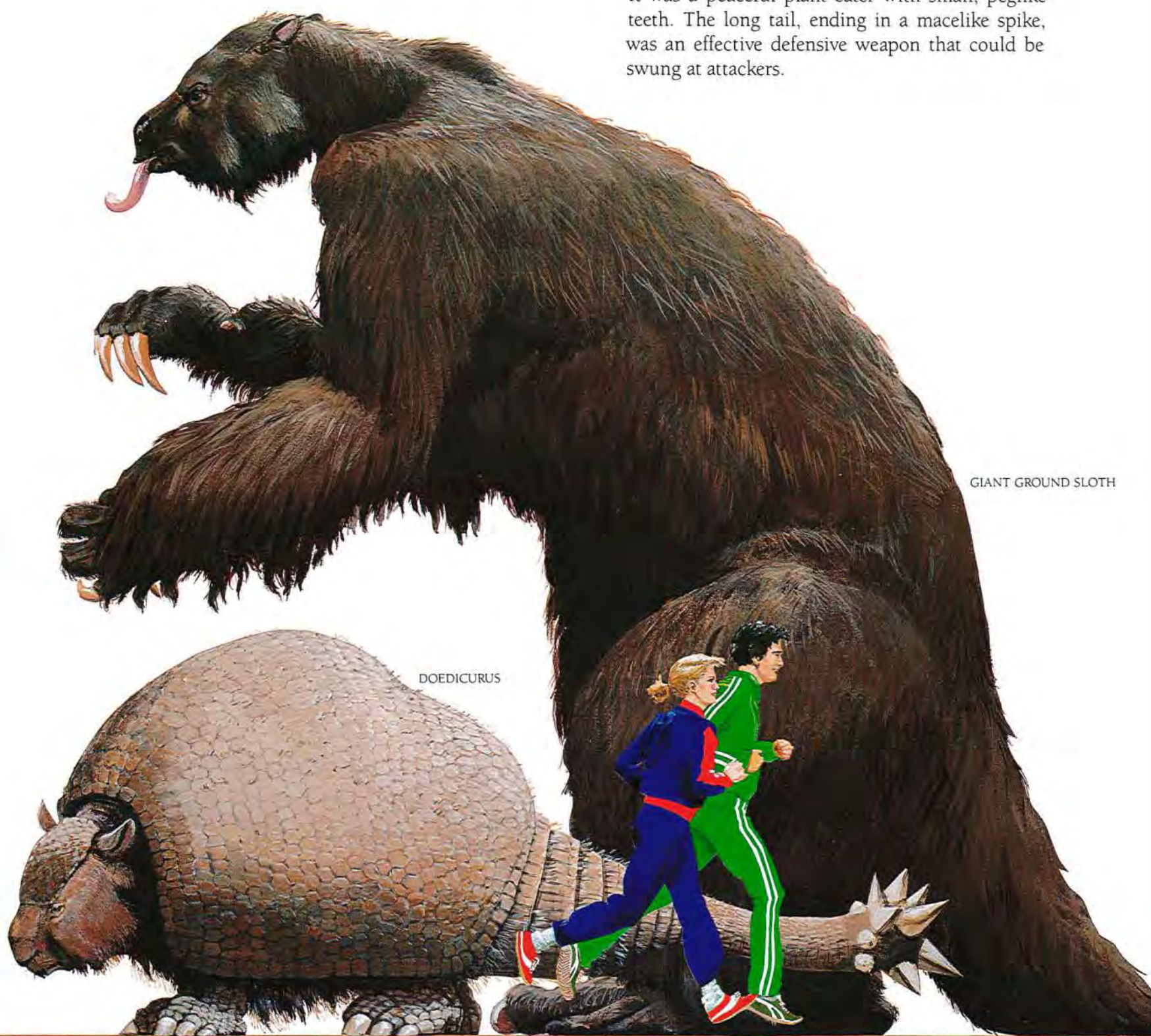


Giant Ground Sloth

Megatherium americanum [extinct]
Edentata • Mammalia • Chordata

The giant ground sloth was a peaceful, tree-browsing mammal that lived during the Pliocene and Pleistocene epochs from 10 million up to only 10,000 years ago. Its 24-foot length made it almost invulnerable to attack by the smallish predators of its time. Newly arriving humans may have hunted the giant ground sloth to extinction.

Native to South America, this massive animal was able to push trees over by brute strength to get at leaves too high to reach. It probably used its long, curved claws to hook low branches and bring them close to its long tongue. Its claws were so long that it had to walk on its knuckles.



Doedicurus

Doedicurus clavicaudatus [extinct]
Edentata • Mammalia • Chordata

Doedicurus (dee-duh-KYEW-russ) was the largest of the glyptodonts, a family of armadillo-like mammals that lived in the Western Hemisphere during the Pliocene and Pleistocene epochs 10 million to 1 million years ago. *Doedicurus* was 14 feet long, with a 5½-foot-high shell.

Unlike the armadillo with its shell of horny skin, glyptodonts had a shell made of bone, unique among mammals. The thick invulnerable armor covered the head, back, and tail. Stiff, coarse hairs stuck out at joints in *Doedicurus*'s armor wherever skin was exposed. The animal had short, massive legs and strong claws for digging. It was a peaceful plant eater with small, peglike teeth. The long tail, ending in a macelike spike, was an effective defensive weapon that could be swung at attackers.

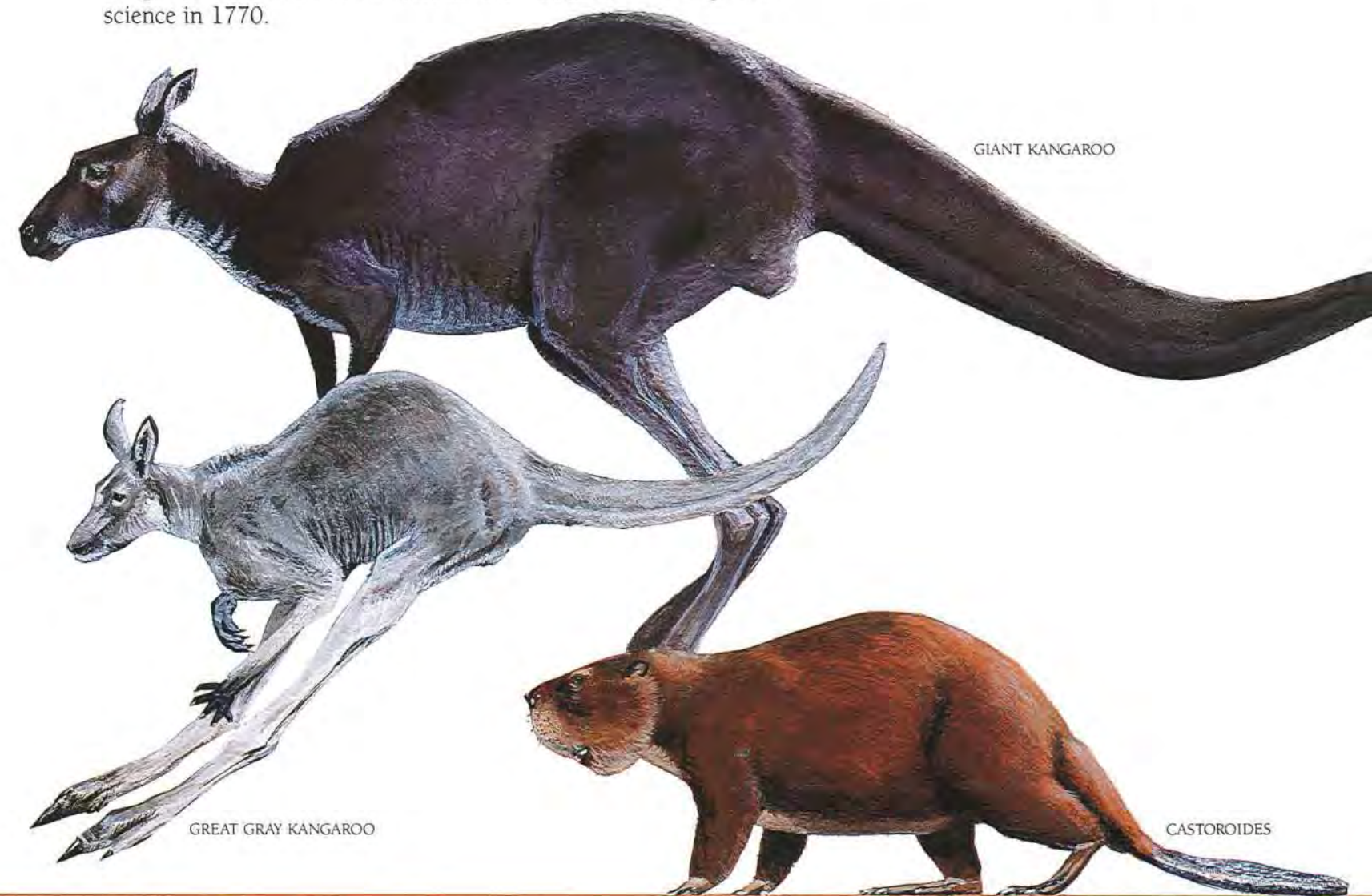
Great Gray Kangaroo

Macropus giganteus
Marsupialia • Mammalia • Chordata

The great gray kangaroo is the largest of all living marsupials—mammals with pouches for their young. The largest males may measure 8 feet 8 inches from head to tail and stand 7 feet tall. They may weigh up to 200 pounds. Females are usually about half as large.

