

Florida Fossil horse Newsletter

Volume 9, Number 1, 1st Half 2000

What's Inside?

- [The Good Olde Days at The Thomas Farm 'Bone Hole'](#)
 - [Thomas Farm's Slingshot Beast Revealed](#)
 - [Toeing the Line](#)
 - [New Florida Oreodont](#)
 - [Skeletons in Our Closet: The treasures of a museum](#)
 - [Book Review - The Bone Hunters: The Heroic Age of Paleontology in the American West](#)
-

The Good Olde Days at The Thomas Farm 'Bone Hole'



Since its discovery in 1939, the Thomas Farm fossil site has been excavated by scientists, graduate students, teachers and fossil enthusiasts under the guidance of paleontologists from the Florida Museum of Natural History. It has been the source of many scientific papers, graduate theses, and brilliant ideas on how to teach paleontology in our public schools. The methods of excavation have not changed much, but the people and their individual experiences have produced

Scientists excavating the Thomas Farm "Bone Hole" in the 1940s. From left to right they are Archie F. Carr, Frank Young, Francis Norman, Buddy Young, Theodor White, and Marjorie Carr (head at bottom). J.C. Dickinson photo

a rich history. Some of these early diggers, Dr. Walter Auffenberg, former Curator of Vertebrate Paleontology at the

FLMNH, Dr. J.C. Dickinson, Director Emeritus of the FLMNH and the late Dr. Archie F. Carr in his book entitled *A Naturalist in Florida: A Celebration of Eden*, share some of their memories from the days when scientists from Harvard, Drs. Thomas Barbour and Theodore White, were digging the site.

Walter Auffenberg dug at Thomas Farm in the 1950s, 1970s and early 1980s. Not much digging occurred at Thomas Farm during the 1960s. His doctoral work was on the fossil snakes of Florida from the Miocene to the Pleistocene. While working on his Ph.D. he would go out to Thomas Farm about once a week, and when he stayed more than a day he camped out in a semi-trailer parked there. To break down the fossiliferous matrix he would bring sediments home and dry the clay on cookie sheets in the oven before washing it through window screen to extract the fossils. He also used to break down the clays by soaking the matrix in gasoline before washing. This method did not require drying, and it was effective in isolating the fossils.

Dr. Auffenberg recalled that he only found one skull at Thomas Farm, but what a specimen it was! Until 1999 it reigned supreme as the only *Amphicyon intermedius* skull in the whole museum. Found during February 1957 it is the type specimen for the species. He recalls that he was digging away with his hunting knife when at some point it went 'clink' when it hit the bone. It took several days to dig it out. While working on the skull his father, who had come out to help, accidentally flung his Masonic ring out with the spoil. The next day Dr. Auffenberg came back with his wife and young son, Walter to work on the *Amphicyon* skull. Young Walter was answering the call of nature when he saw something gleaming in the sun. He had uncovered his grandfather's ring!



Thomas Farm in the 1950s hardly resembled the sinkhole that it was 18 million years ago. Today much of the fossil-rich matrix has been removed and it once again is a sinkhole.

Walter Auffenberg was curator of Vertebrate Paleontology at the Florida State Museum from 1956 to 1959. He remembers when in 1948 the entire VP collection consisted of 3 cabinets, then housed at Flint Hall. During his time as curator he taught Vertebrate Paleontology and took his classes out to Thomas Farm. He put in a grid system of one-meter squares made with metal fence posts. Each bone that was uncovered was mapped in this grid system.

When the Harvard bunch first dug Thomas Farm in the 1930s they used a horse and mulescoop to remove overburden and uncover new layers of fossils. This contraption was owned and operated by the appointed caretaker, John Henry Miller, who was living rent-free on the premises in a one-room shack he built with the help of Theodore White from Harvard. Archie Carr wrote, "He used to bring

his mule to help Tom Barbour and Ted White dig out fossils at the Thomas Farm over in Gilchrist County northwest of Bell. The Thomas Farm dig had just become known to paleontologists and was being called the best deposit of Miocene fossils east of the Mississippi ... Anyway, Dr. Barbour bought the place for Harvard and the University of Florida and used to come down once in a while to help Ted work it. My wife and I would go out there with them. They would work away with a grapefruit knife for several days, scratching the clay away from the skulls of horses or camels or dier[sic]-wolves that died millions of years ago, and then, when everything the grapefruit knife could reach was out and safely shrouded in plaster, John Henry would bring his mule-shovel and scrape off the overburden until more paydirt lay within reach of the grapefruit knives." Dr. J. C. Dickinson remembers that "John Henry did become a skilled digger and in later years worked alongside all the rest of us." He collected the type specimen of *Alligator olseni*.



