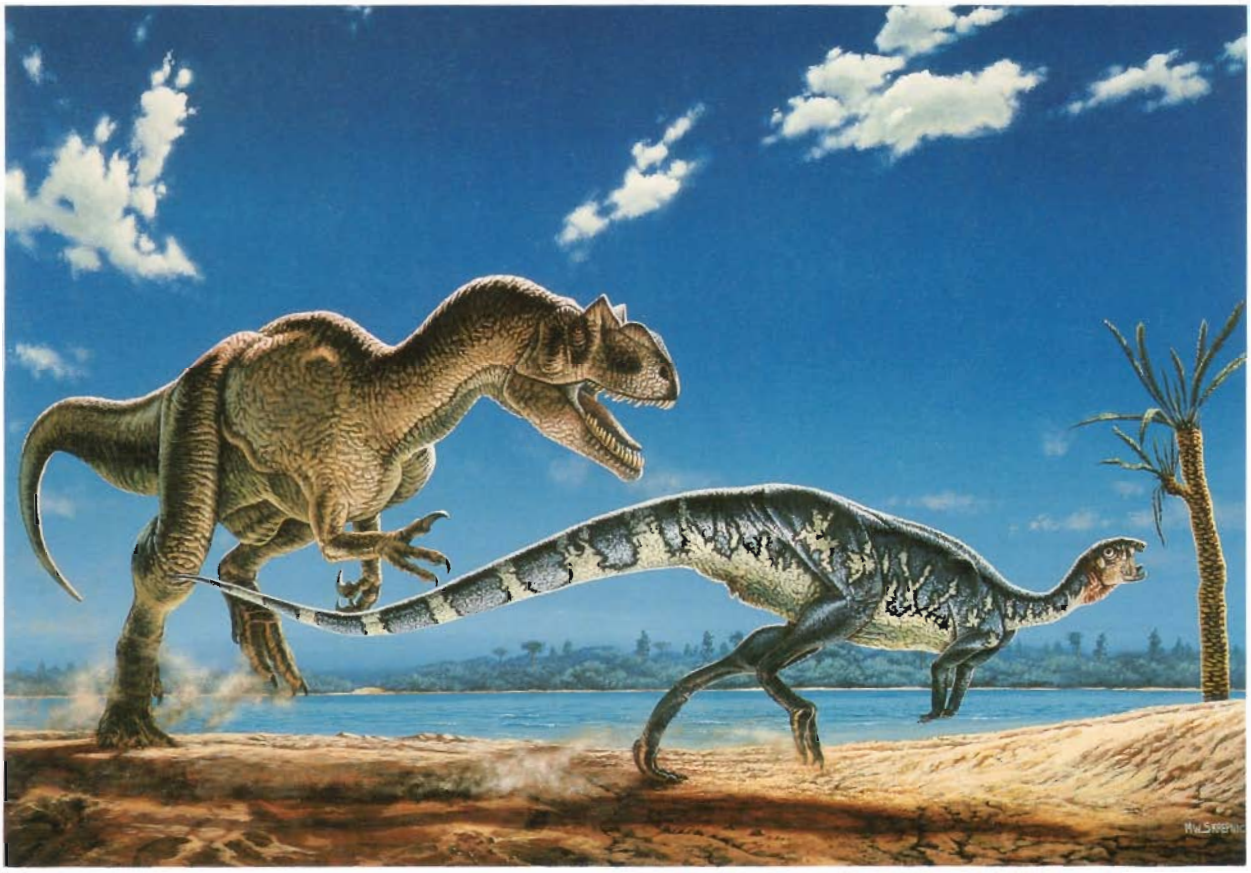
# The Dinosaurs of Marsh and Cope

## the Jurassic dinosaurs of Garden Park



by Kenneth Carpenter

# The Dinosaurs of Marsh and Cope

The Jurassic dinosaurs from Garden Park, Colorado

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with illustrations by Gregory Paul and Mike Skrepnick

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This book is dedicated to all the volunteers and staff at the Schlessman Family Earth Science Laboratory at Denver Museum of Natural History who helped in the field and in the lab over the years. Also to John McMinn, who introduced me to Garden Park in 1964 (teachers do make a difference). Finally, to my parents who took me, as a child, to Garden Park, Dinosaur National Monument and museums to satisfy my interest in dinosaurs (something they never really understood).

## Contents

## Forward

For more than a century, Garden Park has been famous amongst paleontologists and people interested in dinosaurs. It was here in 1877 that the greatest rivals of the American fossil fields initiated their competition for the honor of collecting the most new types of dinosaurs. The frantic retrieval of fossils from Garden Park now seems out of place considering the fossil bones had lain undisturbed for 150 million years. There were more specimens than could be collected by the field parties of E.D. Cope and O.C. Marsh anyway. Over the years, skeletons from this site have become some of the impressive displays at the great natural history museums in Cleveland, Denver, New York, Pittsburgh, and Washington, D.C. And although there have been long periods of time when there were no excavations underway, the rocks at Garden Park have always yielded secrets to each succeeding field party, making this one of the best windows into the world of Jurassic dinosaurs.

The author of the book you are holding is the latest in a prestigious line of expedition leaders to Garden Park. Kenneth Carpenter of the Denver Museum of Natural History represents a new breed of dinosaur hunters who are as concerned about the collection of data and associated specimens as they are about the giant skeletons themselves. It was this difference in approach that led to the discovery of nests of dinosaur eggs at the locality in 1993.

Some dinosaurs that were first reported from Garden Park have appeared at a site in eastern Africa. But even today Garden Park is a palaeontological site of international stature, attracting visitors from around the World. As you look at this gallery of "who's who" among dinosaurs, remember that they all came from a relatively small locality in a quiet corner of Colorado.

Philip J. Currie
Head, Dinosaur Research
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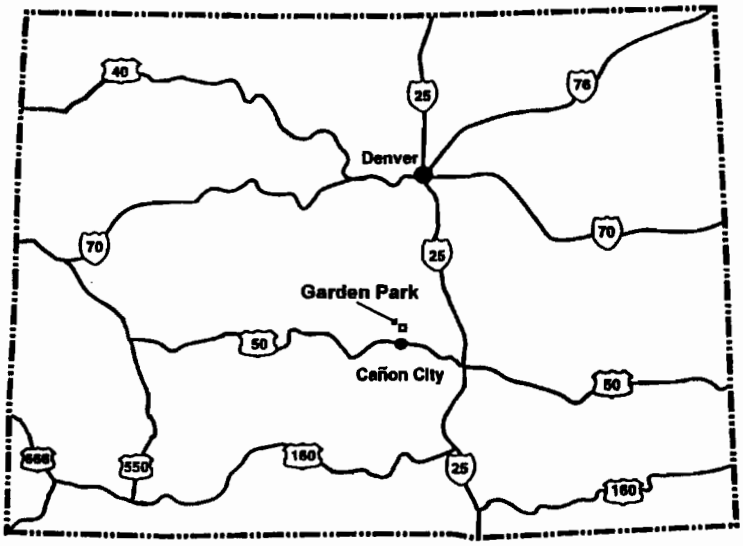
## Preface

This book would not have been possible without the labors of many individuals, living and dead. Much of what we know about dinosaurs from Garden Park is due to the efforts of many individuals who have toiled to extract the bones from the ground. There are the laboratory technicians, called fossil preparators, who have the tedious job of liberating the dinosaur bones from the encasing rock. There are artists who draw the bones for a scientific paper. And finally, there are the paleontologists who identify and describe the bones.

In recent years the Denver Museum of Natural History has begun a detailed study of the Morrison Formation at Garden Park. Volunteers accompanying the staff have had the experience of uncovering their first dinosaur bone and realizing that they were the first person to set eyes on it. They have endured pouring rain, scorching sun, wind, gnats, and mosquitos, just like in the old days. They also have had gourmet meals, trips to the Dairy Queen after a hot day, and showers; something no collectors before them enjoyed. We have had the support of many individuals and organizations in Cañon City including the Bureau of Land Management and the Garden Park Paleontological Society. Their help is greatly appreciated.

