

Age of the Reptiles

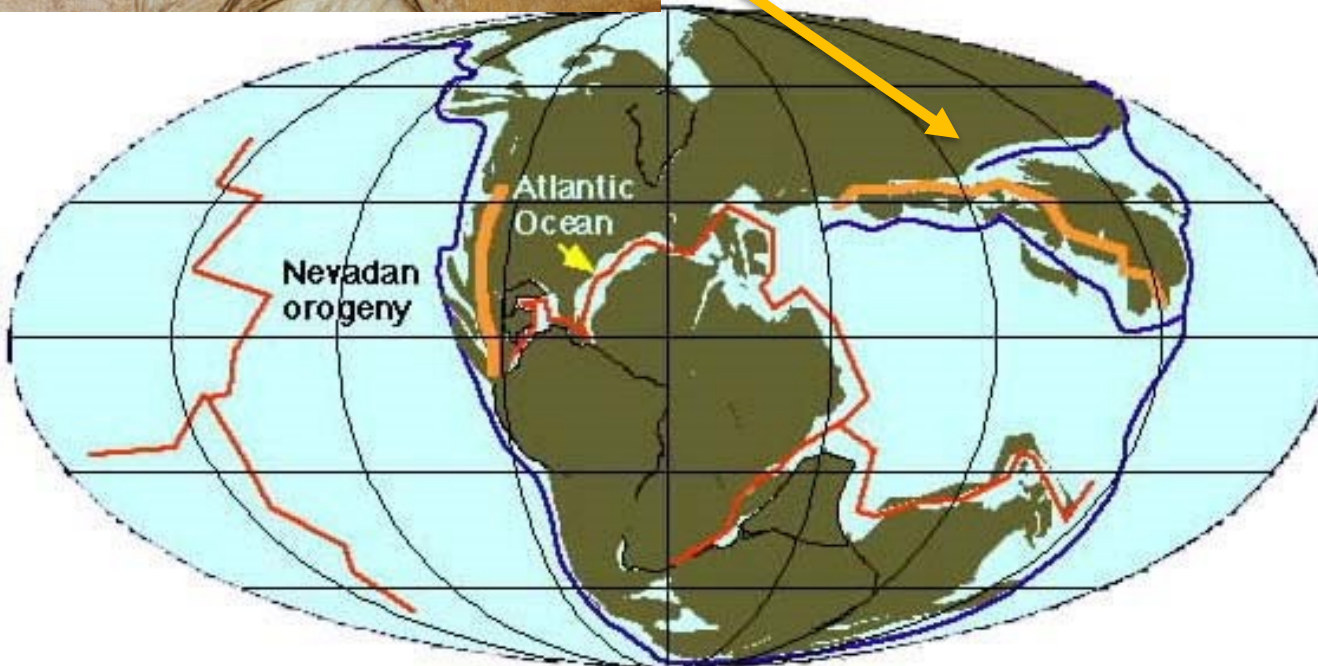
Evolution of Scales & Feathers During the Mesozoic Era

Lecture 5

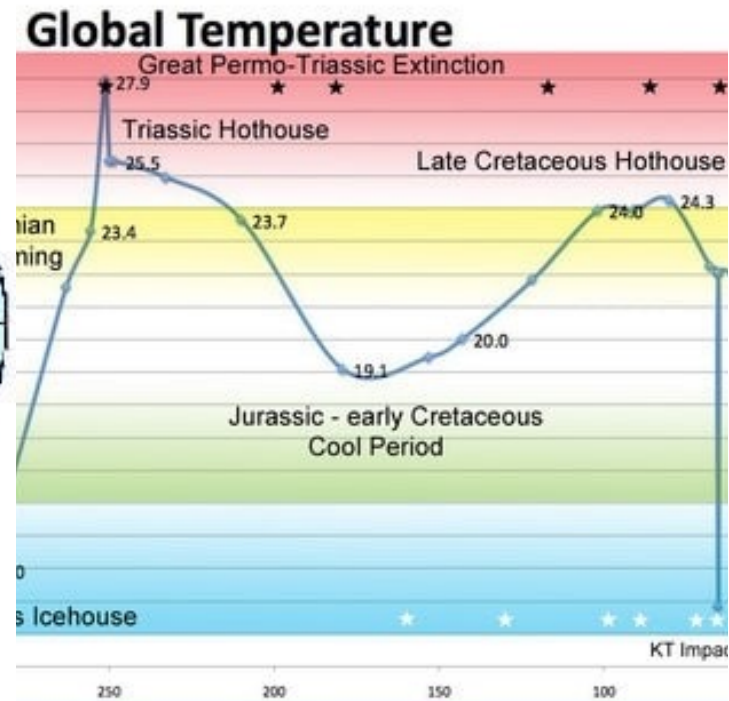
Cretaceous Diversification

Handout:

www.appreciatingearth.com/olli

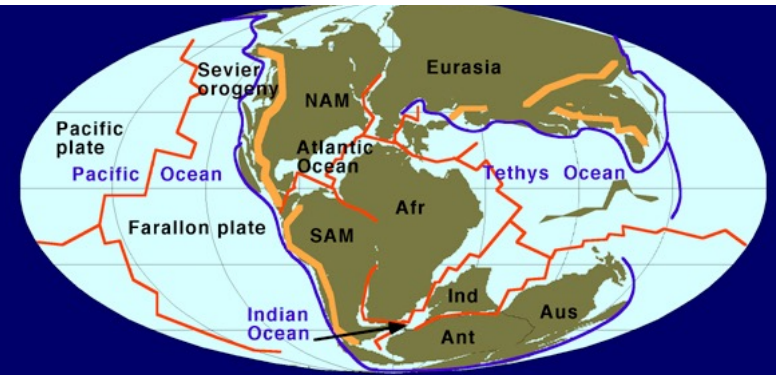


Middle Jurassic - 160 Ma

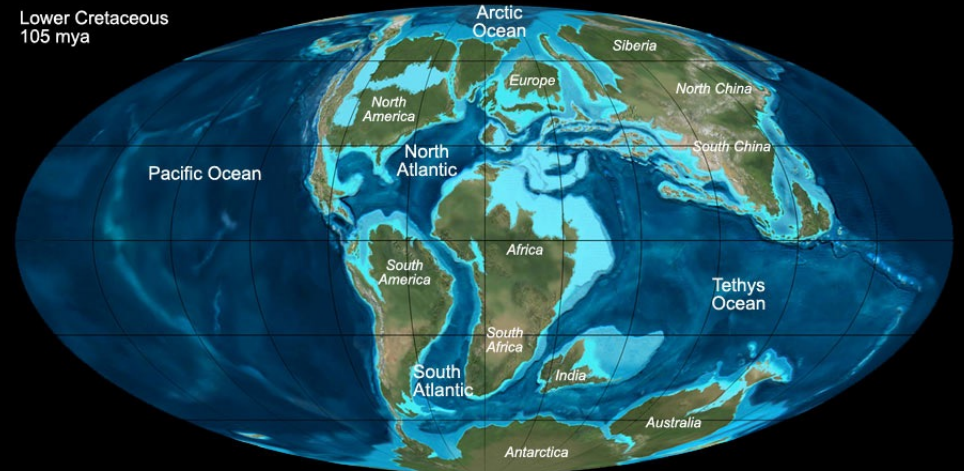


Cretaceous Plate Tectonics

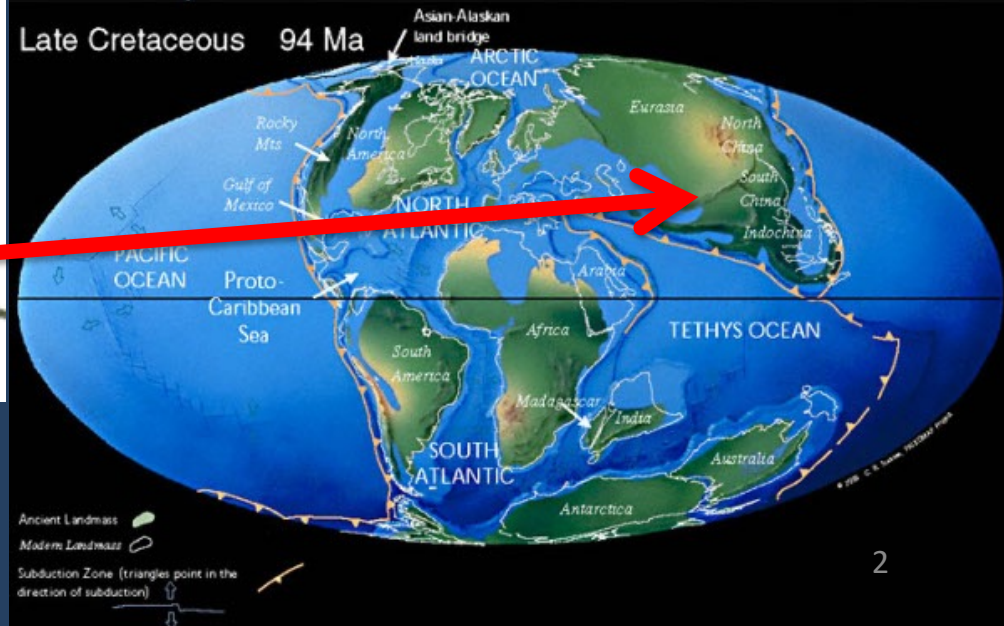
Peak of the Age of the Reptiles



Early Cretaceous 130 Ma



Lower Cretaceous
105 mya



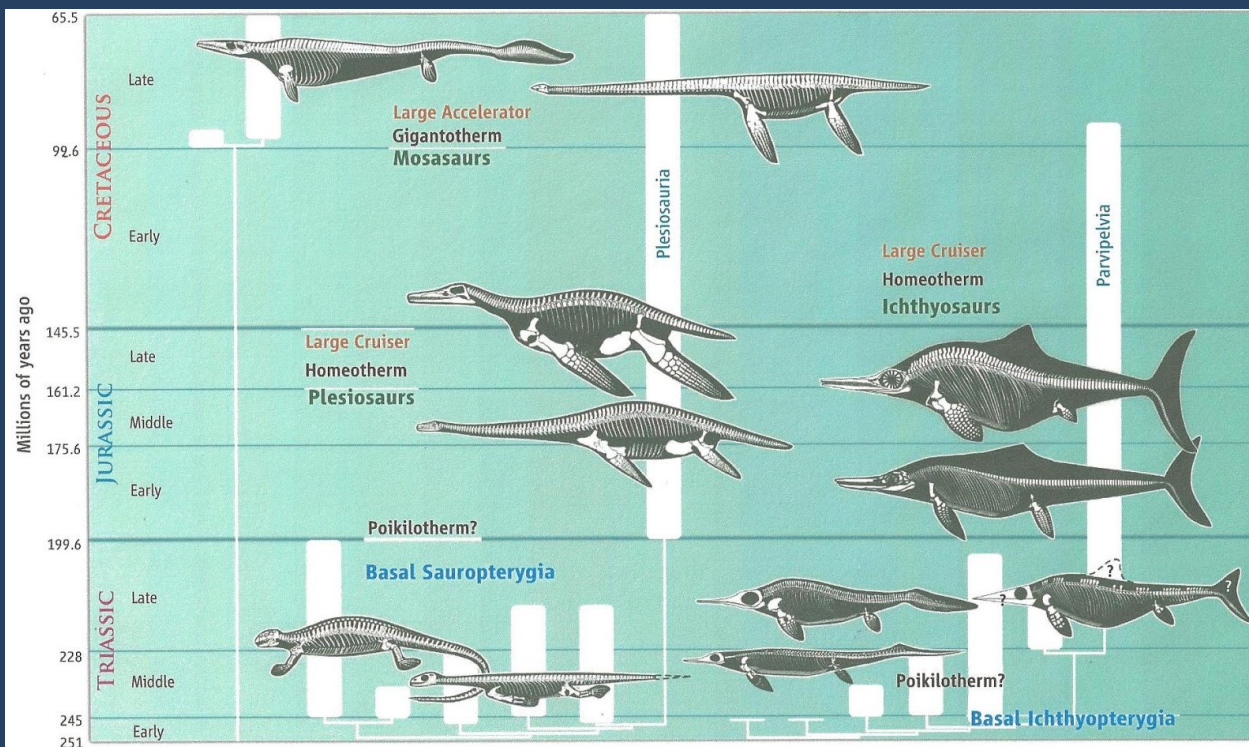
Late Cretaceous 94 Ma



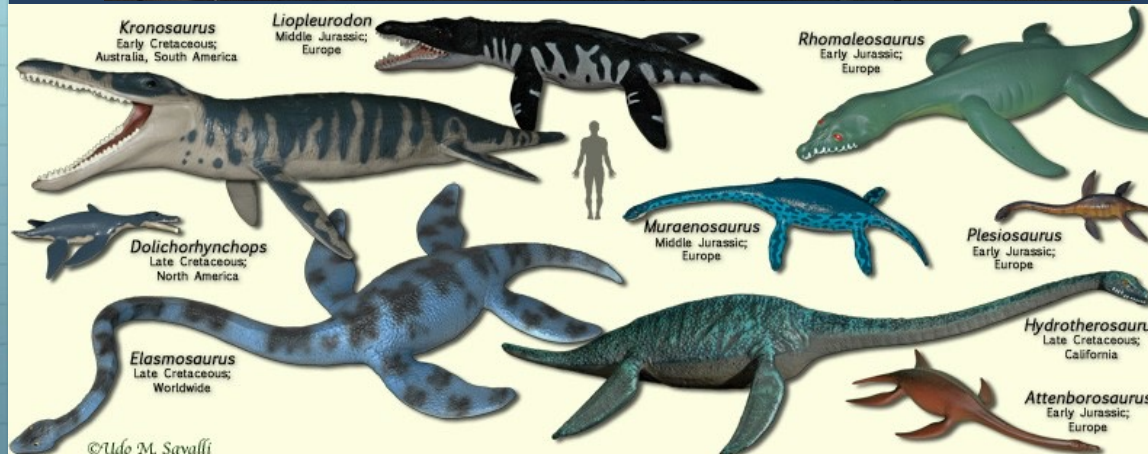
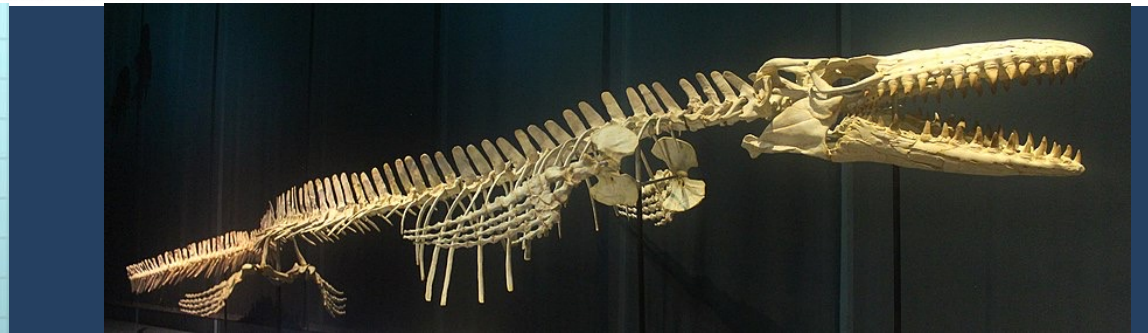
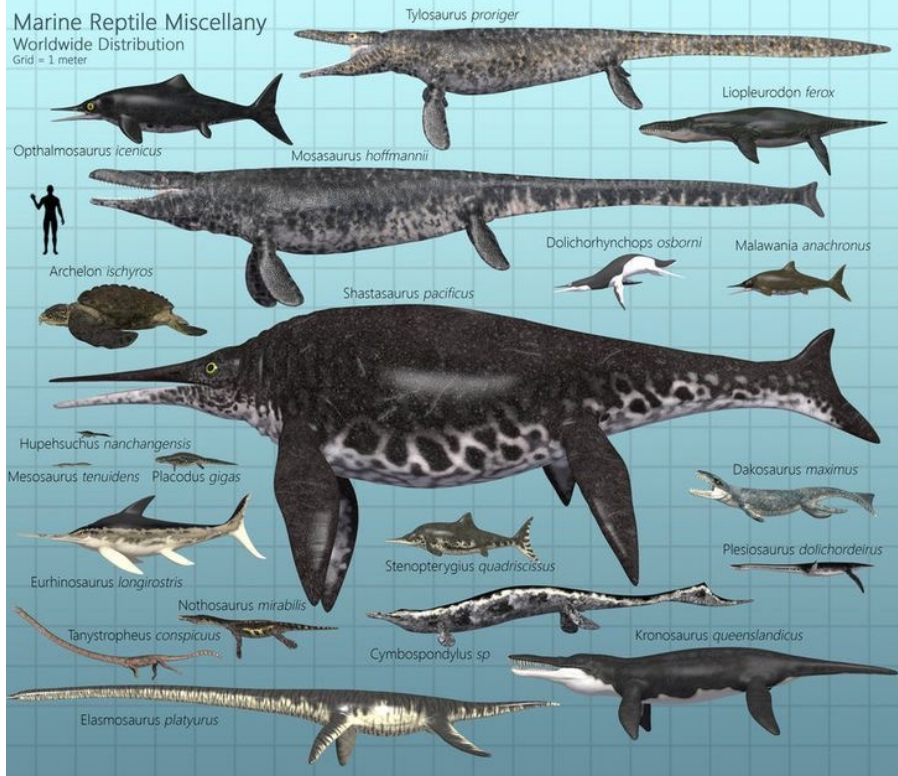
130-122.46Ma
Sinornithosaurus from
China

Marine Reptiles

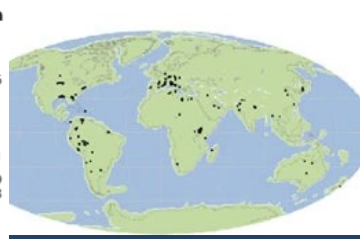
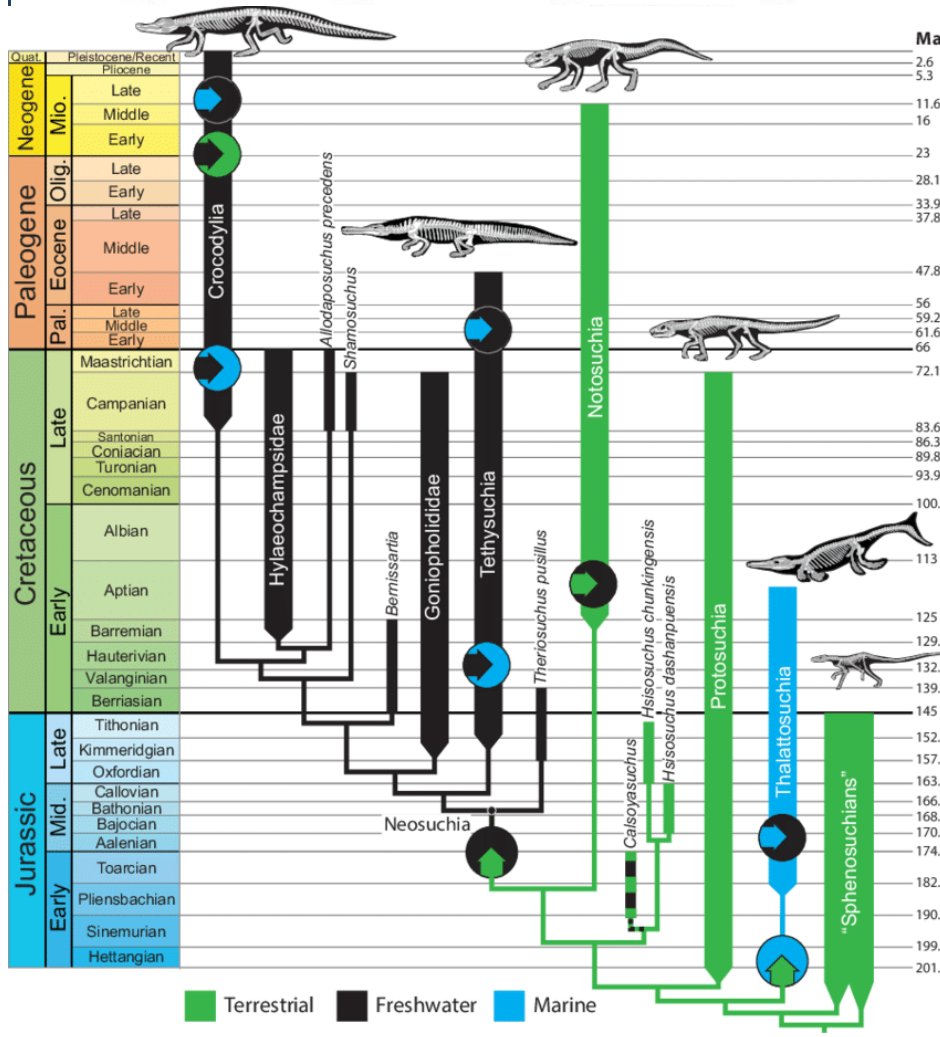
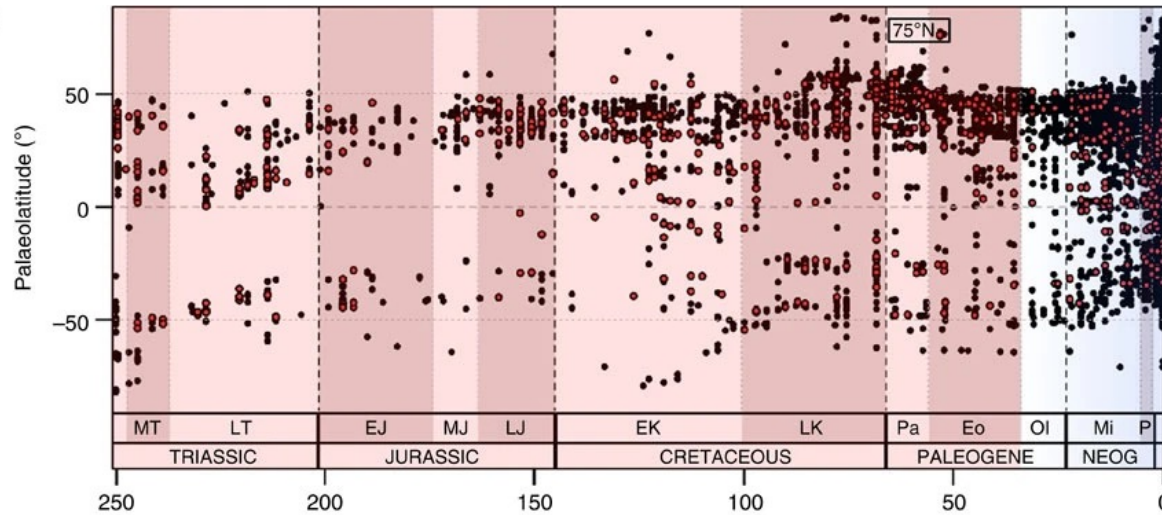
- Plesiosaur & Ichthyosaur survivors
- Mosasaurus = giant marine lizards
 - Global apex predator
 - >36ft long & 10 tons



