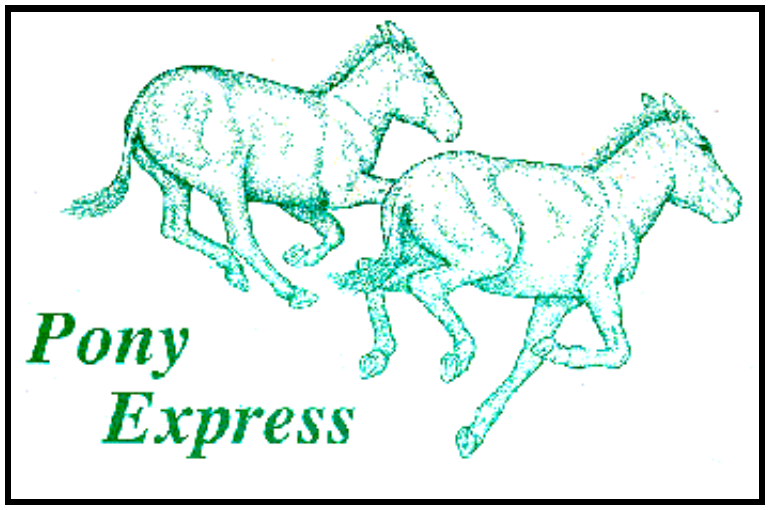


# Florida Fossil Horse Newsletter

**Volume 7, Number 1 1st Half 1998**

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## What's Inside?



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## News from Powell Hall

Our new FLMNH exhibits and education center at Powell Hall opened to the public on 30 January 1998. During the first month of operation, almost 14,000 people visited the museum. Several new and exciting displays are available, with more planned for the next four years. Currently we have two fossil horse skeletons on exhibit in our Central Gallery: an 18 million-year-old *Parahippus* from Thomas Farm and a 1.5 million-year-old *Equus* from Leisey Shell Pit in Hillsborough County. We also are planning to have a skeleton of Thomas Farm

*Central Gallery at Powell Hall (Photo by Stan Blomeley)*

opened to the public, this program has generated a lot of excitement about making natural history collections and repeat trips to our museum. We are currently in the process of forming our fossil hall project team, which includes Bruce MacFadden, Roger Portell, Dave Webb, and public education coordinator Betty Camp. We will recruit a lead designer for this project. The fossil hall will have displays about paleontology, collecting, accessing museum collections and Internet resources, and a walk through 50 million years of Florida's paleontological history.
*Bruce J. MacFadden*

*Archaeohippus* placed on exhibit this Spring. We hope that you all will have an opportunity to come and visit Powell Hall.

We have initiated several new programs at Powell Hall. One that we are very excited about is the Frequent Visitors Club. Visitors register (at no charge) to become members of the Frequent Visitors Club and each time they visit Powell Hall they are allowed to select a natural history object that they may take home with them (for keeps). The objects to choose from include a fossil shark's tooth, modern shell, fossil clam, squash seed, armadillo scute, and fossil plant. With almost 2,000 members signed up during the first month that Powell Hall has been


## FLMNH to Build a Western US Fossil Mammal Collection

The FLMNH has one of the largest fossil vertebrate research collections in North America. Consistent with our mission as the state museum, more than 90% of these collections are from Florida localities. Nevertheless, as we diversify our research and public outreach programs, it is time for us to develop collections from other regions as they pertain to current initiatives in our museum.

In June the *Pony Express* will sponsor its first western trip to visit museums and dig Oligocene fossils in western Nebraska. My preliminary visit to this region last summer indicated that this trip will have lots of attractions and excellent potential to find fossils. Accordingly, one of our goals for this new program will be for us to make precisely documented collections for the FLMNH from classic Oligocene exposures in this region of the west. These new collections are sure to include extinct mammals such as oreodonts, rhinoceroses, rodents, early lagomorphs (related to modern rabbits and their kin), camels, carnivores, and of course, fossil horses. With regard to the latter, the classic Oligocene western localities contain two genera of horses, *Mesohippus* and *Miohippus*. Interestingly, these same two genera of horses are the earliest known from Florida, about 28 million years old. Fragments identified as *Mesohippus* are known from the "I-75" locality uncovered during the late 1960s from just SW of Gainesville when the Interstate 75 was being built., On the other hand, *Miohippus* is known from a few fragments in our collection, but by far the most spectacular specimen of this horse is the individual collected from St. Petersburg and donated to the FLMNH by the Tampa Bay Fossil Club in 1995 (see *Pony Express*, vol. 4, no. 2, 2nd Half 1995).

