

Siberian Traps and the Permo-Triassic Extinction Event



Siberian Volcanics



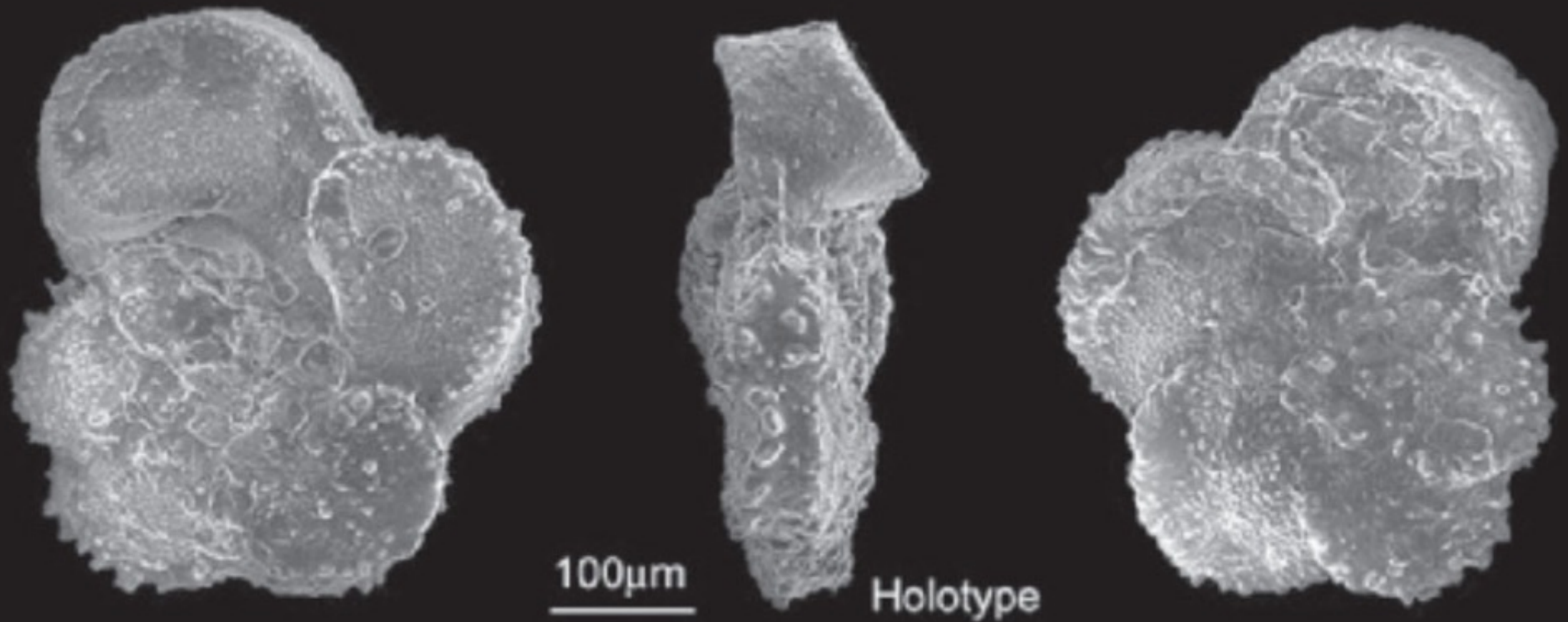
Mass Extinction at the Permo-Triassic Boundary

| Marine extinctions | Genera extinct | Notes |
|----------------------|---------------------|---|
| Arthropoda | | |
| Eurypterids | 100% | May have become extinct shortly before the P-Tr boundary |
| Ostracods | 59% | |
| Trilobites | 100% | In decline since the Devonian; only 2 genera living before the extinction |
| Brachiopoda | | |
| Brachiopods | 96% | Orthids and productids died out |
| Bryozoa | | |
| Bryozoans | 79% | Fenestrates, trepostomes, and cryptostomes died out |
| Chordata | | |
| Acanthodians | 100% | In decline since the Devonian, with only one living family |
| Cnidaria | | |
| Anthozoans | 96% | Tabulate and rugose corals died out |
| Echinodermata | | |
| Blastoids | 100% | May have become extinct shortly before the P-Tr boundary |
| Crinoids | 98% | Inadunates and camerates died out |
| Mollusca | | |
| Ammonites | 97% | |
| Bivalves | 59% | |
| Gastropods | 98% | |
| Retaria | | |
| Foraminiferans | 97% | Fusulinids died out, but were almost extinct before the catastrophe |
| Radiolarians | 99% ^[44] | |