In the early 1980s during the week-long summer digs, the rich Thomas Farm matrix was screen-washed in the Santa Fe River. This activity allowed the diggers to cool off from the scorching summer heat.

According to Dr. Dickinson's account, John Henry and the other local workers not only lacked a spatial geographic knowledge, "they just could not comprehend the age of the bones coming out of the ground. The result was that sort of time shifts were made in referring to the various animals being unearthed. Alligators were no problem, but species such as *Amphicyon* were simply known as the "Big Dog". One day while the Harvard bunch was at the Thomas Farm dig working on the *Amphicyon* skull John Henry and his Uncle Leonard were sitting around watching and were discussing what life must have been like when the big

dogs were running around in these woods. Archie Carr recalls this delightful conversation in his book: "Uncle Leonard said, 'You reckon there was any folks around here in them days?' 'Sure,' John Henry said. 'There's always been folks around these parts.' Leonard pondered the faraway times for a while, and then he said, 'Well, what kind of a rig you reckon they had to handle a critter like this-er-un?' John Henry faced him and scornfully spit snuff juice against a clod of blue clay. 'Great God-a-mighty,' he said. 'What you reckon they used them long roffles fer (long rifles)?'"

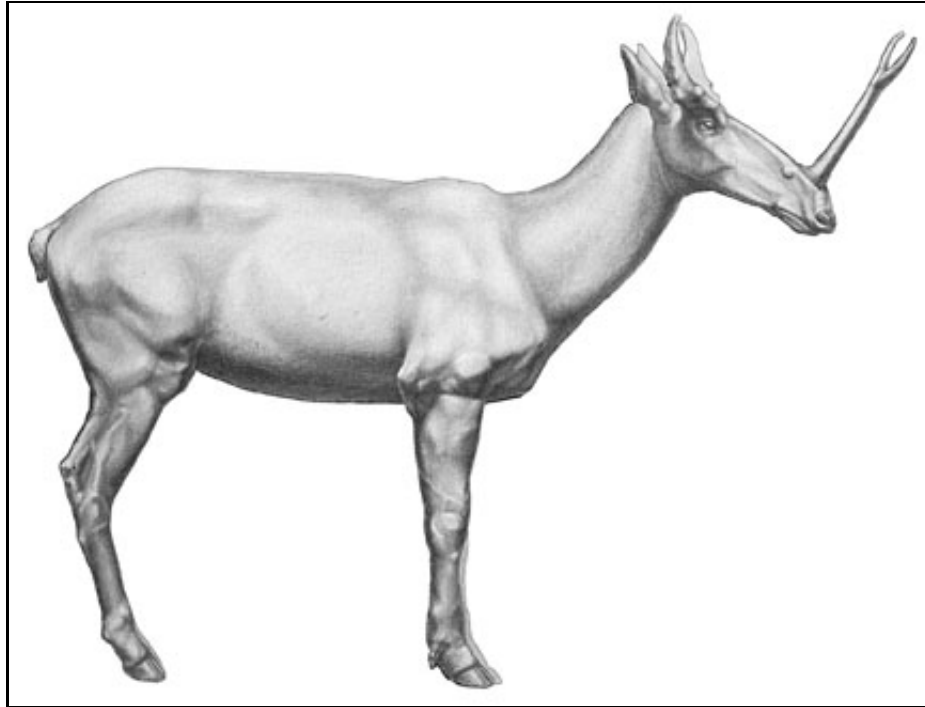
In the 1950s Buddy Vaughn replaced John Henry Miller as caretaker of Thomas Farm. Harvard and the University of Florida put together \$2000 to replace the rotting shack that he had inherited. Dr. Auffenberg recalls that the UF had offered to build a toilet, but Buddy said his wife didn't normally use a toilet and didn't need one now. A privy was built, however, and in an amusing correspondence to Dr. Alfred Romer, then the Director of the Museum of Comparative Zoology (MCZ) it was mentioned that, "the convenience near the bone hole is being used; although there are suggestions that one of the users may need instructions."