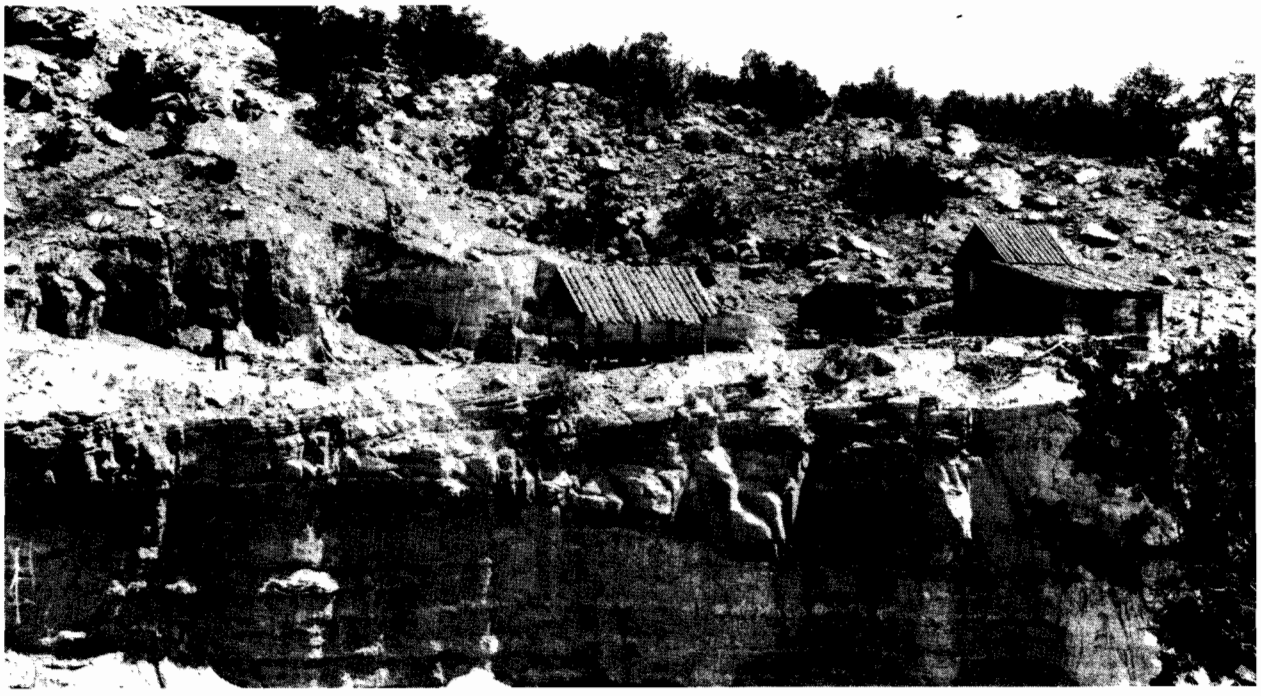
## Introduction




Just north of Cañon City, Colorado, Four Mile Creek winds its way down from the gold mining district of Cripple Creek. For millions of years this and other creeks and rivers have eroded the Rocky Mountains. In doing so, Four Mile Creek exposed the multicolored sedimentary rocks of the Morrison Formation in an area called Garden Park. This area has produced countless dinosaur specimens since they were first found there in 1876. In fact, the dinosaurs from Garden Park played an important role in the "Bone Wars" of the late 1800's.

The "Bone War" was the result of two men, Othniel Charles Marsh of Yale University, New Haven, Connecticut, and Edward Drinker Cope of Philadelphia, Pennsylvania. Both men came from wealthy families and they devoted much of their own (and Government) funds for the collecting and cleaning of dinosaur bones from Garden Park. Initially, the two men had a friendship of sorts based on their shared interest in fossils and their similar social background. Eventually, however, their egos led to conflict and their dislike for one another escalated into accusations of fraud and plagiarism. The result of this feud is that each man sought to name a new fossil species before the other and to

Cope's *Camarasaurus* quarry



Marsh's dinosaur quarry

discredit the work of the other. By the time of the first discoveries of dinosaurs at Cañon City, the feud was well underway.

Unfortunately, in their rush to name new dinosaurs the two men became careless. As we will see, a new species name might be given for fragmentary material or for different parts of a dinosaur already named. Today, such dubious names are not considered valid. A list of valid scientific dinosaur names from the Garden Park dinosaur quarries is given in the Table on the next page.

In 1877, samples of dinosaur bones from Garden Park reached both Marsh and Cope independently. Both men immediately hired workers to begin excavating their sites and send the specimens to them. Soon, tons of fossils began arriving back at the laboratories in New Haven and Philadelphia. Eventually, the fossil quarries were played out or excavation became too difficult. Work came to a stop in Garden Park in 1887.

The Smithsonian Institution acquired a large portion of the Marsh collection from Garden Park in 1899 after Marsh's death. Later, several of these specimens were cleaned of rock and put on display where they may be seen today. The Cope collection was obtained by the

**Table.** The dinosaurs of Garden Park

Theropods (carnivores)
- *Allosaurus fragilis*
- *Ceratosaurus nasicornis*
- *Coelurus agilis*
- *Elaphrosaurus* sp.
- *Torvosaurus* cf. *tanneri*

Sauropods ("brontosaurs")
- *Amphicoelias altus*
- *Amphicoelias fragillimus*
- *Apatosaurus excelsus*
- *Brachiosaurus* sp.
- *Camarasaurus supremus*
- *Diplodocus longus*
- *Haplocanthosaurus delfsi*
- *Haplocanthosaurus priscus*

Ornithopods (bipedal plant eaters)
- *Camptosaurus* sp.
- *Dryosaurus altus*
- *Othnelia rex*
- *Prismatoolithus coloradensis* (eggs)

Stegosaur (plated plant eater)
- *Stegosaurus stenops*
- *Stegosaurus armatus*

Ankylosaur
- *Mymoorapelta*? sp.

American Museum of Natural History in 1902. All of this material remains in the museum's research collection.

After Marsh and Cope halted work in Garden Park, no further work was conducted until 1900 when the Carnegie Museum of Natural History reopened the Marsh Quarry. This quarry is where most of the skeletons were excavated for Marsh. The Carnegie Museum worked the place about a year with only two partial sauropod skeletons found. An attempt was also made to reopen one of Cope's quarries at a place called the Nipple but only a single sauropod vertebra was found.

The next major excavation occurred in late 1915 when Dall DeWeese, a Cañon City "naturalist," found a partial *Diplodocus* skeleton. The Denver Museum of Natural History excavated the specimen the following year. Only the rear portion of a skeleton was found but it became the first dinosaur specimen in the

DeWeese and visitors at his *Diplodocus* excavation

museum's collection.

Many years later, the Denver Museum collected a second dinosaur specimen from Garden Park. This was a Stegosaurus skeleton found by a science teacher and students from the Cañon City High School. The skeleton was chiseled out of a hard sandstone by the Museum and the students in 1937. It was cleaned and mounted for display in 1939.

No further work was done in Garden Park until 1954 when the Cleveland Museum of Natural History began excavating a large sauropod. Excavating conditions were difficult; one plaster jacket of bone was lost during a flash flood in 1955. The skeleton was eventually cleaned and assembled for display in 1961. It remains the only mounted skeleton of the sauropod *Haplocanthosaurus*.

The Denver Museum of Natural History resumed collecting in Garden Park in 1977. A partial skeleton of the sauropod *Camarasaurus* was collected over the span of several years. More recently, the museum has begun a systematic study of the Morrison Formation and its dinosaurs at Garden Park. Already, several important discoveries have been made including several dinosaur skeletons and a dinosaur nesting site. Who knows what wonderful fossils will be uncovered during the next few years?

Denver Museum staff and volunteers excavating a *Stegosaurus*

## THE DINOSAURS

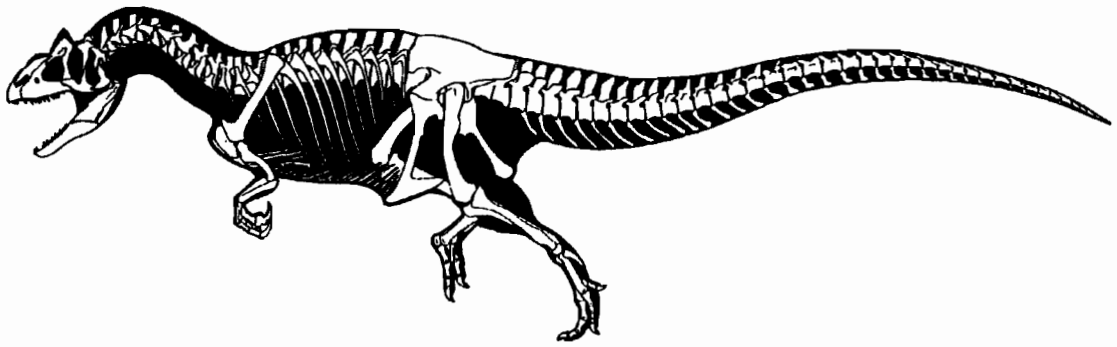
### Carnivores

The most common meat-eater, or theropod, in the Garden Park fossil beds is *Allosaurus fragilis*. Its bones or shed teeth are known from almost every dinosaur quarry in the Park. These teeth are shed, as they are in most reptiles, when the animal feeds and are continually replaced. Teeth about to be shed weaken near the root and when the animal eats, the teeth break free at the root. In a matter of days a new tooth begins to erupt through the gums to replace the lost tooth.

