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THE PLASTER JACKET
Florida Paleontological Society, Inc.
Florida State Museum
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THE PLASTER JACKET

NUMBER 33 FEBRUARY 1980

THE BEGINNING OF THE AGE OF MAMMALS IN FLORIDA

David Frailey

University of Kansas

A Publication of the

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Florida State Museum, University of Florida

Gainesville, Florida 32611

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Official News

ANNOUNCEMENTS

After the initial year of distributing *THE PLASTER JACKET* free of charge to anyone interested in Florida paleontology, this issue, number 33, is the first sent to individual and institutional members in good standing in the FPS. We therefore have reduced our printing of each issue from 3000 (nos. 30 and 31) to 2000 (no. 32) to the present and more comfortable level of 750. This decrease will result in less of an expenditure from the Society's financial holdings.

REMINDER

The membership renewal notices for the FPS were recently mailed out. If you have not already done so, please send in your dues for 1980. As of 1 March 1980, the mailing list will be pared down to include only members in good standing.

THE FOURTH ANNUAL PALEONTOLOGICAL MEETING

The 4th Annual Paleontological Meeting was held in conjunction with the 2nd Annual Meeting of the FPS on 20 October 1979 at the Florida State Museum. A total of about 100 people attended this meeting which consisted of scientific talks, a business session, and an afternoon laboratory session.

MINUTES OF THE BUSINESS MEETING OF THE FLORIDA PALEONTOLOGICAL SOCIETY, INC.

October 20, 1979

CALL TO ORDER: 11:05 A.M., Room 211, Bartram Hall, University of Florida, Gainesville, FL.

PRESIDING: Mr. Ben Waller, Vice President.

Committee reports were called with the President's report first. Dr. Webb reported on the committees appointed and the Society's achievements of the first year. He mentioned that the Board of Directors had offered Dr. George Gaylord Simpson its first Honorary Membership and that he had accepted.

Howard Converse gave the Secretary/Treasurer's report. He announced that the society's membership currently stands at 249 members with new applicants applying daily. The treasurer's report included the following: Receipts to date = $1790.00. Expenditures to date = $1596.01 (Corporated Seal and Ledger $35.81; *THE PLASTER JACKET* Printing $1198.08; Sec. of State [Corporate Report] $10.00; Check Charges [Bank] $8.55; Fees returned to Dr. George G. Simpson $6.00; Annual Meeting Expenses $50.00).

The Editor's report was given by Dr. MacFadden. He reported that the society met its goal in publishing three issues of *THE PLASTER JACKET* this past year. The goal for 1980 will be four issues. A call was given for articles from the membership.

Mr. Roy Burgess gave the Historian's report and submitted a large folder to the archives. He stated that he is trying to build a file on individual members in the society and asked for members to furnish him with information regarding their activities and background.

The By-Laws Committee Report was given by Mr. Ray Robinson. Membership discussion followed on various topics of the By-Laws. A motion was made by Mr. Miller and seconded by Mr. Bill MacDonald to remove Article II, Section 6 from the By-Laws until clarification could be made defining the statement, "for cause." Discussion followed. The Vice President called for a vote from the membership. There were 21 ayes and 10 nays; the motion was passed. The By-Laws as amended were accepted by a motion made by Mrs. Brown. The motion was seconded by Mr. Bill Smith. The motion was passed by unanimous vote.

The Nominations Committee Report was presented by Dr. Jeremiah. He yielded the floor to Mr. Converse to present the nominations. Dr. S. David Webb - President; Mr. Ben Waller - President-Elect; Dr. Clifford Jeremiah - Vice-President; Mr. Howard Converse - Secretary/Treasurer; Board of Directors: Mr. Steve Hartman; Mr. Ray C. Robinson; Dr. Jesse S. Robertson; Dr. Guy Selander; Mr. Bill MacDonald; Dr. Jim M. McWhorter; Mr. Tom Watson; Mr. Larry Martin; Mrs. Bessie G. Hall; Mr. Wesley Coleman; Mr. Roger Alexon; Mr. Harold Majors; and Mr. Frank Garcia.

A brief discussion followed with a request that each of the nominees stand and introduce himself or herself. The Vice-President asked for a motion from the floor. Mr. Bill Smith made the motion to accept the nominations as presented. Mr. Lou Ober seconded the motion. The membership voted unanimously in favor of the motion.

