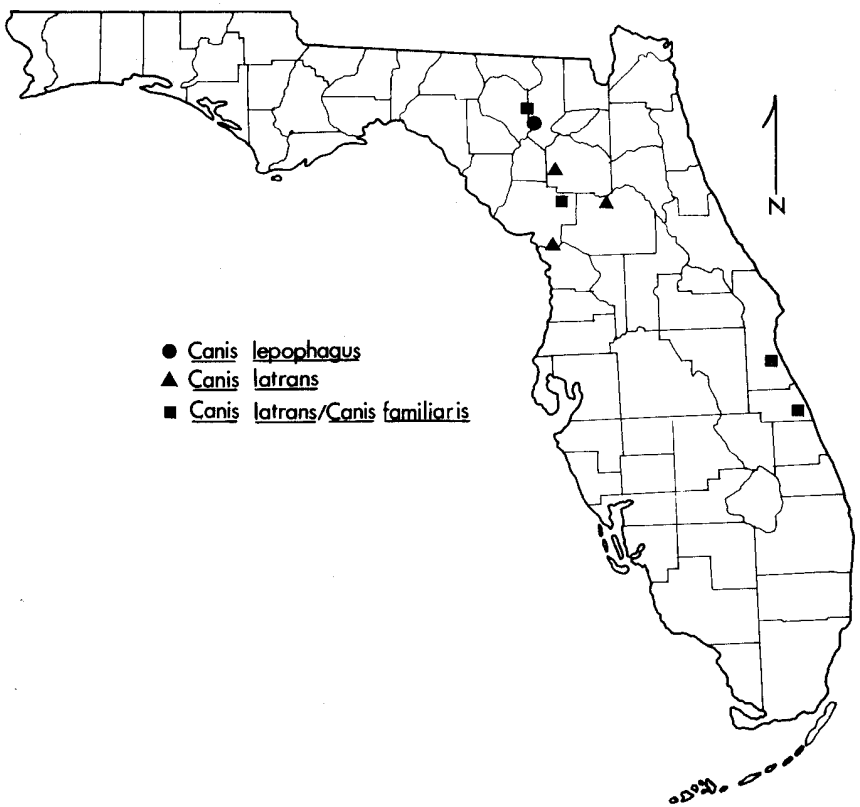


Figure 5. Distribution of Fossil Coyotes and Dogs in Florida

Pleistocene (Rancholabrean) sites in Florida: Reddick IA, Haile XIIB, and Withlacoochee River VIIA.

According to the leading authority on North American fossil canids, Richard Tedford (American Museum of Natural History, New York), coyotes are more closely related to red wolves than to grey wolves. The earliest wolf-like coyote (a group which includes the red wolf *C. rufus* and related forms *C. edwardi* and *C. irvingtonensis*) in Florida comes from the early Pleistocene (Irvingtonian) Inglis IA fauna where upper and lower jaws, teeth, and limb elements of *C. edwardi* have been reported.

Additional remains of small canids recovered from Rancholabrean age faunas--Ichetucknee River, Devil's Den, Vero, and Melbourne--have been referred by some authors to *C. latrans* and by others to the domestic dog, *C. familiaris* (Fig. 5). In order to resolve this problem, additional study of both of these lineages during the late Pleistocene and Holocene will need to be undertaken. According to Florida paleontologist David Webb, the Ichetucknee River, Devil's Den, and Melbourne records of *C. familiaris* suggest that the domestic dog reached Florida during the last glacial epoch, the Wisconsinan. *C. familiaris* has been recovered from many archaeological sites around the world dating from the early Holocene (10,000 ybp) epoch. The earliest well documented remains of the domestic dog in North America were found at Jaguar Cave in Idaho and have been dated at 10,370 $\pm$ 350 ybp.

Fossil remains of the extant wolves are not well represented in Florida faunas. *Canis rufus*, the red wolf, is recorded from the late Pleistocene (Rancholabrean) at Vero, Crystal River Power Plant, and Devil's Den and from the subrecent (Holocene) Nichol's Hammock fauna (Fig. 6). There is no certain record of *C. lupus*, the grey wolf, in Florida either fossil or recent. However, wolves undoubtedly ranged over Florida in historic times only to be exterminated early in this century. In 1774, the naturalist William Bartram, on his journey through the state, observed wolves at several locations. He described the Florida wolves as "being perfectly black except the females which have a white spot on the breasts." Bartram probably observed the red wolf based on its historic range, although both grey and red wolves occur in a black color phase.