With its huge, muscular hind legs, this kangaroo can broad-jump 25 feet or, at full speed, leap 40 feet with each bound, using its long, thick tail as a counterbalance. Each hind foot has four toes—one much larger than the others, with a dangerous claw, and a smaller toe right beside it. The other two toes, growing side by side, are so tiny they don't reach the ground and are used like a comb for grooming. Great grays travel in mobs, browsing on leaves and twigs, rather than grazing the grasslands like the related red kangaroo.

After a 33-day gestation, the young are born as tiny, hairless embryos. Only an inch long, blind, and without hind legs, they manage to crawl without assistance to the mother's pouch, where a milk-filled nipple awaits them. There they stay for up to 8 months while they continue to develop. The great gray kangaroo has a life span of up to 15 years in the wild. Found only in Australia, kangaroos first came to the attention of modern science in 1770.



Giant Kangaroo

Macropus ferragus [extinct]
Marsupialia • Mammalia • Chordata

The giant kangaroo, also called *Palorchestes* (pal-ar-CHESS-teez), was 10 feet tall. It lived in Australia from 1 million years ago until, only 10,000 years ago. Humans arrived in Australia 12,000 years ago and hunted this animal to extinction.

Castoroides

Castoroides ohioensis [extinct]
Rodentia • Mammalia • Chordata

Castoroides (cass-toe-ROY-deez), the giant beaver, grew to 10 feet long, including its 3-foot tail. It evolved in North America during the Oligocene epoch, 35 million years ago, and survived until 10,000 years ago, making it a contemporary of early humans.

Other than size, *Castoroides* shared many physical traits with its 3-foot-long present-day counterpart. Proportionately *Castoroides* had smaller feet and legs than modern beavers but a similar flattened, scale-covered tail. While modern beavers prefer to chisel tree bark with their sharp teeth, the blunt teeth of *Castoroides* seem to have been designed for uprooting cattails and other water plants.

Moa

Dinornis maximus [extinct]
Struthioniformes • Aves • Chordata

The flightless moa was the tallest bird ever, reaching a height of 13 feet. Although some weighed as much as 520 pounds, moas this big were rare. Moas evolved from smaller, flying birds on the islands of New Zealand during the Pliocene epoch, 10 million years ago. There were no predators to impede their increase until humans arrived on the islands 1,500 years ago.

Moas became extinct only 300 years ago. They are known from the thousands of skeletons left by natives of New Zealand who ate these birds until none were left. Moas, ostriches, and other similar running birds form a group called the ratites, characterized by their flat, keel-less breastbone. Moas had long necks, tiny heads, and strong legs but lacked wings entirely. They did not have flat interlocking feathers, like other birds. Instead, those that covered the wings and body were soft and shaggy. Moas ate fern roots and green shoots and built nests of leaves and grasses.

Phorusrhacos

Phorusrhacos longissimus [extinct]
Phorusrhacid • Aves • Chordata

Phorusrhacos (for-uss-RAK-uss), formerly known as *Phororhacos*, was a predatory flightless bird that stood as tall as 10 feet but averaged between 5 and 8 feet in height. It had a head larger than a horse's. Its wings were tiny and useless for flying. In the absence of any large reptilian or mammalian predators, this bird went unchallenged as the largest meat-eater in South America from the Oligocene into the Pliocene epoch, 38 million to 4 million years ago. Undoubtedly, it was a swift creature. With its long, strong legs;

long, sharp claws; and huge, powerful, hooked beak—supremely adapted for tearing flesh—it ran down and devoured small reptiles, mammals, and birds.



MOA

PHORUSRHACOS

Gallimimus

Gallimimus bullatus [extinct]
Saurischia • Reptilia • Chordata

Gallimimus (gal-ee-MIE-muss), at 30 feet long, was a giant ornithomimid, a group of dinosaurs named for their similarity to ostriches. All had small, toothless skulls; large eyes; slender bodies; thin, flexible necks; and long, spindly sprinter's legs. Experts believe they were among the fastest dinosaurs, able to reach speeds of up to 40 miles per hour. They escaped predators by running.

Living in Asia during the late Cretaceous period, from 70 to 65 million years ago, *Gallimimus* inhabited dense cypress forests. There it may have combed through grass and low plants with its clawed forelimbs, looking for eggs and small animals and snapping up anything that tried to scurry away. Its fossils were discovered in 1972.



GALLIMIMUS

NORTH AFRICAN OSTRICH

North African Ostrich

Struthio camelus
Struthioniformes • Aves • Chordata

The tallest bird alive is the ostrich. Although it may grow up to 9 feet tall and weigh as much as 345 pounds, the ostrich typically averages 7 to 8 feet tall and weighs 200 to 300 pounds. It lives on the dry, dusty plains of Africa and western Asia.

The ostrich has long legs, a long neck, and a smallish head. Males are black with white wing tips and tail plumes. Females are dull gray or brownish. The necks and heads of both sexes are lightly feathered with down, but the legs are completely naked.

Unlike all other birds, which have three walking toes on each foot, the ostrich has only two, one larger than the other. It can run at speeds upward of 40 miles per hour using its short wings (which are useless for flying) to help lift some of its weight off the ground. The ostrich can also defend itself against predators by inflicting disabling kicks with its powerful legs.

The ostrich travels in bands of up to 50 individuals, often with herds of zebra and antelope. It is a plant eater but will consume small birds and insects as well.

