

Millennium's End Quarry

Ancient River Reveals Ancient Wildlife

By Bob Grier

An ancient river that once flowed along what is now the Wildcat Ridge south of Gering is giving up its secrets to paleontologists from the University of Nebraska State Museum. Fossilized bones of 46 species that lived 23 million years ago, including several new species, have been recovered. This fossil deposit is one of North America's most diverse and significant discoveries of early Miocene mammals.

Finding important fossil specimens usually takes hours of patient, tedious scraping and digging with trowels, ice picks and small paint brushes – the tools of the paleontologist. But in 1999, a

23-million-year-old fossil found Bruce Bailey, a paleontologist for the University of Nebraska State Museum's Highway Salvage Paleontology Program. At a highway construction site south of Gering, Bailey was walking behind a D-9 caterpillar pulling claw-like, steel teeth and tearing open the rocky soil. He was startled when a fossil snapping turtle tumbled down a bank and landed in the soft dirt at his feet.

"It was just lying there, both the upper and lower shells were complete. I put a plaster jacket on it for protection, but it was in great shape, a beautiful fossil from millions of years ago," Bailey recalled.

Finding the fossil turtle was one of many exciting moments Bailey has had at the site. Working there since the late-1990s, he and other paleontologists have uncovered a world-class fossil deposit located in the highway right-of-way at the Wildcat Hills State Recreation Area.

Because the importance of these discoveries first became apparent in 1999, Bailey named the fossil deposit

Millennium's End Quarry. Mammal fossils recovered so far include small moles, shrews, peccaries and rhinos, as well as horses and hippo-like creatures. One of the quarry's prize fossils is a rare jaw from the powerful Miocene carnivore, *Ysengrinia*, a type of beardog. Fossils of 24 species of small mammals and 22 large mammals, including seven different carnivores ranging from tiny weasels to the wolf-size beardog, have been found. Several fossils new to science, including a genus and species of beaver and a gopher species, have been recovered.

The first hint that important fossils were buried by this ancient river occurred in 1968 when former highway salvage paleontologist King Arthur Richey discovered several vertebrate fossil specimens weathering out from nearly vertical road cuts made when Nebraska Highway 71 was realigned through the Wildcat Hills. On the stretch of highway that makes a scenic descent from the Wildcat Hills into the North Platte River Valley, Richey found the fossils at two distinct levels along what he called the "Wildcat Grade."

From the same area where Richey made his discoveries, Bailey and Robert M. Hunt, Jr., a paleontologist with the University of Nebraska State Museum, later collected several partial skeletons of the sheep-like oreodont, *Merychys*, which is considered an index fossil of early Miocene deposits in the Great Plains. They designated the Wildcat Grade a paleontologically sensitive area. For more than 40 years, the state museum and the Nebraska Department of Roads (NDOR) have cooperated to salvage fossils from sensitive areas where highways are constructed.

