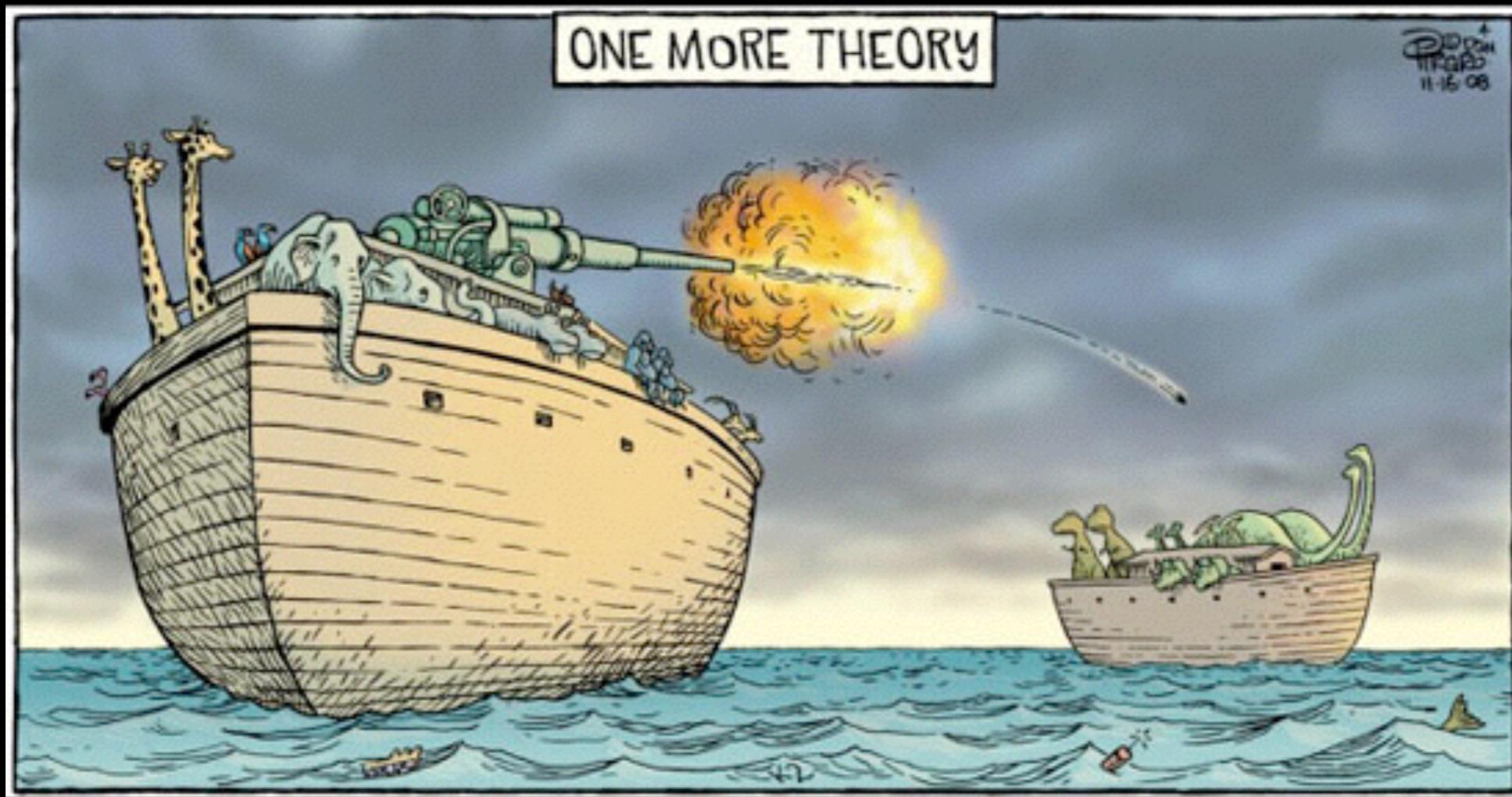


**THIS IS...**

**NO.**

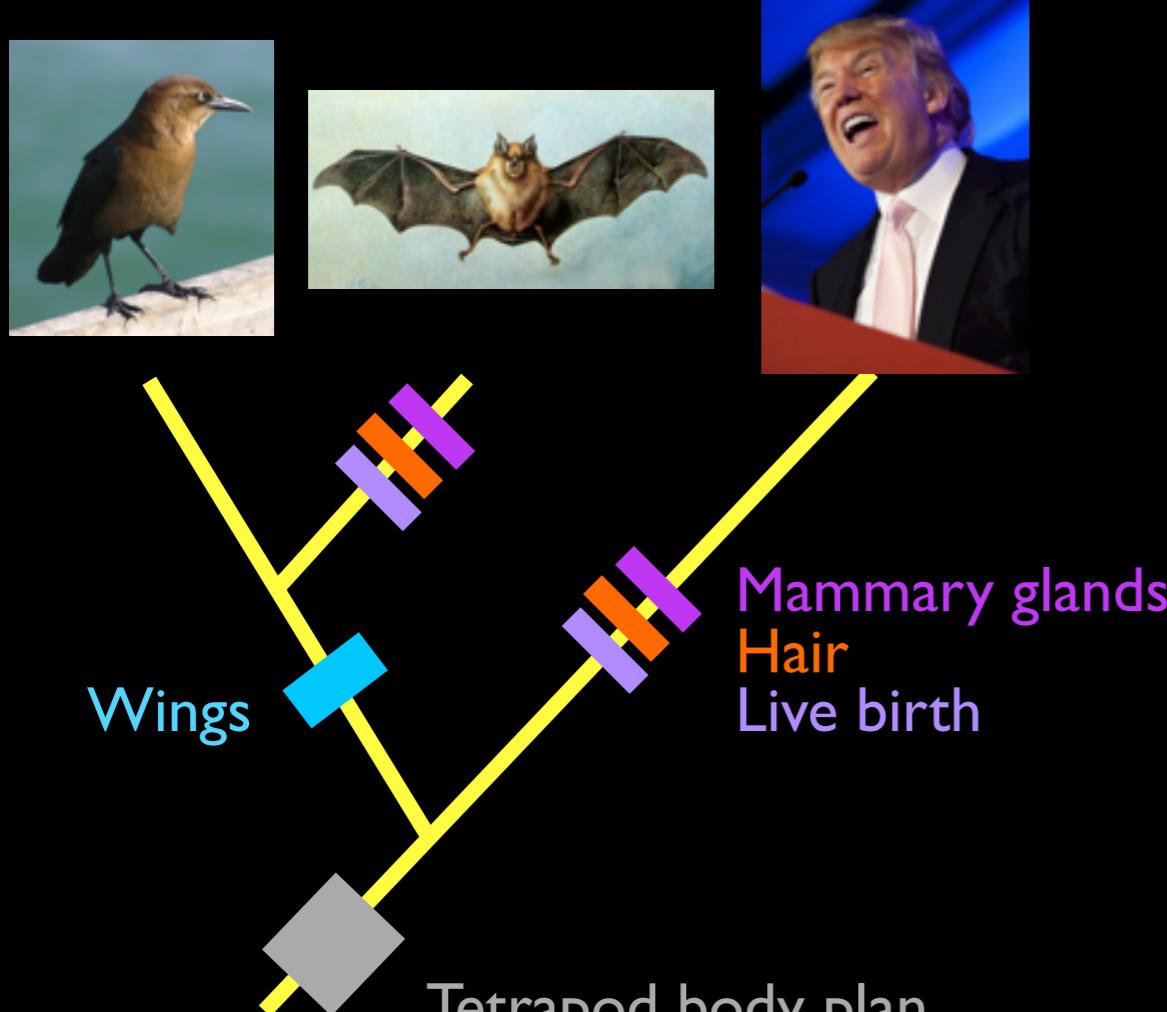




Change to syllabus: Bobby office hours:  
MW 10-11  
Alcove near SEI 288

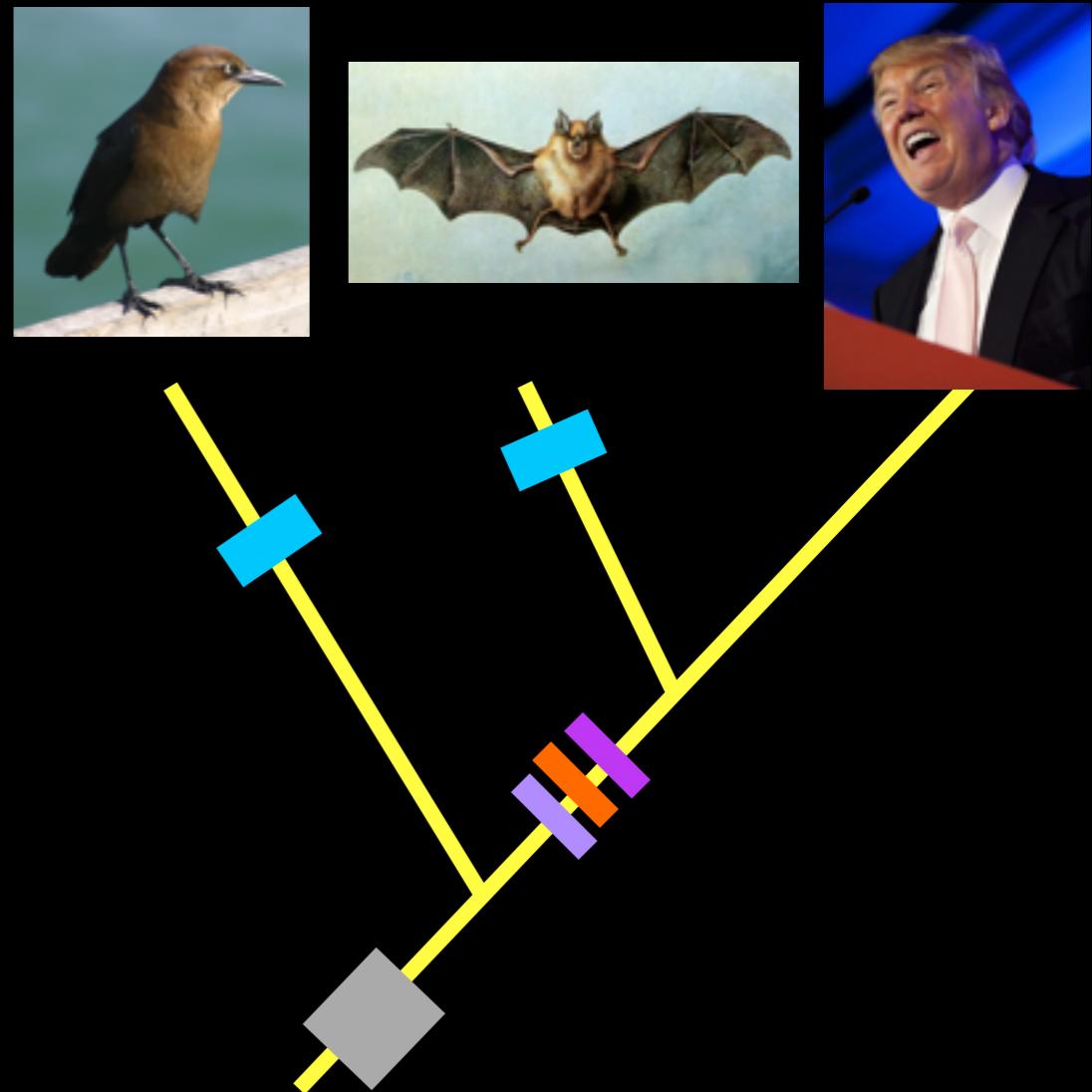
# Parsimony

Most parsimonious



7 evolutionary events

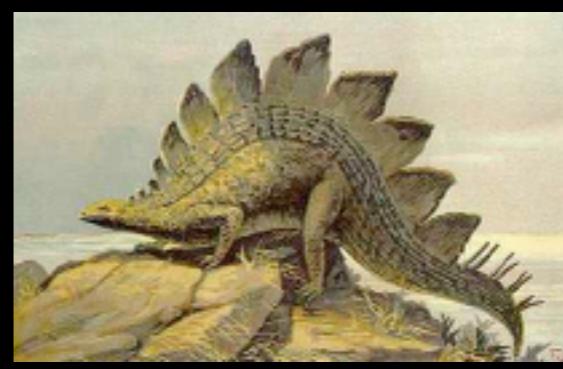
VS.