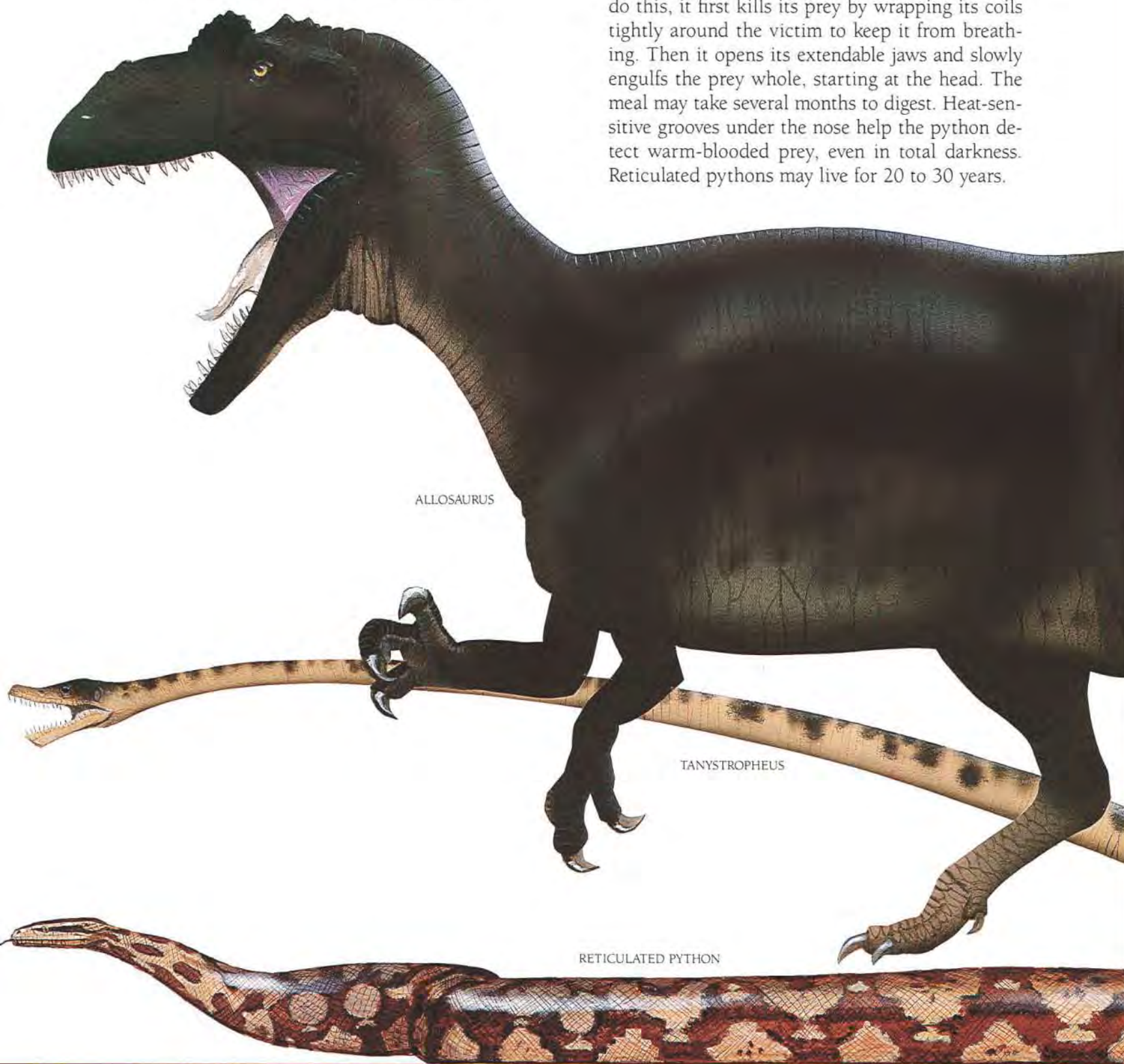
Ostrich eggs are up to 8 inches long and weigh nearly 4 pounds each, the largest of any living bird. The male scoops out hollows in the ground, where the female lays up to 10 eggs. Then they share incubating duties. When hatched, chicks are already the size of barnyard chickens, and they reach full size in 6 months. Ostriches may live up to 62 years.

Allosaurus

Allosaurus fragilis [extinct]
Saurischia • Reptilia • Chordata

Allosaurus (al-uh-SOR-uss) was a two-legged meat-eating reptile averaging 30 feet in length. Some specimens from North America grew as large as 42 feet, as big as any of the largest-known dinosaur predators, including *Tyrannosaurus rex*.

Allosaurus was the largest meat eater of the Jurassic period, living 150 to 136 million years ago. It was probably an active hunter and may have hunted in packs. *Allosaurus* could tear out the entrails of its victims with its huge fangs and the sharp claws on its forelimbs and feet. Fossils of this dinosaur have been found worldwide.



Reticulated Python

Python reticulatus
Squamata • Reptilia • Chordata

The largest snake, perhaps of all time, is the reticulated python, a legless reptile that reaches a maximum length of 32 feet 9 inches and a weight of 450 pounds. Its name derives from the reticulation or netlike pattern of camouflage markings covering its body.

A good swimmer, the reticulated python lives in southeast Asia. The female coils around her eggs and, unlike most reptiles, generates body heat to help incubate them. When hatched, the young are already 3 feet long. A fully grown reticulated python can swallow animals as large as sheep. To do this, it first kills its prey by wrapping its coils tightly around the victim to keep it from breathing. Then it opens its extendable jaws and slowly engulfs the prey whole, starting at the head. The meal may take several months to digest. Heat-sensitive grooves under the nose help the python detect warm-blooded prey, even in total darkness. Reticulated pythons may live for 20 to 30 years.

Jonkeria

Jonkeria truculenta [extinct]
Therapsida • Reptilia • Chordata

At 14 feet long, *Jonkeria* (jon-KERR-ee-uh) was the largest and one of the earliest of the therapsids, the order of reptiles that ultimately evolved into mammals. *Jonkeria* itself was not a direct ancestor of mammals but was an important food source for those that were. Living in South Africa during the late Permian period, 230 million years ago, *Jonkeria* had sharp canine fangs and small grinding cheek teeth. As a plant eater, it needed a huge stomach to digest its food. Taking advantage of its size, blimplike *Jonkeria* was able to keep warm and active in cooler climates and was among the first plant-eating vertebrates to live outside the equatorial regions. On top of its skull, *Jonkeria* retained a third eye called a pineal eye, also found in primitive fish and amphibians. This eye probably helped therapsids regulate body temperature by sensing daylight and weather changes.

Tanystropheus

Tanystropheus longobardicus [extinct]
Protrosauria • Reptilia • Chordata

Tanystropheus (tan-ee-STROFE-ee-uss) was an extraordinarily proportioned reptile with a stiff 18-foot neck that was more than half the total length of this 35-foot animal. The vertebrae were stiffened along the entire length of the neck by slender rods that interlocked one bone with another. The long neck may have helped a small *Tanystropheus* to catch insects and small animals climbing through trees. Young 2-foot-long specimens had three-pronged teeth, ideal for catching insects. Older individuals developed sharp conical teeth for snaring fish. With its sprawling legs keeping it propped in place, *Tanystropheus* may have lain on a rocky outcropping of seacoast, occasionally dipping its long neck into the water for a meal.

Tanystropheus, discovered in 1852, was related to the plesiosaurs (the swimming reptiles) and lived in Europe during the early Triassic period, 225 million years ago—20 million years before the first dinosaurs appeared. Its legs turned out to the sides, unlike dinosaur limbs which are set perpendicular to the ground.



Tyrannosaurus

Tyrannosaurus rex
Saurischia • Reptilia • Chordata

[extinct]

Tyrannosaurus (tie-ran-uh-SOR-uss) was the largest meat-eating land animal of all time, measuring up to 45 feet from nose to tail. This dinosaur could have stood 18 feet high and weighed as much as 15,000 pounds.

Tyrannosaurus used its long tail as a counterbalance to its huge torso and head. It had a cavernous

mouth filled with knife-sharp, serrated teeth up to 7 inches long. It may have attacked large prey by running at it with jaws wide open. The skull was reinforced to withstand tremendous impacts. With its huge, three-clawed hind feet planted firmly on the ground, *Tyrannosaurus* tore its victims apart with its teeth. Its ribs formed a cage covering its chest and belly as a protection against the lunges of thrashing victims. Its front legs were very tiny for such a giant animal; they could not even reach the mouth and were probably useless.

Tyrannosaurus lived in North America at the very end of the Cretaceous period, 65 million years ago. Its fossils were discovered in 1902 and have been found only in Montana.



TYRANNOSAURUS

Spinosaurus

Spinosaurus aegypticus
Saurischia • Reptilia • Chordata

[extinct]

Spinosaurus (spine-uh-SOR-uss) was a 40-foot-long, 14,000-pound meat-eating dinosaur found in mid-Cretaceous Africa, about 110 million years ago.

Possibly living in hot, open country, *Spinosaurus* evolved a set of long, bony spines that stood 6 feet high from the backbone. The spines may have supported a sail of skin that acted as a temperature regulator, according to some scientists. Lined with hundreds of blood vessels stretched over the hugely extended spines, this sail might have helped *Spinosaurus* to warm up or cool off just by changing its orientation to the sun. When the sail

faced the sun, it would have warmed up. The blood vessels in it would have distributed the warmed blood throughout the body. During the hottest part of the day, when *Spinosaurus* wanted to cool off, it might have turned the sail edge-on to the sun, minimizing the heating effect and allowing cool breezes to draw heat away from the radiating sail.

With its long, strong arms, *Spinosaurus* may have walked on all fours to help conserve energy. It may have been an active hunter but was probably a scavenger. Its teeth were straight, not curved backward to hold struggling prey like those of other meat-eating dinosaurs. Fossils were discovered in Egypt in 1915.



