NPS Fossil Resources

PARK PALEONTOLOGY

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The 5th Conference on Fossil Resources 1998

The 5th Conference on Fossil Resources 1998: "*Partners Preserving Our Past Planning Our Future*" was held at the Rushmore Plaza Holiday Inn, Rapid City South Dakota from October 13-16. Rachel Benton, Badlands National Park, and her committee were responsible for organizing this event. The primary purpose of this conference was to serve as a forum to specifically discuss paleontological resource and research issues on federal lands. This was the fifth occurrence of a NPS sponsored fossil resource conference. The first three conferences dealt primarily with NPS issues. The last two have taken on a more national scope involving participants from multiple government agencies as well as non-federal government participants. Several federally employed paleontologists (NPS, USGS, BLM, USFS, etc.,) and state geologists were in attendance. Approximately 20 were affiliated with the NPS. Overall, 200 people participated in this conference.

The Unified NPS Paleontological Community meeting was held on Tuesday, October 13. This was organized by Vince Santucci and Bob Higgins to discus NPS paleontological issues. The group discussed an agenda of items including the revision of management policies and NPS 77. The importance of web postings and the presence of the GRD Geology Tour were also parleyed. The NPS paleontological resources are undergoing a development of a service-wide database in MS Access that will have a broader scope than many of the park-based databases.

http://www.nature.nps.gov/grd/geology/paleo/index.htm

The **Park Paleontology Newsletter** continues to be published by the GRD staff; it is also posted on the web. NPS paleontologists were encouraged to submit short articles for future issues. The **NPS Paleontological Research Volume 3**, a GRD technical report, was distributed to contributing authors at the meeting. A call for papers to be included in the NPS Paleontological Research Volume 4 also went out.

Fossil research and subsequent permits for excavation projects as well as procedures for implementing permits will continue to be a controversial topic. There is the issue of consistency as to how the NPS will need to deal with its own permit that will be implemented (or not implemented), and to the formulation of NPS policy (now in draft).

There is an undercurrent of feeling that fossil repositories were not being organized as efficiently as they could be and therefore were not being utilized effectively by federal government agencies, as well as other organizations.

Major discussions in the formal sessions and informal hall way chat revolved around the explotation of fossil resources. This is being driven by economics as the price tag for fossil re-

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Fossil Vertebrate Tracks in National Park Service Areas

staff writer

Scientific and public interest in fossil vertebrate tracks has grown rapidily during the past decade. Vincent Santuci-FOBU, Adrian Hunt-Mesaland Dinosuar Museum, and Martin Lockley-University of Colorado compiled a report on vertebrate tracks within the National Parks. Fossilized tracks of ancient vertebrates are widespread and known from at least 19 National Park Service areas. Fossil tracks preserved within NPS areas provide important opportunities for public education and interpretation of *in situ* fossils. Fossil tracks differ from fossil bones in that they provide different types of information about ancient organisms. Fossil bones preserve data on the environment in which the animal died and where it was buried, whereas fossil tracks provide data related to the environment in which the animal lived. Tracks represent the interface between the animal and its environment. Environments that promote good preservation of tracks and footprints do not typically promote the fossilization of bone.

The ichnostratigraphic record of vertebrates preserved in the national parks ranges from the late Paleozoic Era through the Quaternary Period. The earliest tracks are known from the Pennslyvanian Wescogame Formation at Grand Canyon National Park. These early tetrapod tracks were identified as amphibian. The largest concentration of vertebrate ichnofossils occurs in the national parks on the Colorado Plateau. Glen Canyon National Recreation Area contains the greatest diversity and stratigraphic range of trackways in any national park. One of the tracksites appears to preserves evidence of a predator attacking a prey item. Dinosaur tracksites are most common, but tracksites from non-dinosaurian reptiles, birds, and mammals are also known from the national parks. The Copper Canyon tracksite in Death Valley National Park preserves one of the most abundant and diverse Tertiary track localities in North America. Nineteen fossil vertebrate track types have been identified from this locality, including birds, artiodactyls, perissodactyls, carnivores and rare proboscideans.