*Allosaurus* is represented at the Marsh Quarry by at least three skeletons, including one on exhibit at the Smithsonian. This skeleton is about 25 feet long and about 6 feet tall at the hips. As with many carnivorous dinosaurs, the tail makes up almost half of the body length. This specimen of *Allosaurus* is estimated to have weighed about 1½-2 tons.

Another fragmentary skeleton of *Allosaurus* from one of Cope's Quarries is even larger. It represents an individual about 30 feet long, eight feet tall at the hips and an estimated weight of 3 tons. Cope named the dinosaur *Epanterias amplexus* in 1878, a year after Marsh named *Allosaurus*. However, there is nothing about the bones except their large size that makes them distinct from those of *Allosaurus*. Whether or not they are the same species as *Allosaurus fragilis*, we won't know until more of the skeleton is found.

The skull of *Allosaurus* is large (about 2 feet long) and armed with sharp teeth. These teeth are long and slender blades, serrated like a steak knife. Such teeth are best suited for

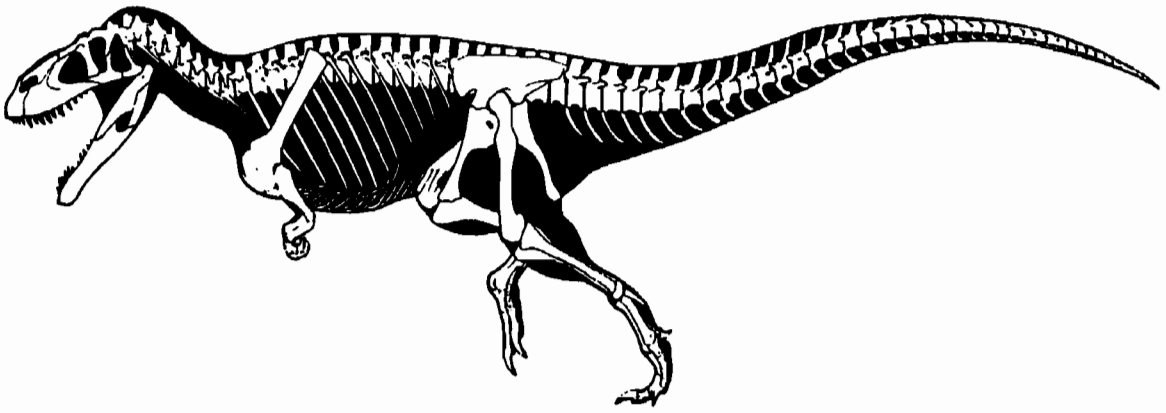


*Allosaurus*

biting and cutting flesh. This is how we know that *Allosaurus* was a meat-eater.

Just above and in front of the eyes are two triangular crests called lachrymal crests. They have an opening in them that may have housed some sort of gland.

Isolated fossilized footprints thought to be of *Allosaurus* have also been found in Garden Park. These clearly show sharp claw impressions. Long trackways that would permit us to determine how fast the animal was walking or running are not known from Garden Park, but have been found in other parts of Colorado.



*Torvosaurus*

The arms of *Allosaurus* are rather short, about 3 feet long. However, the muscle scars are very prominent indicating that it was well muscled and very strong. The three fingered hand has raptor-like claws for grasping prey. The feet also have sharp claws to hold the prey down. All in all, *Allosaurus* was well armed, tooth and claw, for holding and killing a struggling prey.

The most recent addition to the list of dinosaurs from Garden Park is a large meat-eater rivaling *Allosaurus* in size. This dinosaur, *Torvosaurus*, is known from several partial skeletons collected by Jim Jensen near Delta, Colorado. In Garden Park, this dinosaur is known only from a few bones discovered in 1993.

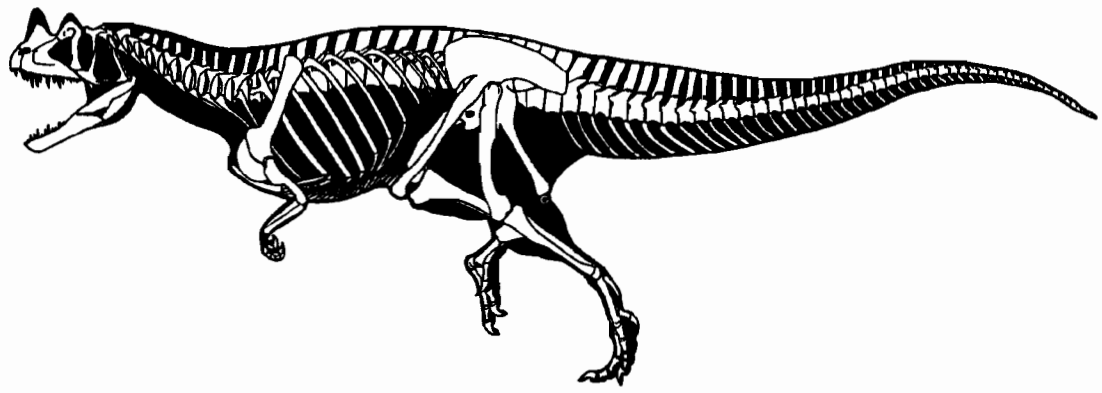
*Torvosaurus* was about 30 feet long, about 8½ feet tall at the hips and weighed about 2½ tons. The skull is very large, almost three feet long. As with *Allosaurus*, the teeth are like large serrated steak knives. With very powerful front limbs, *Torvosaurus* was capable of holding a struggling prey while biting it to death.

*Torvosaurus* is closely related to several poorly known carnivores from Europe called megalosaurs, which have many primitive skeletal features. By primitive, we do not mean inferior but that the features are more like those seen in geologically older, ancestral species. Perhaps *Torvosaurus* is a "relic" of older Middle Jurassic carnivorous dinosaurs in North America.

Another large carnivorous dinosaur from Garden Park is *Ceratosaurus nasicornis*. This carnivore is known from a nearly complete skeleton from the Marsh Quarry. It is currently on display at the Smithsonian Institution. It differs from *Allosaurus* in having a narrow crest or horn on its nose (hence the species name). One primitive feature of this species is a row of small bone "pebbles" embedded in the skin above the backbone. Similar pebbles are seen in the thecodonts, the reptile group that gave rise to the dinosaurs.

*Ceratosaurus* is smaller than *Allosaurus*, being about 19 feet long, 5 feet tall at the hips and weighed about half a ton. It too, had a mouth full of sharp teeth, with talons on its hands and feet.

It surprises us that there were at least three large carnivorous dinosaurs in Garden Park. Did they