SPINOSAURUS

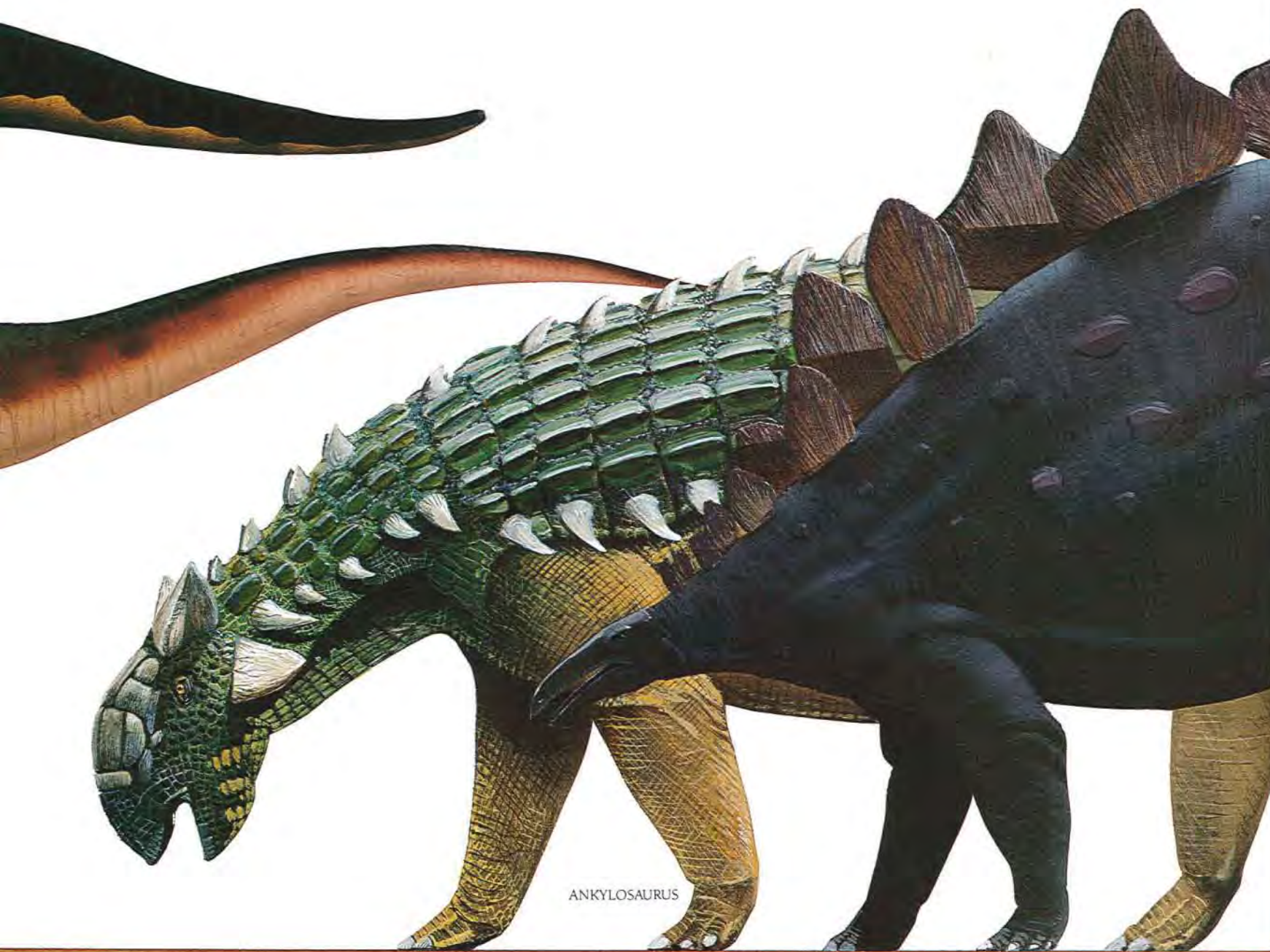
Ankylosaurus

Ankylosaurus magniventris [extinct]
Ornithischia • Reptilia • Chordata

Ankylosaurus (an-kie-luh-SOR-uss), a 35-foot-long giant, was the largest of the ankylosaurs, the four-legged armored dinosaurs. It may have also been the widest dinosaur of any type. In the past, ankylosaurs have been pictured as sprawling and slow-moving. Recent evidence suggests they were probably swift and agile, like a rhinoceros. *Ankylosaurus* ranged across western North America during the Cretaceous period 70 to 65 million years ago.

Like *Doedicurus* (page 14), *Ankylosaurus* was a peaceful plant eater with tiny teeth, but it was built like a tank from head to tail. Its triangular head ended in thick spikes. Thick, oval plates of bone and numerous thick spikes attached to leath-

ery skin protected the animal's back and sides. The skin was embedded with bony studs. Plates of bone were plastered over the skull. Even the eyelids were armored with bone. The tip of its stiff tail ended in a club of bone that could be swung at attackers or mating rivals. It could have knocked a tyrannosaur to the ground, possibly breaking its attacker's leg or hip in the process, which would have been fatal. *Ankylosaurus* was probably invulnerable unless turned over on its back by attack or accident. Its fossils are rare but are always found upside down. The first *Ankylosaurus* fossil was discovered in 1908.



ANKYLOSaurus

Stegosaurus

Stegosaurus stenops [extinct]
Ornithischia • Reptilia • Chordata

Stegosaurus (stegg-uh-SOR-uss) was the largest of the stegosaurs, the four-legged, plant-eating, plated dinosaurs. Living in the Jurassic period 140 million years ago, *Stegosaurus* grew to 32 feet long and may have weighed as much as 6,000 pounds.

Stegosaurus had two rows of flat plates running down its back from head to tail. The plates were imbedded in the skin and were not directly attached to bone, so scientists can't tell from the fossils whether the plates grew side by side or were staggered. Like the presumed sail of *Spinosaurus* (page 21), the plates seem to have been temperature regulators. Supplied with hundreds of tiny blood vessels, their large surface areas could warm the blood when face-on to the sun or cool the blood as air currents passed over them. They may have served as a defense against meat-eating dinosaurs as well.

The tail of *Stegosaurus* ended in two pairs of formidable spikes that could have been swung at hungry predators. The long, small, narrow skull contained a walnut-size brain, which has led some scientists to label *Stegosaurus* perhaps the stupidest dinosaur, but in fact its brain was quite adequate for its needs. *Stegosaurus*'s head was held low so it could browse on ferns and other types of low ground cover. It chopped off vegetation with its toothless horn-covered beak but, lacking chewing or shearing teeth, swallowed its food quickly. In its huge stomach the food could ferment for days while being crushed by stones *Stegosaurus* had deliberately swallowed. Stegosaurs seemed to have disappeared at the beginning of the Cretaceous period, interestingly at the same time that ankylosaurs were becoming more plentiful. *Stegosaurus* fossils, first discovered in 1877, have been found in North America.