Mesohippus *running from carnivores. Original illustration from American Museum of Natural History.*

After the scanty record during the early *Miocene* described above, extensive collections of Florida fossil horses come from the middle Miocene 18 million year old Thomas Farm locality. By this time the horses have evolved to include three genera, including the common three-toed *Parahippus*, the tiny *Archaeohippus*, and the very rare browsing *Anchitherium*. The specimens of Oligocene *Mesohippus* and *Miohippus* in our collections (whether they are from Florida and Nebraska) are about 10 million years older than the horses from Thomas Farm. With new Oligocene collections we therefore will have an enhanced understanding of the ancestry of fossil horses. For example, a horse skeleton collected by Tom and Brian Ahern last year from Nebraska has been prepared and is providing clues to the differences between *Mesohippus* and *Miohippus* (see *Pony Express*, vol. 6, no. 2, page 5 article by Jay O'Sullivan below). The addition of Oligocene collections will allow FLMNH and museum scientists, students, and visiting researchers to make comparisons of the characters that have changed through time documented by 28 million years of evolution, from the Oligocene until horses became extinct in Florida about 10,000 years ago.

Fossils acquired during the western field trips will also provide a broader diversity of possible specimens to be placed on exhibit. We are very excited about a spectacular fossil Oligocene titanothere ("thunder-beast," an extinct family whose modern relatives include tapirs, horses, and rhinos) collected from this region that will be loaned to us by Steve and Suzan Hutchens for display in our new museum building at Powell Hall.
*Bruce J. MacFadden*

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## An Unexpected Bonus

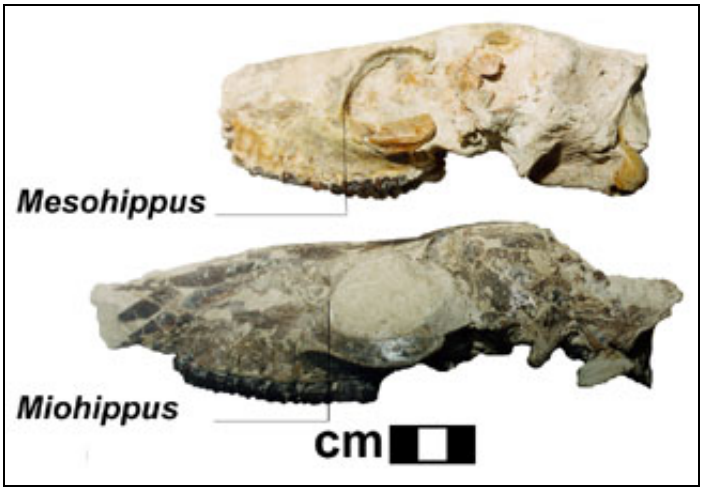
Watching the preparation of the donated Oligocene horse fossil filled me with the same sort of anticipation a child feels on Christmas morning. I could hardly wait to get my hands on it! But, wait I did. As the rock-hard wrapping came off, I grew to suspect that this gift was a more valuable addition to the museum's collection than had been expected originally.

Little horses such as this one that are recovered from the Early Oligocene of Nebraska usually are assigned to the genus *Mesohippus*. However, the slightly larger and more advanced horse *Miohippus* is also present in Oligocene sediments of Nebraska. The species *Miohippus* obliquidens is fairly abundant in the area. As the rock matrix was painstakingly removed from the fossil, I began to suspect that I was looking at a specimen of *Miohippus*, not *Mesohippus*.

