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Florida Paleontological
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Florida State Museum
University of Florida
Gainesville, Florida 32611

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NUMBER 31 JUNE 1979

PALEOECOLOGY: ANCIENT COMMUNITIES AND ENVIRONMENTS

Ronald G. Wolff

University of Florida

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Florida Paleontological Society, Inc.

Official News

IMPORTANT ANNOUNCEMENT

Until October 1979 *THE PLASTER JACKET* will be distributed free of charge to everyone on the mailing list and anyone else who requests it. AFTER OCTOBER 1979 *THE PLASTER JACKET* WILL BE DISTRIBUTED TO INDIVIDUAL AND INSTITUTIONAL MEMBERS IN GOOD STANDING. After this time, single issues will be available for purchase to non-members. For membership information, see outside of back cover.

4TH ANNUAL PALEONTOLOGICAL MEETING

The 4th Annual Paleontological Meeting will be held on Saturday, 20 October 1979, at the University of Florida (Florida State Museum and J.W. Reitz Union). If you are interested in presenting a talk (about 15-20 minutes in length), a poster display, exhibiting specimens, or want to preregister, fill out the enclosed form and return it to Howard Converse, Secretary-Treasurer. Standard 2" x 2" carousel projectors will be available for showing slides.

NOMINATIONS OF NEW OFFICERS

The nominations for the FPS officers for 1979-1980 are listed on the enclosed form. If you have any additional nominations, please complete and return the enclosed form. All nominations will be voted upon during the October Annual Meeting.

SUGGESTIONS FOR FPS LOGO

The FPS would like to choose a logo. If you have a suggestion, please mail an illustration to Howard Converse, Secretary-Treasurer, before 1 October.

Slides will be made of each logo suggested, and the members present at the October Annual Meeting will vote for their choice.

FIRST HONORARY MEMBER OF THE FPS

During April the Board of Directors unanimously voted to extend the first honorary life-time membership in the FPS to Dr. George Gaylord Simpson. Dr. Simpson has graciously accepted this membership.

THE FLORIDA STATE MUSEUM

The Florida Paleontological Society, Inc., would like to thank the Florida State Museum for contributing editorial services and supporting the mailing costs during this transitional first year of our society.

DONATION OF SPECIMENS TO

EDUCATIONAL INSTITUTIONS

The advantages of donating scientific specimens, such as fossils, to educational institutions include the following: (1) the specimens will be well cared for; (2) they will be studied and possibly exhibited; (3) the collector and donor will be permanently recognized; and (4) their estimated value is tax deductible. With regard to tax deductions, the value of fossils may be estimated by the donor on the basis of estimated expenses involved in collecting the specimens or current value of comparable specimens. The value can also be estimated by a reputable person, but not by the institution or employees of the institution receiving the donation.

In the past, private donations of key fossils have provided major advances in Florida paleontology.

(Bruce J. MacFadden, Editor)

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PALEOECOLOGY: ANCIENT COMMUNITIES AND ENVIRONMENTS

Ronald G. Wolff [1]

Understanding the relationships of living animals and plants to their surroundings is the main goal of ecology. We know that these relationships differ from species to species and across broad geographical regions on earth today, often because climate, topography and species composition differ from place to place. Major environmental factors like climate and topography may change in time, bringing alterations in water and nutrient supplies, sunlight, and other critical requirements for life. Animal and plant populations subjected to unsuitable new environmental conditions may be able to shift to more favorable regions. In a slowly changing environment evolution may occur in some populations with consequent adaptations to the new environment. If neither emigration nor evolution occurs rapidly enough, some species

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[1] Ronald G. Wolff is Associate Professor of Zoology and Affiliate Associate Curator in Vertebrate Paleontology at the Florida State Museum, University of Florida, Gainesville FL 32611.

populations may dwindle to extinction in that region.

It is the aim of paleoecology to understand and to reconstruct the habitats and life relationships of the past. A difficult and complex study, it requires knowledge of scientific skills beyond the competence of any one person. It is also difficult because much of the evidence of past environments has been distorted or lost during the process of fossilization. On death the bones of animals are usually scattered or damaged and often completely destroyed by predators and weathering (Fig. 1). Relatively few skeletal remains find their way into streams or lakes where sediments may cover and protect them. Fewer yet are preserved in other ways (as in caves or volcanic deposits); it is often moving water alone which has the power necessary to carry sediments to protectively cover the bones or to carry bones to suitable places for burial.

