Saurosuchus

(sor-uh-SOOK-uss) "lizard crocodile"
Archosauria • Rauisuchia • Rauisuchidae
Late Triassic • Argentina • 20 feet long

One of the largest of the early archosaurs was *Saurosuchus*. Like others in the rauisuchian family, it was a bloodthirsty meat eater that lived primarily on land. In contrast to related archosaurs, *Saurosuchus* featured less armor, a shorter snout, and curved, serrated teeth designed for slicing through flesh. And it was fast, too. *Saurosuchus* may have been able to move at great speed in short bursts because it could pull its hind limbs fully erect.

The scutes along the back and tail of *Saurosuchus* were each linked by a peg that fit into a socket on the next scute. *Saurosuchus*'s long backbone was partially supported by this chain of scutes.

Postosuchus

(post-uh-SOOK-uss) "[town of] Post [Texas] crocodile"
Archosauria • Rauisuchia • Poposauridae
Late Triassic • Texas • up to 13 feet long

Postosuchus was a ferocious rauisuchian with very small front limbs. It was not the first early archosaur capable of walking on only two legs, but it was one of the largest. *Postosuchus* terrified and dominated America's southwest. Its diet probably included other early archosaurs, dinosaurs, dicynodonts (page 16), and lizards.

Postosuchus and *Saurosuchus* were more closely related to crocodiles, despite their resemblance to dinosaurs. Certain features of their hips and ankles identify them this way. And no dinosaur had a linked double row of armor along the back like these rauisuchians.

Ornithosuchus

(or-nith-uh-SOOK-uss) "bird crocodile"
Archosauria • Ornithosuchia • Ornithosuchidae
Middle to Late Triassic • Scotland • up to 13 feet long

Ornithosuchus was one of the largest members of the family that bears its name. Whenever it snapped its mouth shut, twin fangs from the lower jaws remained wickedly exposed, bulldog fashion, outside a pinched-in section of its snout. With its extra-large knife-edged teeth, *Ornithosuchus* could have slashed a victim till it bled to death. A large, bony flange jutted out in front of each eye, perhaps serving as a canopy to shade it.

Ornithosuchians resembled the rauisuchians in having an erect stance and a predatory lifestyle, but they belonged to a separate line, the one that gave rise to dinosaurs.

Lagosuchus

(lah-go-SOOK-uss) "rabbit crocodile"
Archosauria • Ornithosuchia • Lagosuchidae
Middle Triassic • Argentina • 1 foot long

Lagosuchus is the closest thing we know to a direct ancestor of dinosaurs. Evidence for this comes in part from its ankle joint. In most land reptiles the ankle joint must rotate during the course of each step. In dinosaurs, pterosaurs, and birds, the ankle joint is stronger and simpler, working only in a fore-and-aft direction, like a hinge. Tiny *Lagosuchus* is one of the few other archosaurs known to have had this sort of simplified ankle joint.

Like a bird, *Lagosuchus* had hollow bones and was a graceful, agile sprinter at a lakeside community. It may have preyed upon small, swift lizards, relying on its great speed and agility for defense as well. It had five toes, but like most dinosaurs ran on only the middle three.

Pseudhesperosuchus

(sood-hes-per-uh-SOOK-uss) "false western crocodile"
Archosauria • Crocodilia • Sphenosuchia
Late Triassic • Argentina • 4 feet long

The very first crocodilians were not like the lumbering river ambushers we know today. In other words, not every crocodilian looked like a crocodile. The sphenosuchians were quite slender and agile land rovers, similar to their rauisuchian-like ancestors. *Pseudhesperosuchus* was just such an animal, built along the lines of a speedy greyhound, though not as fast.

Outwardly only the low profile of *Pseudhesperosuchus*'s head suggests its relationship with crocodiles. Its teeth were relatively few and small. Perhaps this was a "land croc" that specialized in raiding the nests of other reptiles, carting off the eggs and young. The slender proportions of its body may have helped *Pseudhesperosuchus* remain cool in the heat and humidity of its rain-soaked tropical jungle home.

Saltoposuchus

(salt-uh-poe-SOOK-uss) "leaping crocodile"
Archosauria • Crocodilia • Sphenosuchia
Late Triassic • Germany • 4 feet long

Saltoposuchus was a sphenosuchian land croc with such tiny forelimbs that it must have walked on its hind limbs alone. According to the fossil record, there were very few two-legged crocodilians. This one may have fed on fast-moving lizards and used its speed to escape from predators. (See other crocodilians on pages 43–45 and 60.)

Eudimorphodon

(you-die-MOR-foe-don) "true two-shaped teeth"
Archosauria • Pterosauria • Rhamphorhynchoidea
Late Triassic • Italy • 4-foot wingspread

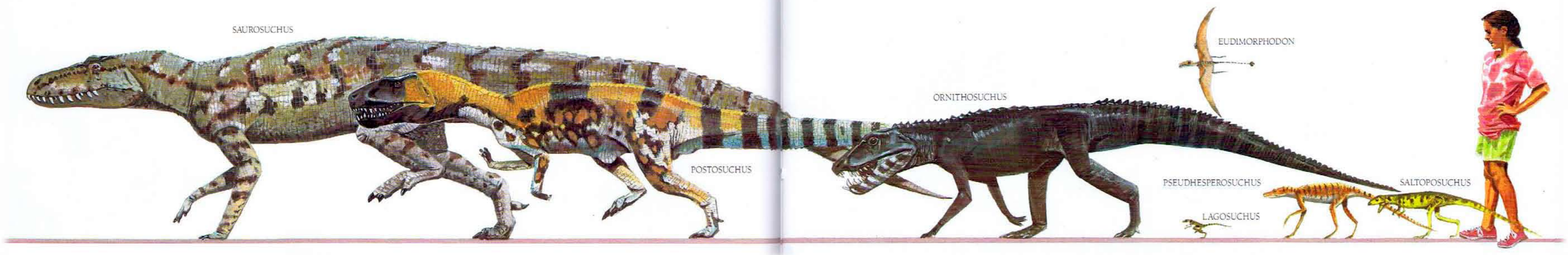
Pterosaurs were the only flying archosaurs (other than birds, which evolved later). Pterosaurs looked like tiny sprinting dinosaurs with wings, and with good reason. An archosaur like *Lagosuchus* was their common ancestor. *Eudimorphodon* is one of the earliest known pterosaurs. (See others on pages 35 and 46–47.)

With its teeth of many sizes, *Eudimorphodon* may have plucked fish from surface waters while flying overhead, like a modern skimmer. Like most known pterosaurs, it lived along the shorelines.

Eudimorphodon's forelimbs and especially its fourth finger were elongated to frame a wing. A special skinlike membrane stretched out between its body and its flapping arms. The wing skin was similar to that of a bat, but embedded with numerous hard, flat, but flexible fibers arranged parallel to one another, patterned like a bird's flight feathers. In contrast to bats, *Eudimorphodon*'s legs were not part of the wing and were kept tucked in during flight.

This early pterosaur was similar in many ways to the first bird, *Archaeopteryx* (page 37), though they were on different branches of the archosaur family tree. Both had a stiff, compact body to provide a sturdy base for their flapping wings. Both had a long, thin, stiff tail and walked with their heels elevated. Both had three sharp-clawed fingers in the leading edges of their wings. Both probably evolved from ground-sprinting, rather than tree-climbing, ancestors.

In contrast, no pterosaur had feathers, and the structure of the wing was different. Birds fold their wings at the wrist; *Eudimorphodon* folded its wings at the joint between the palm and the extra-long finger.



Staurikosaurus

(stoe-rik-uh-SOR-uss) "[southern] cross reptile"
Archosauria • Dinosauria • Staurikosauria
Middle Triassic • southernmost Brazil • 7 feet long

One of the very first dinosaurs was *Staurikosaurus*. This bloodthirsty meat eater was a better runner over longer distances than any of its archosaurian ancestors or contemporaries.

A typical reptile hipbone has a depression into which the head of the thighbone fits. Only in dinosaurs has this depression penetrated the bone to form a hole. This feature, and many others, indicates that dinosaur limbs were held vertically, fully beneath the torso, not splayed out. Like columns under a bridge, erect legs made the support of a heavy body possible, and allowed dinosaurs to become giants.

Alert, active, and perhaps warm-blooded, *Staurikosaurus* ran like a bird, with its backbone held horizontally, its large head counterbalanced by a long tail. As in birds, its ankle joint was a simple hinge. Only its toes touched the ground. Its heels were elevated to extend the stride and spring-cushion each step. This body plan made for a swift and agile animal, able to escape giant four-legged meat-eating archosaurs like *Ornithosuchus* (page 20) and pursue smaller archosaurs, cynodonts (page 16), and other reptiles.

Staurikosaurus's basic features were retained by every one of its meat-eating relatives for the next 150 million years. Those relatives that took to eating plants (such as sauropodomorphs, next page) developed big bellies and dropped down to all fours again when they grew bigger.

