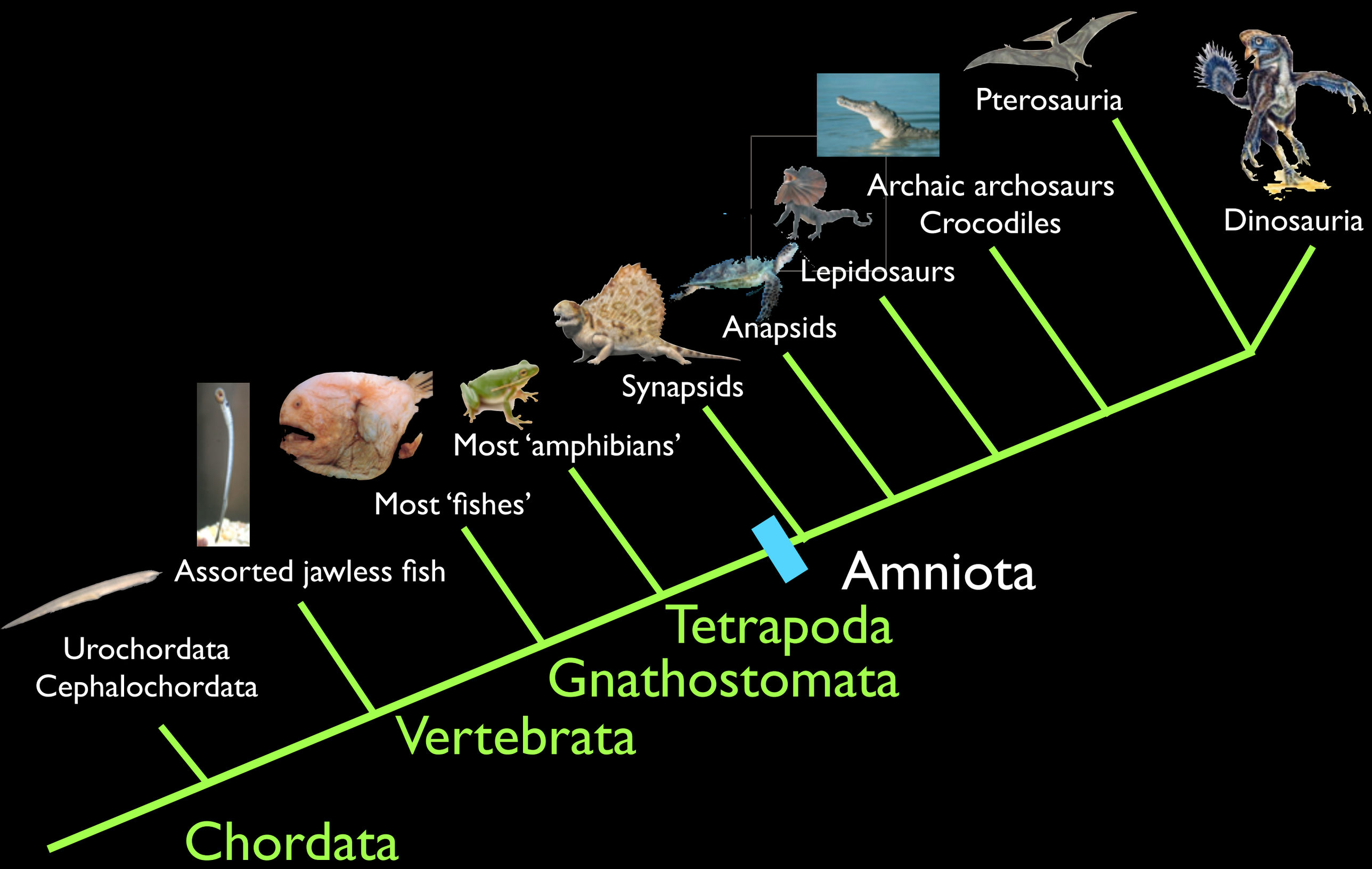
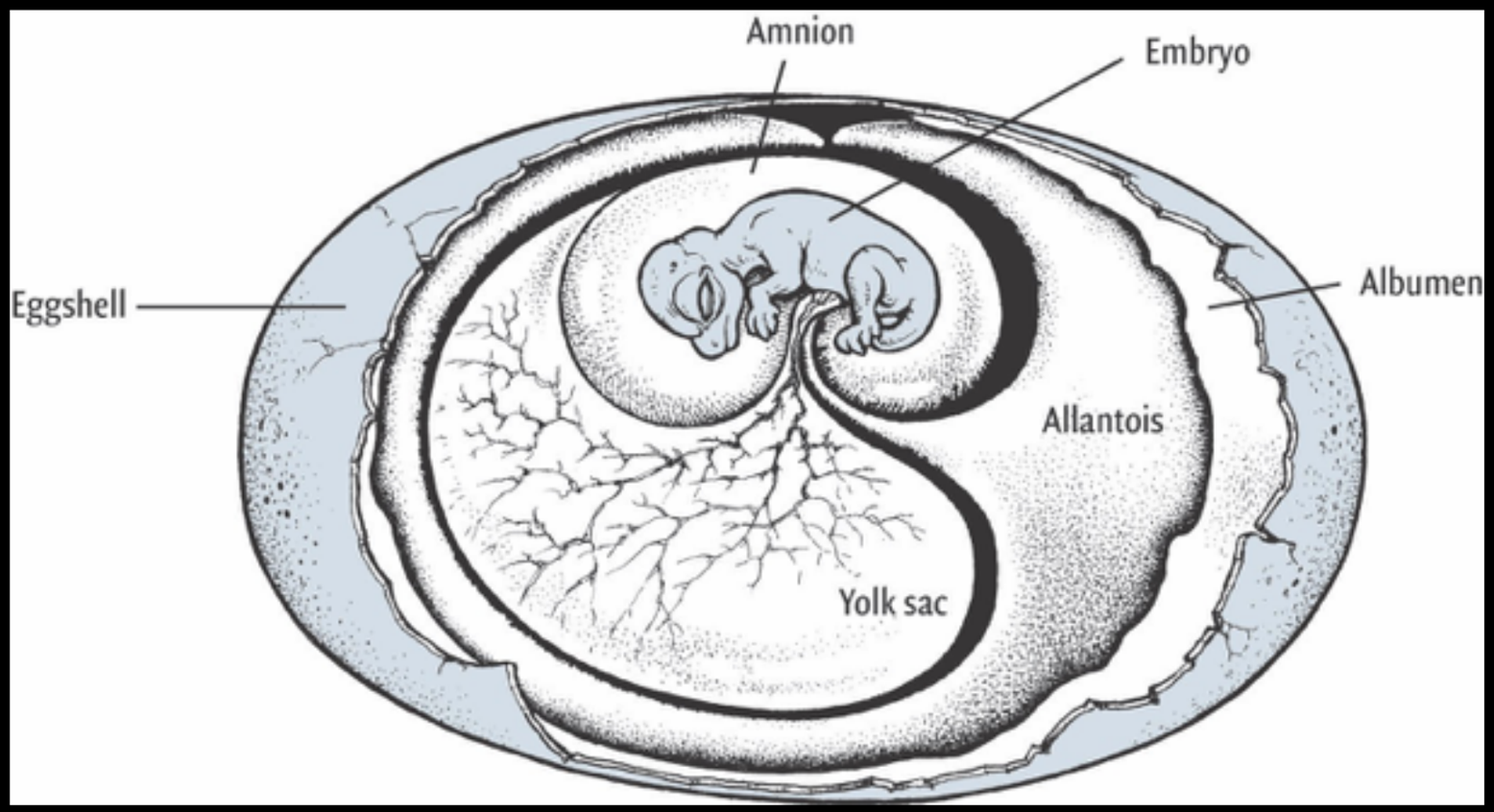
Meet the Amniotes:
The great terrestrial adaptation


Pterosauria
Dinosauria
Archaic archosaurs
Crocodiles
Lepidosaurs
Anapsids
Synapsids
Most ‘amphibians’
Most ‘fishes’
Assorted jawless fish
Urochordata
Cephalochordata
Amniota
Tetrapoda
Gnathostomata
Vertebrata
Chordata

The cleidoic egg: a private pond



Eggshell: Semipermeable
Calcareous or leathery
Albumen: Egg cytoplasm
Amnion: Protection / Gas transfer
Yolk Sac: Nutrient Pool
Allantois: Waste Pool

Synapsida

Anapsida

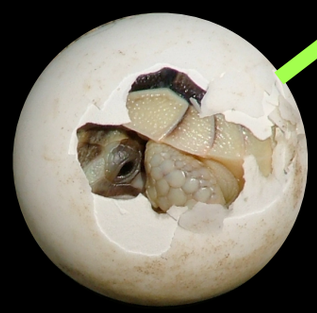
Lepidosauria

Archosauria

First amniotes
in record (!!)