Important to the paleoecologist too are other kinds of fossils, such as pollen and spores, leaves (Fig. 2) and fruits, and invertebrates, as well as tracks (Fig. 3), and feces (Fig. 4). Sometimes these are preserved in the sediments with bones, but usually they are not. Leaves are fragile and easily destroyed by the fast moving abrasive conditions in which bones are commonly preserved. Spores and pollen seem to be adversely affected by the highly oxygenated conditions found in rapidly moving sands and gravels.

Although sediments are the caretakers of this large sample of past life, the sample itself is not usually ideal for paleoecological analysis. Most paleontological sites produce mainly the bones of large animals, yet we know that living animal communities have many more small animals like mice, small birds, and lizards than they do of larger forms like deer, horses, and alligators. A few sites yield mostly the bones of small animals (Fig. 5). Rarely, if ever, do the relative numbers of individuals for species from a fossil site reflect their relative abundance in the community

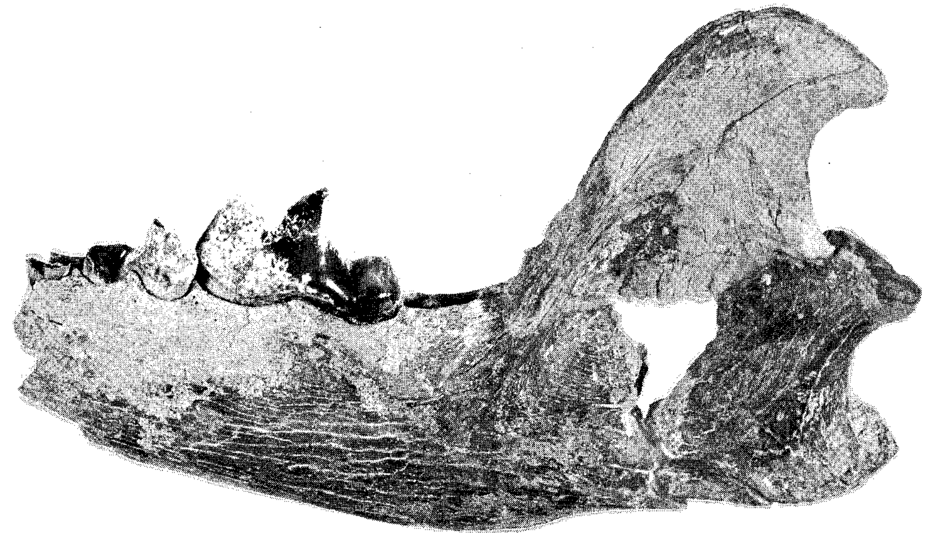

Figure 1. Fine cracks in this jaw of the Pleistocene dog *Theriodictis* from Bolivia indicate that the bones lay weathering on the surface for some time before being covered by sediments. Natural Size.

in which they once lived. Why not? Since small bones have little bulk, they are easily separated from larger bones and carried farther downstream to be deposited elsewhere. Owls may help collect small vertebrates for ultimate fossilization, since they often regurgitate the bones of their small prey in a single area near the nest. These "owl pellets" then may be washed into a stream for deposition. The bones of small animals and the fragile bones of young animals are quickly weathered or abraded by moving sands and gravels and this may result in their poor representation at a site.

In very energetic mountain streams only the most rugged fossils can be preserved. In fact so few are preserved that we have a very poor fossil record of

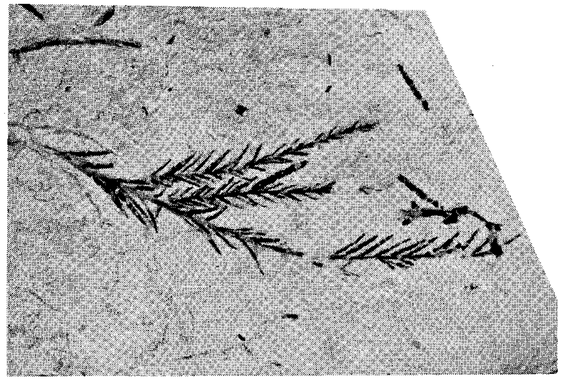

Figure 2. Plant fossils, like this foliage branch of swamp cypress (*Taxodium*) from the Miocene Latah Formation of northern Idaho, show that the cold and dry Pacific Northwest was once a humid and mild habitat for many plants whose descendants today are restricted to the southern states. Natural size.

highland communities. Wet tropical regions may have vast numbers of living vertebrates of many types, yet fossils of terrestrial vertebrates are rarely preserved there, probably because bones weather so quickly they are not often carried to the sediments before destruction. Factors that may affect the representation of a species and even the presence of fossils themselves are broadly related to biological, geographical, and geological processes acting on the remains prior to final entombment.

