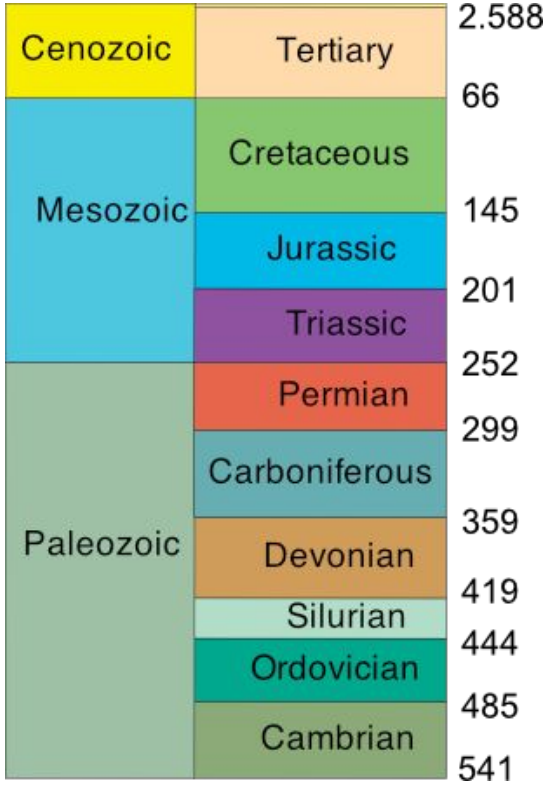
Lecture 16: Cretaceous 1

Cretaceous scene by Andrey Atuchin (source)

