NPS Fossil Resources

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1998 Paleontological Resources Conference

Rachel Benton
Badlands National Monument

Badlands National Park is in the process of coordinating the Fifth Conference on Fossil Resources to be held in Rapid City, South Dakota, October 13–16, 1998. The park will be working in partnership with the United States Forest Service, the Bureau of Land Management, the State of South Dakota, the North Dakota Geological Survey and the United States Geological Survey.

Fossil resource conferences stem from a tradition which began in the Park Service in 1986 and has expanded over the years to include other federal and state agencies. These conferences have been a part of a larger picture, promoting increased levels of communication and educating participants to changes in the management and protection of fossil resources on federal lands. The lack of adequate and specific federal legislation relating to fossil protection has left land managers with little guidance and limited sources of funding to support paleontological resource programs. We hope to continue these discussions and to encourage the support and participation of interested senior management staff.

The overall goals for the 1998 conference include discussions and presentations involving public outreach and education, scientific research, the use of technology in documenting fossil resources, paleontological conservation and interactive discussions on paleontology and the public trust. We have learned that the best way to keep land managers abreast of important paleontological issues is to provide a forum for discussion and the exchange of ideas.

The final product generated from the conference will include a set of proceedings published through the South Dakota School of Mines and Technology, peer reviewed journal: *Dakoterra*. The first announcement for the conference was sent out at the end of November, 1997. Please contact Rachel Benton at Badlands National Park (605) 433-5261 for more information.■

Invitation for contributions

Park Paleontology newsletter is back! To keep it fresh and informative we would like to hear from you. If you have paleontological news relevant to the national parks please write a few paragraphs and send to:

Vince Santucci
Fossil Butte National Monument
P.O. Box 592
Kemmerer, WY 83101
VINCENT_SANTUCCI@nps.gov

Park Paleontology's schedule is quarterly. The spring issue is planned for publication in April, 1998. Written opinions regarding the Fossil Forum topic are also welcomed.■

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Something to whistle about, while we work

Judy Geniac
NPS - GRD

In these times of downsizing, it is hard to find a success story. We have found not only success, but a reason to celebrate! This October marks the passage into the third year of the Geologist-in-the-Parks Program. This program is one of the most promising programs in the National Park Service (NPS). While it will not accomplish all of the geology needs of the NPS, it is certainly a badly needed shot in the arm. The program has experienced an impressive (some might say explosive) growth rate. Because of its increasing accomplishments in park geology, the program appears to have a much greater growth potential. The following is a quick overview of the program and how it is helping accomplish a number of paleontological projects in our national parks.

> "We have found not only success, but a reason to celebrate!"

The National Park Service has been noting the need for more geologists for quite some time. Over 200 parks within the National Park Service are in need of geologic expertise. Currently, the NPS estimates that hundreds of geologists would be needed to manage its geologic resources, and this does not include the NPS research and education needs. The Geologic Resources Division, created in 1996, searched for innovative ways to start addressing these geologic needs. Among other programs, the Division created the Geologist-in-the-Parks Program (GIP). The Program began with simply a Web page to advertise the seasonal, temporary, and volunteer positions, where parks identified a desire to fill these positions with geologists. Then, we began the work of examining individual park needs, creating partnerships with professional geology societies to help fund positions, as well as searching for matching funds. The societies are beginning to get on board. Most of their assistance to date has been in the form of providing funds for stipends.

Whether we are simply helping a park to find a qualified geologist or we are helping fund a stipend, everyone involved is pleased, and the program continues to grow in popularity. In two years, we have jumped from placing 6 geologists to placing 36 geologists. It is highly likely that the number will be even greater this year. Part of that is due to the fulfillment of the needs of all parties. The partners like the recognition of helping national parks. The program fills a student's need for experience and a professional's dream of someday helping a national park. Parks proclaim that the greatest benefit to the NPS is the amount of high quality work that has been accomplished, including that in the field of paleontology.