Marine Reptile Miscellany
Worldwide Distribution
Grid = 1 meter



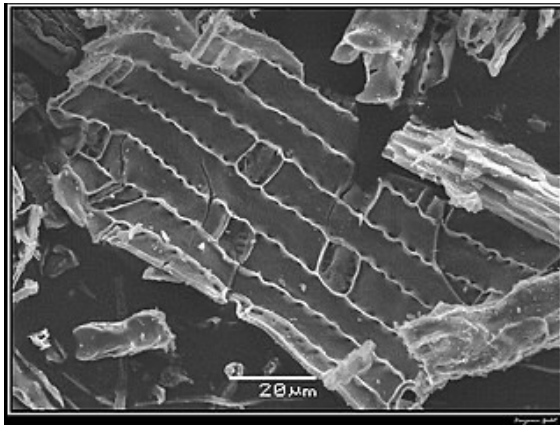
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Cretaceous Crocodylia

- Evolved in Cretaceous
- 82-73Ma Deinosuchus
 - Up to 35ft in length
 - Ate dinos: coprolites, tooth impressions





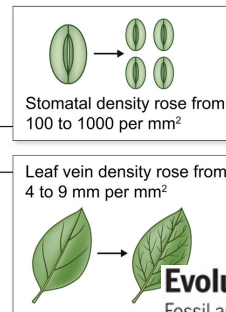
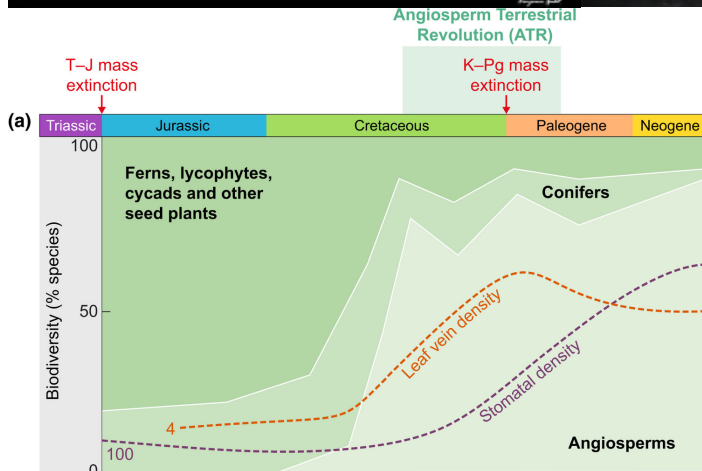
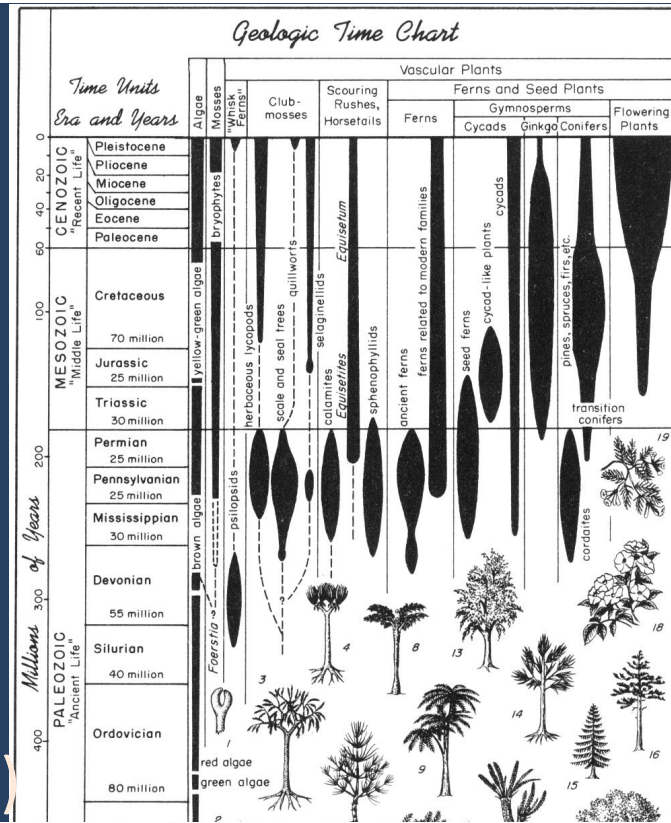
Angiosperms

Sauropod coprolite with phytoliths



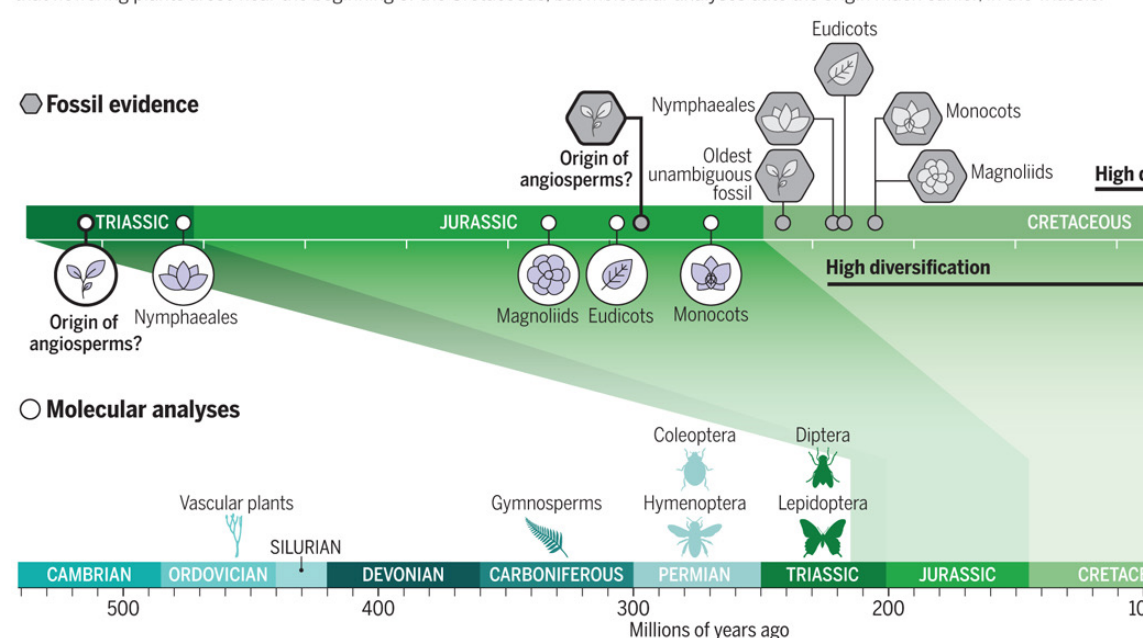
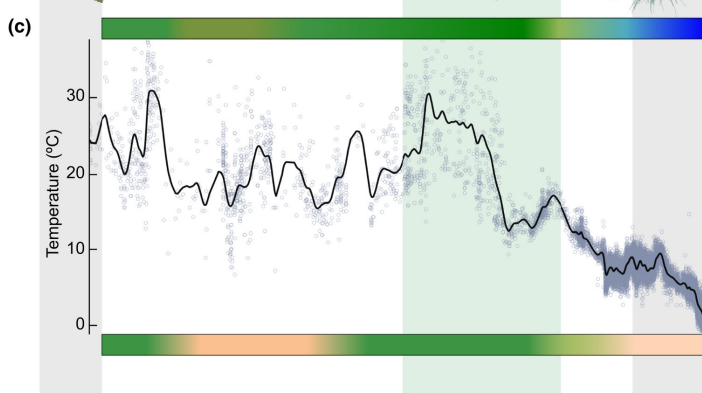
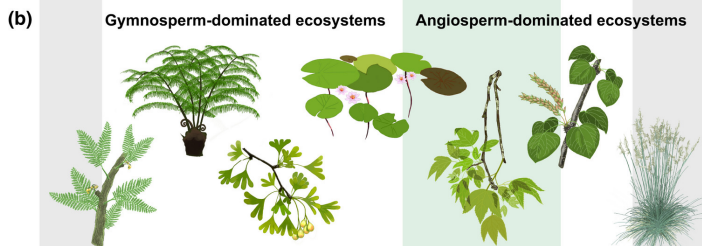
Angiosperms Diversify:

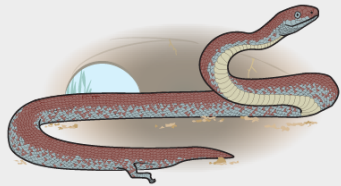
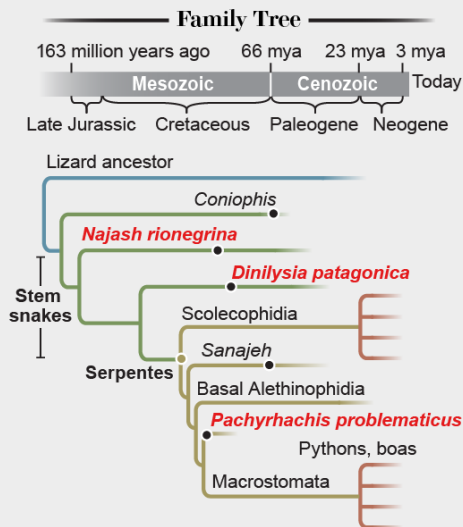
- Magnolia
- Sassafras
- Beach
- Fig
- Poaceae (phytoliths)



Evolution of angiosperms according to molecular and fossil evidence

Fossil and molecular evidence lead to conflicting conclusions about the timing of the origin of flowering plants. Fossil evidence suggests that flowering plants arose near the beginning of the Cretaceous, but molecular analyses date the origin much earlier, in the Triassic.

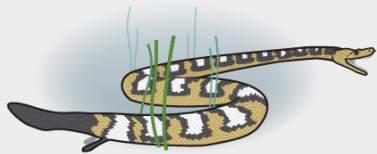




Najash rionegrina is a 92-million-year-old terrestrial snake from Argentina. It has a tiny pair of hind limbs that may have functioned as claspers during mating.