5 evolutionary events

Okay, now put these animals and characters on a PARSIMONIOUS cladogram

## Species



Bird

Bear

Shark

Stegosaurus

Deinonychus

## Characters

‘Bird-Hip’/  
Ornithischian condition

Loss of Teeth

Vertebral Column

Tetrapod body plan

# The Answer



Stegosaurus

Bird

Deinonychus

Bear

Shark

Loss of Teeth

'Bird-Hip'/  
Ornithischian condition

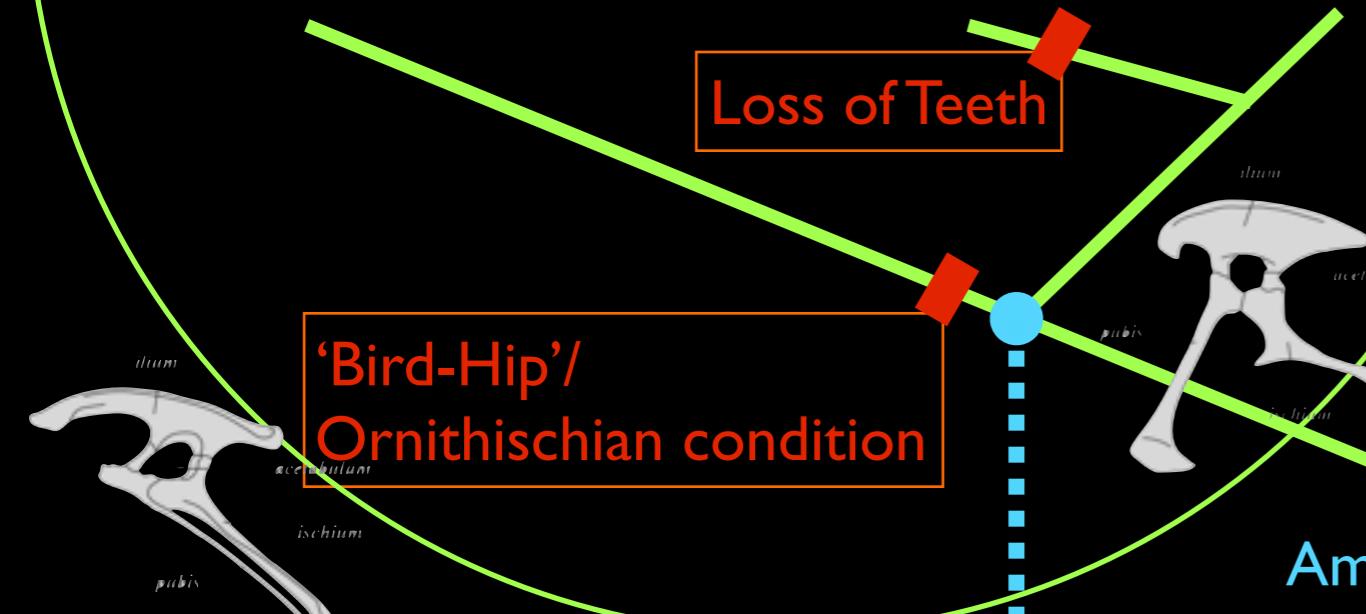
Tetrapod body plan

Vertebral Column

Amniota

Vertebrata

DINOSAURIA



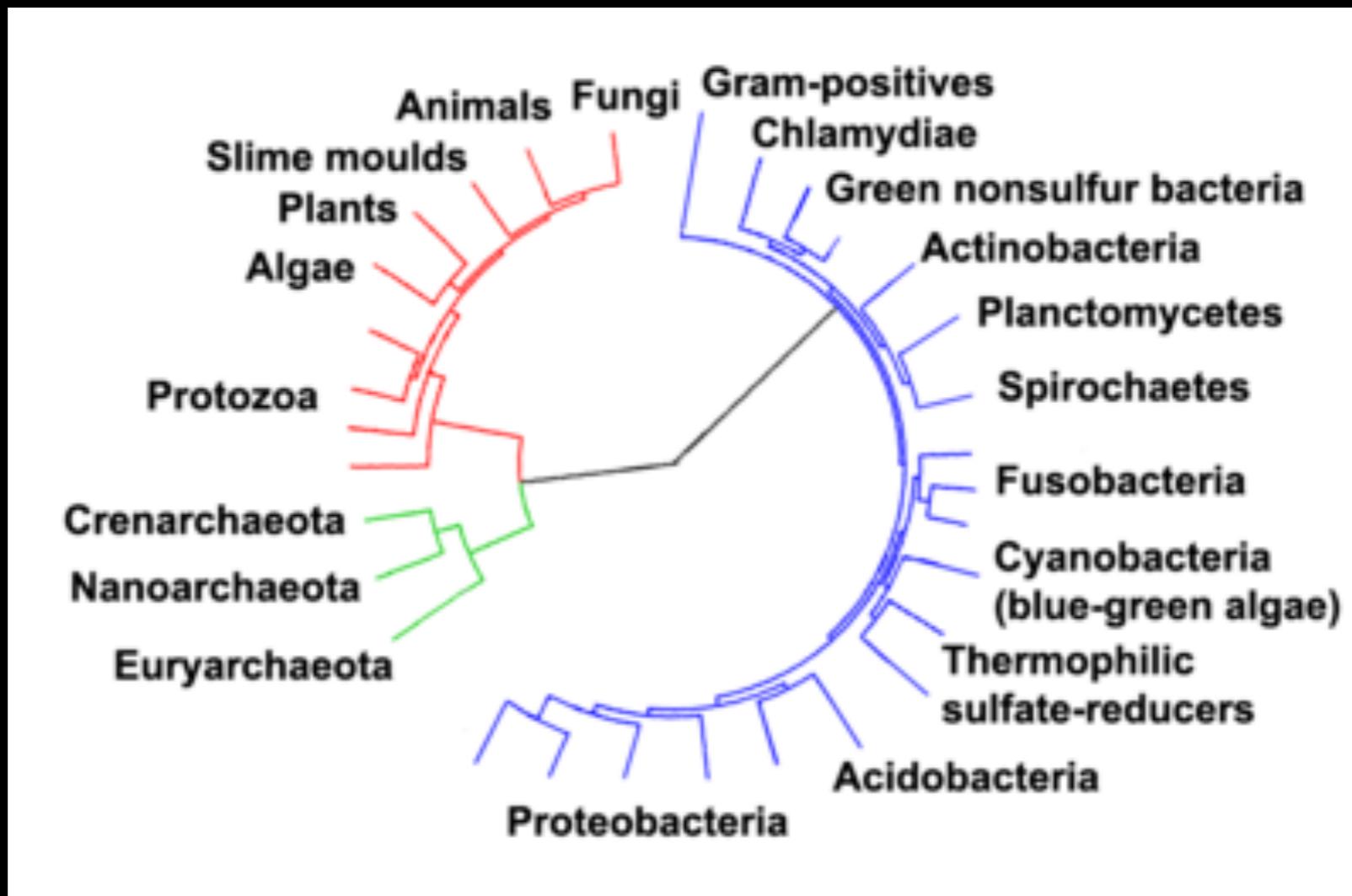
# History of Life Part I.