It has been generally accepted that the Thomas Farm fossil site was a sinkhole that was at one time a cave. In Dr. Auffenberg's opinion it was a sinkhole that was narrow at the top and wide at the bottom. Bats may have flown in and out of it, but it was not a cave system. When the seawater eventually rose it washed off the neck of the sink. Animals fell in, got trapped and died at the bottom and were covered by clay that was continually washed into the sinkhole during rains and

erosion. At the time of its discovery the site was a gently sloped shallow bowl where domestic pigs rooted and gopher tortoises made their burrows. Thomas Farm has an elevation of about 40 feet above sea level. Its environment 18 million years ago probably was much like today's Longleaf Pine-Turkey Oak Sandhill.

Erika Simons

Thomas Farm's Slingshot Beast Revealed

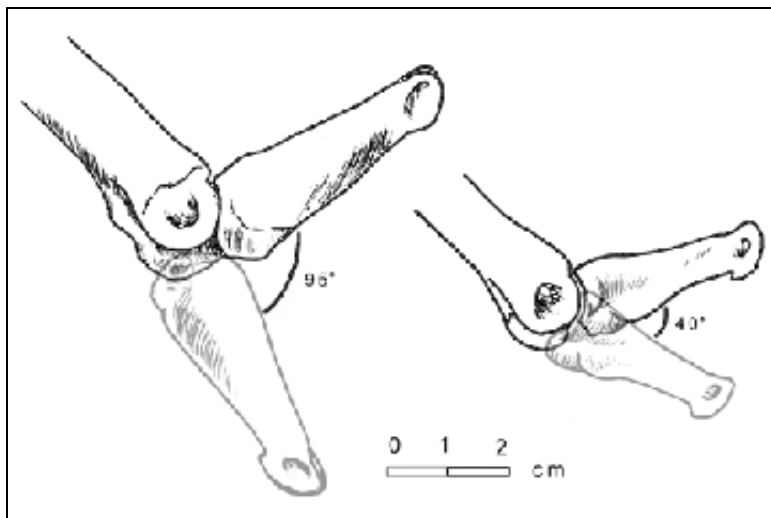


Since Othniel Marsh's day, strange ungulates known as protoceratids have been found exclusively in the North America. In fact, Marsh described the family Protoceratidae in 1891 and since then, more than twenty species of this rare group of animals have been named. Currently believed to be close relatives of the Camelidae, Protoceratids are named after *Protoceras celer*, an early form with small, knobby cranial protuberances, particularly the beginnings of the two-pronged "slingshot" shaped "horn" just behind its nasal opening.

By the time of the early Miocene 18 million years ago, Thomas Farm's Hemingfordian age, protoceratids had already developed this "slingshot". They are represented by *Prosynthetoceras texanus*, first described from the Garvin Gully of the Texas Gulf Coastal Plain. *P. texanus* has been noticeably rare compared to *Parahippus leonensis* and *Archaeohippus blackbergi*, as are artiodactyls in general at this site. Currently, the artiodactyls (cloven-hoofed mammals related to camels and deer, for example) of Thomas Farm are in need of study, due to the great number of additional specimens collected during the many years of successful *Pony Express* digs.

Prosynthetoceras has a number of characters unique to the family. First is the "horn", which is not a horn at all, but a similar structure known as an ossicone. Ossicones are found in giraffes and okapis today and are similar to horns with the single exception of being covered in skin and blood vessels instead of keratinized epidermis (a horn sheath). This ossicone is also developed not from the nasal bone as in rhinos, but from the maxilla growing up and bridging around the exposed nasal passage, fusing as one extension until it forks again to its slingshot shape. Ossicones also curl up and forward from the frontal bones above the eyes as well, much like those of a pronghorn.

To date, no description of the skeleton has been made of this species. Using



Prosynthetoceras texanus Metacarpal III with proximal phalanx right and Metatarsal III with proximal phalanx (left) showing range of motion. Brian Beatty drawing

the collections made by the *Pony Express*, a partial description is now available. During the organizational stage I found a character that appears to be identifiable family-wide in the protoceratids. Between the metatarsal III and IV, which are not fused like in cows, bison, or deer (the cannon bone), there is a 3 mm, well-preserved bean-shaped facet that holds the two bones together in life. This facet is exclusive to the Family Protoceratidae, and can be used to identify this rare group. The proximal toe bone that articulates with the joined metatarsals is notable by its lip of smooth articulating surface that flips over the top edge of the distal end of the bone.