The Cretaceous Period

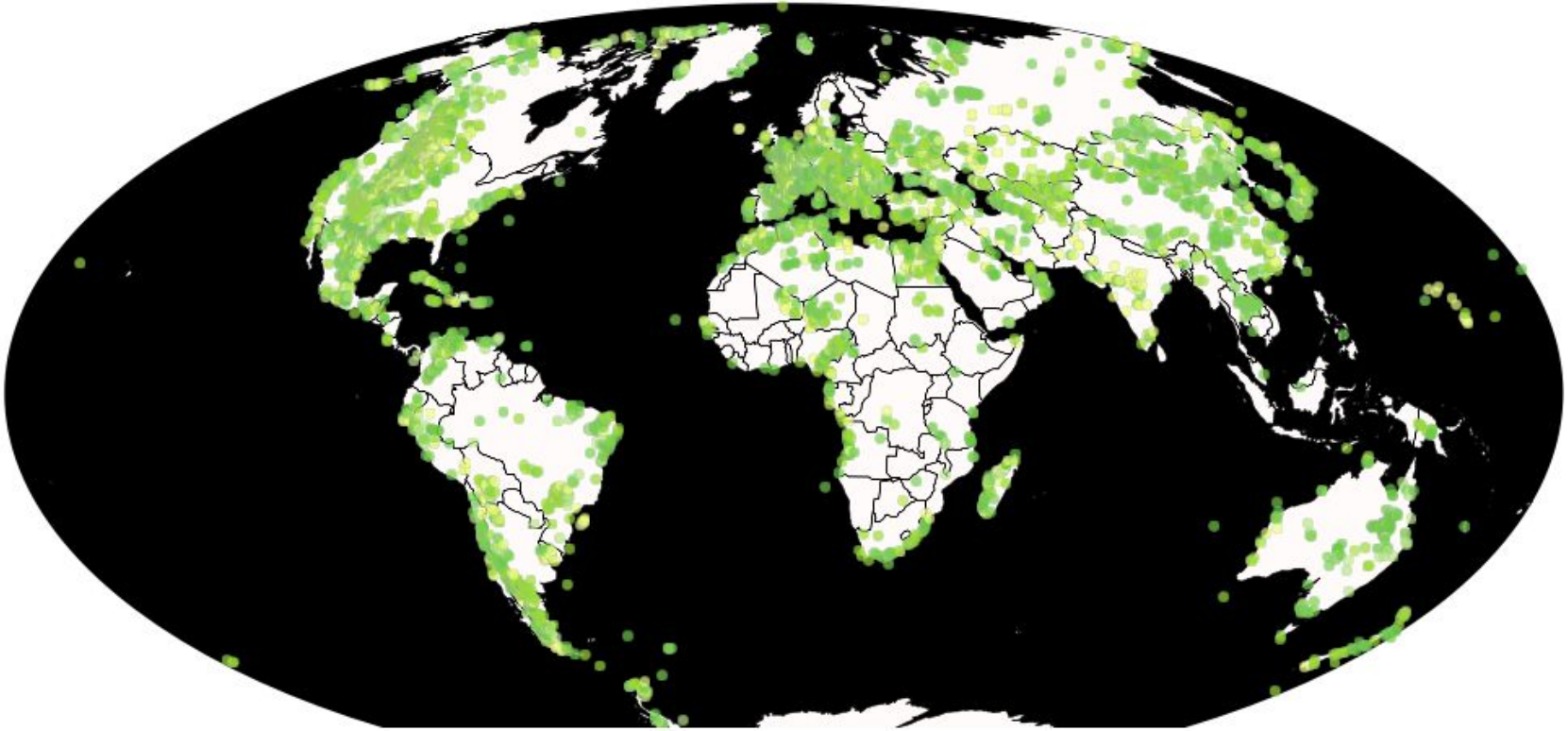


- **Cretaceous (145-66 Mya)** Third and final period of the Mesozoic Era

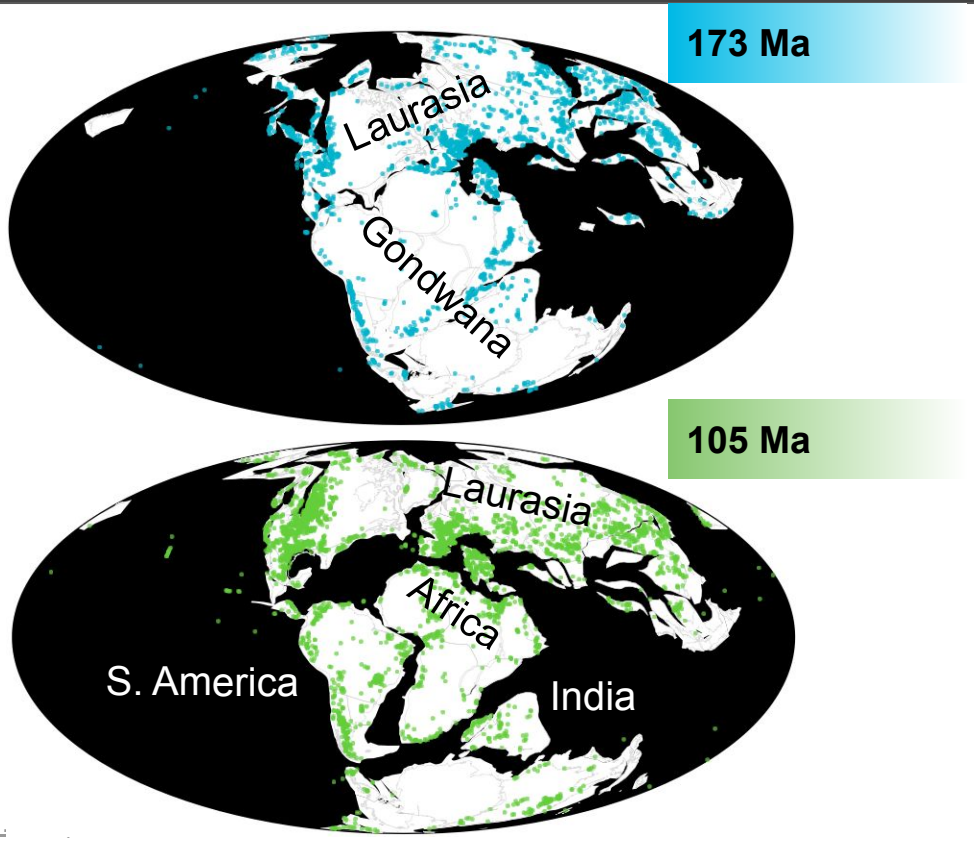
- ~79 My total

- Signified with a “K” (“C” was already taken by the Carboniferous; based on the German “Kreide”)