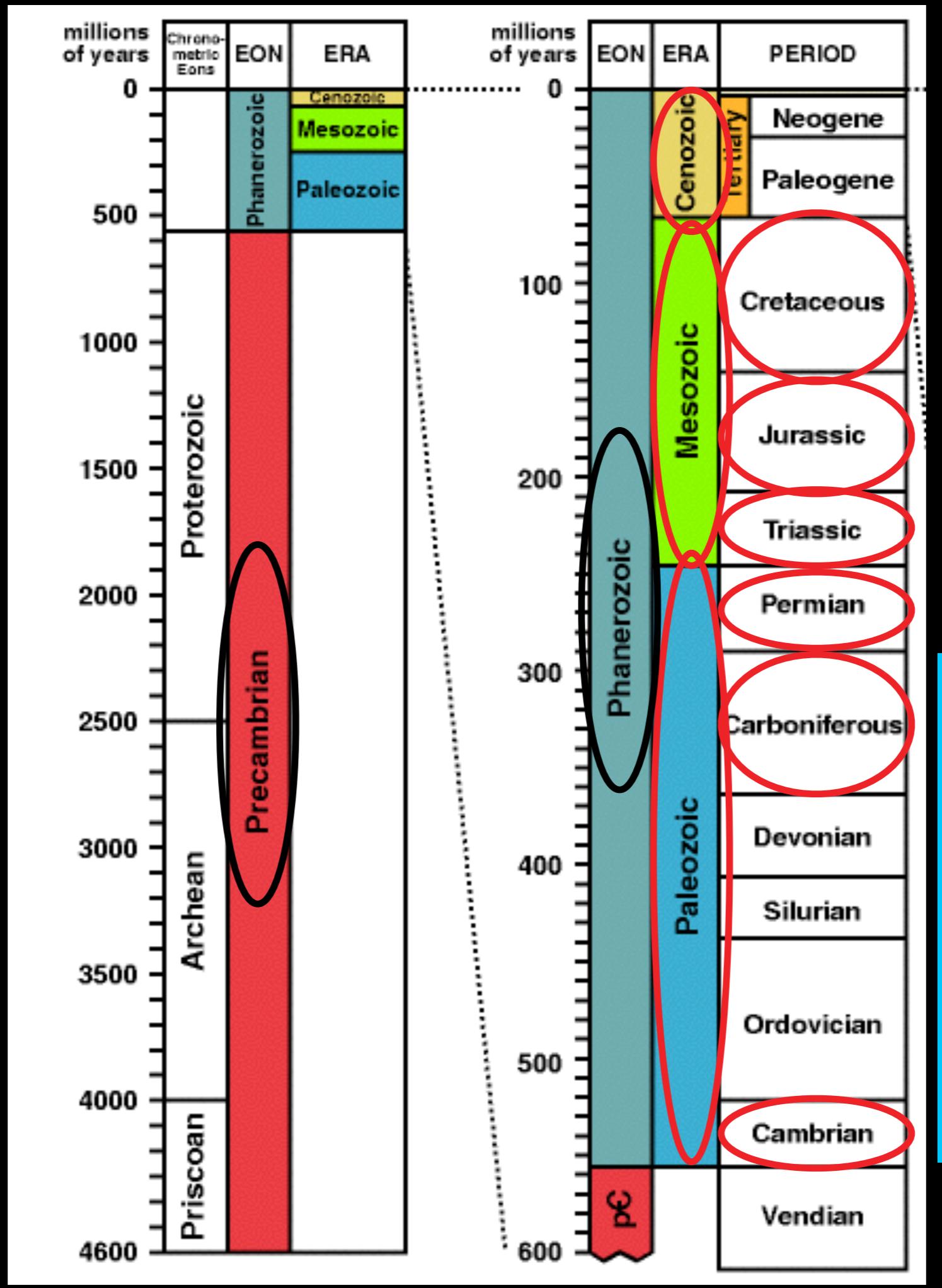


*Diadectes*  
Early Permian

# Life on Earth: united by RNA, DNA, amino acids, metabolic pathways

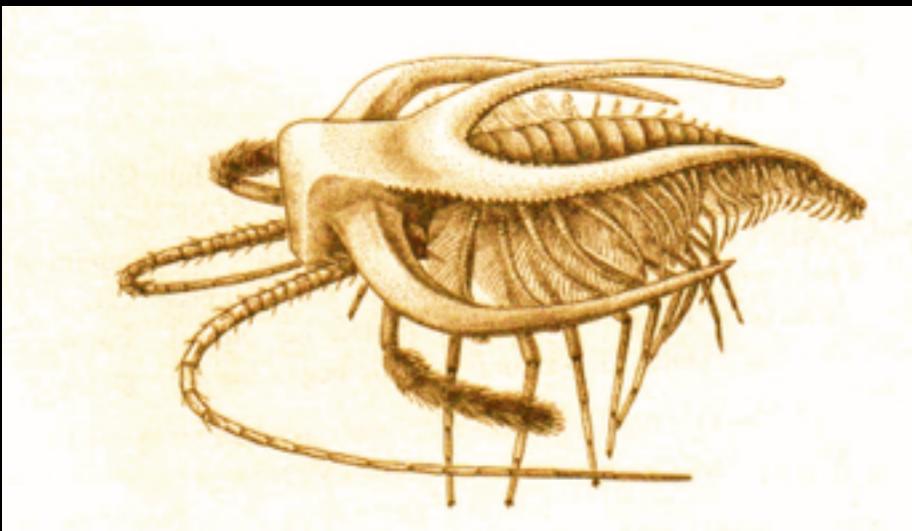