STEGOSAURUS

Lambeosaurus

Lambeosaurus lambei
Ornithischia • Reptilia • Chordata

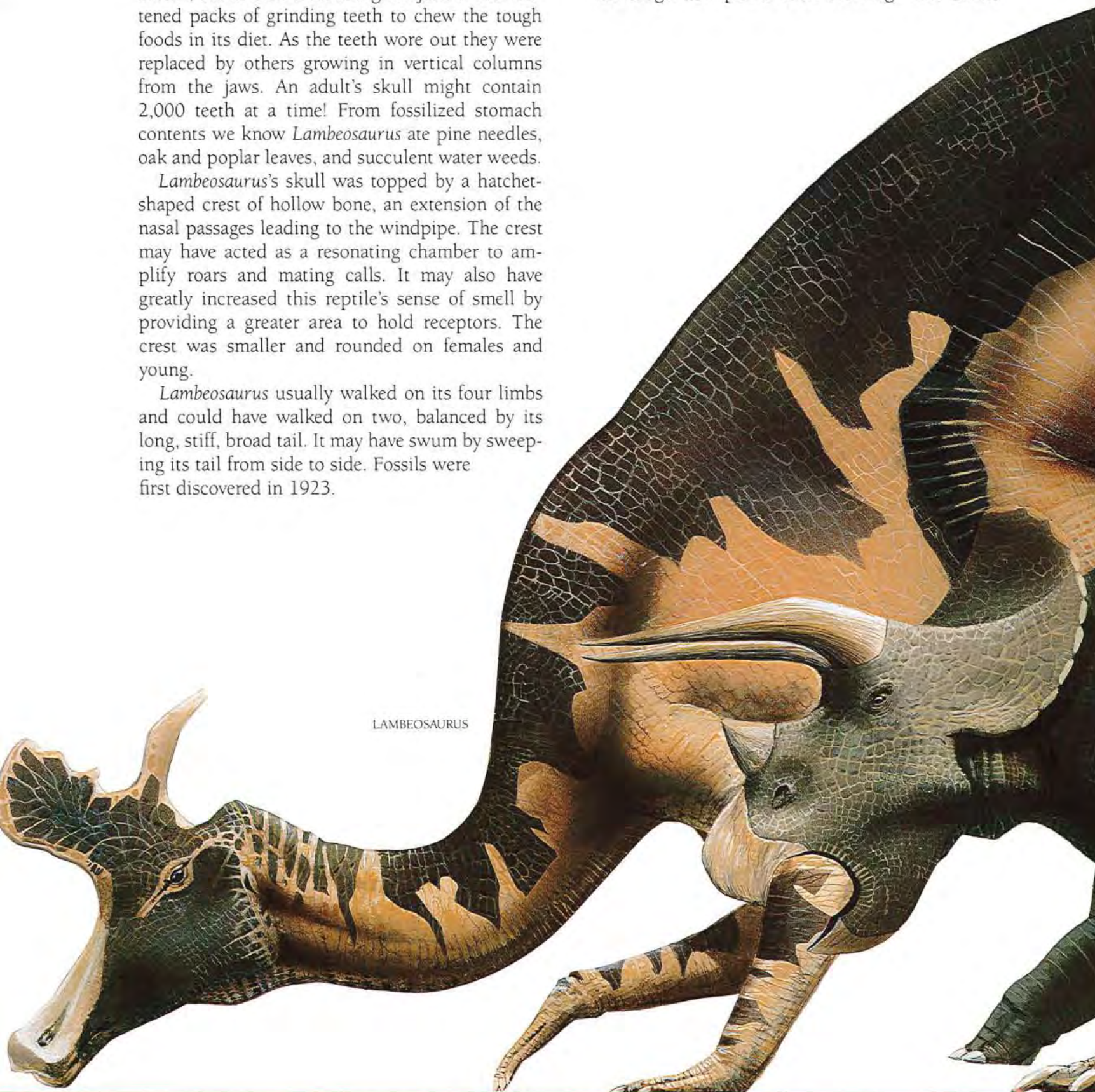
[extinct]

Lambeosaurus (lam-bee-uh-SOR-uss) was named in honor of its discoverer, Lawrence Lambe. A 56-foot skeleton recently unearthed on the Baja California peninsula establishes *Lambeosaurus* as the largest of the hadrosaurs, or duck-billed dinosaurs.

Lambeosaurus lived during the late Cretaceous period, around 80 million years ago. Like other hadrosaurs, it had a broad, toothless beak like a duck's, but farther back along the jaws it had flattened packs of grinding teeth to chew the tough foods in its diet. As the teeth wore out they were replaced by others growing in vertical columns from the jaws. An adult's skull might contain 2,000 teeth at a time! From fossilized stomach contents we know *Lambeosaurus* ate pine needles, oak and poplar leaves, and succulent water weeds.

Lambeosaurus's skull was topped by a hatchet-shaped crest of hollow bone, an extension of the nasal passages leading to the windpipe. The crest may have acted as a resonating chamber to amplify roars and mating calls. It may also have greatly increased this reptile's sense of smell by providing a greater area to hold receptors. The crest was smaller and rounded on females and young.

Lambeosaurus usually walked on its four limbs and could have walked on two, balanced by its long, stiff, broad tail. It may have swum by sweeping its tail from side to side. Fossils were first discovered in 1923.



Triceratops

Triceratops horridus
Ornithischia • Reptilia • Chordata

[extinct]

Triceratops (trie-SER-uh-tops) was the largest of the ceratopsians, plant-eating reptiles with a bony collar frill and a beak like a parrot's. The largest *Triceratops* was a 12,000-pound dinosaur, 30 feet long and 9½ feet tall at the shoulder. Its skull was 7 feet long with 3½-foot-long horns. The collar frill helped to defend the animal from attack and also anchored the large jaw muscles that enabled its curved beak and shearing teeth to crush the tough new plants then evolving. Like cattle,

two *Triceratops* may have locked horns to push and shove each other until one conceded defeat. *Triceratops*'s forelimbs were probably held straight under the body in usual dinosaur fashion rather than stuck out to the sides, as they have usually been pictured. With straight legs *Triceratops* could have run as fast as 30 miles per hour.

Triceratops was one of the commonest dinosaurs in North America toward the end of the Cretaceous period and one of the last of the giant dinosaurs to become extinct, about 64 million years ago. Fossils were first discovered in 1877.

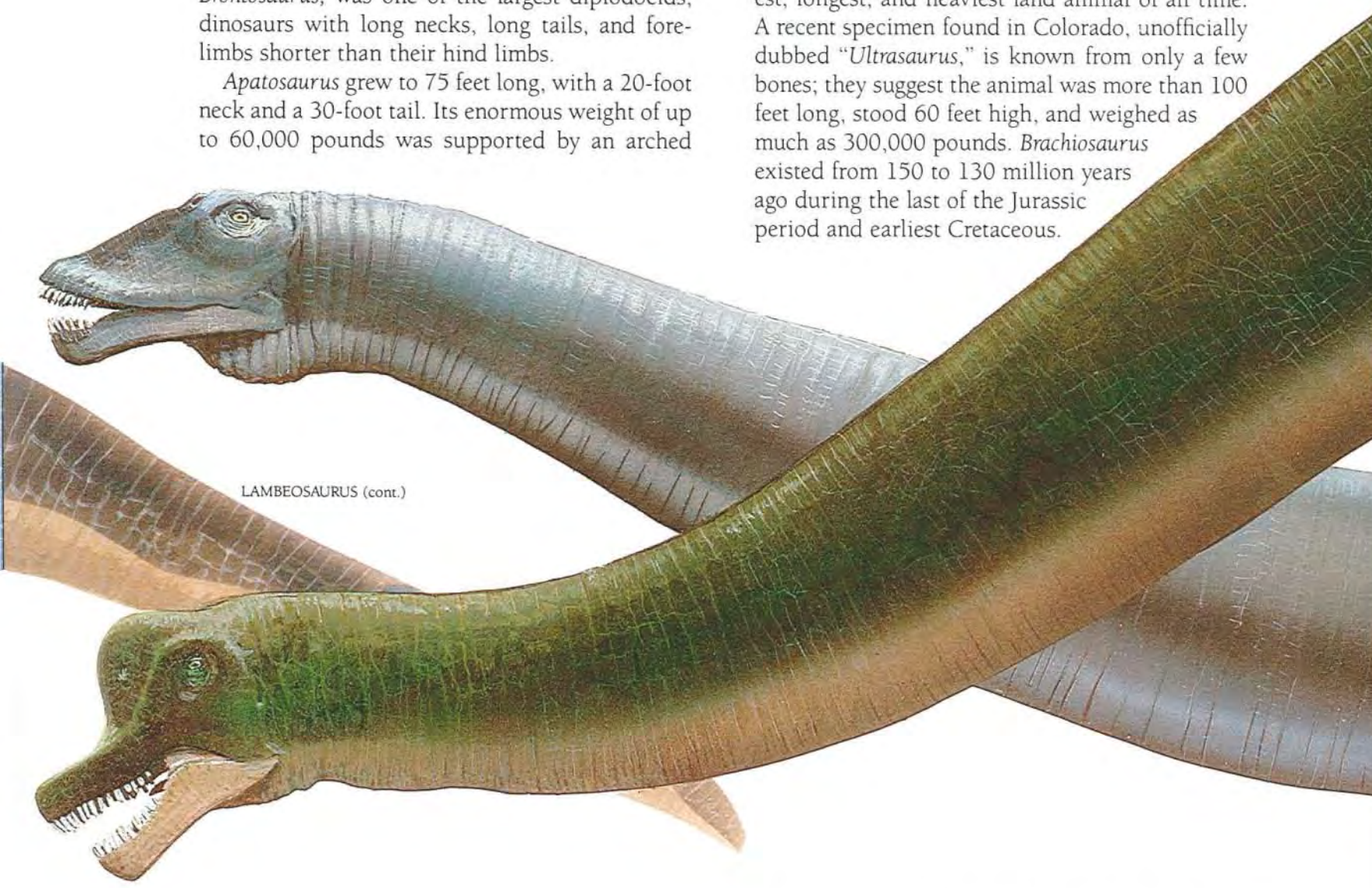


Apatosaurus

Apatosaurus ajax [extinct]
Saurischia • Reptilia • Chordata

Apatosaurus (app-uh-toe-sor-uss), also known as *Brontosaurus*, was one of the largest diplodocids, dinosaurs with long necks, long tails, and forelimbs shorter than their hind limbs.