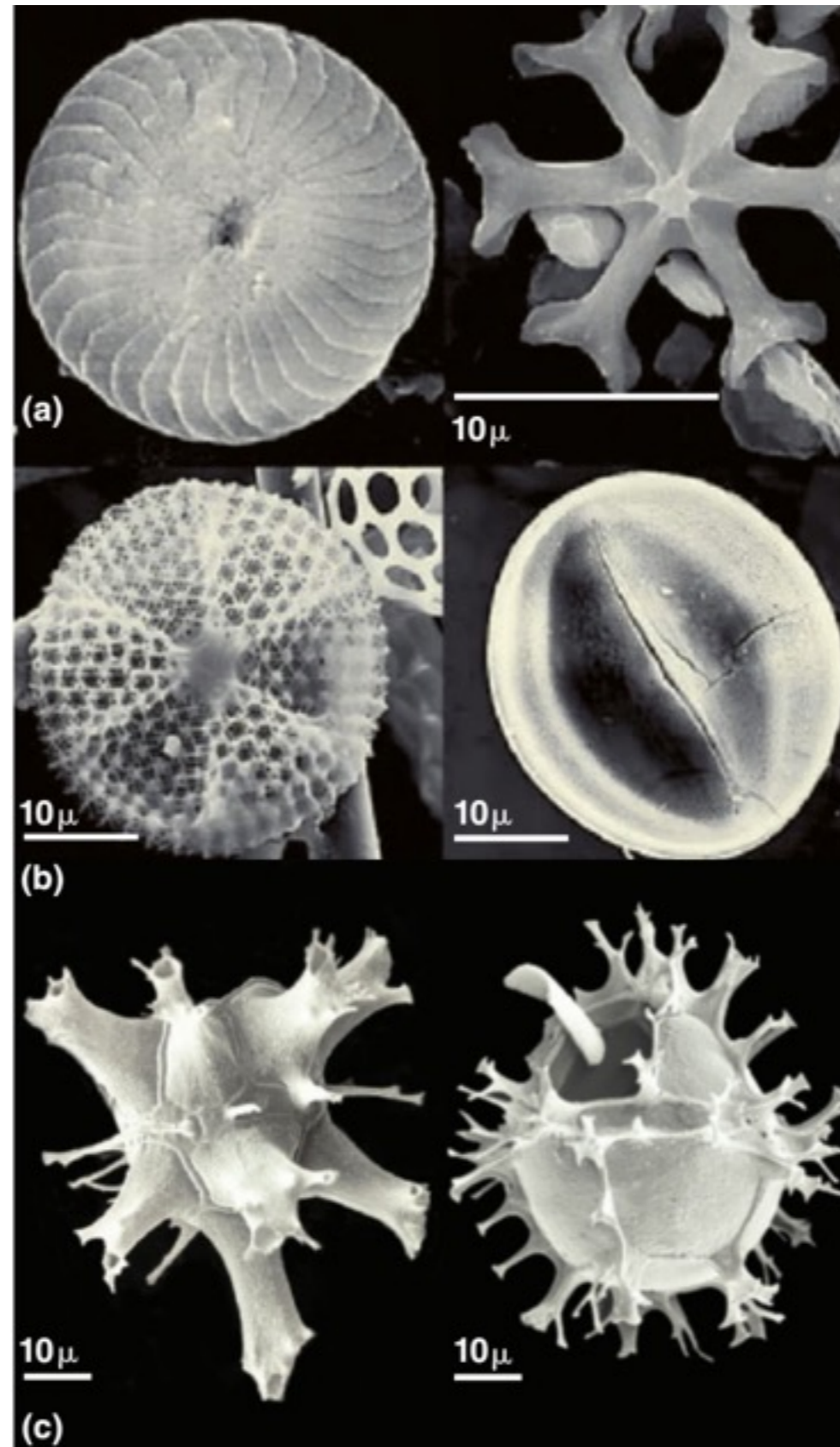
Mesozoic Belimnoids



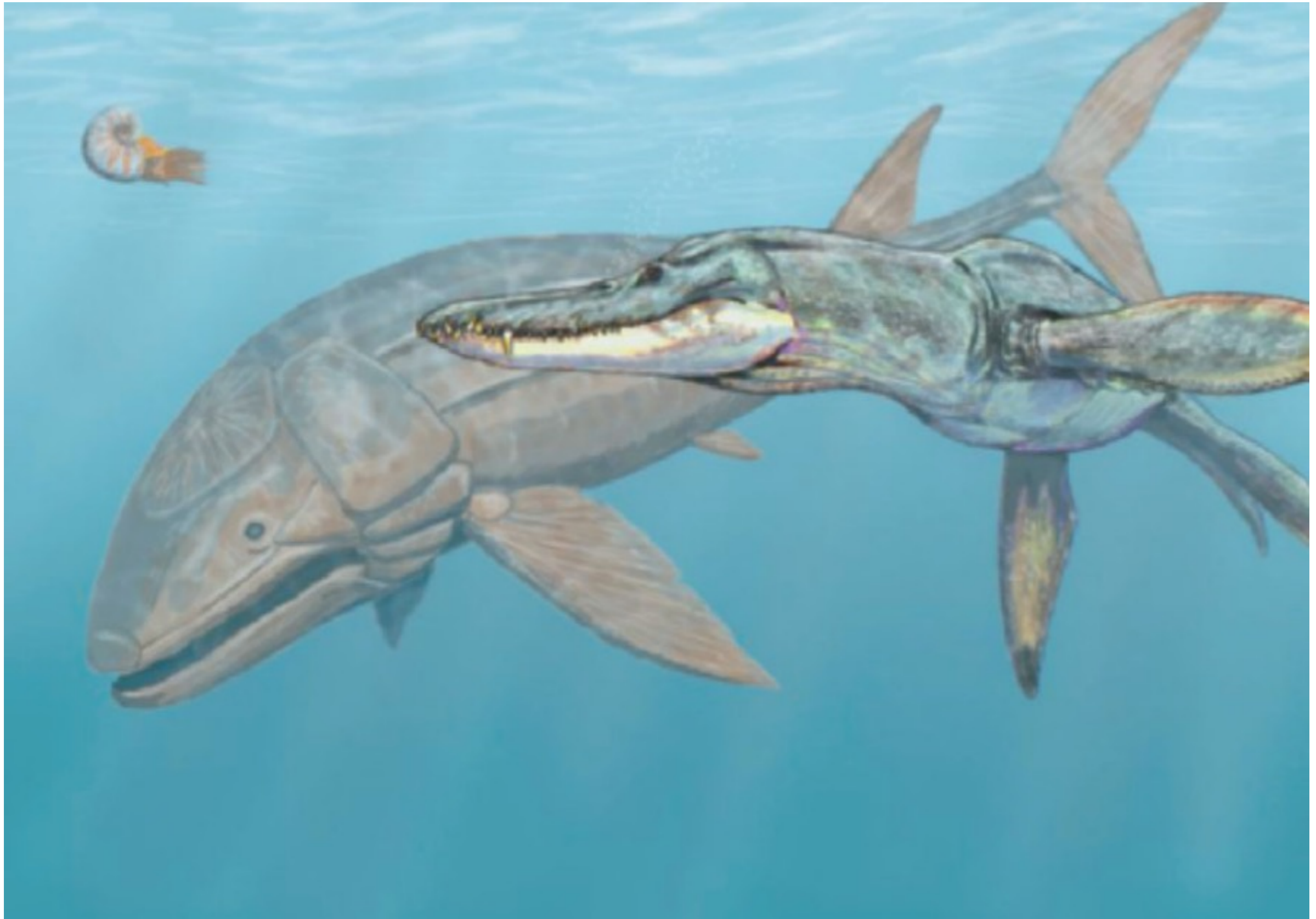
Mesozoic Planktonic Foraminifera



Mesozoic 'Primary Producers'