Diapsida

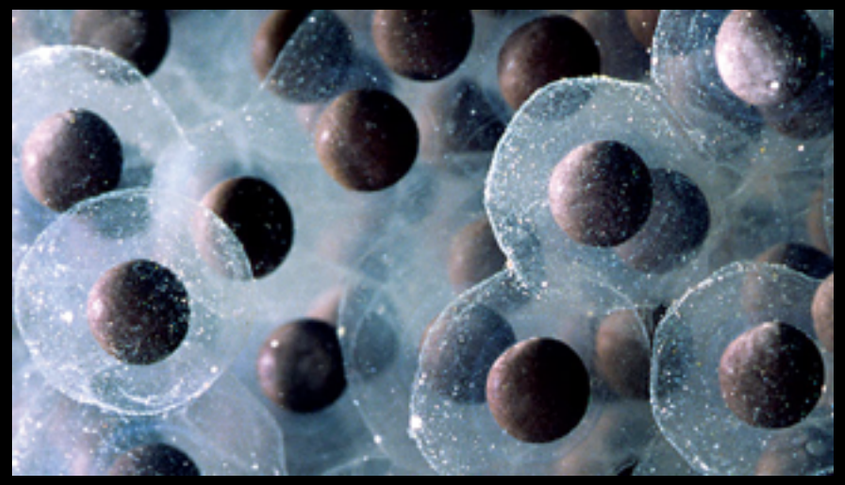
Eureptilia



Amniotes

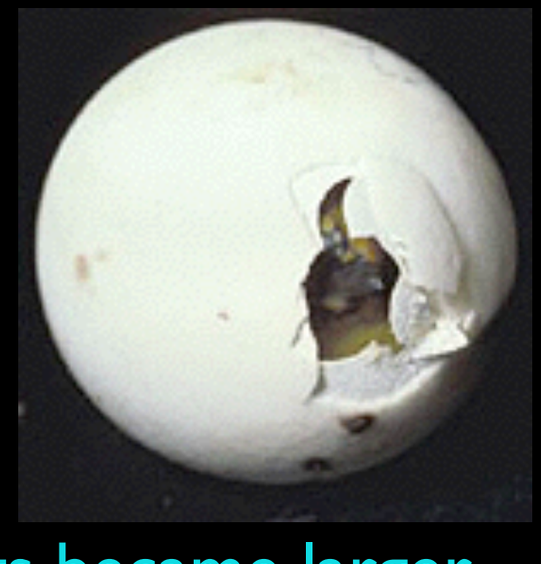
Walking with Monsters
Chapter 2 1:10-5:00

Evolution of Eggs?



Some modern amphibians lay eggs on land... why?
- One inner membrane
1. escape predation

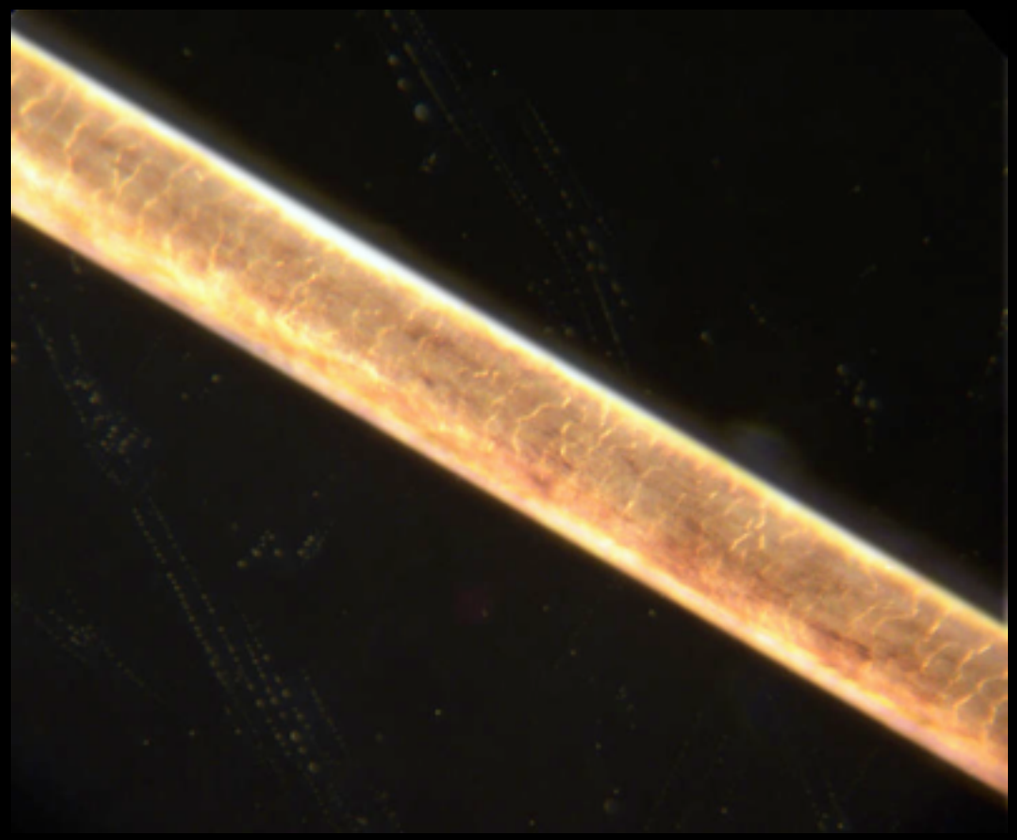
To deal with longer time periods on dry land, tougher shells were selected for. Gas exchange and waste devices evolved for complete eggtonomy



Eggs became larger, tougher. Large eggs can produce larger babies, which had a higher likelihood of survival in a tough world.

Evolution of Hair?

Amniotes all have the gene for hair:
alpha keratin
In birds/lizards, it's expressed in claws
In mammals, it's used in hair & nails



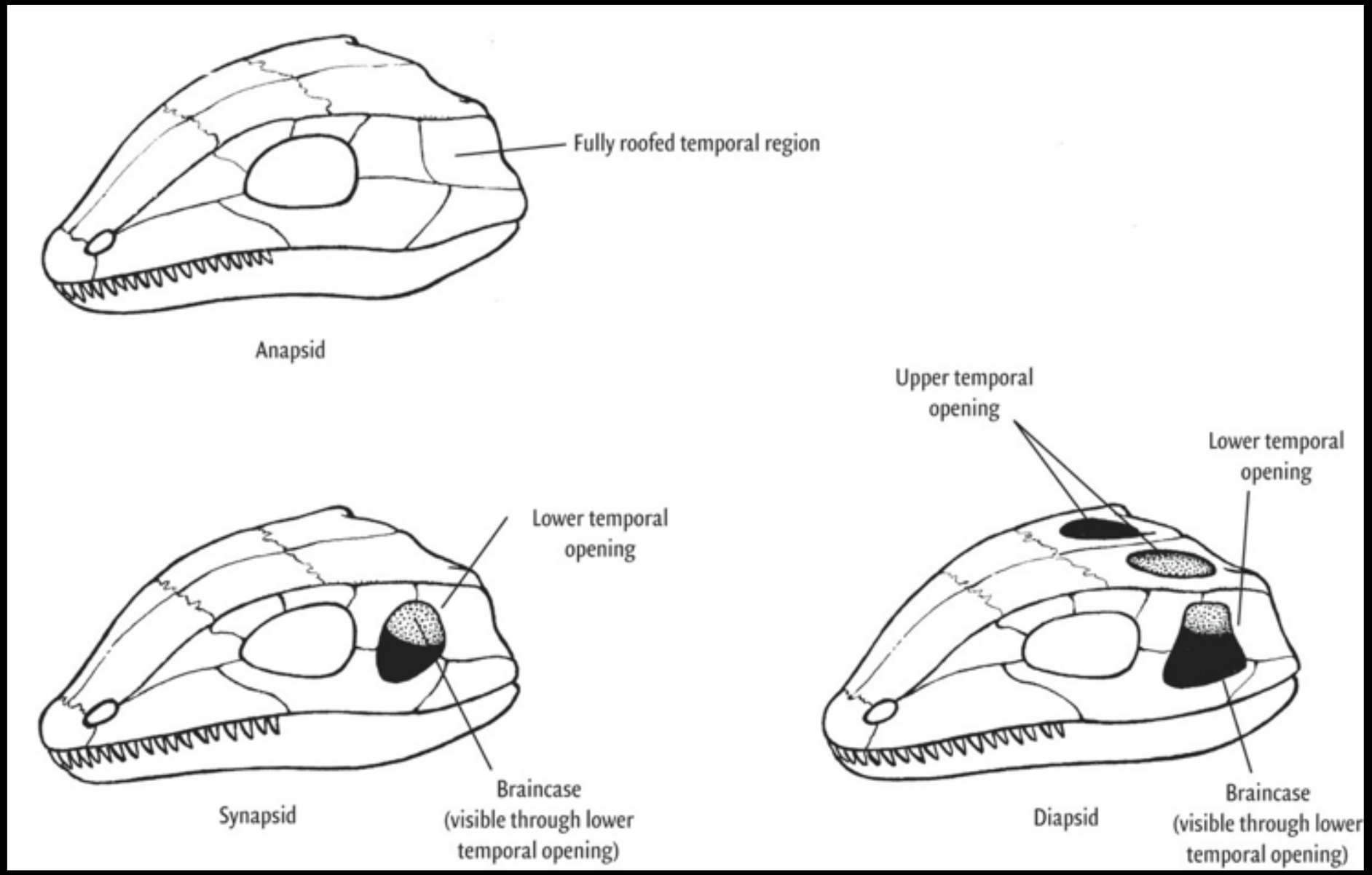
Thrinaxodon

Blood vessel channels on premaxillae, maxillae
~vibrassae (whiskers)
(early Triassic)