Coelophysis

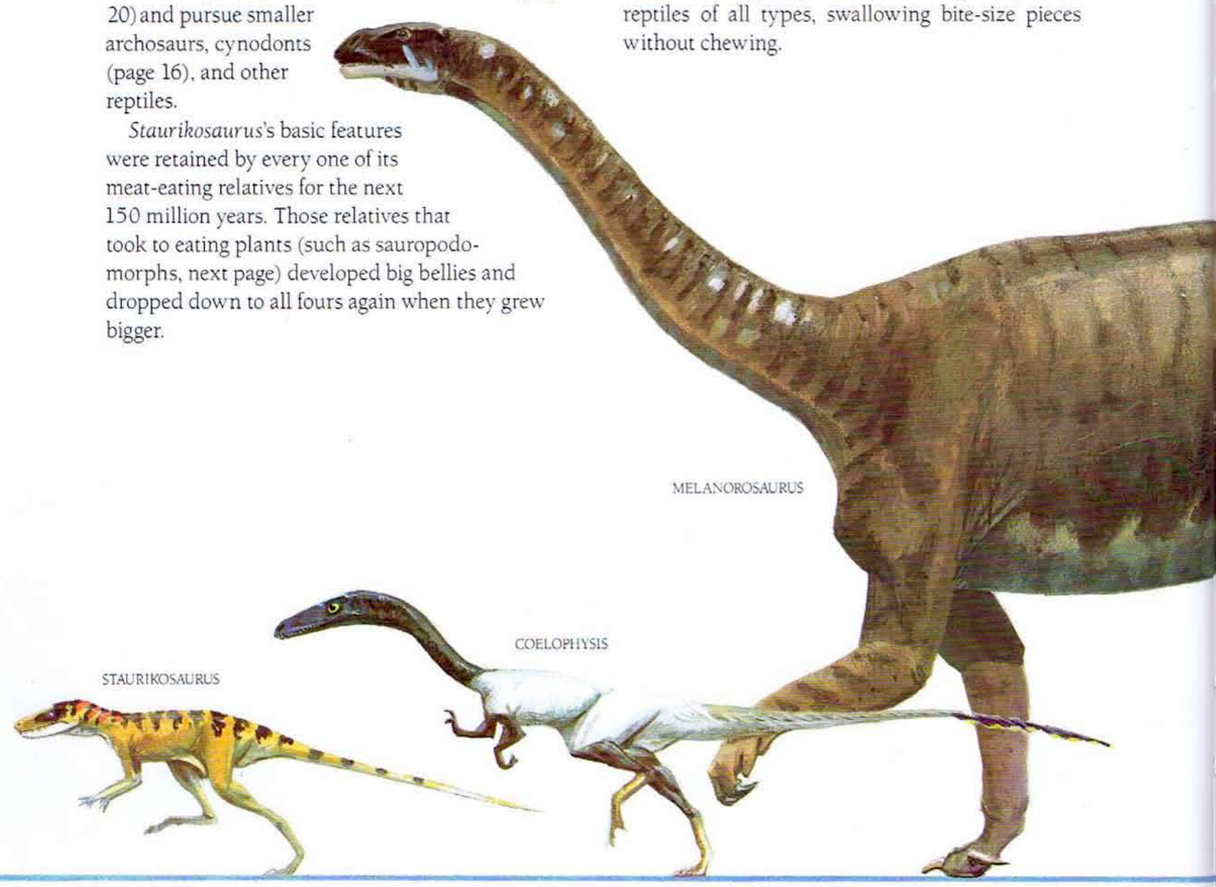
(see-loe-FIE-siss) "hollow form"
Archosauria • Dinosauria • Saurischia • Theropoda
Late Triassic • New Mexico, Arizona • 10 feet long

Coelophysis is classified as a saurischian ("reptile-hipped") dinosaur because its pubic bone pointed forward, as in most reptiles (see page 62).

About 210 million years ago dozens of *Coelophysis* were buried together, perhaps as the result of a flash flood that caught the flock by surprise. The abdomen area of some of the fossil skeletons contains young ones that appear too mature to have been embryos. Perhaps they were hatchlings that had been eaten by cannibalistic adults.

Scaly *Coelophysis* was one of the early theropods, the two-legged meat-eating dinosaurs. Lightly built and agile, it had hollow bones (hence its name) like those of a bird. *Coelophysis*'s skull was narrow and its jaws were lined with serrated slashing teeth for making deep gashes in the flesh of its prey. A flock (or pack) could have inflicted dozens of flesh wounds in a large victim, causing it to bleed to death.

Found in warm, humid forests of giant conifers alongside dicynodonts (page 16) and other archosaurs, *Coelophysis* probably ate large and small reptiles of all types, swallowing bite-size pieces without chewing.



Plateosaurus

(plate-ee-uh-SOR-uss) "flat reptile"
Archosauria • Dinosauria • Saurischia • Sauropodomorpha
Late Triassic • Europe, South Africa, Nova Scotia • 21 feet long

Plateosaurus was one of the earliest known saurischian plant eaters. A stretched-out body and neck enabled this dinosaur to feed on leaves beyond the reach of other plant eaters. Propped against a tree, *Plateosaurus* was able to stand on its hind legs alone, but fossil footprints indicate that this top-heavy dinosaur moved on all fours.

Plateosaurus had serrated, leaflike teeth and small cheeks to hold its food in while eating. It also swallowed rocks ("gizzard stones") to help pulverize the plant bits. For defense, its four long toes were each armed with a large claw and each hand bore an enormous "thumb" claw.

Melanorosaurus

(mel-ah-nor-uh-SOR-uss) "black mountain reptile"
Archosauria • Dinosauria • Saurischia • Sauropodomorpha
Late Triassic—Early Jurassic • South Africa • 36 feet long (est.)

Larger size meant that *Melanorosaurus* could feed even beyond the reach of *Plateosaurus*. Few enemies were large enough to attack an adult, especially within the protection of the herd. Like all dinosaurs, *Melanorosaurus* had a scaly skin.

Fabrosaurus

(fa-broe-SOR-uss) "[Jean Henri] Fabre's reptile"
Archosauria • Dinosauria • Ornithischia • Fabrosauridae
Late Triassic–Early Jurassic • South Africa • 3 feet long

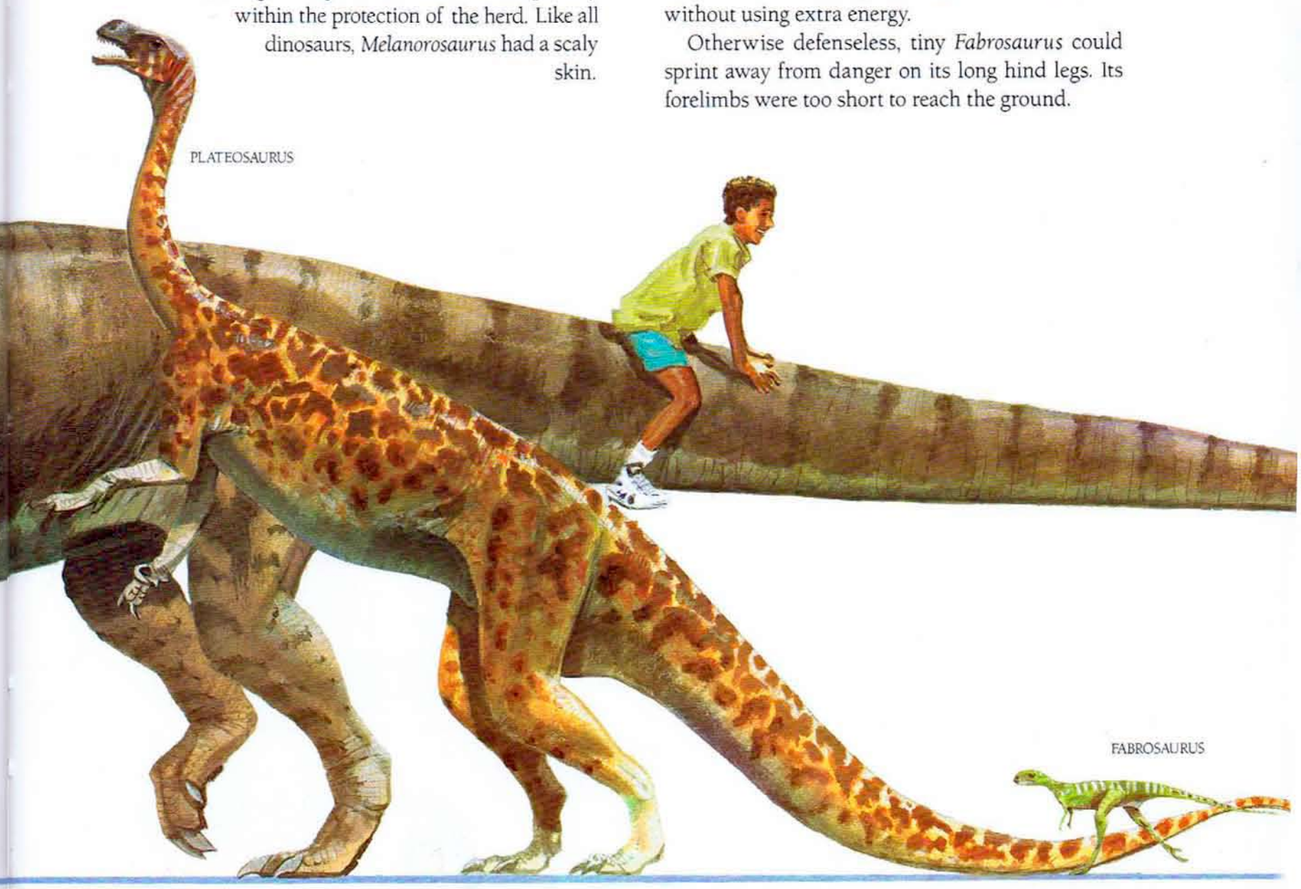
Closely resembling the small early saurischian dinosaurs was the early ornithischian *Fabrosaurus*. Ornithischians were plant-eating dinosaurs with birdlike hipbones and a lower jaw tipped with a beak. Most also had a corset of bone along the vertebrae.