In the late 1990s, the roads

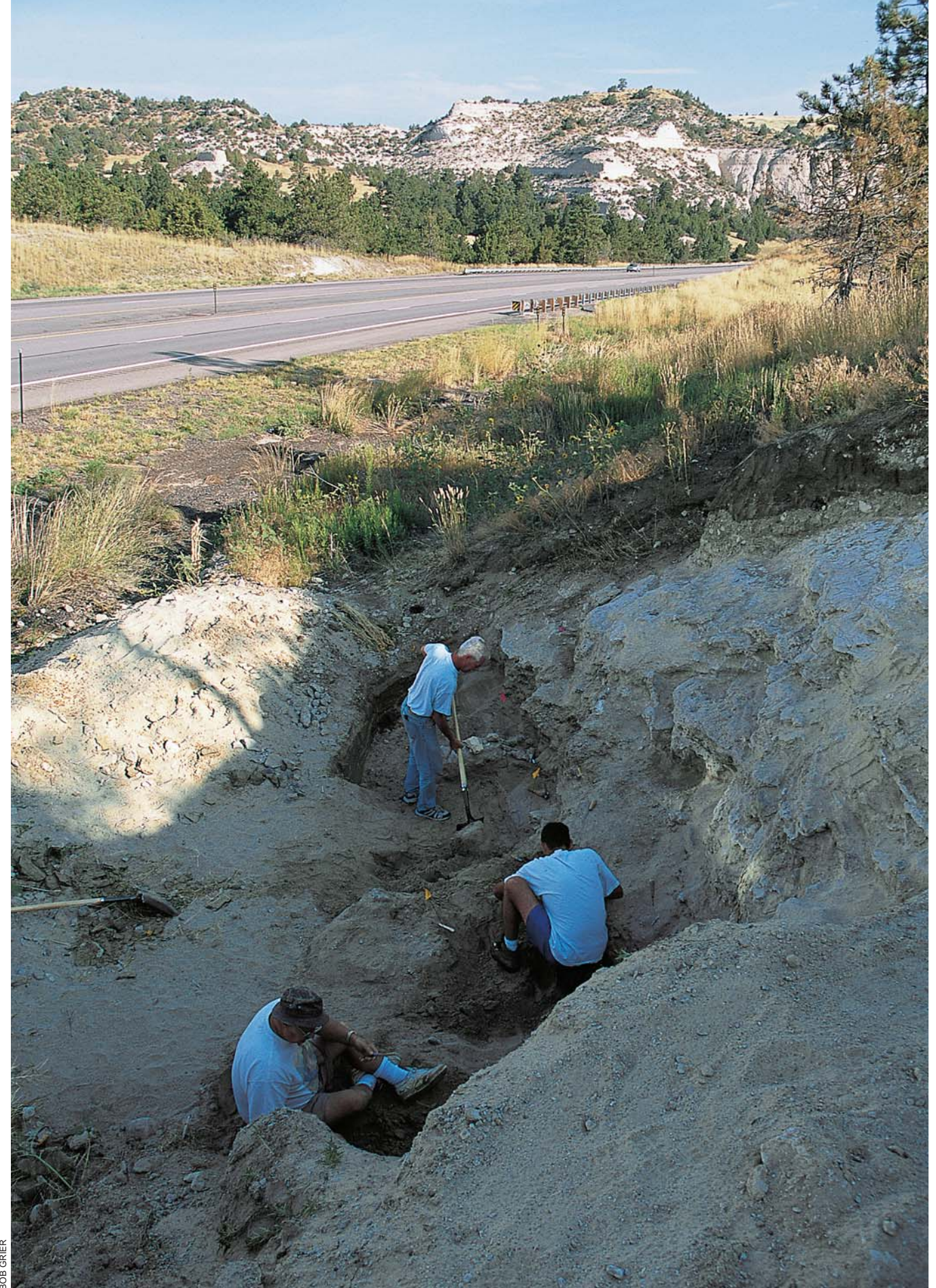


Millennium's End Quarry is located in the Nebraska Highway 71 right-of-way at Wildcat Hills State Recreation Area 10 miles south of Gering. Many of the fossils found at the quarry are displayed in the recreation area's Nature Center.



The upper shell of the snapping turtle fossil measured 8.5 inches.

BRUCE BAILEY



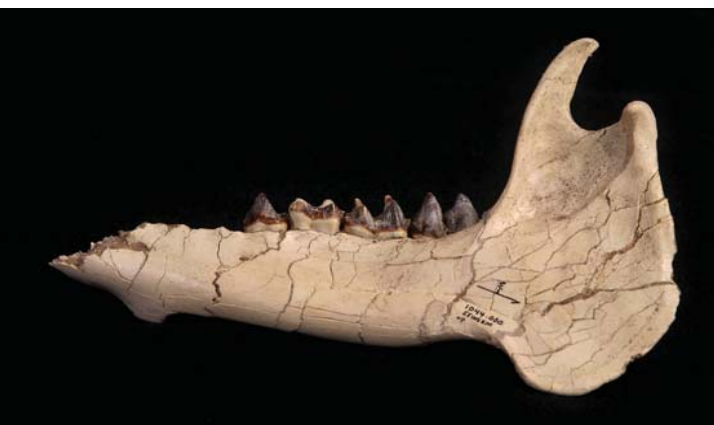
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Bruce Bailey (top), Shane Tucker (center) and volunteer Ray Boice of Gering work in the northern end of Millennium's End Quarry adjacent to Nebraska Highway 71.



