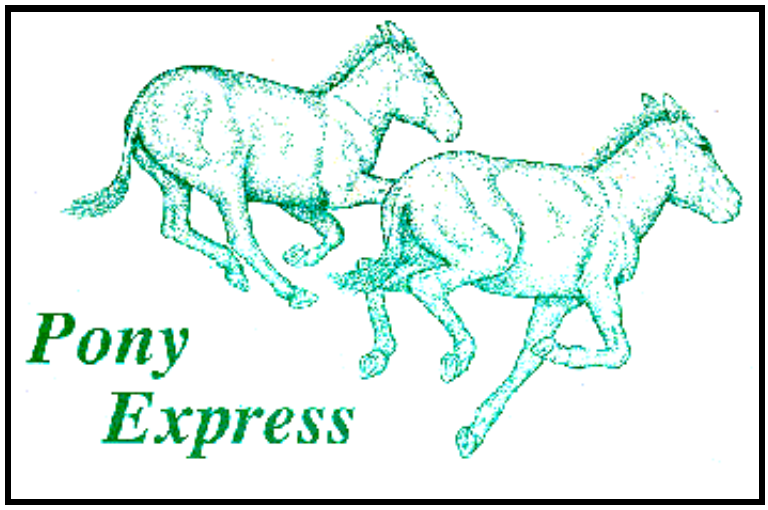

Florida Fossil horse Newsletter

Volume 8, Number 1, 1st Half 1999

What's Inside?

Making a Difference in Bolivia

Dr. Bruce Shockey, former UF paleontology graduate student and ever-popular assistant on the Thomas Farm digs, currently holds National Science Foundation and Fulbright postdoctoral fellowships in Bolivia. Bruce has been active at the Bolivian National Musuem of Natural History doing research and collections work related to extinct fossil herbivorous mammals of South America called Notoungulates (*noto-*, southern; *-ungulates*, hoofed

Dr. Bruce Shockey and La Paz schoolchildren holding a skull and jaws of a modern crocodilian as compared to a fossil jaw of a giant Cretaceous crocodilian from the lowland Amazon region of Bolivia.

mammals). He also has become heavily involved in public exhibits outreach. Bolivia has a fantastic wealth of vertebrate fossil remains, from famous dinosaur tracks to Pleistocene mammals. In conjuction with the paleontology staff at the Bolivian Museum, Bruce has initiated a series of local fossil exhibitions at cultural centers and toursist attractions in La Paz. In so doing, thousands of "Paceños" (people of La Paz) are gaining an enhanced appreciation of Bolivian paleontology. Having observed Bruce at one of these expositions myself, I can attest to the fact that the schoolchildren are absolutely fascinated with fossils and eager to learn about paleontology. Bruce is to be applauded for his efforts to promote paleontology! (*Bruce J. MacFadden*)

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5 Million-Year Old Fossil Horses From Florida

GAINESVILLE --- Out of the mouths of long-dead animals come stories of vanished landscapes, ancient weather and the way the creatures lived and died.

With a unique combination of two scientific techniques, UF paleontologist Bruce MacFadden and colleagues analyzed fossilized horse teeth to see what the animals ate, and in doing so reconstructed Florida's environment as it existed 5 million years ago.

MacFadden's article in this week's Science magazine (February 5, Vol. 283, pp.824-827) describes how he analyzed ratios of carbon isotopes along with the scratches and pits in the fossilized teeth found in Lakeland phosphate mines. He concluded that the horses ate a combination of foods befitting an ancient Florida of savannah-like grasslands interspersed with lush forests and marshy wetlands inhabited by rhinos, llamas, elephants and other exotic creatues.

"This study is noteworthy because it's the first to be published that looks at the combination of these two techniques to understand ancient diets and the ecology of a particular group of extinct mammals," MacFadden said.

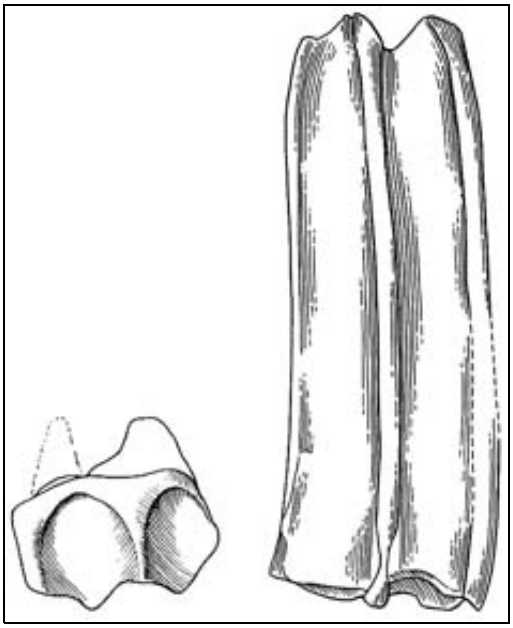
"These techniques are revolutionizing our ability to understand what prehistoric animals ate," he said. "Before now, the only way we could figure that out was by looking at their teeth. Not only that, our research challenges the traditional view that the form and structure of the teeth alone can tell you something about diet."