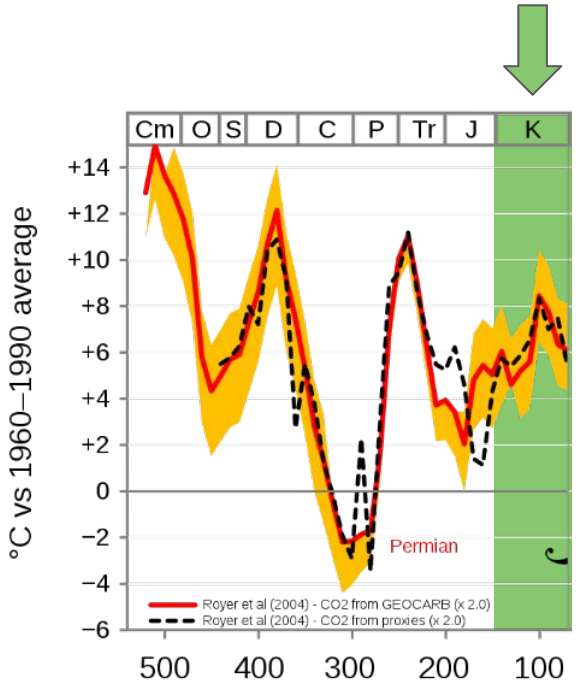
The distribution of Cretaceous fossils



Reconstruction of the Cretaceous world



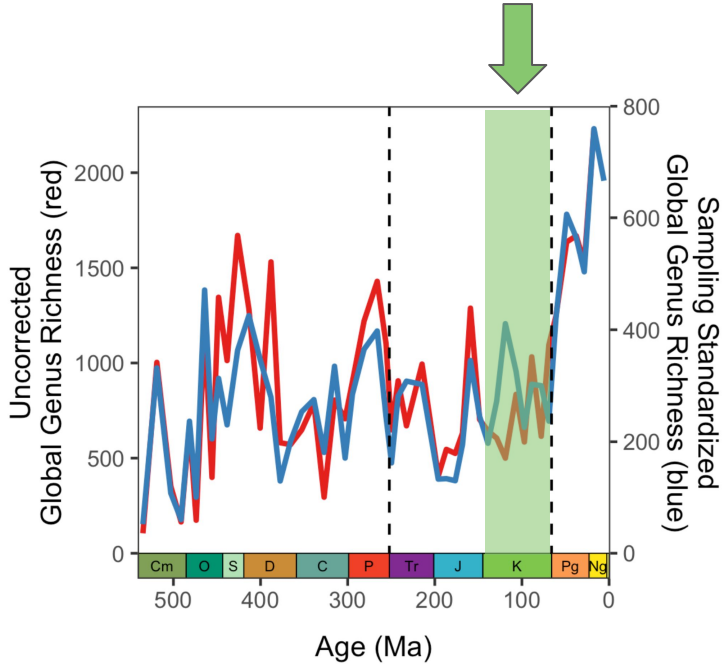
Cretaceous paleoclimate



Paleotemperatures from 500-65 My (source)

- Warm climate with high sea levels and vast inland oceans
- At it's high point, ~⅓ of continents were covered in ocean

Diversity in the Cretaceous



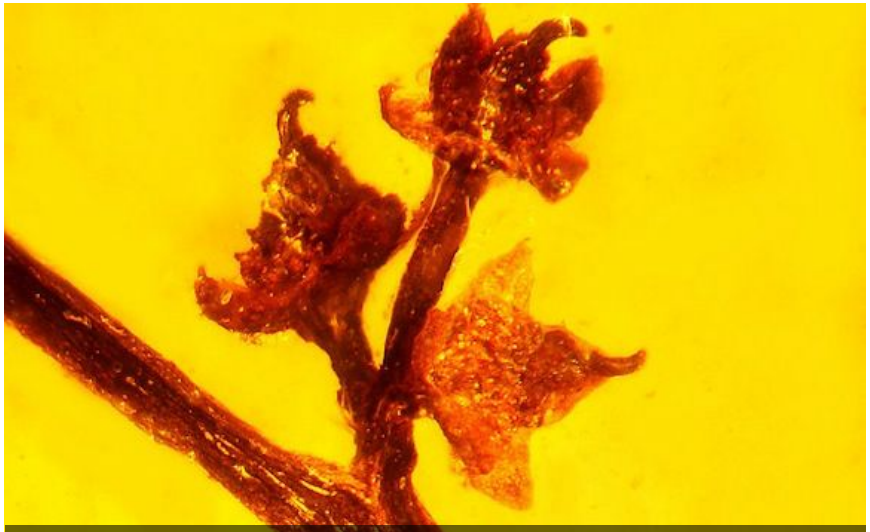
Close, R. A., et al. "The spatial structure of Phanerozoic marine animal diversity." *Science* 368.6489 (2020): 420-424.

- An uptick in diversity, particularly in the Early/mid Cretaceous
- Ongoing debate about whether the rate of new dinosaur species was stable or decreasing near the end of the Cretaceous

Cretaceous oceans

Prognathodon, Allopleuron-like turtle, elasmosaurids and sharks by NGZver (source)

Flowers!

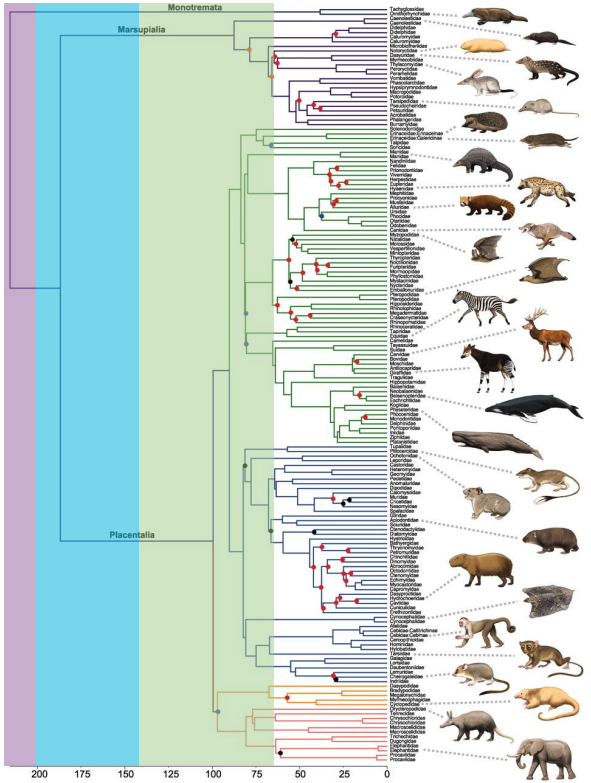


The ~100 Ma fossil *Micropetasos burmensis*, one of the first known flowers

- **Angiosperms**: plants that bear flowers and fruits
- Have seeds like gymnosperms, but use flowers and fruit for pollination and dispersal
- Associated with diversification of insects in the fossil record

