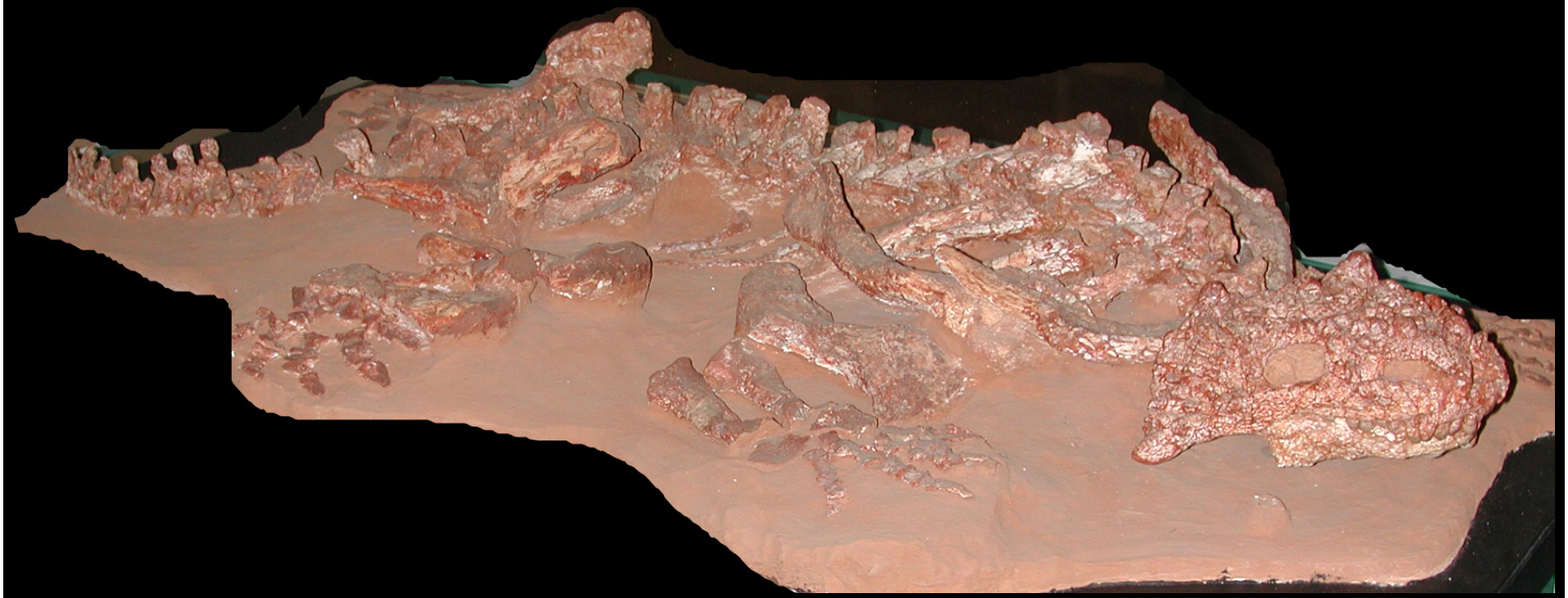
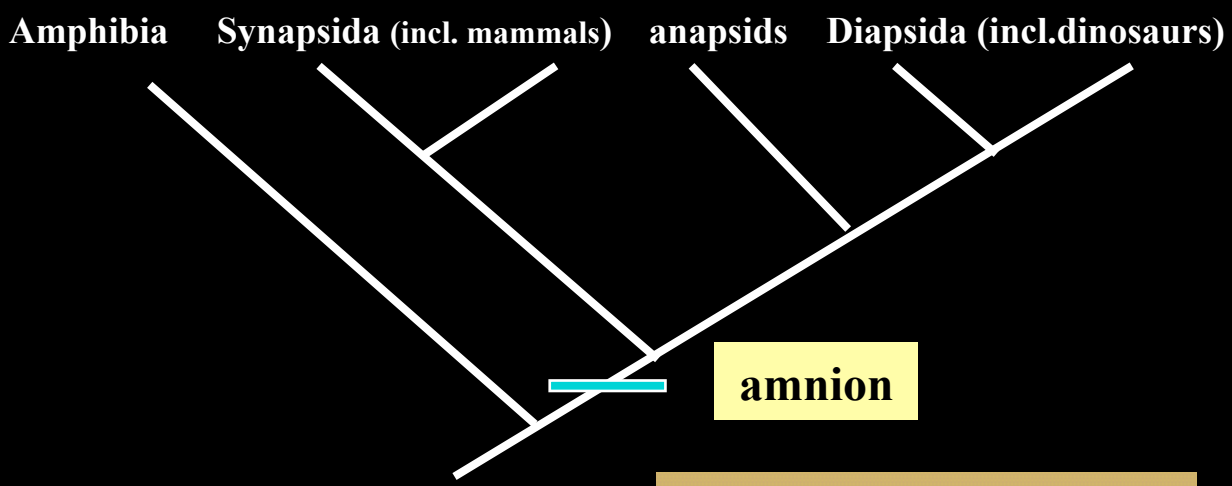
Early amniotes

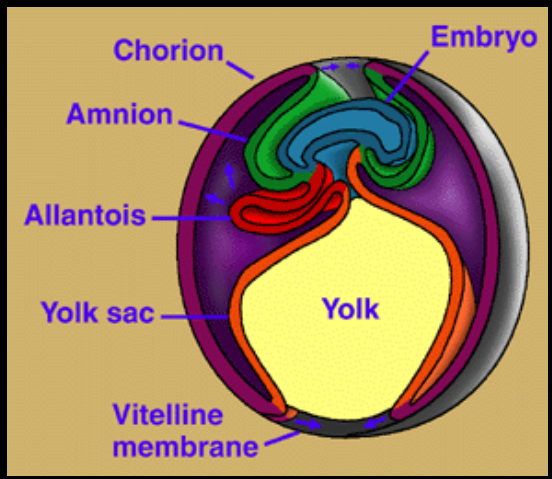
(anapsids, mammal-like reptiles and the earliest dinosaurs)



Amniota - *fosterhinnedjur*

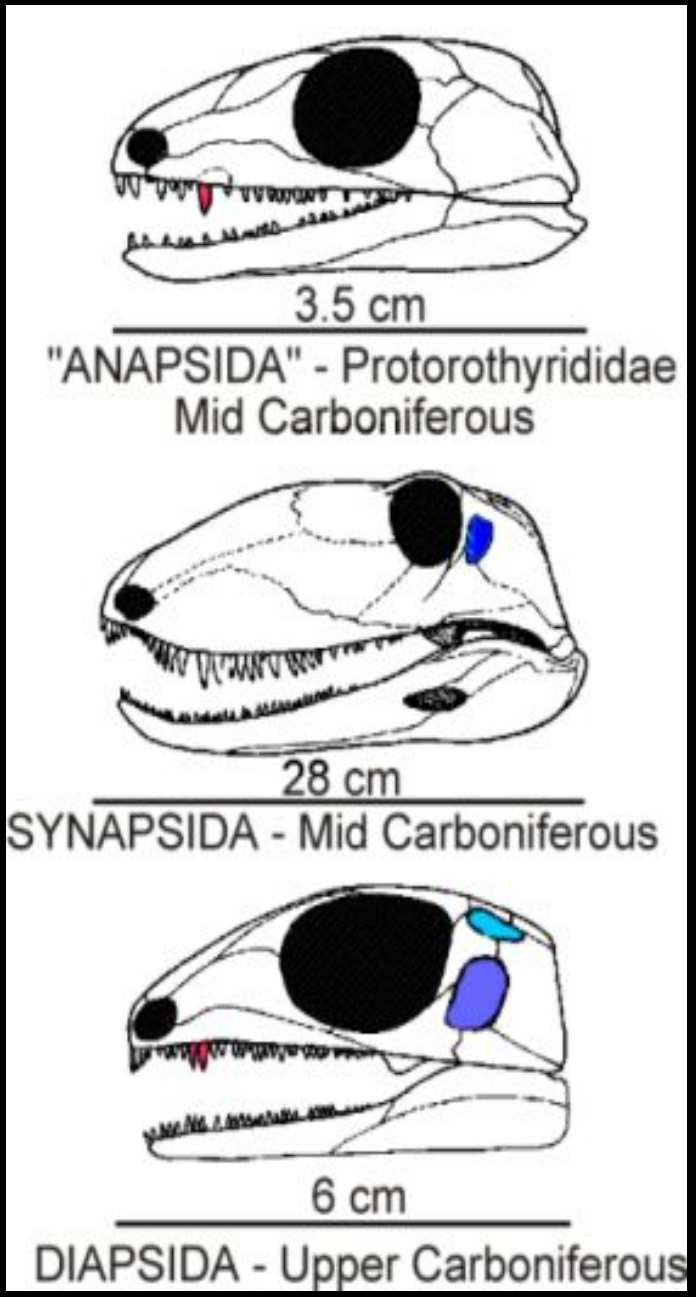
- First in the Carboniferous
- monophyletic group
- First real terrestrial vertebrates
- occupy a variety of environments