3.8 Ga





# Cambrian ‘Explosion’

ca. 520-510 Ma



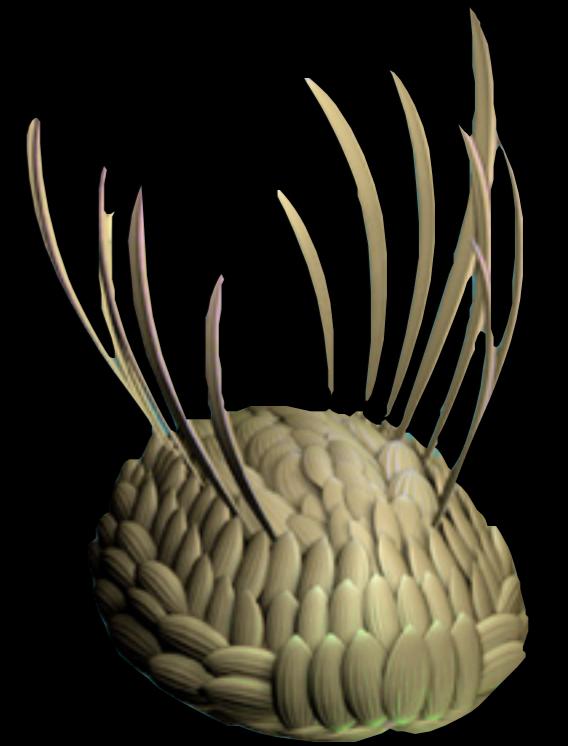
*Marrella*



*Opabinia*



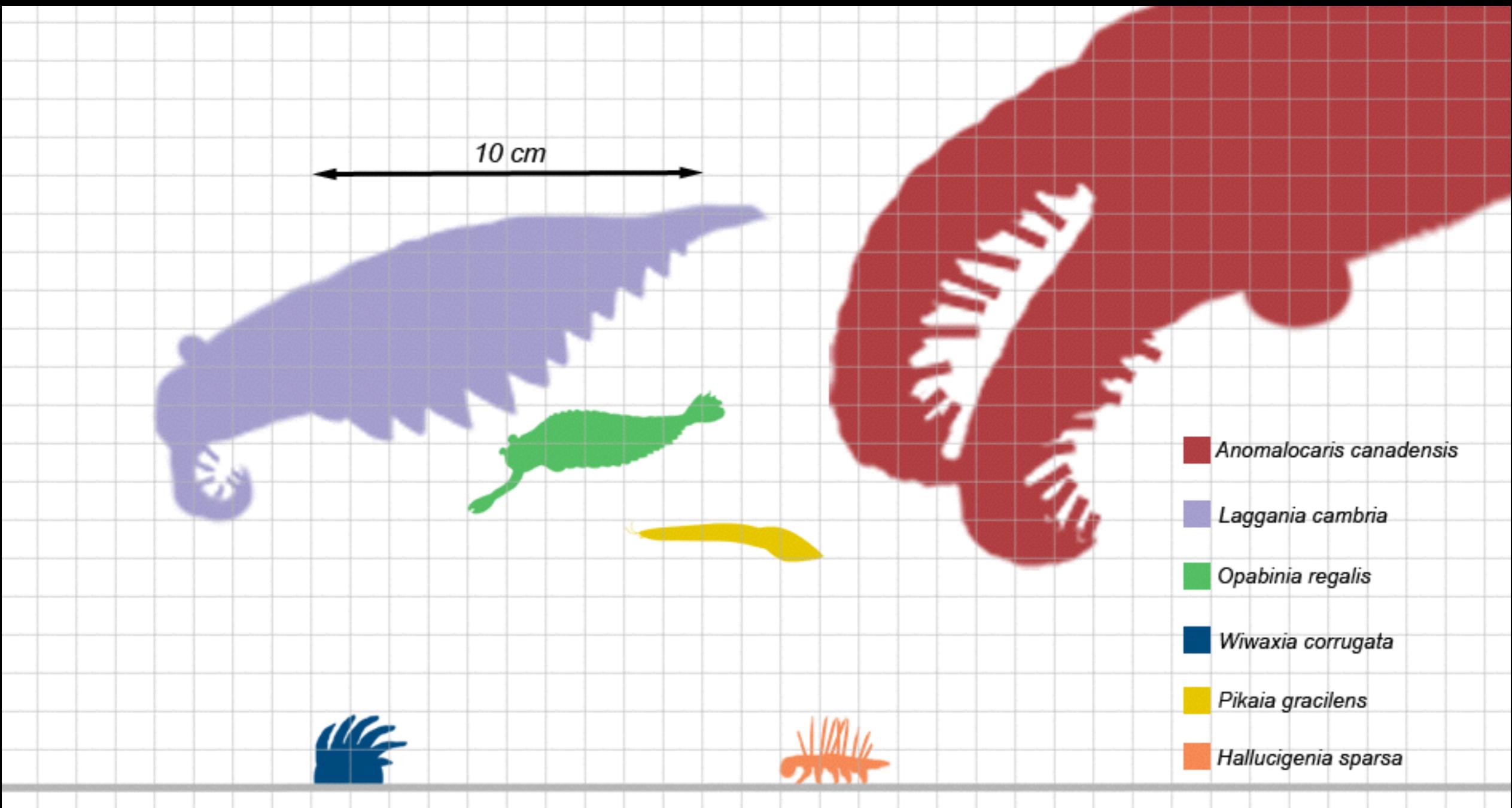
*Hallucinogenia*