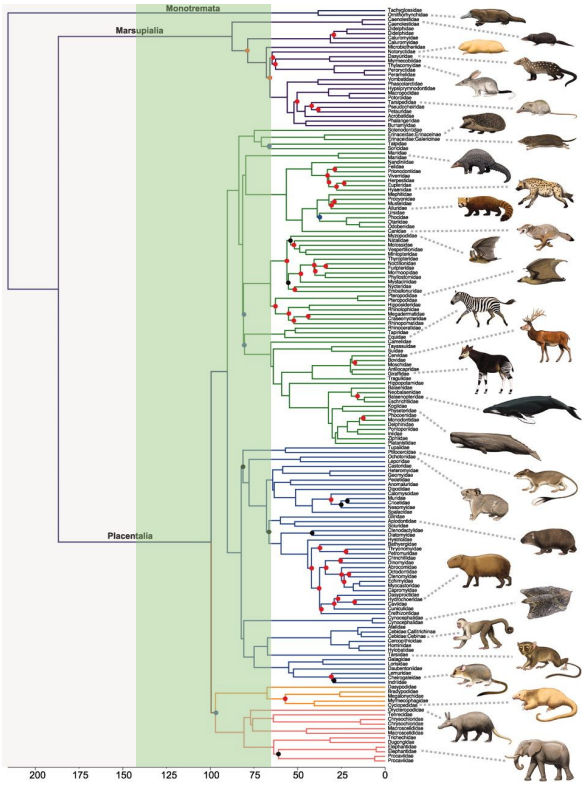
Mammals

- **Molecular clocks** reveal when the crown group mammals evolved
- They demonstrate that the major clades diversified by the late Cretaceous



Meredith, Robert W., et al. "Impacts of the Cretaceous Terrestrial Revolution and KPg extinction on mammal diversification." *science* 334.6055 (2011): 521-524.

Mammals



Marsupials and their ancestors (metatherians) evolved early and spread around the globe

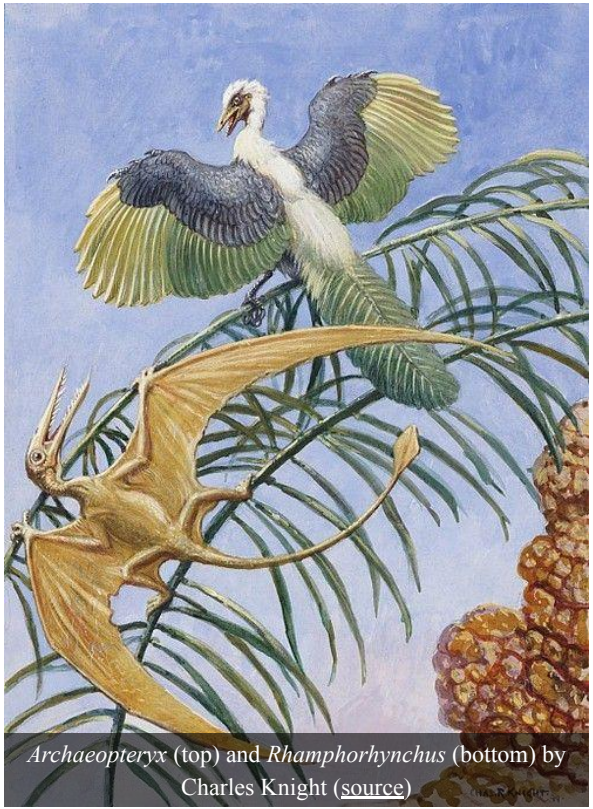
Laurasiatheria: Originate in the Northern supercontinent

Xenarthra: Originate in South America

Afrotheria: Originate in Africa

Pterosaur evolution in the Cretaceous

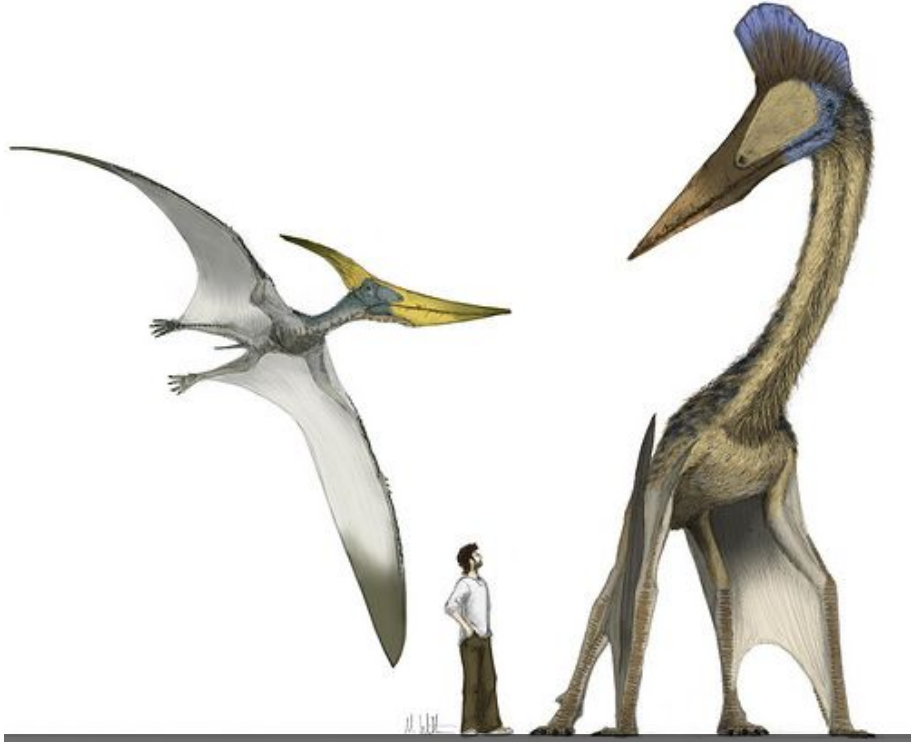
- True birds diversify in the Cretaceous
- To avoid direct competition, pterosaurs become larger
- Cretaceous birds are generally <2m in wingspan, while pterosaurs have wingspans up to 10m