Castorcauda

First direct fossil evidence of hair
(mid-Jurassic)

Meet the Amniotes

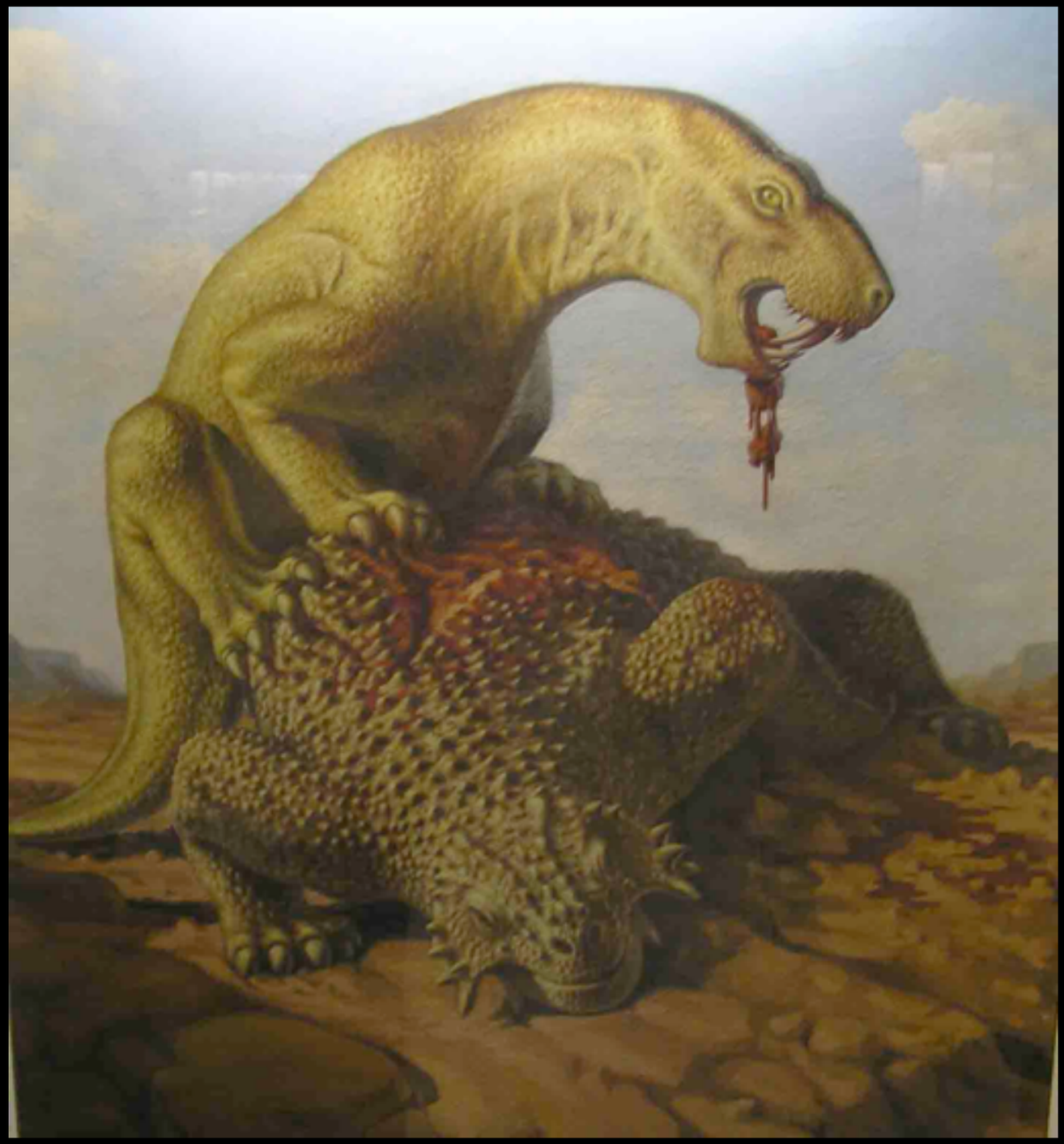


Upper temporal fenestra
Lower temporal fenestra

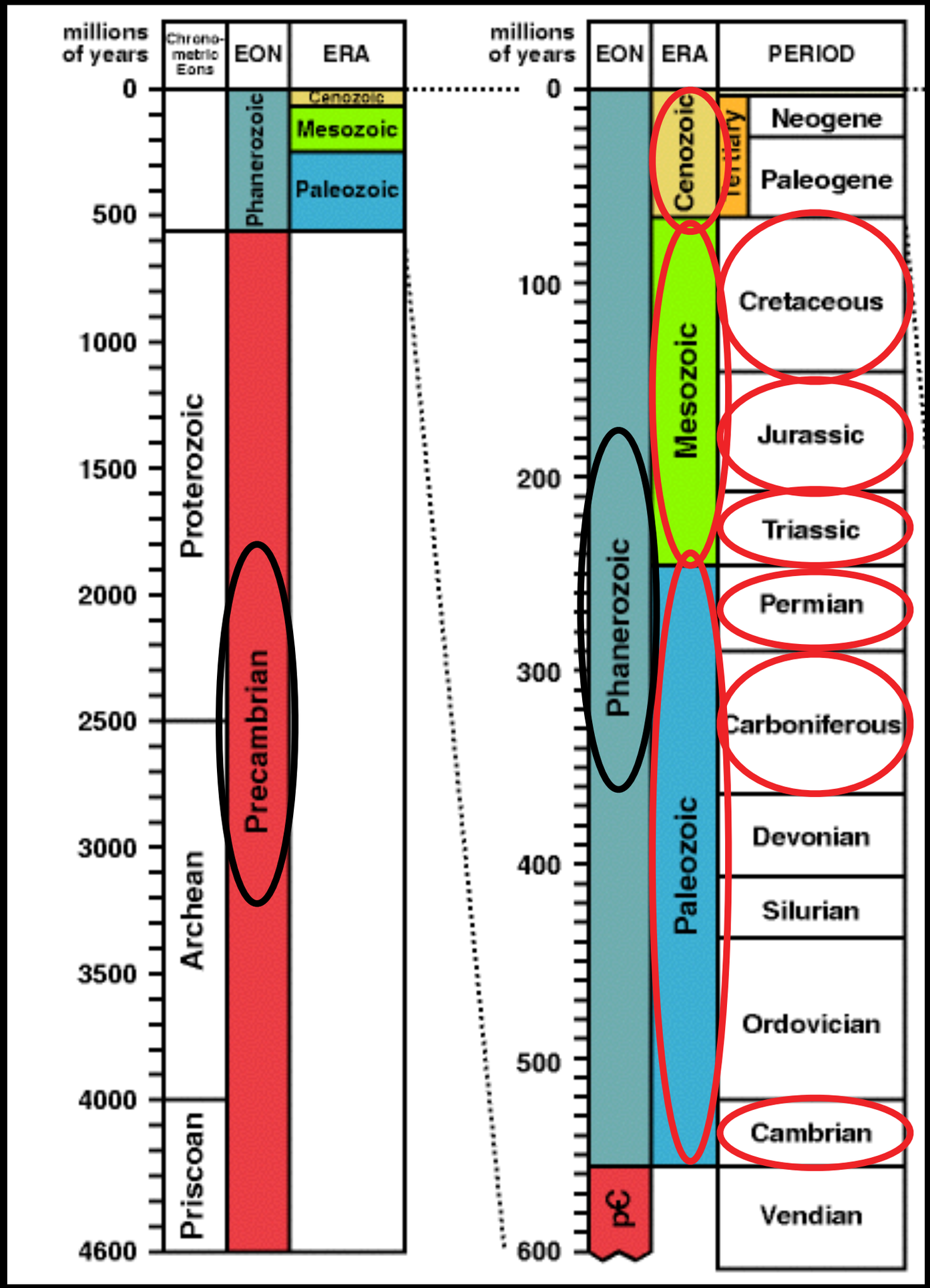
Single temporal fenestra

fenestra = ‘window’