Parks that have used the GIP to accomplish paleontological projects include Denali, Badlands, Fossil Butte, Florissant Fossil Beds, Pictured Rocks, and Zion. Park staff were grateful to the participants and the program and noted that the work could not have gotten done without this help. Last summer, the eleven GIP participants involved in paleontology were able to do the following:

- update the organization of museum fossils;
- perform hundreds of hours of fossil preparation;
- greatly diminish a backlog of museum cataloging work;
- assist in research and resource management (documentation and collection) of a rich fossil site,;
- synthesize existing literature and provide the information necessary to update park interpretation;
- create interpretive exhibits;
- create interpretive traveling trunks focused on fossils of the park;
- write audio visual scripts;
- present campfire talks and interpretive walks;
- write handbooks and trail guides,
- assist in research (catalog and photograph sites) to identify fossil locations and age;
- document and mark fossil sites via global positioning system (GPS);
- create a paleontological database to help track location and age of fossils;
- assist in monitoring erosion rates at sites;
- document which fossils in a university's collection originated in the park;
- interpret a dig site to the public, thereby freeing the researchers to continue their work uninterrupted;
- interpret and illustrate geologic history, allowing visitors to "see" that prehistoric ecosystem.

More paleontological work will be done this year. The Division is currently examining proposals for this year's funding. We will post a park's ad to the GIP Web site at any time of the year. You are invited to explore the Web site, located at http://www.aqd.nps.gov/natnet/grd/geojob/geojob.htm . If you have questions, concerns, or ideas that you would like to share with the Geologic Resources Division regarding the GIP Program, please feel free to contact the program coordinators:

Judy Geniac
(303) 969-2015
judy_geniac@nps.gov

Diann Gese
(303) 969-2011
diann_gese@nps.gov ■

Hagerman Fossil Beds National Monument renews excavations at Hagerman Horse Quarry

H. Gregory McDonald
Hagerman Fossil Beds National Monument

After a hiatus of 29 years a new excavation at the Hagerman Horse Quarry was initiated in May 1997 thanks to a grant from Canon U.S.A. and the National Parks Foundation through their Expedition Into the Parks program. Initially opened in 1929 by crews from the Smithsonian under the direction of James W. Gidley and later excavated by other museums and universities, the Horse Quarry has proven to be the largest single sample of the earliest species of the modern horse genus *Equus*, *Equus simplicidens*. While previous research at the quarry has focused on recovering the remains of the horse (actually more like a zebra than a horse) this new excavation was designed to learn more about the sediments, depositional history and taphonomy of the site, which in turn can provide more information on the ecology of this pivotal species in horse evolution. One of the ultimate goals of the project is to determine why so many individuals of this zebra-like horse are preserved in one spot. Examination of other collections coupled with the 24 skulls recovered this last summer puts the minimum number of individuals at 200. In addition to skulls and jaws all parts of the rest of the skeleton were also recovered.

Based on their work at the quarry the Smithsonian's interpretation was that it represented a water hole and the large number of horse remains represented a long term accumulation. However, study of skulls and jaws in the Smithsonian and other collections indicates a population structure suggestive of a single catastrophic death assemblage. Study of the sediments this summer indicated not a waterhole but rather a river system. However, this was not a river with sufficient depth or current strength to drown a herd crossing it as first supposed.

In order to accommodate our new data we now feel that two separate events took place. First, what caused the death of the horses? Although we cannot be absolutely sure at this stage we are presently using a drought to account for this. As this broad shallow river dried, water would be left in the deeper parts of the channel. Horses would be drawn to this remaining water and the high concentration of individuals would eat all the surrounding vegetation, eventually starving. The carcasses lay on the dried bottom of the channel and decomposed. Later, the rains came and refilled the channel with the water moving the bones around and burying them. But the current was not so strong that it removed any bones from the death assemblage, it only moved them about a little.

> "First, what caused the death of the horses?"

While we have direct evidence for the second phase of this scenario, we need more information to be really sure about the first. Certainly one can come up with other explanations to account for a lot of horses of all ages dying in one spot, such as a disease. However, getting good evidence out of the fossil record to support this interpretation or our preferred one is more challenging and will take more work. In many ways work at the site is similar to the story of the blind men and the elephant, the Smithsonian, and other workers and now Hagerman Fossils Beds have each had a part of the story, perhaps eventually we will get enough information to really figure out what happened.n

New fossil plant localities discovered in Yellowstone National Park

staff writer

Two new fossil plant localities were recently discovered in Late Cretaceous deposits in Yellowstone National Park. Preliminary field work at these localities has revealed fossils of fern, willow (*Salix* sp.) and other deciduous broadleaf plants. Some of the leaves exhibited plant animal interaction in the form of possible insect damage.