The number of tracksites recognized within national parks is likely to increase in the future. Likewise, the demands of park staff in management and protection of these non-renewable resources will also increase. Park management should seek to understand the significance of fossil tracksites and identify the variety of human and non-human threats that may adversely impact these paleontological resources. ■

An Oligocene Tree Stump in Badlands National Park

staff writer

During the summer of 1997, a taphonomic field study of an early Oligocene faunal assemblage in Tyree Basin uncovered the second recorded fossil tree stump in the badlands and the first in Badlands National Park. The study area is stratigraphically located in the lower Scenic Member of the Brule Formation, White River Group of South Dakota. The stump was found *in situ* with a partially preserved root system penetrating a lacustrine paleosol. The stump is approximately 15 cm in diameter with 20 cm of vertical exposure. A piece of attached bark extends 50 cm from the stump in the direction of the paleocurrent direction.The bark appears twisted while still parallel to the horizontal. This level is marked by the presence of three carbonate sheets of varying thickness which recoerd the presence of ephemeral lacustrine/paludal environment. The tree genus is presently unidentified, but based on preliminary bark patterns, and ecological restriction of a stream side habitat three potential candidates are: *Celtis* (Hackberry), *Alnus* (Alder), and *Umbellularia* (Laurel).■

This is an excerpt from DiBenedetto, J.N. 1998. An Oligocene tree stump from BADL *In* J.E. Martin, J.W. Hogenson, and R.C. Benton (eds.), Partners Preserving Our Past, Planning Our Future: Proceedings for the Fifth Conference on Fossil Resources Dakoterra volume 5.

Conference on Fossil Resources

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sources is continuing to be driven up by demand as there is a viable market. Sometimes this is a black market as collectors continue to illegally remove fossils from federal lands and place them for sale on the commercial market. This raised many issues on:

- law enforcement
- the lack of good paleontological resource surveys within federal land management agencies
- the lack of substantial laws and penalties for theft.

Numerous field trips significant to NPS paleontological sites were offered including the Badlands National Park (lead by BADL paleontologist Rachel Benton) and the *former* Fossil Cycad National Monument (lead by Geologic Resource Division paleontologist Vince Santucci).

The resulting publication, **Partners Preserving Our Past, Planning Our Future: Proceedings for the Fifth Conference on Fossil Resources Dakoterra volume 5,** is composed of 15 papers pertaining to research, resource management, and conservation. Papers address such topics as vertebrate tracks in NPS areas (page 2), Ordovician biostratigraphy in the Delaware Water Gap Recreation Area, and a survey of Entelodonts in the John Day Basin. These papers are quite informative and reflect substantial efforts by both planners and participants of the event. These conferences facilitate better understanding of the fossil resources that exist and management strategies for them. ■

Hands On! Fossil Rubbings at Fossil Butte National Monument

staff writer

The art of interpretation has taken on a new dimension. At the Fossil Butte National Monument visitor's center, 3 different plates with the skeletal impressions of the famous Green River Formation fossils are mounted on a low platform. The raised skeletal structure provides an excellent framework via rubbing to uncover the details of the animals of FOBU. Twelve fossils plates are available to switch out, with a stingray, snake, 9 fishes and the oldest known bat. Above the platform, sit 2 slabs from the Green River Formation. One slab is partially prepared with a *Priscacara liop*s for visitor's to examine. The other slab has a skeleton that can be seen edge on, as it is still encased in the matrix of the Green River Formation. Visitors of all ages enjoy the opportunity of revealing their own fossil and they have a rubbing of a Green River Formation fossil to take home with them.

This poem is posted at the rubbing station.

The Rubbing Table
The art of rubbing takes a knack,
hold your paper like a tack.
Choose your crayon with some care,
multicolors add a flair.
Move your crayon in one direction,
avoiding tearing due to friction.
Carefully rubbing the fins is best,
less care is needed 'cross the rest.
Once completed take a look,
be sure you've covered every nook
Now roll it up and take some care
and on your trip don't let it tear.

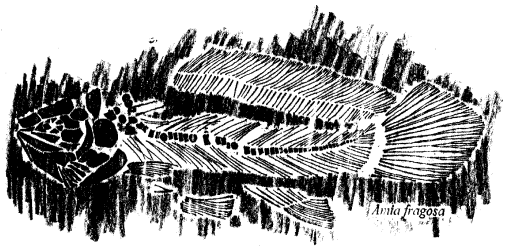
Arvid Aase■

Invitation for contributions

To keep Park Paleontology Newsletter 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 winter issue is planned for publication in February 1999. Written opinions regarding the Fossil Forum topic are also welcomed.■



Permian Root Traces from Natural Bridges National Monument

Shawn Duffy

NABR

The Cedar Mesa Member of the Cutler Formation in southeastern Utah dominates the canyons in and adajacent to Natural Bridges National Monument. Primarily composed of white sandstone with pink arkosic shale and limestone lenses, the member displays strong cross bedding suggesting an aeolian origin. Because of the presence of fragmentary marine creatures within the sandstone, other interpretations conclude a marine origin. This latter interpretation does not fully take into account the abundant root casts and traces found throughout the member. Originally, the casts and traces were believed to have been transported to their present position from regional streams, however, the orientation of the roots suggests an *in situ* origin.