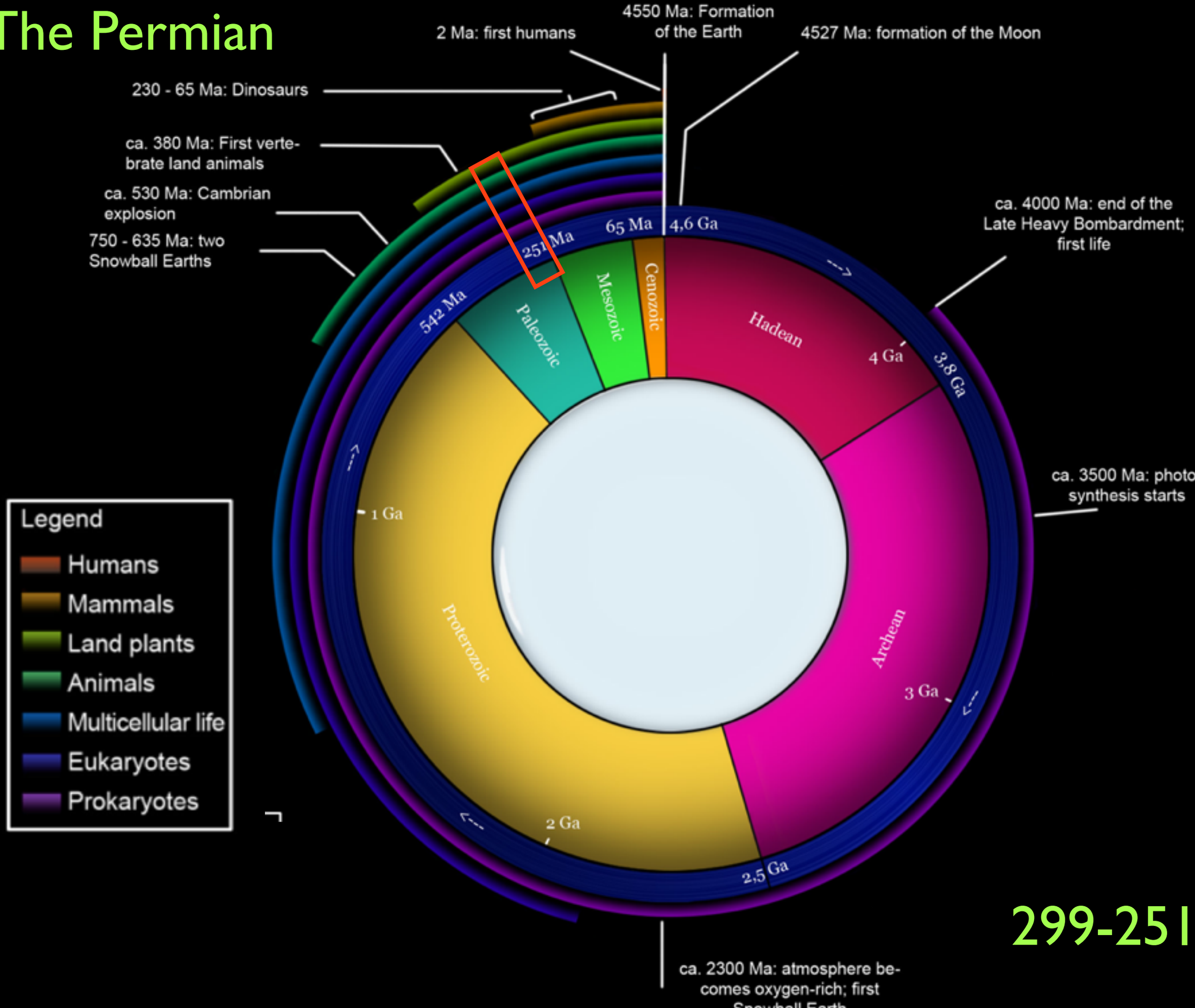
The Permian



299-251 Ma


millions of years
Chrono-metric Eons
EON
ERA
0
500
1000
1500
2000
2500
3000
3500
4000
4600
Cenozoic
Mesozoic
Paleozoic
Phanerozoic
Proterozoic
Archean
Priscoan
Precambrian
millions of years
EON
ERA
PERIOD
0
100
200
300
400
500
600
Cenozoic
Mesozoic
Paleozoic
Phanerozoic
p€
Tertiary
Neogene
Paleogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Vendian

The Permian



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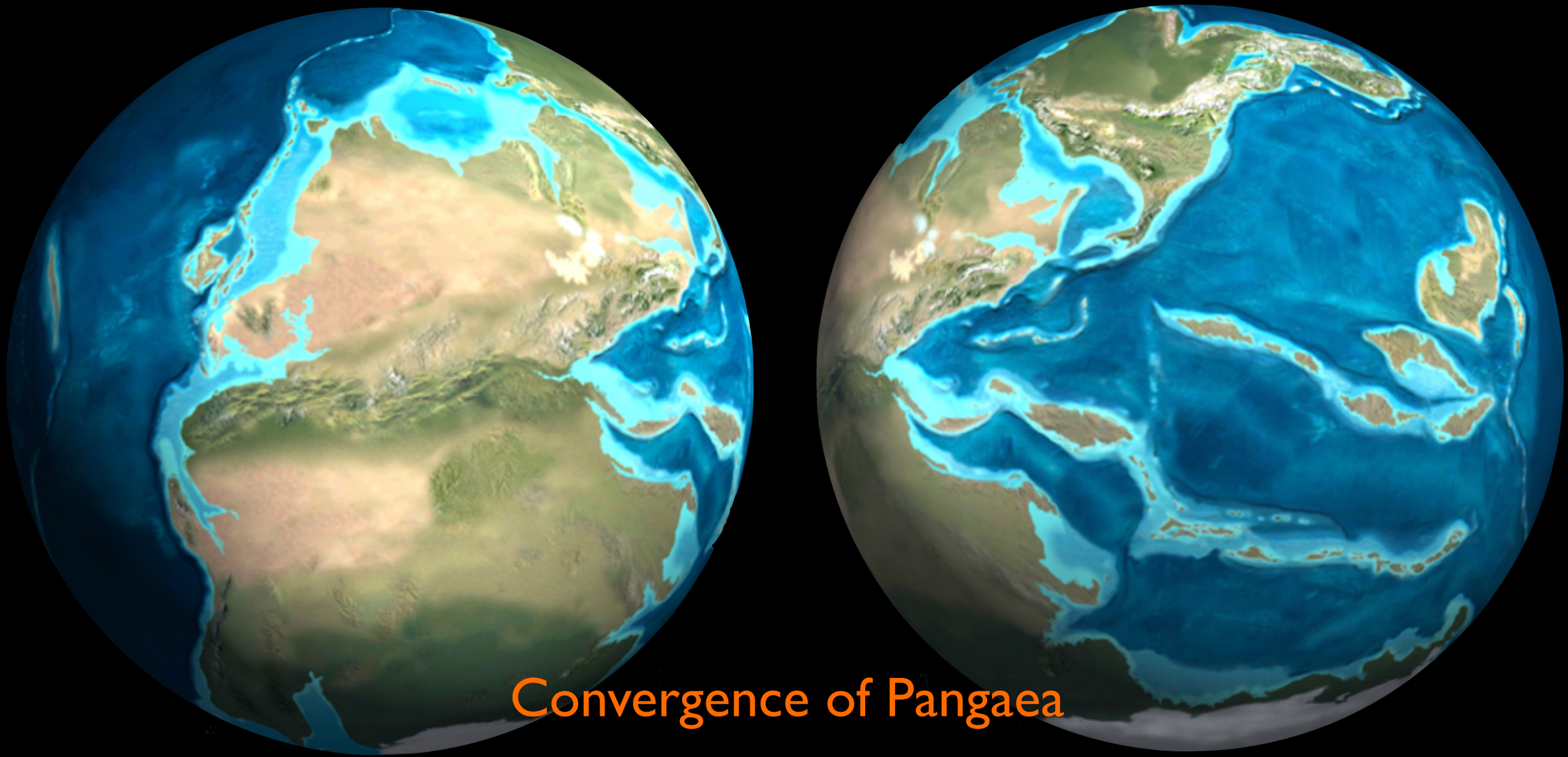