New business consisted of several brief discussions. Mr. Ed Brown asked that the society consider setting up a field program with the proper training available in all aspects of field work. Dr. Webb stated that this will be taken under consideration by the Board of Directors. Mr. Converse projected all of the entries received for the society's logo. After some discussion, the membership decided upon a combination of two entries. The society logo will consist of the head of *Hexamerux* over the State of Florida. Encircling the head and Florida will be the words: "Florida Paleontological Society, Inc. - Founded 1978."

The meeting was adjourned at 1:00 P.M.

(Official News Continued on inside back cover)

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THE BEGINNING OF THE AGE OF MAMMALS IN FLORIDA

David Frailey[1]

The history of land mammals in Florida begins a little later than elsewhere in North America. While the little dawn horse *Hyracotherium* was sharing tropical forests in Wyoming with the bizarre and lumbering *Unitatherium*, *Coryphodon*, and other primitive ungulates, Florida was the limey bottom of a shallow tropical sea much like the Bahama Banks are today. Through this Eocene sea coursed the first whales, slender snakey, and highly predaceous, the construction of their skulls and paddles indicating they were not long separated from their land-dwelling forebears. Occasionally one may find a tooth or other piece of these early whales, the Archaeoceti, in the clean, cream-colored limestones

[1] David Frailey is a graduate student working toward the Ph.D. degree in the Museum of Natural History and Department of Systematics and Ecology, University of Kansas, Lawrence, KS 66045. Dave received his Masters degree from the Department of Zoology at the University of Florida and he maintains an active research interest in fossil mammals of Florida.

which are the oldest rocks exposed at the surface in Florida (see *THE PLASTER JACKET* no. 29). Here too, and equally rare, may be found the dense ballast ribs of unknown types of dugongs. Currently under study, these fossils vie with the dugongs of the famous Fayum Badlands of Egypt for the honor of being the oldest known sirenians.

Gradually the sea withdrew, following a pattern begun at the close of the Cretaceous, and new land, possibly as a string of islands, appeared. Exactly when these first lands emerged is not known but our earliest fossils of the animals which occupied the land are late Oligocene in age, approximately 28 million years old. In this one fauna, called the I-75 fauna because it was unearthed during construction of Interstate 75 near Gainesville. The mammals from the I-75 site are equivalent in faunal identity and diversity to late Oligocene faunas from the famous Big Badlands of South Dakota and Nebraska. Early horses (*Mesohippus*), oreodonts, peccaries, and the small jackrabbit-sized artiodactyls *Leptomeryx* and *Hypisodus*, all show close relationship between Florida and the western faunas.

The I-75 fauna is not fully studied and perhaps a closer look would reveal differences between this early Florida fauna and Oligocene faunas in the western states, as recent work has demonstrated to be the case for the more numerous early Miocene (approximately 22 million years old) faunas of Florida.

In the Great Plains, where the majority of fossil localities of this age are located, the early Miocene was a period of widespread expansion of dry grasslands and a grassland fauna. In Florida, on the other hand, floral and hence faunal diversity were evidently much greater. On the basis of information derived from Miocene marine mollusca, fish faunas, and paleofloras, mean annual temperatures in the temperature latitudes are estimated to have been 5-7° C (9-12°F) warmer than present temperatures during the mid-Tertiary. The

tropical climate which today occupies only southernmost Florida undoubtedly encompassed much of southeastern U.S. during the mid-Tertiary (Oligocene and Miocene).

A tropical climate is characterized by seasonal fluctuations of moisture, i.e. pronounced wet and dry seasons, which have a direct influence on the vegetation type which develops. This climate is closely associated with a savanna woodland over much of today's Caribbean region. Trees are widely spaced permitting development of a dense lower layer of grasses or shrubs, a savanna habitat referred to as parklike in appearance. Trees in this savanna woodland are fire-resistant, and fire helps to maintain the integrity of the habitat by keeping non-resistant rainforest trees out.

The turkey oak and longleaf pine association of the xeric sandhills of modern Florida is a savanna woodland in appearance and adaptations, and today this forest extends southward into tropical southern Florida. During the Oligocene and Miocene emergent limestone banks would have had some surface runoff but sinkholes were nonetheless forming at that time, like the one that is formed in the I-75 site. These sinkholes indicate that some drainage was subsurface as well and might have been sufficient for xeric surface conditions, such as are required by the turkey oak-longleaf pine association. It is possible that this forest has remained virtually unchanged since the earliest land history of Florida.