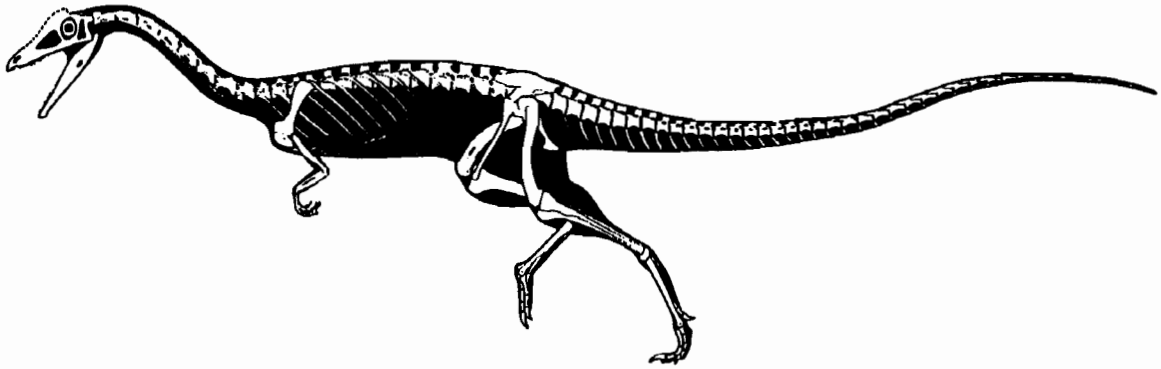


*Ceratosaurus*

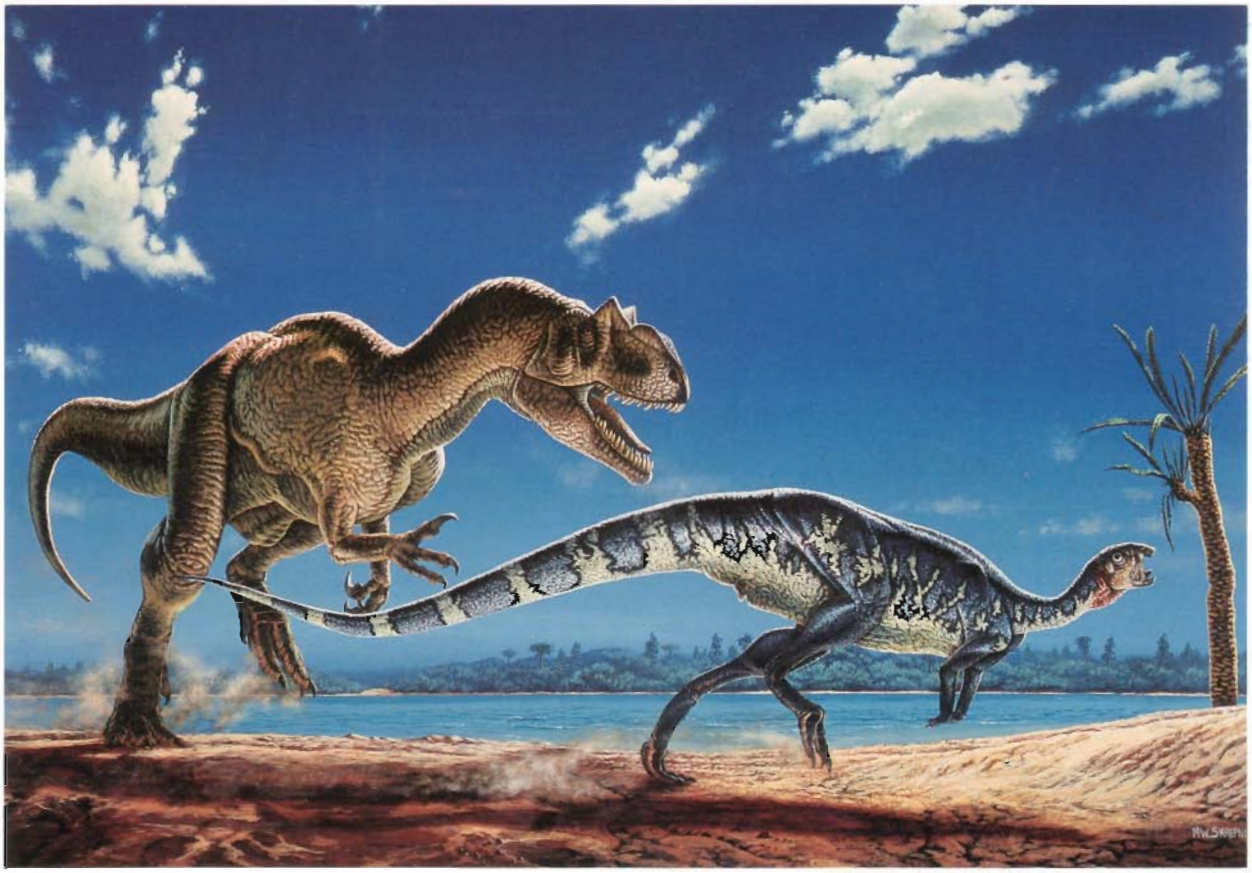
compete for the same prey? Probably not. Instead, they most likely engaged in "niche partitioning" where each predator usually ate the prey the others ignored. An example of niche partitioning today is seen among the large carnivores of Africa; the cheetah feeds almost exclusively on the Thompson's Gazelle while its neighbor, the lion, frequently feeds on the wildebeest.

The three carnivorous dinosaurs are not equally abundant as fossils in Garden Park. *Allosaurus* is known from several skeletons, whereas *Ceratosaurus* is known from a single skeleton and *Torvosaurus* from a few bones. We assume that there were more *Allosaurus* alive in the Garden Park area than the other two. Since they were more abundant, the chances of *Allosaurus* becoming fossilized were greater.

There are other carnivorous dinosaurs in Garden Park. One of the smallest is *Coelurus agilis*. It is known only from two distinctive bones from Garden Park. This species is better known from a partial skeleton collected from the Morrison Formation near Como Bluffs, Wyoming, in the 1880's. While the skull is missing in this specimen, we know that *Coelurus* was a carnivorous dinosaur because the bones show many similarities with *Allosaurus* and other meat-eaters. The most striking similarity is their hollow bones. This hollowness, also seen in bird skeletons, indicates that birds are closely related to carnivorous dinosaurs. In addition, various cavities in the dinosaur bones

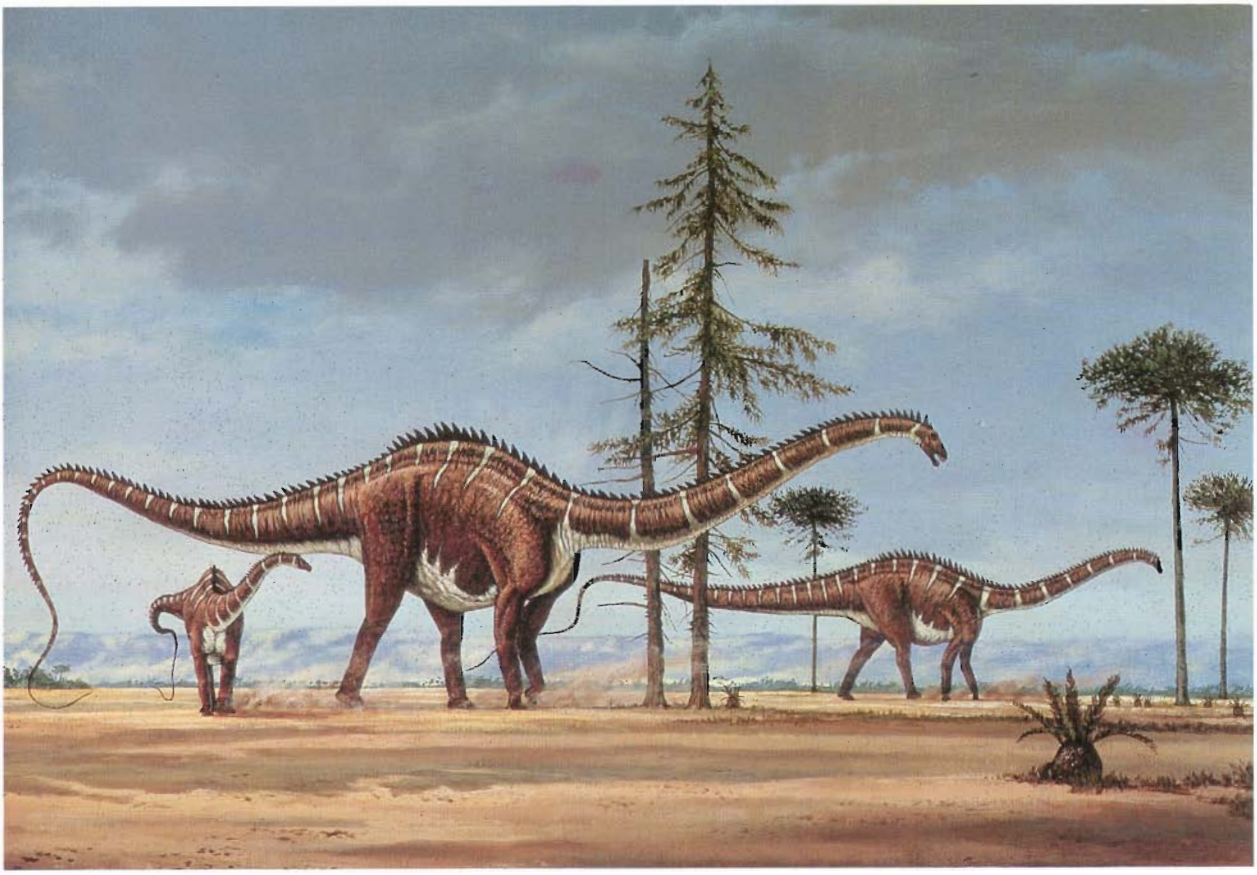


*Elaphrosaurus.*



*Allosaurus* chasing *Dryosaurus*

*Brachiosaurus* (left) and *Camarasaurus* (right)



A herd of *Diplodocus*

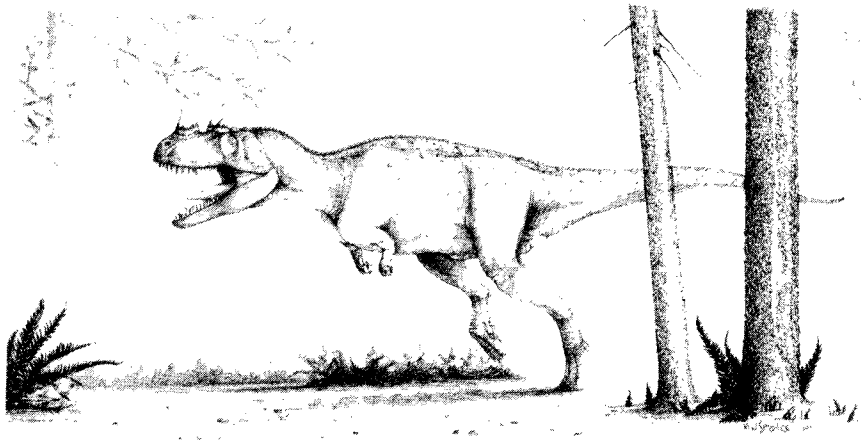
*Stegosaurus stenops*

suggest a breathing system similar to that of birds.