Convergence of Pangaea

The effects of the landscape on climate:

Heat distributed more equally through fluids than solids

Oceans slower to warm/cool than continents

Pangaea: Rapid warming/cooling ~ more intense than today

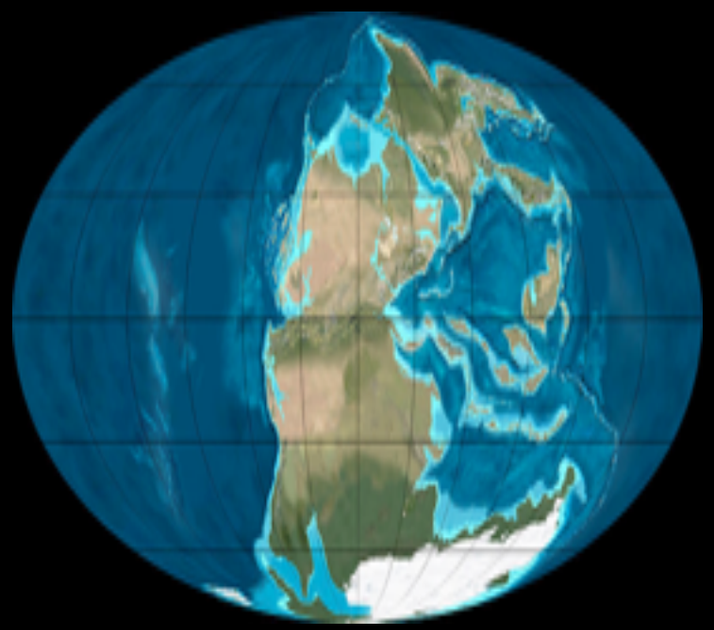
Temperature extremes

Our modern continents are ‘tempered’ by oceans between them. Not Pangaea

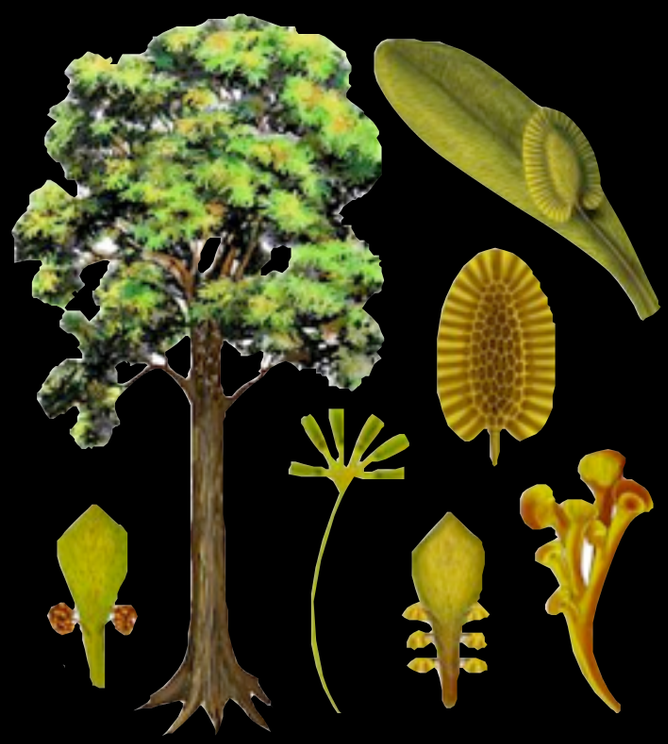
Hot, arid terrains formed in the northern hemisphere

~Evaporite deposits

Wetland plants mostly replaced by seed-bearing plants and conifers



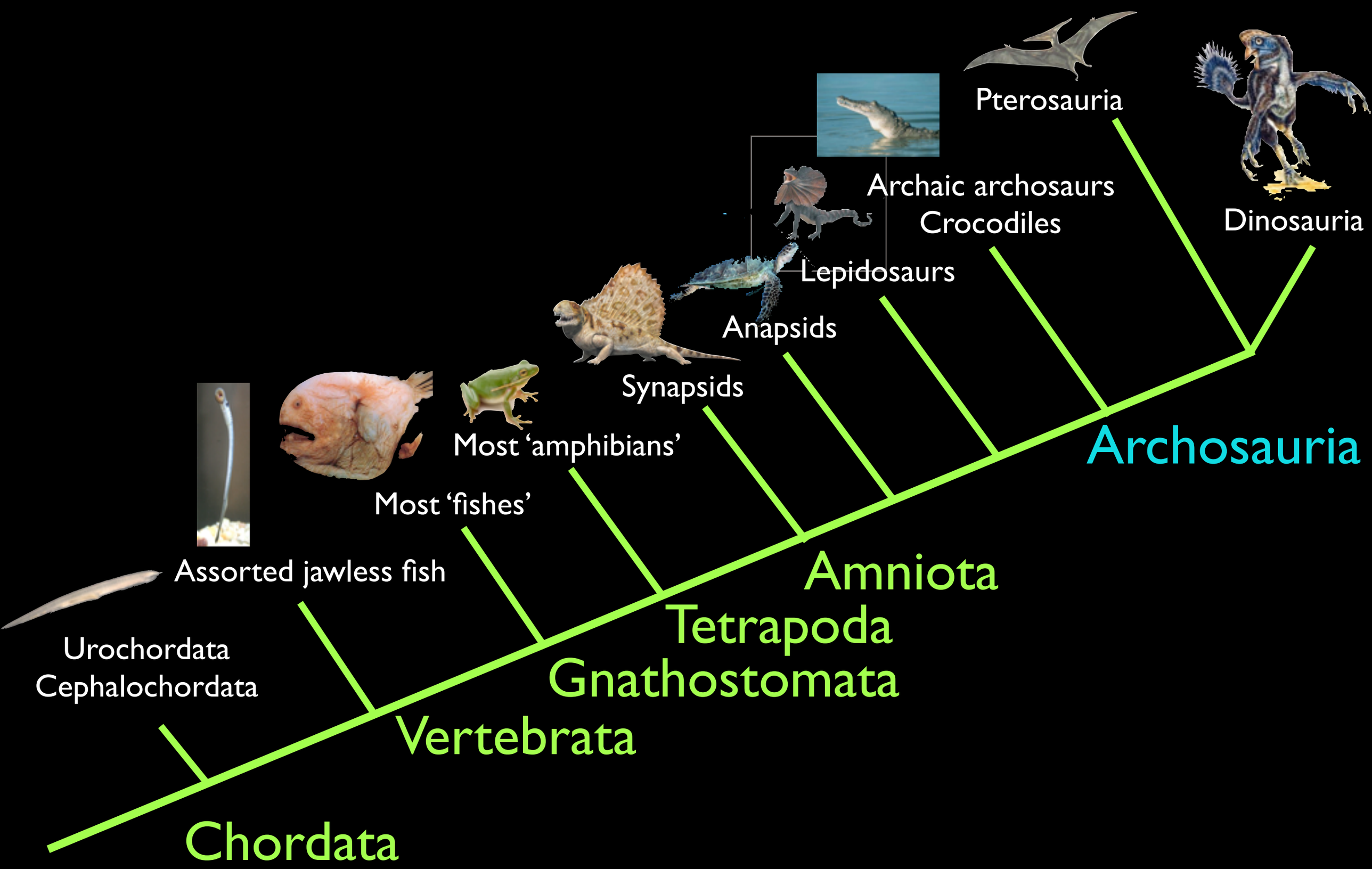
Northern conifer forests



Southern glossopterid forests: pteridosperms, or seed-ferns

A bit about seed-ferns:

- A paraphyletic group of seed-bearing extinct plants
- Refer to members of a group that are fern-like & seed-bearing, but are not angiosperms, ginkgophytes, conifers, or cycadophytes (distinct by elimination)
- Related to other seed plants
- Flourished during Carboniferous, Permian
- Declined during Cretaceous
- They aren't ferns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Anapsida

Lepidosauria

Archosauria

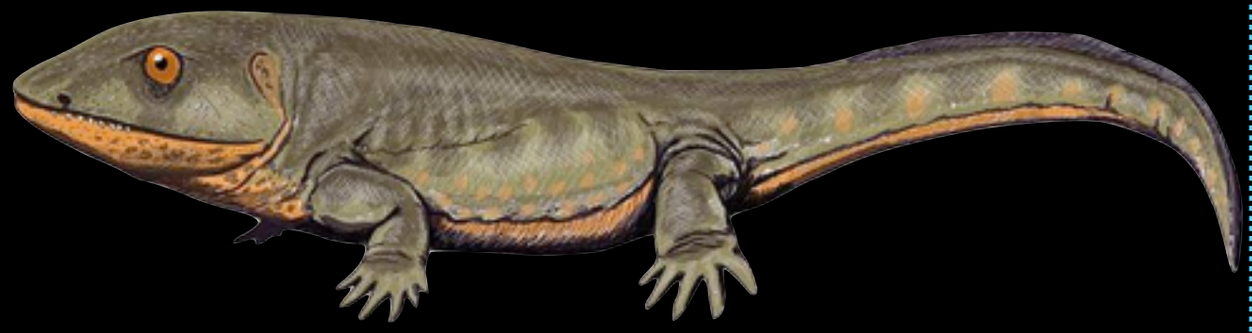
Diapsida

Eureptilia

Amniotes

Ecological Turnover:
Basal tetrapods => amniotes

Capetus



Pederpes

Exploit the dry land!