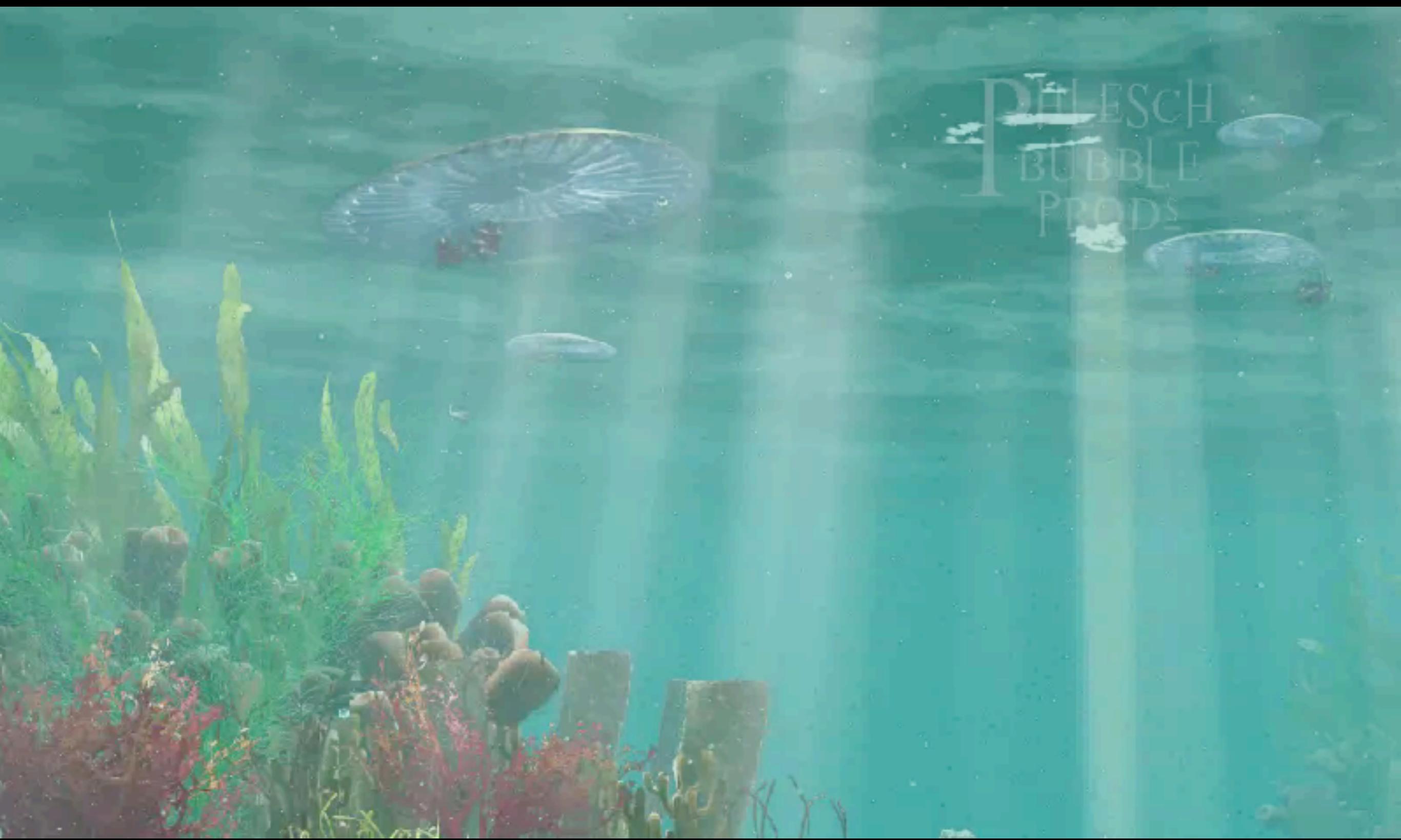
*Wiwaxia*



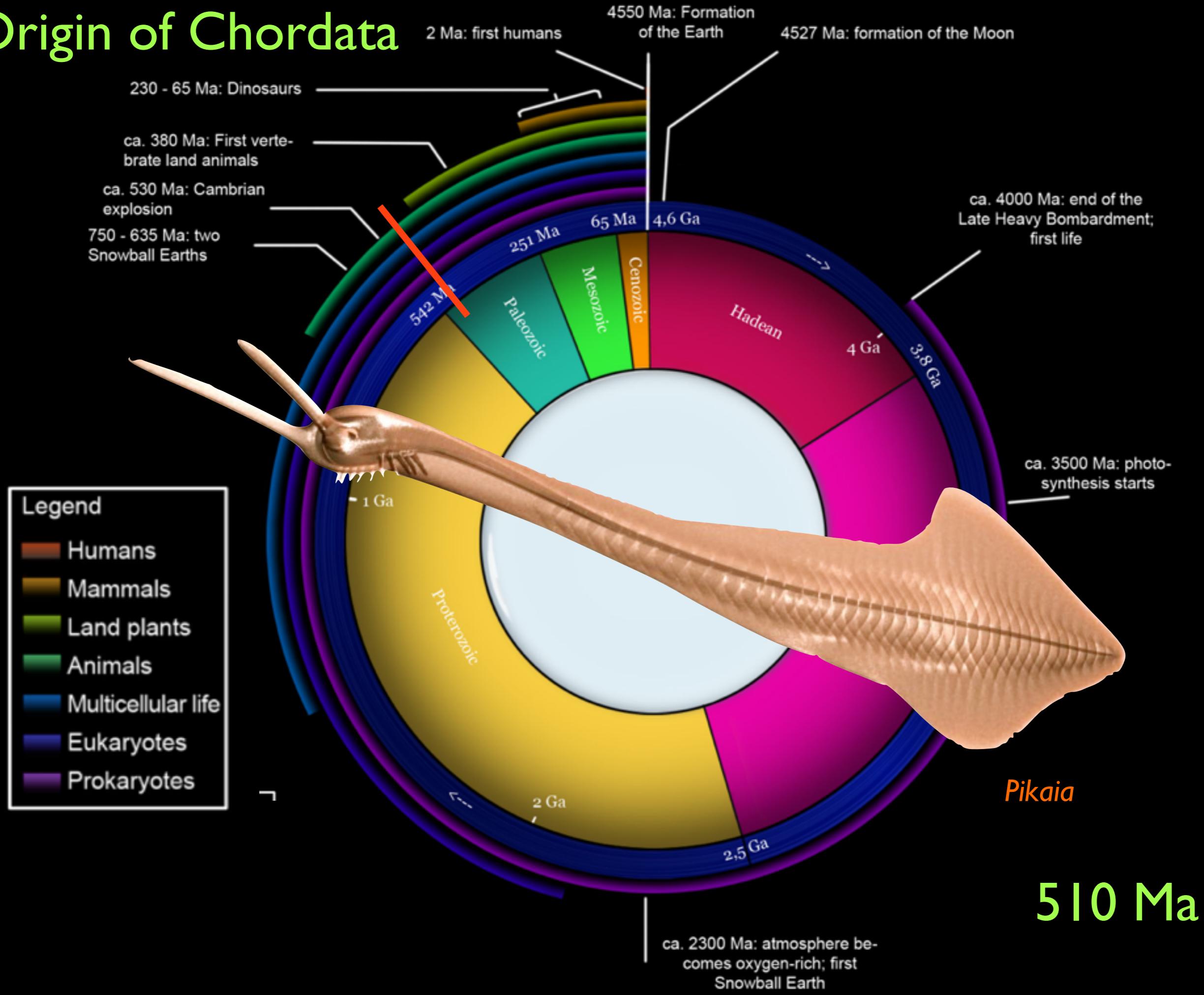
*Anomalocarids*

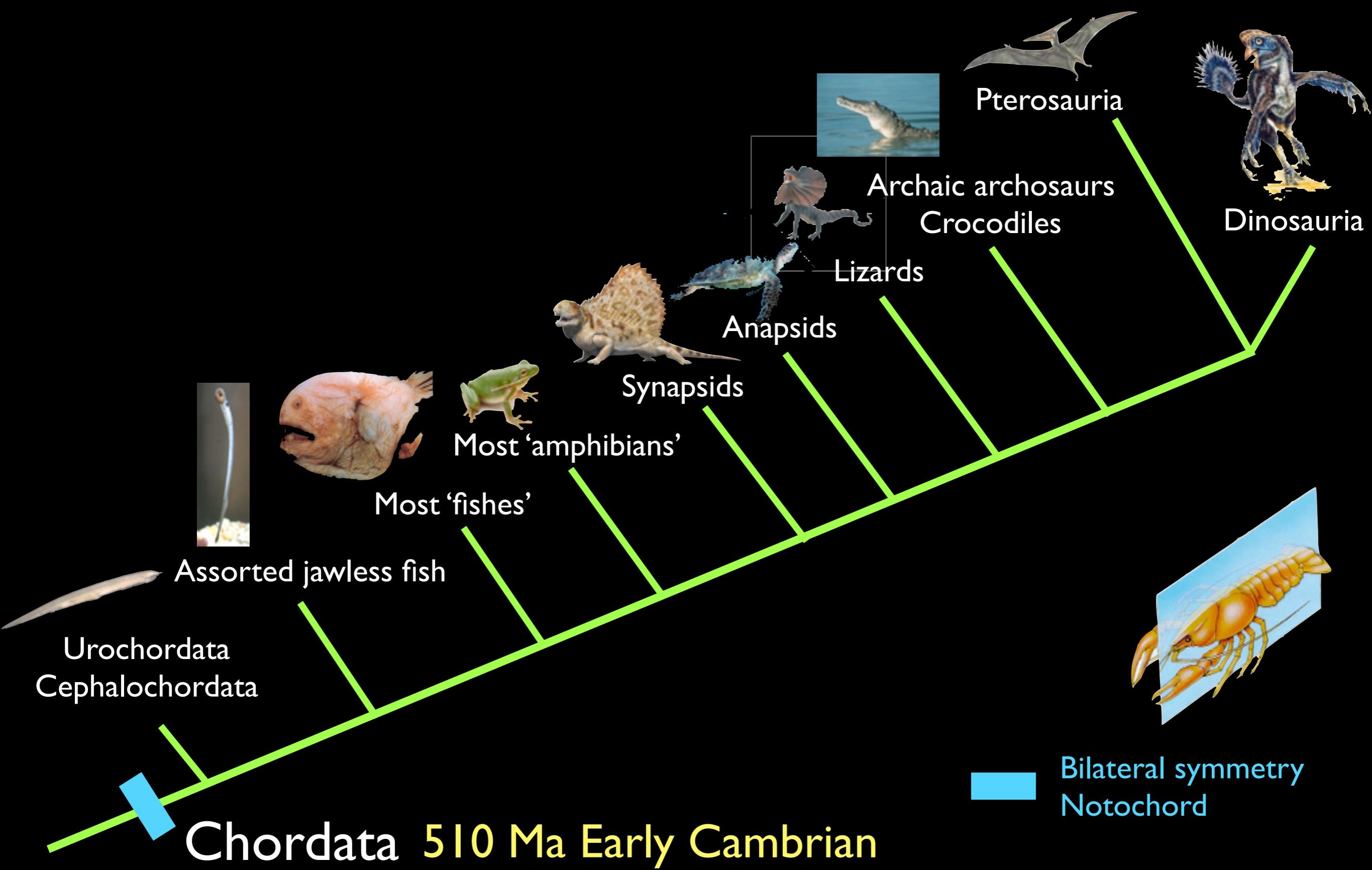