The hipbones of *Fabrosaurus* were unlike those of the "reptile-hipped" saurischians. In ornithischians ("bird hips") the pubic bone pointed backward, creating room in the abdomen for a larger gut (see page 62). Birds have similar hips, but they are not related to ornithischians.

In place of teeth at the tip of its lower jaws, *Fabrosaurus* had a horn-covered beak that it used to snip off fernlike fronds from stumpy cycads. Its cheek teeth were small, weak, and useless for chewing.

Fabrosaurus, like all unarmored ornithischians, had a trellislike grouping of bony splints tying the vertebrae together from the lower back to the tail. This arrangement stiffened and supported the back like a corset, raising the counterbalancing tail without using extra energy.

Otherwise defenseless, tiny *Fabrosaurus* could sprint away from danger on its long hind legs. Its forelimbs were too short to reach the ground.



Utatsusaurus

(oo-tat-soo-SOR-uss) "Utatsu [Japan] reptile"
Ichthyosauria • Utatsusauridae
Early Triassic • Japan • 5 feet long

Ichthyosaurs ("fish reptiles") were reptiles that lived in the open seas like whales and dolphins. *Utatsusaurus* was one of the earliest. Its unknown ancestors must have been four-legged lizardlike land reptiles that found food in the water, much like the marine iguana of today. *Utatsusaurus*'s long, thin tail was not very different from that of a land reptile, but its limbs were transformed into swimming paddles. Inside each paddle were the bones that had once supported five separate fingers. Like a whale, *Utatsusaurus* breathed air, surfacing occasionally to do so, and gave birth to its young at sea.

Utatsusaurus was a fish eater with a short snout, long, thin teeth, and a streamlined body. Its eyes were large to spot its prey. The nostrils were near the eyes, far from the tip of the snout, as in most reptiles. Like other early ichthyosaurs, *Utatsusaurus* lived near the North Pole, suggesting either that the poles must have been much warmer then than they are today or that ichthyosaurs were unusual reptiles that could tolerate the cold.

Shonisaurus

(shone-ee-SOR-uss) "Shoshone [Mountain] reptile"
Ichthyosauria • Shastasauridae
Late Triassic • Nevada • 46 feet long

Shonisaurus was the largest ichthyosaur and one of the largest animals of its day, rivaling many living whales in size. It may have tipped the scales at 80,000 pounds.

This marine giant had long, slender jaws 10 feet in length that, curiously, were armed with only a few small teeth near the tips. Whatever it ate must have been small, soft, slow, and numerous. *Shonisaurus*'s eyes were 12 inches in diameter and ringed with overlapping bones that supported the eyeball to maintain focus and prevent its collapse under water pressure. The body was deep and especially wide at the belly to enclose a cavernous stomach that constantly needed refilling. *Shonisaurus* had huge paddles, and as in all early ichthyosaurs, the front pair was equal in size to the rear pair. The tail supported a small, triangular fin to help push or guide this reptile through the water. (See later ichthyosaurs on page 38.)

UTATSUSAURUS

CYMBOSPONDYLUS

SHONISAURUS

Cymbospondylus

(sim-boe-SPON-dee-luss) "hollow vertebrae"
Ichthyosauria • Shastasauridae
Middle Triassic • Nevada • up to 45 feet long (est.)

Cymbospondylus was the slenderest of the ichthyosaurs. In length some specimens rivaled *Shonisaurus*, though they were less than a fourth as heavy. For its size *Cymbospondylus* had the smallest head of any ichthyosaur, and it was the only one with a neck long enough to be flexible. The jaws of this vicious predator were filled with sharp, spiky teeth, ideal for snaring slippery fish and squidlike creatures.

PLACODUS

HENODUS

Placodus

(PLAK-uh-duss) "plate tooth"
Placodontia • Placodontidae
Middle Triassic • Europe • 9 feet long

Walruslike *Placodus* was one of the placodonts, unusual Triassic marine reptiles with massive flat back teeth set like paving stones in the jaws and palate for crushing the shells of sea mollusks. *Placodus* also had protruding front teeth for plucking mollusks off rocks.

Placodus had a stout body resembling that of other marine reptiles, except that it was armored with a single row of round, bony bumps above the spine. These would not have offered much protection from underwater predators. *Placodus* swam by undulating its long tapered tail and paddling with its small webbed feet. It could have been found either submerged in quiet shallow sea inlets or sunning itself on the nearby shore.

Henodus

(heh-NOE-duss) "one tooth"
Placodontia • Henodontidae
Late Triassic • Europe • 7 feet long

Henodus was a placodont with a shell resembling that of a turtle. But *Henodus*'s shell was broad and flat, and the pattern of its bones and scutes was totally different. *Henodus* had only four teeth, one upper and one lower on each side of its jaws (hence its name). Edging the front of the mouth beneath its squared-off beak were short strainer plates that filtered small crustaceans and plankton out of seawater. *Henodus* was probably a timid creature that buried itself in the sands beneath shallow waters where food was plentiful and air was not far away. Its tiny limbs would not have propelled it quickly through the sea. *Henodus* would have relied on its large tail to do that.

Paranothosaurus

(pair-uh-noe-thuh-SOR-uss) "similar to the false reptile"
Sauropterygia • Nothosauria • Nothosauridae
Middle Triassic • Germany • 13 feet long

Paranothosaurus was one of the largest nothosaurs, "reptilian seals" better adapted to swimming than to hauling themselves out on land. A swift and agile marine reptile, *Paranothosaurus* had a long flexible neck, like all nothosaurs, and long, flat jaws that would have snapped at passing fish faster than the blink of an eye.

Paranothosaurus was an aggressive predator, well adapted to life in the sea. Its limbs were small but had not changed into flippers. Perhaps they were useful in "rowing" through the water. *Paranothosaurus* probably made quick starts and fast changes of direction by rapidly undulating its long flexible body and tail like a crocodile. On rare excursions to land, perhaps to nest or sun itself, *Paranothosaurus* would have pushed itself along, sledding on its belly, because its legs were too small to have hoisted its body off the ground.

Pistosaurus

(pis-toe-SOR-uss) "liquid reptile"
Sauropterygia • Plesiosauria • Pistosauroidea
Middle Triassic • France • 10 feet long

Pistosaurus was one of the earliest of the plesiosaurs, seagoing nothosaur relatives that swam by flapping their large flipperlike limbs, not by undulating their long torsos and tails. Not very different from a large nothosaur, *Pistosaurus* may have undulated a bit while flapping. *Pistosaurus* was a fish eater that darted its long neck and narrow snout into schools of fish for a meal. Whether it ever ventured on land is not known. (See later plesiosaurs on pages 39–42.)

PARANOTHOSAURUS

PISTOSAURUS

"SEISMOSAURUS"

Patagosaurus

(pat-uh-go-SOR-uss) "Patagonia [Argentina] reptile"
Archosauria • Dinosauria • Saurischia • Sauropodomorpha
Middle Jurassic • Argentina • 40 feet long

The largest animals to ever walk on the earth were the fabulous long-necked, long-tailed sauropods, known chiefly from the Late Jurassic Period. Less well known were their ancestors, the cetiosaur sauropods, such as *Patagosaurus*, from the Early and Middle Jurassic.

The name sauropod means "lizard foot" and refers to the fact that sauropods had five digits on each foot, like most lizards and unlike most dinosaurs. The hind feet were thickly padded, like those of elephants. The digits on the "hands" were so short that no "fingers" were visible except for the clawed "thumb." On cetiosaurs, such as *Patagosaurus*, all five fingers may have been visible.

Patagosaurus, like most sauropods, was able to rear up on its hind legs, using its long tail as a prop, and raise its 12-foot-long neck and tiny head into the conifers, cycads, and ginkgoes for a meal of cones, needles, or leaves. Its nostrils were set high on its head, probably as an aid to breathing while *Patagosaurus* was drinking.

Two different-size adults and three juveniles of various sizes were all found at one fossil site, suggesting that *Patagosaurus* stayed together as a family.

PATAGOSAURUS

Dilophosaurus

(die-loe-fuh-SOR-uss) "two-crested reptile"
Archosauria • Dinosauria • Saurischia • Theropoda
Early Jurassic • Arizona • 20 feet long

Roaming the floodplains, *Dilophosaurus*, a relative of *Coelophysis* (page 22), seems to have been the largest theropod (meat-eating dinosaur) of its time. The fragile twin crests on top of *Dilophosaurus*'s head were probably attractive to potential mates and may have served as blood-cooling devices too.

"Seismosaurus"

(size-moe-SOR-uss) "earthquake reptile"
Archosauria • Dinosauria • Saurischia • Sauropodomorpha
Late Jurassic • New Mexico • 110+ feet long (est.)

For the last hundred years or so the longest dinosaur on record was *Diplodocus*, a slender sauropod measuring up to 87 feet in length. Now it appears that *Diplodocus* had a big brother.

