Three-toed Horse

Badlands National Park

THREE-TOED HORSE

SCIENTIFIC NAME: *Mesohippus*
WHEN IT LIVED: Eocene and Oligocene Epochs
MODERN RELATIVES: Horse
SIZE: 2 feet (0.6 m) tall and 4 feet (1.2 m) long
LIFESTYLE: Herbivore (browser)

NATURAL HISTORY: This tiny early horse was a browser, not a grazer like modern horses. As horses changed through time, or evolved, their teeth became larger and stronger. Another difference is that *Mesohippus* had three toes, and not one toe (hoof) like modern horses. A horse that lived even earlier than *Mesohippus*, called *Hyracotherium*, had five toes. As horses gained speed, the number of toes decreased. Maybe earlier relatives of the horse went extinct because they could not run fast enough or grind enough grass to eat.

Carnivorous Mammal (Dog-like)

Badlands National Park

CARNIVOROUS MAMMAL (DOG-LIKE)

SCIENTIFIC NAME: *Hyaenodon* is one genus in the order Creodonta.
WHEN IT LIVED: Eocene and Oligocene Epochs
MODERN RELATIVES: None. Modern carnivores (e.g., dogs and cats) would have the most similar adaptations.
SIZE: One species was the size of a modern day German shepherd and the other species was about the size of a lion.
LIFESTYLE: Carnivore (predator and scavenger)

NATURAL HISTORY: Creodonts were primitive carnivorous mammals with powerful bone crushing jaws. They may have hunted prey like hyenas do today, but they are not related to hyenas. They went extinct in the Miocene Epoch in Asia and Africa.

Saber-toothed Cat

Badlands National Park

SABER-TOOTHED CAT

SCIENTIFIC NAME: *Hoplophoneus*
WHEN IT LIVED: Eocene and Oligocene Epochs
MODERN RELATIVES: None. They are *not* related to modern cats.
SIZE: 3.5 feet (1 m) long
LIFESTYLE: Carnivore (predator)

NATURAL HISTORY: *Hoplophoneus* once roamed through the open woodlands of the Eocene and Oligocene Epochs. Although they resemble cats and had retractable claws, they were not really cats. These creatures are famous for their knife-like canines, which may have been used for stabbing prey or to scare away enemies and show dominance.

Big Pig

Badlands National Park

BIG PIG

SCIENTIFIC NAME: *Archaeotherium*
WHEN IT LIVED: Eocene and Oligocene Epochs
MODERN RELATIVES: None. They are not related to pigs.
SIZE: 4 feet (1.2 m) tall at the shoulder and 5 feet (1.5 m) long
LIFESTYLE: Omnivore and carnivore (scavenger)

NATURAL HISTORY: *Archaeotherium* is nicknamed the “big pig;” however, it is not related to pigs. These large beasts scavenged on dead animals and could also eat plants. They preferred to live on floodplains and around rivers.

Tortoise

Badlands National Park

TORTOISE

SCIENTIFIC NAME: *Stylemys*
WHEN IT LIVED: Eocene and Oligocene Epochs
MODERN RELATIVES: Turtles
APPROXIMATE SIZE: 3.5 feet (1 m)
LIFESTYLE: Herbivore

NATURAL HISTORY: Most of the well-known fossils of the Badlands are mammals but not this one! *Stylemys* was a reptile that lived on land, like all tortoises. Paleontologists also find fossils of lizards (another group of reptiles) in the Badlands.

Oreodonts

Badlands National Park

OREODONTS

SCIENTIFIC NAME: *Merycoidodon* and *Leptauchenia* are two examples from the family of oreodonts
WHEN IT LIVED: Eocene and Oligocene Epoch
MODERN RELATIVES: None
SIZE: Different species of oreodonts varied greatly in size. *Merycoidodon* was about the size of a big dog.
LIFESTYLE: Herbivores (browsers and grazers)

NATURAL HISTORY: Oreodonts were a group of ungulates, which means they were hoofed mammals. Undoubtedly, they chewed their cud and had a chambered stomach. They fed on both soft plants and more coarse grasses. They probably lived in herds. They were one of the first families of mammals to survive by eating and digesting grass.

Titanothere

Badlands National Park

TITANOTHERE/BRONTOTHERE

SCIENTIFIC NAME: Brontops
WHEN IT LIVED: Eocene Epoch
MODERN RELATIVES: No close relatives, but in the same group (perissodactyl) as horses, rhinos, and tapirs.
SIZE: 8 feet (2.4 m) tall and 9 feet (2.7 m) long
LIFESTYLE: Herbivore (browser)

NATURAL HISTORY: Titanotheres were one of the dominant animals during the Eocene. They were about the size of a small elephant and had a bony projection that looked like horns just above their nose. From studying the titanothere's low crowned teeth, scientists infer that they ate soft leafy vegetation in a subtropical environment. Brontotheres went extinct at the end of the Eocene Epoch because of climate change. It changed to a much cooler and drier climate and they were not adapted to live in such conditions.