Modern grazers such as horses and zebras develop elongated teeth because they eat gritty, abrasive grasses, while browsers such as deer, whose diet consists mainly of soft leafy vegetation, have short

teeth, MacFadden said.

But MacFadden's research on six species of prehistoric horses that lived 5 million years ago shows that despite all the horses having elongated teeth, they were a combination of browsers, grazers and mixed feeders. "This is the first time we've been able to use other techniques to challenge this assertion that the height of a tooth is uniquely indicative of diet," he said.

MacFadden believes the reason all these particular species had elongated teeth is that elongated teeth also existed in their ancestors, who were grazers.



Side views of short-crowned browser tooth of Hyohippus *(left) and high-crowned grazer tooth of* Dinohippus *(right), both from Bone Valley of Central Florida.*

The findings support modern ecological theory that animals who live together divide up the food supply in order to minimize competition for the same resources, he said.

Learning about changes in the diets of ancient animals is important because it provides clues about how species interacted at certain points in time, MacFadden said. "If all the animals in a particular area were feeding on the same resources and there was a big extinction, you might suspect something about their diet affected the extinction.

"It also gives a lot of information about ancient environments," he said. "If you have a community of ancient animals that are all found to be grazers, then you can infer that the environment of the local habitat was grassland. If the animals are all browsers, then you can infer that there was more forest or scrub. It can give you a broad perspective over millions of years what animals fed upon and what changes occurred in the plant communities."

Scientists are learning that grasslands didn't exist until about 20 to 25 million years ago, making grazing a relatively recent arrival on the ecological landscape, he said.

For this work, MacFadden ground up small parts of the horses' tooth enamel and chemically analyzed them, using an instrument called a mass spectrometer, to determine the kind and proportions of carbon in the teeth. Because of photosynthesis, the way carbon molecules are incorporated into leaves, fruits and other soft vegetation is different from the way they become a part of grass, with the different carbon makeup showing up in the teeth, he said.

The study, supported by the National Science Foundation, also involved the microscopic analysis of scratches and pits on the teeth to determine whether the horses were browsers or grazers. Because it is abrasive, grass forms scratches on the tooth enamel when chewed, while the compression of leaves form pits on the teeth, he said. *(Cathleen J. Keen, UF News and Public Affairs)*

Paleofest98

Paleofest98, a celebration

of Florida paleontology held on Friday and Saturday 20-21 November, was a resounding success with 320 participants. ***Paleofest98*** coincided with the annual Fall meeting of the Florida Paleontological Society. The activities started on Friday Night with a great lecture by internationally faous dinosaur digger Jack Horner. Over 1,000 folks attended his lecture and Museum Associate-sponsored reception afterwards in the FLMNH's new Exhibits and Educational Center at Powell Hall. The ever-popular and affable Jack was highly sought-after for autographs, as can be seen by the line waiting for an audience with him in the museum (photo). The Friday evening reception also included a dedication by S. David Webb of the fabulous new Aucilla River Columbian Mammoth skeleton, which is now installed in our Central Gallery at Powell Hall. Saturday's activities included a morning lecture on the new Hall of Florida Fossils by Dr. Gina Gould, Project Director, and then a tour behind the scenes of the FLMNH's paleo. research collections. Saturday afternoon activities were devoted to workshops and field trips, including Dr. Webb's well attended workshop on Florida elephants. The ***Paleofest98*** activities concluded on Saturday evening with a banquet and benefit auction. ***Paleofest98*** was educational and fun for all. The net proceeds from ***Paleofest98*** will be used to support the new fossil exhibits at Powell Hall. We are currently in the planning stages for ***PaleofestY2K*****. This celebration is planned for the Spring of 2000 and will coincide with the Millennium Celebration to be held in conjunction with the Center for the Performing Arts and Harn Museum of Art, located in the Cultural Complex adjacent to Powell Hall.** *(Bruce J. MacFadden)*