"*Seismosaurus*," unofficially named and currently being excavated, seems to have resembled *Diplodocus*, but each new bone that comes up is bigger by far than its previously known counterpart. To date, 25 vertebrae, the pelvis, a thighbone, and miscellaneous other bones have either been exposed or excavated. Scientists estimate that the final length of "*Seismosaurus*" will reach between 110 and 145 feet, which is longer than the blue whale, the largest known animal of all time. In life "*Seismosaurus*" would likely have weighed more than 80,000 pounds.

Like other diplodocid sauropods, "*Seismosaurus*" must have had an extremely long neck and tail. The longer its neck, the higher it could reach into the conifers for food. Its tail probably ended in a whiplash tip that could have served as a defensive weapon. The incredible size of "*Seismosaurus*," however, must have been intimidating enough to scare away most would-be predators, especially if an entire herd reared together on their hind legs. The nostrils of "*Seismosaurus*" probably opened on top of the head between the eyes. Its teeth were likely pencil-shaped and set only in the front of its mouth for scraping needles and cones from conifer branches.

DILOPHOSAURUS

Allosaurus

(al-uh-SOR-uss) "different reptile"
Archosauria • Dinosauria • Saurischia • Theropoda
Late Jurassic • North America, Africa • 39+ feet long

The largest predator of the Jurassic was the mighty 15,000-pound *Allosaurus*. Hunting in ravaging packs, this land-roving killer chased down its prey, subduing it by piercing the victim's hide with large wickedly curved claws and knifelike serrated fangs. Afterward it feasted on great chunks of flesh and entrails jerked out with its massive neck muscles and swallowed whole, without chewing. Deep water was no haven for potential prey because fossil evidence shows that large theropods could swim.

Scaly *Allosaurus* had a larger head than those of earlier meat-eating dinosaurs. Its neck was also stronger and shorter to support the additional weight. Its skull and jaws were lightly built and flexible to expand around large mouthfuls of dinosaur flesh. Hollow bony ridges decorated the skull over the eyes, giving *Allosaurus* a pair of evil-looking "horns." The teeth were likely covered by lips. *Allosaurus* was able to run with a 12-foot-long stride that would have enabled it to overtake almost any prey.

ALLOSAURUS

Compsognathus

(komp-SOG-nuh-thuss) "elegant jaw"
Archosauria • Dinosauria • Saurischia • Theropoda
Late Jurassic • France • 2 to 4.5 feet long

Living at the same time as the largest dinosaur of all was the smallest known dinosaur, the chicken-size *Compsognathus*. Related to *Coelophysis*, this fleet-footed birdlike predator evidently chased agile lizards and early mammals through the brush.

COMPSOGNATHUS

BRACHIOSAURUS

"SEISMOSAURUS" (cont.)

CERATOSAURUS

Brachiosaurus

(bray-kee-uh-SOR-uss) "arm reptile"
Archosauria • Dinosauria • Saurischia • Sauropodomorpha
Late Jurassic • North America, East Africa
up to 100 feet long (est.)

The tallest known animal of all time was the sauropod *Brachiosaurus*. A complete skeleton of a 76-foot-long specimen displayed in Berlin reaches 39 feet in height. But some bones have been found of an even larger brachiosaur that would have been 100 feet long and 60 feet tall! No predator dared to confront one of these giants.

Unlike most other four-legged animals, *Brachiosaurus* had longer arms than legs, hence the name "arm reptile." Like the giraffe, this sauropod had no need to rise up on its hind legs in order to feed in the leaf canopies of redwoods and cycads. Its tail, unnecessary as a prop, was relatively short.

For its size *Brachiosaurus* was surprisingly light. The largest of adults may have weighed as little as 100,000 pounds in lean condition. Except for its leg bones, its entire skeleton was hollowed out to lighten its weight without sacrificing structural strength.

Brachiosaurus could avoid overheating by remaining in the shadows of the forest to let the cool breezes circulate around its slender 26-foot-long neck, or perhaps it waded into the shallows of a river to cool off its legs.

A unique tall, narrow crest housed *Brachiosaurus*'s nostrils. Perhaps the crest acted as a resonating chamber for some sort of a toot, bleep, or whistle. This giant's stout teeth were shaped roughly like spoons, unlike the pencil-shaped teeth of diplodocids like *Apatosaurus*. Of any known vertebrate, *Brachiosaurus* may have had the smallest brain in relation to the size of its body. Apparently a lack of brain power posed no problems in the Late Jurassic.

Ceratosaurus

(ser-ah-toe-SOR-uss) "horned reptile"
Archosauria • Dinosauria • Saurischia • Theropoda
Late Jurassic • Western North America • 20 feet long

A savage meat eater with tooth-lined jaws, *Ceratosaurus* is immediately distinguished from all other theropods by an unusual bladelike horn on its snout and a decorative row of tiny narrow plates down its back. Perhaps this horn was used as a decoration attractive to the opposite sex or in sparring contests with rivals. Anything would have been better than inflicting lethal bites into other ceratosaurs in battles for dominance. *Ceratosaurus* featured a pair of decorative bony outgrowths above and in front of its eyes. Its skull and jaws were lightweight to be less burdensome, and both were flexible in order to allow huge chunks of meat to pass into its throat. *Ceratosaurus* could have attacked a young *Brachiosaurus* but was much too small to threaten an adult.

Apatosaurus

(ah-pat-toe-SOR-uss) "deceptive reptile"
Archosauria • Dinosauria • Saurischia • Sauropodomorpha
Late Jurassic • Colorado, Wyoming • up to 75 feet long

Formerly known as *Brontosaurus*, *Apatosaurus* was a giant sauropod weighing in at 60,000 pounds. This dinosaur had shorter arms than legs, its nostrils were on top of its head, and its tail ended in a whiplash tip. It also had a thick neck and a high arch in its backbone.

Apatosaurus was a common plains dweller that lived in family herds that migrated from place to place. Young ones may have found protection in the middle of the herd, as suggested by fossil footprints. Adults, because of their great size, probably had no enemies.

When it found a suitable forest grove, *Apatosaurus* would rear up on its hind legs and raise its small cheekless jaws into the cycad and conifer boughs for a meal, raking in fronds and needles with its pencil-like teeth. It deliberately swallowed rocks to mash the unchewed plant matter to pulp in its gizzard.

Many fossil reptiles are found without their skulls, and *Apatosaurus* was no exception. For many years the wrong head was assigned to its skeleton, but recently the right head was found and put into place.

Dicraeosaurus

(die-kree-uh-SOR-uss) "forked reptile"
Archosauria • Dinosauria • Saurischia • Sauropodomorpha
Late Jurassic • East Africa • 40 feet long

Not all sauropods had especially long necks and that of *Dicraeosaurus* was the shortest known, in proportion to the rest of its body. Evidently this dinosaur browsed on much lower-growing vegetation than other sauropods. Its neck vertebrae were deeply forked, hence its name. At the other end, its tail was very long and ended in a whiplash tip.

Dimorphodon

(die-MORF-uh-don) "two-shape teeth"
Archosauria • Pterosauria • Rhamphorhychoidea
Early Jurassic • England • 4-foot wingspread

Dimorphodon is the earliest known of the Jurassic pterosaurs (flying reptiles). It had a body that resembled that of its Triassic relative, *Eudimorphodon* (page 21), but its head was tall and its front teeth were spiky, perhaps to spear fish while on the wing. *Dimorphodon*'s cheek teeth were tiny and numerous, useful for gripping prey while swallowing.

Like the modern big-billed bird the toucan, *Dimorphodon* had an enormous airy snout that may have been equally colorful, perhaps to advertise itself to potential mates. *Dimorphodon*'s legs and front claws were very strong and sturdy. Perhaps it ran after lizards, attacking with tooth and claw, then flew away back to its nest with a meal for its hatchlings.

Dimorphodon, like other pterosaurs, was covered with a hairlike substance for insulation. Insulation helps keep the body at a constant temperature in extreme weather. It is found on warm-blooded animals, so pterosaurs may have been warm-blooded. (See also pages 46–47.)

APATOSAURUS

BRACHIOSAURUS (cont.)

DICRAEOSAURUS

DIMORPHODON

Scelidosaurus

(sel-ee-doe-SOR-uss) "limb reptile"
Archosauria • Dinosauria • Ornithischia • Scelidosauria
Early Jurassic • England • 13 feet long

The early bird-hipped plant eaters (such as *Fabrosaurus*, page 23) had many later relatives that were so large and top-heavy that they had to walk on their hands as well as their feet. Some of these developed an armor of bony plates arising from horny skin tissue, which protected them against the attacks of predators.

One of the earliest of these beaked, armored plant-eating dinosaurs was *Scelidosaurus*, weighing in at close to 1,000 pounds. This scaly dinosaur had rows of enlarged scutes underlaid with low bony studs, as in the ankylosaur *Sauropelta* (page 51). Its feet, legs, and tail remained similar to early ornithischians like *Fabrosaurus*. Its hips and head resembled those of the stegosaur *Stegosaurus* (facing page).

Scelidosaurus probably lived in forests, munching soft ferns while staying alert for danger. It would have run from predators, but if overtaken would have counted on its armor to help it survive.