Identifying fossils comes with patience and one must not forget that fossils

were once part of a living, animal which walked, slept, and even had to scratch itself once in a while. Biomechanics, the study of animal movement, allows the paleontologist to understand how these animals functioned. Looking at the toe bones and how they articulated with the metapodials, I was able to identify the difference between the toe bones of the fore and hind feet. The most striking difference is how they articulate allowing for different degrees of movement (40 degrees fore, 95 degrees aft) indicating that the hind foot was more flexible than the front foot. This differing flexibility allowed me to identify the fore and hind toes, and to get a more accurate MNI count (minimum number of individuals) than previously possible from teeth and/or other elements. To date, we can be certain now that at least six individuals of *P. texanus* fell into the sinkhole that is now Thomas Farm.

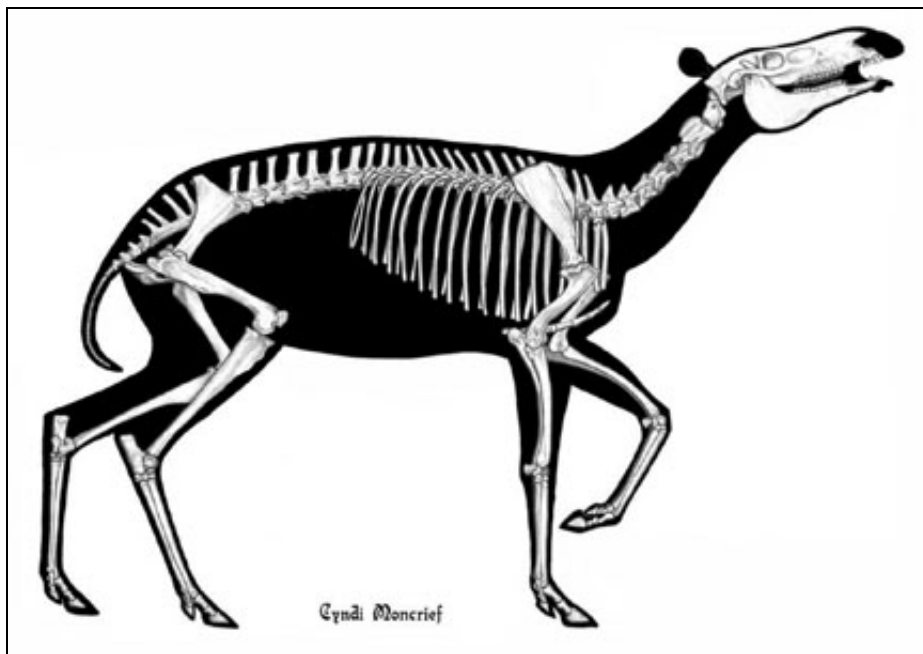
Brian Beatty, Collections Assistant

"Toeing the Line"

Until recently, an accurate illustration of the fossil three-toed dwarf horse *Archaeohippus blackbergi* would have been difficult due to the lack of a complete skeleton from which to model. Then, in 1998, a composite fossil skeleton of an adult male *Archaeohippus* was reconstructed by Steve and Sue Hutchens of Oldtown, Florida, and is now on display at the Florida Museum of Natural History. This is the first and only fully articulated skeleton of this species in the world.

This significant event warrants an illustration to bring this rare little fossil horse to life for all to see. Having a background in scientific illustration and zoology, I was inspired to undertake the project, and to my knowledge this represents the first time an attempt has been made to portray *Archaeohippus*. Much information was needed for an accurate depiction, and I began by researching the anatomy, behaviour, and habitat of related species such as horses, zebras, donkeys, onagers, and tapirs, as well as other ungulates like deer and duikers. Tapirs and duikers were included because their diet and habitat matches those presumed for *Archaeohippus*. The tapirs are also closely related to horses but have toes instead of hooves, while duikers are dwarf antelopes that have a variety of colored and spotted coat patterns.