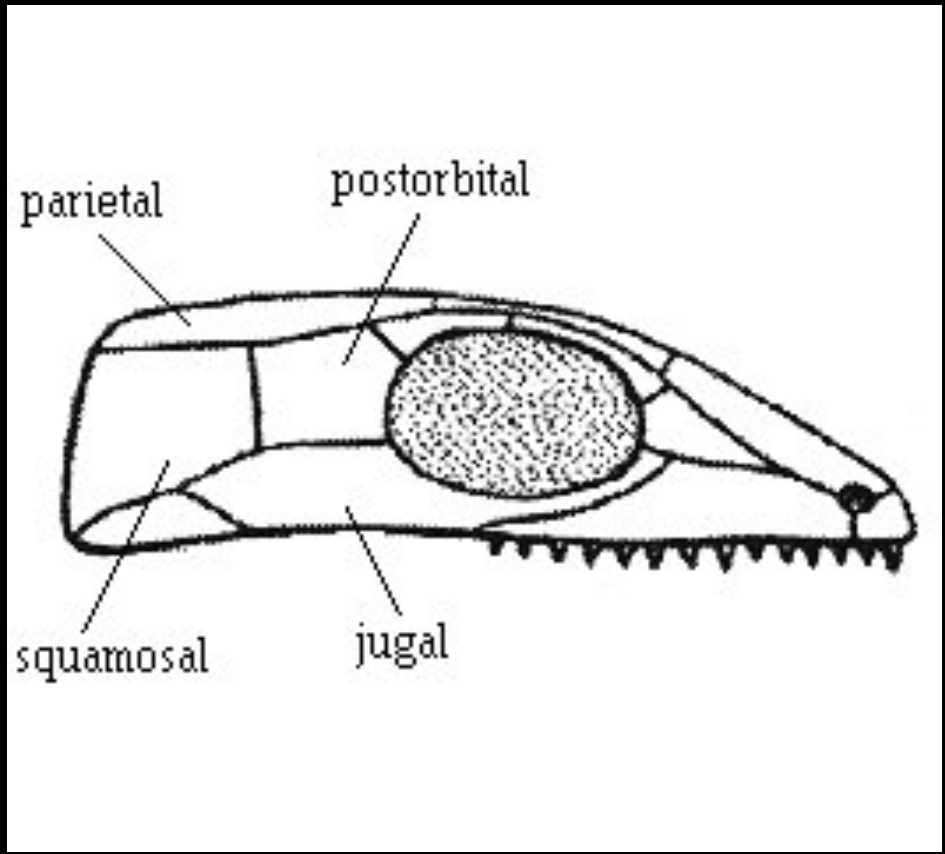
amniote skulls

- number and position of temporal fenestrae

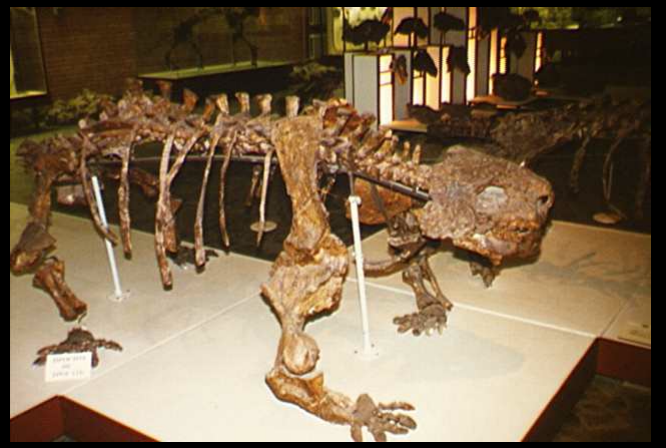


Early amniotes
1) Anapsid reptiles

Most primitive skull? – no temporal opening

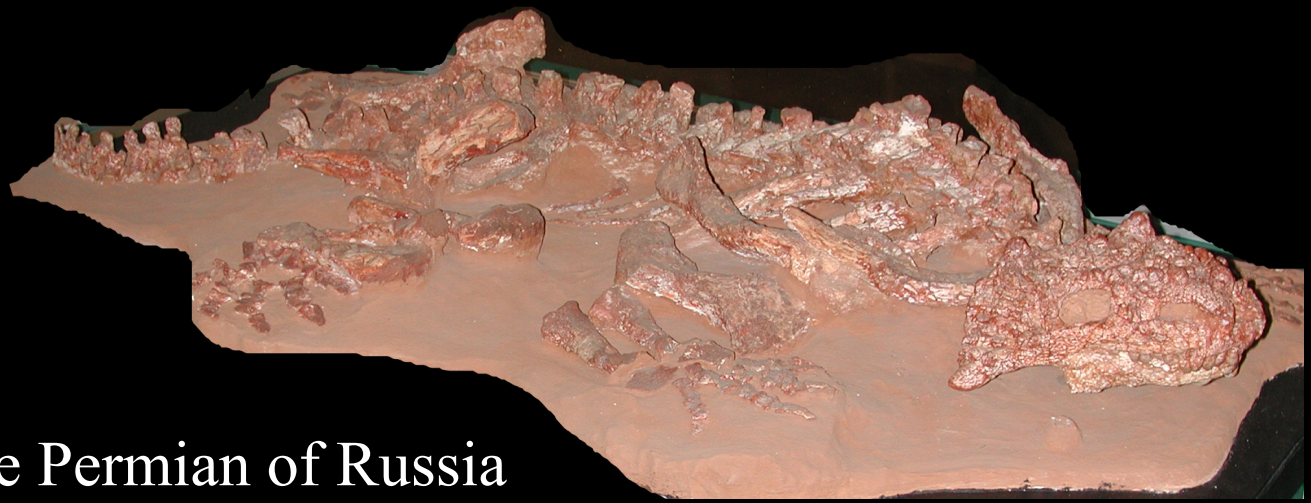


Pareiasauria (Permian, anapsid herbivores)



Scutosaurus, Late Permian of Russia
2.4 m long

Pareiasauria (Permian, anapsid herbivores)

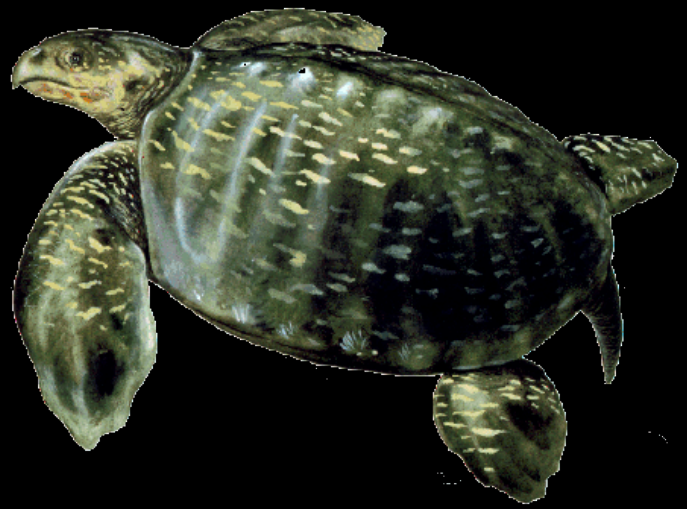


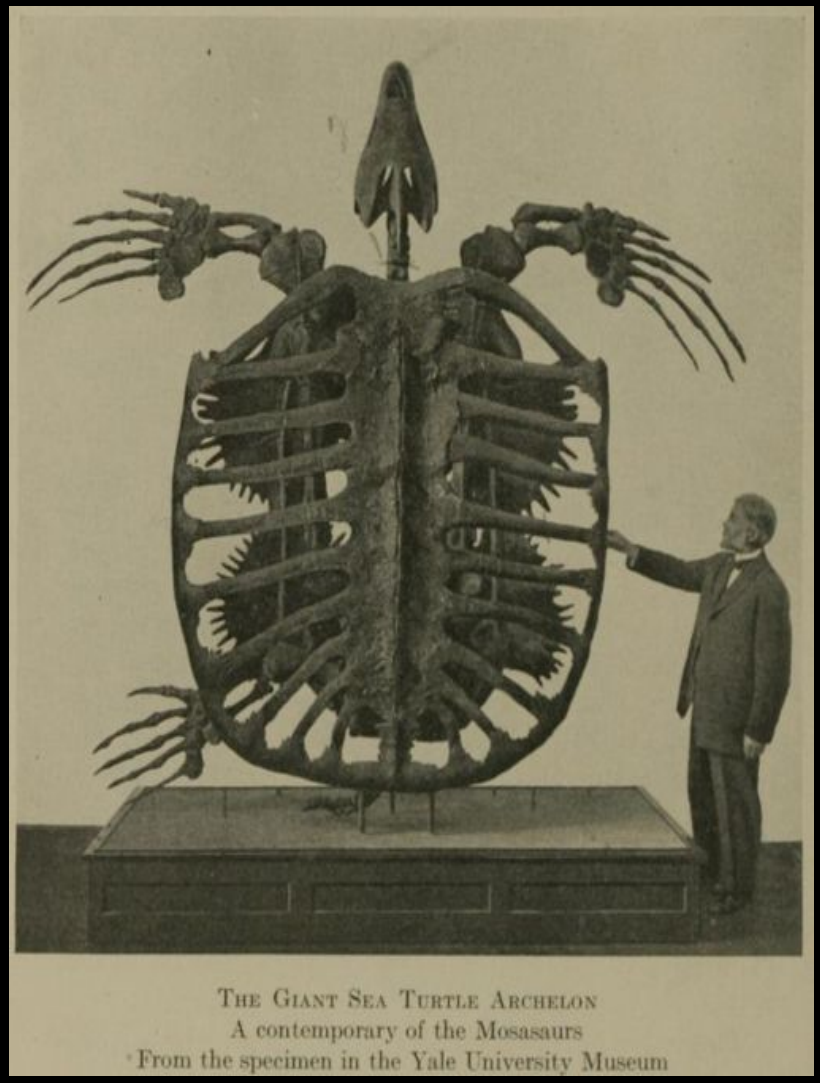
Deltavjatia, Late Permian of Russia

Modern Anapsida – turtles and relatives

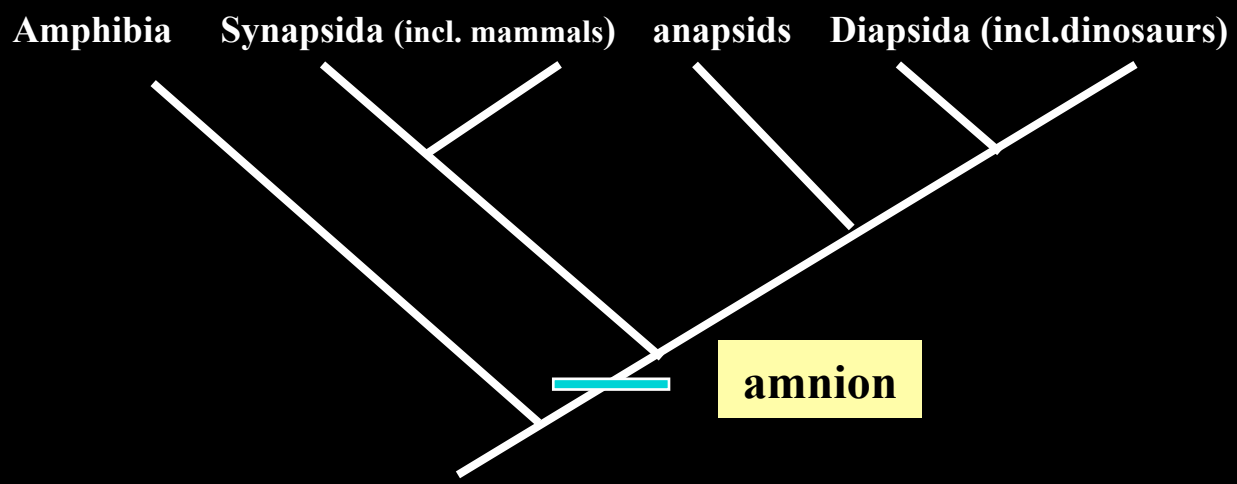
“Early” amniotes – 2) turtles

- Since the Late Triassic
- One of the oldest ”reptile” groups
- *Archelon* – a gigantic (3-4 m), marine turtle from the Cretaceous (USA)

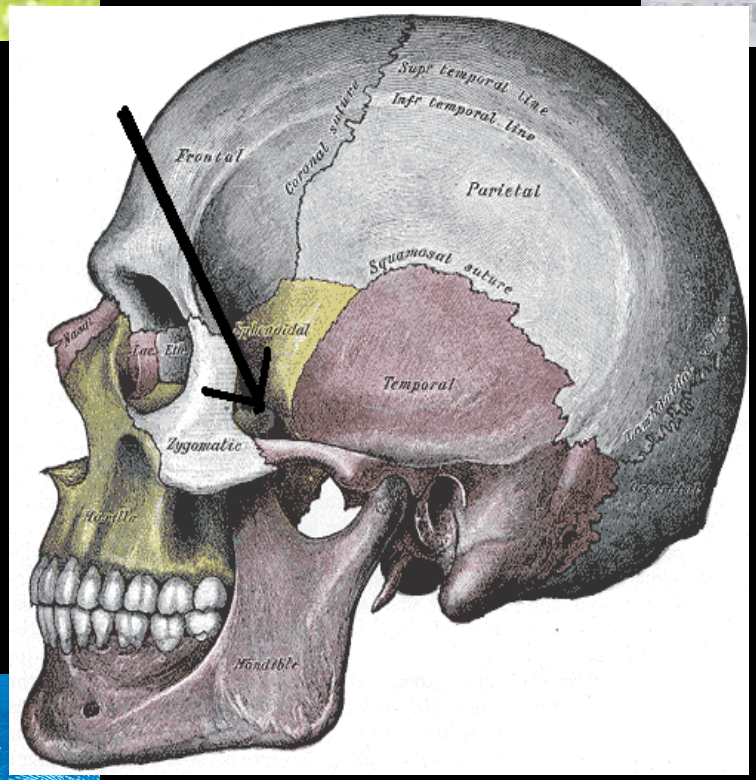


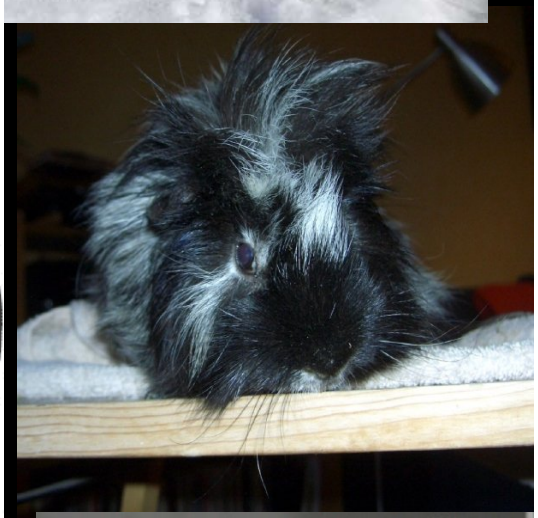


The Giant Sea Turtle Archelon
A contemporary of the Mosasaurs
From the specimen in the Yale University Museum