Associated hind limb fossils of the hippo-like anthracothere, *Arretotherium fricki*, in a 28-inch block.

GREGORY W. BROWN



This left lower jaw of a young, adult, female *Arretotherium fricki* measures eight inches long.

DOUG CARROLL



The right, lower jaw of the powerful bearded dog, *Ysengrinia americana*, is 6.5 inches long.

DOUG CARROLL



This is the skull, measuring 3.5 inches long, and right, lower jaw of a new genus and species of round-incised beaver.

DOUG CARROLL

department notified the museum it planned to widen Nebraska Highway 71, a segment of the Heartland Expressway that links Interstate 80 at Kimball to Interstate 90 at Rapid City, South Dakota. Advance notice allowed Bailey and Heidi Mead, then the museum's salvage preparator, to collect fossils before construction. NDOR opened a small test pit for exploration and Bailey and Mead screened and sorted nearly a ton of gravel for microvertebrate fossils. They found 16 species of insectivores, rabbits, and rodents, including the new gopher species. A bonus discovery was a complete, articulated skeleton of the small deer *Barbouromeryx*, which was named for Erwin Hinckley Barbour, a founder of the state museum. That find is probably a new species as well as the earliest occurrence of the group in North America. They named the large and small mammal assemblage the Stage Hill local fauna, for its location within the Wildcat Hills.

Some of the site's earlier fossil bones, such as the oreodont *Merychys*, were long-ranging species that gave the scientists a rough estimate of the deposit's age, but the small mammal discoveries narrowed the age range to approximately 23 million years ago.

Significant Discoveries

"We look forward to a project of this sort with great anticipation," Bailey said. "You might think heavy equipment and fragile fossils are a combination to be avoided. Quite the contrary. Heavy equipment is the best way to remove tons of rock and reach the fossil treasures hidden beneath. I would often dream of discovering complete, articulated skeletons within the upper channel sandstones."

Road construction began during the spring of 1999. Bailey recalled, "By mid-July the mechanical earth-moving monsters had transformed once familiar surroundings into a Martian landscape of bare rock and dust. Under these conditions the paleontologist resorts to walking the rubble wakes of D-9 ripper-cats, scrambling to carry sandstone blocks containing bones out of harm's way. In this fashion two of the prized big-game animals of the early Miocene were discovered: The extremely rare four-horned deer *Syndyceras* and *Miotapirus*, a tapir similar to modern forms found exclusively in tropical rain forests."

That July the upper channel of the ancient river disappeared quickly and the paleontologists put their salvage operations on hold until excavation reached the river's lower channel.

It was three weeks later, after the dirt crews moved their equipment into the area of the lower channel, when the fossilized turtle tumbled in front of Bailey. At that time, he had noticed large, granite pebbles in the bottom of the channel – the first indication that a through-flowing river with its headwaters in the Rockies, 100 miles to the west, had deposited the sediments. The next day the earthmovers began to uncover the lower channel and Bailey first saw the significance of the site. His most optimistic dreams were exceeded when numerous, significant discoveries were made during the first hours and days of excavation.

"As the fleet of a dozen scrapers neared grade to the north, they uncovered a veritable treasure trove of fossil bones," Bailey wrote in an article in *Roadrunner* (April/May 2001), a NDOR publication. "Platte Valley Construction Superintendent Dennis Giesman instructed his crews to work around this area while we resorted to more conventional tools of the trade – namely shovels, trowels and paint brushes. During the next month, the entire bone



BRUCE BAILEY

In 1999 bulldozers and scrapers remove the ancient river's upper channel deposits (foreground) at the Wildcat Grade during the widening of Nebraska Highway 71. In the background excavators are nearing the lower channel.

bed was excavated from the median to the back slope with phenomenal results – more than 160 specimens were collected, a third of which were skulls or jaws!"