PALEOECOLOGY IN PRACTICE

As yet, paleoecosystems cannot be reconstructed with precision. The first step in reconstruction usually involves the careful identification of the species present; this requires specialists competent to study particular groups, say frogs or carnivores.

Figure 3. Footprints of a bird that walked along an Eocene shoreline—now the Green River shales of Wyoming. Natural size.

A group of species from a site may be similar to those living in a particular habitat today, but usually there are important differences which must be explained. The older the deposit, the greater are both the differences in the species and the difficulties in interpretation. When an extinct species with unusual anatomical characters is found (such as a saber tooth cat or giant ground sloth), a careful analysis of functional morphology should be undertaken to determine how the species may have interacted with others.

The sediments themselves often provide extremely important clues to the paleoecology of the site.

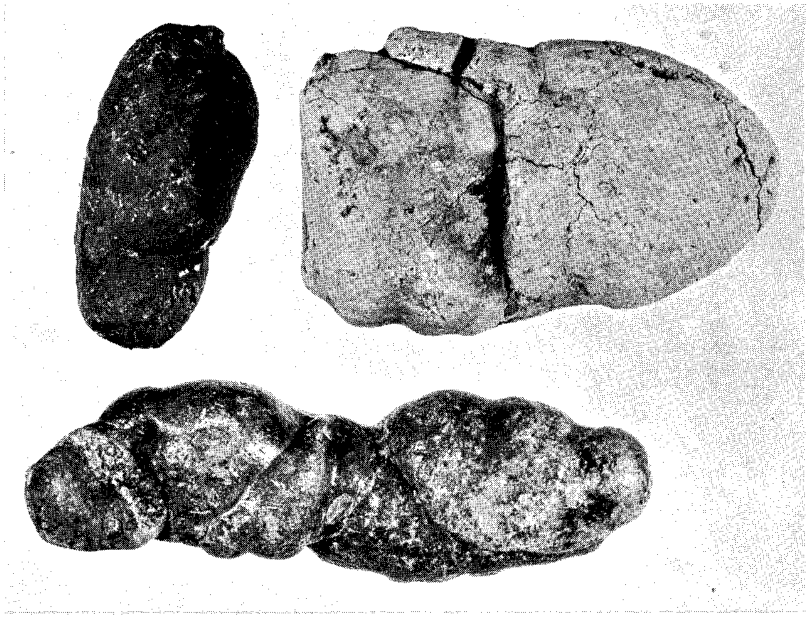

Figure 4. Pleistocene *Alligator* feces (coprolites) from the Ichetucknee River, Florida. Sometimes useful in dietary, digestive, and parasite studies, they are frequently common in fossiliferous sediments. Coprolites from crocodiles, turtles, giant ground sloths, and even humans are known. Slightly reduced.

Structural characters of sediments such as banding, grain size and orientation, color and minerals present, will often give information about the site of deposition. Lake, river and marine sediments are all of underwater development, yet each has special characteristics. Those sediments in one part of a stream differ from those of another part. Particle size distribution in sediments are indicative of the transport capabilities, or transport energy, of the long extinct stream. Low energy systems carry only the finer particles like sands, silts, and clays. This can be related indirectly to stream width and depth, amount and frequency of rainfall and stream gradient.

Figure 5. Tiny fossils from the Pleistocene site at Reddick, Florida, fit comfortably on a dime. Four times natural size.

The origin of marine phosphate deposits, such as those of Florida, remain controversial, yet there is solid evidence that at least some phosphate deposits may begin as calcium phosphate-rich granules formed by the kidneys of certain clams. The Atlantic Bay Scallop of Boca Ciega Bay, Florida, produces such kidney granules during reproductive and environmental stress. A large amount of magnesium in the sediments (or in the shells of shellfish) indicates a marine habitat, although magnesium content is also directly related to depth, temperature, and latitude. Over the past few decades it has become apparent that even very old sediments may contain residues of organic compounds directly derived from the fossils they contain. Sugars, amino acids, and organic pigments are known to have been preserved. Studies of these chemicals may give us information on life forms which left no other remains.