Milleretta

Captorhinus

Mesosaurus

Pelycosauria
(paraphyletic)

Dinocephalia

Dicynodontia

Gorgonopsia

Therocephalia

Cynodontia

Sphenacodontids
Edaphosaurids

Theriodontia

Therapsida

Eupelycosauria

Synapsida

Diapsida

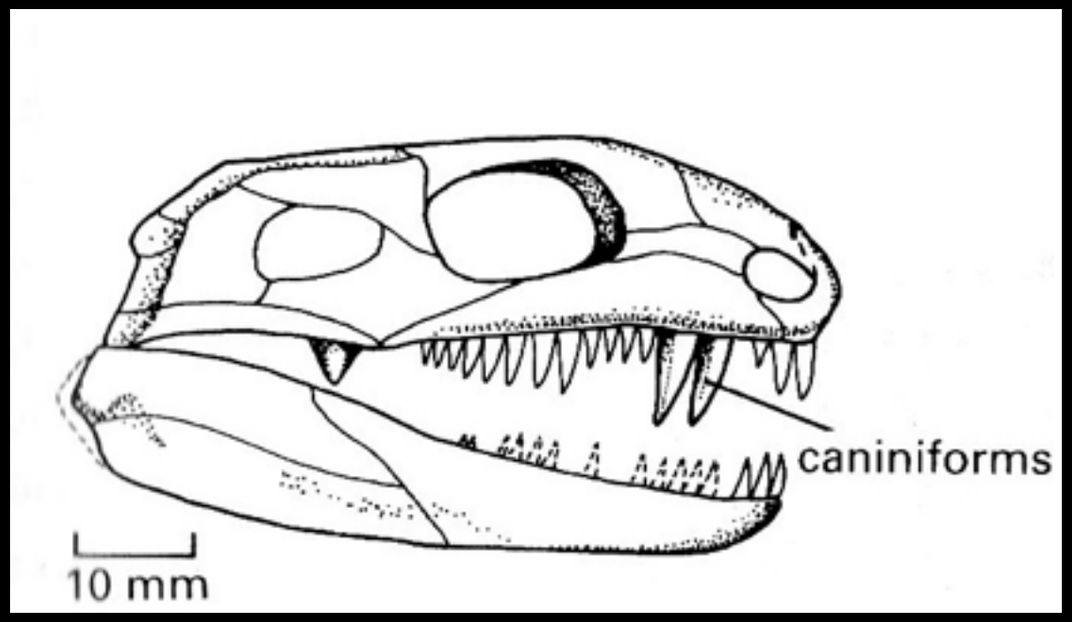
Anapsida

Eureptilia

Amniota

Pelycosauria

-early Permian
-most diverse group (70% of genera)
-basal

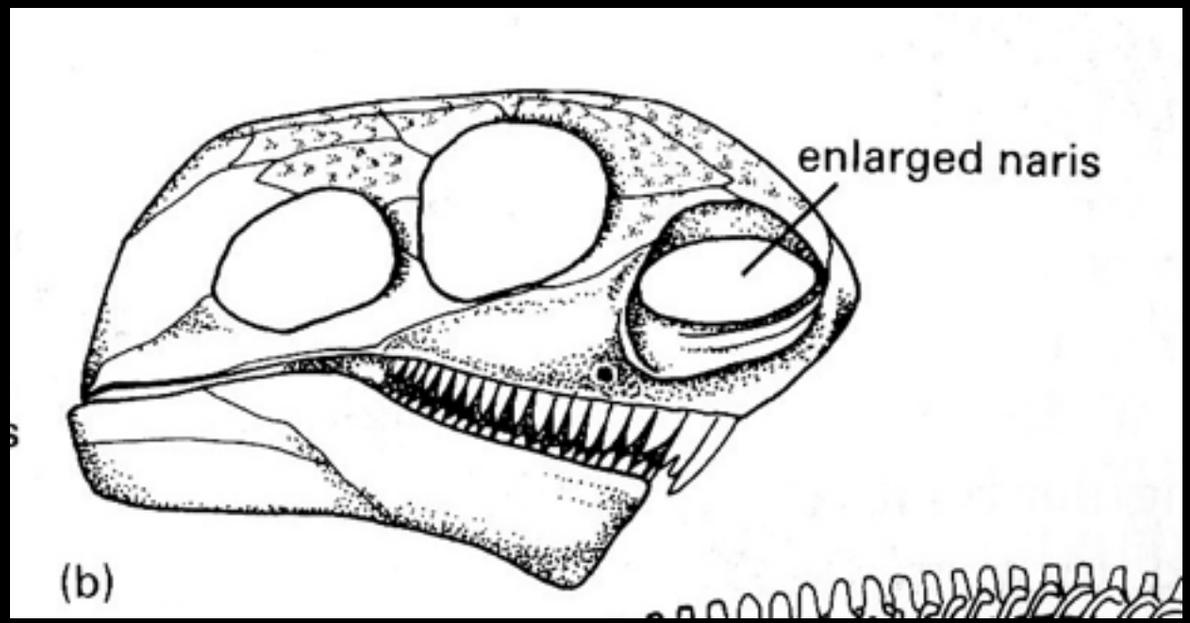


Early Pelycosaurs: small, carnivorous
Eothyris: early Permian
-Large canine teeth

Pelycosauria

-most diverse group (70% of genera)