Although too little of this skeleton is preserved to illustrate what it looked like, enough is present to indicate an animal about 5 feet long, 18 inches tall at the hips and 30 pounds in weight. The foot bones, very long and slender, indicate a swift runner. Perhaps *Coelurus* preyed upon small, early mammals, insects and lizards, easily captured by this small rapid runner.

*Elaphrosaurus* is a rare predatory dinosaur at Garden Park, known from two bones from different localities. It has been identified from an almost complete skeleton from the Upper Jurassic strata at Tendaguru in Tanzania, Africa. As we will see, there are other dinosaurs from Garden Park that are also known from Tendaguru. This supports the idea that all of the Earth's continents were joined at one time, since the dinosaurs could not have crossed the Atlantic Ocean.

*Elaphrosaurus* was the first of the ornithomimids or ostrich dinosaurs. It was about 20 feet long and stood about 5 feet tall at the hips. Despite this apparent large size, it probably only weighed about 500 pounds; half of the body length was tail! Because the skull is missing, we don't know if it had a toothless beak like its better known Cretaceous relatives. The hind limbs and feet were long and slender, suggesting that *Elaphrosaurus* was a swift runner.



*Ceratosaurus nasicornis* on the prowl

## Thunder Lizards

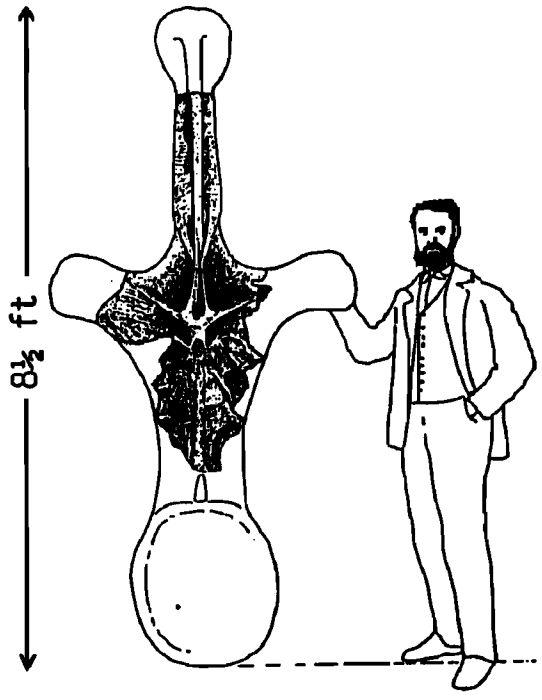
The largest dinosaurs that ever walked the earth are the sauropods. They got their nick-name "thunder-lizards," because it was thought that their footsteps sounded like thunder when they walked. Sauropods are characterized by their large bulk, elephant-like legs, long necks and long tails, with a head that seems disproportionally small for the size of the body. The teeth are blunt and suitable only for feeding on plants.

Sauropods were once thought by paleontologists to live in lakes because it did not seem possible that their legs could support their large bodies. However, newer studies have shown that the limbs are well suited for carrying the body weight on land. Furthermore, fossilized footprints of sauropods from southeastern Colorado and elsewhere show that sauropods did walk on land.

The bones of sauropods are unique in that all the limb bones are solid. However, the neck and back bones of this heavy animal are full of large spaces and bone struts to lessen the weight of the bones while remaining strong.

The largest sauropod from Garden Park is *Amphicoelias*. One species, *Amphicoelias fragillimus*, is known only from a partial vertebra collected in 1878 from Cope's Nipple. If complete, the vertebra might have been more than 8½ feet tall, indicating an animal 150 feet long, 32 feet at the hips, and weighing 130 tons!

Another species, *Amphicoelias altus* is known from a few bones collected 1877 and 1878, from very high in the Morrison Formation, only a few feet from the top. This makes it one of the geologically youngest

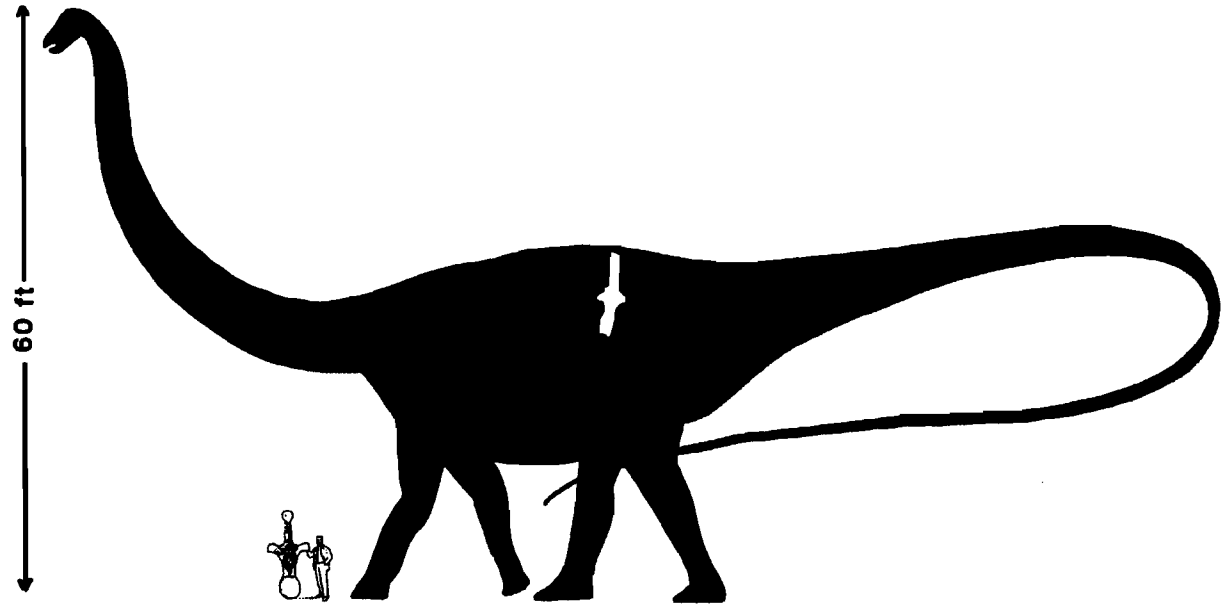



E.D. Cope with the vertebra of *Amphicoelias fragillimus*

dinosaurs from the Morrison Formation. The most distinctive bone is a vertebra from the back which shows that *Amphicoelias* is closely related to another sauropod, *Diplodocus*, known from several skeletons. By inference with *Diplodocus*, *Amphicoelias altus* is estimated to have been 98 feet long, but weighed only 30 tons.

A much smaller, but a more common sauropod in Garden Park is *Apatosaurus excelsus*, also known as *Brontosaurus*. While it is represented by bones from the Marsh Quarry, much of what we know about *Apatosaurus* comes from the nearly complete skeleton of closely related species, *Apatosaurus louisae*, from Dinosaur National Monument, Utah. *Apatosaurus* is about 78 feet long, and 15 feet tall at the hips, whose skeleton indicates a bulky animal that weighed about 18 tons. The long and whip-like tail may have been used to defend itself from attacking predatory dinosaurs, such as *Allosaurus*.

Only a single skull of *Apatosaurus*, from Dinosaur National Monument, is known. It looks much like that of Diplodocus, which caused its misidentification for many years.

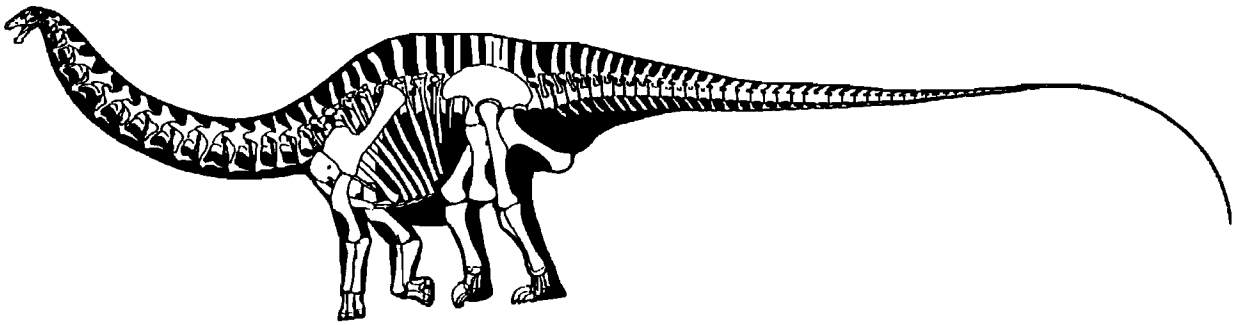



*Amphicoelias fragillimus*

The teeth are like slender rods crowded to the front of the mouth as they are in *Diplodocus*, but the muzzle is much wider. Often illustrated as feeding high in the trees, the wide muzzle suggests that it may have actually cropped low ground cover, such as ferns.