The first clue was the length of the face and condition of the preorbital fossa (pit) of this specimen. Generations of paleontologists have sought an easy way to tell *Miohippus* from *Mesohippus*, with little success. They found that *Miohippus* is typically somewhat larger and looks slightly more like later horses than does *Mesohippus*. In particular, *Miohippus* has a longer face. The depression known as the preorbital fossa has a distinct indentation in front of the eye orbit, and tapers to a shallow groove towards the middle of the snout. *Mesohippus* has the shallow depression, but lacks the pinched look in front of the eyes. The donated horse specimen from Nebraska has the long face and pinched fossa of a *Miohippus*.

Although I had seen illustrations of complete skulls of *Miohippus*, there are only a few specimens of *Mesohippus* and no *Miohippus* in the collection of the FLMNH. Since my doctoral research on the Miocene dwarf horse *Archaeohippus* requires me to figure out to which species of *Miohippus* it is most closely related, it is very important that I learn to recognize *Miohippus*. The prospect that we now had a relatively complete specimen of *Miohippus* here at the museum was exciting, and warranted further investigation.

The most recent study of these horses offers only one (supposedly) unambiguous distinguishing character for *Miohippus*. The third metatarsal (toebone) has a small smooth facet (area) for articulation with the cuboid bone in the ankle. Evolutionarily, this is due to the broadening of the third metatarsal, as it becomes the primary (and eventually only) weight-bearing metatarsal (cannon bone). According to most authors, this articular facet is not found in *Mesohippus*. It is as prominent in the new specimen as it is in *Archaeohippus* and *Parahippus*. Unfortunately, every specimen I found in our collection labeled *Mesohippus* also appears to possess this cuboid-MTIII articular facet, though to a lesser degree. Now, this could be the result of mislabeling; as I said above, nearly everything that comes out of the Oligocene of the western United States is assumed to be *Mesohippus*. Or, it could be that the facet is weakly present in some specimens of *Mesohippus*. Unsatisfied, I sought more solid characters to differentiate these two very similar horse genera. I think I may have found some.

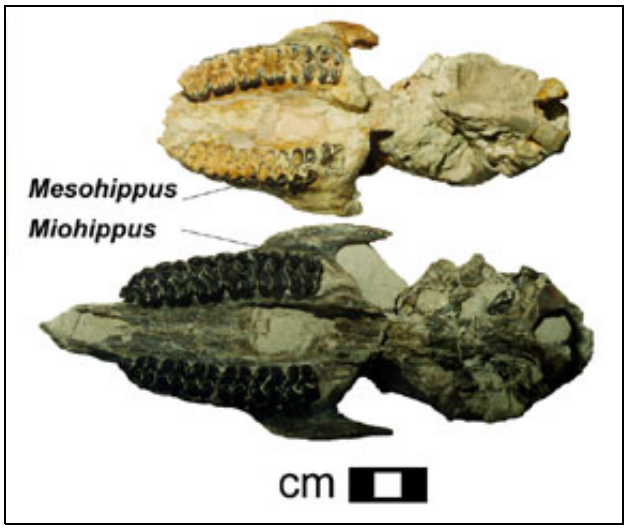


Mesohippus *and* Miohippus *skulls showing the position of the orbit relative to the teeth*

The lengthening of the horse face over evolutionary history includes the migration of the orbit (socket) of the eye further back on the skull. This can be measured by observing the location of the front border of the orbit in relation to the tooth row. In *Mesohippus*, the forward edge of the orbit can be even with the back half of the first upper molar (M1). In *Miohippus*, the orbit is even with the back half of the M2. (In *Equus*, the orbit has withdrawn to a position over the M3.) I had noted this condition only from photographs. Now, with the donated specimen, I can confirm that this is not the result of post-depositional deformation of the fossil. Looking at the underside of the skull, I noticed that the zygomatic arch (the cheekbone) is set back in *Miohippus*. The opening through which the cheek muscles pass extends to a point next to the M3 in *Mesohippus*, but is behind the tooth row in *Miohippus*. This arrangement of the teeth in relation to the jaw muscles affects the mechanics of chewing, and might indicate dietary differentiation between *Mesohippus* and *Miohippus*.