Teleost Fish



Triassic - Jurassic Gymnosperms

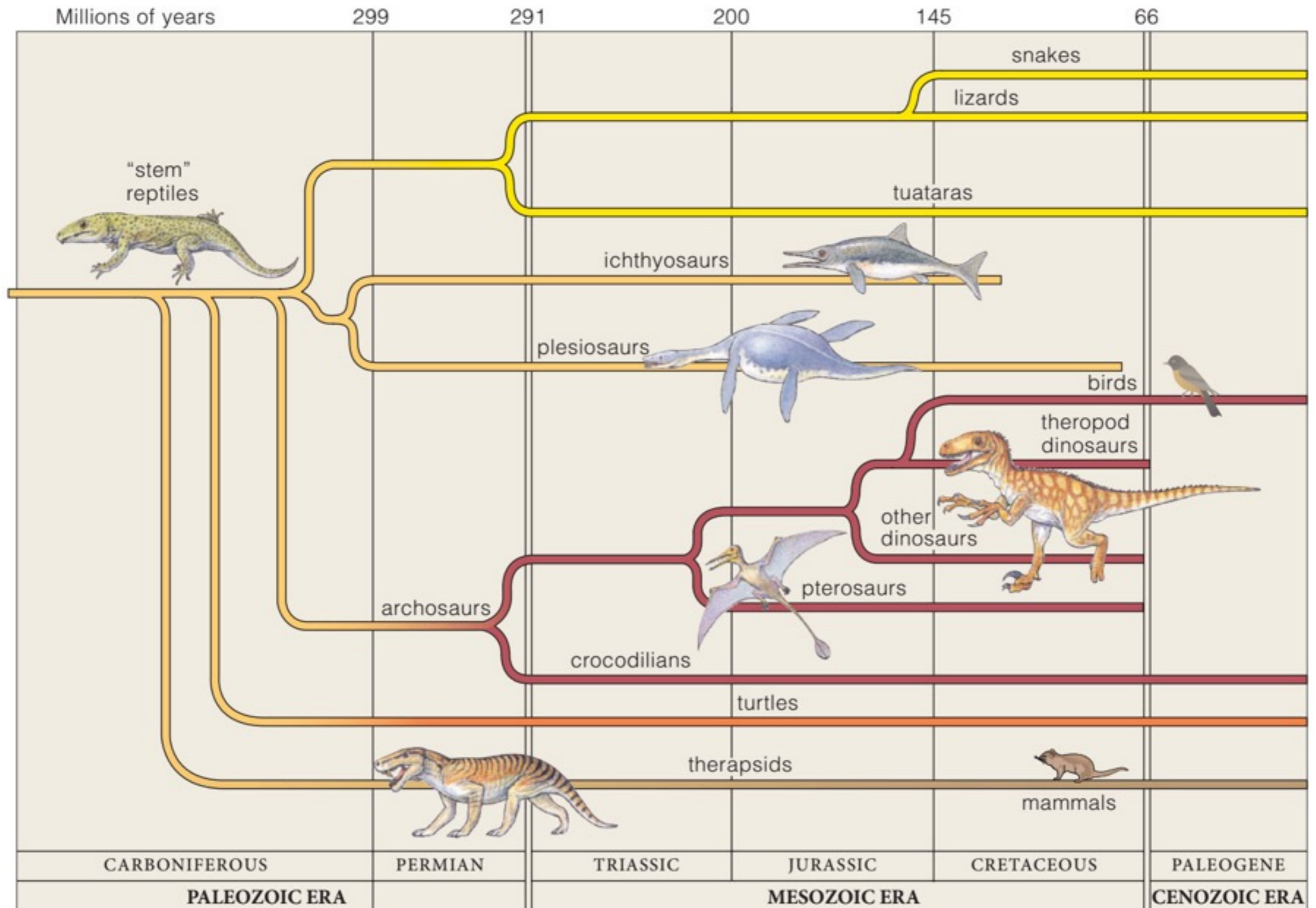


Cretaceous Angiosperms (flowering plants)

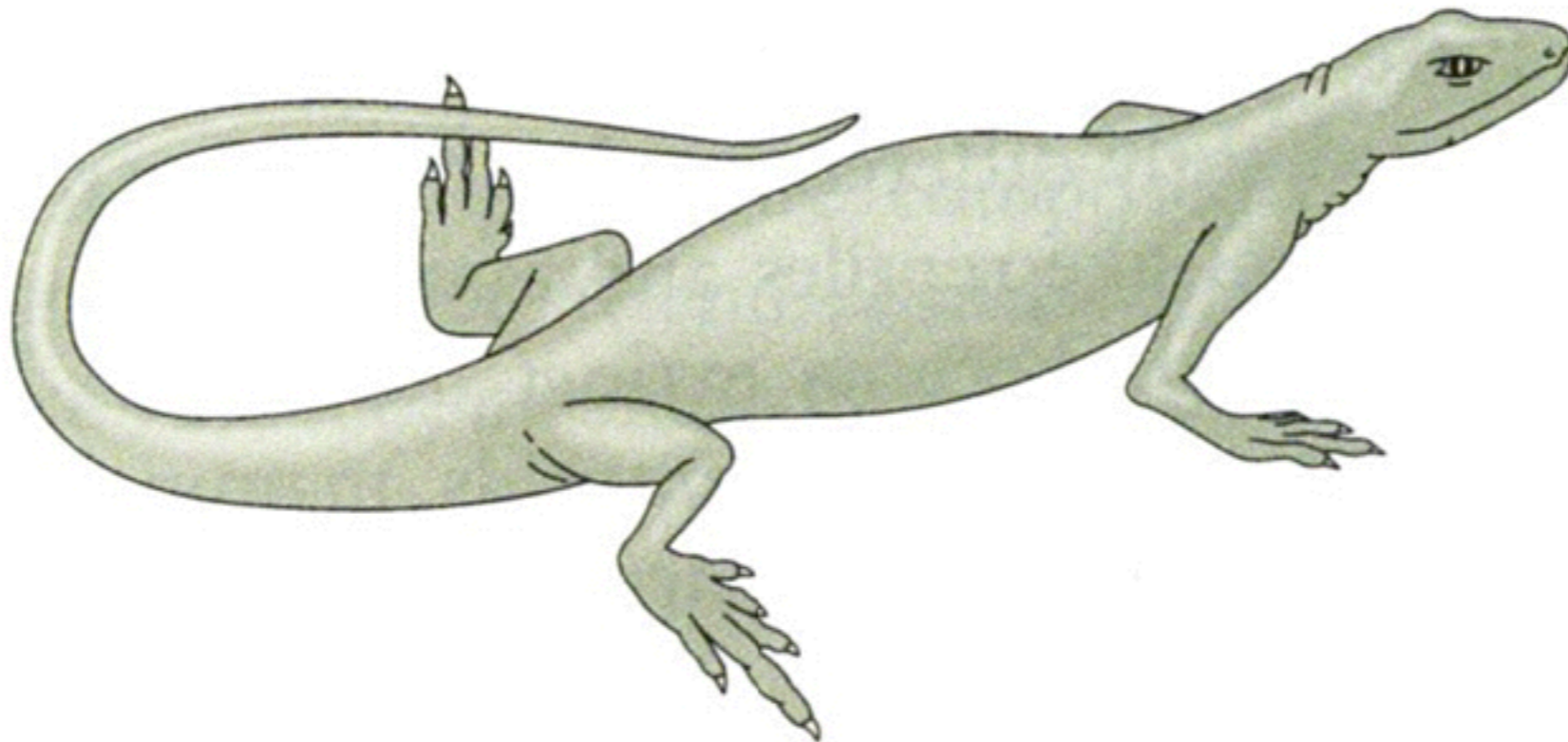
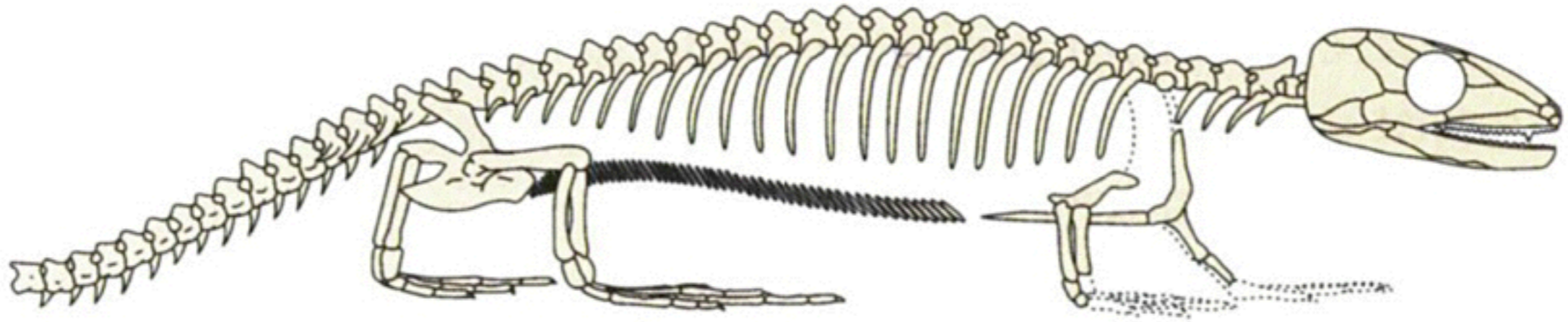