Kentrosaurus

(KEN-truh-sor-uss) "spiked reptile"
Archosauria • Dinosauria • Ornithischia • Stegosauria
Late Jurassic • East Africa • 18 feet long

The fantastic stegosaurs arrived in the Late Jurassic sporting a variety of vertical spikes and plates. These served both as defensive armor and as an aid in giving off excess body heat. Closely related to scelidosaurs, stegosaurs spread world-wide. After the Jurassic, however, nearly all of them disappeared.

The most famous southern stegosaur, scaly *Kentrosaurus*, must have looked like a walking pincushion. Pairs of small, flat plates sprouted from its head to its hips and two-foot-long spikes sprang up along the top of its tail to the tip.

A contemporary of both *Brachiosaurus* and *Dicraeosaurus*, *Kentrosaurus* roamed in herds, finding additional protection in greater numbers. Judging by its toothless beak and small cheek teeth, *Kentrosaurus* ate soft plants that were swallowed whole and left to slowly ferment in its huge belly.

With its weight centered over its high hips, *Kentrosaurus* could pivot on its hind limbs and so keep its sharp-spiked tail swinging in the faces of its enemies. *Kentrosaurus* could also rise up off its front legs and browse on high-growing vegetation.

Stegosaurus

(stegg-uh-SOR-uss) "plated reptile"
Archosauria • Dinosauria • Ornithischia • Stegosauria
Late Jurassic • Colorado, Wyoming • 21 feet long

The largest and most famous of the stegosaurs was *Stegosaurus* itself. Many species are known. Each one has its own variety of plates and spikes. Vertical plates were unique to stegosaurs. Like the scutes of the early archosaurs, plates and spikes were embedded in the skin and were not directly attached to other bones. Evidently plates acted as cooling fins that worked in a similar fashion to the sail on the back of *Dimetrodon* (page 13). In life a horny sheath would have given the plates a razor-sharp edge for extra protection. Near the tip of its tail *Stegosaurus* had from four to eight formidable spikes. In some cases these reached 4 feet in length and would have gored any hungry predator foolish enough to approach them. Young stegosaurs seem to have had neither plates nor spikes.

Among dinosaurs, stegosaurs had the smallest feet. They plodded slowly like an elephant, with very little bend in the knees. Tough pads cushioned each footstep.

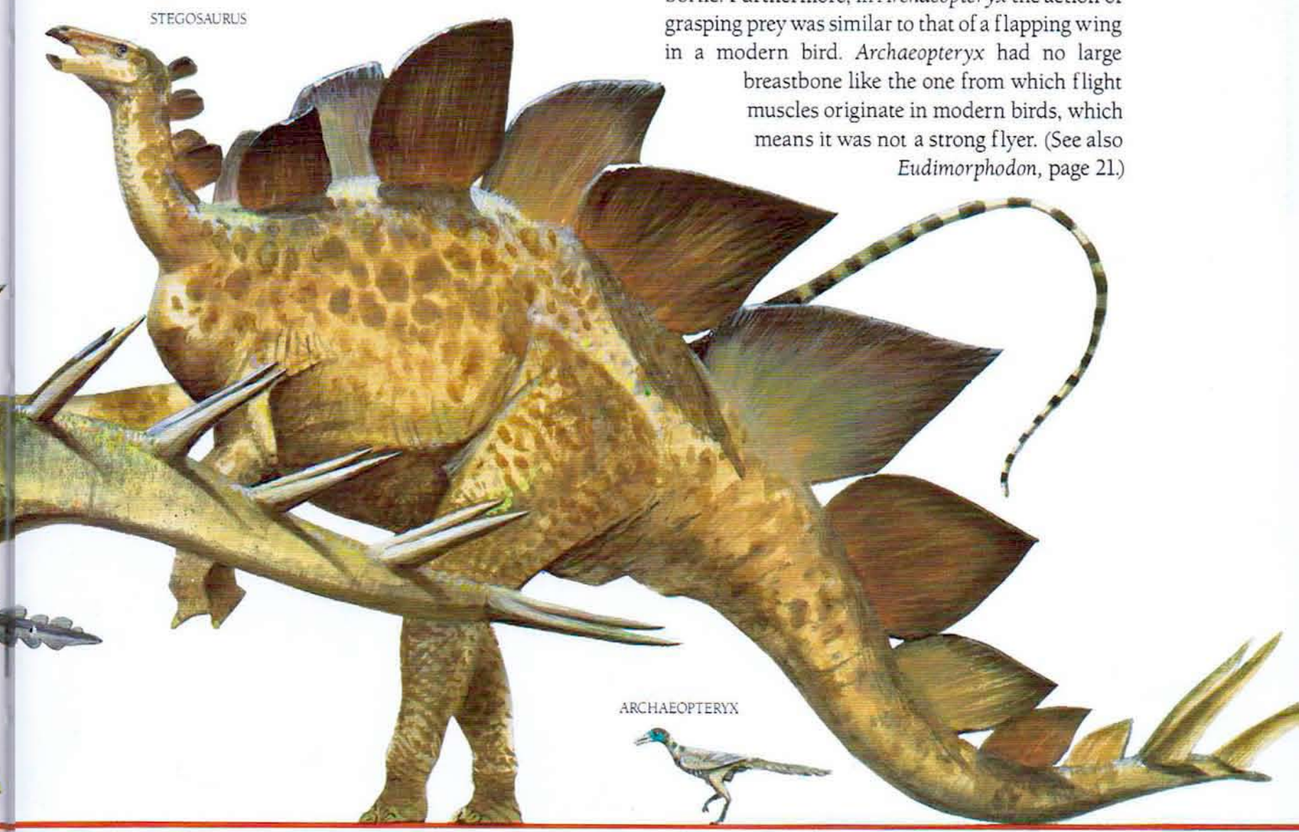
Archaeopteryx

(AR-kee-op-ter-iks) "ancient wing"
Archosauria • Aves • Archaeopterygiformes
Late Jurassic • Germany • 2-foot wingspread

Archaeopteryx is considered to be the first bird because it had feathers, according to well-preserved fossil impressions. Like other birds, *Archaeopteryx* was probably warm-blooded and used its feathers both to insulate itself and to fly. Feathers evolved from enlarged scales.

Without its feathers *Archaeopteryx* had all the features of its relative, the meat-eating dinosaur *Compsognathus* (page 30), except that its hip bones were birdlike and it had longer fingers. *Archaeopteryx* was capable of grasping its prey, unlike modern birds.

Flight seems to have originated not with tree climbing and gliding, as was once thought, but with sprinting on the ground after prey, like a roadrunner. *Archaeopteryx* would have kept its long, dangling fingers and arms folded tightly against its body while running, extending them only to pounce on prey or to keep its balance while hurdling over obstacles. At such times its feathers would let this bird literally glide over obstructions or increase its speed with a flap. Repeating this action rapidly would have gotten *Archaeopteryx* airborne. Furthermore, in *Archaeopteryx* the action of grasping prey was similar to that of a flapping wing in a modern bird. *Archaeopteryx* had no large breastbone like the one from which flight muscles originate in modern birds, which means it was not a strong flyer. (See also *Eudimorphodon*, page 21.)



Leptopterygius

(lep-top-ter-IH-jee-uss) "slender fin"
Ichthyosauria • Longipinnatoidea • Leptopterygiidae
Early Jurassic • Germany • 30 feet long

Leptopterygius was one of the largest Jurassic ichthyosaurs (fish-shaped, air-breathing marine reptiles). Unlike Triassic ichthyosaurs (page 24), *Leptopterygius* had a large crescent-shaped tail that made it one of the fastest swimmers of its time. Like a shark, *Leptopterygius* had a large, fleshy fin on its back that acted like the keel on a sailboat to counteract the tendency to roll. All known Jurassic ichthyosaurs were built to withstand the pressures of deep dives for fish and squid. Like dolphins, they seem to have traveled together in pods.

Eurhinosaurus

(you-rie-noe-SOR-uss) "broad-nosed reptile"
Ichthyosauria • Longipinnatoidea • Leptopterygiidae
Early Jurassic • Europe • 26 feet long

Eurhinosaurus was a giant slender-finned ichthyosaur shaped like a speedy swordfish. Its upper bill extended far beyond the lower one, yet both bills were lined with teeth all the way to the tips. Perhaps like a swordfish, *Eurhinosaurus* slashed its way through a school of fish or squid, mangling some, dazing others, then circling back for a leisurely lunch.