Apatosaurus grew to 75 feet long, with a 20-foot neck and a 30-foot tail. Its enormous weight of up to 60,000 pounds was supported by an arched



LAMBEOSAURUS (cont.)

backbone of hollow vertebrae held aloft by massive, nearly solid leg bones. Like an elephant, *Apatosaurus* had a single nasal opening, located high on its head between its eyes.

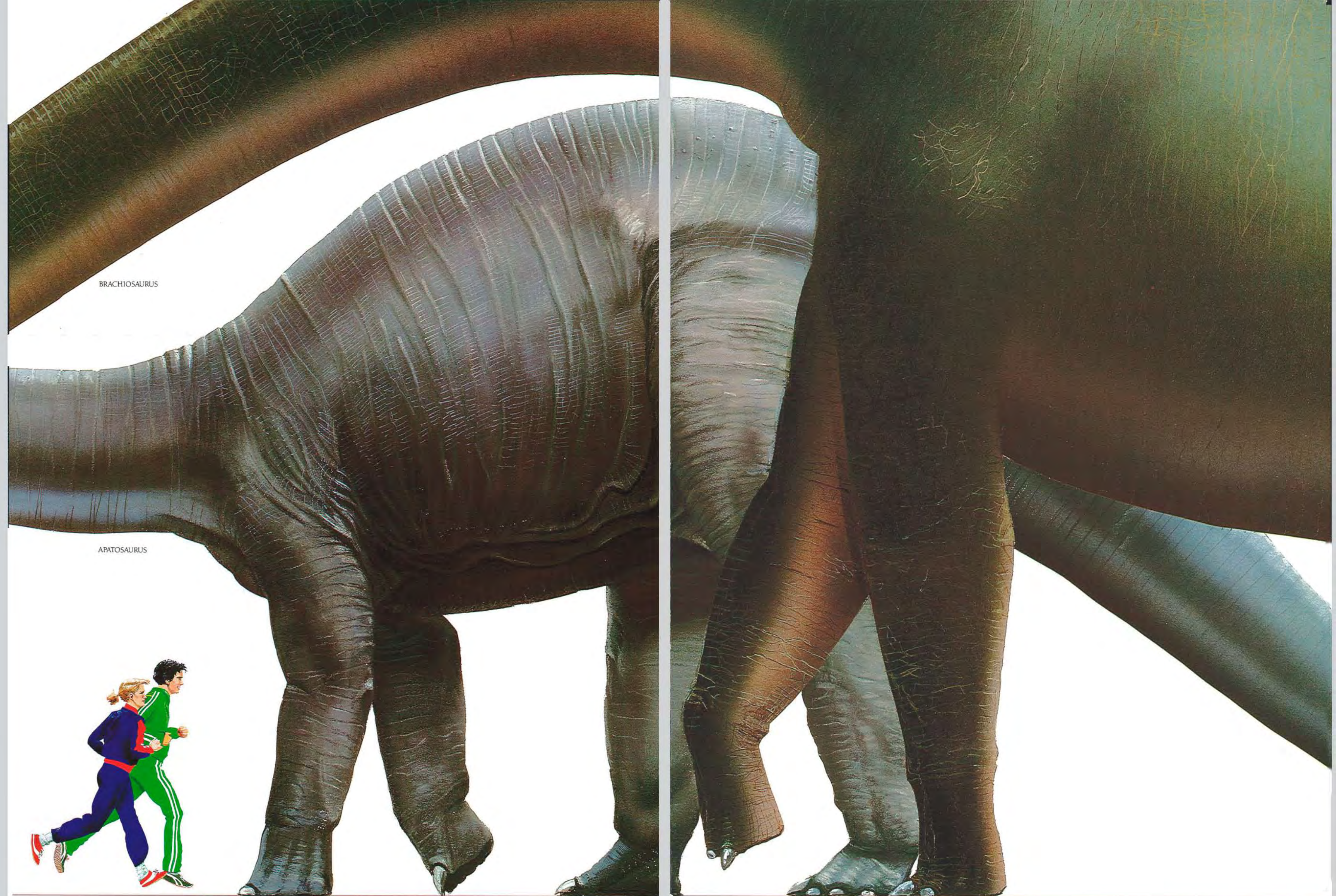
With its peglike teeth, it snipped off swamp vegetation and pine needles, swallowing everything whole because it had no chewing teeth. Like birds and crocodiles, *Apatosaurus* deliberately swallowed rough-edged stones to help grind food inside its stomach.

Apatosaurus seems to have been a land dweller that occasionally went into the water. It lived in North America during the late Jurassic period, 140 million years ago, and was among the commonest land animals of its day. From fossil footprints we know it moved in herds with the adults surrounding the young to protect them. Fossils were first discovered in 1877.

Brachiosaurus

Brachiosaurus branchi [extinct]
Saurischia • Reptilia • Chordata

Brachiosaurus (bray-kee-uh-sor-uss) was the largest, longest, and heaviest land animal of all time. A recent specimen found in Colorado, unofficially dubbed "*Ultrasaurus*," is known from only a few bones; they suggest the animal was more than 100 feet long, stood 60 feet high, and weighed as much as 300,000 pounds. *Brachiosaurus* existed from 150 to 130 million years ago during the last of the Jurassic period and earliest Cretaceous.



BRACHIOSAURUS

APATOSAURUS

It is the largest of the brachiosaurs, a family of long-necked plant-eaters with high shoulders, and forelimbs longer than their hindlimbs, giving their backs a characteristic down slope.

A full-grown *Brachiosaurus* was protected from predators by its great bulk. It retained heat by the sheer mass of its body and may have cooled off by wading into water. With its long neck, it could reach high leaves that no other dinosaur could touch. *Brachiosaurus*'s nostrils were placed on a crest on top of its head, perhaps so that it could breathe while cropping water plants. The crest may have increased *Brachiosaurus*'s sense of smell or acted as a resonating chamber for mating calls.

Its feet were broad, with a pad on the bottom that flattened and spread to cushion each step and prevent the animal from sinking too deep into soft mud. Fossils of *Brachiosaurus* were first discovered in 1903 in East Africa and have since been found in Europe as well as North America.

Mamenchisaurus

Mamenchisaurus hochuanensis [extinct]
Saurischia • Reptilia • Chordata

Mamenchisaurus (mah-MEN-chee-SOR-uss) was named for the town of MamENCHI, in China, where its fossils were discovered. This 72-foot-long dinosaur, related to *Apatosaurus* (page 26), is distinguished by its extremely long neck.

The neck, made of 19 vertebrae (more than in any other dinosaur), was held fairly rigidly by a series of overlapping bones for more than half its 35-foot length. It was more flexible only near the small head and where the neck attached to the chest. The best guess is that like *Brachiosaurus*, *Mamenchisaurus* stood in shoulder-deep water and floated its neck on the surface, sweeping its head back and forth collecting aquatic plants to eat. Some scientists think it could have stood on its hind legs to reach vegetation on trees.

Mamenchisaurus lived in the late Jurassic period in Asia, some 150 million years ago. Fossils were first discovered in 1954.

MAMENCHISAURUS

BRACHIOSAURUS (cont.)

APATOSAURUS (cont.)



Quetzalcoatlus

Quetzalcoatlus northropi [extinct]
Pterosauria • Reptilia • Chordata

Quetzalcoatlus (ket-sahl-koe-AHT-luss), named for Quetzalcoatl, the Aztec plumed-serpent god, was the largest flying animal of all time. It had a wingspan, estimated from bone fragments, of between 35 and 40 feet. This pterosaur must have weighed about 150 pounds. It had a long neck, a sharp beak, and no skull crest. The arm and leg bones of *Quetzalcoatlus* were twice as long as *Pteranodon's* and some of its neck bones were seven times as long.