-caseids



Herbivorous Pelycosaurs: large

Cotylorynchus: mid-Permian

-Largest Pelycosaur

-Peg-like Teeth

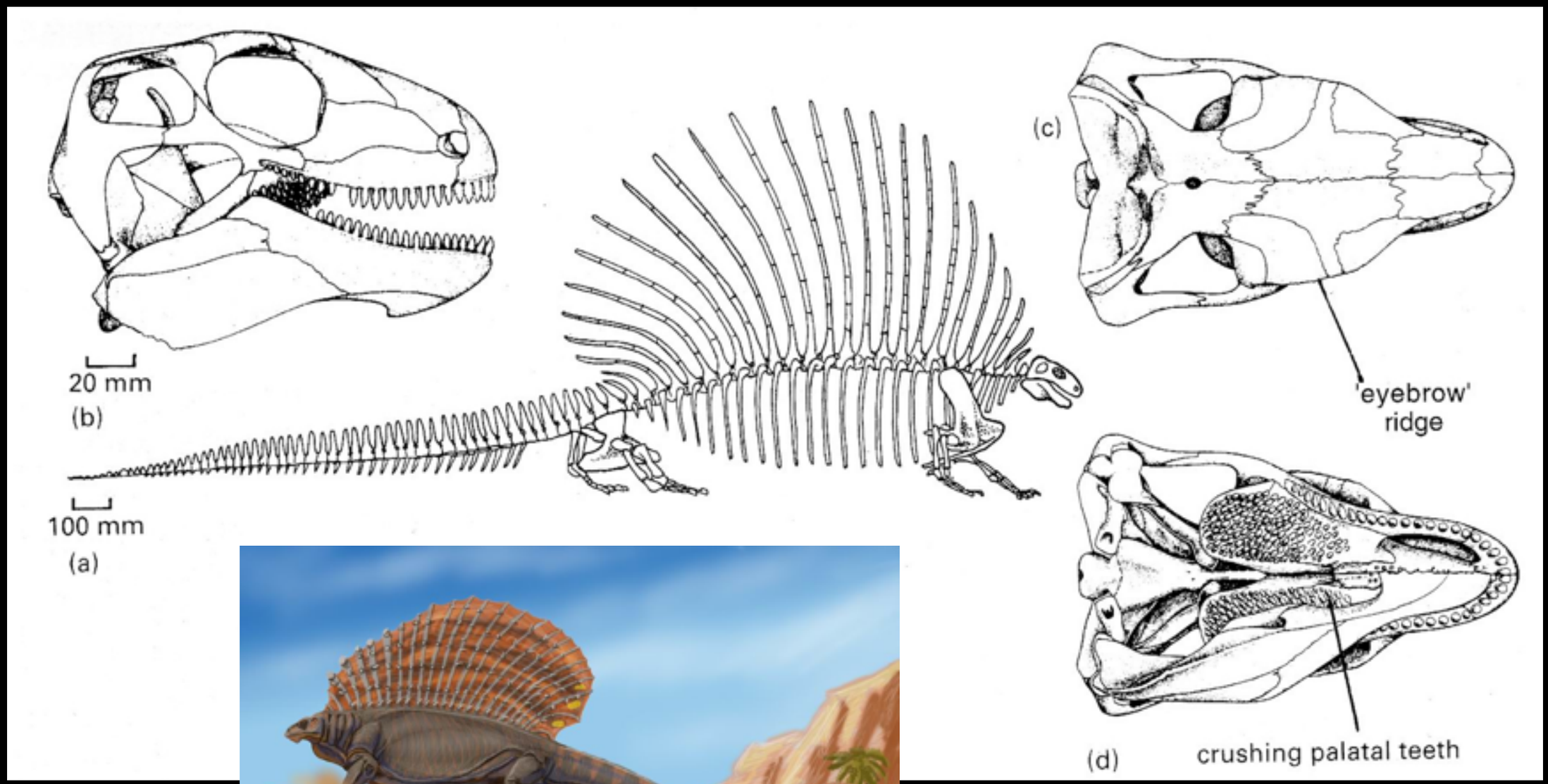
-Enormous gut cavity

-Angled Jaw

Pelycosauria

-most diverse group (70% of genera)

-Edaphosaurids



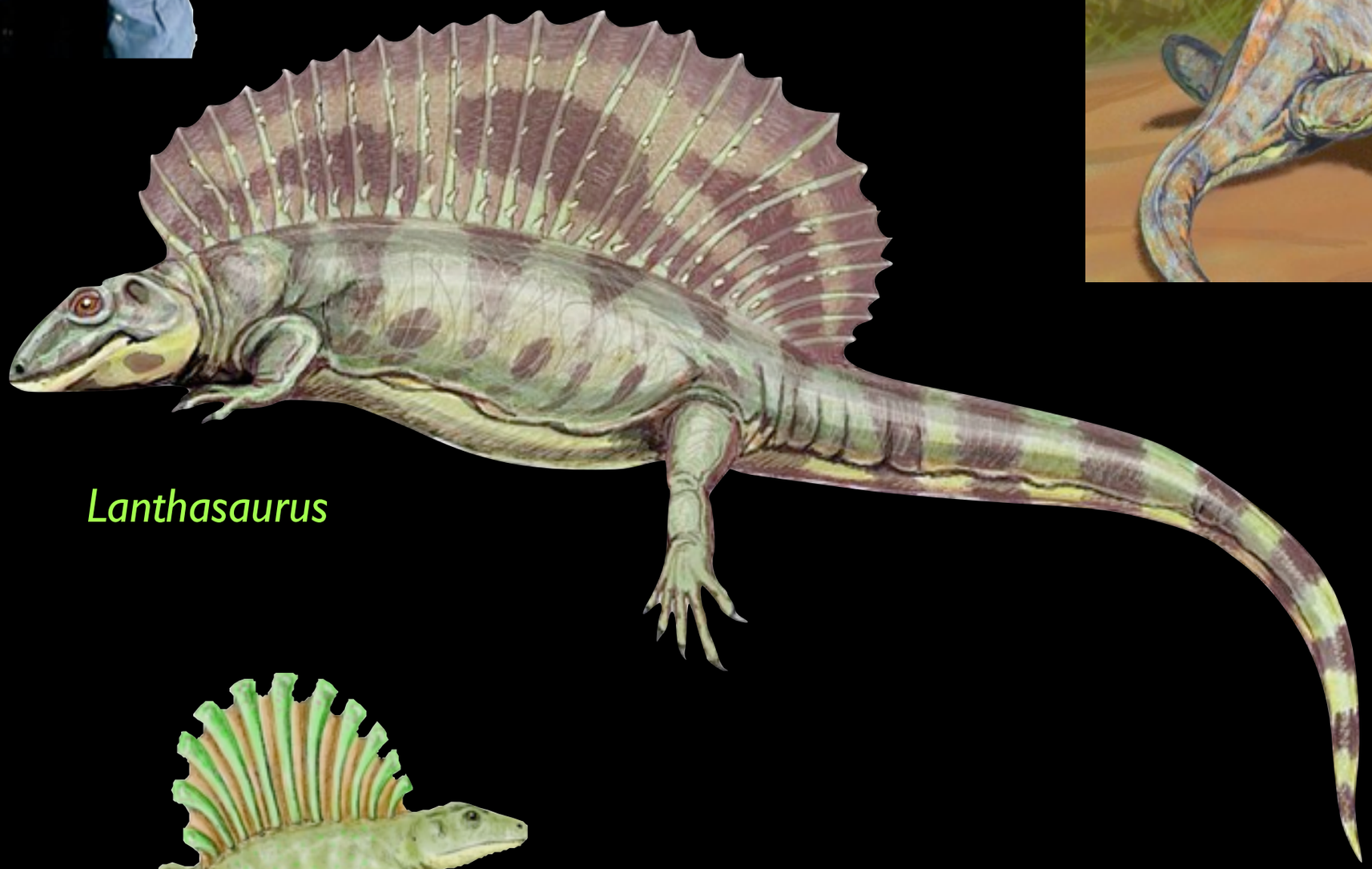
Pelycosauria

-Sphenacodontids Large Carnivores, early to mid Permian

Dimetrodon

What's the deal with the sail?

Sphenacodon



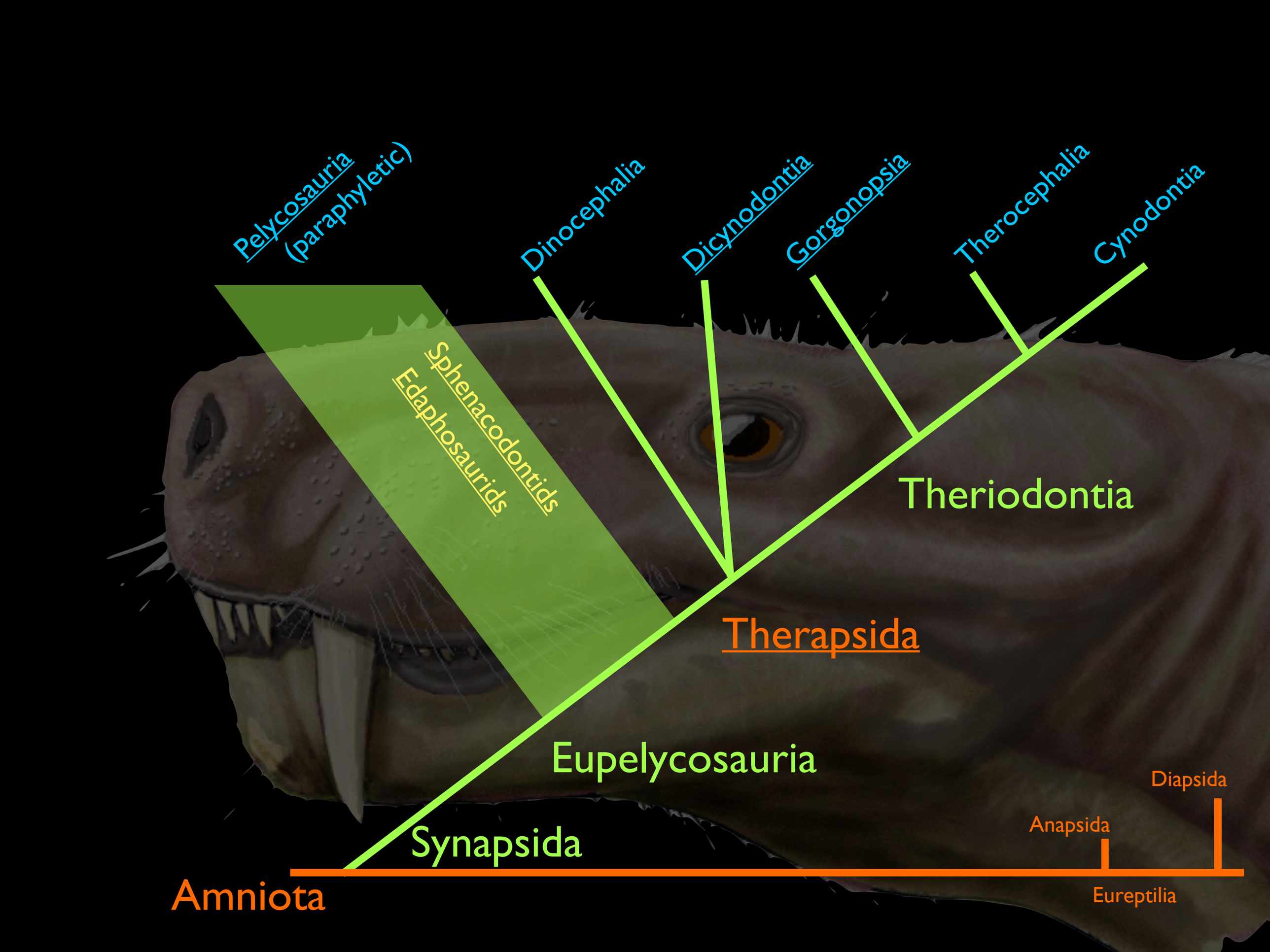
Lanthasaurus

Poikilotherms

Platyhystrix (Temnospondyl)
Contemporary of Pelycosaurs
CONVERGENT EVOLUTION

?