In poorly drained soils along streams, water-filled sinkholes, and solution prairies (such as Payne's Prairie near Gainesville), mesophytic and hydrophytic vegetation belts would have broken up the overall pattern of a savanna woodland in the interior of the peninsula. These tightly shrubbed communities are characterized by dense broadleaf canopies which permit little sunlight to reach the forest floor. Shrubs and small trees are common but ground cover may be sparse. Tropical elements found in mesic hammocks of the

Everglades, such as mahogany, are probably remnants of a tropical forest community which was once more widespread in Florida.

Several investigators have suggested that the vegetation of early Florida was similar to that of modern Florida. For one thing, studies indicate that the Eastern Deciduous Forest had assumed essentially its present structure and composition by the beginning of the Miocene. Regarding Florida directly, the pioneer paleobotanist E.W. Berry said that the fossil flora of the early to middle Miocene Alum Bluff Formation would find a congenial habitat at the present time in the delta of the Apalachicola River or almost anywhere along the coast of peninsular Florida. The Alum Bluff flora contained a number of temperate forms, as well as tropical species, that are regarded as the result of a cooling Tertiary climate.

The early Miocene climate and vegetation of Florida would probably not look out of place in modern Florida. The xeric forests probably dominated much of the interior and may have been composed of or included dominant species other than today's oak and pine. The wet lowlands were probably more extensive in the interior (all of Florida was probably at lower elevation at that time) and included a greater number of tropical species, but even these would have suggested a modern aspect.

This patchwork set of habitats would have permitted a great faunal diversity in a comparatively small geographic area and in fact the four early Miocene land vertebrate localities in Florida greatly differ in their faunal constituency. These four localities are: SB-1A from near Live Oak; Franklin Phosphate Pit No. 2 from near Newberry; Buda from near Alachua; and Brooksville, now lost but from a mine pit near that city.

SB-1A is perhaps the most perplexing of these four localities in that it is dominated by a single, small species of camel, *Nothokemas waldropi*. (This is a

small relative of a species known from the younger and more extensive Thomas Farm site from Gilchrist County.) Fossils of this camel account for 95% of all specimens recovered from the SB-1A site. Other notable faunal members which are also known only from SB-1A are a species of wolverine-sized mustelid, *Paroligobunis frazieri*, and a tree-dwelling squirrel, *Protosciurus*. The *Protosciurus* fossils, a jaw and a tibia, are particularly interesting because from the shape of the tibia for the first time in the fossil record it can be seen that this squirrel was truly arboreal. A controversy has persisted as to whether these early squirrels were as fully arboreal as are modern squirrels and, at least for the early Miocene *Protosciurus* from Florida, this seems to be the case. The presence of this squirrel at SB-1A also implies the proximity of trees to the site of deposition. SB-1A also has the distinction of producing the only early Miocene horse specimen in Florida, a single toe bone. Horses are well represented at I-75 and constitute 60% of the fossils at the middle Miocene Thomas Farm locality. Their near absence in the known early Miocene faunas remains enigmatic.

The Brooksville and Franklin Phosphate Pit No. 2 faunas each consist of only a handful of fossils yet each contains species not seen in any of the other faunas. Brooksville produced the only early Miocene tapir tooth yet found in Florida and a type of oreodont not found elsewhere in the state. Franklin Phosphate Pit No. 2 produced the only entelodont ("Giant Pig") ever found in the state. There is in fact only one species which can be said with certainty to have occurred in these last two faunas and Buda, the largest early Miocene fauna in Florida. That species is a dog-like carnivore, *Daphoenodon notionastes*. Predators, especially large ones, normally have large ranges that encompass different habitats, and the appearance of *D. notionastes* with a variety of animals is acceptable within an hypothesis of a tropical peninsula supporting a diversity of habitats.