Quetzalcoatlus lived 65 million years ago on the plains of Cretaceous Texas. Like a modern soaring bird, it probably waited until late morning for the hot sun to stir up rising currents of warm air, called thermals. It could catch one of these with only a few flaps of its gigantic wings. The thermal would lift it high in the air, giving it an excellent view of its territory. Some scientists think that *Quetzalcoatlus* was a carrion eater. Others suggest that it waded along the shallows of ponds and lakes, spearing fish and other animals with its long, toothless jaws. Fossil remains were first described in 1975.

QUETZALCOATLUS



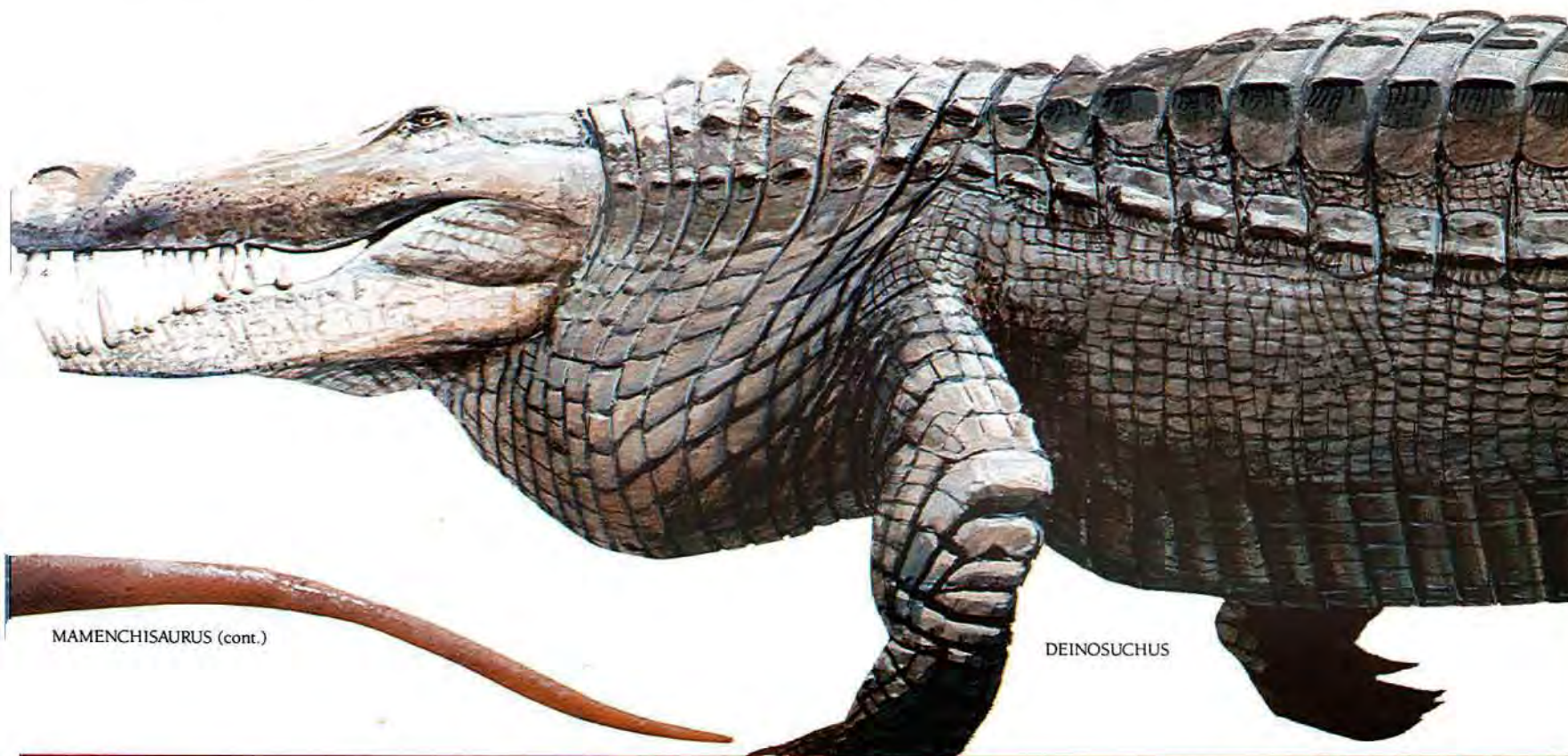
Deinosuchus

Deinosuchus hatcheri [extinct]
Crocodilia • Reptilia • Chordata

Deinosuchus (die-nuh-SOOK-uss), also known as *Phobosuchus*, was the largest crocodylian of all time. It may have been as long as 52 feet and may have weighed 27,200 pounds. The largest modern crocodiles, presently the largest living meat eaters on land, may reach up to 20 feet long but average 15 feet long and 900 to 1,200 pounds.

Deinosuchus lived during the Jurassic period, 150 million years ago. It had a 6-foot-long skull and heavy, platelike scales. Except for its teeth, which were larger but fewer in number than a modern crocodile's, it likely had the same proportions, habits, and diet as today's animal. Living near coastal land in tropical and subtropical waters, it probably laid its eggs in nests on land. *Deinosuchus* would have swum like other crocodiles, using its tail in a side-to-side serpentine motion. It could probably run over land for short distances but likely spent most of its time sunning itself, digesting a meal, or lazing about at the surface of the warm water.

With nostrils on the tip of its snout and eyes on the top of its head, *Deinosuchus* could breathe and see while almost completely submerged. It could sneak up and attack unwary wading dinosaurs. Like most reptiles, it had no chewing teeth and would have swallowed huge chunks of food whole. *Deinosuchus* could reduce large prey to bite-sized pieces by clamping it securely in the jaws and viciously twisting and whipping it about in the water until the victim fell apart, as crocodiles do today.



MAMENCHISAURUS (cont.)

DEINOSUCHUS

Giant Dragonfly

Meganeura monyi [extinct]
Odonata • Insecta • Arthropoda

Meganeura (megg-uh-NYEW-ruh) was a giant prehistoric dragonfly with the largest wingspan of any insect ever known: 28 inches from tip to tip. Fossils of *Meganeura* were found in Carboniferous-period rocks dating from 280 million years ago.

Apart from its gigantic size, *Meganeura* looked exactly like a modern dragonfly, with a long, slender body and two pairs of transparent, veined wings. If *Meganeura* resembled modern dragonflies in other respects, it may have flown at speeds of up to 60 miles per hour. *Meganeura* held its legs underneath its body as a basket so that it could trap airborne insects and eat them in flight.

A young *Meganeura* hatched from an egg and began life as a meat-eating, wingless, underwater nymph. Its extendable jaws could reach out half the length of its body to snatch prey. Growth occurred through repeated shedding of the skin. After a few years, the nymph crawled onto a rock or water plant above the surface of the water for its last shedding. The skin along its back split open, revealing a winged adult *Meganeura*, ready to fly, eat, and mate.