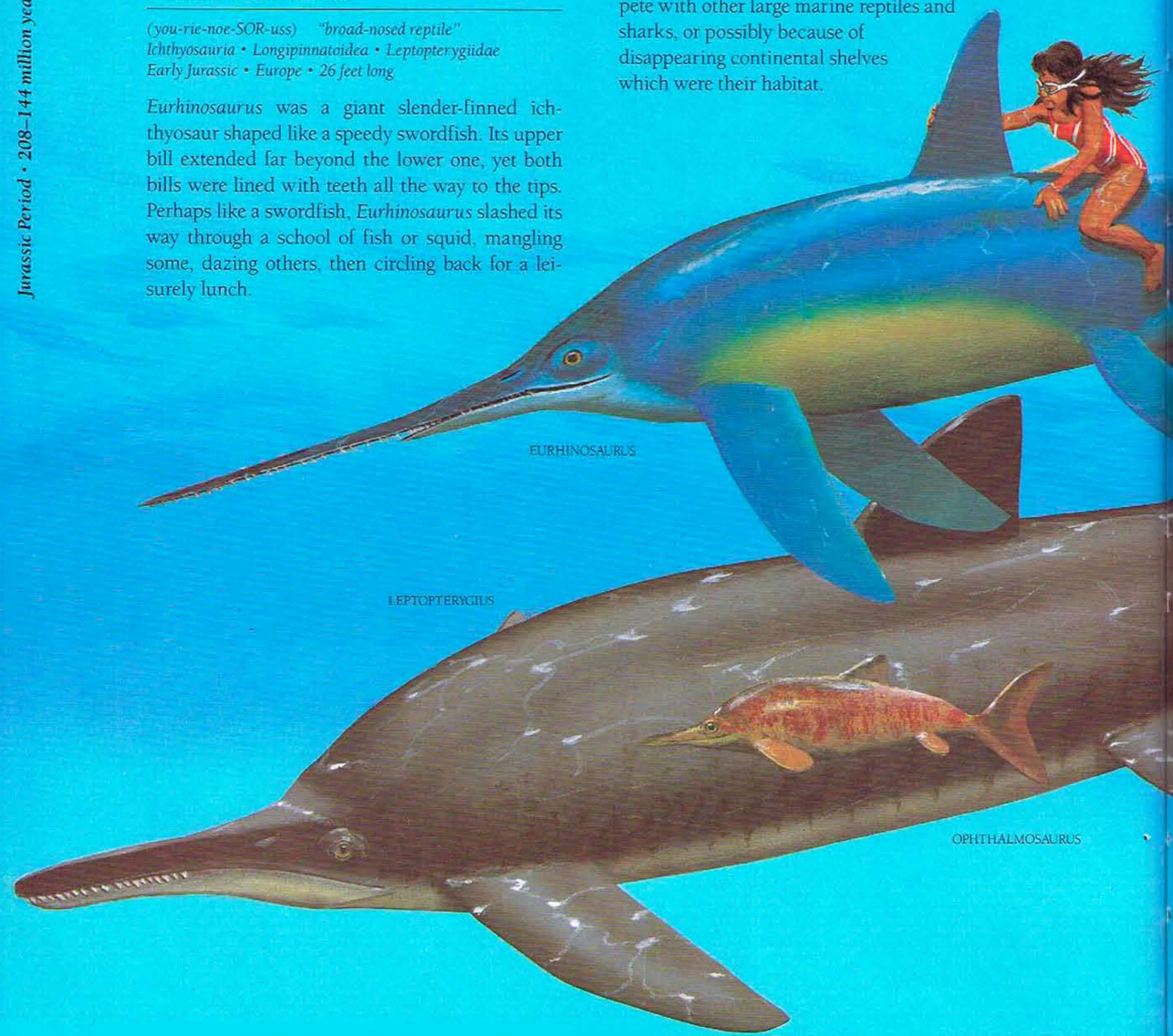
Ophthalmosaurus

(off-thal-muh-SOR-uss) "eye reptile"
Ichthyosauria • Latipinnatoidea • Ichthyosauridae
Late Jurassic • Europe, South America • 10 feet long

Ichthyosaurs declined in number and variety after the Early Jurassic. Although common and widespread, *Ophthalmosaurus* is one of the few ichthyosaurs known from later times.

Ophthalmosaurus was named for its enormous eyeballs, which were 8 inches in diameter. Most ichthyosaurs had huge eyes for seeing their prey because unlike toothed whales, they had no sonar to guide them. Small teeth lined only the front of *Ophthalmosaurus*'s jaws, suggesting it ate a diet of soft-bodied squid or jellyfish.

Ichthyosaurs became totally extinct by the Late Cretaceous, possibly because they failed to compete with other large marine reptiles and sharks, or possibly because of disappearing continental shelves which were their habitat.



Plesiosaurus

(plee-zee-uh-SOR-uss) "near lizard"
Sauropterygia • Plesiosauria • Plesiosauroidea
Early Jurassic • England • 13 feet long

Plesiosaurs probably swam like penguins and sea turtles, only with two pairs of "wings." Such locomotion is called underwater flying and the swimming stroke resembles a vertical figure 8. The torso of a plesiosaur was rigid between both sets of flippers so that they would transmit all their driving power to the body without it bunching up or stretching out. The top and bottom sets of ribs, however, were only loosely connected. If a plesiosaur became stranded on shore, its lungs would have been crushed under the weight of its back.

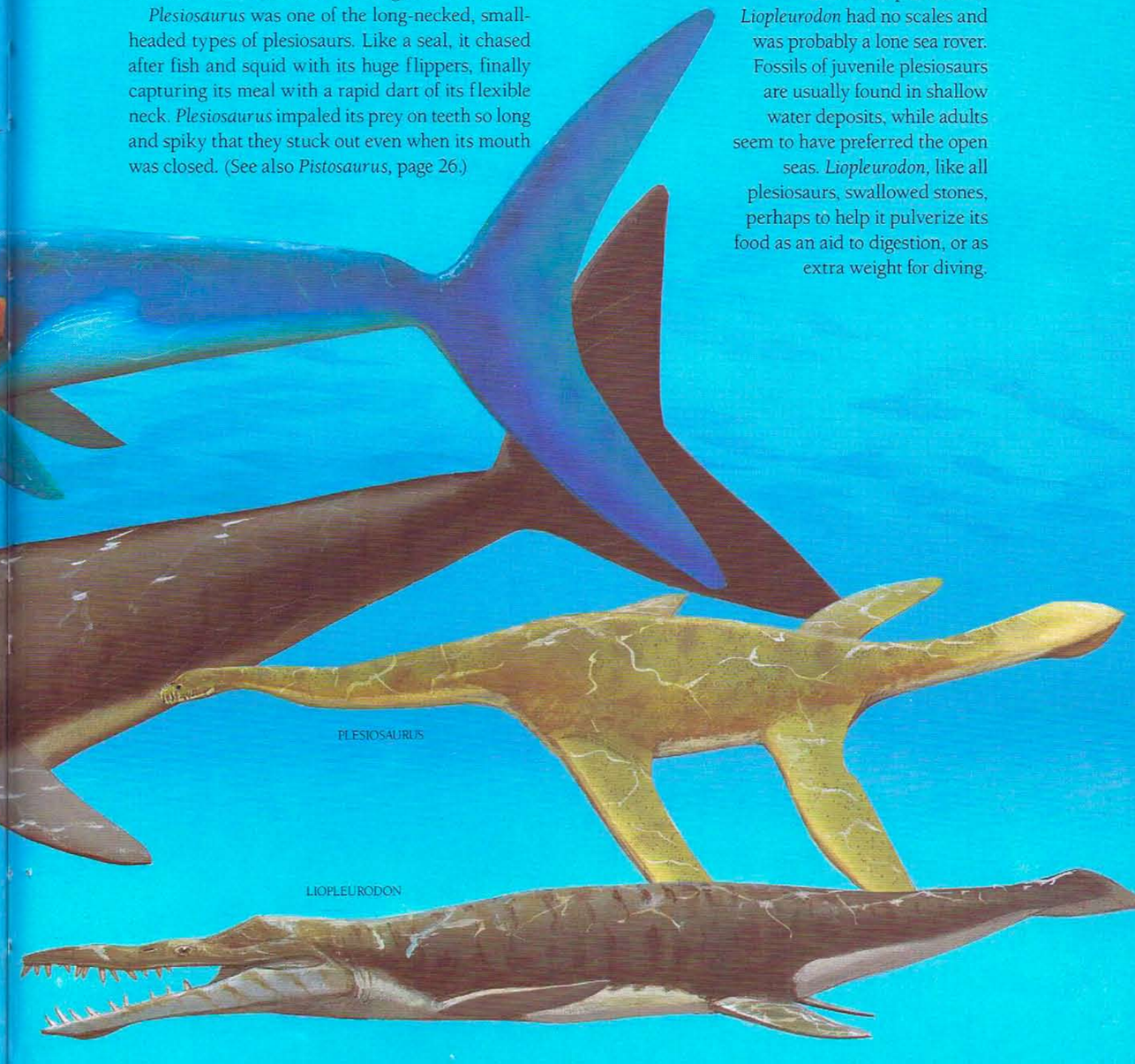
Plesiosaurus was one of the long-necked, small-headed types of plesiosaurs. Like a seal, it chased after fish and squid with its huge flippers, finally capturing its meal with a rapid dart of its flexible neck. *Plesiosaurus* impaled its prey on teeth so long and spiky that they stuck out even when its mouth was closed. (See also *Pistosaurus*, page 26.)

Liopleurodon

(lee-uh-PLUR-uh-don) "smooth side tooth"
Sauropterygia • Plesiosauria • Pliosauroidea
Late Jurassic • England • 16 feet long

Plesiosaurs with (relatively) short necks and large heads, like *Liopleurodon*, were known as pliosaurs. No doubt this pliosaur ate bigger fish, marine reptiles, and mollusks than *Plesiosaurus* did, so it ate less often. When attacking, *Liopleurodon* employed its entire body in short bursts of great speed, using its large, wide head and flexible neck as a rudder for quick turns underwater. *Plesiosaurus* had a short, rudderlike tail fin. With its equally long tail, *Liopleurodon* may have had one too.