World renowned dinosaur paleontologist Jack Horner signs poster for one of his many fans and **Paleofest98** *visitors. Stan Blomeley photo.*

Our Western Collection Grows

Thanks to the *Pony Express* 1998 western adventure and related activities, several hundred new specimens of Oligocene mammals from western Nebraska have been added to our research collections. These collections will be used to broaden the research capabilities of the FLMNH Vertebrate Paleontology collection, and some of the finer specimens will be made available for exhibits. This past years' collection includes fine specimens of the horses *Mesohippus* and *Miohippus*, the ubiquitous oreodonts and turtles, camels, pig-like artiodactyls, and a variety of small mammals (including tiny deer and rodents). We are particularly grateful to Barbara and Reed Toomey and Sue and Steve Hutchens for their

hospitality while in Nebraska and for donating some key specimens to our new collection. (*Bruce J. MacFadden*)

Jaws (left), skull (center) and neck vertebrae of Mesohippus *found by Steve and Sue Hutchens and collected during the 1998* Pony Express *South Dakota/Nebraska trip. Erika H. Simons photo.*

Pony Express Article Choosen as "Cool Site of the Day"

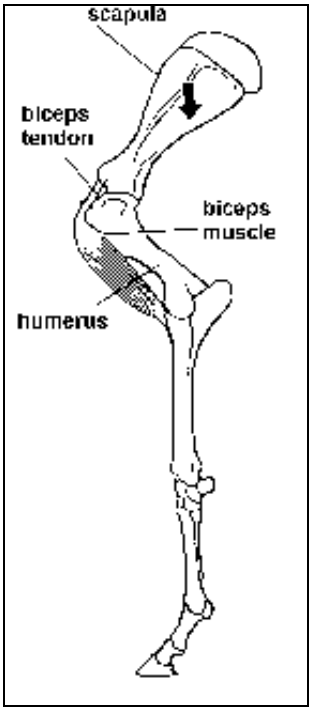
The Learning Kingdom chose Pony Express *(vol. 2, no. 4) as the "Cool Site of the Day" on 26 August 1998 with the following excerpt:*

Horse Legs

"The legs of horses are designed so that they can stand up for very long times without using their muscles. They can even sleep standing up! Human legs (and the legs of most other mammals) are designed so that the weight is supported partly by bones and partly by muscles. If we let our leg muscles relax, we fall down! The bones, muscles, and tendons of horse's legs are arranged so that the stress of supporting the animal is not on the muscles. Instead, the leg is supported by the bones and tendons. This is especially important for heavy-bodied horses and their relatives, whose legs might need to support as much as 500 pounds each."

For more about horse legs, and other cool facts about fossil horses, check out:
http://www.flmnh.ufl.edu/vertpaleo/ponyexpr.htm
http://www.flmnh.ufl.edu/fhc/

For more about the Learning Kingdom:
http://www.learningkingdom.com



Forelimb of a modern horse. The force of gravity (dark arrow pointing downward) can cause collapse of the leg. Gravitational forces are counteracted by the functional complex including the biceps muscle and trendon; the tendon fits over the humerus and locks the forelimb forming the passive stay apparatus.

Undergraduate Research Intern: Mary Catherine Boyett

Editor's note: Mary Catherine Boyett of Gainesville has worked during high school as an assistant

in the Vertebrate Paleontology collection. She also was a participant on the 1998 Western Adventure to South Dakota and Nebraska. Mary Catherine currently is a freshman at Oberlin College, where January is "off" so that students can pursue independent studies. After cataloging bones for years, Mary Catherine wanted a different experience of how research is actually done. During this January Mary Catherine is working on a project to study the chemistry of 30 million-year-old Oligocene fossil mammal teeth from Nebraska in order to detect ancient climate change. Mary Catherine files this report:

Working with Bruce MacFadden and Bob Feranec [UF graduate student] for the month of January, considerably broadened my knowledge of paleontology. As a result, I now view the museum's vertebrate paleontology collection in a different light. In the past, I have worked in the prep-lab and the VP range to restore and preserve fossils. My Winter Term project involved learning the entire process of isotopic sampling. This type of research permanently scars the fossils that are under study. At first, it was difficult for me to grasp the idea of sacrificing a complete *Subhyracodon* (fossil rhinoceros) tooth for the sake of research.