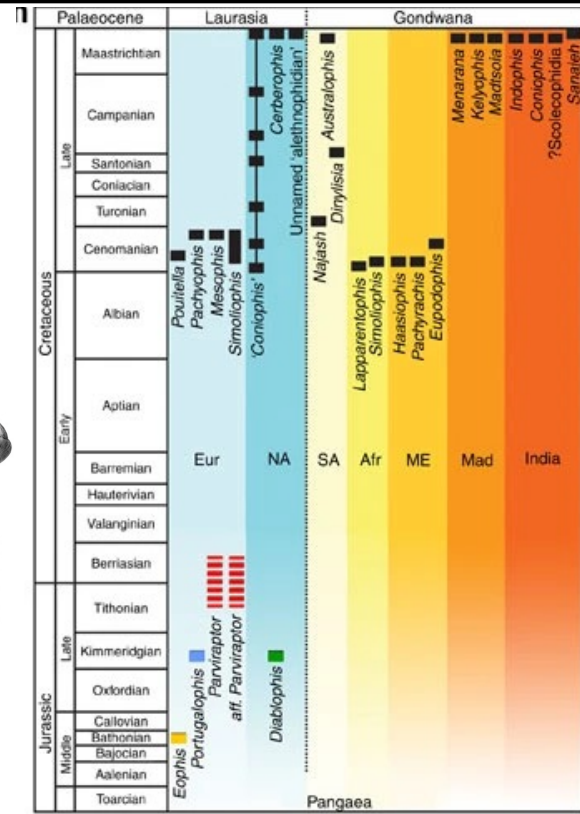
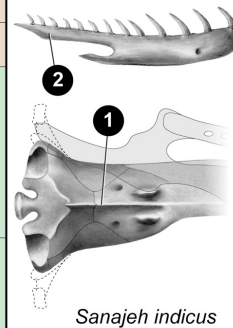
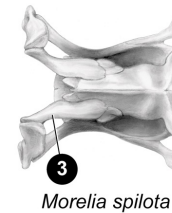
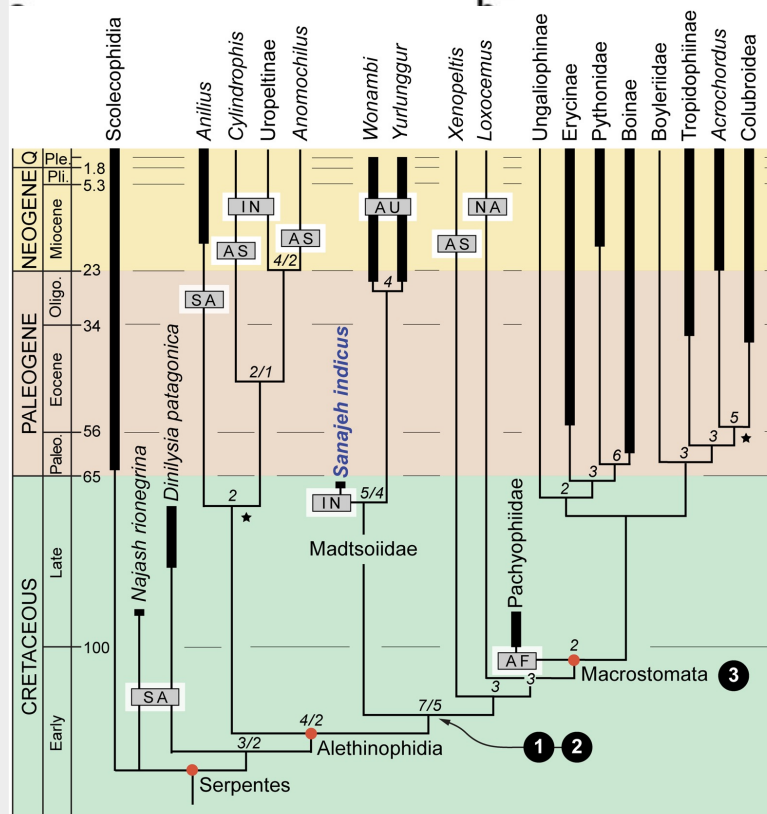
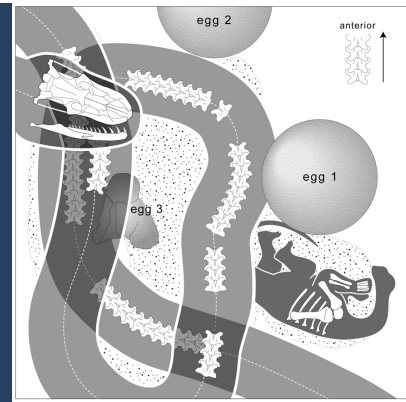
Dinilysia patagonica, an 85-million-year-old burrowing snake from Argentina, is the earliest known snake to completely lack limbs. It is also the closest fossil relative of today's snakes. *Dinilysia* suggests that the ancestors of modern snakes lost their legs while adapting to life underground.



Pachyrhachis problematicus, a 98-million-year-old marine snake found near Jerusalem, has tiny back legs but no hips to support them, which means they would have been useless for swimming.

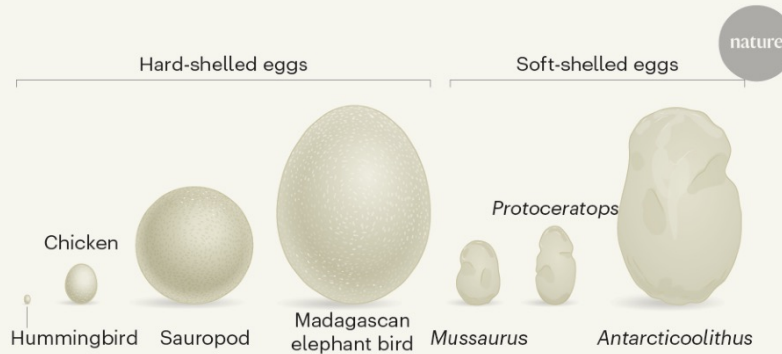
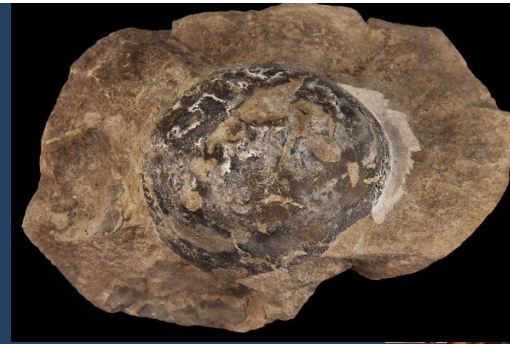
Cretaceous Snake Evolution

- Major serpent family evolved in the Cretaceous
- 150-100Ma some lineages limbless
- Fossil evidence of snake preying on



Dino Reproduction & Eggs

- Soft & hard shelled eggs
- Protected eggs or abandoned?
- Oviraptor fossilized on eggs/nest
- Montana Maiasaur group nesting grounds
- Chemical analysis of original shell
- Body T: 32°-38°C (O_{18} & C_{13} in shells)



Video Link:

<https://www.youtube.com/watch?v=d7bFqkJHcEc>

Dinosaur Sex

- Amniotic eggs require internal fertilization
- Oviraptor pelvis with 2 preserved eggs
- Footprint evidence of mating dance?
- T-Rex tiny arms for tickling?

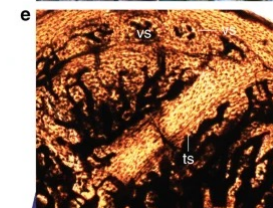
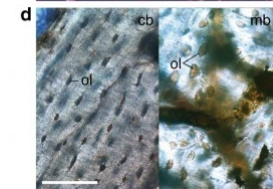
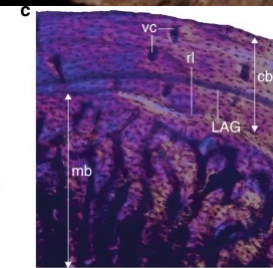
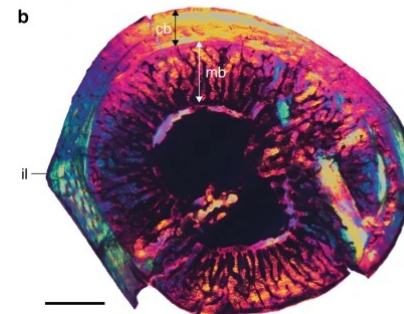
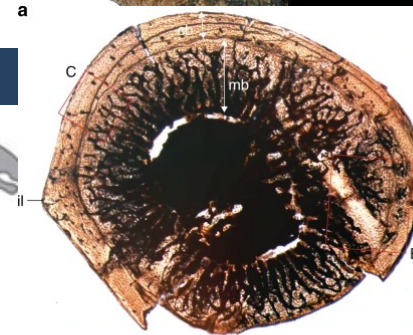
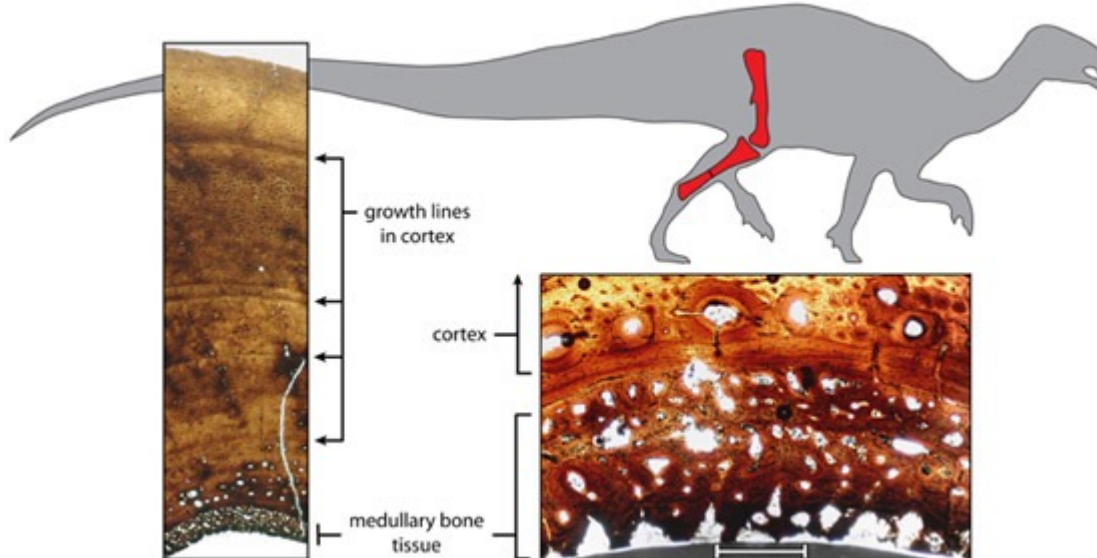
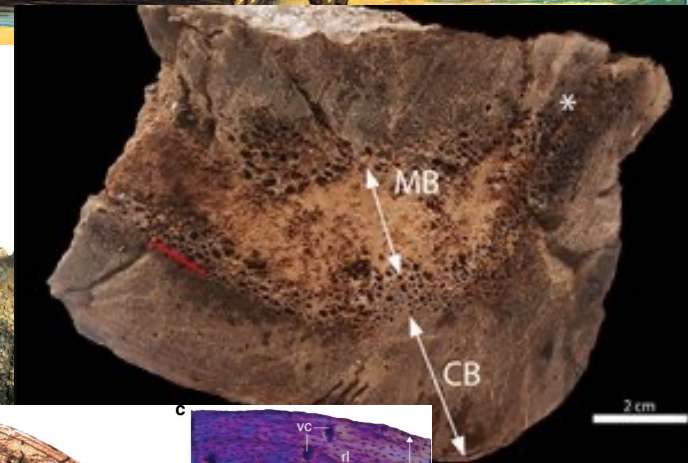
Video Link:

https://www.youtube.com/watch?v=-mv_v4ltSrY



Dino Sexual Dimorphism

- Medullary bone fossilized in: Theropods, Sauropods, Ornithopoda + Pterosaurs
- Length of chevrons?
- Shape of stegosaurus plates?
- Shape of display features?
- Size differences?
- Color?
- Plumage?



Feathers & Filaments

- Insulating features = endothermic animals
- Theropod, Ornithopod, Ceratops, Pterosaur
- When did endothermy evolve in animals?
- Chemical studies = feather color evidence:
 - could see red, green & blue + UV
 - color influences communication, recognition, & mating
 - can refract light