Bailey recalled, "The discovery was beyond my wildest dreams – a deposit loaded with the tell-tale gravel of a

perennial river and the bones of fossil mammals; the mother lode, just a little deeper than I had hoped to find it."

The Ancient River

As a University of Nebraska-Lincoln graduate student in the 1970s, geologist



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Shane Tucker draws a map showing the positions of the plaster-jacketed anthracothere bones along the base of the ancient river's south channel wall.

Carl Vondra mapped river gravel and sand deposits along the Wildcat Ridge where pioneering geologist Nelson Horatio Darton had photographed spectacular gravel outcrops in 1899. Bailey colored Vondra's geologic map, marking coarse gravel deposits of the main channel gray and fine-grained sandstones of the ancient valley fill tan. The colored-coded map clearly showed the river's course along the spine of the Wildcat Hills escarpment that extends from Wyoming into Nebraska south of the North Platte River Valley. Following this map in the fall of 1999, Bailey traced the river's cemented conglomerates west of Nebraska Highway 71 and east as far as Wright's Gap, where gravel beds that cap Big Haystack Mountain indicated the main channel was more than 20 feet deep during high water.

Bailey described the ancient river: "About 23 million years ago a swift-flowing river carved a canyon over 200 feet deep and over a mile wide, east out of the uplifted Rocky Mountains and onto the loess (wind-blown silt) plains of western Nebraska. Geologists call this type of



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Laterally accreted gravel caps Big Haystack Mountain in Wright's Gap. The thickness of these deposits indicate a channel depth of more than 20 feet. David Fisher of Melbeta stands on the edge to provide scale to the photograph.

river entrenched because it cuts a deep, narrow, canyon through compacted rocks that confine the flow of water. In contrast to today's slow-moving, shallow North Platte River, the rock deposits left by the ancient Wildcat Hills river indicate a deep, narrow channel of swift-flowing water. A modern analogue would be the reach of the Niobrara River between Gordon and Merriman, where the modern river has cut a narrow, meandering canyon up to 200 feet deep. The ancient river was an energetic system that became a raging torrent and physical barrier to animal migration during flood events."

Bailey explained why so many animals were buried at the Millennium's End site: "The river undercut the steep canyon wall causing a bank collapse and introducing large boulders, one the size of a Volkswagen, into the channel. This diverted the high-energy flow, allowing the deposition of fine gravel, sand, and silt which formed a point bar on the inside bend of the river and quickly buried and protected fragile bones. At no other locality we have visited along this watercourse have we

encountered similar conditions, which are necessary to produce fossil bone beds. The high diversity of the riparian (stream-side) mammal community is due to the river being the principal source of water in the region 23 million years ago, which attracted the great variety of wildlife buried in the deposit.

"The ancient river cut almost completely through the lower part of the Arikaree Group into the salmon-colored sediments of the Gering Formation, which contain distinctive, white pumice fragments blown out of a volcano in northeastern Colorado called Specimen Mountain and washed into western Nebraska."

In the millions of years since river sediments and bones were deposited, the Rocky Mountains and adjacent plains to the east have been uplifted on several occasions and then eroded by river systems.

For several million years, the modern North Platte River has carved the local landscape into a maze of canyons and outlying buttes. The sediments of the ancient Wildcat Hills river have been preserved along the spine of the ridge

more than 500 feet above the modern river.

Jungle Fauna With Beardogs

In the state museum's newsletter, *Mammoth*, Bailey noted that 16 different large mammals have been discovered in the Millennium's End Quarry, including herbivores such as the giant, clawed chalicothere, three varieties of three-toed horses, tapirs, rhinos, two camels, peccaries, and three kinds of deer, as well as seven species of carnivores that fed upon them. Most of the herbivores were low-crowned browsers, what legendary Nebraska paleontologist Morris Skinner would have called "jungle fauna." The only high-crowned grazing herbivore of the time, the slender camel *Stenomylus*, has not been found in this deposit, probably because it preferred open grasslands far from the forested river valley.