Using the location of the eye and cheekbone, I was able to go to our small collection of Oligocene horses from the western United States and identify some skull fragments to genus. Several specimens that are labeled *Mesohippus* look like *Miohippus* to me. Without the addition of this wonderfully intact skull with its associated postcranials, this would not have been possible. In a couple of months, I will visit the American Museum of Natural History in New York to look at the collection of Oligocene and Miocene horses there. Thanks to the generous donation of this specimen of *Miohippus*, I feel that I will have a better

understanding of this genus and its contemporary, *Mesohippus*.
*Jay O'Sullivan*



Mesohippus *and* Miohippus *skulls showing the position of the zygomatic arch relative to the teeth*

## News from the Prep Lab

Being from Florida, I'm used to the sands, clays and creek beds found here. However, last year, a fossil horse from Nebraska was donated to the FLMNH (see page 3, this issue). It was encased in a fifty pound block of HARD clay held in a plaster jacket; much of it fractured into several big pieces. The jacket was made to include some extraneous rock on the underside for protection. This was removed the old-fashioned way, with a hammer and chisel. With such hard clay it is good to use fractures to your advantage, just be aware that often times fossils provide those cleavage points where the fractures occur. This can end in either perfect cleaving of the rock from the fossil, or regrettably a break, although clean, in the fossil itself. Little bone was in the extraneous rock, but once fossils began to appear, the block was prepared in detail in the lab.


*Brian Beatty prepares the* Miohippus *skull.*
*(Photo by Erika H. Simons)*

The most valuable tool has been a pinvise for detail work; of course, an awl would suffice (dental picks used on softer matrices just wear down). A hydraulic Airscribe is invaluable, as it allows for detail work with lots of rock removal. The drawbacks of an Airscribe are threefold: the intense and loud buzzing makes it difficult to work for extended periods of time, the vibrations can cause brittle bones to crumble, and the dust produced. The dust isn't just messy, but it also contains silica, which is really NOT good to breathe, especially for extended periods, so WEAR A RESPIRATOR! If anything, at least get some of the disposable ones from a hardware store. As for glues, butvar is a good all-purpose hardener when thinned with acetone and a good glue for some of the more stable joints. Butvar can be dissolved with acetone, and hardener can be peeled off. Once bone is exposed, I clean and harden it. If later I want to get it cleaner, I just peel off the hardener and harden again. Cyanoacrylate glues are very useful, especially with the more brittle scapula and vertebrae. Vertebrae especially are difficult because the matrix fills the neural canal and surrounds all the protruding processes. If the rock fractures, so does the little process or fragile arch.

This was my first time working with such a hard matrix, so all I can say is, when in doubt, rely on the pinvise. It may not save time, but it does save fossils. Patience and time are great assets for this kind of preparation.
*Brian Beatty*

## The Enigmatic Thomas Farm Rhinos

*Steve and Sue Hutchens digging up rhino pelvis from Thomas Farm April 1997. Photo by Brian Ahern*

Although abundant throughout the late Miocene into the early Pliocene in Florida, rhinos are rare in earlier times. With the exception of a few isolated specimens, the Thomas Farm fossil locality contains the best early record of rhinos in Florida. Remains of two rhino species, *Menoceras barbouri* and *Floridaceras whitei*, are found in the compact Thomas Farm clays and sands, but they are elusive in both fossil abundance and in what we know about them. Horace E. Wood described both species in 1964 from a collection of Thomas Farm fossils at Harvard University. (See: Wood, Horace E. 1964. Rhinoceroces from the Thomas Farm Miocene of Florida. Bulletin of the Museum of Comparative Zoology, Vol. 130, pp. 363-386.)