The sites were discovered in 1997 by Bianca Cortez, a member of the Yellowstone Paleontological Survey field crew. The survey team initiated work in Yellowstone during 1996. Dozens of fossil localities have been recorded within the park. Cambrian trilobites, a Cretaceous marine reptile and Tertiary plant fossils are some of the more interesting discoveries. A summary of the work related to the Yellowstone Paleontological Survey will be published early in 1998.

The new fossil plant material from Yellowstone will improve our understanding and ability to interpret the Late Cretaceous geology and paleoecology of the area.■

Disney World displays Grand Canyon fossils

staff writer

The geology and paleontology of Grand Canyon National Park are captured in the design and exhibitry of the Wilderness Lodge Resort in Walt Disney World, Florida. Visitors to the rustic resort can search for fossils in the 82 foot tall stone fireplace. Colorful rock layers reflecting the strata of the Grand Canyon are incorporated in the three-sided fireplace.

The geologic tour begins at the lobby level with a rich blue-black formation representing the Vishnu Schist. The oldest fossils at Grand Canyon are stromatolites and examples can be seen in the Bass Limestone layers. The Redwall and Temple Butte limestones are exposed at the fifth floor level and contain a variety of marine fossils. On the seventh floor, fossil clams are embedded in the Kaibab Limestone strata. Display cases containing Grand Canyon fossils can be found in various corridors of the Wilderness Lodge.■

Colorado NM plans paleo survey

staff writer

Colorado National Monument consists of 32 square miles of land adjacent to some of the richest Mesozoic fossil localities in the United States. The Chinle, Wingate, Kayenta, Morrison and other formations are well exposed within the boundaries of the monument. Plans for initiating a paleontological survey of Colorado National Monument were developed in 1997.

The Colorado National Monument Paleontological Survey will assemble a team of paleontologists from the National Park Service, the Museum of Western Colorado and Dinamation International Society. Field inventories are planned for the summer of 1998.■

Denali terranes—from here, there, and everywhere

Phil Brease
Denali National Park and Preserve

The geologic history of most of Alaska has been relegated to the accretionary terrane model since the late 1970's, when it was postulated that exotic, or "suspect terranes" may have been transported from southerly latitudes by Pacific plate migration to create present-day Alaskan geography. This plate tectonic model correlates strata from various locations of the west coast of North America with rocks in Denali National Park and other central Alaskan locations, by stratigraphic sequence, fossil assemblage, and some paleomagnetic evidence. Over 50 terranes have been described in Alaska, with up to 10 of those making up Denali, and 7 or 8 of those suspected of having origins in more southerly locations, including portions of Paleozoic and Mesozoic California, Nevada, Idaho and other lower 48 states.

Recent paleontological work in Denali National Park and Preserve, and adjacent locations in central Alaska suggest that the southerly tectonic transport model may not support all the usual terrane "suspects." Early to Mid-Paleozoic marine invertebrate specimens, including up to 30 species of brachiopods, 9 corals, 14 conodonts, and various bivalves, gastropods and trilobites collected from the Mystic, and Nixon Fork, (or Farewell) terranes, imply closer affinities with Siberian Russia. Other work on biogeographical data along the southern boundary of the park in the Chulitna terrane preliminarily suggests moderate to high latitudes in Permian time (possibly northern Canada), with some possible southerly migration to tropical climes by Late Triassic time. The origin of these terranes was formerly considered to be in southern equatorial regions, with all northerly translations having occurred by the latest Mesozoic or early Tertiary time.

It is hoped that additional work by various specialists (brachiopods, Robert Blodgett and Michael Sandy; corals and spongiomorphs, George Stanley; and bivalves, Chris McRoberts) will further sort out this paleogeographic identity crisis of Denali National Park and Preserve and surrounding areas.■

Fossil flora from Mt. Dall, Denali

Phil Brease
Denali National Park and Preserve

The only known Permian flora in Alaska was identified by Serg Mamay and Bruce Reed (USGS) in 1984, from a site located on Mt. Dall, a 8756 ft. peak in western Denali National Park and Preserve. Discovery of the Permian flora was made during a regional geologic mapping effort of the 1:250,000 Talkeetna Quadrangle by the USGS, and essentially no stratigraphic detail was recorded regarding the fossil occurrence during that project.