The roots occur as casts, molds and traces staining the host rock. Most roots are an average of 2.5 to 5 centimeters thick and roughly 30 centimeters long. Several roots were discovered to be over 3 meters in length and exhibit a branching or radiating pattern which suggests connecting either to each other or to a centralized point like a tree trunk. The sandstone within the Cedar Mesa Member is primarily white, however, most localities in which the roots occur display strong pink and brown mottled patterns suggesting a paleosol. During the spring of 1997, a site was discovered in Natural Bridges National Monument in which the root casts were over 2 meters in length. The most interesting feature about the site was the fact that the roots did not follow the bedding planes within the sandstones as in most sites, but rather, cut across the bedding planes. This pattern suggests that the roots were growing down through the sand before lithification. Along with these larger roots were masses of smaller intertwinning roots covering the sandstone surface. It has been determined thus far that this smaller roots are not connected to the larger ones and most likely represent recent calcification of park flora.

Taken as a whole, the random orientation, definite spacing, and the cutting across bedding planes along with the association of mottled patterns strongly suggests that we are dealing with an *in situ* origin for the roots. This in turn supports the interpretation that the Cedar Mesa Member of the Cutler Formation represents a series of terrestrial dunes containing islands of vegetation similar to today's coastal sabkhas.■

Fossil Tracks: Implications on Evolution and Reports of Billion-Year-Old Tracks

staff writer

Ancient tracks paint a detailed picture of a creature's life. As stated in the fossil vertebrate article on page 2, fossil tracks provide information on where and how the organism lived. Probable behavior of organisms has been interpretated from tracksites. In one instance, a group of tetrapods were determined to have a gregarious social structure from evidence of a tracksite. How is such an explanation reached? Analysis of the tracks indicated that the distribution of the directions and speeds of the trackmakers were consistent with movement as a group. Reconstruction of the locomotion dynamics of animals also aid in anatomical studies. Different functions of digits in the different movement phases can be produced. Those digits that have a dominant function during the touchdown, the beginning of the weight-bearing phase and the propelling movement can be determined.

Stephen Hasiotis, Russell Dubiel, and Timothy Demko published the paper **A Holistic Approach to Reconstructing Triassic Paleoecosystems: Using Ichnofossils and Paleosols as a Basic Framework** in the NPS Park Paleontological Research volume #3. They propose that paloesols and ichnofossils, in conjunction with the sedimentology and stratigraphy of a unit, be used as a basic framework to build on in conjunction with other paleontological data for reconstructing paleoecosystems. Paleosols record the effects of climate, ecology and the environment of the time. The integration of ichnologic, sedimentologic, paleopedologic data allows for a more concise interpretation of paleoecosystems, including interpretation of their hydrologic and climatic settings.

Ichnology is an extremly important tool in resolving depositional environments and aid in uncovering the secrets of life. A recent article in the 2 October 1998 issue of *Science* discusses the claim of researchers determining 1.1 billion year old wriggly grooves on an ancient sandstone in central India as tracks of burrowing, half-centimeter thick, wormlike animals. The wormlike animal, about the thickness of a pencil, plowed through the sediment a few millimeters below a shallow sea. This group of scientists argues that the organism propelled itself with rhythmic muscle contractions, or peristalsis, leaving open burrows with raised edges like those of modern worms that move by peristalsis. Peristalsis implies a fluid-filled cavity that can be contracted by muscles, and it is argued, for the presence of a coelom, a lined cavity between the gut and the body wall. If this find is substatiated, a major reorganization of evolutionary lineages would occur. Proterozoic faunas consist of mostly of nonmetazoans, with the exception of the Ediacaran fossils of the late Proterozoic.