100 μ m



200 μ m



200 μ m



1 mm



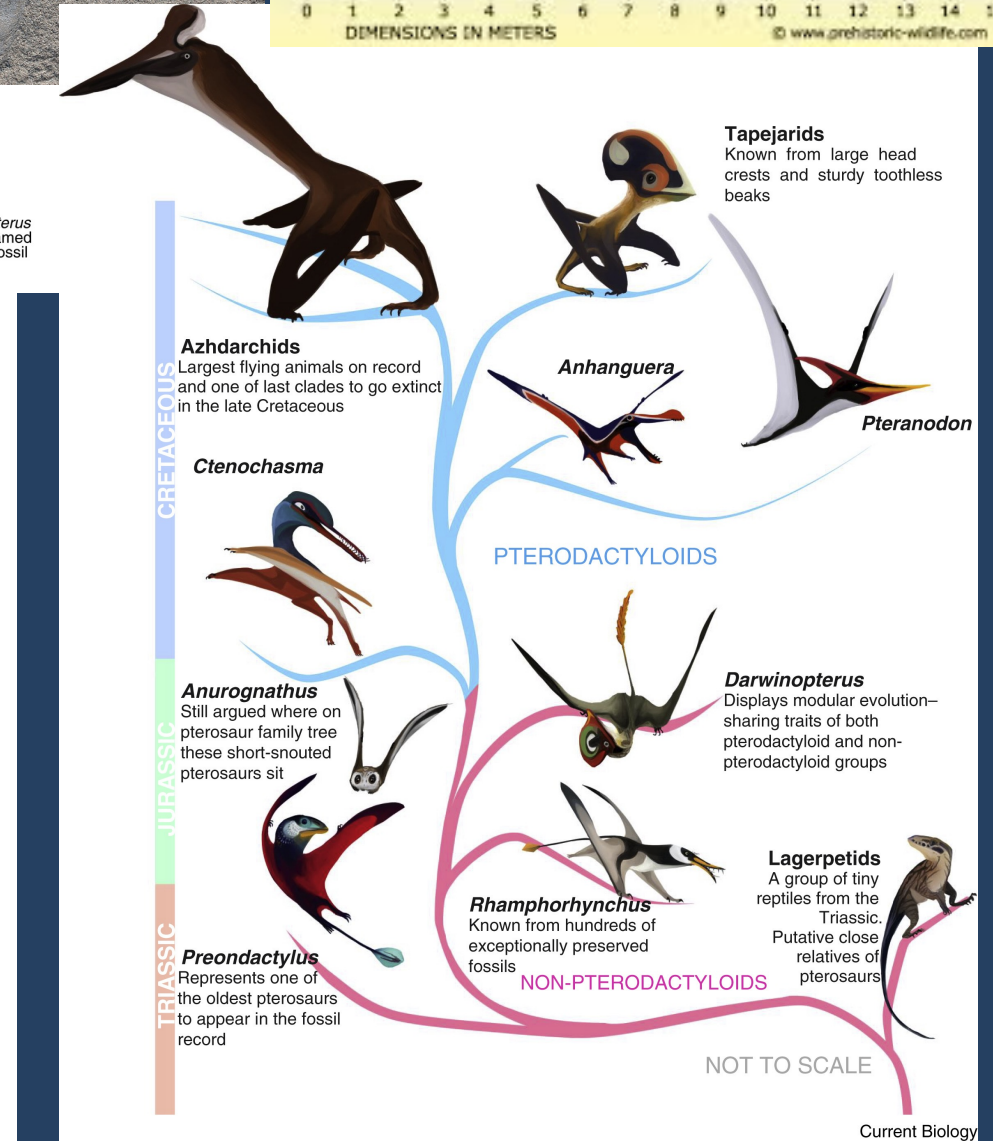
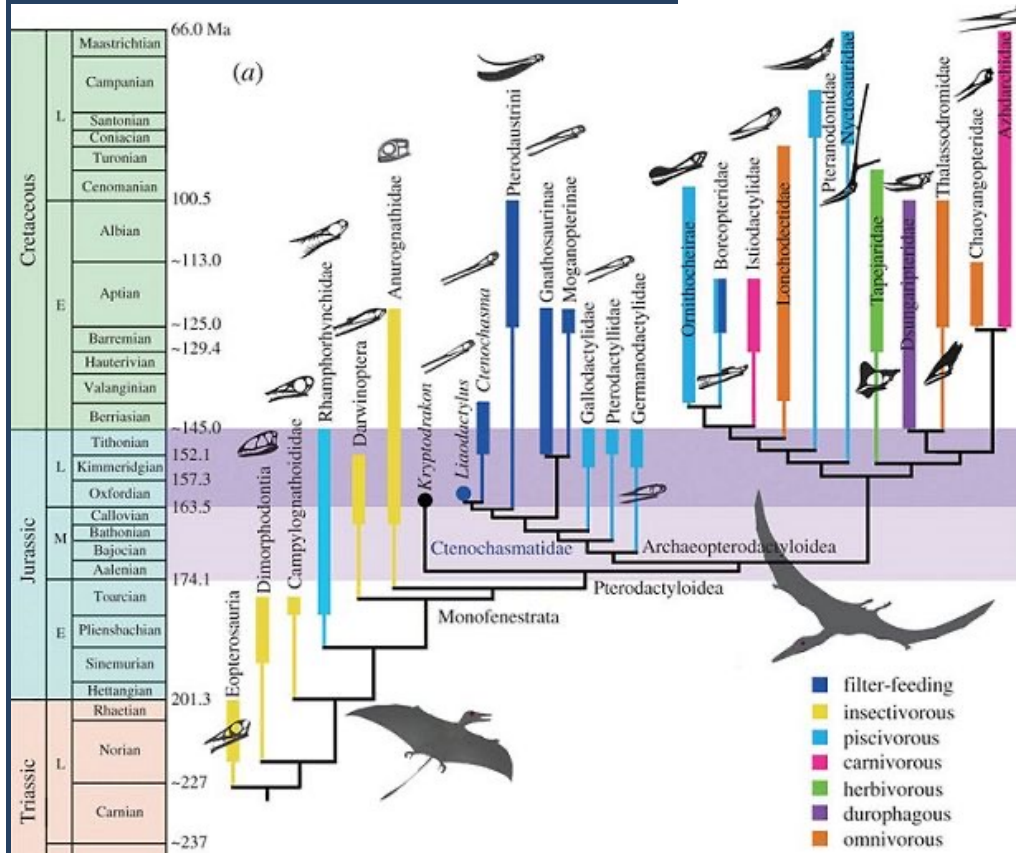
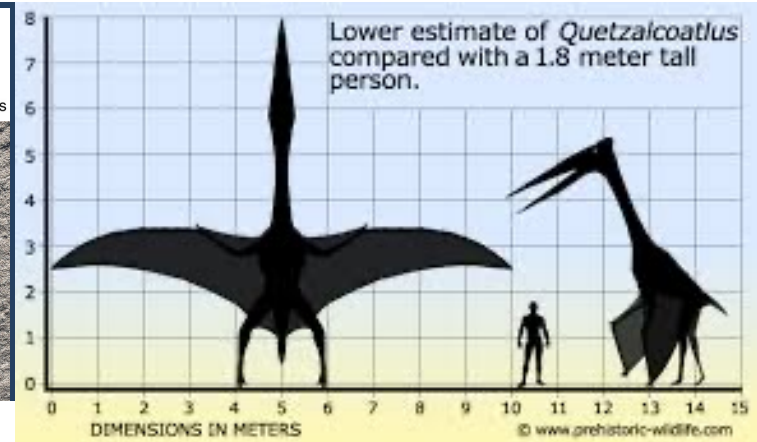
10 Minute Break!

Video Link:

<https://www.youtube.com/watch?v=TaMTLJUa-b4>

Cretaceous Pterosaurs

- Various eating strategies
- Display features & filaments (insulation)
- Soft shell eggs
- *Quetzacoatalus* 33-36ft wingspan & 440-550lbs

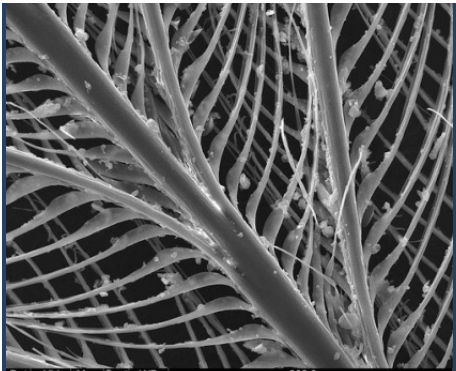
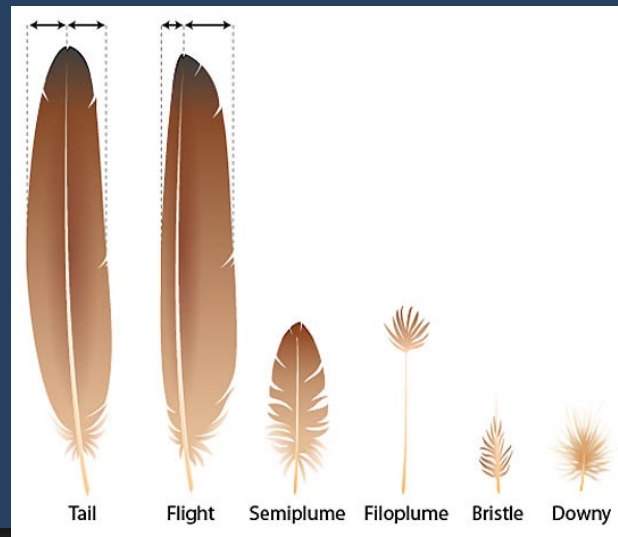
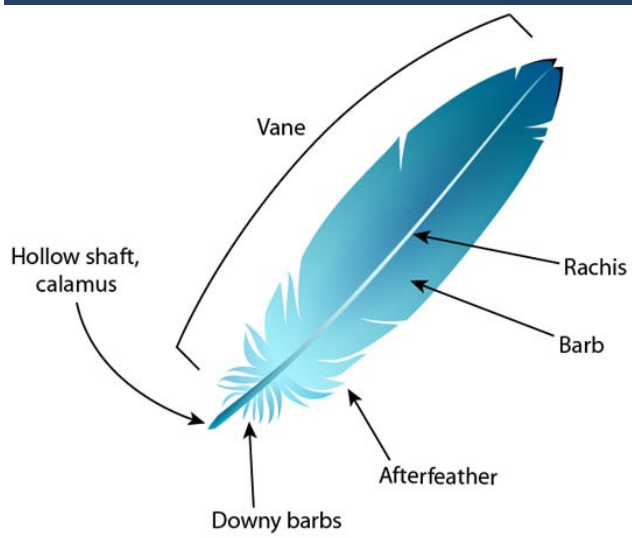


Evolution of Feathers

- Feathers did NOT evolve for flight:
 - insulating properties
 - Identification/display
- Embryology:
 - 5 stages of feather development
 - Feathers are highly modified scales

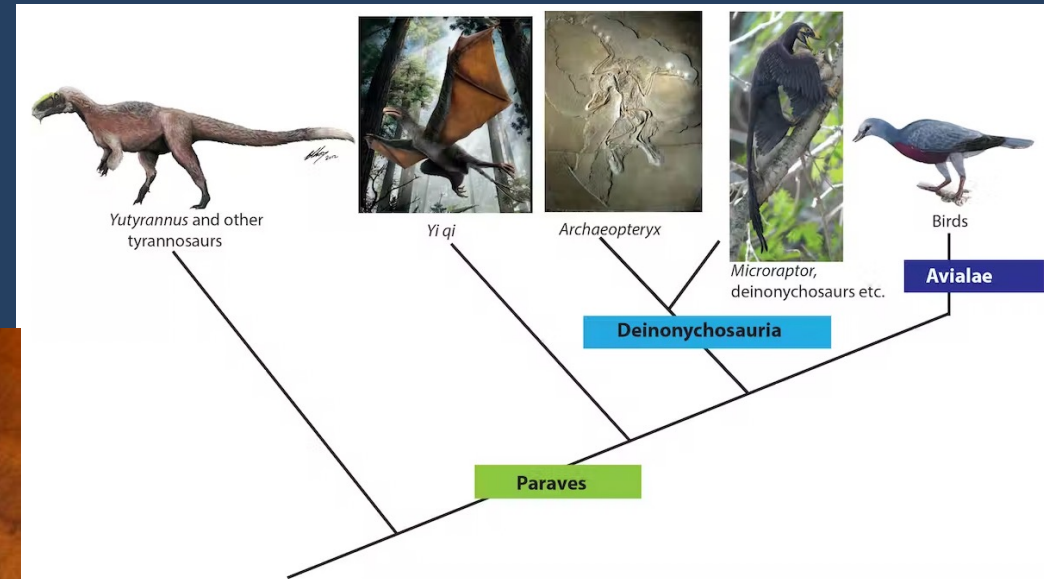
Video Link:

<https://www.youtube.com/watch?v=95ypGX5n9fo>



Yi qi

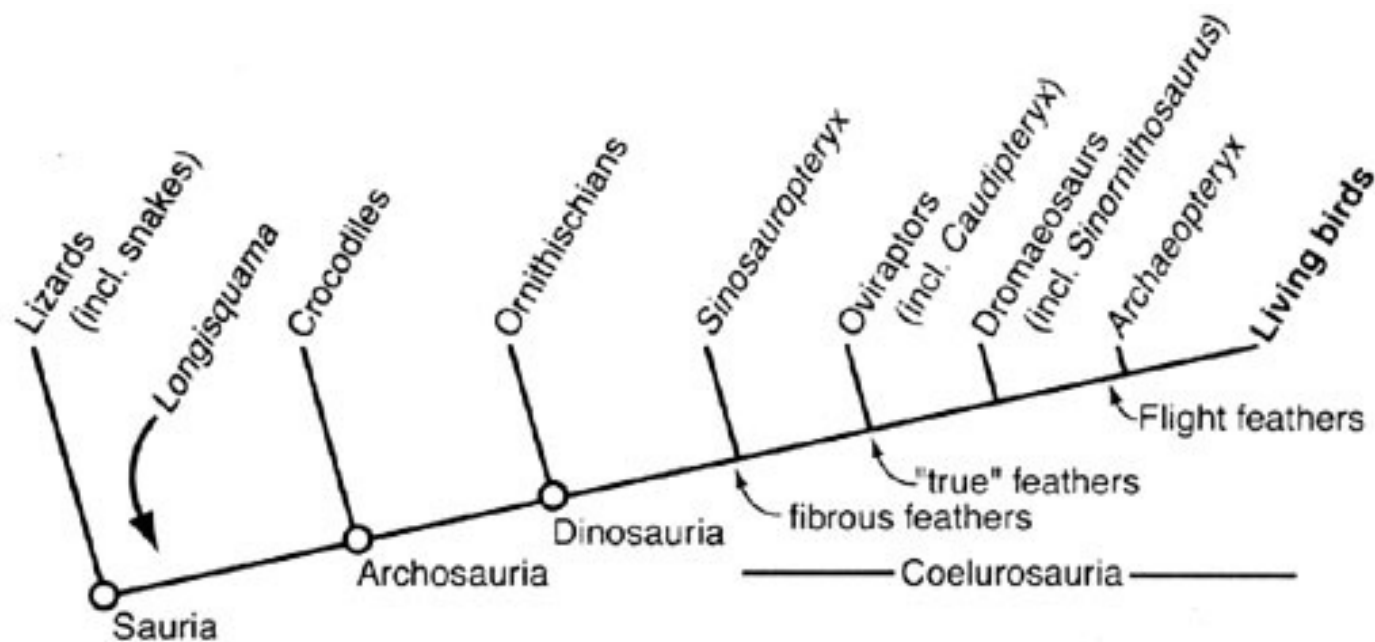
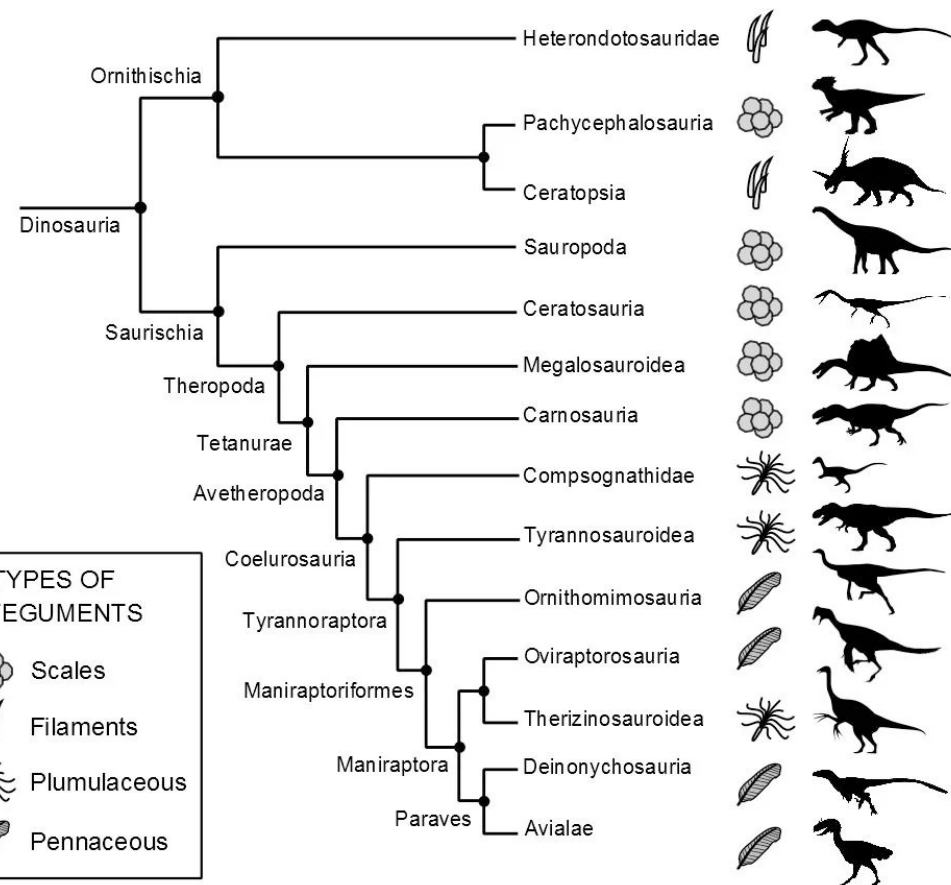
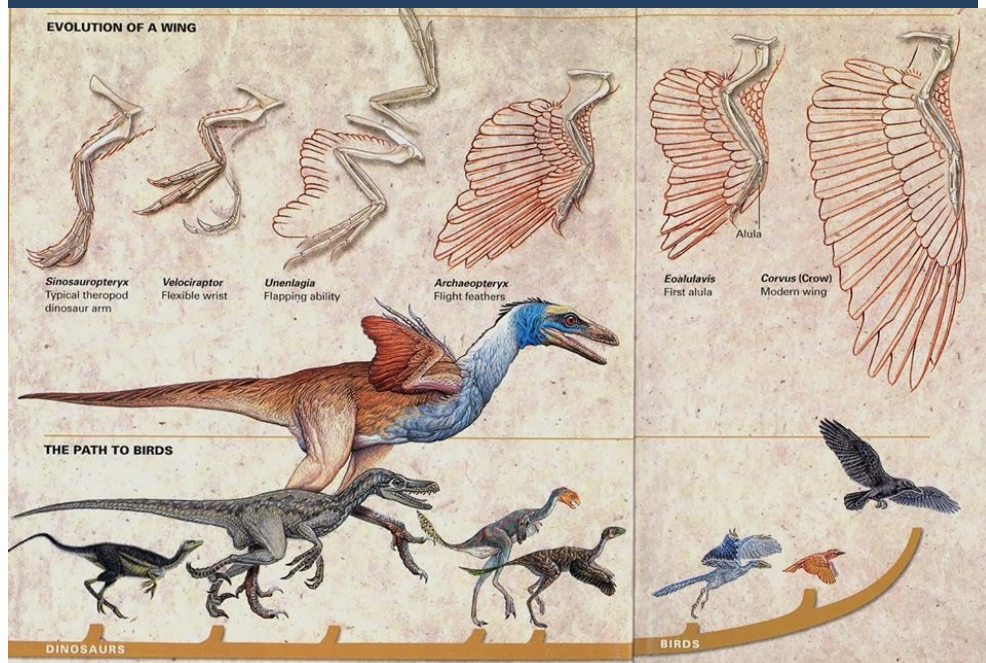
- 160Ma Theropoda - Paravian - Scansoriopterygid
- Name means “strange wing”



The simplified evolutionary position of *Yi qi*, showing it is a couple of nodes below the appearance of true birds. Artwork by Brian Choo, *Yi qi* Dinostar Co Ltd and Archaeopteryx image National Geographic Society and Wikimedia

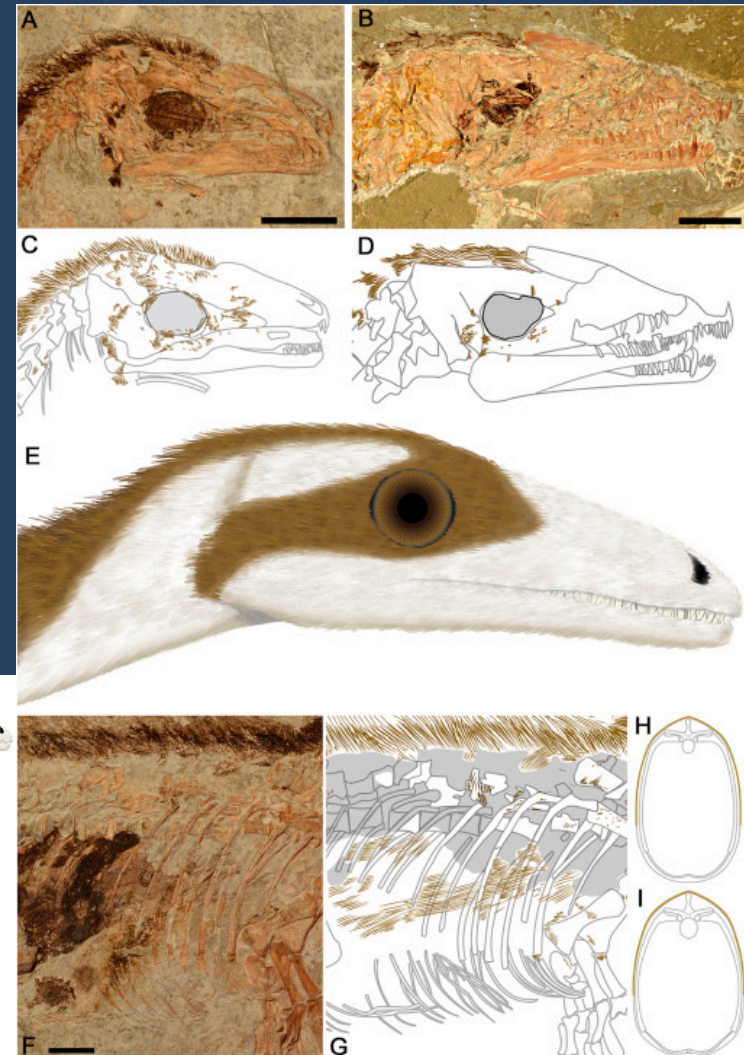
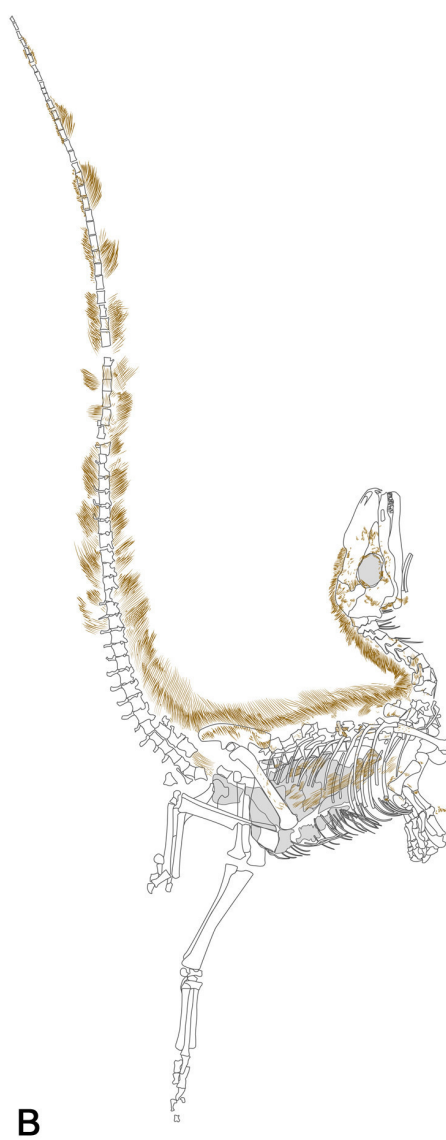