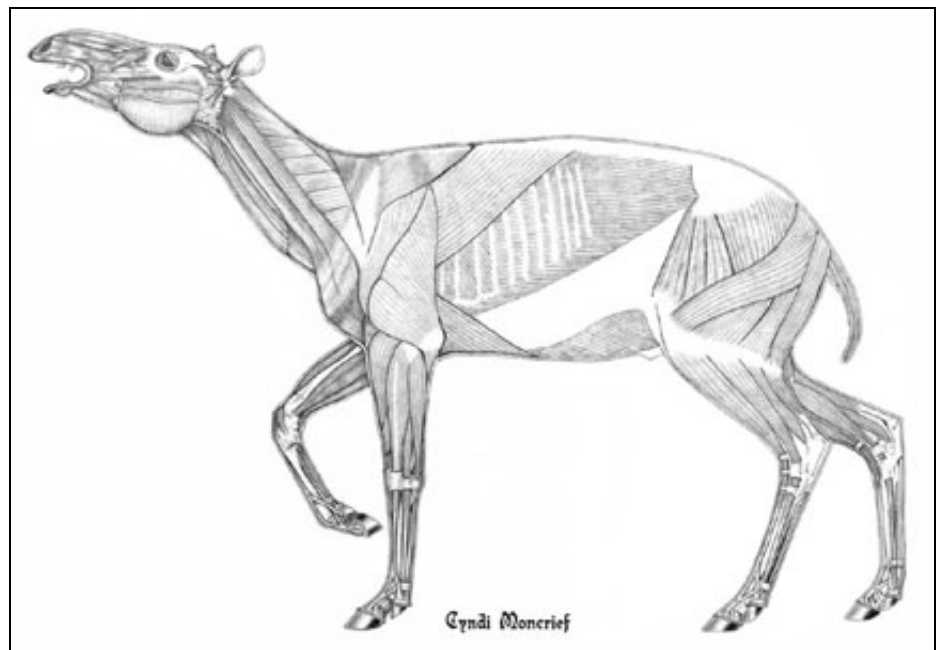
DRAWING THE SKELETON



The project began by taking several photographs of the articulated *Archaeohippus blackbergi* skeleton and then tracing an enlargement of the most suitable one. Double checking the sketch with the skeleton itself verified details not readily apparent in the photos. The illustration of the skeleton was then completed with technical pen and shaded with charcoal pencil.

DETERMINING THE MUSCULATURE

Next was the overlay of the muscle layers. For the areas of the skeleton where the configuration of the horse, tapir, and *Archaeohippus* were similar and also if the corresponding musculature of the horse and tapir were identical, the muscles were illustrated similarly on the *Archaeohippus*. As would be expected, most large body muscles remained essentially identical in form and function to those of the horse. However, some differences were found in areas of the skull, the spinal column, the abdomen, and the lower limbs.



The *Archaeohippus* skull as reconstructed displays a combination of features thought to indicate the presence of a long mobile upper lip similar to that of the tapir. These features include a moderate gap between the nasal bone and the maxilla, and a marked facial depression in the cheek region called the dorsal preorbital fossa. Here the nose and lip musculature was applied in a shape intermediate between that of the modern horse and tapir. Such a lip would have been surprisingly agile since even with proportionately smaller upper lips, modern horses are able to untie knots and open doors. Standard mammalian guidelines were used to finish the mouth area and represent the

corners of the mouth ending at the rear of the canine teeth. Small round ears were chosen for the fossil horse, resembling those of the tapir because both species live or are presumed to have lived in a forest environment, where having smaller ears might have been an advantage by being less susceptible to injury or entanglement.

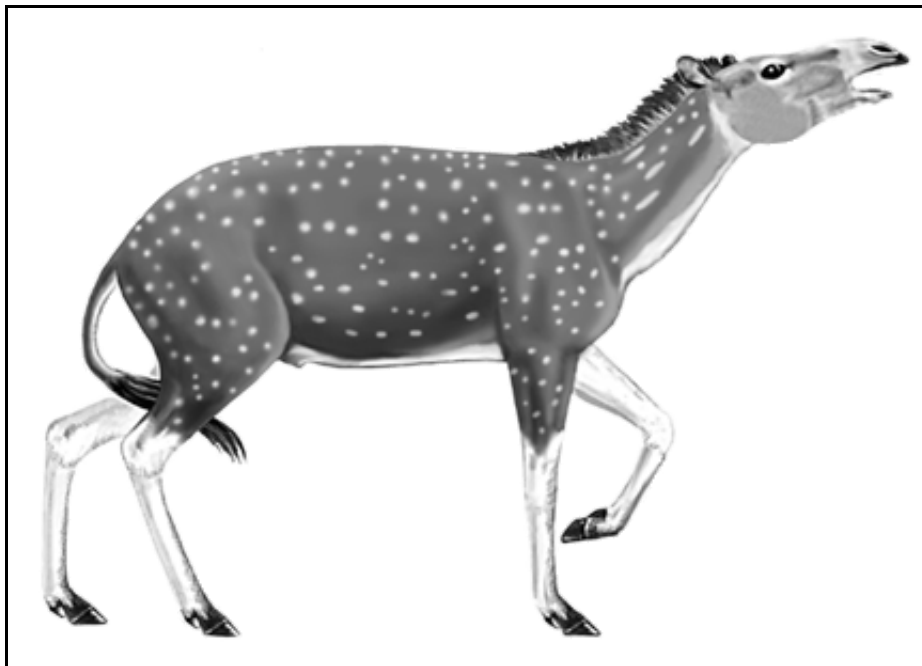
The shape of the neck and shoulders were next constructed by drawing the topline from the withers (the first 7 thoracic vertebrae) to the posterior point of the skull known as the *Crista nuchae* by anatomists or the poll by equestrians. Since *Archaeohippus* had very short neural spines in the withers area, this probably gave the top of the shoulders and back a flat look that is typical of zebras, donkeys, onagers, deer, tapirs, and duikers.