Ichnology has several important functions. Ichnology aids in understanding the ethologic and ecologic significance of tracemaking organisms, the organism-substrate interrelationships and the role of biogenic processes in environmental reconstruction, sediment dynamics, sequence or event stratigraphy, biogeochemistry, and sedimentary diagenesis. The applications are far ranging.■

New Publication National Park Service Paleontological Research Volume #3

staff writer

The National Park Service Paleontological Research Volume #3 is in print. This volume compiles 38 articles representing paleontological research in 21 different parks. These individual reports reflect a cross-section of the dedicated workers and the research undertaken in the National Park System. Several forms of paleontological studies are being accomplished in the parks. The cover of this volume illustrates a Triassic fossil bee's nest at Petrified Forest National Park. This illustration is from a paper on Triassic bee and wasp nest ichnofossils at PEFO. Systematic reviews include papers on fossil birds in Agate Fossil Beds National Monument Park and and on fossil lizards and snakes at Badlands National Park. The first reports on paleontological inventories for Bryce Canyon National Park, Denali National Park and Preserve, Great Smokey Mountains National Park, Mammoth Cave National Park, and Ozark National Scenic Riverway are included in this volume. The multiple park ecosystem project on the Morrison Formation, a joint USGS and NPS collaboration, is reported on in this issue. A compilation of such a wide scope of paleontological research is invaluable. The quest for knowledge about the history of life is a continuous endeavor that these devoted researchers work on. This type of information can only enhance the understanding of the wonderful paleontological resources in the National Parks. ■

Life reconstruction of Triassic fossil bee nests in a conifer, *Araucarioxylon arizonicum*

Fossil Forum

Tracking Troubles

The following editorial was written by Shawn Duffy, a National Park Service Ranger. This editorial does not necessarily reflect the opinions of the National Park Service or any other agency, however, this reflects key issues related to management of geologic/paleontologic resources on federal lands.

In recent years there has been increasing interests in dinosaurs. Prompted by pub lic support and increased funding, a multidisciplinary approach to the study of dinosaurs has been underway and includes, among other aspects, the study of trace fossils and specifically fossil tracks. Although traditionally ignored by earlier researchers, fossil tracks have proven to be invaluable in understanding locomotion and some behaviors.

Within the last decade thousands of tracks and trackways have been discovered and published creating both public awareness and interest. At the same time, a number of commercial entities have added tracks to their inventory of specimens for sale. It should come as no surprise that there is a corresponding increase in theft and vandalism to tracks on public lands.

Public demand has created a market for tracks and although some commercial enterprises carry casts, some are supplying the "Real McCoy." I have had the opportunity to speak with the proprietors of several of these companies and have received a mixture of rational for the removal of tracks. The classic response was that they were obtained from private land, but other excuses were centered upon interpretations of the current laws and regulations. Some indicated that they believed that fossil vertebrate tracks on public lands did not fall under the same protection as other vertebrate fossils. This seemed to be the general opinion among most dealers.

The removal or casting of fossil tracks from public lands requires a permit, but to my knowledge, none or very few have been requested. This trend suggests that individuals either didn't take the time to learn this fact or they have ignored it altogether anticipating that they would have been refused. The end result has been outright theft. Earlier this decade, the Bureau of Land Management Office for The Grand Resource Area in Southeast Utah reported to me an attempted theft of some of their dinosaur tracks. Someone had unsuccessfully attempted to chisel the tracks out of the rock.

A successful theft did take place at the Dinosaur Probe Tracksite near Denver Colorado. Situated near a highway is a remarkable track site containing many dinosaur tracks. Highly celebrated and visited often, the site which is managed by the County Parks Department has a barrier fence and interpretive signs. Among the many excellent trackways are several circular holes the remains of what were tracks chiseled from the rock.

Bird tracks with probe marks. Adapted from Frey, 1975, *The Study of Trace Fossils.*

I had the opportunity to attend the gem and mineral shows in Tucson and Denver and have observed fossil tracks for sale. The most common tracks were from the Coconino Sandstone of northern Arizona, but I also observed rare reptile tracks from the Robledo Mountains of New Mexico, and an ornithopod track from England.

In addition to theft of fossil tracks, the vandalism of tracks has also become an increasing problem. The most common form of vandalism occurs when individuals, while attempting to create a cast, pour plaster into the track and damage it in the process. I have witnessed the aftermath of this seemingly innocent practice too many times. In Tuba City, Arizona, the Navajo gentlemen I spoke with refused to allow me to create a cast of their dinosaur tracks using my clay because recently some individual, without permission poured plaster into their tracks resulting in it fusing to the rock. Working with the gentlemen , we were successful in carefully removing the plaster, but it was a time consuming process and required the whole day.