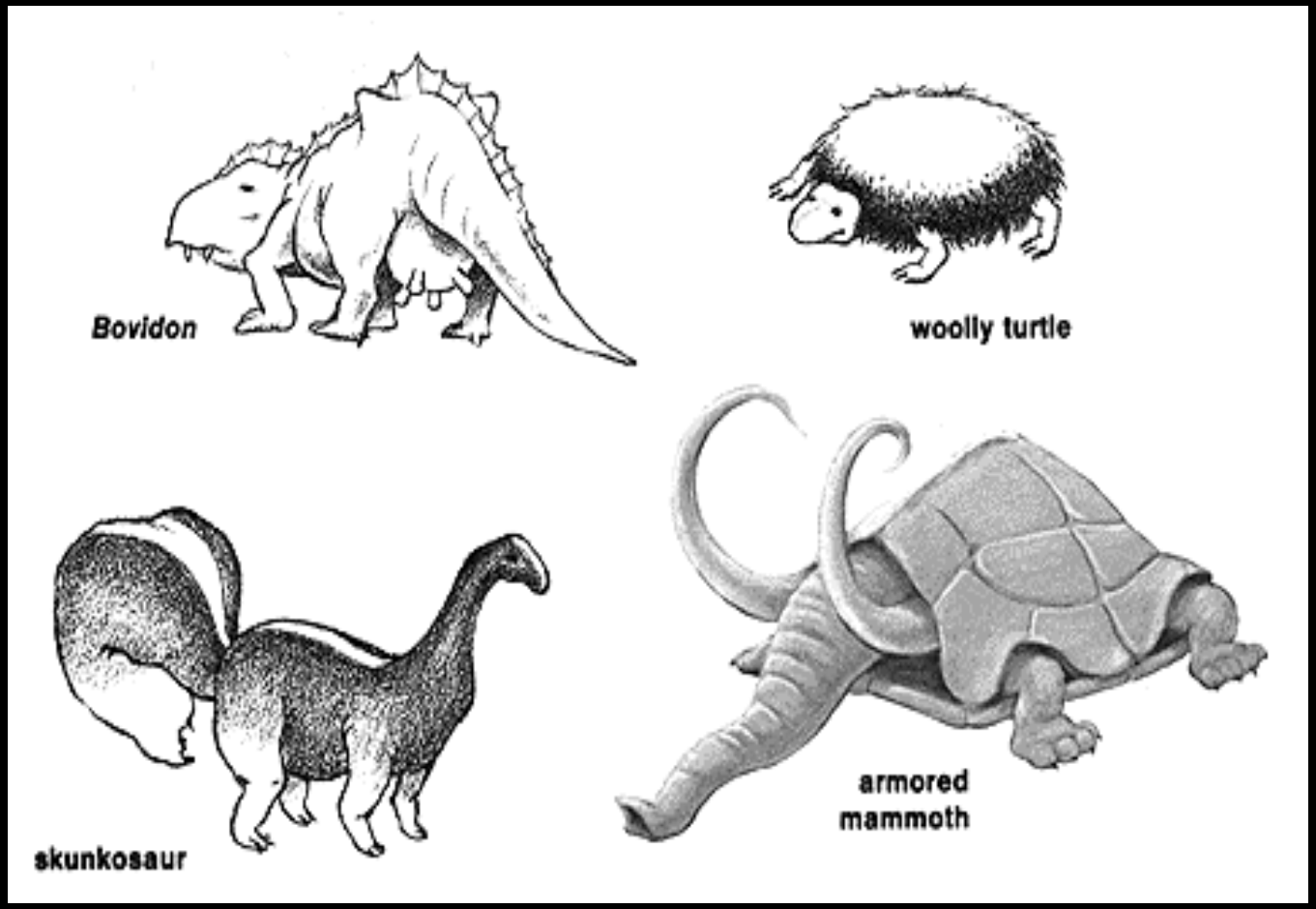

Amphibia
Synapsida (incl. mammals)
anapsids
Diapsida (incl.dinosaurs)
amnion

Early amniotes:
3) Synapsida





Early synapsids a.k.a. Mammal-like reptiles

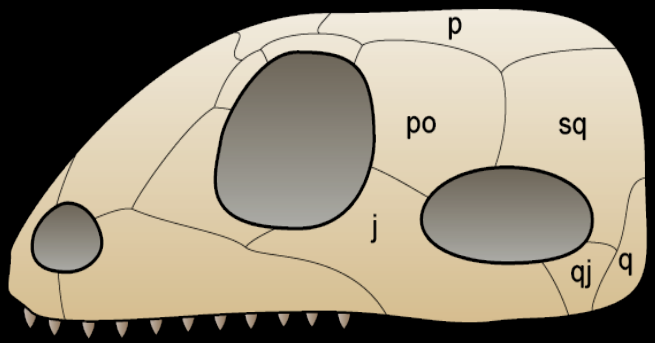


Mammal-like reptiles

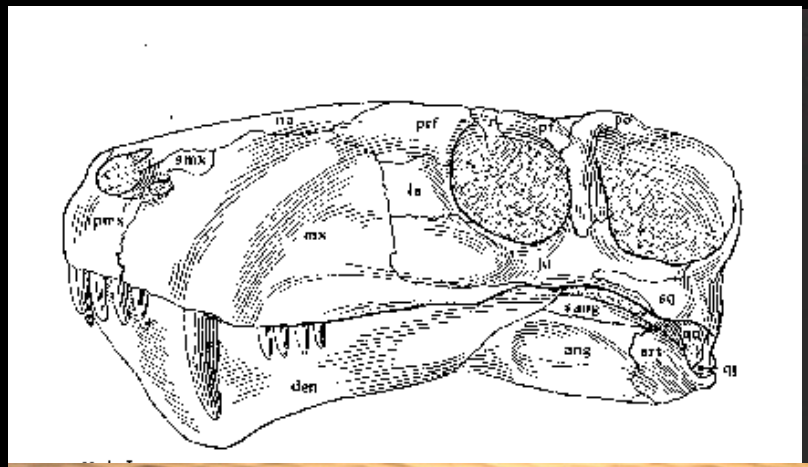
- Carboniferous to Jurassic (? Cretaceous)
- Dominant terrestrial animals during the Permian and Triassic
- included the ancestors of mammals
- became gradually more and more mammal-like during their evolution

Mammal-like reptiles

- **Synapsida** (“with one temporal fenestra")
- quite low situated fenestra
- "reptiles" with differentiated teeth

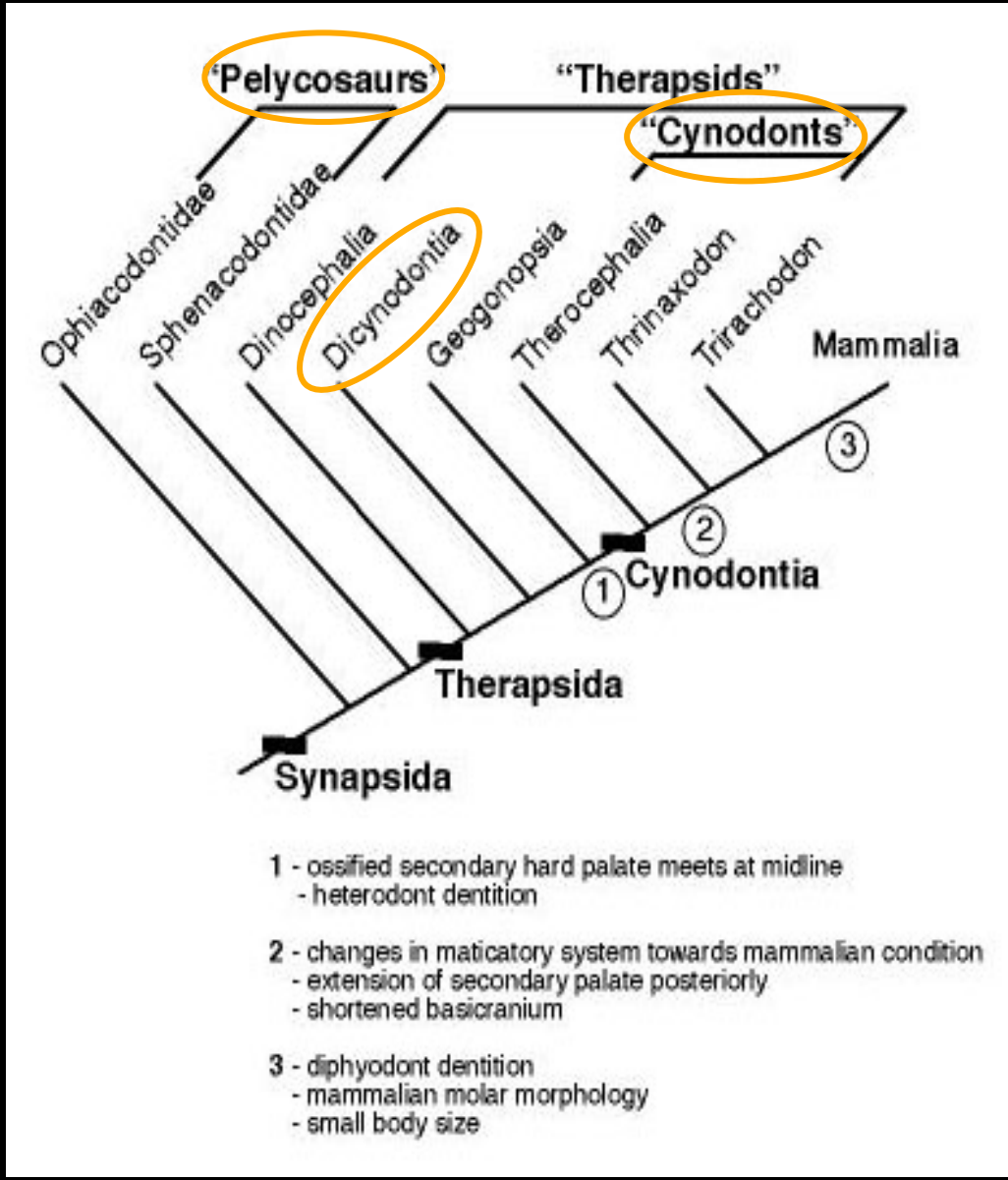


Mammal-like reptiles (Synapsida)

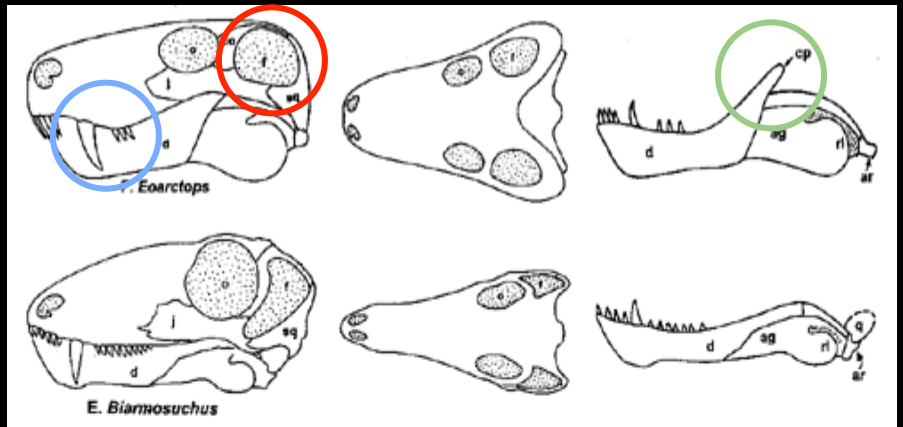


Synapsid evolution

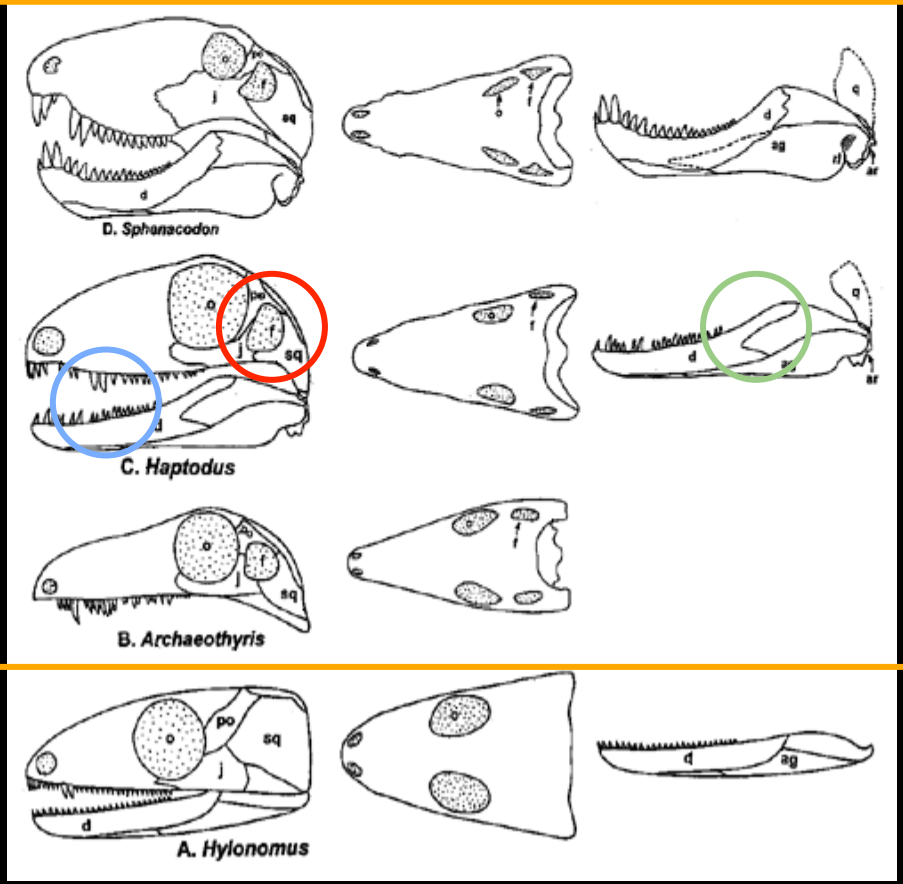
- primitive synapsids
- pelycosaurs (Segelödlor)
- therapsids
- cynodonts
- mammals