Like other plesiosaurs, *Liopleurodon* had no scales and was probably a lone sea rover. Fossils of juvenile plesiosaurs are usually found in shallow water deposits, while adults seem to have preferred the open seas. *Liopleurodon*, like all plesiosaurs, swallowed stones, perhaps to help it pulverize its food as an aid to digestion, or as extra weight for diving.



Kronosaurus

(kroe-nuh-SOR-uss) "Kronos [god of time] reptile"
Sauropterygia • Plesiosauria • Pliosauroidea
Early Cretaceous • Australia • 42 feet long

Named for the bloodthirsty mythological god who ate his own children, *Kronosaurus* had the largest head and teeth of any known reptile. Its deadly jaws exceeded 10 feet in length, and its massive bullet-shaped teeth stood nearly 10 inches high. Related to *Liopleurodon* (page 39), this long-bodied plesiosaur must have been the killer whale of its day, eating anything that swam, including other plesiosaurs. *Kronosaurus* could have dived nearly 1,000 feet for a meal of ammonites, those free-swimming squidlike creatures with coiled shells. After a big meal, it probably floated lazily at the surface, raising its nostrils occasionally to spout and take in a fresh supply of air.

KRONOSAURUS

CLIDASTES

Clidastes

(kly-DASS-teez) "key resemblance"
Lepidosauria • Squamata • Lacertilia • Varanoidea
Late Cretaceous • Kansas • 10 feet long

True lizards similar to those living today first appeared as early as the Late Jurassic, 155 million years ago. Throughout their long history, most lizards remained small, sprawling, land-living insect eaters. Monitor lizards are an exception in that they grow larger than other lizards (see *Megalania*, page 61), eat meat, and swim. One side branch of the monitors, the sea-dwelling mosasaurs, became fully aquatic.

Clidastes was one of the earliest mosasaurs. It swam with rapid flicks of its tail, keeping its limbs tucked in except while maneuvering. Shaped like a streamlined torpedo, *Clidastes* had a pointed snout, a large chest, and slick flanks that narrowed to merge with the base of its long, slender tail. A distinct fin emerged near the tip of its tail, which made it faster than some other mosasaurs. Its short, stout limbs were webbed but had not become flippers. They were rather small, making *Clidastes* less able to maneuver than other mosasaurs. It probably preyed on fish and squidlike mollusks that weren't able to corner very quickly.

HAINOSAURUS

Thalassomedon

(thuh-LASS-so-meh-don) "lord of the sea tooth"
Sauropterygia • Plesiosauria • Plesiosauroidea
Late Cretaceous • Colorado • 39 feet long

Thalassomedon was one of the largest of the elasmosaurs, later relatives of *Plesiosaurus* (page 39) with much longer necks. *Thalassomedon* had a 19-foot neck, half the total length of its body. Although the neck contained 62 vertebrae, it was stout and stiff near the body, for stability, and increasingly flexible near the head, especially in the downward direction. *Thalassomedon* may have been a slow, steady swimmer that "grazed" throughout the day, dipping its head into schools of fish and squid for a meal. Each time its head and neck veered off to the side, they would have acted like a rudder to turn the entire animal. Both pairs of fins had to move constantly to keep *Thalassomedon* on a steady course. The stubby tail would have been useless as a rudder. *Thalassomedon* had 28 long, sharp fish-trap teeth in its lower jaws and only 8 in its uppers. All of its teeth stayed exposed like thorns when the jaws were closed.

Hainosaurus

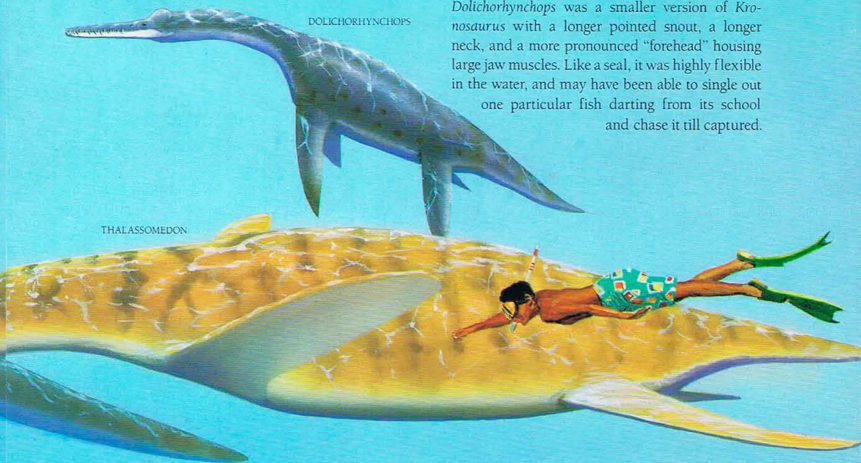
(hane-uh-SOR-uss) "Hainaut [Belgium] lizard"
Lepidosauria • Squamata • Lacertilia • Varanoidea
Late Cretaceous • Belgium • 52 feet long

The largest lizard of all time was *Hainosaurus*. Rivaling the sea serpents of myth, this eel-like sea lizard must have been a rapacious killer with sharp, deadly teeth lining its jaws. As in all living lizards and snakes, *Hainosaurus*'s old worn teeth were shed every so often, making room for sharp new teeth that were constantly growing in. An extra set of teeth grew from the roof of its throat to ensure that prey could not escape once it was headed toward the stomach.

Dolichorhynchops

(dole-ih-koe-RIN-kops) "long nose face"
Sauropterygia • Plesiosauria • Pliosauroidea
Late Cretaceous • Kansas • 11 feet long

Dolichorhynchops was a smaller version of *Kronosaurus* with a longer pointed snout, a longer neck, and a more pronounced "forehead" housing large jaw muscles. Like a seal, it was highly flexible in the water, and may have been able to single out one particular fish darting from its school and chase it till captured.



DOLICHORHYNCHOPS

THALASSOMEDON

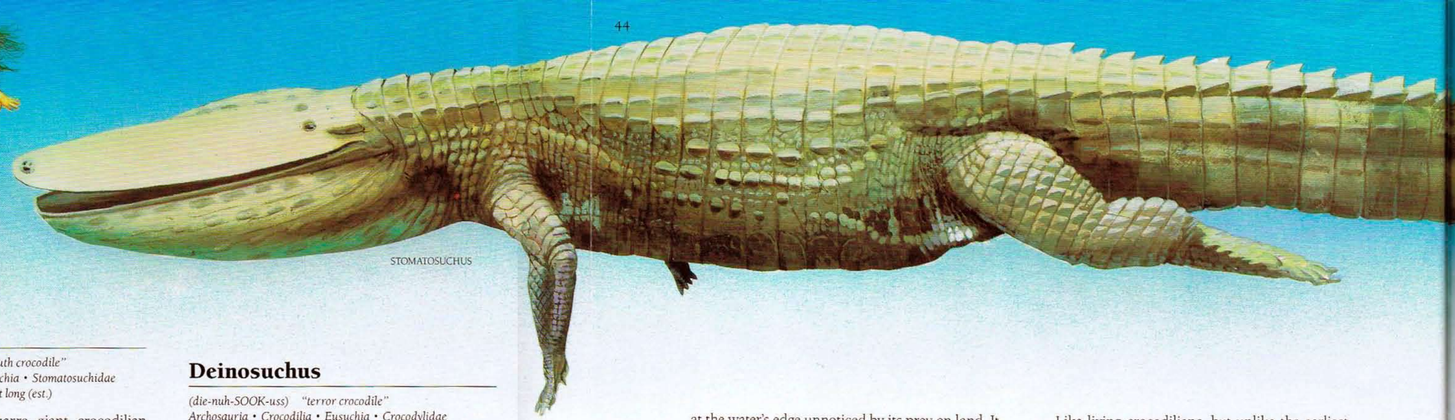
Plotosaurus

(ploh-toe-SOR-uss) "swimming lizard"
Lepidosauria • Squamata • Lacertilia • Varanoidea
Late Cretaceous • California • 32 feet long

Plotosaurus may have been one of the fastest mosasaurs. It had a very deep chest, probably to enclose a large set of lungs, and a large tail fin for speed. Its limbs were solid flippers like those of a plesiosaur but were used only for steering, not for paddling.

All lizards, including mosasaurs, have flexible jaw hinges that bow out to allow extra-large prey to be swallowed. Movable jaw and skull joints also enabled mosasaurs to shift a large slippery fish around in the mouth without losing a grip on it underwater. A fish couldn't be swallowed easily until it was pointed headfirst down the throat.

PLOTOSAURUS



STOMATOSUCHUS

Stomatosuchus

(stoe-mah-toe-SOOK-uss) "mouth crocodile"
Archosauria • Crocodilia • Eusuchia • Stomatosuchidae
Late Cretaceous • Libya • 36 feet long (est.)

Stomatosuchus was a bizarre giant crocodilian without any teeth at all in its long, slender lower jaw. Only tiny, widely spaced teeth rimmed its upper jaw beneath a broad, flat 6-foot-long skull. The lower jaw had a special flange that most likely supported a huge pelicanlike chin sack. These features suggest that this unusual crocodilian was a filter feeder that may have fed like the blue whale. Gorging its chin sack full of water containing fish or plankton, *Stomatosuchus* may have risen upside down to the surface, letting gravity drain the sack while its tiny teeth strained out whatever food it had managed to capture.