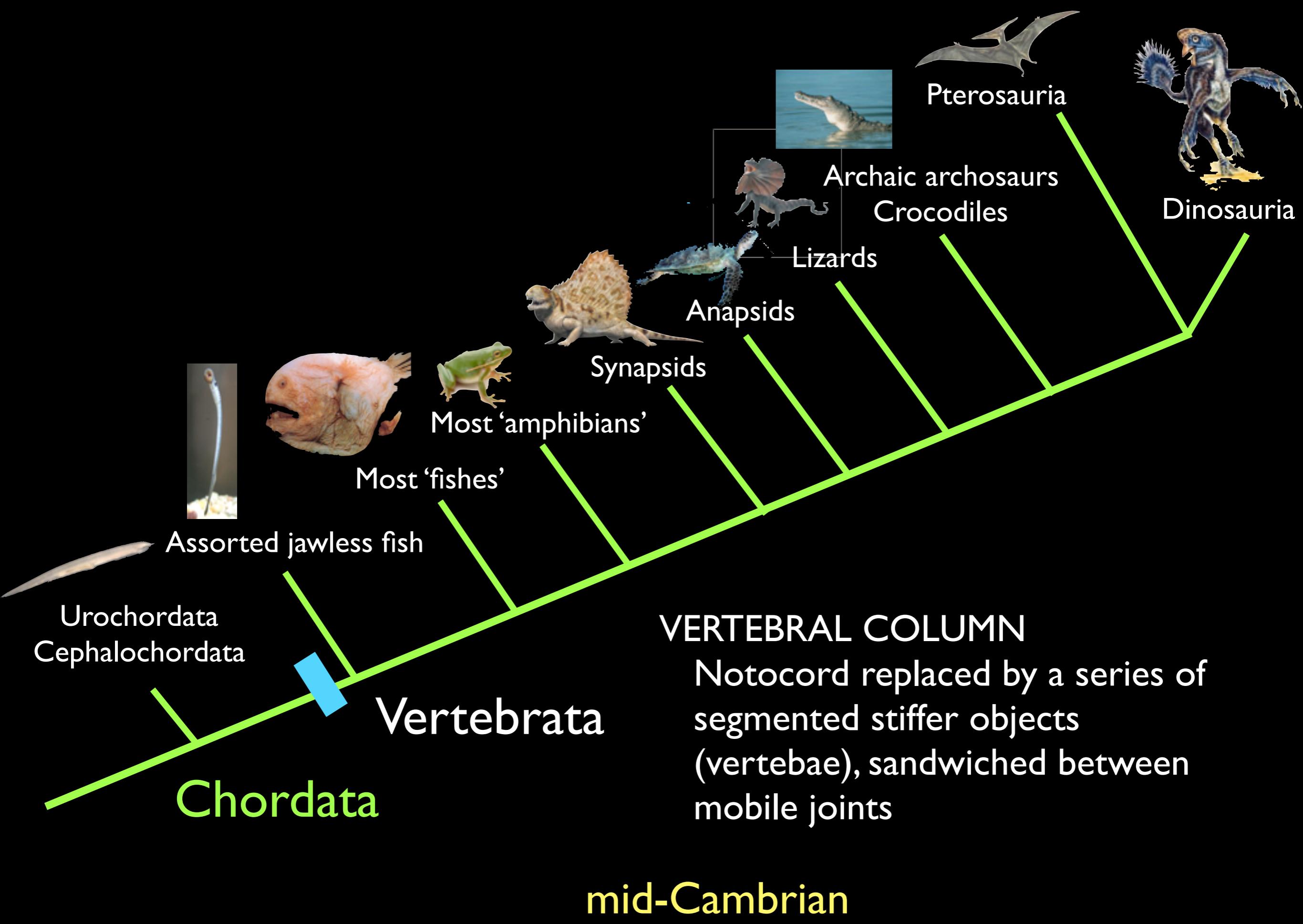
# The Cambrian Sea

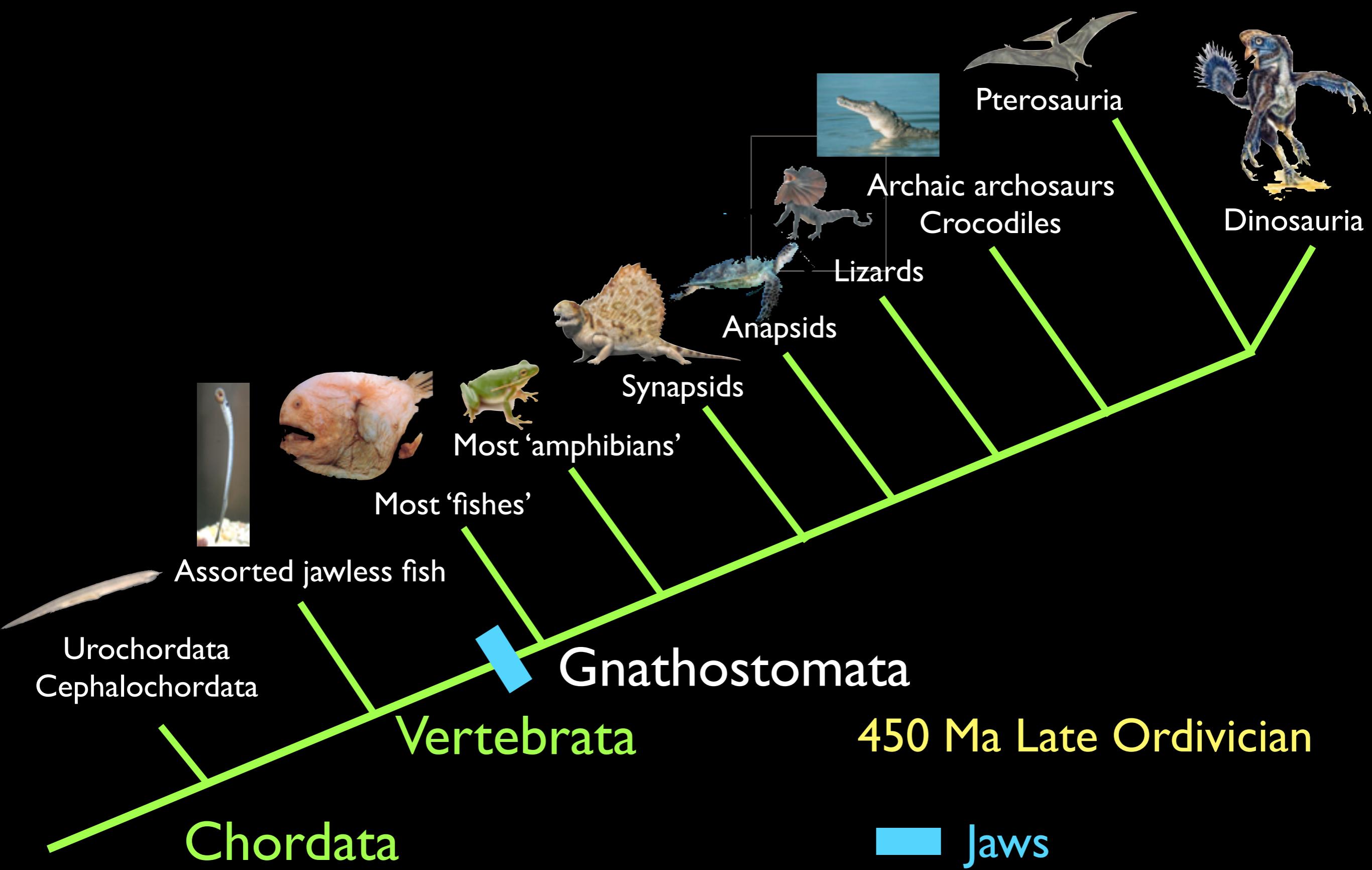


# Origin of Chordata



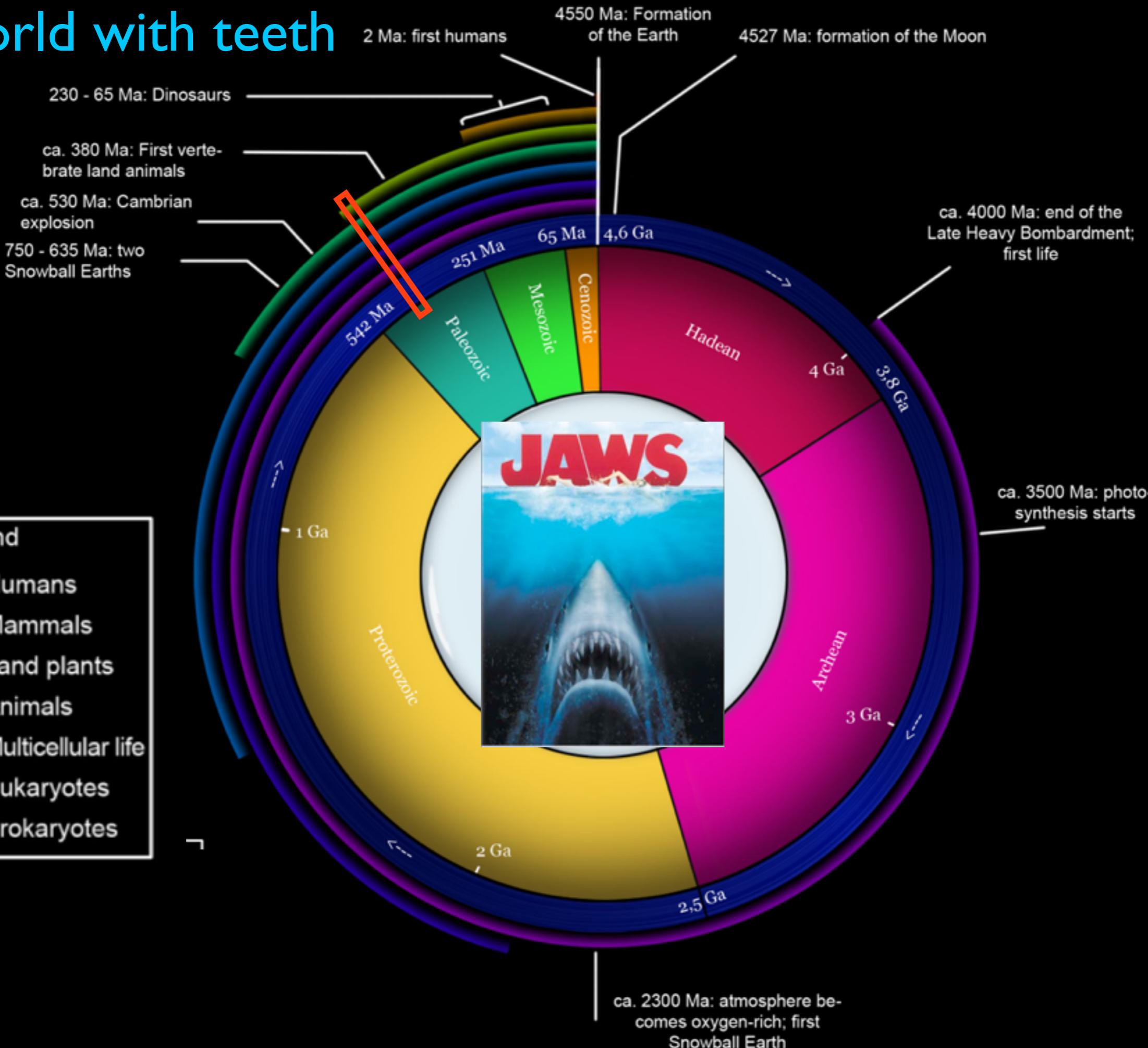