Archaeopteryx (top) and *Rhamphorhynchus* (bottom) by Charles Knight (source)

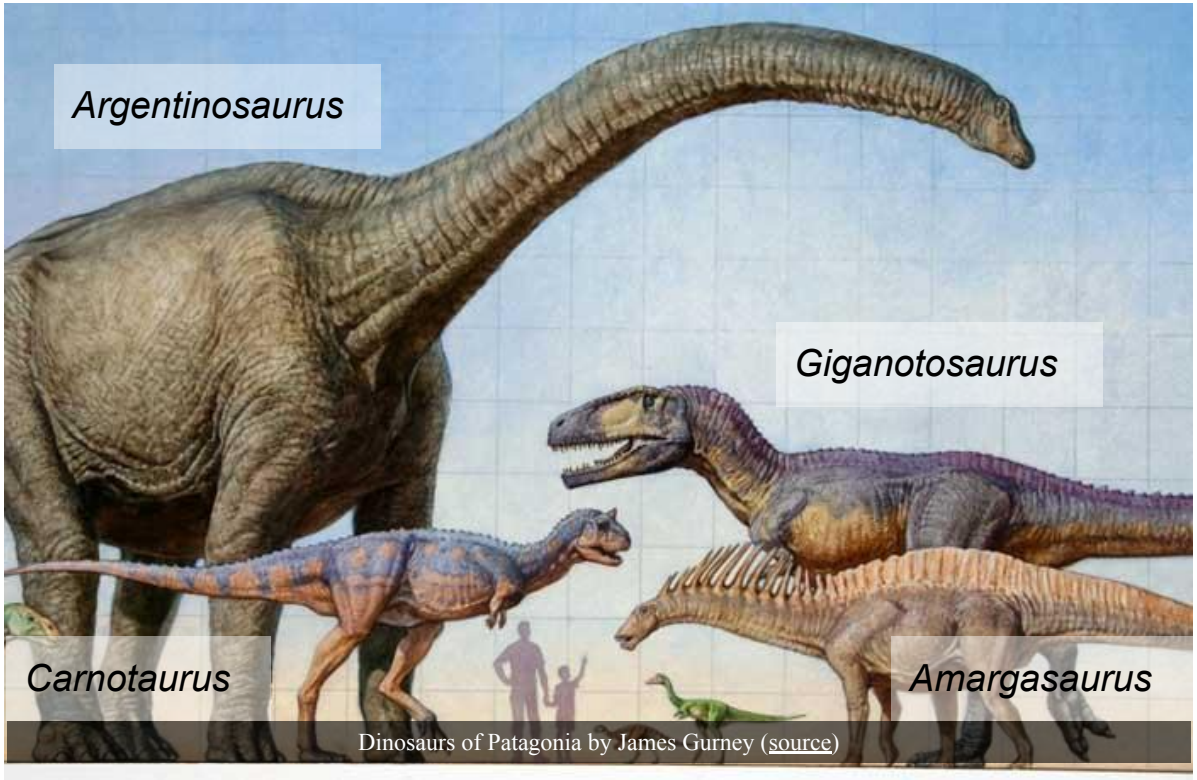
Pterosaur evolution in the Cretaceous

- Pterosaurs reach enormous sizes, but remain capable of flight
- Loss of teeth, elaborate air sacs, and powerful chest/shoulder muscles keep pterosaurs light and strong



Pteranodon (left) and *Quetzalcoatlus* (right) by Mark Witton (source)

Dinosaur evolution in South America



Dinosaurs of Patagonia by James Gurney (source)