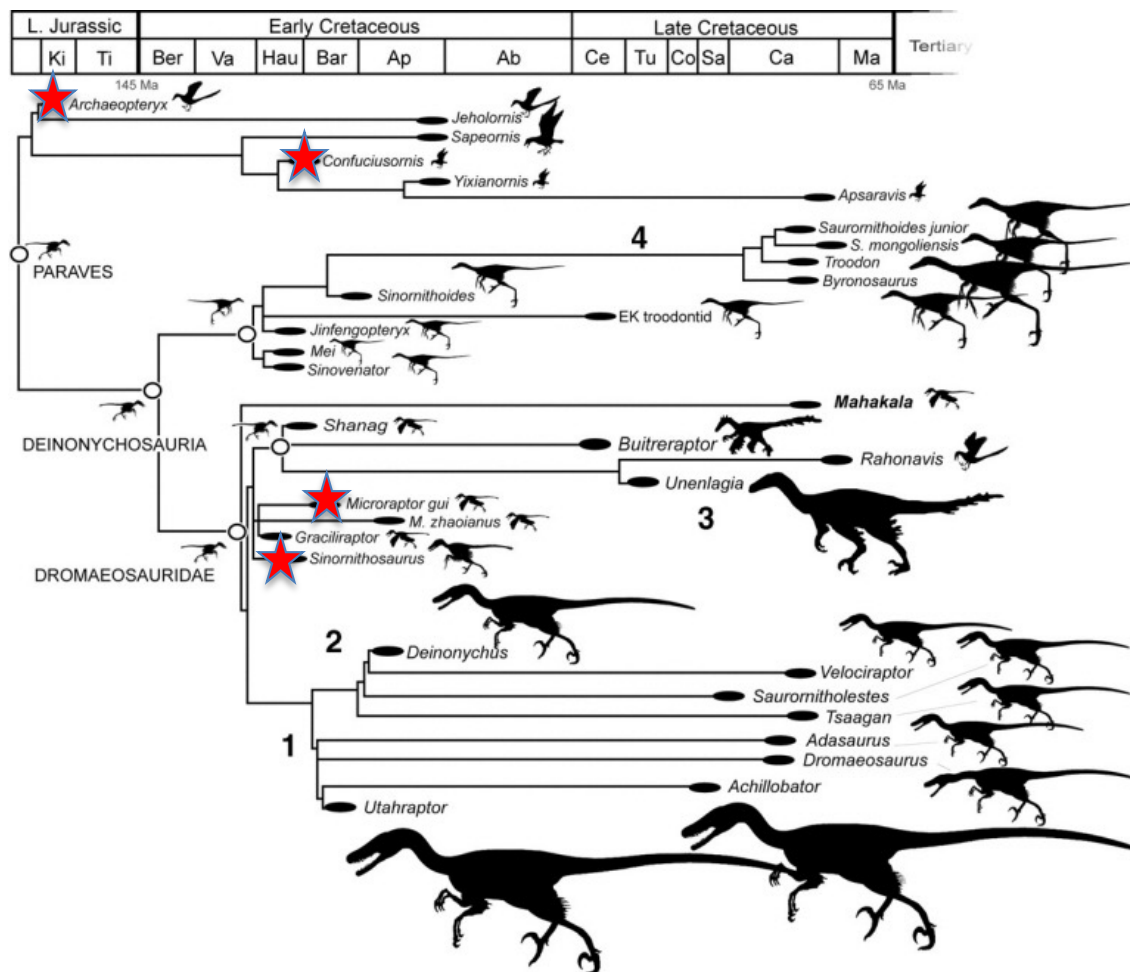
Bird Ancestry



Sinosauropteryx

- 131-120Ma Early Cretaceous
- ~1m Compsognathidae (basal Coelurosauria) from China





Microraptor

- Early Cretaceous (~120Ma) Dromaeosaurid (Coelurosauria) from NE China
- Most likely a glider



Video Link:

<https://www.youtube.com/watch?v=8-jpuywa6lg&list=PL50KW6aT4UgwyxBDgijhvjZxslxRM71d5&index=11>



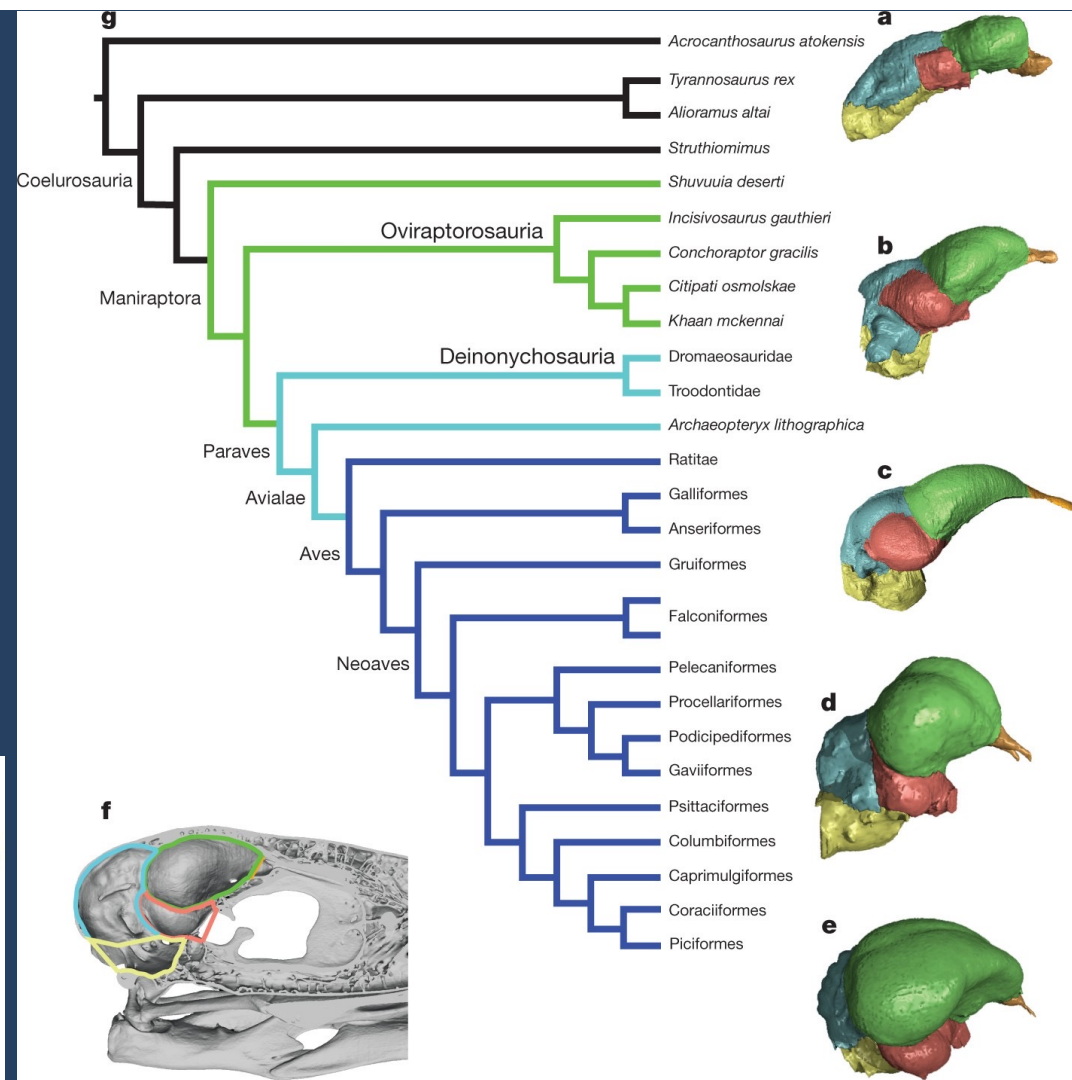
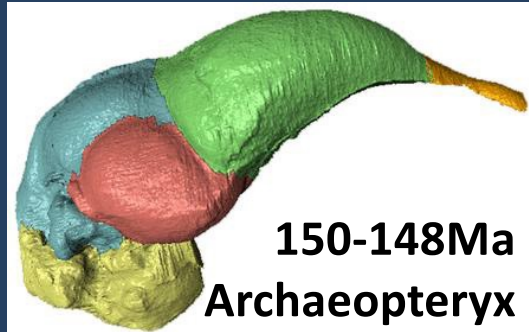
Confuciusornis

- 130Ma Early Cretaceous
- Parave Coelurosauia (not Ornithoraces)
- Fossilized in lake deposits preserving beta-keratins & melanosomes indicating grey, red/brown & black



Endocast of Dino Brains

- Brain Stem: basic life function (involuntary)
- Cerebellum: fine motor control, coordination, balance
- Cerebrum: voluntary actions of the body, emotions, hearing, intellect
- Optic lobes: vision
- Olfactory lobes: smell