Those details may now be revealed by Steve Nelson, University of Alaska, Anchorage, Dwight Bradley, USGS Anchorage, and Phil Brease, NPS, Denali Park, in a proposed project aimed at re-collecting the specimens, measuring the stratigraphic section(s), and otherwise determining their stratigraphic distribution.

Interestingly, similar *Zamiopterids* are only found in Angaraland, an area of Precambrian rocks in north central Siberia. This project, with fieldwork slated to begin this summer, may further reinforce the notion of a Paleozoic Russian connection with Alaska.■

FOSSIL FORUM

Definition of a fossil

Vincent L. Santucci
Fossil Butte National Monument

Paleontology is unquestionably an established and recognized scientific discipline. Professional paleontologists have become highly specialized and employ a wide range of scientific methodologies in pursuit of data. Research into the functional morphology of ancient organisms, the physics of tetrapod locomotion, the development of extinction models, the application of molecular biology in systematics, comparative bone histology, and other practices are certainly based upon the scientific method.

What common denominator unifies all of the diverse fields within paleontology? The answer is clearly - FOSSILS. However, a close examination of the use of the word fossil in modern society demonstrates that the definition of a fossil is less than scientific.

As an interpretive theme, "What is a fossil?" is commonly presented in museum exhibits, educational activities, natural history programming, books, media, and so forth. Each individual has their own perception of a fossil. To many children the word fossil means dinosaur. To a ranger at Petrified Forest National Park, a fossil may be something that visitors occasionally collect illegally. To a commercial dealer a fossil may mean $$$$. Grandma sometimes even calls grandpa a fossil! What variables should be included in a scientific definition of a fossil? Likewise, what variables should be omitted from the definition?

To begin on some common ground, it is widely accepted that a fossil is evidence of life. This includes the physical components of the biological organism (e.g., leaves and teeth) or some indication of biological activity (e.g., footprints and burrows).

The term fossil has been inappropriately applied to geologic features such as "fossil sand dunes" or "fossil ripple marks." Although these descriptions have become commonly accepted, this usage adds to the subtle consternation that exists in the use of the word fossil.

Another area of confusion comes with the use of the word fossilization. To some the word fossilization is synonymous with the word petrification. Both words denote a process. The word fossilization implies some process, transition or metamorphosis in the development of a fossil. Essentially, if the definition of the word fossilization is limited to represent some type of preservation, then, perhaps, the ambiguity associated with its definition would be reduced.

The preservation aspect of a fossil needs further analyzing. Perhaps the concept, "I am, therefore I exist" could be applied directly towards limiting our definition of a fossil. For a fossil to be a fossil it must exist, and therefore, it must be preserved in some form or state. It should be noted that the use of the words preserve and preservation does not necessitate mineral replacement or chemical alteration.

Does the degree or mode of preservation need to be incorporated into the definition of a fossil? Do the remains from the past need to be chemically replaced, recrystallized or turned to stone (petrified) in order to be accepted as a fossil? Indeed, we can answer "No" to both of these questions. The fossil record includes many examples of unaltered animal and plant remains. Conversely, are the bones of a coyote that fell into a Yellowstone hot spring a few years ago fossils? The mineral-rich waters of the hot spring promote rapid mineralization of recent bones. In some cases, these recently trapped bones show a higher degree of mineralization than do some bones that are millions of years old. The fact that a fossil simply exists and is therefore preserved is more meaningful in defining a fossil than the degree or mode of preservation.

The word subfossil appears in scientific publications. What does this mean? Perhaps it means small fossils, or material incompletely fossilized, or something beneath/below the fossil. There are two common uses of the term subfossil. The first is in reference to the degree of preservation. It suggests a low level of mineralization. The second use is common when references are made to remains of life from the Holocene. This use of subfossil is related to the acceptance of the idea that a fossil must be from a previous time period. Subfossil is a term that is used inconsistently and its ambiguity hinders the ability to rigorously define the term fossil.

Definitions of the term fossil that incorporate a time reference or date result in interpretations that are unscientific. Many sources have presented a definition that indicate a specimen must be older than 10,000 years, or from a previous geologic time period to qualify as a fossil. Establishing a boundary or date may make classification easy, but do they make real scientific sense?