Stomatosuchus lived in lush coastal swamps covering what has now become the Sahara Desert. Only one fossil skull of this strange crocodilian has so far been discovered. Unfortunately it was housed in Germany during World War II and destroyed by a bomb.

Deinosuchus

(die-nuh-SOOK-uss) "terror crocodile"
Archosauria • Crocodilia • Eusuchia • Crocodylidae
Late Cretaceous • Texas • 52 feet long (est.)

One of the largest crocodiles that ever lived was *Deinosuchus* (also known as *Phobosuchus*). This cold-blooded king of the tropical rivers and marshes had fewer but longer teeth than the modern crocodiles it otherwise resembled. It must have used these long teeth to bite unwary dinosaurs and then drag them underwater to their doom.

The skull, a few loose bones, and a few large scutes are all that is known of this prehistoric giant. Because they resemble those of many living crocodiles, we can make a good guess at *Deinosuchus*'s likely appearance and habits.

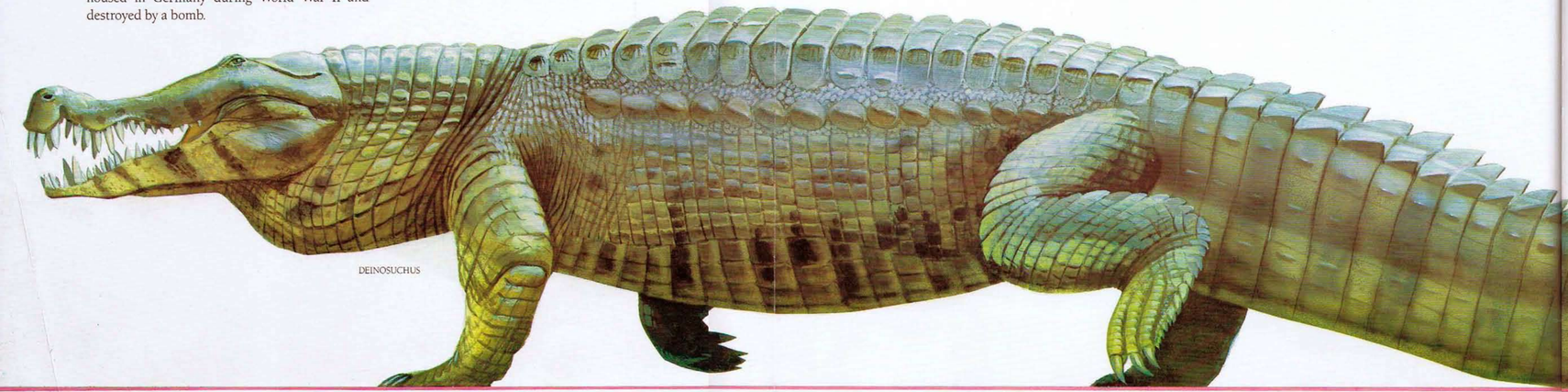
Deinosuchus's low, flat 6-foot-long skull was topped by protruding nostrils and eyes. With only these breaking the surface, *Deinosuchus* could float at the water's edge unnoticed by its prey on land. It also ate fish, marine reptiles, and anything that fell into the water. *Deinosuchus* could reduce large prey to bite-size pieces by clamping it securely in its jaws and viciously twisting and whipping it about until the victim fell apart. Digestion was aided with stomach stones that pulverized unchewed food.

Deinosuchus swam by making broad sinuous sweeps of its tall, narrow tail. On land it lazed about in the sun, but might have run faster than a person in a short sprint. While thrashing about, it could have knocked any large foe to the ground.

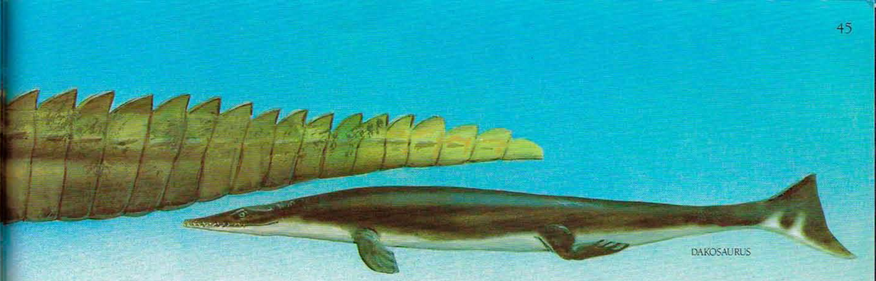
Deinosuchus probably laid its eggs in carefully hidden nests and kept watch over its hatchlings' safety in the wild. A mother crocodile is notoriously protective of her young, offering them rides on her back or gently within her open mouth.

Like living crocodilians, but unlike the earliest types (page 21), *Deinosuchus* had a complete secondary palate, a shelf of bone separating the nasal passages from the mouth cavity. This feature allowed *Deinosuchus* to eat and breathe at the same time. Its skull was very heavily constructed, which helped it withstand the violent thrashing of victims.

With few exceptions crocodilians are and were covered with bony scutes. Scutes not only provide body armor but also help support the long backbone through their tough, sinewy connections to the bones and muscles of that area. The heavy tail pulls the long backbone into a graceful arch, which lifts the belly clear off the ground while the crocodile roves about on land. (See also *Rhamphosuchus*, page 60.)



DEINOSUCHUS



DAKOSAURUS

Dakosaurus

(dak-uh-SOR-uss) "bite reptile"
Archosauria • Crocodilia • Mesosuchia • Metriorhynchidae
Late Jurassic to Early Cretaceous • Europe • 20 feet long

Dakosaurus was one of the largest, and the last, of the thalattosuchians or "sea crocodiles." They were the only archosaurs to take up a completely marine existence. Originating during the Middle Jurassic in Europe and South America (at that time parts of one supercontinent), sea crocodiles existed only into the Early Cretaceous, dying out along with the ichthyosaurs (page 38).

Dakosaurus had smooth, scaleless skin, which streamlined its body, and an ichthyosaur-like tail fin for swimming in the sea. Its front limbs were very small steering fins with all five digits wrapped together as a flipper. Its hind limbs were not flippers but legs that must have been kept tucked in at the sides. Perhaps *Dakosaurus* females still needed legs to come ashore in order to build a nest and lay eggs. They likely returned to the shallows of freshwater rivers to breed so that their young could grow in comparative safety before returning to the sea. Males may have never returned to land.

Dakosaurus probably ate fish. Its head was small in comparison to most crocodiles, and short in comparison to other sea crocs. The skull was smooth and streamlined, not pitted as in most crocodilians. *Dakosaurus* had fewer neck bones than usual for a crocodilian, making its neck less flexible. Its eyes were on either side of its head, not on top as in other crocodiles. Extra-broad bony eye shades gave *Dakosaurus* a permanent "eagle-eye" frown and protected its eyes from damage.

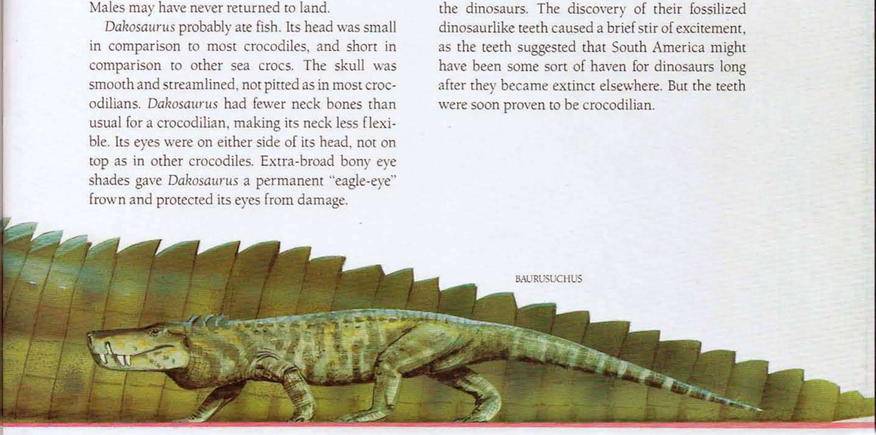
Baurusuchus

(bough-ruh-SOOK-uss) "Bauru [formation] crocodile"
Archosauria • Crocodilia • Mesosuchia • Baurusuchidae
Late Cretaceous • Brazil • 7 feet long (est.)

Baurusuchus was one of the South American land crocodiles, a group with a long history largely separate from that of the typical aquatic crocodiles. With its short, high snout and serrated, knifelike teeth *Baurusuchus* looked, and probably behaved, much like *Ornithosuchus* (page 20) or the living Komodo dragon. It probably waited in the bush for prey to happen by, then attacked with a quick bite, snagging its victim on its huge teeth and shaking it to death.

Only the skull of *Baurusuchus* is known. From other closely related species we know that it probably was armored with scutes like a typical crocodile. As a land rover, *Baurusuchus* likely had longer legs, a shorter body, and a round, lizardlike tail, not the tall, narrow tail of a swimming crocodile.

Land crocs survived long past the extinction of the dinosaurs. The discovery of their fossilized dinosaurlike teeth caused a brief stir of excitement, as the teeth suggested that South America might have been some sort of haven for dinosaurs long after they became extinct elsewhere. But the teeth were soon proven to be crocodilian.



BAURUSUCHUS