therapsids



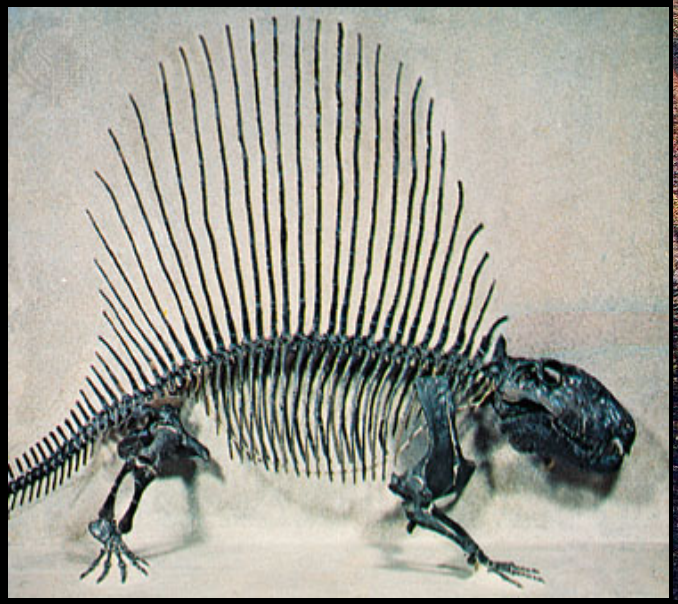
pelycosaurs



Archaeothyris:
Carboniferous;
one of the oldest synapsids

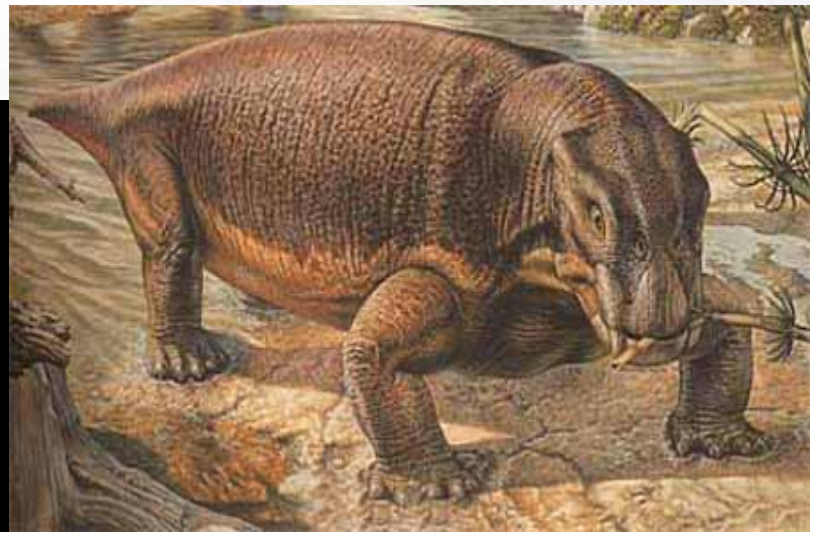
Pelycosaurs

- *Dimetrodon*
- *Edaphosaurus*
- Early Permian

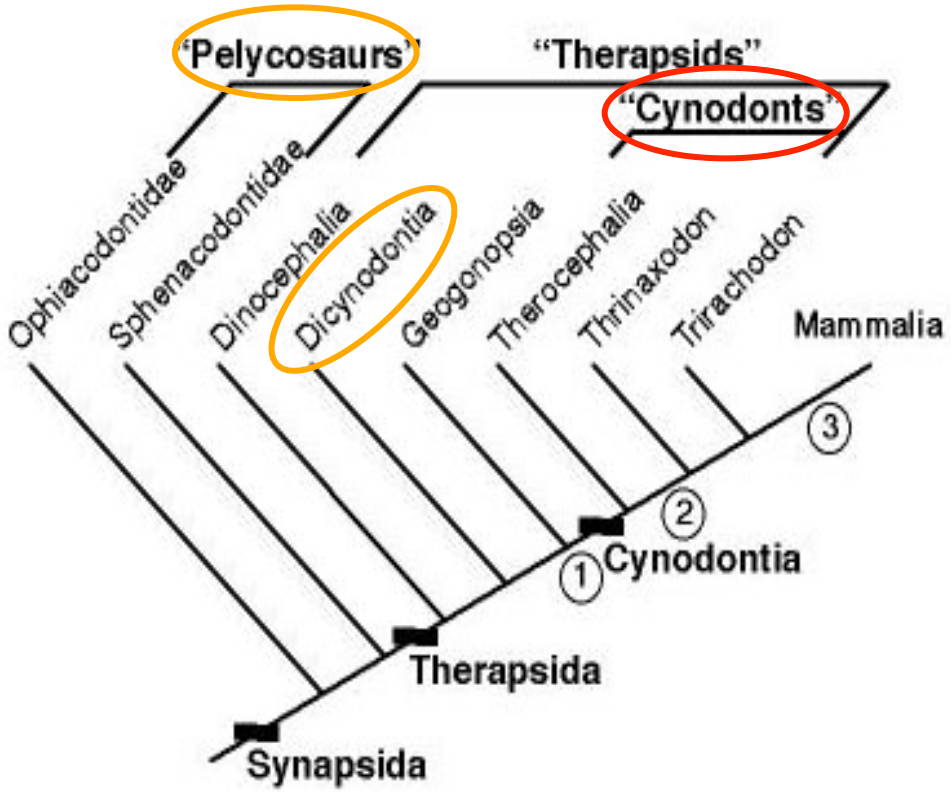


Dicynodonta
(Therapsida)

- herbivorous dinocephalids
- lived in packs
- most common herbivorous animals in the Late Permian and Early Triassic
- sexual dimorphism
- Middle Permian to Late Triassic (? Cretaceous)



Placerias



1 - ossified secondary hard palate meets at midline
- heterodont dentition

2 - changes in maticatory system towards mammalian condition
- extension of secondary palate posteriorly
- shortened basicranium

3 - diphyodont dentition
- mammalian molar morphology
- small body size

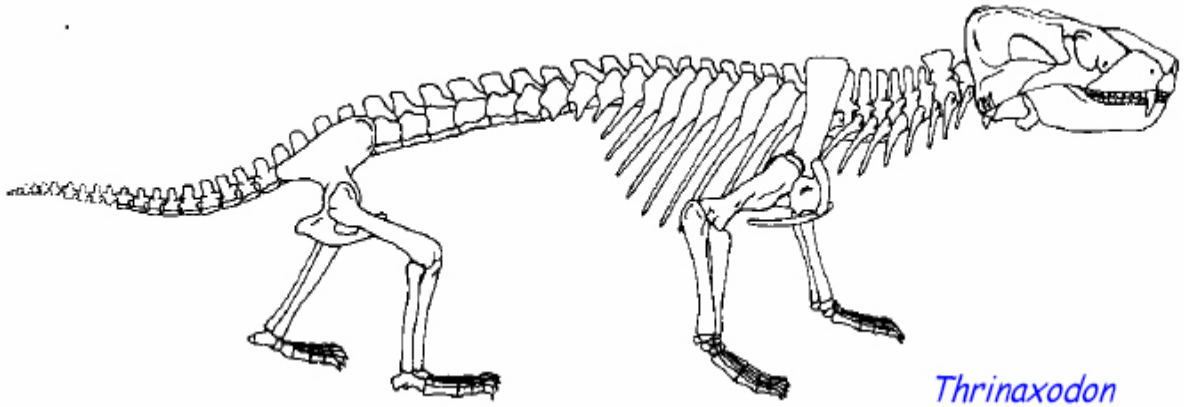
Cynodontia

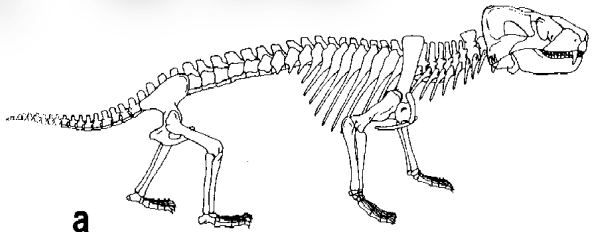
- Advanced therapsids
- Late Permian and Triassic
- differentiated teeth
- probably warm-blooded and covered by hair (whiskers!)

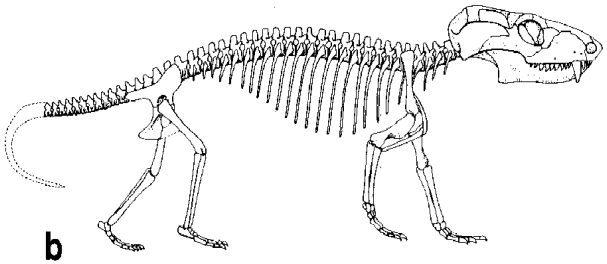
Inostrancevia – a cynodont

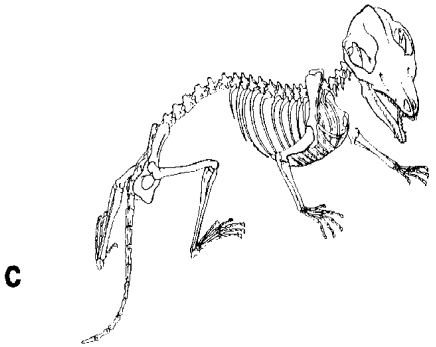
Permian, Russia

The first mammals









(A) early Triassic cynodont *Thrinaxodon*
(B) advanced cynodont *Probelesodon* from the middle Triassic.
(C) early mammal *Megazostrodon* from the early Jurassic

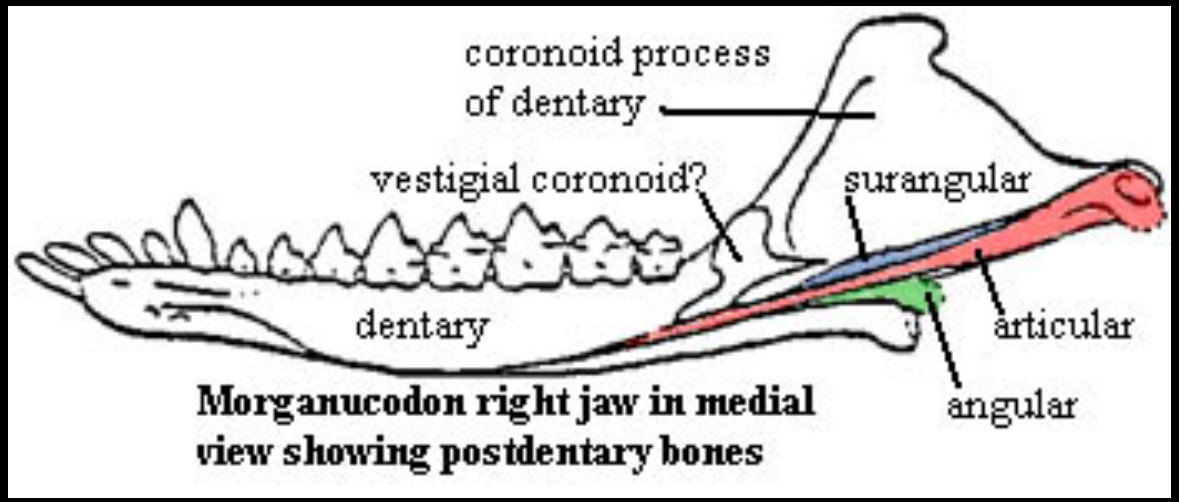
Morganucodon

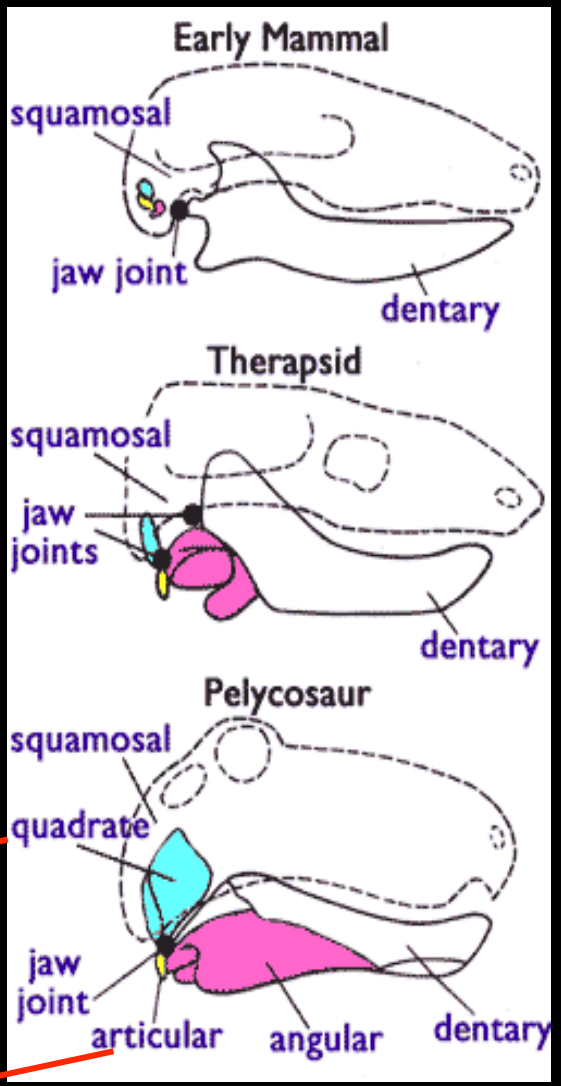
- late Triassic
- shrew-like
- insectivorous
- mammaliform