Menoceras barbouri was the older of the two species. *Menoceras* was a member of an extinct lineage of rhinos that is characterized by a unique set of double nasal horns. Living African rhinos have two horns, a large horn in front and a smaller one behind, but *Menoceras* had two equally sized horns positioned side by side. Unfortunately, the horns of extinct rhinos are not made of bone and do not preserve in the fossil record. Instead, they are made of keratin, much like your fingernail or the hoof of a horse, and grow throughout life. We can make some observations about the horns of extinct rhinos by the rugosities on their nasal bones. Rugosities are roughened areas where the horn attaches to the skull. hile no complete skull of *Menoceras* has ever been found at Thomas Farm, specimens from other fossil localities demonstrate that the females were hornless and only the males possessed these double horns. You can imagine that the males may have utilized these horns in a battering ram-like fashion, fighting other males for mates, or in territorial disputes. By rhino standards, *Menoceras* was small. It weighed much less than any of the living rhinos, was more slender and a quick and agile runner. The genus *Menoceras* migrated from Eurasia during the latest Oligocene time. The only other rhino living in North America at the time of this migration was another two horned rhinos named *Diceratherium*. *Diceratherium* never lived in Florida and was extinct by the very early Miocene, perhaps due to competition with *Menoceras*. As a result, *Menoceras* may have been the first rhinoceros to ever wander into Florida.

The second Thomas Farm rhino, *Floridaceras whitei,* was much larger, about the size of a modern black rhino. It was a true gargantuan for its time and it easily dwarfed the contemporary *Menoceras* and other North American rhinos that lived before it. *Floridaceras* belongs to a group of large hornless rhinos, known as the aceratheres (beasts without horns), that migrated to this continent during the earliest Miocene. While they lacked nasal horns, aceratheres retain a pair of tusk-like lower incisors that may have been used as defensive weapons. Three different genera of aceratheres lived in North America during the Miocene: *Paraceras, Aphelops* and *Floridaceras*. *Paraceras* is well known outside of Florida and *Aphelops is* very common throughout the late Miocene in Florida. *Floridaceras* was an early Miocene form and is the rarest of the three. In fact, Thomas Farm contains the only known record of this elusive rhino. With very few skeletal remains it is difficult to say much about it. Its skull and dentition are more primitive than the later aceratheres and *Floridaceras* probably browsed on soft forest leaves. Despite its great weight, *Floridaceras* had relatively long legs and was more slender than living rhinos. *Floridaceras* appears to have been able to achieve surprising speed when running. While most rhinos have three toes per foot, *Floridaceras* had four toes on its front feet. The loss of the most lateral digit occurs early in rhino evolution but for some reason, *Floridaceras* retained this primitive characteristic. Perhaps the extra digit aided Floridaceras in supporting its great weight and prevented it from sinking when running in mucky, swampy conditions.

*Floridaceras* and *Menoceras* died out before

the late Miocene. They were probably adapted to eating soft forest vegetation. As the Miocene progressed, the North American climate became more arid. Grasses and other tough plants spread across the continent and *Menoceras* may have been outcompeted by horses that had evolved to eating these plants. Likewise, *Floridaceras* was replaced by two other rhinos with more advanced dentition. One of these was its close relative, *Aphelops*, and the other was a short, squat rhino known as *Teleoceras*. Both of these died out about 5 million years ago and were the last rhinos to roam North America.
*Matthew C. Mihlbachler*

*Left mandible of* Menoceras barbouri *found by Jeff Yaun during the 1997 Thomas Farm dig. Photo by Erika H. Simons*

## The Carnivores of Thomas Farm

*Left mandible of* Tomarctus canavus, *found by Glyniss Hudson during the 1997 Thomas Farm dig. Photo by Erika H. Simons*

The Thomas Farm carnivores present an interesting snapshot of early Miocene times and early, modern carnivore evolution. As in most fossil assemblages, the carnivore material is relatively scarce, however, four families and nine genera of predators have been identified including five new, two western immigrant and two archaic species. The early Miocene represents an important transition from the late Oligocene primitive carnivores to the Miocene more advanced carnivores.

Three mustelids (weasels, skunks & relatives) have been found at Thomas Farm. *Oligobunis floridanus* is a remnant carnivore considered part of the stem mustelid radiation during the Oligocene and went extinct during the early Miocene. It is the largest mustelid at the site and is characterized by rather large lower fourth premolars and first molars. It is thought *Oligobunis* may have been a badger/wolverine-like animal that filled the scavenger niche, eating bones and carcasses. *Miomustela* sp. and Leptarctus ancipidens are part of the modern mustelid radiation, which also started in the late Oligocene. *Miomustela* is the smallest carnivore found at Thomas Farm and is represented by only a few fragmentary remains. *Leptarctus* is a relatively common western species and is approximately the same size as the modern weasels.