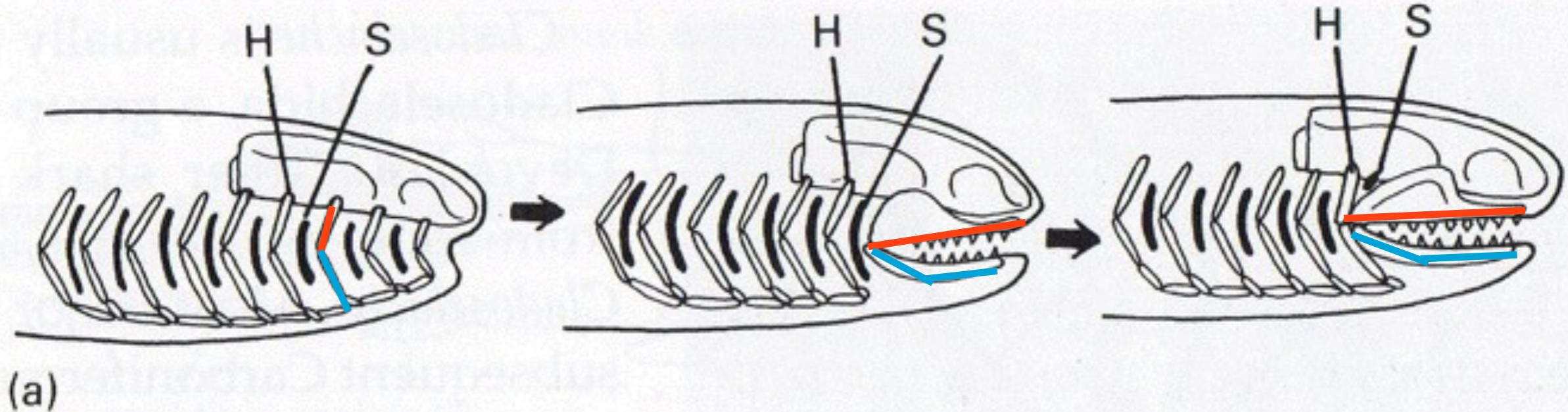




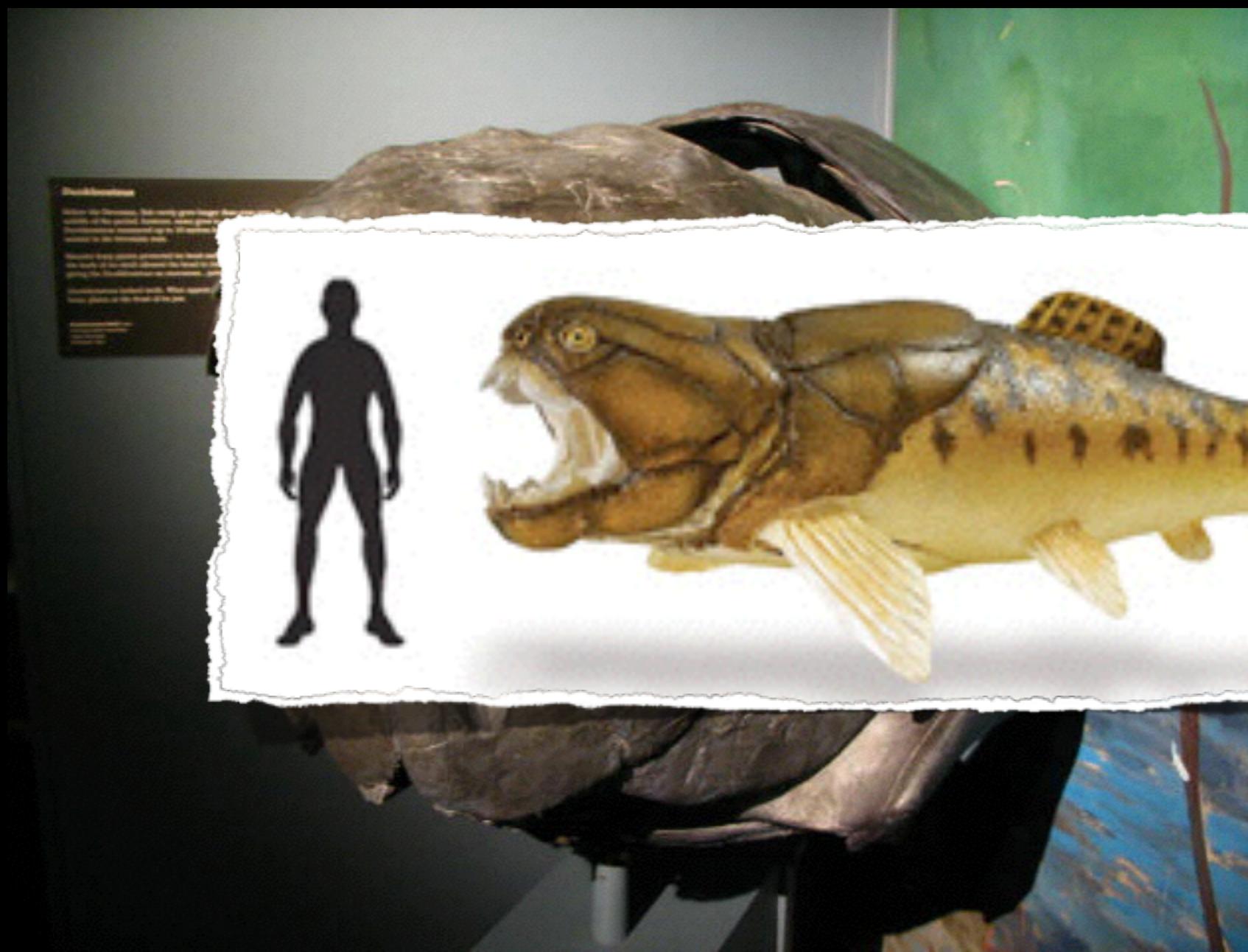
# A world with teeth

Legend	
Humans	
Mammals	
Land plants	
Animals	
Multicellular life	
Eukaryotes	
Prokaryotes	