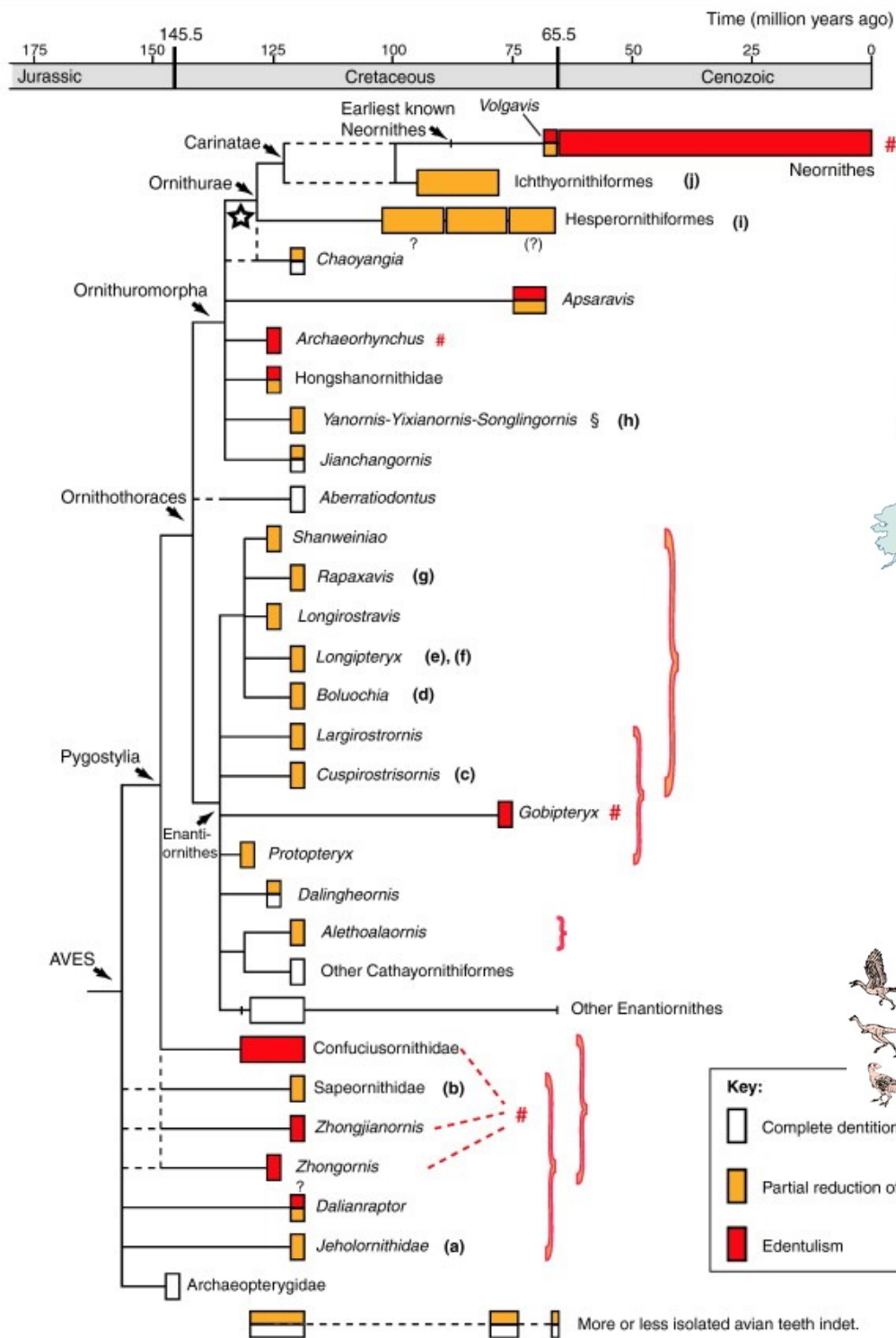


75-71Ma Oviraptor

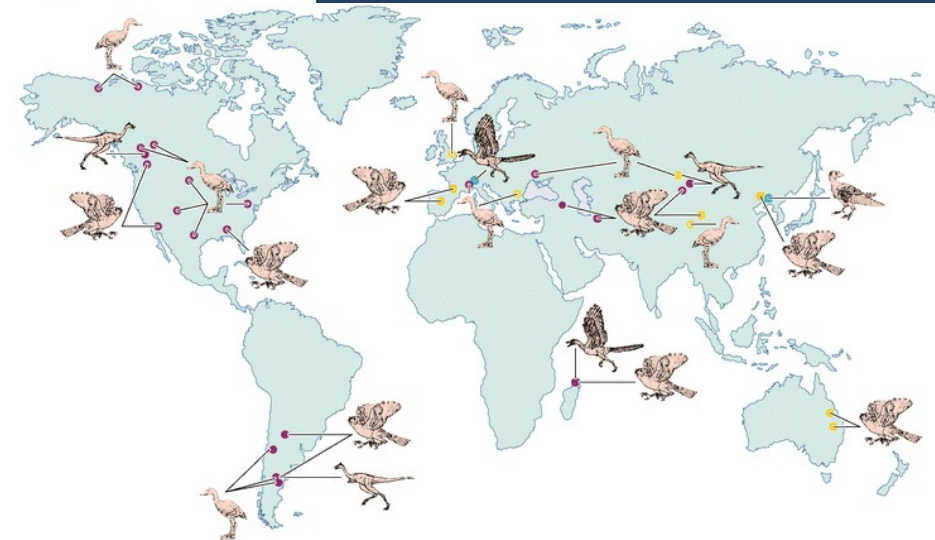


70Ma Zanabazar Junior (Troodontid)





Avian Diversification



- Archaeopterygidae
- Alvarezsauridae
- Confuciusornithidae
- Enantiornithomorphs
- Ornithuromorpha
- Late Jurassic
- Early Cretaceous
- Late Cretaceous

Bird Fossilization

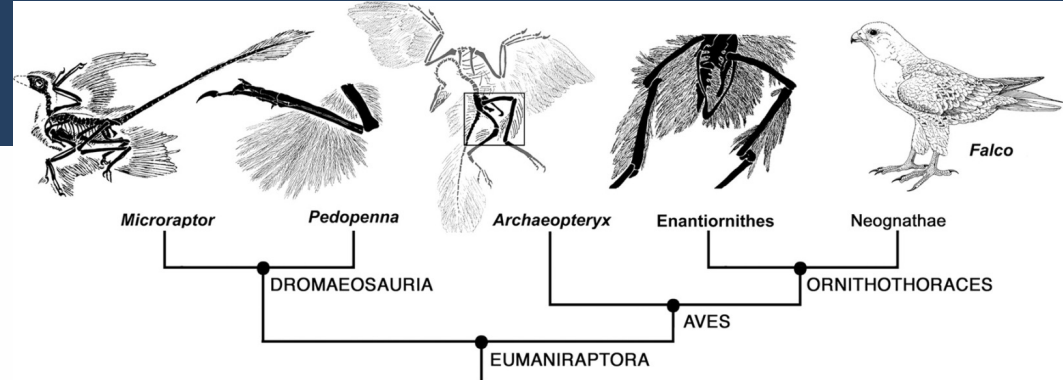




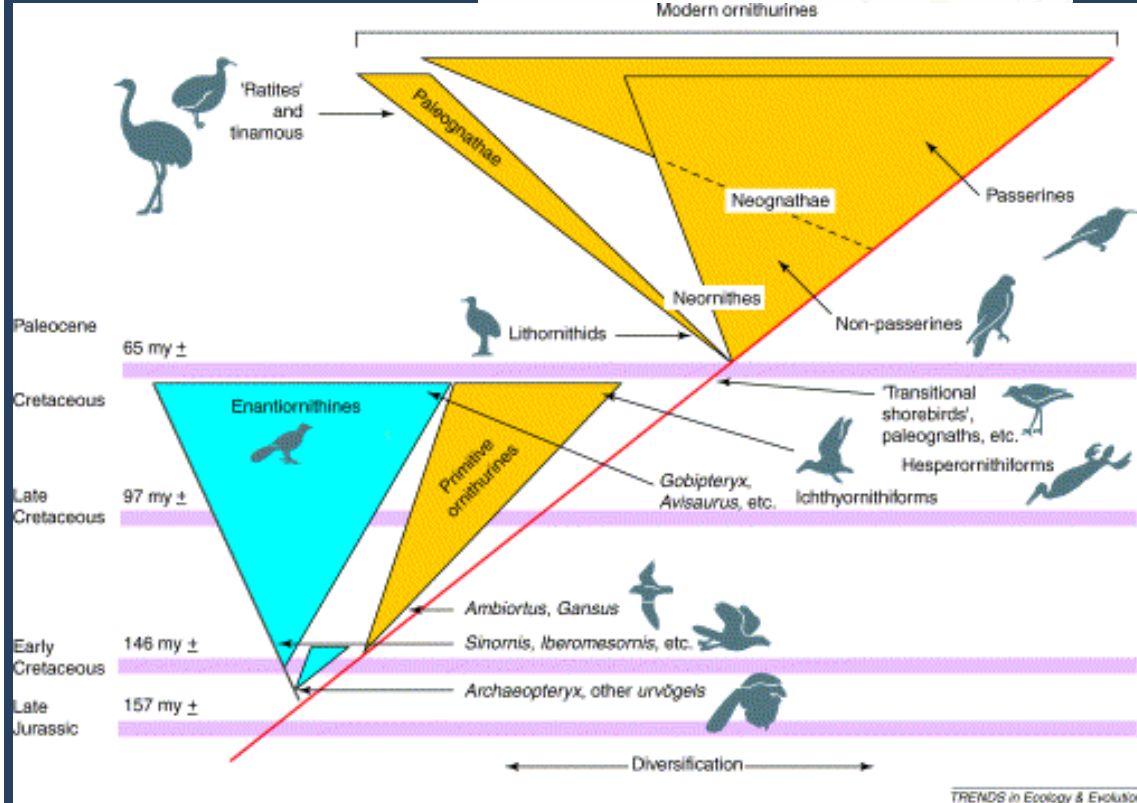
Enantiornithes

- 99Ma hatchling
- Burmese amber

Enantiornithes vs. Ornithurae

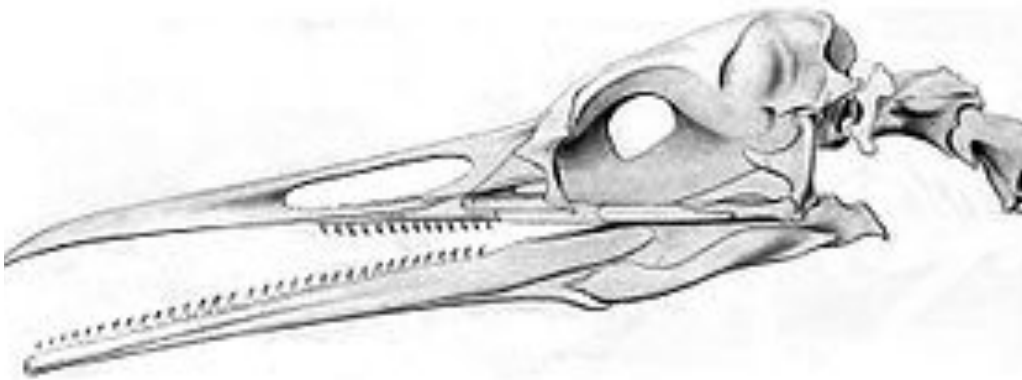


Modern ornithurines



Hesperornithes

- 100-66Ma
- Ornithurae Aqualian
- Only True Mesozoic Marine Dinosaur

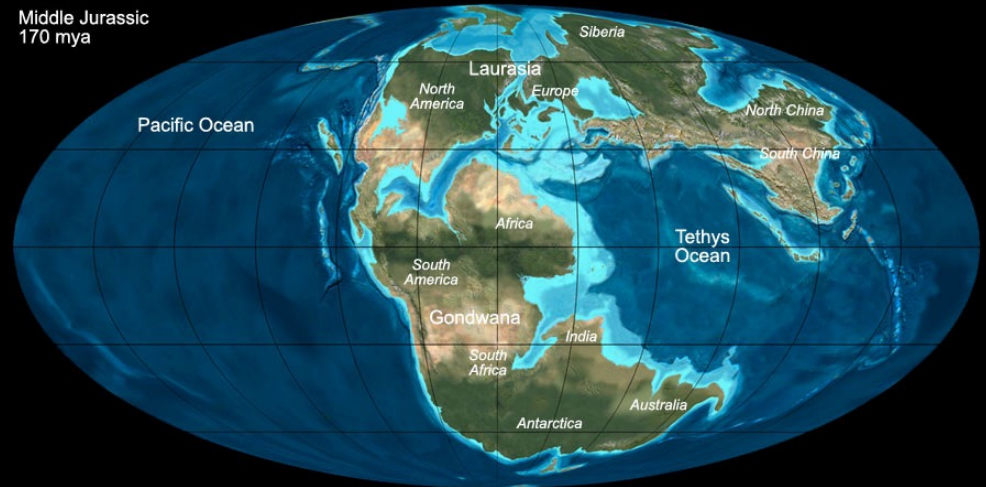


Next Week

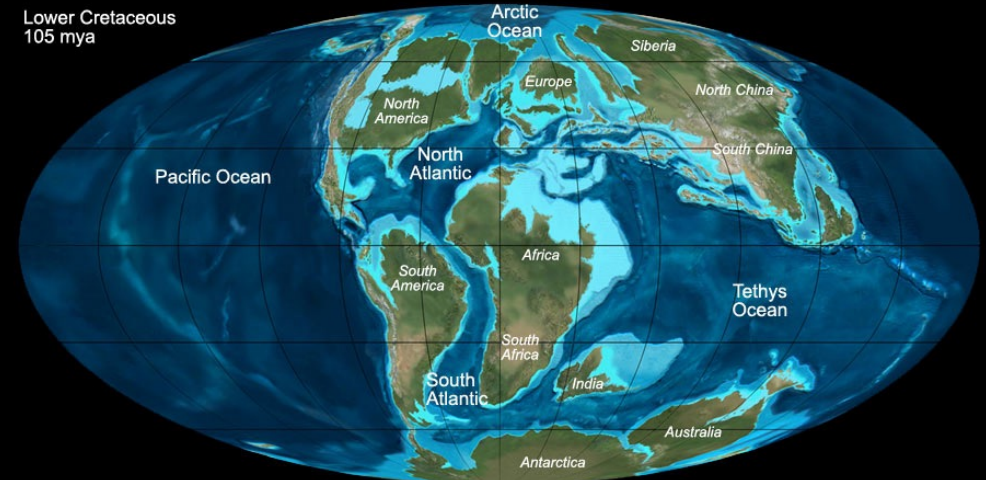
- Which dinosaurs lived at the end of the Cretaceous?
- What other reptiles were alive?
- What caused the K-T extinction?
- Why did birds survive?
- What other reptilian lineages survived, & which went extinct?
- Which reptiles did well after the extinction?



Middle Jurassic
170 mya



Lower Cretaceous
105 mya



Late Cretaceous 94 Ma