SAMPLING

Perhaps the single greatest question in analyzing the paleoecology at a fossil site is how to extract the necessary data without further distorting the information already recorded in the sediments. Most museum collections are severely limited in usefulness for paleoecological investigations because many necessary data were never recorded during collection at the site and because small forms are often poorly represented. This is true for collections made both by nonprofessional and by professional paleontologists. Paleontologists frequently sample a site by searching exposures of a geological formation and collecting fossil bones and teeth which appear at the surface. While the resulting collection may be large, it mostly consists of only the larger and most easily seen fossils. Surface prospecting favors the collection of large mammal remains for two reasons. Obviously, larger bones are more visible than smaller bones while the collector is walking or crawling along the outcrop.

Less obvious is the fact that water runoff is more likely to carry small bones and teeth away and to cover them with fine sediment which makes them less visible. Over a period of time, weathering and erosion of large areas of outcrop—areas still easily traversed in a few days of surface prospecting—may remove great amounts of sediments. The relatively low energy effects of rainfall and runoff transport larger bones and teeth much less readily than smaller. The large bones become concentrated at the surface as the surface layers of sediment, including the smaller bones and teeth, are carried away. Because of this, the prospector often does not collect small vertebrate fossils simply because they are hidden from view. Since small bones and teeth are not picked up, many collections lack these critical environmental indicators, for small vertebrates are unusually sensitive to local environmental conditions.

How can we make certain to collect these small bones and teeth? How can we be sure that in our collection the proportion of each species, whether large or small, is the same as was in the sediments? The answer to the first question is to look more carefully and with better techniques. One of the better techniques is screenwashing, using a box in which the bottom is a fine mesh screen (to better catch the smallest teeth and bones, the mesh size should be 20, or even 24, holes per inch, smaller than ordinary window screen). Through such a screened box, silt and fine sand is washed (or shaken) out leaving any "micro" fossils in the screen to be picked up more easily (Fig. 5). The answer to the second question is not to choose what to pick up. This means more than picking up everything, although that is a very fine start. Ideally it means that no fossil (seen or unseen, large or small, carnivore or herbivore) should have a greater chance of being picked up than any other. Such a collection is a random sample (that is, a non-selective or unbiased sample) of the fossils in the outcrop. By shoveling out many pounds of sediments, screenwashing this, then picking out every one of the fossils remaining, one can approach a true random sample.

How much shoveling depends on how many fossils there are in the sediments. Work at several sites in the U.S. and Europe suggest that at least 15,000 to 30,000 specimens of bones and teeth are needed in order to get all species including the rarest from the site. We are fortunate in Florida to have some very rich sites that can produce that size of a collection. Inglis, Reddick, Love, and Thomas Farm each have such potential. Once a collection is properly made, the paleoecologist can analyze it to determine what effects the process of fossilization has had on the remains of the original community of animals, and which species may have been washed in from some outside community. Importantly, he can do so knowing that his collecting techniques have added no further distortions. Further analysis yields insights into the nature of the once living community.

The paleoecologist's notebook will contain data on geology, sedimentology, and paleontology. Careful paleoecology involves the unbiased collection and study of all aspects of a site. Every day's work must be directed to getting all kinds of information. It is a lot of work, but to the paleoecologist it is worth it just to partly open that window to the past.

FLORIDA PALEONTOLOGICAL SOCIETY, INC.

As stated in the Articles of Incorporation: "The purposes of this Corporation shall be to advance the Science of Paleontology, especially in Florida, to disseminate knowledge of this subject and to facilitate cooperation of all persons concerned with the history, stratigraphy, evolution, ecology, anatomy, and taxonomy of Florida's past fauna and flora. The Corporation shall also be concerned with the collection and preservation of Florida fossils."

(Art. III, Sec. 1)

THE PLASTER JACKET is a publication of the Florida Paleontological Society, Inc. Its purpose is to circulate authoritative material on Florida paleontology and to foster communication among enthusiasts of this subject. It is our intent to produce this series at a rate of three or four issues per year.