Walking with Monsters
11:58-18:06


Pelycosauria
(paraphyletic)
Dinocephalia
Dicynodontia
Gorgonopsia
Therocephalia
Cynodontia
Sphenacodontids
Edaphosaurids
Theriodontia
Therapsida
Eupelycosauria
Synapsida
Amniota
Diapsida
Anapsida
Eureptilia

Therapsids

-Late Permian

- **Basal**
- Dinocephalia
- Dicynodontia
- Gorgonopsids
- Mammal Ancest.

Tetraceratops

Basal Therapsid

Biarmosuchus

Single prominent Canine tooth

Therapsids

-Late Permian

- Basal
- **Dinocephalia**
- Dicynodontia
- Gorgonopsids
- Mammal Ancest.

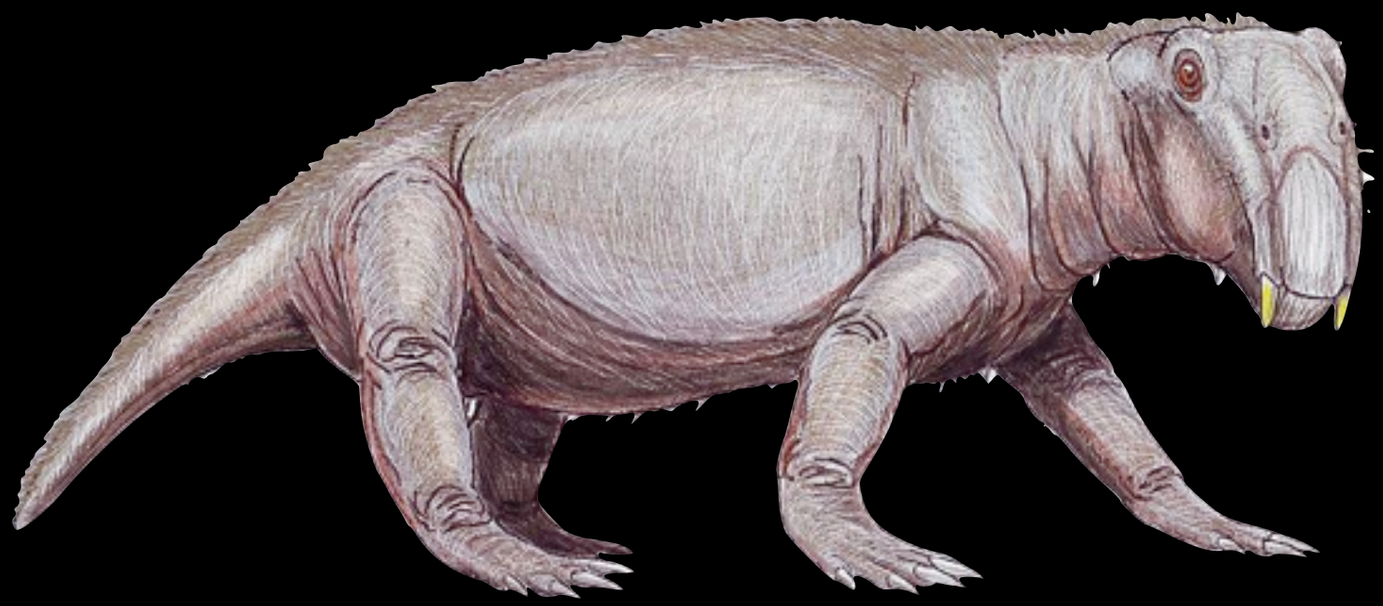
Titanophoneus

Moschops

Therapsids

-Late Permian

- Basal
- Dinocephalia
- **Dicynodontia**
- Gorgonopsids
- Mammal Ancest.



Lystrosaurus

Wadiasaurus

Kingoria

Placerius

The last dicynodont: an Australian Cretaceous relict

Tony Thulborn[1,2*] and Susan Turner[1,3]

Therapsids

-Late Permian

- Basal
- Dinocephalia
- Dicynodontia
- **Gorgonopsids**
- Mammal Ancest.

Arctognathus

Therapsids

-Late Permian

- Basal
- Dinocephalia
- Dicynodontia
- Gorgonopsids
- **Mammal Ancest.**

Cynodontia

Hey Great*10^7 Grandma!

Synapsida

Anapsida

Lepidosauria

Archosauria

Diapsida

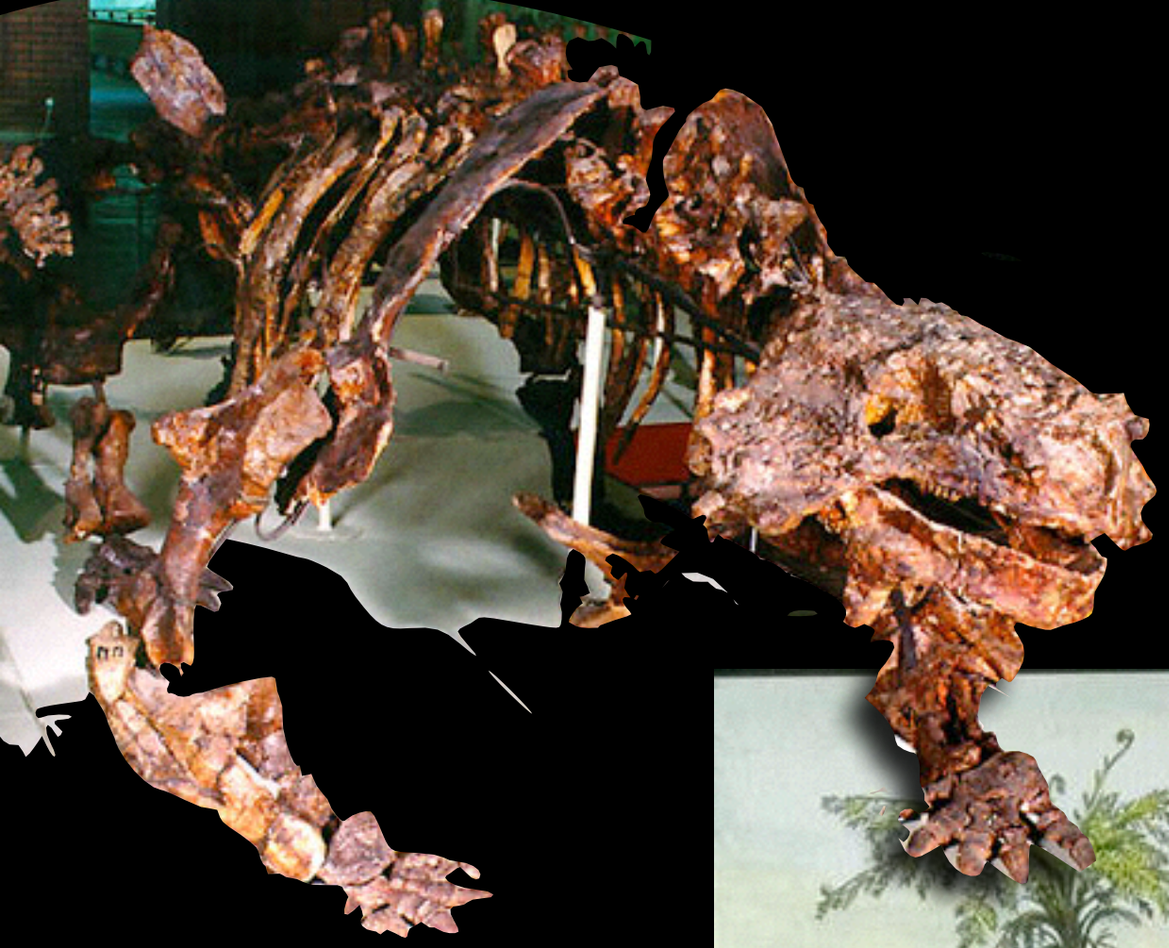
Eureptilia

Amniotes

Anapsids

-Late Permian

Pareiasaurs



Scutosaurus