The abdomen and belly shape was approximated by the usual method of drawing a line between the ischium of the pelvis and the xiphoid process of the sternum. This resulted in a lean abdomen and a lightly built (gracile) look for the fossil horse. But, was this the true outline? In contrast, modern equids frequently have a rounded abdomen - the so-called "haybelly" resulting from digesting large quantities of poor quality fodder such as grasses. However, with the slight build of *Archaeohippus* and the probability of its richer diet of leaves and fruits, I reaffirmed my original approximation of depicting it as a slender creature.

By far the most interesting and difficult area to reconstruct was the distinctive three-toed foot and lower limb musculature. I compared and correlated information gleaned from the literature, including articles on fossil horse digital ligaments, musculature of the tapir, modern horses born with extra toes (atavistic polydactyly), and books on modern horse anatomy. Listing each muscle so investigated would be too tedious for the purposes of this article, so, in summary, the lower limb musculature of *Archaeohippus* is most closely analogous to that of its distant relative the tapir.

DECIDING THE EXTERIOR VIEW

The much-anticipated final overlay drawing came as a pleasant surprise. I was expecting a small horselike creature, but what took shape instead was a delicate tapirlike animal.



The last stages of deciding the creature's fur texture and color were the most enjoyable as well as the most hypothetical. *Archaeohippus* was supposedly a forest creature that lived in a warm or temperate climate where it would not have needed long hair, so it is represented here with a short pelt. Next, what color(s) might it have been? I chose a medium brown coat with lighter underbelly tones because it is a basic mammalian color pattern and one still seen frequently in horses, donkeys, and even some zebras (the quagga and

Chapman's zebra). Even more interestingly, *Archaeohippus* might also have been brightly spotted or striped like forest creatures of today such as deer, duikers, and tapirs. *Hyracotherium* (formerly known as *Eohippus*, the "dawn horse"), the tiny forest-dwelling ancestor of both tapirs and horses,

is frequently depicted as spotted like a deer. If we also consider that *Hyracotherium*'s modern descendants the horse, donkey, onager, zebra, and , more distantly, the tapir still exhibit various degrees of striped and spotted coats, it is reasonable to speculate that such coloration also could have existed in other intermediate descendants, such as the extinct *Archaeohippus*.

Last but certainly not least, a mane and tail was added. For the mane, I chose a so-called "primitive" type - a short, stiff, upright mane - like those of modern Przewalski horse, Fjord pony, zebra, donkey, onager, and even some tapir species. One could, of course, postulate a beautiful long flowing mane for *Archaeohippus*, but I suspect it would have been a hindrance when galloping madly through the forest escaping predators. For the tail, I reviewed the fact that all non-horse equids today (zebras, donkeys and onagers) have an incompletely haired "brush" tail, where the hair forms in a short cluster only near the very end of the tail. This also is regarded as a primitive or ancestral feature in equids. The "brush" tail likewise would have been more advantageous in the forest than the long tangling tail hairs of a modern horse.

All told, the process of recreating the look of a hitherto undepicted fossil horse was immensely satisfying as well as instructional. Every decision made about depicting the *Archaeohippus* seemed to raise another two questions about how it lived. Hopefully in the future paleontologists will uncover more fossils [editor's note: *and more studies will be conducted (like the one currently in progress by PhD. Student Jay O'Sullivan)*] that will give us a more complete picture of the life and times of this endearing 3-toed dwarf horse.