Small Dog

Badlands National Park

SMALL DOG

SCIENTIFIC NAME: *Hesperocyon*
WHEN IT LIVED: Eocene and Oligocene Epochs
MODERN RELATIVES: Dogs
SIZE: 3 feet (0.9 m) long
LIFESTYLE: Carnivore (predator)

NATURAL HISTORY: *Hesperocyon* is one of the earliest known true dogs. It originated in North America and was adapted to hunting in an open woodland environment. It could run on its toes and its teeth slashed prey and crushed bones.

Hornless Rhino

Badlands National Park

HORNLESS RHINO

SCIENTIFIC NAME: *Subhyracodon*
WHEN IT LIVED: Eocene and Oligocene Epochs
MODERN RELATIVES: Rhinoceros
SIZE: 5 feet (1.5 m) long
LIFESTYLE: Herbivore (browser)

NATURAL HISTORY: Unlike other rhinos, these animals did not have horns. These large rhinos lived near streams and had teeth specialized for chewing leaves. They went extinct at the end of the Oligocene Epoch.

Badlands Fossils

Badlands National Park

BADLANDS FOSSILS

Why are there so many fossils in Badlands National Park?

Though fossils are often found in Badlands National Park, they are rare throughout the world. The environmental conditions that deposited the strata (sedimentary layers) here significantly increased the potential for fossilization. When an animal died, say a saber-toothed cat on an ancient floodplain, its body would have decomposed just like animals do today. But if conditions were just right – protecting its remains from decomposition and scavengers – its hard parts such as teeth, jaws, and skull might have become fossils. In the case of Badlands, this was achieved through rapid burial from sediments washing in and covering recently dead animals.

Badlands fossils show how extinct animals interacted in ancient environments. Some left no descendents; some evolved into the mammals of today. By carefully studying fossils associated with each rock formation, paleontologists discover ancient life and observe changes throughout geologic time. They can answer questions: What were the plants and animals like? How and why did things change? What does this indicate about life today?

Eocene Epoch Chadron Formation

Badlands National Park

EOCENE EPOCH CHADRON FORMATION IN BADLANDS NATIONAL PARK

37 to 34 million years ago

The fossils of seemingly strange animals and the sediments from ancient depositional environments help paleontologists piece together a scientific explanation of what life was like during the Eocene Epoch. Rain fell heavily across the land, and icecaps did not cover the poles. The tropics stretched into southern Canada. Dinosaurs had been extinct for 28 million years, and mammals were now the dominant land animal.

The Chadron Formation preserves numerous root casts. When trees die and their roots rot away, an empty space is often left behind. If this void is quickly filled with sediment and hardened, then a fossil cast of the root forms. This fossil cast preserves the shape and size of the root. Scientists who have studied root structures in the Badlands have documented a change in size through time: from large roots in older (lower) rocks to smaller roots towards the top in younger rocks. In general, smaller trees have smaller roots so over time the large trees were being replaced with smaller ones. Because fossils are indicators of past environmental conditions, large trees dying and smaller vegetation becoming dominant generally means less rainfall.

Oligocene Epoch: Brule and Sharps Formations

Badlands National Park

OLIGOCENE EPOCH: BRULE AND SHARPS FORMATIONS IN BADLANDS NATIONAL PARK

34 to 25 million years ago

During the start of the Oligocene Epoch in what is now the Badlands, rivers flowed across wide floodplains that spanned for miles. Animals wandered through forested areas during a warm, mild climate. This early Oligocene environment replaced the lush tropical jungle found during the previous Eocene Epoch.

During the mid-Oligocene the climate shifted. It changed from warm and wet to cooler and drier. Less rain and cooler temperatures caused temperate open woodland to stretch across what is now the Badlands. This woodland replaced the more heavily forested ecosystem found during the beginning of the Oligocene Epoch.

By the end of the Oligocene, the climate was significantly cooler and drier. Grasses spread as trees and shrubs died from lack of water. Some animals evolved adaptations that allowed them to digest this newly abundant source of food—grass. This drying and cooling trend has continued into modern times, giving way to today's mixed-grass prairie.

A couple of geologic events contributed to the changes in climate recorded in the rocks at Badlands. First, movement of the Earth's plates caused India to crash into Asia. That continental change affected the ocean currents. Because of this altered continental configuration, colder ocean currents now flowed around North America. Second, the Rocky Mountains were rising in the middle of North America, which created a "rain shadow" that cut off moist air arriving from the west, resulting in a cooler, drier climate.

Some mammals of the Oligocene may look vaguely familiar because many modern animals descended from these creatures. Early predecessors of rhinoceros, camels, rabbits, rodents, horses, and dogs wandered this emerging grassland.