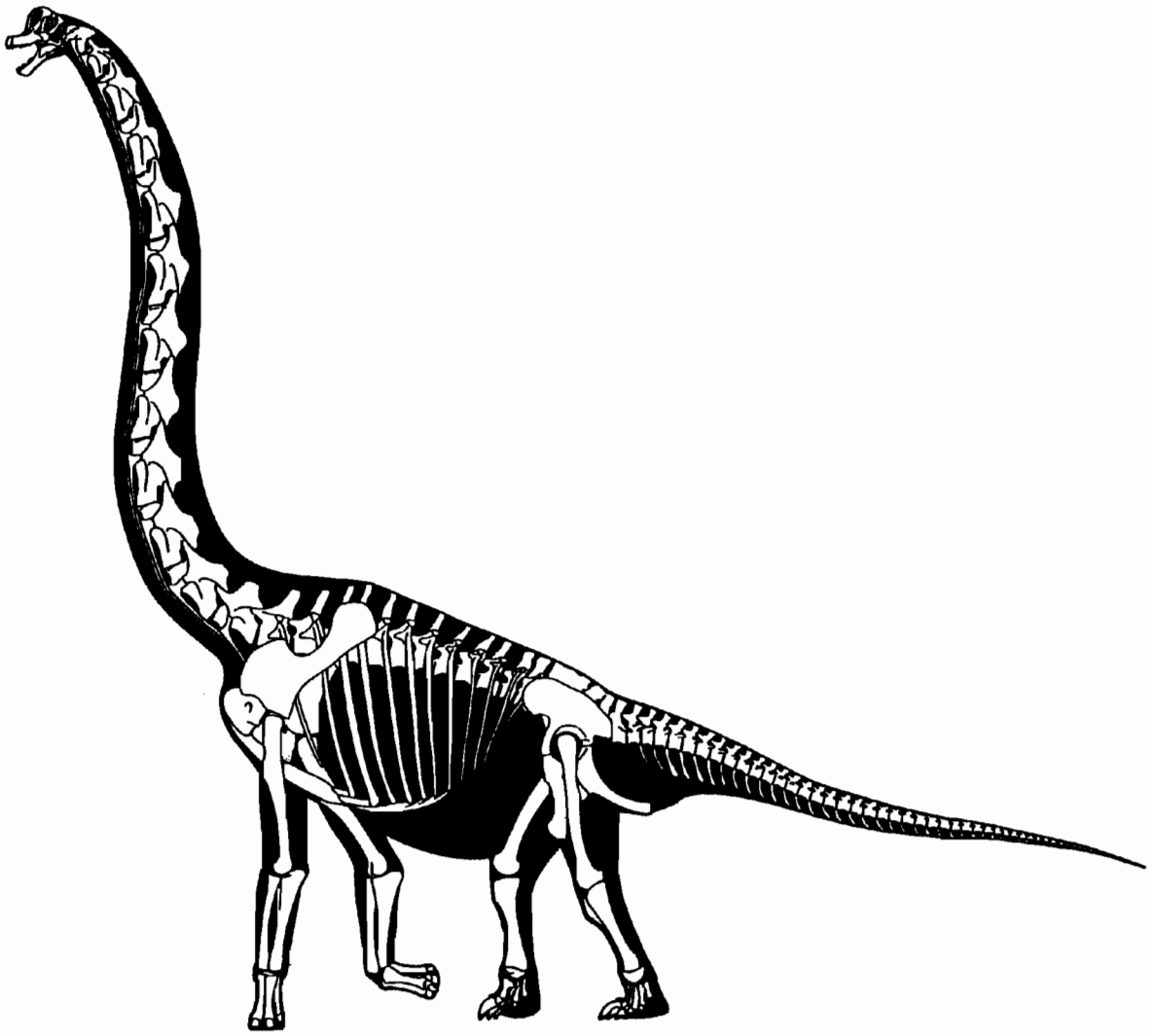
Another dinosaur from the Marsh Quarry, also found in Africa, is the large sauropod, *Brachiosaurus,* known from a few bones, including a partial skull. *Brachiosaurus* was first named for a few bones collected near Grand Junction, Colorado, in 1903, but much of what we know is based on a skeleton collected from Tendaguru, Tanzania, now on display in Berlin, Germany.

At 40 tons, this dinosaur was one of the heavier dinosaurs to walk the earth and is estimated to be about 85 feet long and 23 feet tall at the shoulders (the highest point on the body). *Brachiosaurus* is unique among dinosaurs in that the forelimbs are much longer than the hindlimbs making it the "giraffe-dinosaur," since the neck is very long and carried the head high in the air. With the head perched four stories up, *Brachiosaurus* had a bird's eye view of the world. Actually, with the head that high, *Brachiosaurus* must have fed from tree tops much like a giraffe does today.



*Apatosaurus*

Another unusual feature of *Brachiosaurus* is that the nostrils are located high on the face. Possibly this feature kept the tree branches from damaging the nostril tissue when the animal thrust its head into the foliage for food.

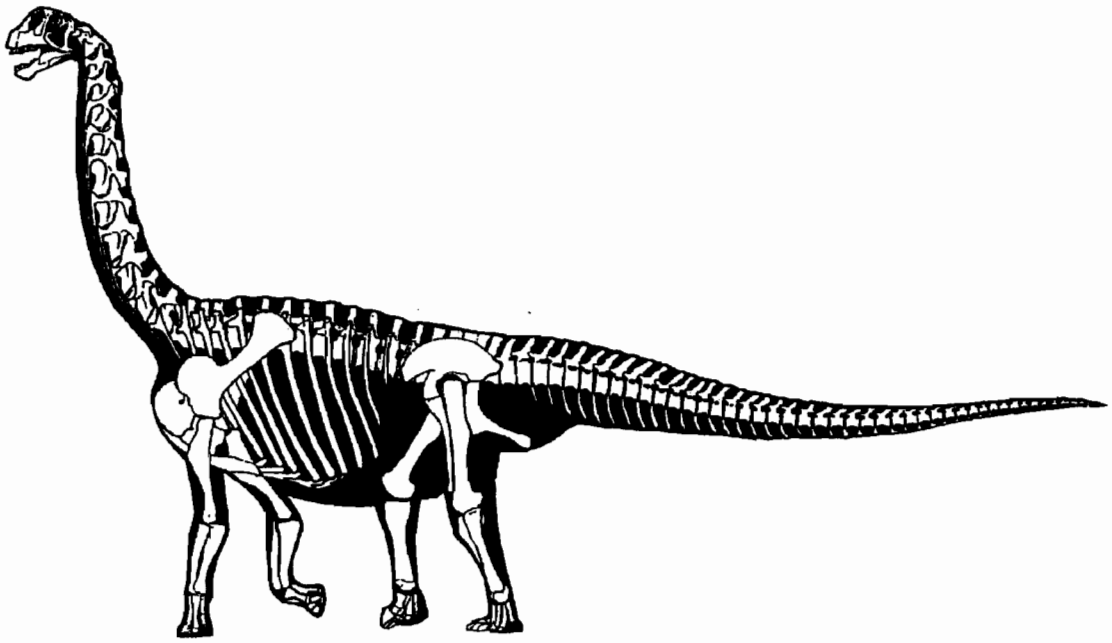


*Brachiosaurus*

A close relative of *Brachiosaurus* is *Camarasaurus supremus*, the first dinosaur to be named from the Garden Park excavations. Parts of several skeletons have been collected at different localities in the region, but none are on display in any museum.

*Camarasaurus supremus* is one of three species of *Camarasaurus* known from the Morrison Formation and is also the most common dinosaur in the Morrison Formation. It had an estimated length of 60 feet, stood 15 feet tall at the shoulders and weighed 20 tons.

*Camarasaurus* was also tallest



*Camarasaurus*

at the shoulders, although not as much as *Brachiosaurus*. Another difference is that the neck is proportionally shorter and the tail longer than in *Brachiosaurus*. However, like *Brachiosaurus*, the nostrils are located high on the face just in front of the eyes. *Camarasaurus* is unusual among sauropods in that the ribs on the neck are very long, spanning up to 2½ vertebrae, probably keeping the neck from having very much mobility.