The dog family (Canidae) is represented by the largest number of fossil carnivore specimens from Thomas Farm. Canid evolution is highlighted by an early Miocene split of the primitive Hesperocyoninae into the two major groups of canids that lived during the later Tertiary. *Osbornodon iamonensis* (formerly *Cynodesmus)* is a basal ancestor of the modern dogs, subfamily Caninae, and most abundant predator of Thomas Farm. It was the largest canids and most gracile of the Thomas Farm predators. *Tomarctus canavus* is one of the earliest known members of the Borophaginae, a group of canids that evolved several different forms including the hyaena-like *Osteoborus*. The borophagine went extinct in the late Pliocene. *Tomarctus* is characterized by shorter, more robust limbs and shorter face than *Osbornodon*. Euplocyon spissidens was a small, rare canid and is characterized by having an extra cusp extending along the shearing length of the molar. This structure implies a more carnivorous lifestyle than its other canid counterparts.

Two bear-dogs, *Amphicyon longiramus* and *Cynelos caroniavorus*, are found at Thomas Farm. The Amphicyonidae is considered the most primitive of the "modern" carnivore families. They retained a full dentition including the upper third molar, which was lost in all other families. Bear-dogs did not survive beyond the Miocene in North America. *Amphicyon* is the largest and third most abundant predator at Thomas Farm. Cynelos is a smaller bear-dog and is only known from a few specimens. The primitive ursid (bear family) *Phoberocyon* (formerly *Hemicyon) johnhenryi* is of approximately equal size to *Amphicyon* but has more slender limbs. *Phoberocyon* evolved dental and locomotor adaptations equivalent to canids. This bear is known from only a few dental specimens and several post-cranial bones from Thomas Farm.

*A reconstruction of Thomas Farm 18 million years ago. Original illustration by Biological Sciences Curriculum Study, American Institute of Biological Science*

The two major dogs and *Amphicyon* represent most of the Thomas Farm carnivores, while the remaining are known form only a few specimens. There were at least 12 genera of ungulates and three species of rodents present as potential food, of which the horses *Parahippus* and *Archaeohippu*s were probably the main prey. The carnivores from Thomas Farm are unusual because they existed during "the cat gap", a period in which "cats" (felids and nimravids) were absent from the North American fossil record. Cat-like predators disappeared at the end of the Oligocene and did not reappear for eight million years. The lack of these meat-specialist carnivores probably had a major influence on the evolution of the new genera present a Thomas Farm. The Thomas Farm carnivores represent very general forms, which were neither as fleet runners nor as highly adapted to eating meat compared to previous and subsequent specialized predators. The mixture of ancestral and experimental predator forms portrays a transitional, quickly evolving stock of predators. Although the animals are fairly generalized in anatomical adaptations, they do show obvious differentiating features, which fill the predatory, scavenging, and omnivorous roles within the ancient Thomas Farm ecosystem.
*Casey M. Holliday*

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## THE ELEPHANTS ARE COMING! THE ELEPHANTS ARE COMING!

- Shovel tusked gomphotheres
- Wooly Mammoths from the last Ice-Age
- Dwarf elephants that stood just 3 feet high (see photo below)
- Dima, the baby mammoth frozen in the Siberian permafrost for the last 44,000 years
- Modern Asian and African elephants

**THEY'RE ALL COMING TO THE FLORIDA MUSEUM OF NATURAL HISTORY IN OCTOBER 1998, IN THE EXHIBIT ELEPHANTS!**

In this informative and educational exhibit, mounted skeletons of modern elephants and their ancestors

along with fossils and interactive exhibits will explore the evolution, ancestry, and relatives of the proboscideans, those unique mammals we call elephants. This amazing group of animals gets its name from its most defining and unusual feature - its trunk or proboscis in fact, the word "proboscidean" means "trunk bearer".