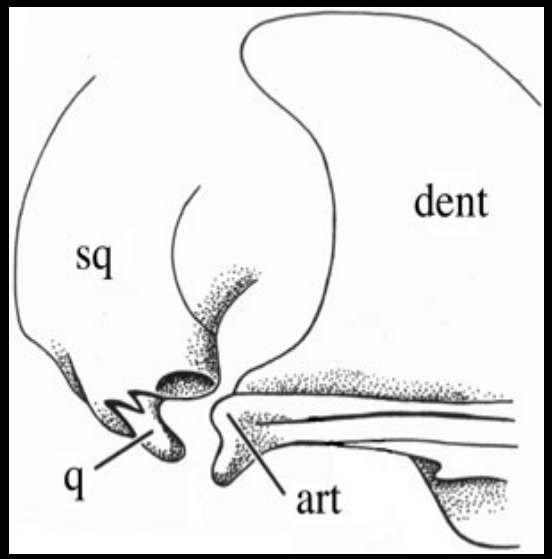
↓

reptilian jaw joint

Mammal characters - Jaws och auditory ossicles (*hörselben*)

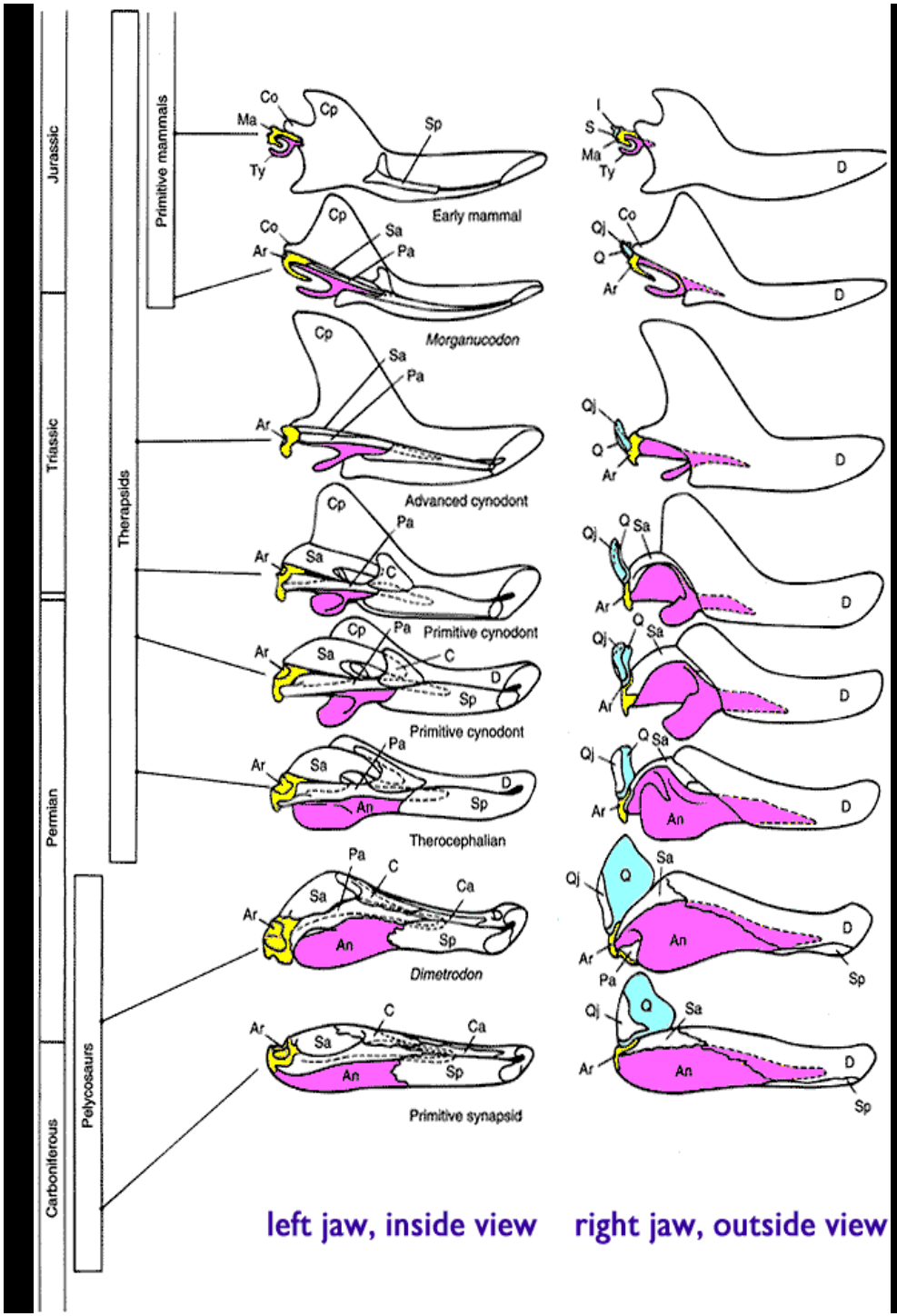






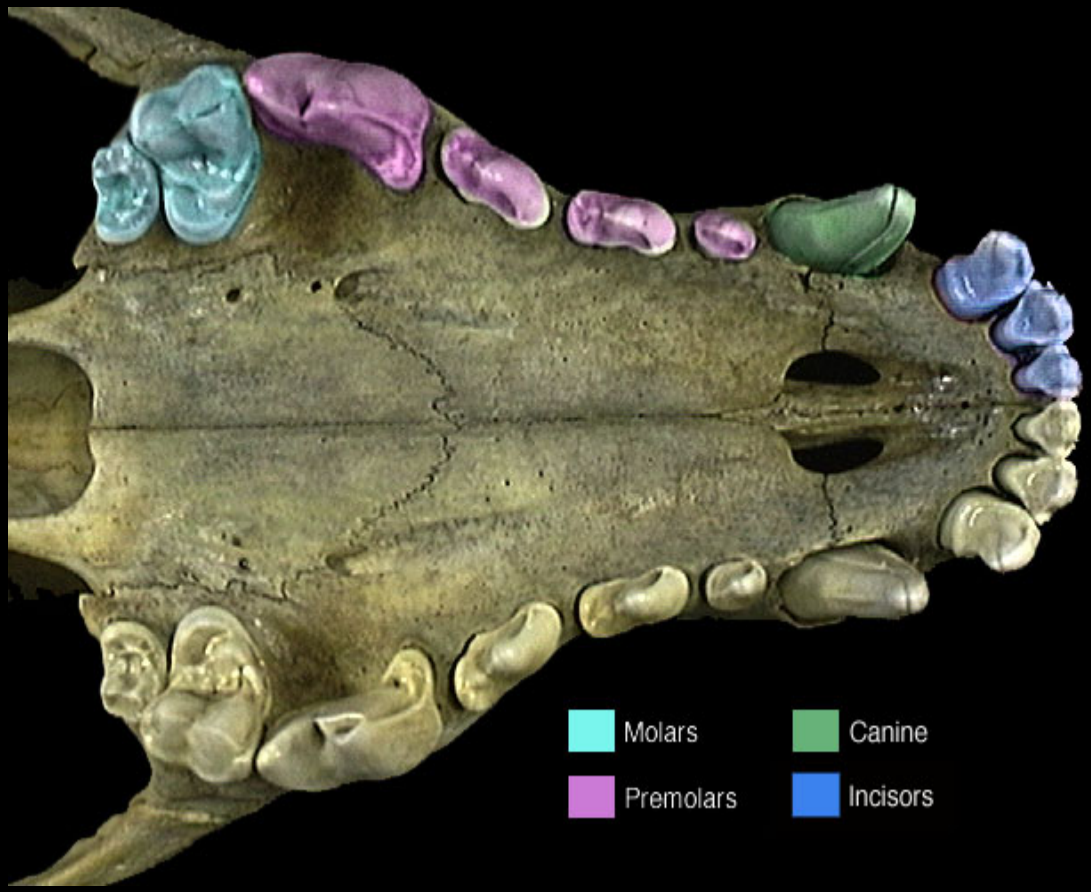
incus (anvil)

malleus (hammer)



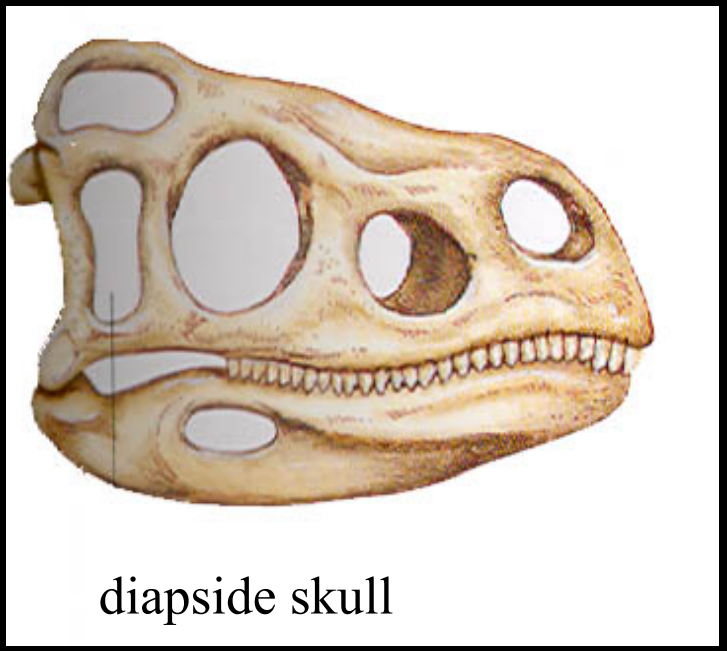
- complete evelutionary series
- all intermediate stages are functional

Differentiated teeth

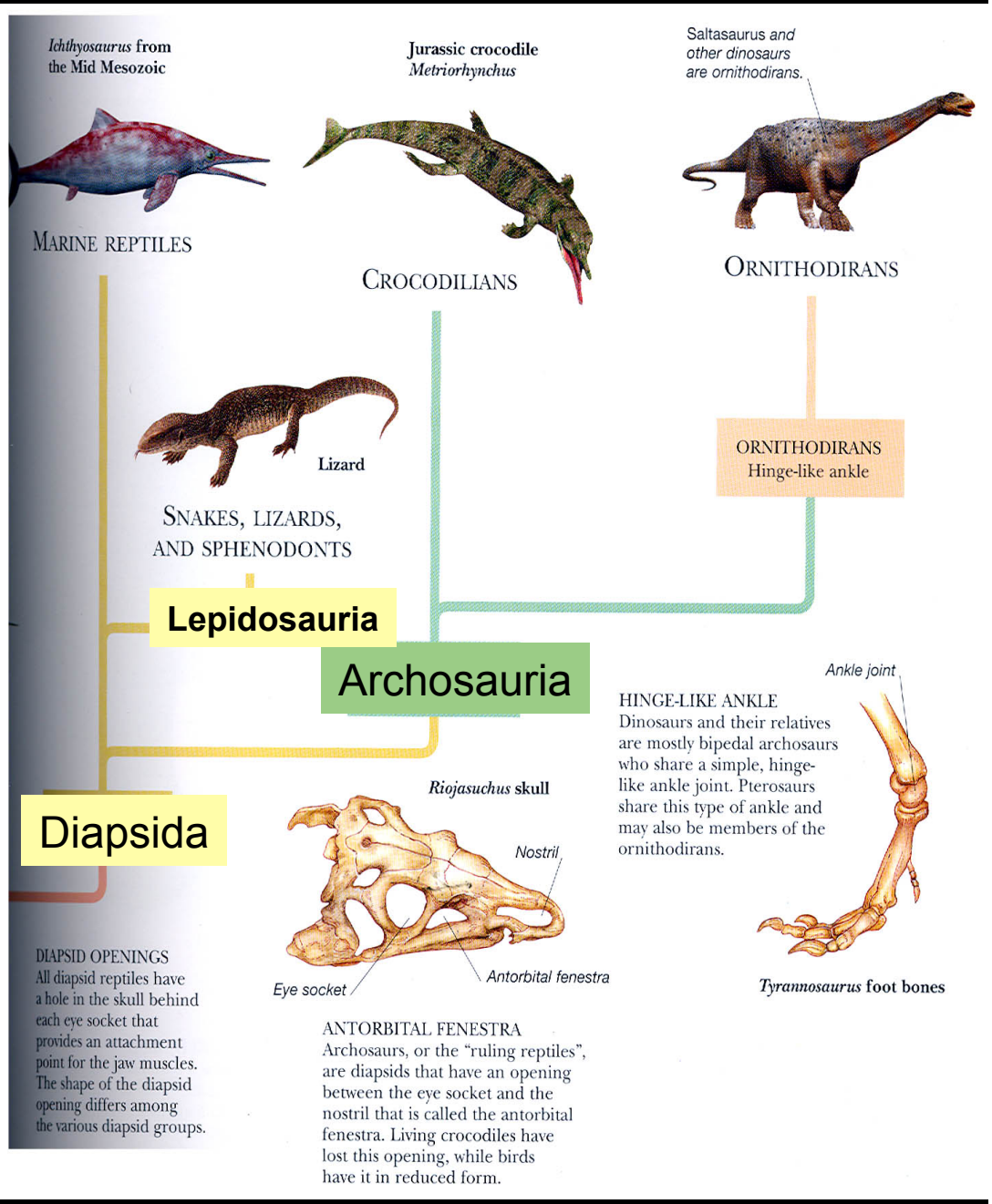


Early amniotes: 4) Diapsida

- since Carboniferous
- but not common until the Triassic



diapside skull



ARCHOSAURIA

(ruling lizzards; "*Härskarödlor*")