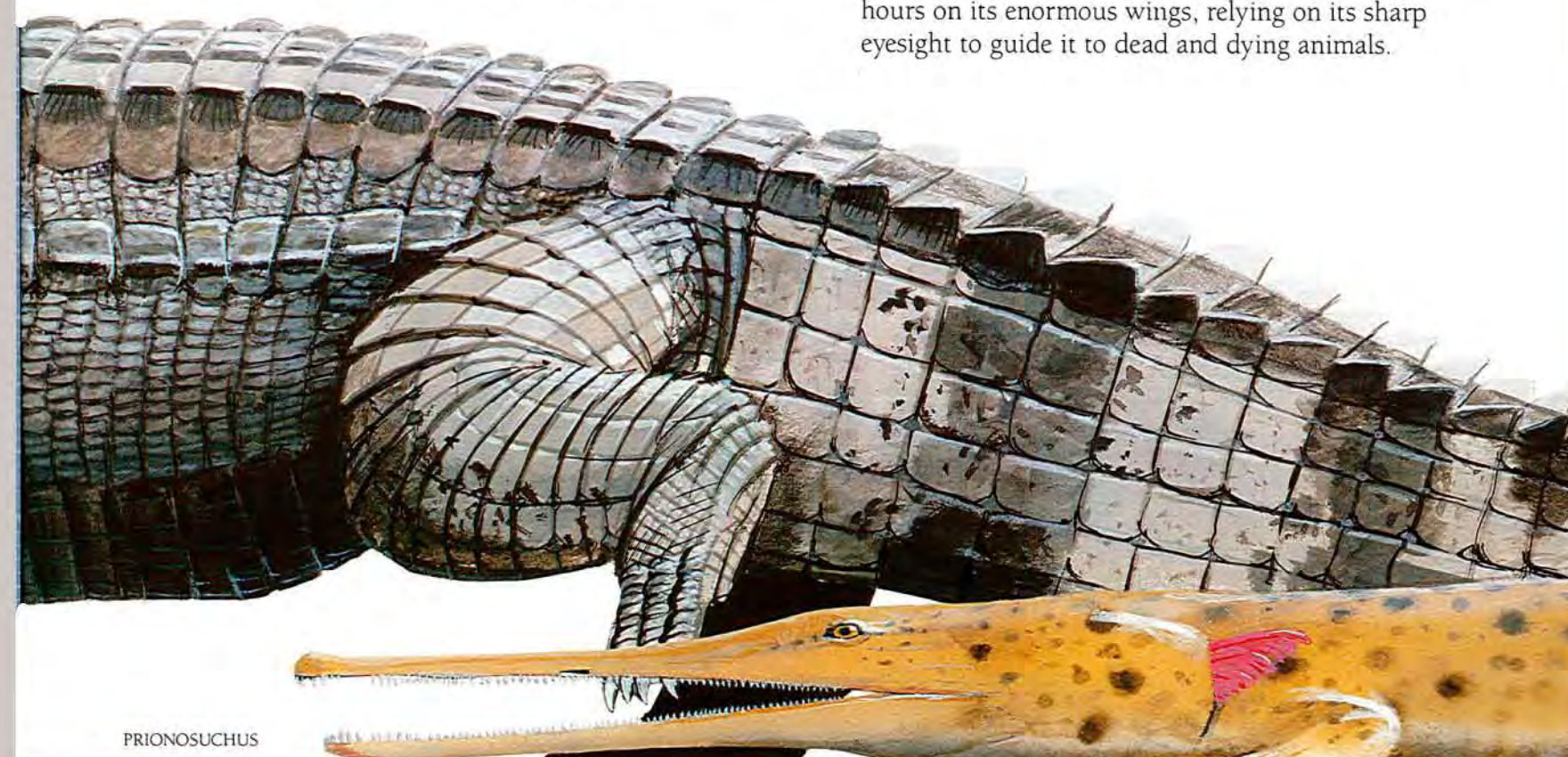
GIANT DRAGONFLY

Prionosuchus

Prionosuchus plummeri [extinct]
Temnospondyli • Amphibia • Chordata

Prionosuchus (pree-oe-noe-SOOK-uss) was the largest amphibian that ever lived and the largest land animal of the Permian period, 230 million years ago. Discovered in 1972 in northern Brazil, the fossilized bone fragments of this 30-foot-long amphibian indicate it resembled a present-day gavia, a type of crocodylian. Its extremely long and narrow tooth-lined jaws made an efficient fish trap.

Some scientists think *Prionosuchus* was entirely aquatic. After hatching from eggs laid in the water, its young lived like fish, using gills to breathe.



PRIONOSUCHUS

Pteranodon

Pteranodon ingens [extinct]
Pterosauria • Reptilia • Chordata

Pteranodon (ter-AN-uh-don) was a tremendous pterosaur—a flying reptile—with a wingspan of up to 24 feet. It had a 6-foot-long head, including a 27-inch crest. *Pteranodon* probably weighed only 36 pounds.

Pteranodon's wings were thin membranes of skin connected along its body to its hip and out to its greatly elongated fourth "finger." The wing membranes were reinforced by long, flat fibers that gave the wing strength. *Pteranodon*'s hollow bones made the animal so lightweight that it could simply stretch out its wings and soar in light sea breezes. Its bony crest, which was only 1/8 inch thick in places, jutted from the back of its skull, acting as an aerodynamic balance to its long, toothless beak. Flying over Cretaceous oceans 90 million years ago, *Pteranodon* plucked shelled squids, fish, and other small animals from the sea and stored them in a small pouch under its throat.

Scientists think *Pteranodon* was probably warm-blooded, able to make its own body heat instead of just absorbing heat from its surroundings as most reptiles and other cold-blooded animals do. This guess about *Pteranodon* is based on the fact that furlike impressions have been found in the fossils of similar pterosaurs. Fur and feathers are insulating materials presently found only on warm-blooded animals.

Pteranodon may also have been light-colored or white. As it stretched its wings while flying under the hot sun, a light coloring would have helped it stay cool by not absorbing the heat as dark colors do. Also, a white underside helps flying animals blend in with the sky and not scare the surface fish that were *Pteranodon*'s main source of food. Fossils were first discovered in the 1860s and continue to be discovered in Kansas and Nebraska.

Giant Condor

Argentavis magnificens [extinct]
Falconiformes • Aves • Chordata

The giant condor, a South American vulture, had the largest wingspan of any bird ever, estimated at 23 to 25 feet, twice that of modern condors. The giant condor lived during the Pleistocene epoch a million years ago. Fossilized bone fragments were discovered in 1979, from which scientists have reconstructed a bird nearly identical to the California condor except in size.

The giant condor was probably a carrion eater. Carrion, the carcasses of dead animals, is filled with the bacteria of decay and is poisonous to most living animals, but the giant condor would have been well adapted to deal with it. Its digestive system could probably kill bacteria. Vultures eat by poking their heads into bloody, open carcasses. The giant condor's head was likely bare of feathers so that it would dry quickly and be exposed to the purifying effects of sunlight. The giant condor must have lived near areas with permanent soaring conditions and stayed aloft for hours on its enormous wings, relying on its sharp eyesight to guide it to dead and dying animals.



GIANT CONDOR



PTERANODON

Elasmosaurus

Elasmosaurus platyurus [extinct]
Sauropterygia • Reptilia • Chordata

Elasmosaurus (ee-laz-moe-SOR-uss) was the largest of the plesiosaurs, seagoing reptiles with long necks, smallish heads, and limbs that had evolved into flippers. *Elasmosaurus* reached a length of 47 feet. Its snaky 25-foot neck was more than half the length of its body and had up to 71 vertebrae. *Elasmosaurus* held its long, flexible neck ready to catch any fish unfortunate enough to swim by. Its mouth was an effective fish trap, filled with teeth so long and sharp they stuck out to the sides when it closed its jaws.

Elasmosaurus lived 80 million years ago in Cretaceous seas. It was a fast, agile swimmer. Scientists believe *Elasmosaurus* could paddle backward, forward, or in circles equally well. It is not known whether *Elasmosaurus* returned to land to lay eggs or gave birth to live young at sea. First described in 1868, fossils have been found in North America.

ELASMOSAURUS

KRONOSAURUS

Kronosaurus

Kronosaurus queenslandicus [extinct]
Sauropterygia • Reptilia • Chordata

Kronosaurus (kroe-nuh-SOR-uss) was the largest of the pliosaurs, seagoing reptiles with short necks, large heads, and feet that had evolved into flippers. *Kronosaurus* was 56 feet long, including its 12-foot-long jaws lined with 80 sharp, conical, 9-inch-long teeth. It swam in Australian seas during the Cretaceous period, 100 million years ago.

Kronosaurus was a powerful long-distance swimmer. It may have dived nearly 1,000 feet to catch ammonites, once common, free-swimming, squidlike creatures with spiral shells. *Kronosaurus*'s flippers moved like the wings of a penguin, up and down against the water. Huge muscles

twisted and pulled the flippers back like wings, helping *Kronosaurus* "fly" through the water, gaining speed on both the upstroke and the downstroke. *Kronosaurus*'s lower breastbones, ribs, and hip girdle formed a hard basket of bone that served both to protect its vulnerable underside from attack and to securely anchor its huge swimming muscles.

Kronosaurus breathed air and must have returned to the surface frequently to do so. Because of the animal's huge size it is improbable that females returned to land to lay eggs, in the manner of sea turtles. Perhaps they gave birth in shallow ocean waters where their young could rise quickly to the surface for a first breath.