Archaeofructus sinensis

Evolution of the Amniotes



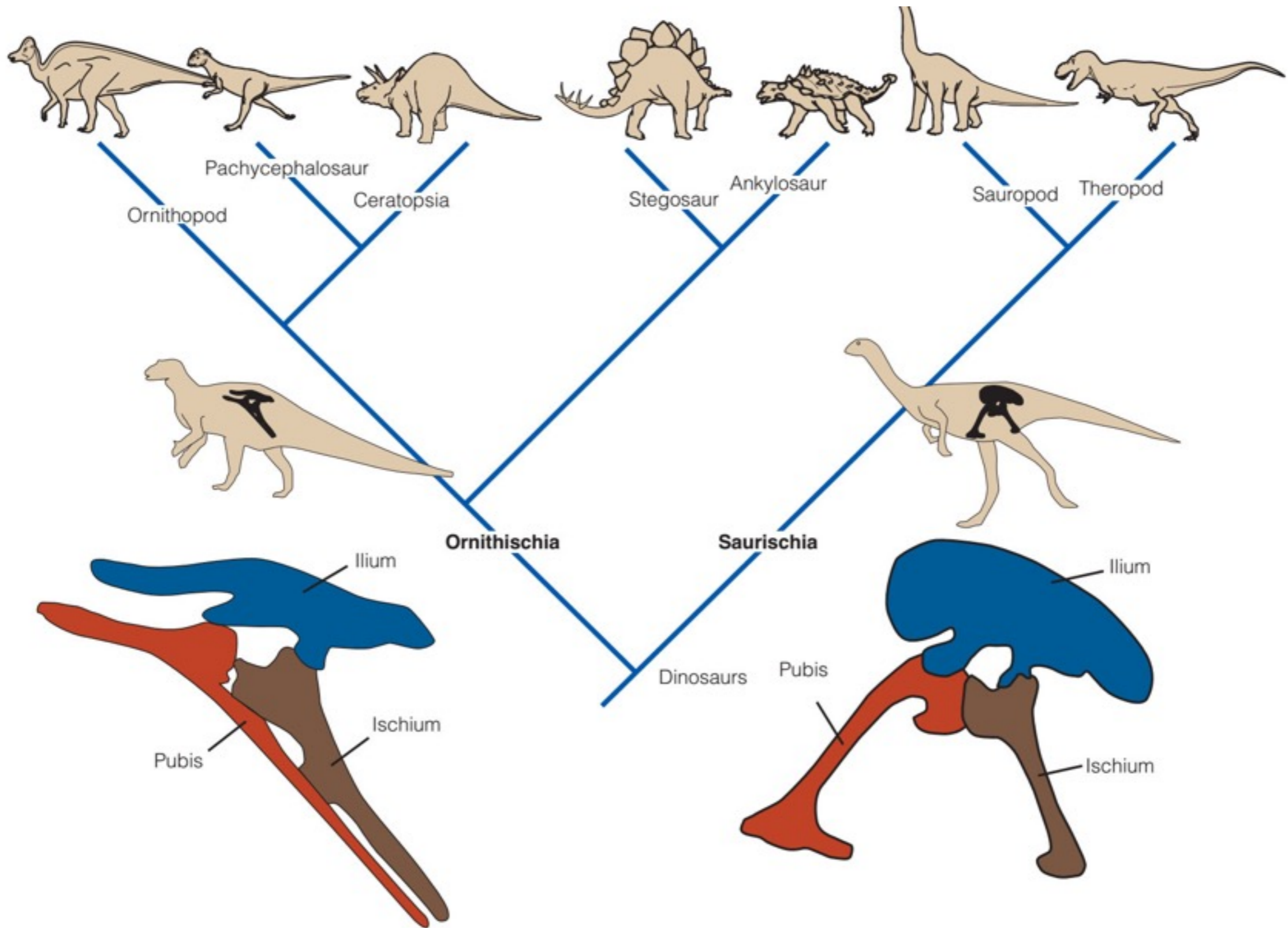
Captorhinomorph - an early stem lizard



Eoraptor - Late Triassic Dinosaur



The Dinosaur Tree



Dinosaur Classification

| Order | Suborder | Familiar Genera | Comments |
|--------------|--------------------|--|--|
| Saurischia | Theropoda | <i>Allosaurus</i> , <i>Coelophysis</i> , <i>Compsognathus</i> , <i>Deinonychus</i> , <i>Tyrannosaurus*</i> , <i>Velociraptor</i> | Bipedal carnivores. Late Triassic to end of Cretaceous. Size 0.6–15 m long, 2 or 3 kg to 7.3 metric tons. Some smaller genera may have hunted in packs. |
| | Sauropoda | <i>Apatosaurus</i> , <i>Brachiosaurus</i> , <i>Camarasaurus</i> , <i>Diplodocus</i> , <i>Titanosaurus</i> | Giant quadrupedal herbivores. Late Triassic to Cretaceous, but most common during Jurassic. Size 27 m long, 75 metric tons.** Trackways indicate that sauropods lived in herds. Preceded in fossil record by the smaller prosauropods. |
| Ornithischia | Ornithopoda | <i>Anatosaurus</i> , <i>Camptosaurus</i> , <i>Hypsilophodon</i> , <i>Iguanodon</i> , <i>Parasaurolophus</i> | Some ornithopods such as <i>Anatosaurus</i> had flattened bill-like mouths (duck-billed dinosaurs). Size from a few meters long to 13 m and 3.6 metric tons. Especially diverse and common during the Cretaceous. Primarily bipedal herbivores, but could also walk on all fours. |
| | Pachycephalosauria | <i>Stegoceras</i> | <i>Stegoceras</i> only 2 m long and 55 kg, but larger species known. Thick bones of skull cap might have aided in butting contests for dominance and mates. Bipedal herbivores of the Cretaceous. |
| | Ankylosauria | <i>Ankylosaurus</i> | <i>Ankylosaurus</i> more than 7 m long and about 4.5 metric tons. Heavily armored with bony plates on top of head, back, and sides. Quadrupedal herbivore. |
| | Stegosauria | <i>Stegosaurus</i> | A variety of stegosaurs are known, but <i>Stegosaurus</i> , with bony plates on its back and a spiked tail, is best known. Plates probably were for absorbing and dissipating heat. Quadrupedal herbivores that were most common during the Jurassic. Size was 9 m long, 1.8 metric tons. |
| | Ceratopsia | <i>Triceratops</i> | Numerous genera known. Some early ones were bipedal, but later large animals were quadrupedal herbivores. Much variation in size; up to 7.6 m long and 5.4 metric tons, with large bony frill over top of neck, three horns on skull, and beaklike mouth. Especially common during the Cretaceous. |

* *Tyrannosaurus*, at 4.5 metric tons, was the largest known theropod, but now similar and larger animals are known from Argentina and Africa.