Triassic-Recent

- Tendency from sprawling posture towards upright posture & bipedalism
- Two new openings in the skull = antorbital fenestra and mandibular fenestra (attachments for muscles; weight reduction)

Archosauria

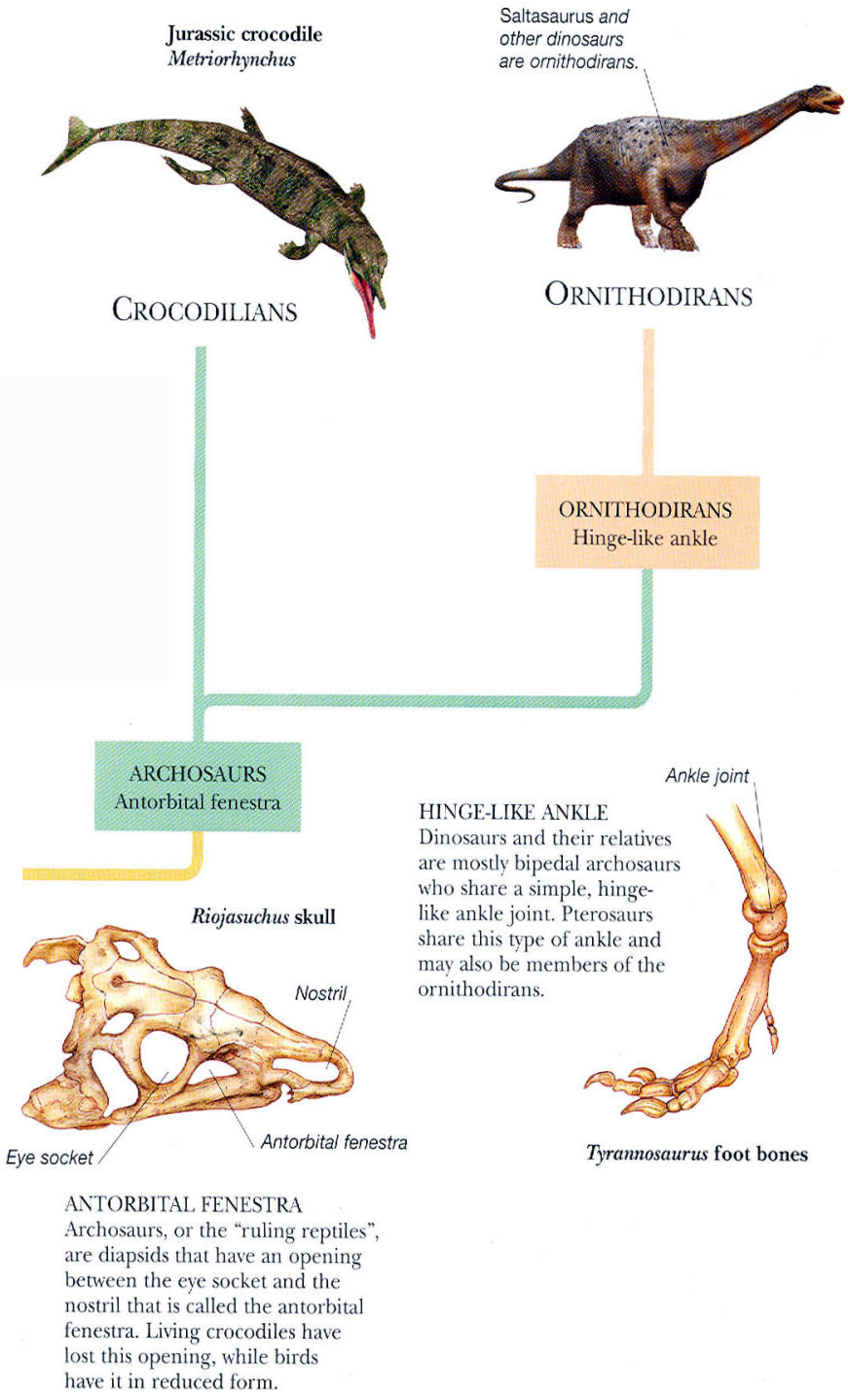
"thecodonts"

crocodiles

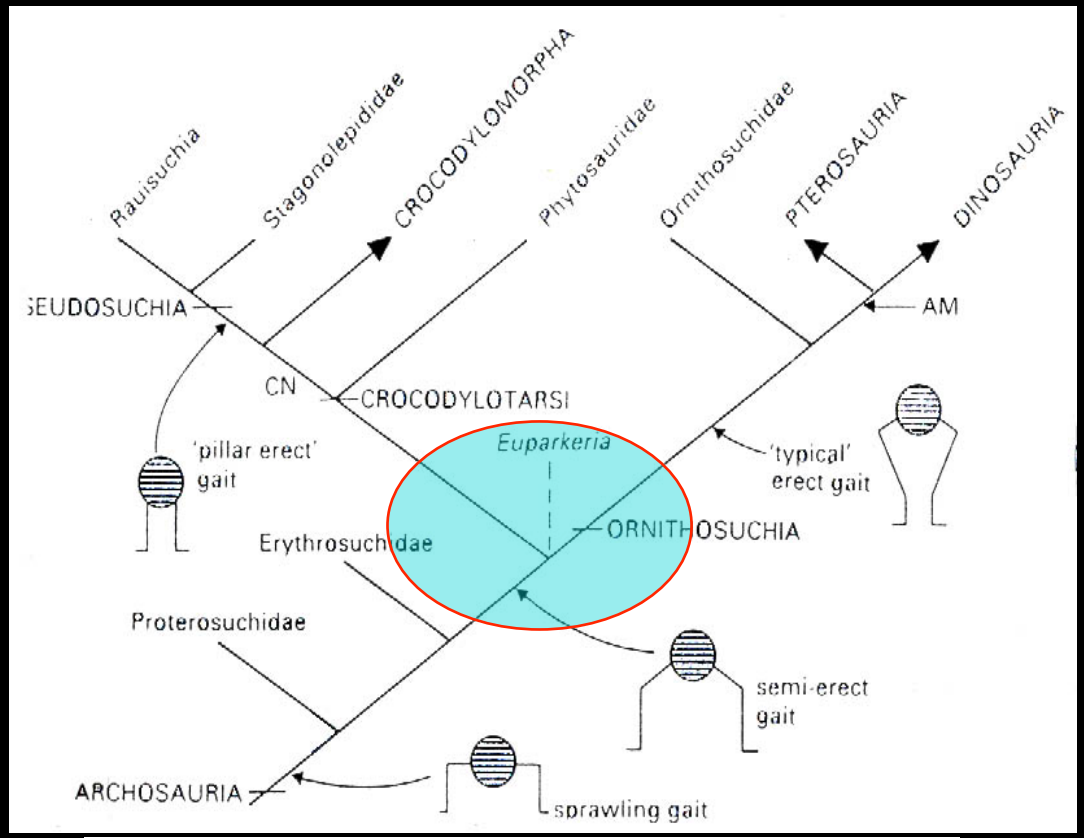
dinosaurs

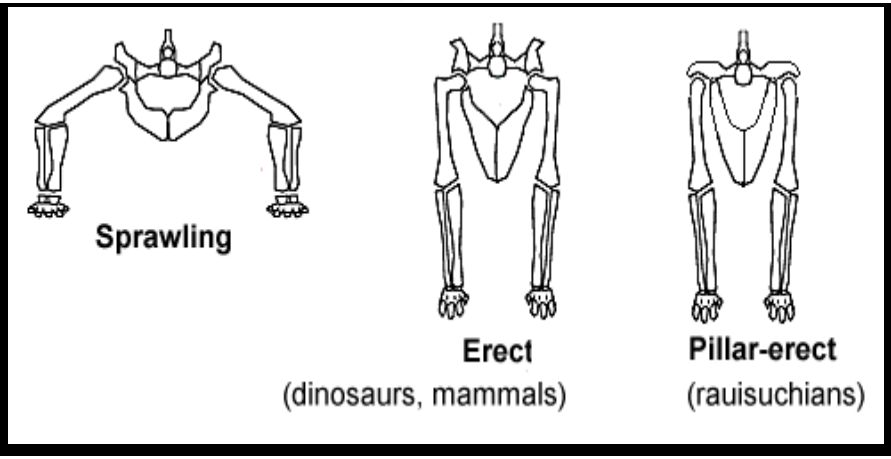
birds

pterosaurs



ARCHOSAURIA Triassic - Recent





Archosauria

"thecodonts"

crocodiles

dinosaurs

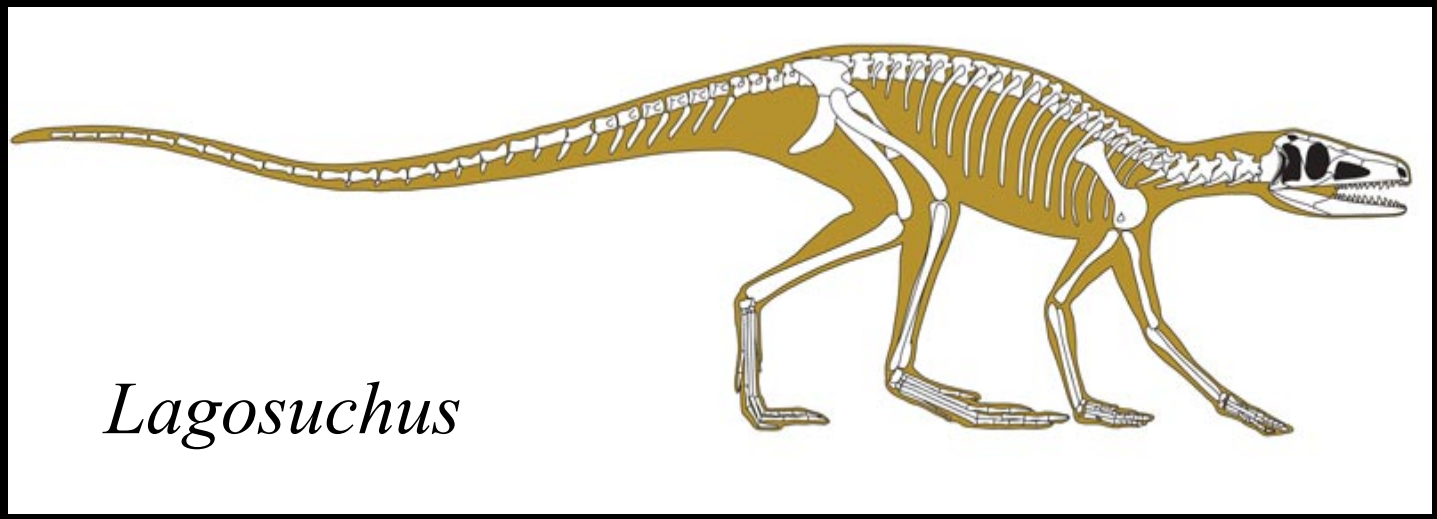
birds

pterosaurs

"Thecodonts"