With the exception of Antarctica and Australia, fossil proboscideans have been found on every continent. The earliest ancestors of modern elephants appeared more than 50 million years ago in the early Eocene Epoch and had not yet developed recognizable trunks. They may have been similar in appearance to the "coney" or hyrax, a small tailless, short-nosed herbivore found in Africa and the Middle East.

Near the end of the Oligocene Epoch, about 30 million years ago, proboscideans possessing both trunks and tusks are found. In another six million years, early in the Miocene Epoch, *Gomphotherium*, an ancestor to modern elephants, appears. The exhibit ELEPHANTS! features a rare and nearly complete skeleton of a shovel tusked gomphothere found in Nebraska in 1993.

Mammoths, although now extinct since the end of the last Ice Age, 10,000 years ago, are the closest relatives to modern elephants. The exhibit ELEPHANTS! brings the mounted Hebior Mammoth to the Florida Museum of Natural History. Discovered in 1994 in Wisconsin, this woolly mammoth, standing 13 feet high is the largest and most complete ever found.

Dwarfing in elephants is seen more than once in the fossil record. In the exhibit ELEPHANTS! you can see one of the smallest known elephants, a mounted specimen from Sicily that stands no more than three feet high. Dwarf mammoths are also known from the Catalina Islands off the coast of California, and Wrangel Island in the Siberian straits where a dwarf mammoth is reported to have existed until about 3000 B.C.

While most of the fossils accompanying the ELEPHANTS! exhibit are skeletons, this exhibit has a body cast of Dima, the baby mammoth which was found frozen in the permafrost of Siberia. It is all the more remarkable for having preserved, not only the skeleton, but skin, stomach contents, and internal organs as well, to give us a rare glimpse into the past.

*Dima, the baby mammoth from the St. Petersburg Museum in Russia, will be featured in this exhibit by special arrangement.*

ELEPHANTS! also presents a mounted skeleton of a modern Asian elephant. Similarities and differences between modern elephants and fossil relatives are readily evident when all the mounted skeletons are viewed.

Modern mammals, such as manatees and hyraxes, although seemingly quite different animals are nevertheless, close cousins of the elephants. ELEPHANTS! explores these relationships and much more as it takes us on a fascinating tour of proboscidean evolution, natural history, and folklore. This educational journey is presented through the media of actual fossils, photographs, video presentations, and text, as well as interactive walk-throughs and hands-on exhibits.
*Russell McCarty*

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## Announcements

**The Elephants Are Coming!**

From 10 October 1998 to 3 January 1999, the FLMNH will be host to a magnificent travelling exhibit on fossil and modern elephants. This is sure to be of interest to fossil enthusiasts and we are looking forward to this venue. We hope you will make a point to visit our museum during this time period.

**Paleofest 98! Mark 20-21 November on your Calendars!**

Back by popular demand, the FLMNH is again co-sponsoring with the Florida Paleontological Society a Fall festival of paleontology Paleofest98, to be held on Friday evening, 20 November and all-day Saturday, 21 November. Paleofest98 will include a lecture by noted dinosaur hunter Jack Horner, a reception in Powell Hall, tour of the ELEPHANTS! exhibit, field trips, benefit auction, FPS business meeting, and awards dinner. Blocks of rooms have been reserved at the Gainesville Radisson (1-800-333-3333; 352-377-4000). Be sure to mention Paleofest98 to secure the conference rate.

**Museum Open House 98**

On September 27th we will have our annual open house at Dickinson Hall for a look behind the scenes! Yes, Dickinson Hall, which houses our collections and research programs, is still on the map and we're here to stay! This year's Open House promises to be a real blowout! We will be open from 1:00 to 4:30 PM. Be sure to mark this date on your calendars!

## *Pony Express*

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- Erika H. Simons, Editor and Program Coordinator

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## *Pony Express*--Statement of Purpose:

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.

Do you travel along the information superhighway?
The *Pony Express*is now on the World Wide Web via the
Internet URL location:
http://www.flmnh.ufl.edu/vertpaleo/ponyexpr.htm

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- Wright, Marcia, Winter Park

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