**Partial remains indicate even larger brachiosaurs existed, perhaps measuring 30 m long and weighing 100 metric tons.

Early Theropods

TRIASSIC THEROPODS



Staurikosaurus

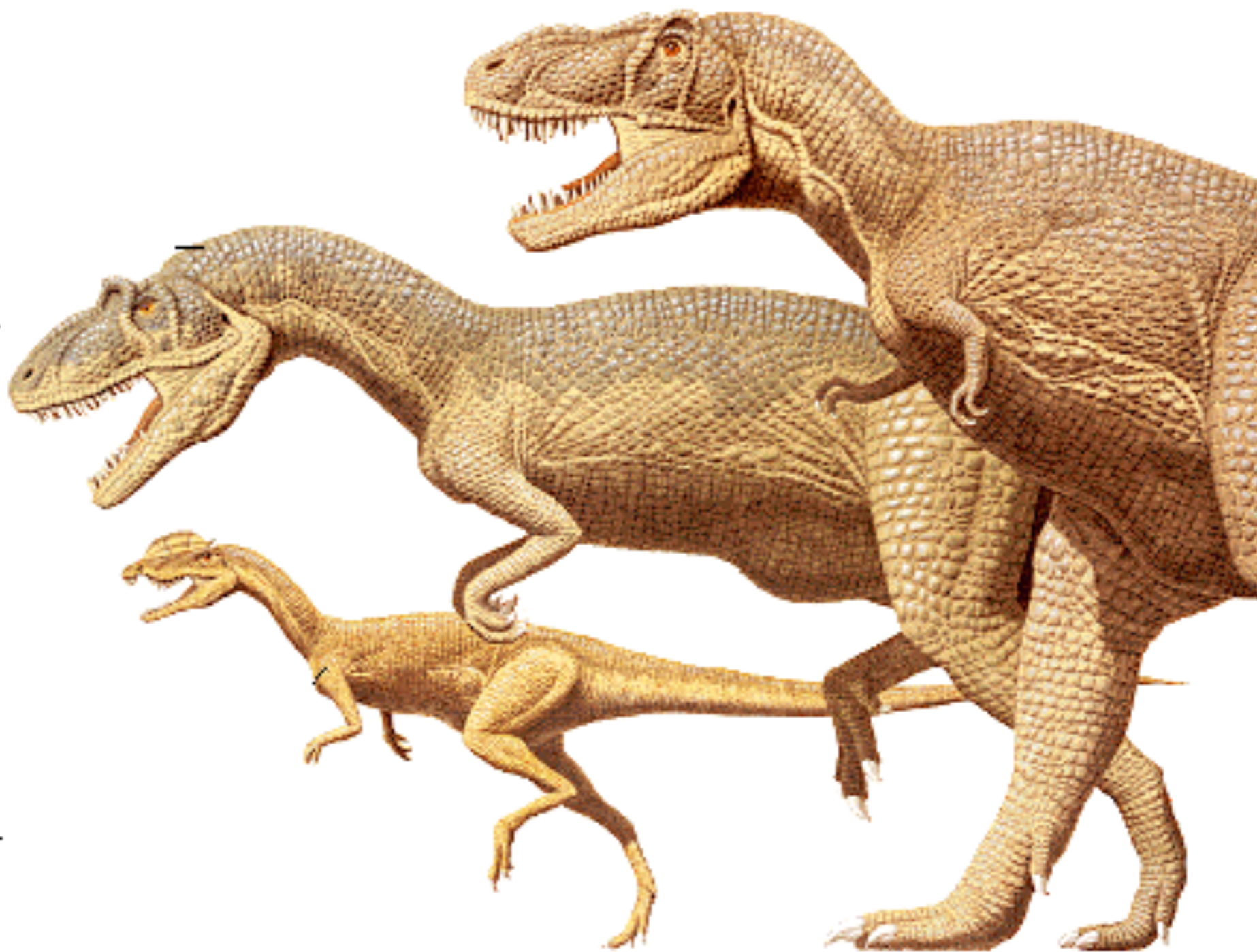


Coelophysis