Cyndi Moncrief, Biological Scientist

New Florida Oreodont

Oreodonts, an extinct group of even-hoofed mammals were very common in the western United States 35 to 20 million years ago (late Eocene through early Miocene). Some of the first fossils collected out west during the 1850's were oreodonts. Around the Big Badlands of South Dakota and adjacent Nebraska, extensive "Oreodon" beds are replete with these mammals. Oreodon fossils are conserved and exhibited in many U. S. natural history museums. Consisting of an overall diversity of about 50 species, oreodonts were mostly small dog to large pig sized and were herbivores, feeding on mostly leafy vegetation. The arrangement of the toes in their feet indicate that oreodonts are artiodactyl mammals related to pigs, hippos, sheep, cows, and deer. Despite the fact that oreodonts were very common out west, they are exceedingly rare in Florida. Prior to 1990, our entire knowledge of Florida oreodonts consisted of only a handful of teeth and bone fragments from a few sites, including Thomas Farm. Then, an extraordinary locality was discovered in northern Florida that has since yielded a fantastic collection of fossilized skulls, jaws, and limb bones of a single ancient oreodont population. This locality is still under excavation by FLMNH paleontologists.

This new collection of Florida oreodont is currently under study by Bruce MacFadden and Gary S. Morgan, vertebrate paleontology curator at the New Mexico Museum of Natural History. After comparison with other oreodonts from all around the U. S., MacFadden and Morgan have determined that this Florida oreodont represents a new species of



Florida oreodont, Mesoreodon new sp. currently in the Skeletons in our Closet exhibit at FLMNH's exhibition center Powell Hall. Jeff Gage photo

Mesoreodon that lived about 25 million years ago. The genus *Mesoreodon* is otherwise best known from late Oligocene and early Miocene localities in South Dakota and Nebraska (near localities visited during our Western Fossil Dig). It lived alongside a few different species of camels, horses, rodents, and bats, all natives to ancient Florida. Taken together, the various bones, skulls, and jaws of Florida *Mesoreodon* were sufficient to reconstruct a "composite" (i.e., taken from several individuals) skeleton for exhibition in Powell Hall. It is currently

on display in the FLMNH *Skeletons in Our Closet* temporary exhibit. We thank Steve and Sue Hutchens for their excellent work reconstructing this skeleton.

Bruce J. MacFadden

For further reading

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Skeletons in Our Closet: The treasures of a museum

After Powell Hall opened in 1998, and the fossil exhibits were dismantled in the old building (Dickinson Hall), we had a large "inventory" of fossil



skeletons, jaws, and related specimens that were placed in storage. These vertebrate skeletons will ultimately find a permanent home in the Hall of Florida Fossils, currently scheduled to open in late 2001. However, until that time, we want our visitors to be able to see these specimens, so we created the temporary (2-year) exhibit "*Skeletons in Our Closet*," which

highlights these treasures. Mounted skeletons are very popular with the public--they bring to life long-extinct beasts. They also are very expensive to build--some cost more than \$100,000--just for the life-like skeletal reconstruction of the bones. Fossil skeletons are thus recycled when exhibits are renovated and remain as permanent icons of most natural history museums. (Although recently refurbished, many of the dinosaur skeletons at the American Museum of Natural History in New York were originally reconstructed in the late 1800s.)

Rather than keep our skeletons "behind-the-scenes," we decided to gather these mounts into an exhibit that teaches the visitor about vertebrates. Vertebrates are united by common features such as bilateral (left-right, mirror-like) symmetry, highly developed brains, vertebral column, and most have jaws and paired (fore and hind) limbs. *Skeletons in Our Closet*, which opened in mid 1999, tells the story of 500 million years of vertebrate evolution and adaptation. It shows how fish, amphibians, reptiles, birds, and mammals have evolved diverse body forms and adaptations. *Skeletons* is divided into four thematic units: (1) the study of bones (osteology) and how they fossilize; (2) evolutionary principles represented by vertebrates; (3) feeding adaptations--herbivory, omnivory, and carnivory; and (4) locomotion--how vertebrates move. The walls in the gallery are about 25 feet high, so we painted silhouettes of *Tyrannosaurus rex* (see photo) and extinct Great White Shark to give the visitor an appreciation of some of the larger vertebrates that have existed in the past. The skeletons on exhibit include a modern llama, the extinct Irish Elk (*Megaloceras*), two Miocene horses from Thomas Farm (*Parahippus* and *Archaeohippus*) and one from Leisey Shell Pit (*Equus*), the Miocene rhino (*Teleoceras*), a giant ground sloth (*Thinobadistes*), a tiny Florida deer (*Pseudoceras*), the new oreodont (see other article in this issue), the false-saber-toothed carnivore (*Barbourofelis*), sirenian (*Metaxytherium*, a manatee relative), and gavial (*Gavialosuchus*, related to crocodiles and alligators).