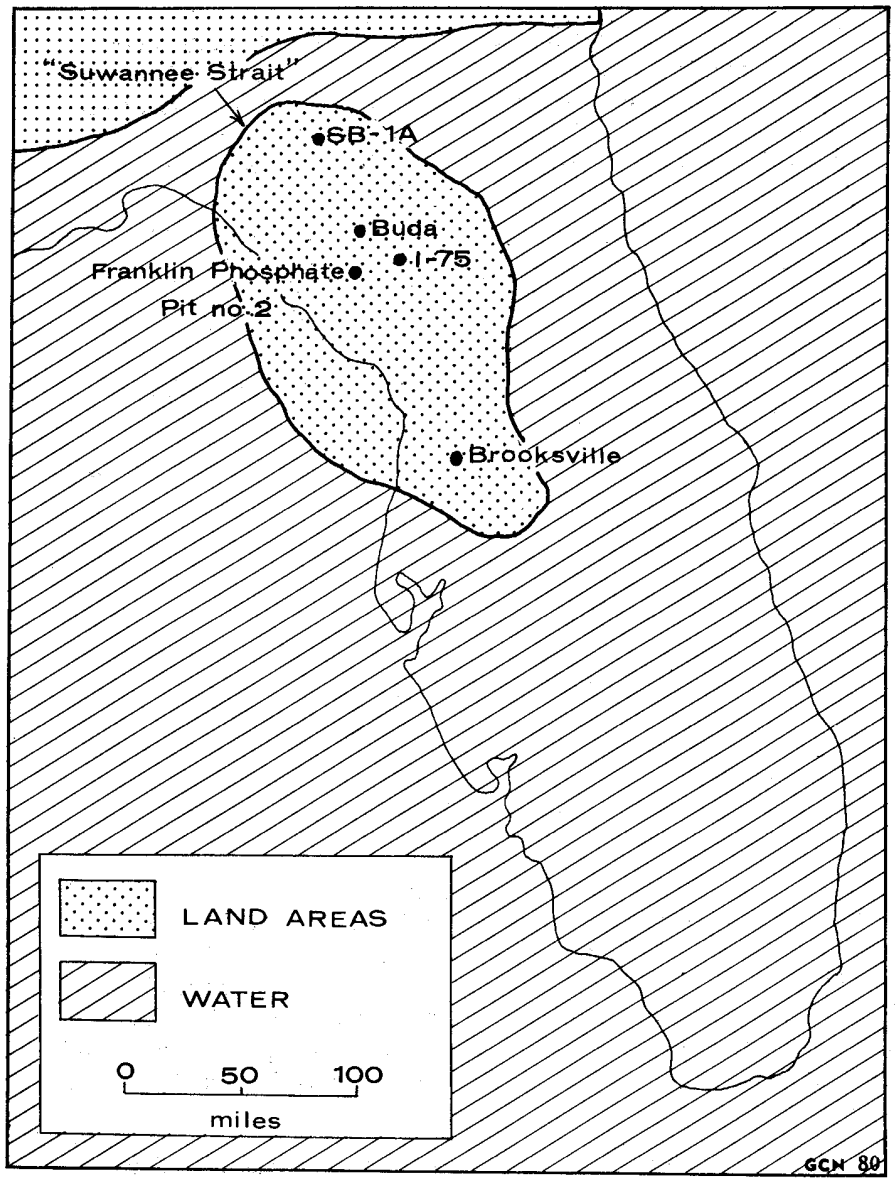

Figure 1. Oligocene and early Miocene localities in Florida with the hypothetical "Suwannee Strait" and "Isle Florida."

This species of *Daphoenodon*, now known only from Florida, brings up another curious aspect of Florida faunas in comparison to the rest of the North American continent. *Daphoenodon notionastes* is the smallest species of *Daphoenodon* known; other species that lived in western North America at the same time were 25-50% larger. *Daphoenodon notionastes* was also the most slender of these large carnivores. This size pattern continues in other members of the Buda fauna for here too is found one of the smallest known chalicotheres (clawed ungulates related to horses and rhinoceroses) and the smallest known camel ever; no larger than a whippet and equally slender.

Numerous explanations come forth as a solution to this striking pattern. It was pointed out in early biogeographic studies, and called Bergman's Rule after its originator, that within a species the smaller individuals would generally be found in the warmer part of the range and larger individuals at colder and higher latitudes. This was thought to reflect a more advantageous body weight to surface-area ratio in conserving warmth. Florida is certainly farther south than the majority of fossil localities of comparable age in the western states and Bergman's Rule may have been a factor in the number of small forms found in early Miocene faunas in Florida.

This pattern evidently does not continue through the Tertiary, and even in the early Miocene, small chalicotheres are found in more temperate climates in Oregon and France. Moreover, Bergman's Rule has recently been challenged by several researchers who note that this size gradient is far from universal among warm-blooded animals and that some cold-blooded animals exhibit the same pattern.

Another possibility comes from the tendency for lineages to proceed from small to large individuals. This is Cope's Law, named after one of the most distinguished American paleontologists, Edward Drinker Cope.