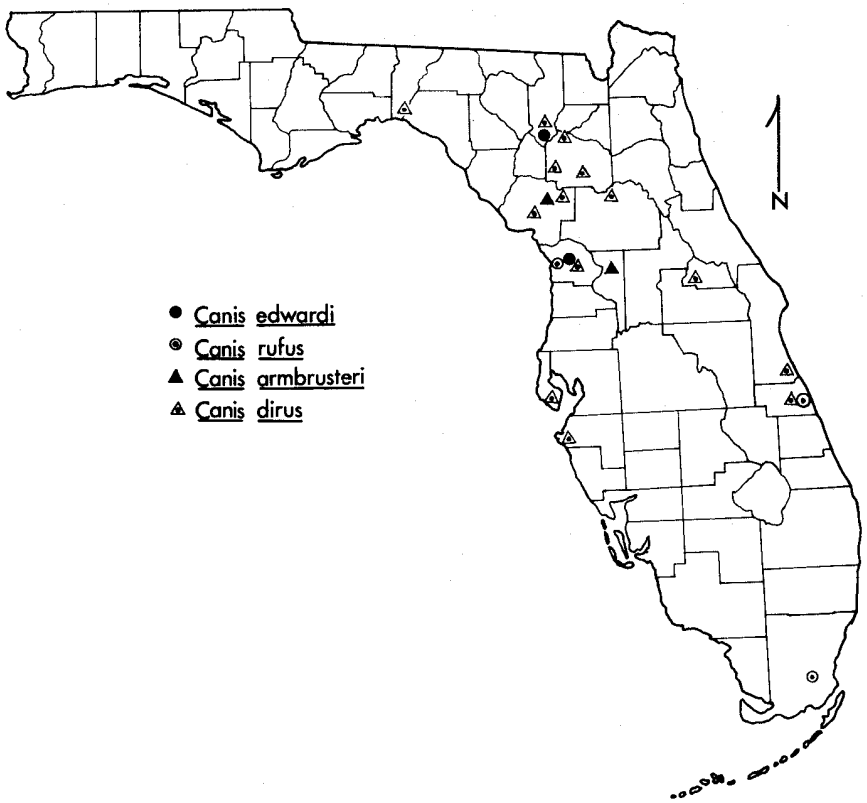


Figure 6. Distribution of Fossil Wolves in Florida.

Two large extinct wolves, *C. armbrusteri* and *C. dirus*, relatives of the living species, are however well represented in a number of Florida fossil sites and will be discussed here at some length.

ARMBRUSTER'S WOLF, *Canis armbrusteri*

This species was originally described by the North American paleontologist James Gidley in 1913 on the basis of lower jaws collected from Cumberland Cave in Maryland. Besides Maryland, this species occurs in Arizona, California, Florida, and Kansas. Two Florida faunas record the presence of this species during the medial Pleistocene (Irvingtonian), McLeod Lime Rock Mine and Coleman IIA (Fig. 6).

Although this wolf is closely related to grey wolves, it is usually regarded as a distinct species. It can be distinguished from *C. lupus* by the following characters: skull and muzzle narrower in most proportions, upper first molar (M^1) with the cingulum (ridge of enamel) extending around the protocone, lower anterior premolars (P_{2-3}) simple without accessory cusps, and lower fourth premolar (P_4) with a small accessory cusp positioned on the heel of the tooth (Fig. 7).

Armbruster's wolf is most closely related to the European wolf, *Canis falconeri*. It has been suggested that the ancestry of the wolf lies in the Old World and that *C. armbrusteri* represents its first appearance in North America. This species is last recorded on this continent from the early Rancholabrean.