- Similar to mammals, dinosaurs evolve independently on the major continents
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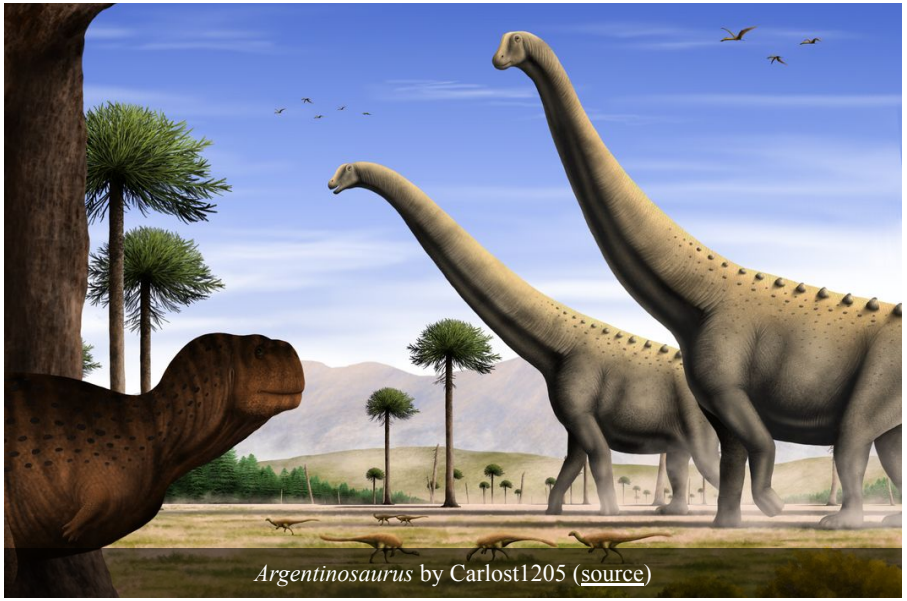
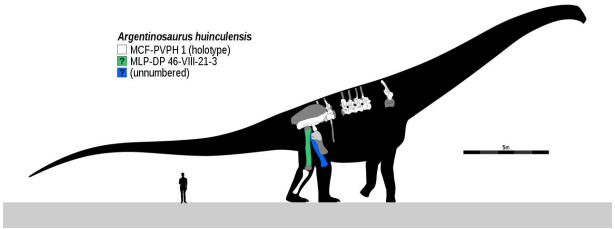
Key Taxon: *Argentinosaurus*

Argentinosaurus

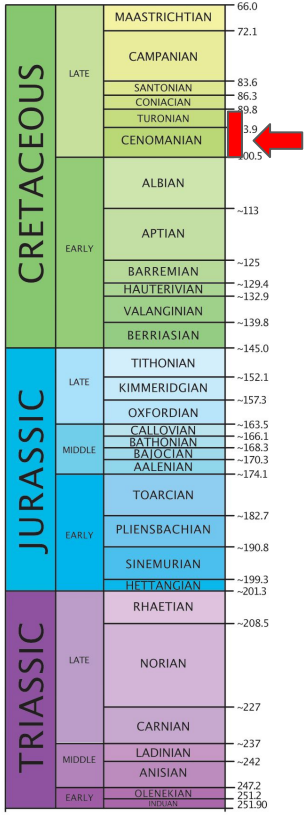
Argentina + Greek: “saurus” = lizard



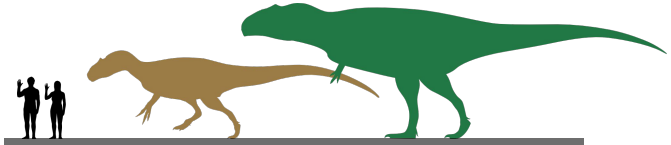
Argentinosaurus by Carlost1205 (source)



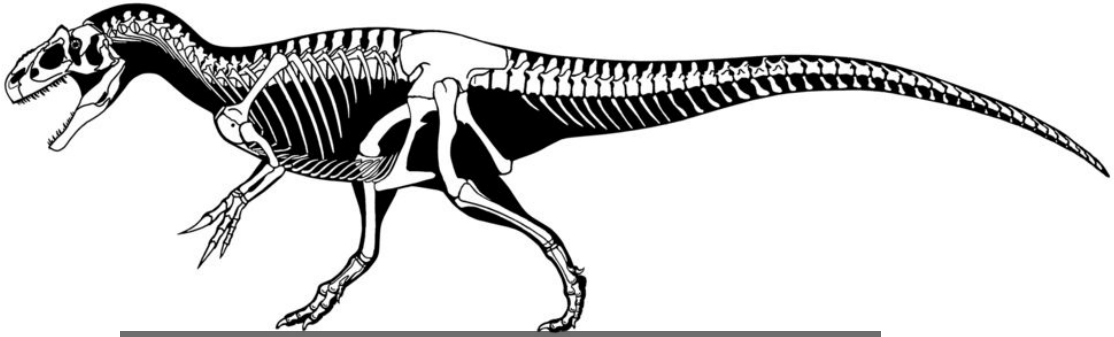
- 98–115 ft long; ~70 tons
- Part of the Titanosaurs, the dominant Cretaceous sauropods



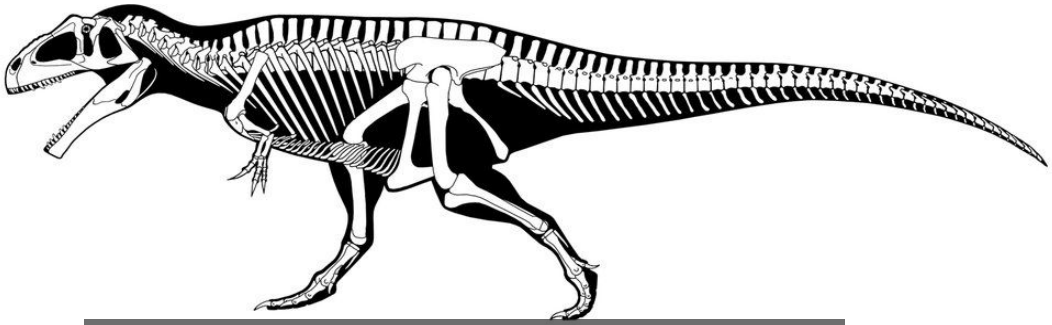
Allosaurus versus *Giganotosaurus*



Allosaurus (left) and Giganotosaurus (right)