Herrerasaurus

Cretaceous Theropods

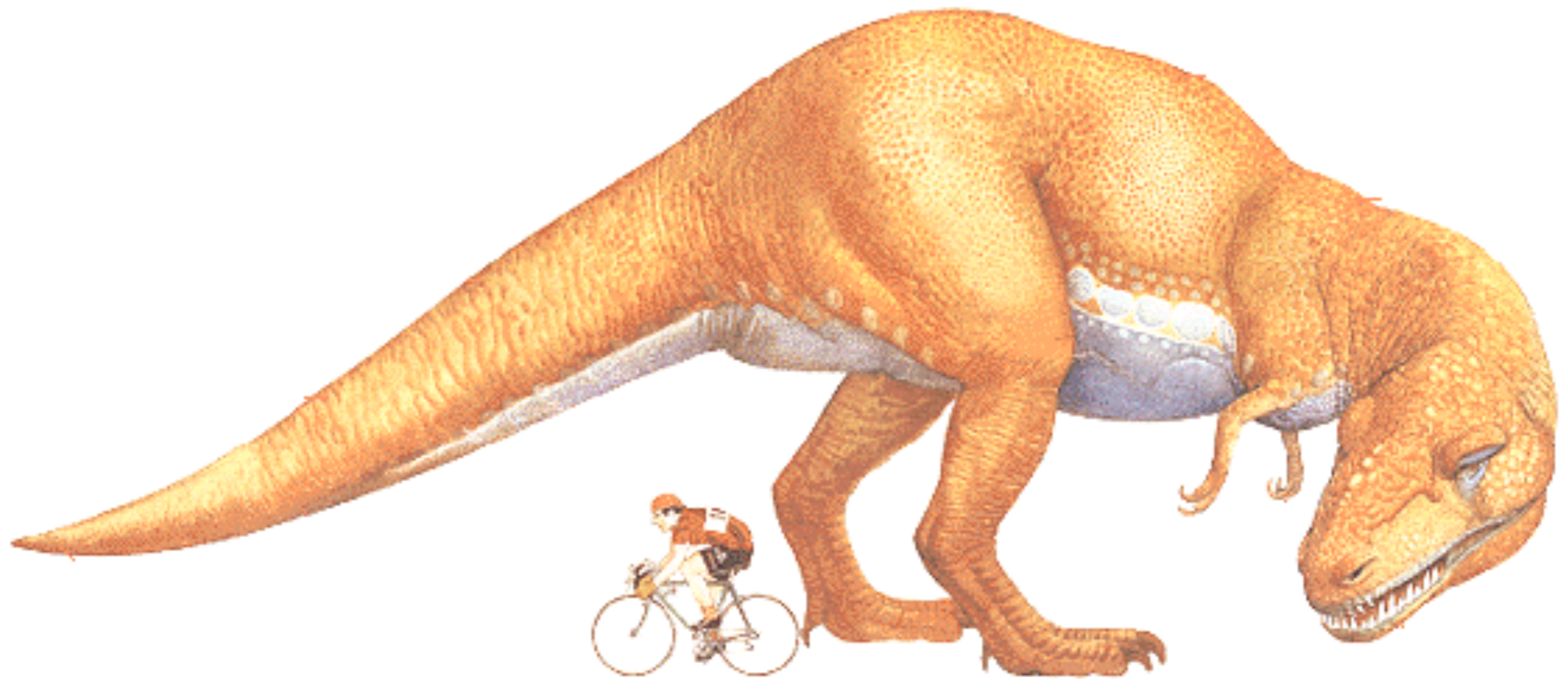


Dilophosaurus

Allosaurus

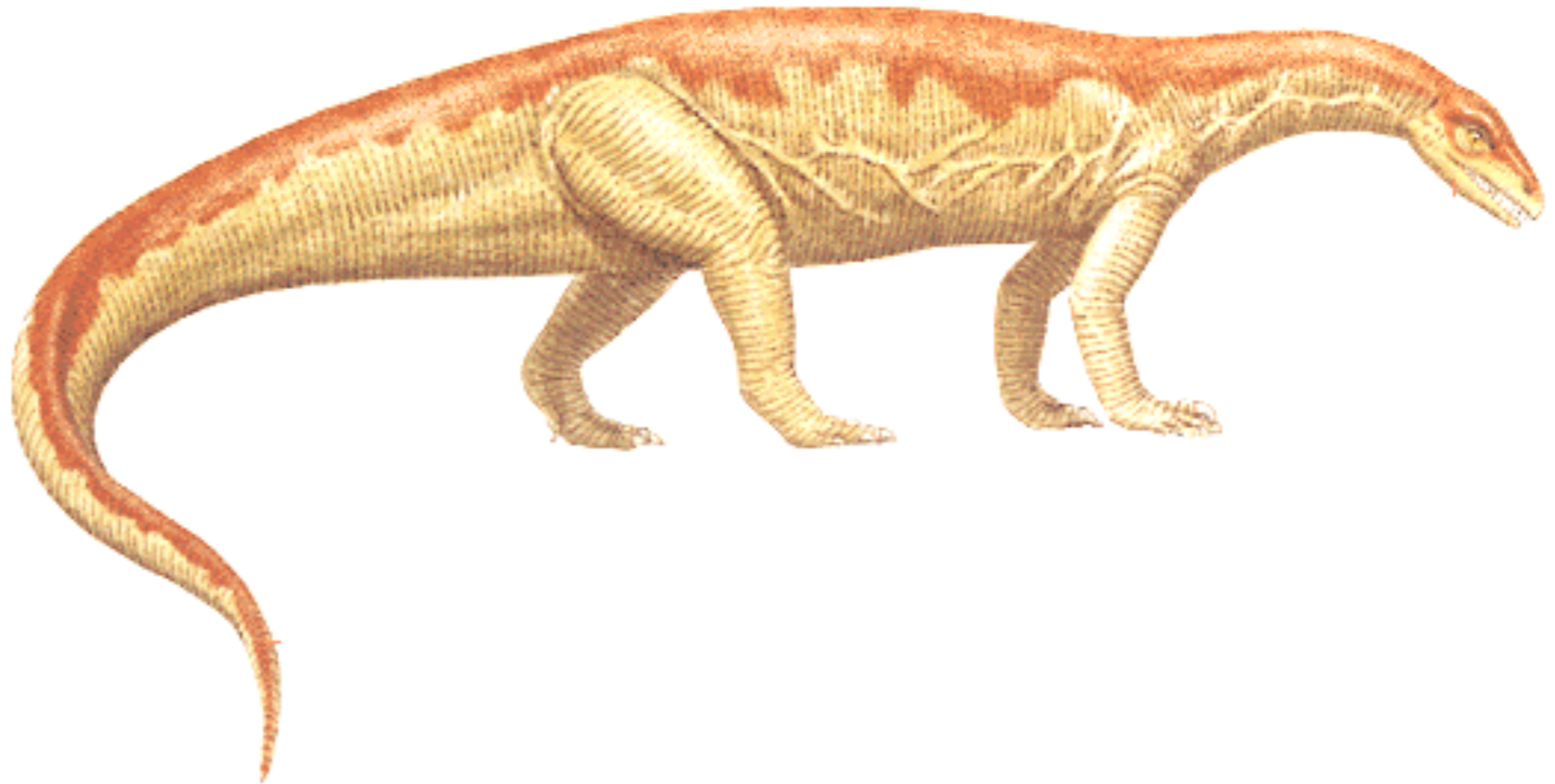
Tyrannosaurus rex

Late Cretaceous Tyrannosaurus Rex