Mary Catherine pouring powdered tooth samples into vials. Erika H. Simons photo

When I first e-mailed Bruce asking him if there was anything I could work on for the month, I wasn't quite sure what I would be getting into. The project he designed involved using oxygen isotopes to determine climate change at the Eocene-Oligocene boundary. The first thing I learned was that research requires a lot of reading! My job was to prepare *Subhyracodon* enamel samples to be run on the mass spectrometer, the machine that measures the oxygen ratio of the samples. This involved using a small drill bit to collect powdered enamel, purifying the samples with chemical baths, and weighing out precise amounts of each sample for analysis. Bob was extremely helpful in guiding me through each step.

Perhaps the most enjoyable part of my project was working alongside graduate students, doing the same type of work that they do. As a first year undergraduate, it is very exciting to have these opportunities. I also really enjoyed using the equipment in UF's Geology department, such as the drills, microscopes and very precise scales.

The Florida Museum of Natural History has been a wonderful place for me to lay the foundations of my interest in paleontology and continues to support my increasing interest in the field. As an Oberlin geology major looking towards a career in vertebrate paleontology, opportunities to participate in projects of this caliber are both rewarding and exciting. (*Mary Catherine Boyett*)

About Thomas Farm

Editor's note: Nicole Lenard is a high school student from San Antonio, Texas. The following class report about her first visit to Thomas Farm has been slightly modified for this newsletter.

Thomas Farm is located near a small Florida town named Bell. An employee of the Florida Geological Survey discovered it in 1931. The fossil site is 18 million years old and was a sinkhole filled with animals that fell into and got trapped in the hole. There are three kinds of horses found at the site, *Parahippus*, *Archaeohippus*, and *Anchitherium*. The most common is *Parahippus* (80% of the horse material found at Thomas Farm). *Archaeohippus* is a small rare horse that accounts for only 10%. The rarest and largest horse is *Anchitherium* of which only 1% is found at the site.

The Thomas Farm site is owned by the University of Florida and all the fossils there are taken to the Florida Museum of Natural History where they are prepared, catalogued and placed in the fossil collection. The fossils are used by professionals in their research. Graduate students pursuing advanced degrees in zoology, geology, vertebrate paleontology and other related natural sciences also use the fossils.

Thursday, April 16 We arrived at the site and set up camp. Dr. Bruce MacFadden, associate director of the Florida Museum of Natural History, talked about the history of Thomas Farm and gave a lecture about the site and told us what kind of different species of fossils we would be finding. The most common is *Parahippus* ('Para' meaning side and 'hippus' meaning horse) side horse because it has side toes, 3 toes instead of 1).

Friday, April 17 I woke up at 7:00 a.m. and ate delicious banana walnut pancakes. After that we immediately started our dig. At first I was timid and afraid I was going to break the bones but my uncle helped me and I was finding all kinds of things. I found a rib bone of a *Parahippus* and as I was trying to get that out I ran into several other bones. The rib was way too fragile to get out so I had to put a plaster jacket on it. To do this I had to dig a trench around the fossil and put paleo tissue (toilet paper) around the fossil and wet it. Then I covered it with plaster and waited for it to harden. I found many vertebrae of *Parahippus* and some tortoise shell. Most of what I found was of *Parahippus*. I found many fragments of leg and foot bones. I also found a scute of an alligator.

Nicole Lenard (left) and her Uncle Bill Lee (right) waiting for the plaster to dry. Jewel Pozefsky photo.

Saturday, April 18 We ate omelets and then went down to the site. When I got down there I immediately found a whole tibia (lower leg bone) of a *Parahippus*. The bone was very fragile so I had to put a jacket around it to get it out. As I was digging a trench around it, I ran into a pelvic bone of some horse (they weren't sure which kind). It was really fragile. I gently placed it in heavy tin foil for extra cushioning. After the two major bones were taken out I found several toe bones of *Parahippus* and some vertebrae of *Archaeohippus*. Later that night Jewel Pozefsky, a teacher who was participating in the dig, gave me a lesson in geometry and gave me her e-mail address to contact her and ask any questions I need to know. Around 9:00 p.m. Dr. MacFadden gave a

Nicole Lenard preparing to make a plaster jacket.

lecture and showed us slides of ancient horses and fossil locations. Then we talked about what we can do to improve Thomas Farm. After Dr. MacFadden's Talk, a student of UF, Jay O'Sullivan lectured and talked about his interests in paleontology. He explained about his research on the small rare horse, *Archaeohippus*. I thought his research was very interesting because he said that paleontologists have come up with a new way of finding out how old the horse was when it died. He says they use a method called mass-spectrumetry. This was a very difficult subject to understand, but what I understood was that they would take the enamel from a horse's tooth and test it to see how many or what kind of molecules it has pertaining to the season of water it drank. The last time it drank would show up in the tests that they took to see what season it died and how long it lived. The horses lived to be at least four years old. They had a short life span because they were killed and eaten by other living creatures millions of years ago. *[See editor's note below]*