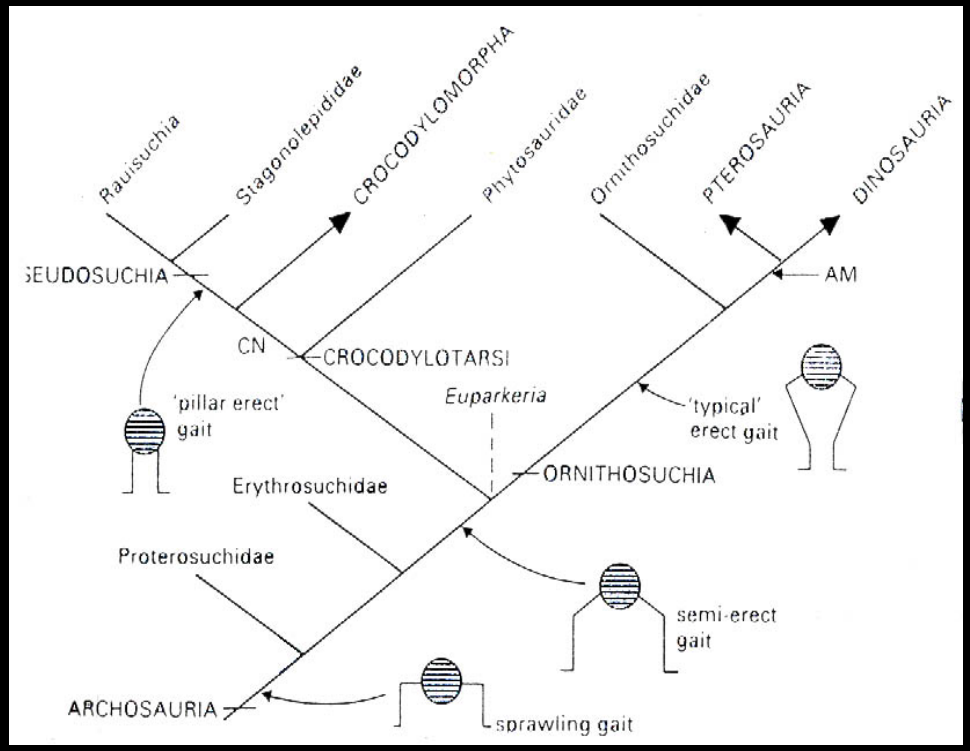
("socket-toothed"), Triassic

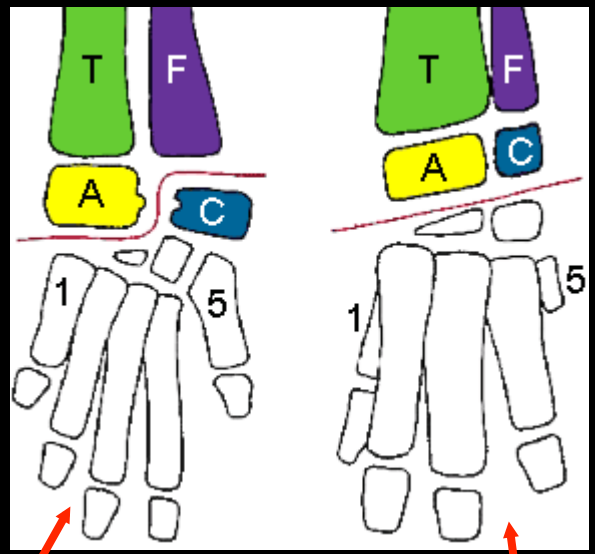
- stem-group to dinosaurs, pterosaurs and crocodiles
- small predators, bi- and quadruped
- longer hind limb than forelimb



Lagosuchus

ARCHOSAURIA
Triassic - Recent



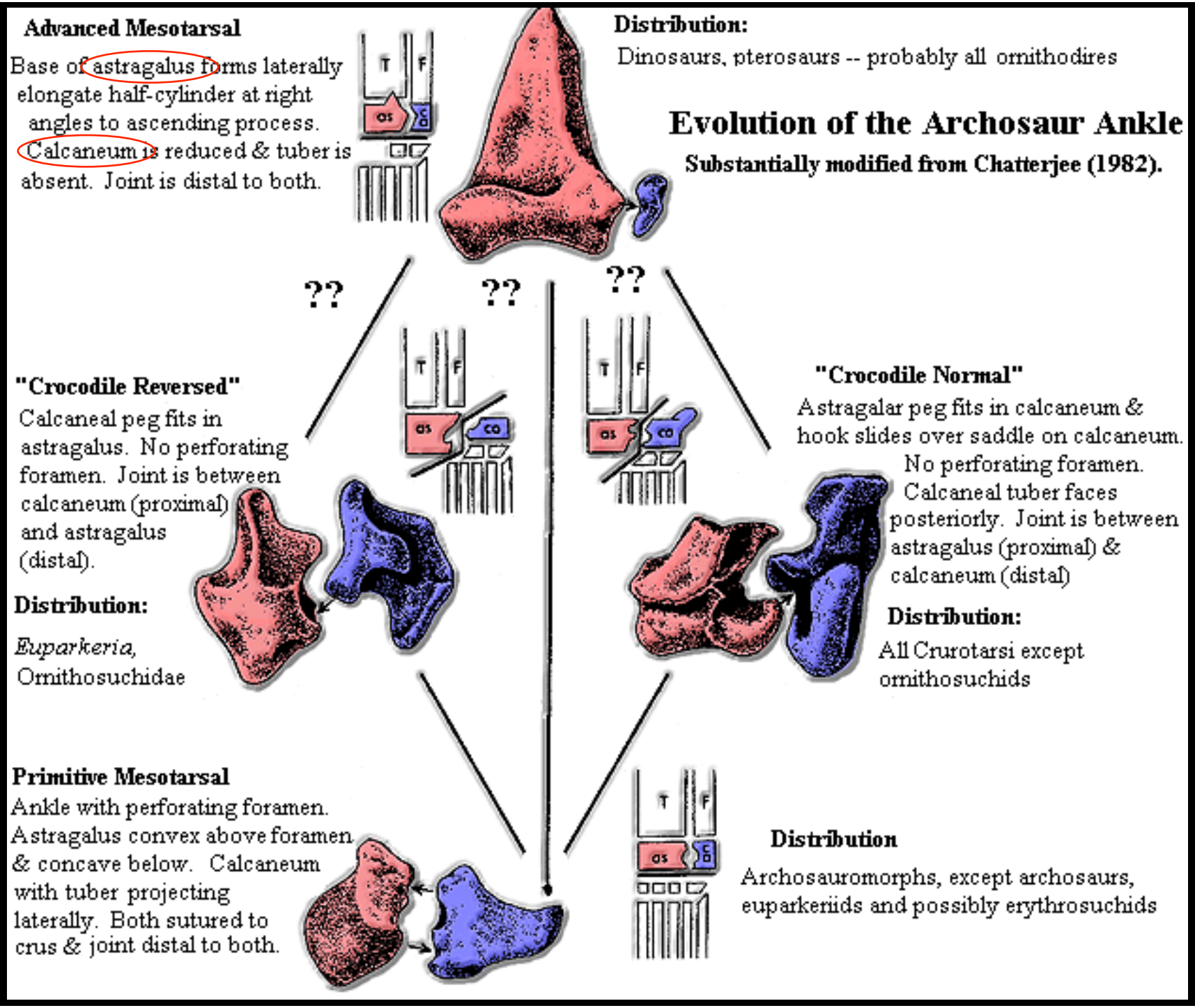


crocodiles and their relatives:
crurotarsal ankle joint

dinosaurs and pterosaurs:
mesotarsal ankle joint

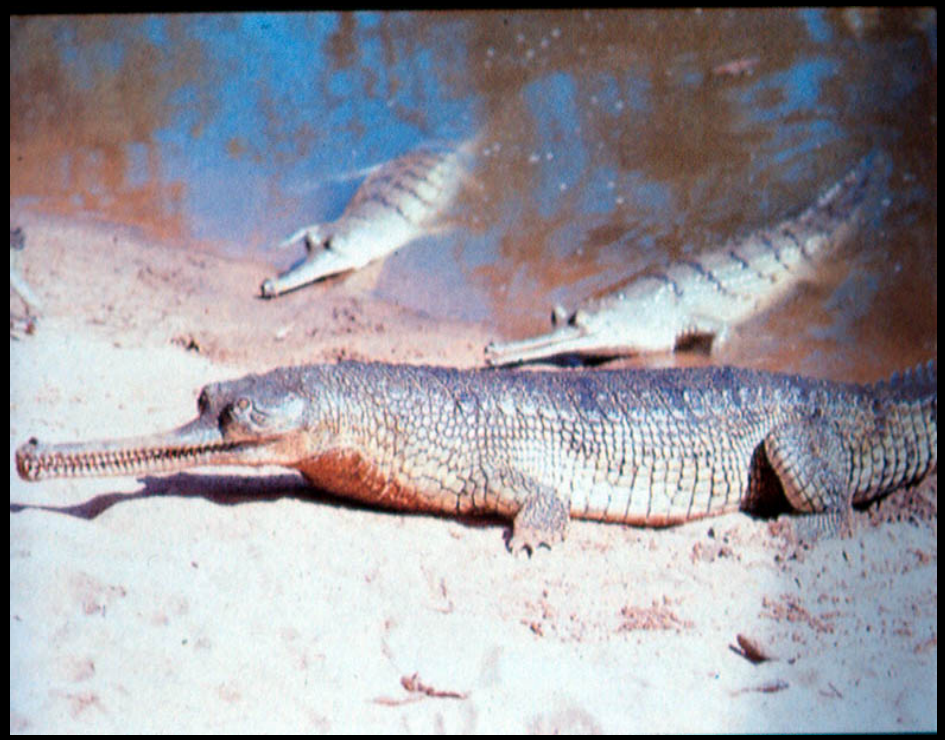
Evolution of the Archosaur Ankle

Substantially modified from Chatterjee (1982).



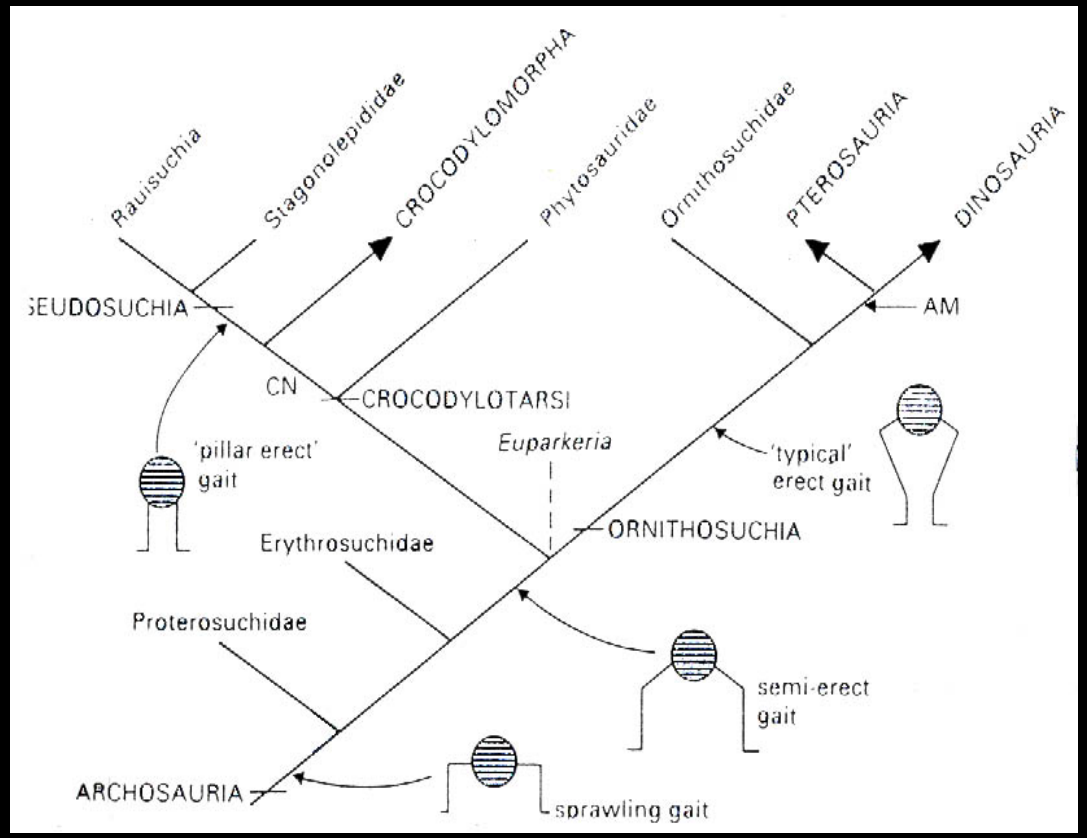
CROCODILIA
(Crurotarsi, Crocodylomorpha)
(crocodiles; Jurassic - Recent)