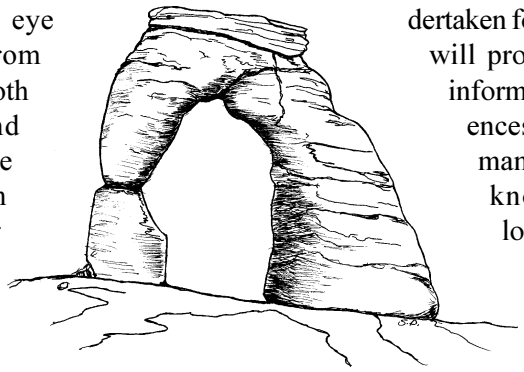
In Southeast Utah, I have observed 4 different plaster damaged tracksites within the last year alone. While I was able to remove most of the plaster, I was unable to remove the stains. Some individuals, while attempting to get around the "stuck track" problem coat the track with a non-sticking agent, but again this can permanently stain the surface and sometimes hastens the erosion process.

I strongly advocate for land managing agencies and organizations to increase public awareness of this growing problem. Perhaps information can be incorporated into conservation or interpretive literature. There are also several organizations which supply casts of tracks which were carefully created without damage to the original for those individuals desiring to have a keepsake. As both a conservation minded individual and as an advocate for scientific endeavor I strongly urge that we should act as quickly as possible before common misconception becomes common practice.■

Arches and Canyonlands National Parks Prospective Paleontology Survey

Shawn Duffy
FOBU

As the sun rose, its morning rays transformed the muted browns and beiges of the canyon edge into brillant oranges and fiery reds. From the rim I could now peer down upon mile after mile of convoluted earth. In that endless sea of rock, I imagined the untold numbers of fossils that no human eye had ever seen. From petrified trees to both dinosaur bones and tracks, many of the discoveries which have made other places (including parks) famous are also found here. The sediments which make up this spectacular scenery of southeast Utah contain a rich record of earth's history from the Pennslyvanian through the Quaternary Period.



Long awaited, a new project begins this next season. Park staff are beginning to compile data for the first paleontological survey of the region in and around both Arches and Canyonlands National Parks. Requiring roughly two seasons to complete, the survey will be the most extensive ever undertaken for this area. This will provide invaluable information and references to public land managers about the known paleontological resources. Other divisions such as interpretation will also benefit. The scope and the format for the project will be similar to the Death Valley National Park Survey currently nearing completion. ■

Park Paleontology Recognition Pin

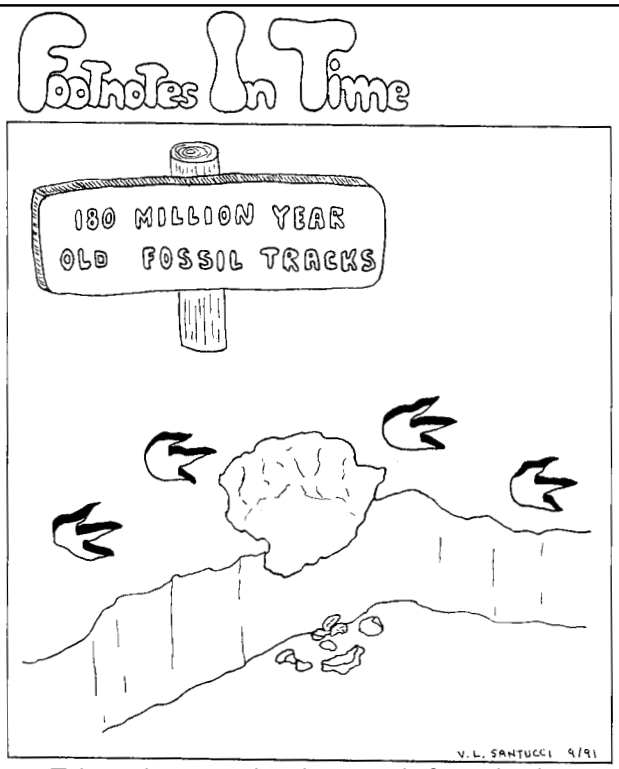
staff writer

Individuals making noteworthy contributions to promote paleontology in the national parks and to the National Park Service Paleontological Resource Program are recognized and rewarded with gold pins modeled after the PARK PALEONTOLOGY Newsletter logo.

Lindsay McClelland, a Geologist working for the Geologic Resources Division in Washington D.C., has provided a strong voice to promote paleontology and geology within the parks. He has also assisted co-editing 2 NPS Paleontology research Publications.

Ted Fremd, a paleontologist at JODA, has provided leadership in paleontological resource management and important research at JODA.

Torrey Nyborg, a paleo intern at DEVA and FOBU, is co-author on the DEVA paleo survey in the final stages of completion. Withstanding field work in 120 degrees, Torrey documented and discovered several important sites at DEVA. ■



Take only memories; leave only footprints!

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