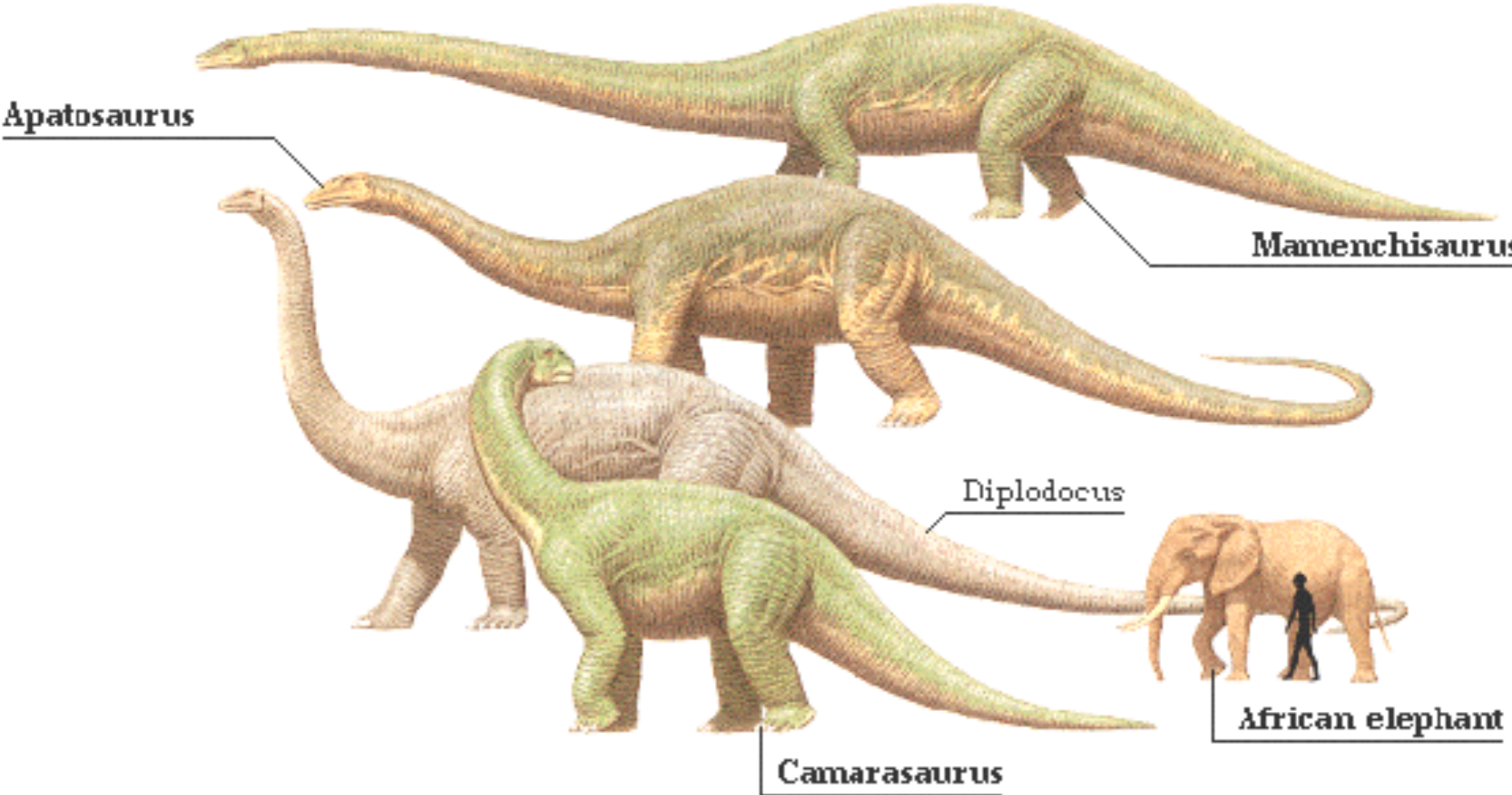


Late Triassic Sauropod

ANCHISAURUS



Late Cretaceous Sauropods



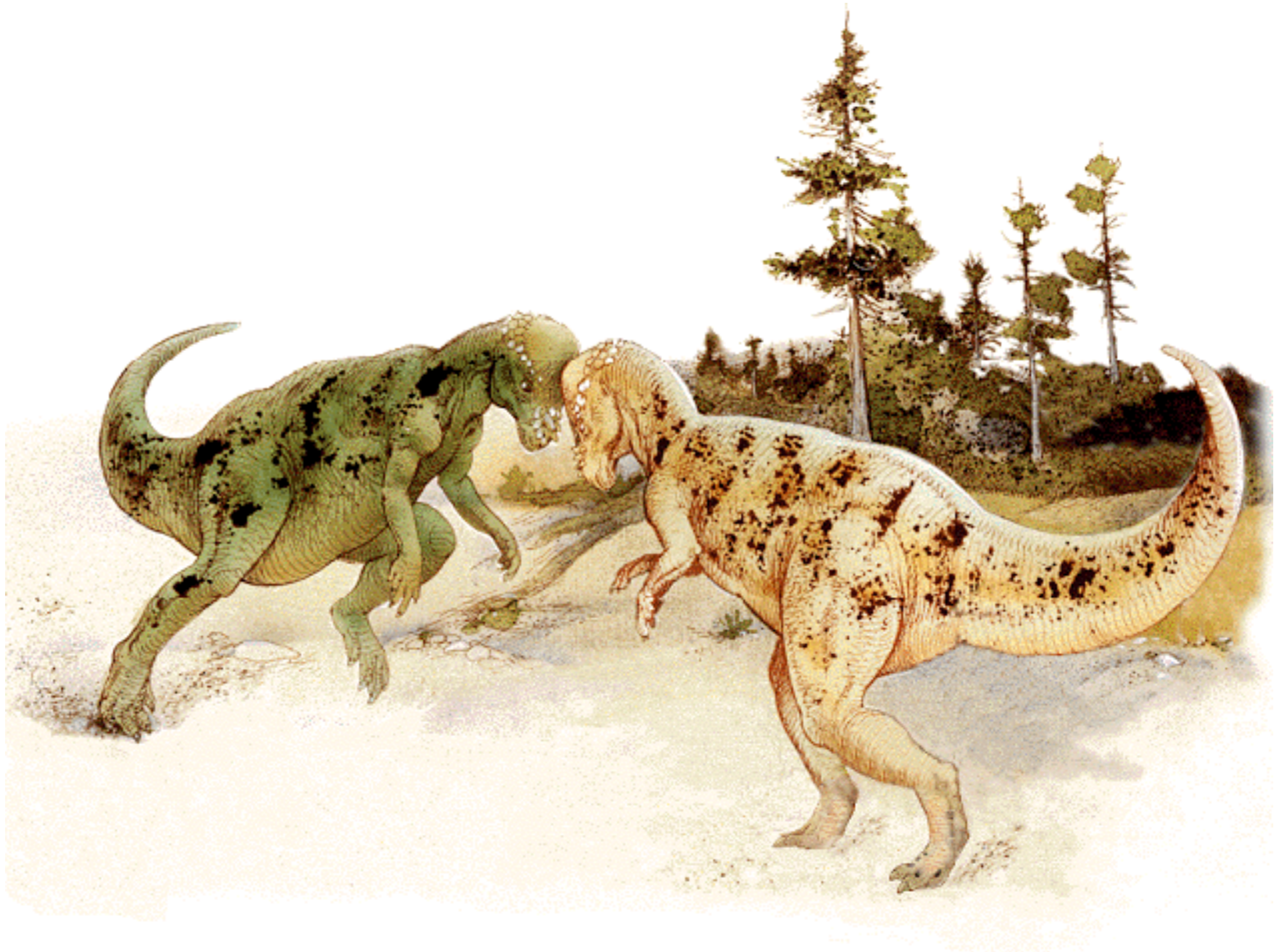
Ornithopods



Ornithopod Crests



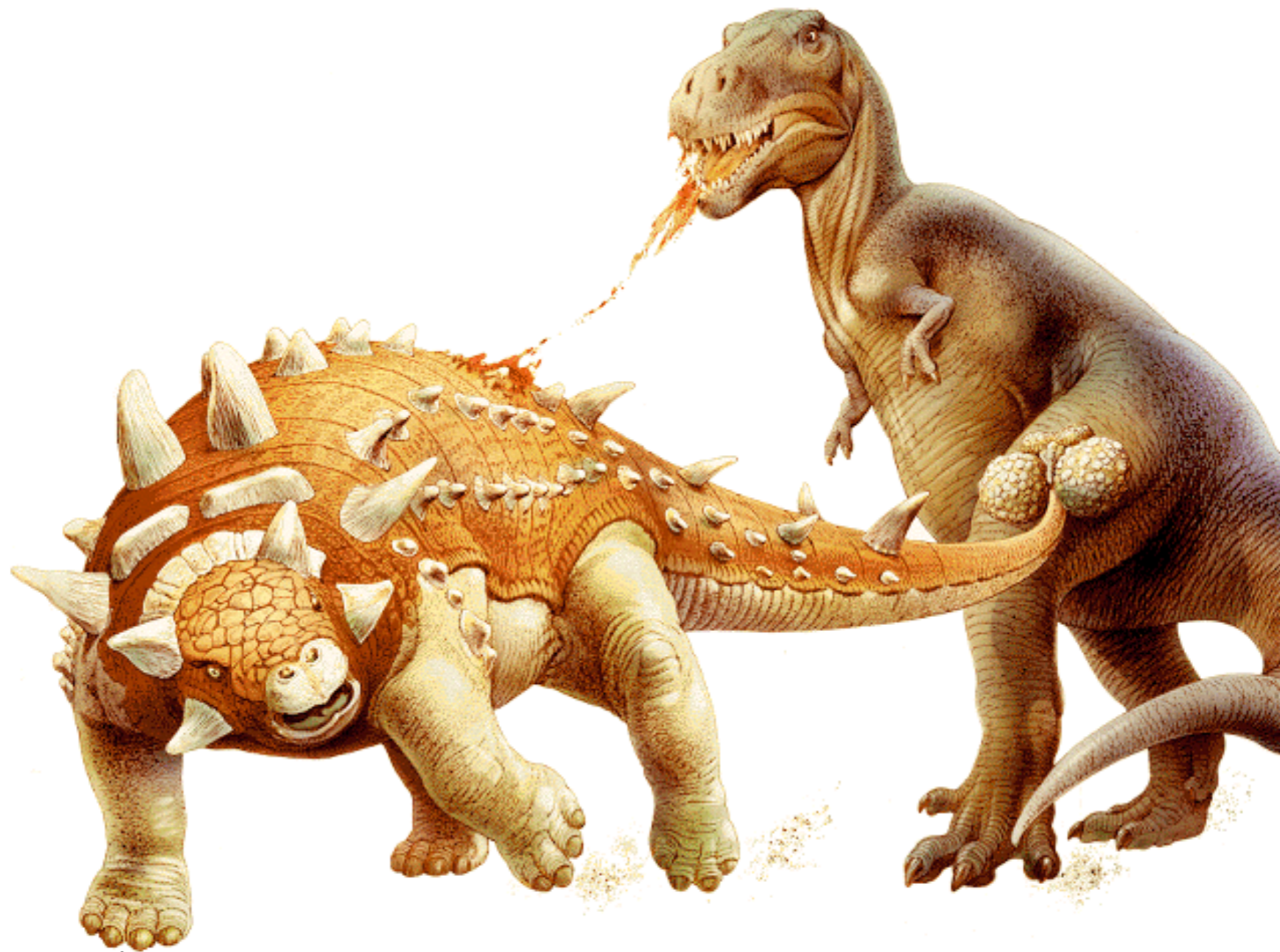
Pachycephalosaur