DIRE WOLF, *Canis dirus*

This species was described in 1858 by the father of North American paleontology, Joseph Leidy, on the basis of an upper jaw collected near Evansville, Indiana. The dire wolf, largest and commonest canid recovered from late Pleistocene faunas of North America, has been reported from more than 80 localities on this continent. It occurs as far north as Alaska and in South America at many sites, including Tarija, Bolivia; Talara, Peru; and Muaco, Venezuela. The numerous Florida late Pleistocene (Rancholabrean) occurrences of this species include Aucilla River, Ichetucknee River, Santa Fe IIA, Hornsby Springs, Haile VIIIA, Arrendondo IB, Devil's Den, Wekiva River, Melbourne, Reddick IA,

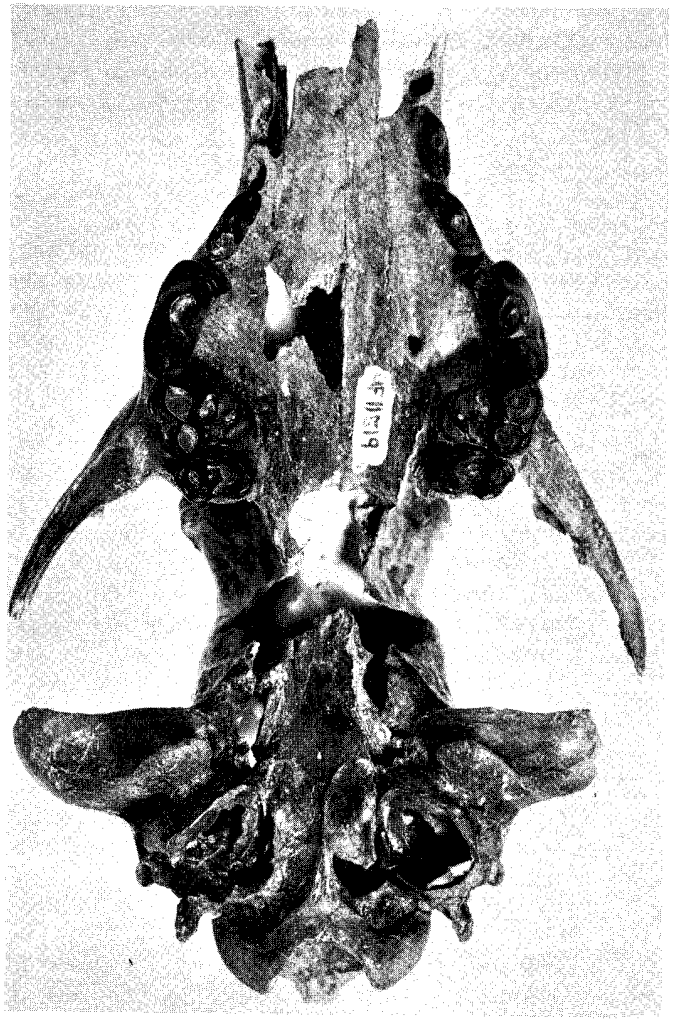


Figure 7. Canis armbrusteri, a palatal view of cranium from Coleman IIA, late Irvingtonian (medial Pleistocene) of Florida. x 1/2.

Eichelberger Cave, Sabertooth Cave, Seminole Field, Rock Springs, Sebastian Canal, Vero, Bradenton, and Phillipi Creek-Fruitville Ditch (Fig. 6). The Vero sample was once described as a distinct species, *C. ayersi*, but this is now recognized as a synonym of *C. dirus*. According to paleontologist David Gillette, Aucilla specimens of *C. dirus* have yielded the largest measurements of any known dire wolf.

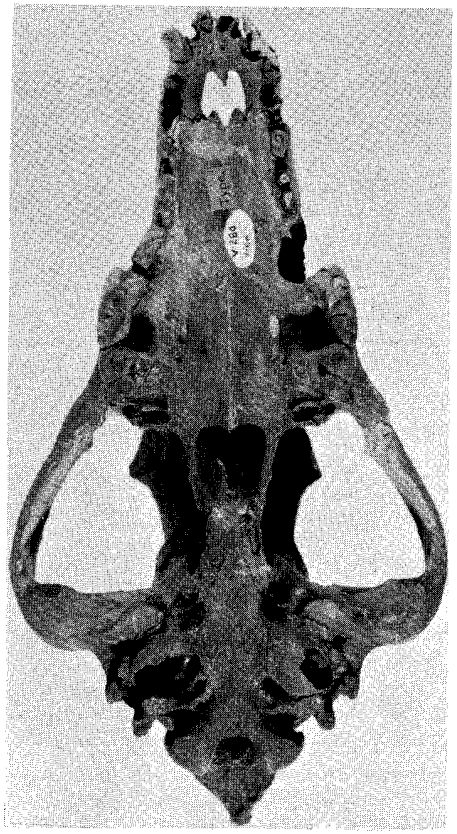
Wider skull proportions, exceptional heaviness of jaw below the lower carnassial, extraordinary height and backward projection of the posterior portion of the skull, enlarged carnassial teeth are all features that distinguish this species, (Figs. 8a and 8b, 9). Together these skull and dental features accommodated the development of the large masticatory muscles this animal needed to consume large prey.