We also are using *Skeletons* to highlight recent paleontological fieldwork. For example, a growth series of the Oligocene tortoise *Stylomys* and skull of the "pig" *Archaeotherium*, collected during recent *Pony Express* western trips, are on exhibit. We are also pleased to have a beautiful skull of the Oligocene thunder-beast *Brontops*, also from western Nebraska, that was loaned for this exhibit by Steve and Sue

Hutchens. People visit museums to see "the real stuff." Skeletons are the real stuff. Once the Hall of Florida Fossils opens in 2001, *Skeletons* will have fulfilled its mission and these treasures will be moved into the new permanent exhibit for our future visitors to enjoy.

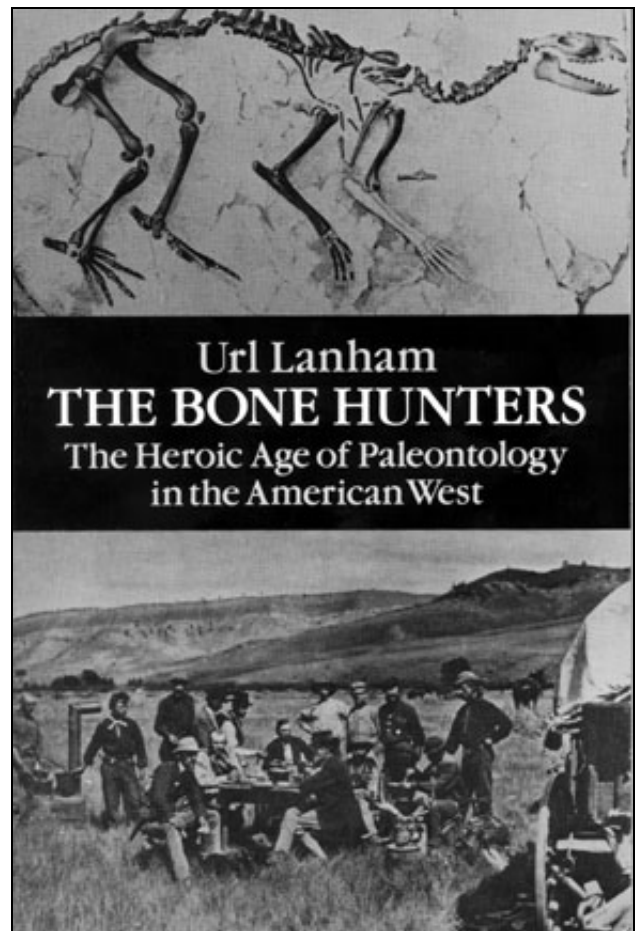
Bruce J. MacFadden



Book Review

The Bone Hunters: The Heroic Age of Paleontology in the American West

The Bone Hunters: The Heroic Age of Paleontology in the American West, by Url Lanham, 1973, New York, Dover paperback (reprinted, originally published by Columbia University Press), 285 pp., \$10.25 retail. Available at amazon.com and alibris.com. (Prices vary slightly). The middle of the 19th century was an important time for vertebrate fossil discoveries from the western U. S. Lanham's book, written for the lay-person, is a highly readable and accurate account of the early expeditions, personalities, and discoveries of dinosaurs, and fossil mammals out west. This book contains 20 chapters, and chronicles such topics as the U. S. President (Jefferson) with an avocation for paleontology, the "Dawn Horse," as well as the infamous Cope-Marsh feuds. It also talks about the importance of the High Plains Badlands in an understanding of Oligocene fossil mammals, including the kinds of fossils that we collect on the western trip. Many historically important photographs enhance the attractiveness of this book. My tattered copy of *The Bone Hunters*, originally published in hardcover, attests to its importance as a well-used reference book in my library. I have read it several times, cover to-cover, over the past 27 years. I was delighted to learn that this wonderful history had been reprinted, and at a price that makes it very affordable to everyone interested in the beginning of the science of paleontology in North America. I recommend it highly as an addition to your library or as a gift for fossil enthusiasts.



Pony Express

Florida Fossil Horse Newsletter
Volume 9, Number 1
1stHalf 2000
ISSN# 1065-285X; Indexed in the Zoological Record

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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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