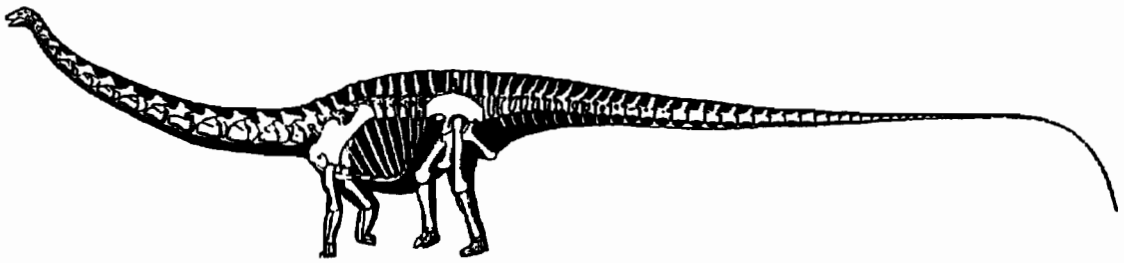
*Diplodocus longus* was named by Marsh for a few bones collected at the Marsh Quarry. A few years later, a complete skull was also collected there and is now on display at the Smithsonian Institution. *Diplodocus* grew to 84 feet in length and stood 14 feet tall at the hips. Despite its large size, *Diplodocus* only weighed 11 tons because its skeleton is slender and a considerable portion of the length is neck and tail. The long head has rod-shaped teeth confined to the front of the mouth. The muzzle is not as wide as *Apatosaurus* but otherwise the skulls look similar.

Recently, some carbon remains of *Diplodocus* skin have been discovered in the Morrison Formation of northern Wyoming. This skin shows a frill or fringe of small

triangles, similar to that seen in some lizards, extending along its tail and also possibly along the neck and back. Other pieces of skin from the body show that it was pebbly in texture. Unfortunately, we do not know what color this skin was.

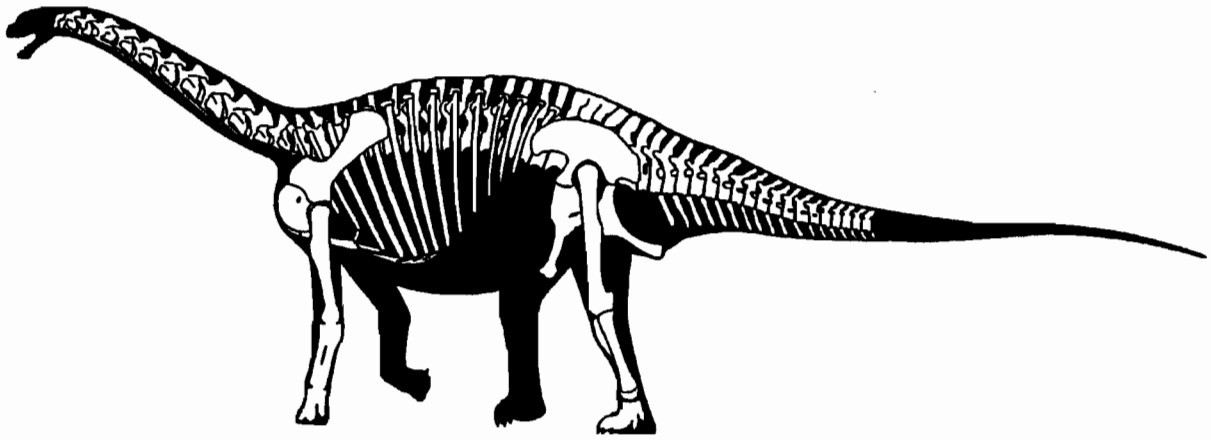
*Haplocanthosaurus* is another type of sauropod from Garden Park. In fact, except for one occurrence in Wyoming, this dinosaur seems to be limited to the Garden Park area, with its occurrence in Garden Park limited to the lower portion of the Morrison Formation. It may have become extinct because of competition with *Camarasaurus* which seems to appear about when *Haplocanthosaurus* made its last appearance in Garden Park. No skull of *Haplocanthosaurus* is known, although a skull fragment from the Marsh Quarry named *Morosaurus agilis* by Marsh may belong to it. Nevertheless, we assume that *Haplocanthosaurus* was a plant eater because other sauropods have teeth suitable only for a diet of plants.

We call *Haplocanthosaurus* a primitive sauropod because the spines on the vertebrae are not forked as they are in all the other Garden Park sauropods. Its closest relatives include *Cetiosaurus* from England, *Patagosaurus* from Argentina, and *Shunosaurus* from China.



*Diplodocus*

Two species of *Haplocanthosaurus* are known from Garden Park. The largest, *Haplocanthosaurus delfsi*, is estimated to be 70 feet long, stood 14 feet tall at hips and weighed 20 tons. *Haplocanthosaurus priscus* is smaller and is estimated to be 45 feet long, 9 feet tall at the hips and



*Haplocanthosaurus delfsi*

weighed 13 tons. A skeleton of *Haplocanthosaurus delfsi*, on display at the Cleveland Museum of Natural History, was collected not far from where *Haplocanthosaurus priscus* was collected.

## Ornithopods

Ornithopods, or Bipedal plant eaters, stood and walked on their hind legs using their tail to balance their body over the legs. To keep the tail from dragging on the ground, ornithopods all have crisscrossed bony rods embedded in the muscles of the back and tail. These rods allow some side to side movement of the body and tail but little movement up and down.

Ornithopods are often found in numbers, suggesting that they frequently traveled in small groups or herds. This may explain how such defenseless creatures could survive in a world with large meat eaters. Like herding antelopes today, some individuals are always on alert for an approaching predator. At the least threat, the alarm is given and they all scamper in the same direction. Faced with a group running together, it is often difficult for the predator to single out an individual for the kill. That is why a lion's kill success rate is usually low, only 1 in 4. Lacking any defensive structures such as armor plates, ornithopods may have sought protection in a group like antelopes.

*Camptosaurus*

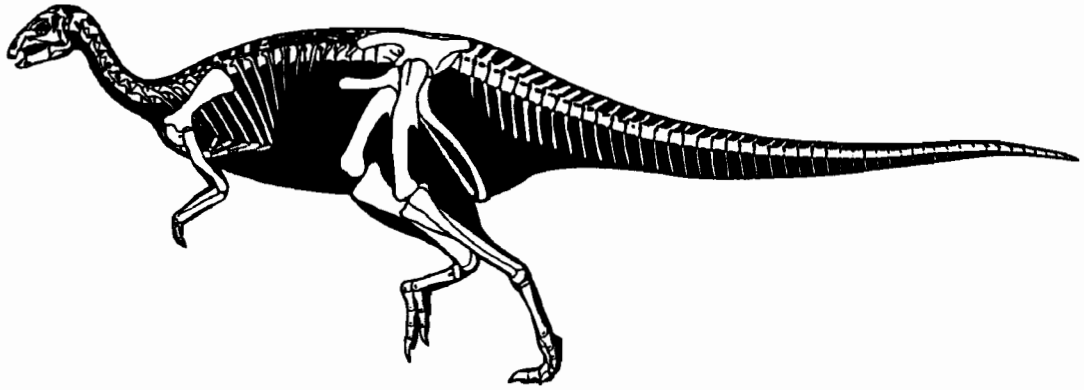
The largest ornithopod is *Camptosaurus dispar*, possibly represented by a few bones from one of Cope's quarries but complete skeletons are known from Como Bluffs, Wyoming, and Dinosaur National Monument. *Camptosaurus* was about 18 feet long, 5 feet tall at the hips and weighed about 3/4 tons.

It is an early relative of Iguanodon, a dinosaur with a spike on its thumb. *Camptosaurus* is also known from the Upper Jurassic of England.

*Camptosaurus* had no teeth at the front of the mouth but has a beak for cropping vegetation. What teeth it has are limited to the cheek region. As these teeth wear, they formed a broad, crushing surface for chewing plants. The cheek teeth are inset away from the edge of the face suggesting that *Camptosaurus* had a fleshy cheek which would keep food from spilling out as the animal chewed.

A single hand print of *Camptosaurus* is known from Garden Park. Originally described as a sauropod footprint, its small size, shape and number of digits make this unlikely. A footprint of *Camptosaurus* has also been found in Garden Park.

A distant relative of *Camptosaurus* is *Dryosaurus altus.* This ornithopod was up to 16 feet long, 4¼ feet tall at the hips and weighed over a half-ton. In the Garden Park area, *Dryosaurus* is only known from a few bones at the Marsh-Felch Quarry. A nearly complete skeleton was found in Como Bluffs, and another from Dinosaur National Monument. *Dryosaurus* is also known from Tendaguru, Tanzania, where many individuals have been found together.