In most respects the dire wolf postcranially was like the modern grey wolf. It was of course somewhat larger and heavier than the large wolves of today, and it has been estimated that it may have weighed as much as 20% more than the largest Alaskan wolves. Comparatively small limbs in relation to its overall weight and a massive head seem to suggest that this animal was not as well adapted for running as are living wolves and coyotes.

The Rancholabrean dire wolf may have evolved from an Irvingtonian wolf that shows a mosaic of *C. dirus* and *C. armbrusteri* features and has been referred to *C. cf. C. dirus*.

During the late Pleistocene in North America the now extinct dire wolf was contemporaneous with grey and red wolves. However, the dire wolf is far better represented, both in terms of sites and number of specimens, than other wolves. The rapid expansion and proliferation of the grey wolf during early postglacial times coincides with the disappearance of the dire wolf. Why was the dire wolf not able to survive and what led to its extinction?

Extinction of the dire wolf at the end of the Pleistocene may have been due to its inability to adapt to the extinction of its large herbivorous prey, including, mammoth, mastodon, camel, horse, giant sloth, and giant bison. Possibly the dire wolf lacked some important feature in its social organization to adapt to a changing environment and prey, as one would expect to occur during the transition



Figures 8a and 8b. Canis dirus (also type of C. ayersi) from Vero Beach, late Rancholabrean (latest Pleistocene) of Florida. a-right side view; b-palatal view. x 1/4.

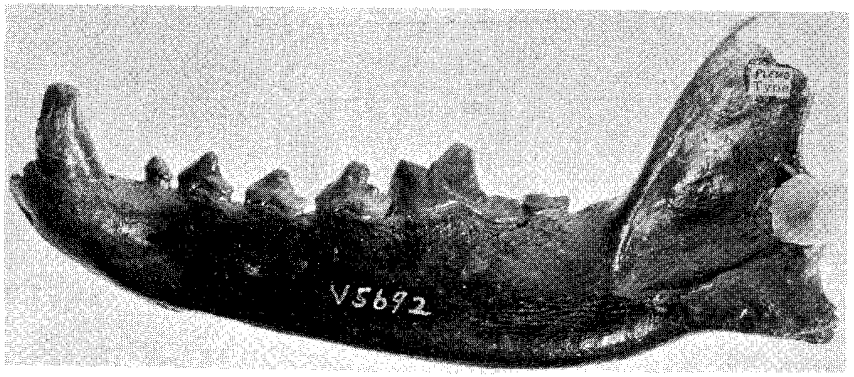


Figure 9. Canis dirus, left mandibular ramus from Hornsby Springs, late Rancholabrean (latest Pleistocene) of Florida. x 1/3.

from glacial to postglacial times. The grey wolf, with its high degree of social organization, may have persisted because it was better adapted to the fluctuating resources of a changing ice-age environment.

While the demise of Pleistocene wolves and the proliferation of grey wolves may be linked to environmental changes during the glacial-postglacial transition, the present day near-extermination of the wolf is largely our responsibility. For centuries man has engaged in a persistent struggle against the wolf. Unless preservation projects are actively undertaken, the wolf will join its Pleistocene predecessors in extinction.

ADDITIONAL READING

For a general survey of carnivore biology, readers should consult R.F. Ewer's excellent book, The Carnivores (New York, Cornell University, 1973). The Wild Canids (New York, Van Nostrand Reinhold, 1975), edited by M.W. Fox, is more specific in its review of the Family Canidae. The wolf, coyote, dingo, and fox are among the canids examined; the emphasis is on behavior and ecology, but there are also chapters on classification and evolution. North American North American Quaternary Canis (Monograph of the Museum of Natural History, Kansas, No. 6, 1979), by Ronald M. Nowak focusses on the systematics and relationships of living and fossil Canis in North America. Brief systematic accounts of fossil wolves, coyotes and dogs from Florida sites may be found in Pleistocene Mammals of Florida (University of Florida Press, Gainesville, 1974) edited by S. David Webb.