- descend from terrestrial thecodonts
- secondary aquatic



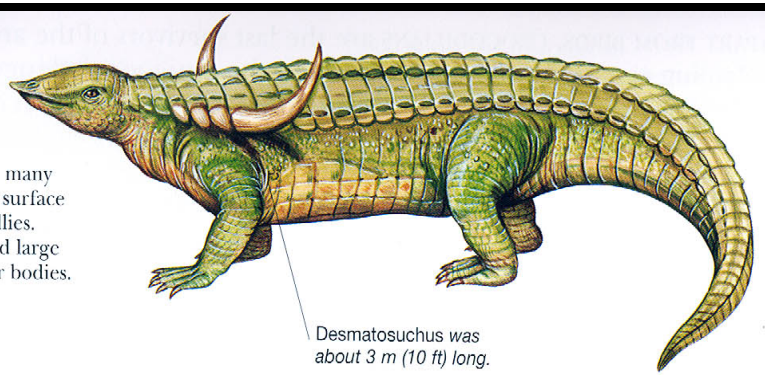
biggest living reptiles (6 m)

Archosauria
"thecodonts"
crocodiles
dinosaurs
birds
pterosaurs


Rauisuchia
Stagonolepididae
CROCODYLOMORPHA
Phytosauridae
Ornithosuchidae
PTEROSAURIA
DINOSAURIA
SEUDOSUCHIA
AM
CN
CROCODYLOTARSI
'pillar erect' gait
Euparkeria
'typical' erect gait
ORNITHOSUCHIA
Erythrosuchidae
Proterosuchidae
semi-erect gait
ARCHOSAURIA
sprawling gait

ARMOURED PLANT-EATERS

Aetosaurs were large crocodile-group reptiles related to rauisuchians. Their leaf-shaped teeth suggest that they were plant-eaters and their blunt, upturned snouts could have been used to dig up roots. Aetosaurs had many large armour plates covering the whole upper surface of their bodies and encasing their tails and bellies. Some aetosaurs, such as *Desmatosuchus*, also had large spikes or horns growing from the sides of their bodies.



Desmatosuchus *was about 3 m (10 ft) long.*

Two rows of armour plates ran along the top of the spine.

Large muscles connected the tail to the thigh bone.

t fifth urned ds.

Short, rather straight neck

Backwards curving, serrated teeth

Prestosuchus

Powerful leg bones suggest that Prestosuchus *could run at high speeds.*

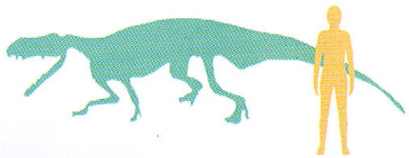
The nostrils were situated on a bump in front of the eyes.

Long, powerful jaws with sharp, pointed teeth

CROCODILE MIMICS

Phytosaurs such as this *Machaeroprosopus* were amphibious Late Triassic crocodylotarsians. Although they looked like modern crocodiles, phytosaurs were in fact among the most primitive of

PRESTOSUCHUS



Scientific name: *Prestosuchus*

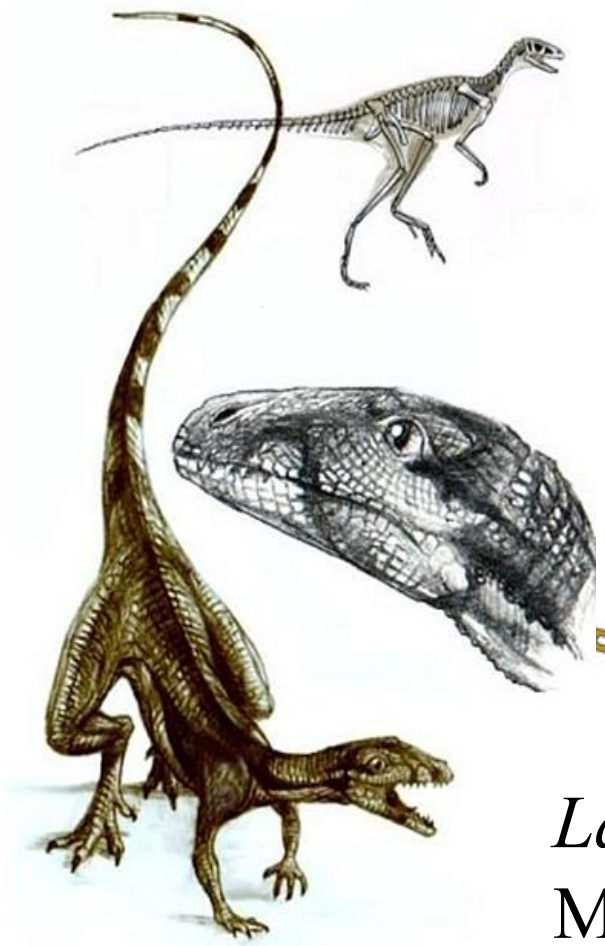
Size: 5 m (16 ft) long

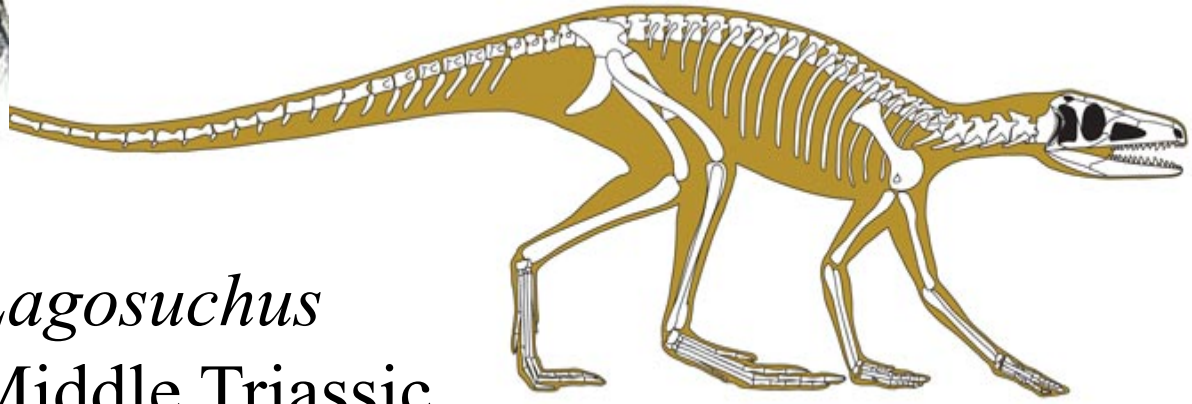
Diet: Large vertebrates such as dicynodonts, cynodonts, and rhynchosaurs

Habitat: Scrubland, open woodland

Where found: [illegible]

Dinosaur ancestor - Dinosauromorpha

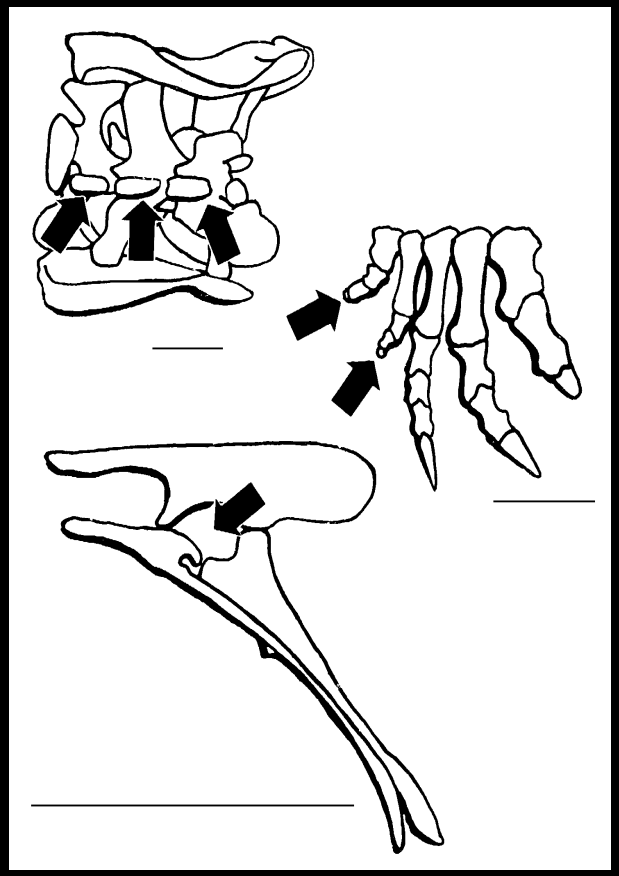


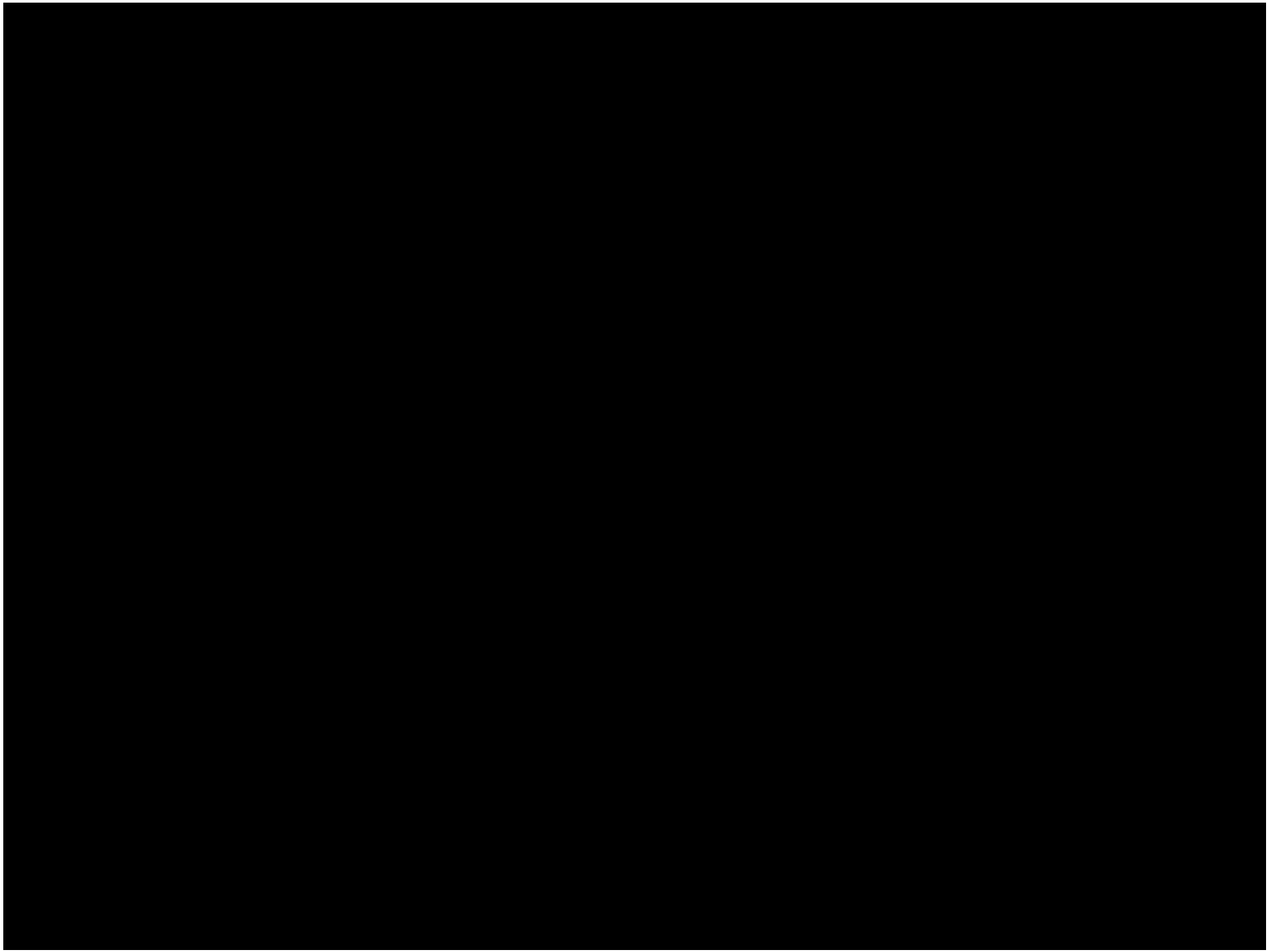


Lagosuchus
Middle Triassic

DINOSAURIA - synapomorphies

- advanced mesotarsal (AM) ankle
- limbs beneath the body, upright posture
- (a sacrum composed of three or more fused vertebrae)
- (open hip socket, the acetabulum)
- asymmetric hand with two smaller outer digits





DINOSAURIA

"*skräcködlor*"; Triassic-Cretaceous

- upright posture