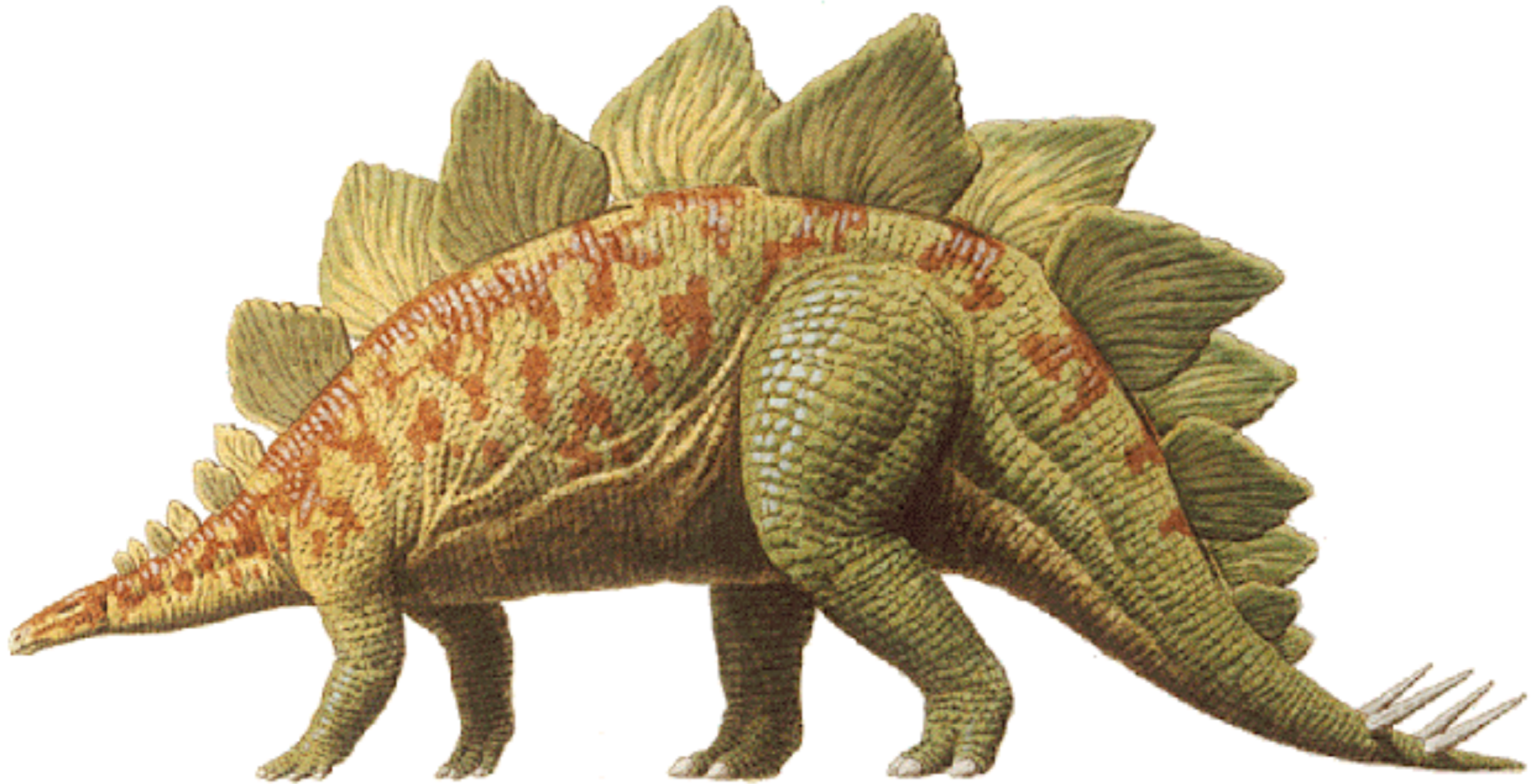
Ankylosaur



Ankylosaur versus T-Rex



Stegosaur



Ceratopsids

Centrosaurus



Protoceratops

Styracosaurus

Pterosaur



Archaeopteryx



Life in the Mesozoic Seas



Chicxulube