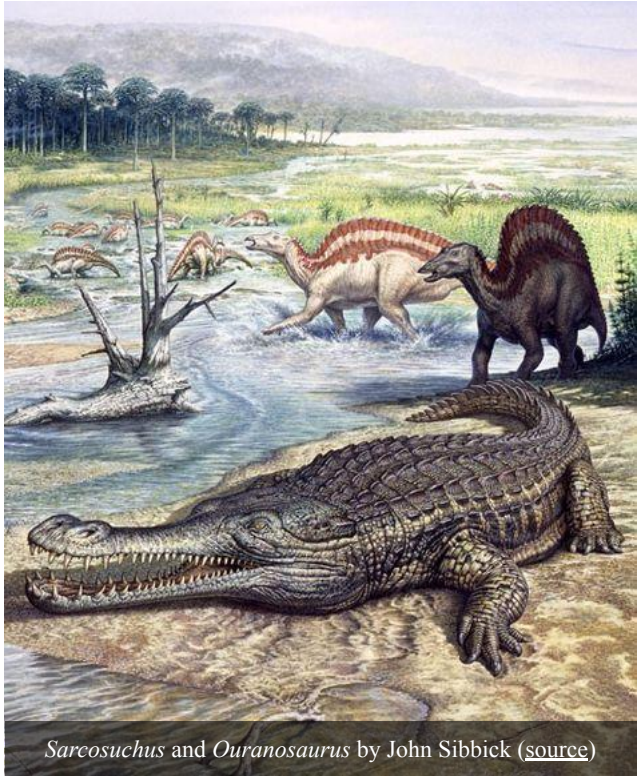


Allosaurus skeleton by Scott Hartman (source)



Giganotosaurus skeleton by Scott Hartman (source)

Dinosaur evolution in Africa



Sarcosuchus and *Ouranosaurus* by John Sibbick (source)

- Early Cretaceous fossil deposits in Morocco and other sites in North Africa demonstrate a wet, tropical environment
- *Sarcosuchus*, one of the largest crocodiles ever (~30 ft.) preyed on abundant, large fish
- Medium sized sauropods and large theropods related to *Giganotosaurus* also found in the region

Dinosaur evolution in Africa

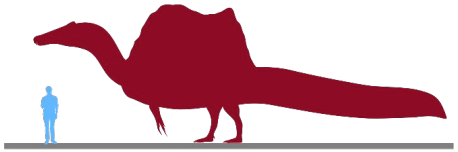
- Some large theropods specialized in fish eating
- *Suchomimus* has many adaptations for a piscivorous diet

The ~35 ft skeleton of *Suchomimus* (source)

Close-up of the teeth of *Suchomimus* (source)