Although exceptions abound in the fossil record, it is a recurring pattern that was originally thought to follow from the inherent survival value of large size. More recently, it was suggested that such may not be the case; that in fact increased size is a specialization that makes transition to a new environment difficult and that smaller, less specialized species are those which are more likely to adapt to new circumstances and leave the next generations. Cope's Law becomes tenable with regard to the early Miocene Florida faunas in that many of the small species are the first of their line (*Nothokemas waldropi*) or very near it (*Daphoenodon notionastes*).

The emergence of the Florida peninsula brings in another, more exotic explanation. Florida, during part of its early history, was possibly one or several islands. One theory suggests that the absence of shallow water Oligocene marine beds in the northern part of the peninsula is due to the presence during this time of a deep strait or trough, the Suwannee Strait, which extended across northern Florida in a line running roughly through Jacksonville and Perry. This theory is supported by Eocene and Oligocene invertebrate faunas that differ greatly between central Florida and the rest of southeastern United States. A strong current through the trough, according to theory, would have prevented deposition and maintained faunal separation from the continent until a flood of clastics (sand and clays) from the north during the middle Miocene filled the trough and established the present connection with the mainland. The Ocala Arch, a large structural dome that resulted from the buckling of the Eocene strata in post-Eocene time might have formed an island, "Isle Florida," over an area extending from Tallahassee to Tampa and inland to Gainesville.

On the other hand, it is possible that the "Ocala Arch" is not a structural feature at all but is, in fact, an erosional remnant and that the Eocene-Oligocene limestones underwent a long sequence of deposition

followed by erosion. Isle Florida may have never been isolated for long periods of time and never by strong currents in a narrow strait, although the periods of separation may have been long enough to effect certain changes in some early Miocene mammals.

Animal species that inhabit islands often exhibit unusual characteristics in comparison to their continental relatives. These characteristics include differences in color and changes in body proportions and body size. Dwarfism is a notable island adaptation easily seen in many living species (the Key deer, for example) as well as in fossil species. (Exceptional examples from the fossil record are the pygmy elephants, *Mammuthus* on the Channel Islands of Southern California, *Elephas* on Malta, Crete, and Cyprus in the Mediterranean, and recent discoveries of small *Stegomastodon* from Indonesia.) Size reduction may be a response to limited food supplies in that food resources may not permit large growth or that a viable population, i.e. a sufficient number of individuals to maintain genetic variability, can only be maintained on limited food supplies if the individuals are smaller than normal. (Increased predator pressure on island forms has been postulated as a factor in size reduction of the prey species. This factor has likewise been suggested to promote gigantism, and the point is certainly nebulous in either regard. A third possible factor is that the small size of island forms merely reflects the small size of the immigrant species which brings us once again to a consideration of Bergman's Rule.)

The theoretical Suwannee Strait would have produced a lengthy isolation for any mammals that were located on Isle Florida. The natural progress of adjustment to this restricted geographic area would have produced differences between island populations and closely related continental forms that we would expect to see in the fossils. On the other hand, repeated deposition and erosion in the northern part of the state, periods

of island separation closely followed by periods in which Florida was a short peninsula, would not have permitted great morphological divergence. The close similarity of the late Oligocene and early Miocene faunas of Florida and western United States indicate the latter idea is the more probable. Island dwarfism is not ruled out, however, when one considers that only a few tens of thousands of years were necessary to produce the pygmy elephants on some rather large islands.

The interesting pattern of small size among species in the early Miocene faunas of Florida will remain one of many mysteries about life in Florida 20-30 million years ago. As is more often than not the situation in paleontology, the search for answers lies in a search for more fossils.

Official News, Continued

NOTE OF APPRECIATION

The Editor would like to express his appreciation on behalf of the FPS to Ms. Rhoda J. Rybak of the Florida State Museum for her editorial assistance and typing of *THE PLASTIC JACKET*. Ms. Rybak has been involved in preparation of this publication since 1970.

BACK ISSUES OF *THE PLASTIC JACKET*

During the FPS Business Meeting, numerous members present were in favor of reprinting back issues of *THE PLASTIC JACKET* that were previously out of print. We are pleased to report that all back issues of *THE PLASTIC JACKET* are available to members of the FPS. These can be obtained by writing to Mr. Howard Converse, Secretary-Treasurer, Florida State Museum, University of Florida, Gainesville 32611.

(Bruce J. MacFadden, Editor)