Monte Wegelin, a NDOR employee who often volunteered to help Bailey, discovered the fossilized jaw of the beardog, *Ysengrinia*. This wolf-size species had replaced the large cats of

the Oligocene, which had become extinct, and became the dominant carnivore in the Miocene landscape. The beardog's jaw, one of the quarry's prize fossils, is on display at the Wildcat Hills Nature Center.

The abundance of petrified wood and the discovery of a new genus of round-incisored beaver kindled another line of speculation for Bailey: "It is a new kind of beaver found in North America for the first time. They are more closely related to the modern line of wood-chewing beavers than contemporary burrowing beavers, such as the flat-incisored *Paleocastor*, which was responsible for the well-known "devil's corkscrew" (*Daemonelix*) burrows. This beaver may have been acting like the modern Castor, cutting down trees and damming watercourses. Of course we won't know that for certain until petrified wood with gnaw marks is discovered."

Compared to Agate Fossil Beds National Monument, a similar-age deposit located about 40 miles to the northwest, Millennium's End Quarry has yielded a greater diversity of mammal species. The most common fossils at Agate are rhino bones. Only two rhino specimens have been found at Millennium's End.

Located close to Highway 71's northbound lanes, the Millennium's End Quarry continues to be a working

paleontological site through the courtesy of the roads department and with security provided by the Nebraska State Patrol. Over the past five years, Bailey and Shane Tucker, the current salvage preparator, have worked river sediments across the main channel complex, which is 30 feet wide and 20 feet deep. During the past two years, they have recovered six perfect skulls and dozens of lower jaws from forms, such as *Zodiolestes*, a weasel, *Pseudoblastomeryx*, a small saber-deer, and *Archaeohippus*, the collie-sized three-toed horse whose skull has beardog-size puncture wounds.

To date, workers have collected and carefully mapped more than 500 large-mammal bones and well over a thousand identifiable small-mammal specimens, representing the 46 known species. Over a third of the fossils represent partial to complete skulls or lower jaws. Few are articulated skeletons. Many of the species are extremely rare, some are new to science, and some are seen in North America for the first time. The Stage Hill assemblage of mammals is North America's most diverse, single-site, Early Miocene fauna.

Paleontology Corridor

Regional planners have proposed adding this paleontology discovery site to others, including Agate Fossil Beds,

Visitors are invited view the paleontology and wildlife displays at the Wildcat Hills SRA Nature Center from 8 a.m. to 4:30 p.m. daily from April through September and on weekdays from October through March. A Nebraska Park Entry Permit is required.

The 761-acre Wildcat Hills SRA and Big Game Reserve is located 10 miles south of Gering on Nebraska Highway 71. Wildlife in the area include bighorn sheep, elk, deer and wild turkeys.

For more information about Wildcat Hills SRA and its facilities, call (308) 436-3777, or go online to www.outdoornebraska.org.

Collection of vertebrate fossils within the Wildcat Hills State Recreation Area is prohibited. Any fossils discovered should be reported to the Nature Center. For more information about Millennium's End Quarry fossils and other fossil sites in Nebraska, go the University of Nebraska State Museum web site at www.museum.unl.edu.

Toadstool Geologic Park and the Mammoth site at Hot Springs, South Dakota, in promoting a "Paleontology Corridor" roughly paralleling the Heartland Expressway. A fund-raising effort, primarily by the Oregon Trail Foundation in western Nebraska, is underway to create artwork depicting the ancient river's landscape and wildlife and to build displays at the Wildcat Hills Nature Center.

Bailey said, "The site has tremendous potential for educating students of all ages. We are pursuing several avenues to tell the story, including keeping a working quarry open for trained volunteers and graduate student research projects to learn more about the deposit itself. This could be coupled with a new, geologic and paleontologic interpretive trail from the nature center to the quarry. Additional fossil displays are planned to supplement the striking specimens currently on display in the lower level of the nature center. In addition, we are contracting Mark Marcuson to paint a mural of the early Miocene landscape, reconstructing a number of the animals we have found for the first time." ■



BOB GRIER

The Wildcat Hills SRA Nature Center has exhibits about the flora and fauna of the area and displays some fossils from the Millennium's End Quarry.