*Dryosaurus*

*Dryosaurus* has a toothless beak and chewing teeth similar to *Camptosaurus.* However, these are set in a skull much shorter and deeper than *Camptosaurus.*

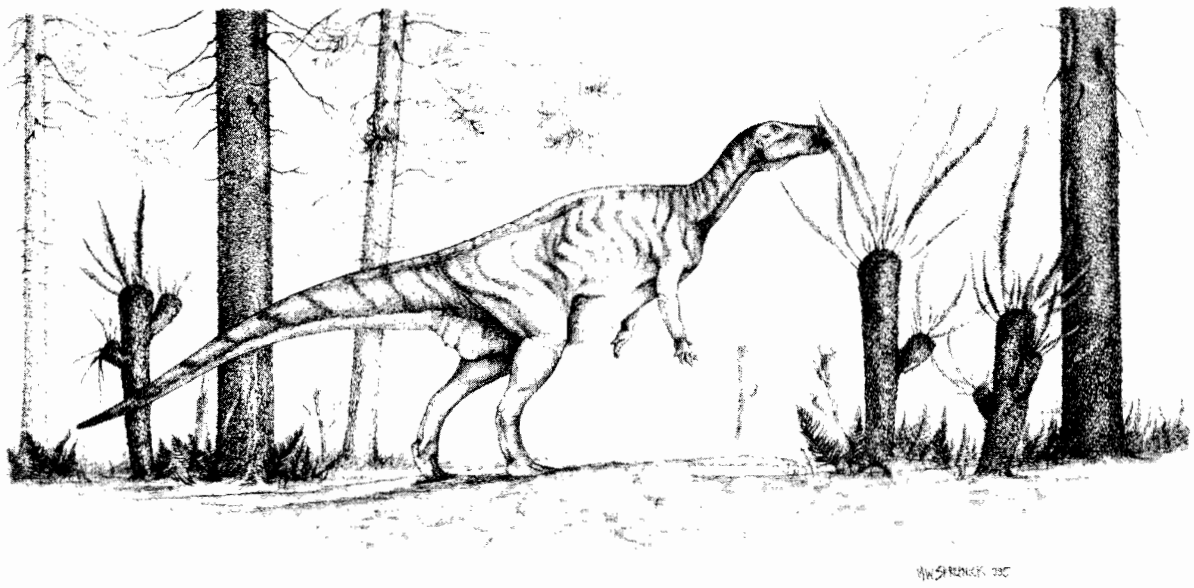
Eggs, eggshells and baby bones, possibly of *Dryosaurus*, have

recently been found in Garden Park. Some of the bones are so small and underdeveloped that they may represent unhatched embryos. Some slightly larger bones may be those of the hatchlings. These eggs and eggshells prove that *Dryosaurus* laid hard shelled eggs much like birds.

Garden Park has also produced a close relative of *Dryosaurus* called *Othnelia rex*. This dinosaur is known from a small, partial skeleton and a few isolated bones of adults from the Park. The adult bones especially are easily confused with those of *Dryosaurus*. This confusion explains why *Othnelia* was only recently named.

An adult *Othnelia* was 5 feet long, 18" tall at the hips and weighed about 300 pounds. A jaw fragment from the Marsh-Felch Quarry is the only skull bone known. The teeth resemble those of *Dryosaurus* showing that *Othnelia* was a plant eater.

One other ornithopod from Garden Park remains a mystery. Named *Nanosaurus agilis*, it was the first dinosaur named by Marsh from Garden Park. Although collected more than 100 years ago, only a single specimen of this dinosaur is known, consisting of a jumbled partial skeleton in a very hard sandstone block collected at Cope's Nipple.



*Camptosaurus*

*Nanosaurus* may be related to a small dinosaur from the Lower Cretaceous in England called *Hypsilophodon*. Extrapolating from the size of *Hypsilophodon*, for which complete skeletons are known, *Nanosaurus* was about 2 feet long, about 7" tall at the hips, and weighed about 5 pounds. This small size implies that *Nanosaurus* may be a juvenile, but there is no agreement on this. It may be that *Nanosaurus* was a small type of adult dinosaur. The teeth of *Nanosaurus* indicate that it was a plant eater, but whether or not it had a toothless beak is not known.

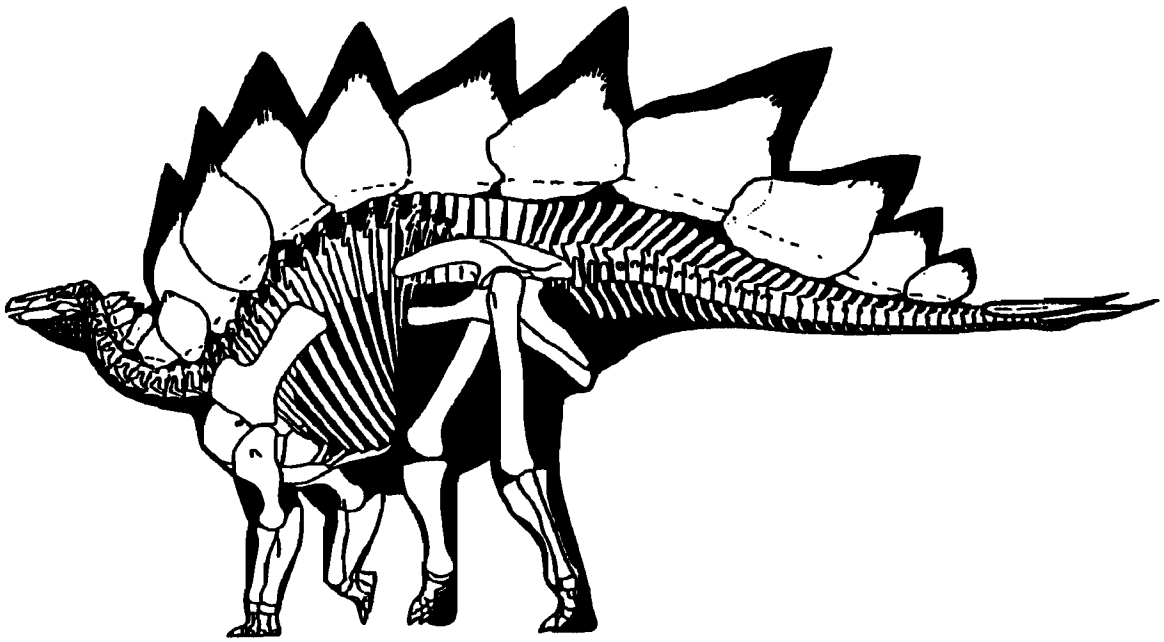
## Armored Dinosaurs

One type of armored dinosaur, the stegosaurs, are large creatures with flat plates standing on end along their backs and sharp spikes on their tails. The skull is elongated and appears too small for the body. The teeth are very small and rounded indicating a diet of plants.

For many years, most of what we knew about *Stegosaurus* was based upon a single, nearly complete skeleton from the Marsh-Felch Quarry called *Stegosaurus stenops* now on display at the Smithsonian Institution where it is laid out as it was found.

Two other skeletons have been collected by the Denver Museum of Natural History at Garden Park. One of these is on display at the museum, while the other, only recently found, may be the most complete *Stegosaurus* ever found. This specimen preserves much of the body armor in place. Interestingly, we think we know what killed this individual. One of the tail spikes is broken off, possibly in a fight, and disease ravaged the bone, with the infection eventually killing the animal

*Stegosaurus stenops* skeletons may be seen in several museums



*Stegosaurus stenops*

and is the *Stegosaurus* most frequently illustrated. It was up to 24 feet long, 7 feet tall at the hips (not including the plates) and weighed 5 tons.

A second species of *Stegosaurus* is also known from Garden Park and both occur together at the Marsh-Felch Quarry. *Stegosaurus armatus* is known from a partial skeleton from the quarry now in the collections of the Smithsonian Institution. However, much of what we know about this species is based on a skeleton on display at Yale University, which is actually a combination of two partial skeletons collected in Wyoming in the 1880's.

*Stegosaurus armatus* is a large animal 22 feet long, 10 feet tall at the hips (not counting the plates) and may have weighed 5 tons. It has very long limbs, plates on the tail that are elongated almost into spikes, and eight spikes at the end of the tail. It differs from *Stegosaurus stenops* because it has very long limbs, the plates on the back are considerably smaller, and the tail has eight spikes.

Another armored dinosaur, a nodosaurid ankylosaur, is very rare in the Jurassic. It was first named *Mymoorapelta* in 1994 for some bones collected near Grand Junction. Its remains have also been found in Garden Park. We don't know exactly what *Mymoorapelta* looked like, but its Cretaceous relatives walked on four legs, ate plants, had bone plates that covered much of the body and tail, and spikes projecting from the sides of the body.

The Garden Park Paleontological Society is an organization of whose aim is to help the Bureau of Land Management protect the fossil resources in Garden Park. For more information about the Society and how you may help in their work, please write to the society at P.O. Box 313, Cañon City, Colorado 81215