Sunday, April 19 I woke up at 7:30 a.m. and ate banana walnut pancakes again. Then, at 8:15 we went down to the site to start digging. Today I only had three hours to dig so I didn't get to find anything real big. I found a hoof of a *Parahippus*, which was real nice because it was so complete. I found the side toe and an astragalus of *Parahippus*. I also found a wrist bone of an *Archaeohippus*. Then it was time to go. I took a shower and then went back to eat lunch. Bruce gave a final lecture and off we were back to Jacksonville. (*Nicole Lenard*)

Editor's note: To clarifiy Mass-spectrometry, UF graduate student Jay O'Sullivan contibuted this explanation:

Nicole has made about as much sense of my research as anyone could hope to, but let me try to clarify a few points. I am looking at oxygen isotopes in tooth enamel, and the ultimate source of that oxygen is water that animals drink or get from plants they eat. I will use the chemistry of the tooth enamel from *Archaeohippus* to determine how long it took this dwarf horse to become an adult. Each tooth in a jaw records the season during which it grew. This record is in the form of proportions of oxygen isotopes. Oxygen atoms come in several versions called isotopes. The common form of oxygen atom has 8 protons and 8 neutrons in its nucleus. A less common heavy isotope contains two extra neutrons. The relative abundance of the rarer, heavier version of oxygen varies between Summer and Winter. Growth layers in tooth enamel record the season of their growth because the isotopic composition of each layer is the same as the water used to make that layer. Using the mass spectrometer to determine the composition of each growth layer, I will count the number of seasons involved in the maturation of *Archaeohippus* and its ancestor, *Miohippus*, to see if *Archaeohippus* was smaller because it matured earlier.

The Turtles of Thomas Farm

Fossil turtles often suffer abuse and neglect from collectors, because they represent some of the

more commonly found fossils in many sites. There is a reason for their ubiquity. Turtle shells are hard and compact, causing excellent preservation and animals on the bottom of the food chain are usually more numerous than the predators at the top. Because of their commonality turtles are rather unappreciated by fossil collectors. Nevertheless, they are very special animals that deserve a little more respect.

Have you ever compared your skeleton to that of a turtle? Look in the mirror and, with your x-ray vision, find where your pectoral girdle (shoulder blades, collarbone) and arm bones originate. Do the same for your pelvic girdle (hip bones) and leg bones. They are all outside your rib cage. Even your rib cage has gaps in it and your internal organs aren't fully protected.

Now take the turtle skeleton. Millions of years ago, during the age of dinosaurs, this creature modified its ribs and spine to form an all-enclosing armor for itself. The turtle carries its little mobile home with it wherever it goes and can retreat into it at the slightest show of danger or inclement weather. The vertebrae became the top of the shell and the ribs made up the walls. This formed what we call the carapace of the shell. The bottom plate or plastron is (probably made of the breastbone or sternum). Together the two halves enclose the pectoral and pelvic girdles to which the limb bones are attached. In most turtles the limbs can be retracted within the shell if not completely enclosed. The neck vertebrae are specially modified to loop into an S curve so that the head can also be retracted into the shell.

The box turtles, (*Terrapene* spp.) and mud turtles, (*Kinosternon* spp.) have hinged plastra which can close tightly against pesky predators. I have seen my dog play with a box turtle for over an hour before she gave up and the much-harassed turtle walked away unharmed. Most other turtles that are unable to close their shells have developed very thick bone, impenetrable even to Alligators.

The turtles from Thomas Farm are from two distinct groups: The tortoises (Testudinidae) and the pond turtles (Emydidae). The tortoises belonged to the genus *Hesperotestudo* that includes the extant Galapagos tortoise. They were small for their genus, being not much larger than a gopher tortoise (*Gopherus polyphemus*) though their shell was thicker. The pond turtle from Thomas Farm is of the genus *Pseudemys*. This turtle and the Alligator present at Thomas Farm are two of the few animals that suggest that the site must have had at least a seasonal body of water nearby. (*Erika H. Simons*)

Pony Express

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The purpose of this newsletter is to communicate news and information and disseminate knowledge about fossil horses, particularly in Florida, and to develop a state-wide constituency that will support and enhance the research, exhibition, and educational programs offered at the FLMNH that pertain to fossil horses. Contributions to the Fossil Horse Fund are deposited into an account at the University of Florida Foundation, Inc., a tax-exempt entity, and will be used for the purposes stated here.

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