Shall biological remains that only date to 9,000 years old be discriminated against? Are they forbidden space in the paleo cabinets because they fall short of the 10,000 year boundary? Haste should not be taken to replace those remains with fossils, however, because in a thousand years they will be recognized as a fossil, too.

Likewise, what is significant about defining a fossil through its occurrence in a past geologic time period? These boundaries are drawn by humans. What intrinsic relationship do these boundaries have with recognizing whether biological remains are fossils?

Are the Wrangell Island mammoths

to be excluded from being recognized as fossils? In the late 1980's the remains of mammoths were discovered in the Russian Arctic. These mammoths from the Wrangell Islands underwent exhaustive research. Scientists from St. Petersburg established isotopic dates of 4,000 years B.P. for the mammoth remains. This work was confirmed independently by other researchers. Does this data support a definition of a fossil which includes a reference to a particular date or time period?

If the definition of a fossil is free of time association, then what are the limits defining a fossil? Is there rational for including extinction as a criterion in the definition of a fossil? A cursory look at the fossil record indicates that there is no basis for including extinction as a criterion. For example, the extant genus *Lingula* extends back to the Cambrian. Whereas, there are many species of plants and animals that have succumbed to extinction within the last century. There does not seem to be a unified taxonomic component suitable for inclusion as a criterion in the definition of a fossil.

What, then, is a scientifically sound definition for a fossil? Government protocols may be useful. An acronym could be developed, perhaps F.O.S.S.I.L. (Fairly Old Stone-like Specimen Indicating Life). It is apparent, however, that this approach is still not scientifically sound.

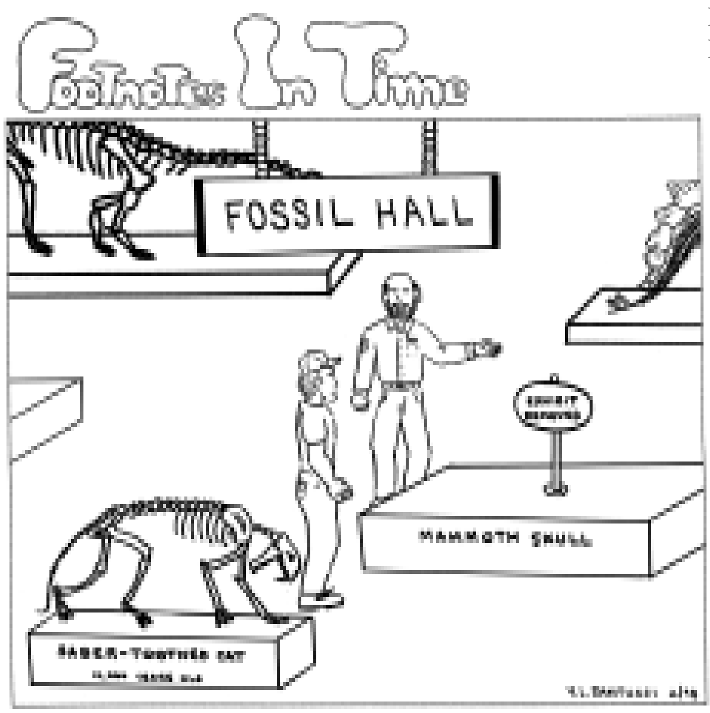
What about this:

Fossil: evidence of life preserved in a geological context.

Does this definition have a more rigorous scientific basis? Including geological context may be the component that helps to resolve some of the "gray areas" existing in the current definition. Geological context helps to differentiate a fossil from fresh roadkill along the highway. Placing biological remains in a geologic context seems more congruent with the actual scope of paleontology than to reference a relative time marker or a degree of preservation.

This topic was not presented to be dogmatic. Nor was it presented to be adversarial. On the contrary, *FOSSIL FORUM* is designed as a means to generate meaningful discussions between the few of us that manage and care for fossils on public lands. Perhaps an underlying question raised here is "Does the National Park Service provide consistency in our interpretation of paleontological resources?"

As a final note, we have come to learn in the science of paleontology that our knowledge of the history of life is only as good as our previous field season. Let's work together and discuss topics such as *Definition of a Fossil* so we will be better able to facilitate the highest level of understanding in our educational and interpretive programming.■



"Well.... C_{14} testing indicated the skull was only 9,500 years old. We'll display it again in 500 years."

Park Paleontology
c/o Fossil Butte NM
P.O. Box 592
Kemmerer, WY 83101