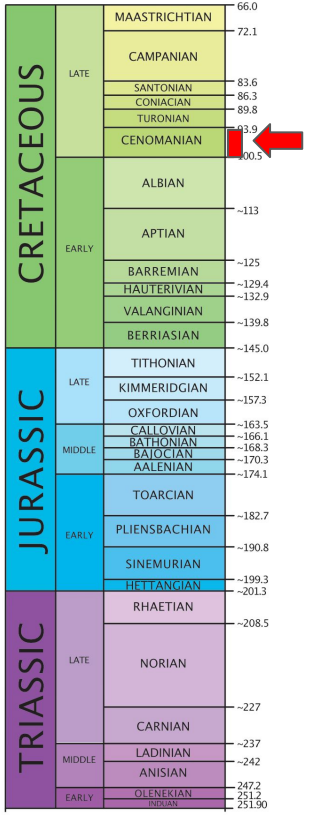
Key Taxon: *Spinosaurus*

Spinosaurus
Greek: “spino” = spine “saurus” = lizard

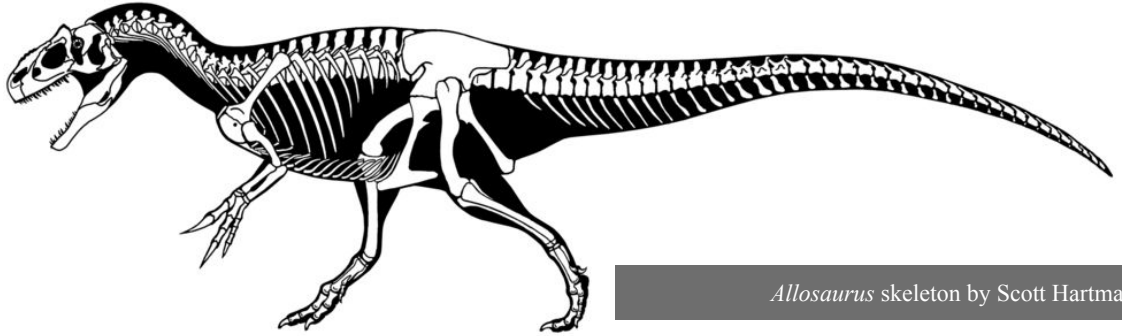


- ~40-60 ft. long
- One of the most unusual theropods

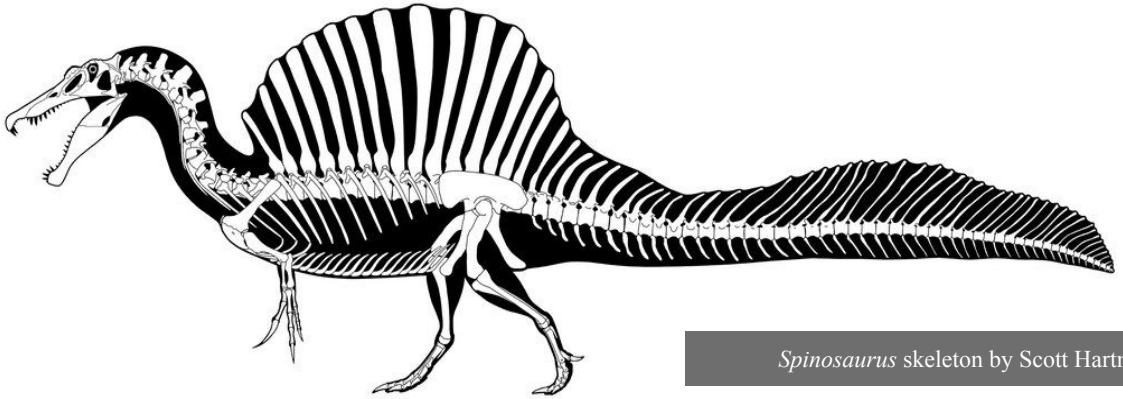
Spinosaurus by R J Palmer (source)



Allosaurus vs. *Spinosaurus*



Allosaurus skeleton by Scott Hartman (source)



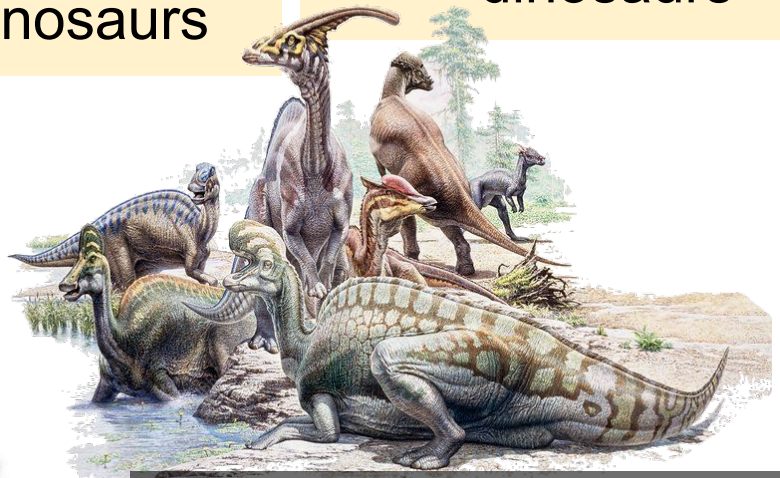
Spinosaurus skeleton by Scott Hartman (source)

Dinosaur evolution in Laurasia

- Several new groups of **ornithischian** dinosaurs evolve in Laurasia and become the dominant herbivores

Hadrosaurs: duck billed dinosaurs

Pachycephalosaurs: bone-headed dinosaurs



Hadrosaurs and pachycephalosaurs by John Sibbick (source)

Ceratopsia: horned dinosaurs

Diablosceratops by Andrey Atuchin (source)

Feathered theropods of Cretaceous Asia

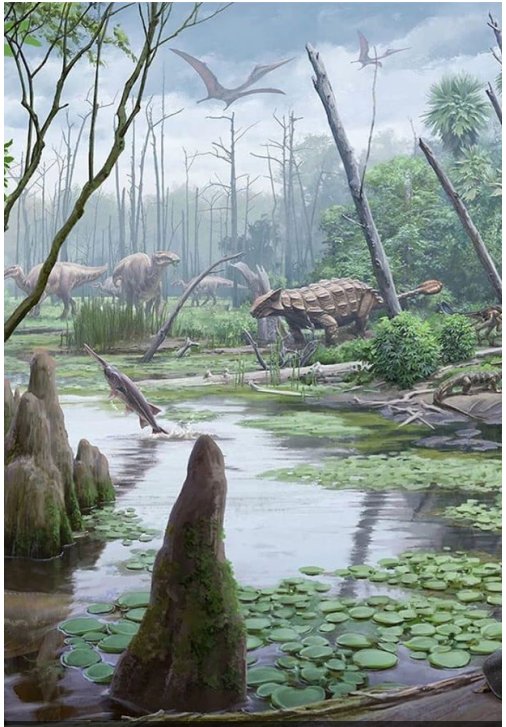
Microraptor by Sergey Krasovskiy (source)

Yutyrannus (source)

- Feathered dinosaurs continue to diversify alongside early birds
- At ~25 ft. *Yutyrannus* from Northeastern China is the largest theropod with direct evidence of feathers

Nanuqsaurus versus *Pachyrhinosaurus*

Conclusions



Hell Creek by Beth Zaiken (source)

- Changing climate and the rise of flowers created a turnover in animals (the Cretaceous Terrestrial Revolution)
- Combined with continental drift, the Cretaceous was a time where new dinosaur groups flourished and diversified

Next class

Hadrosaurs and pachycephalosaurs by John Sibbick (source)