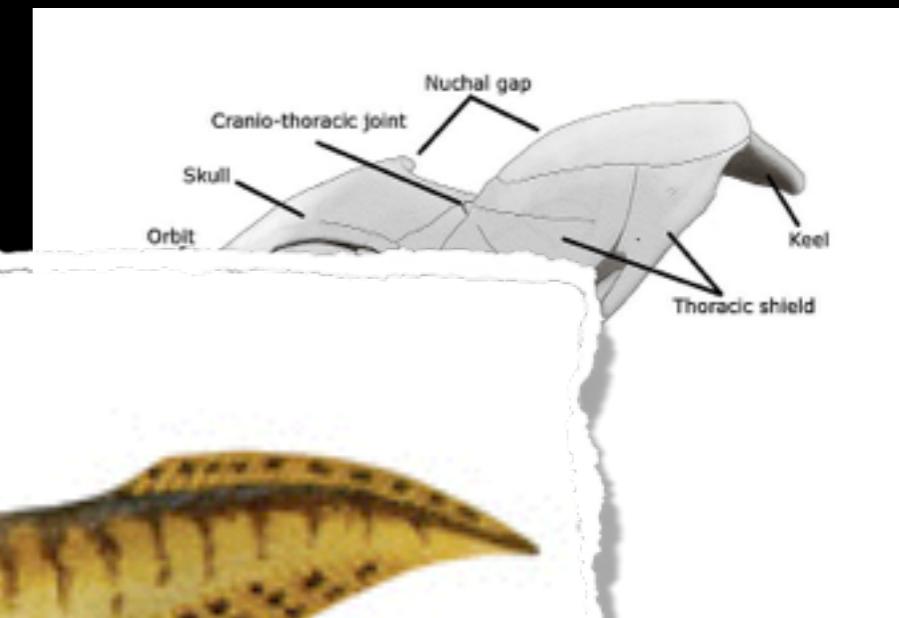




## Evolution of the Jaw



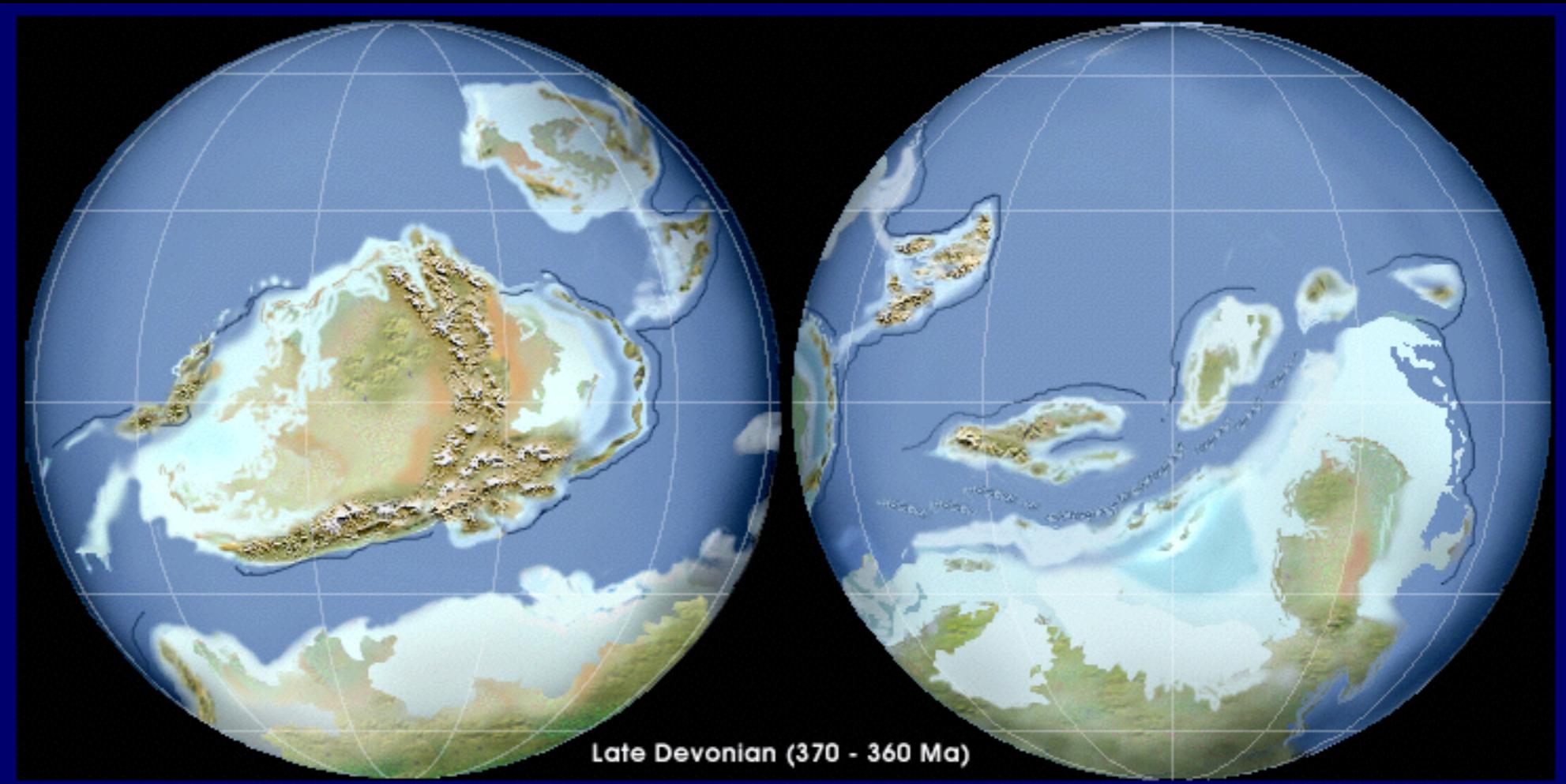
*Dunkleosteus*  
Late Devonian  
(Just before the Carboniferous)



Selective pressures?  
Apex predator  
Unhealed bite marks on some specimens  
Other Dunkleosteus

# The Origin of Tetrapoda



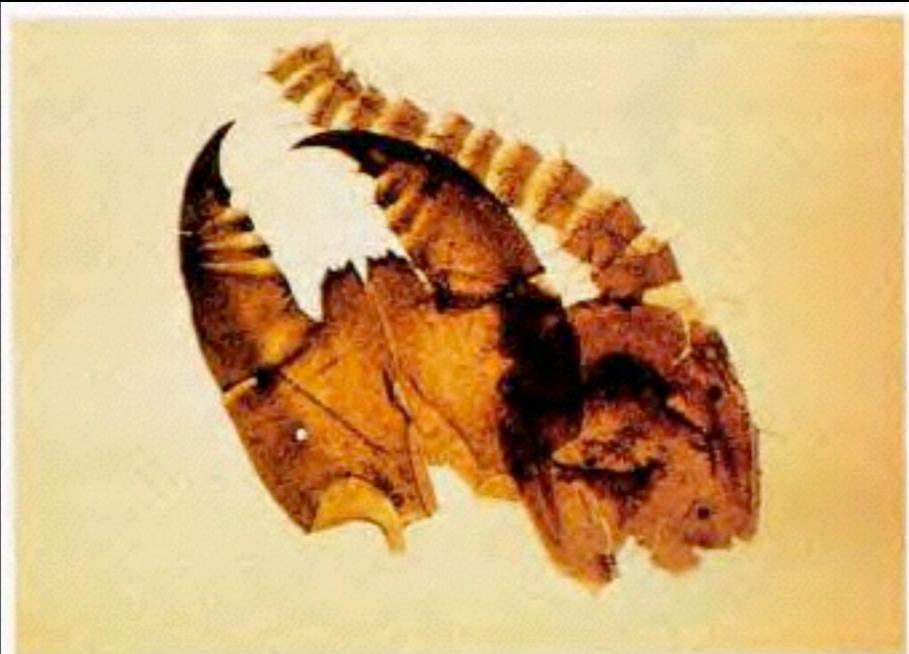


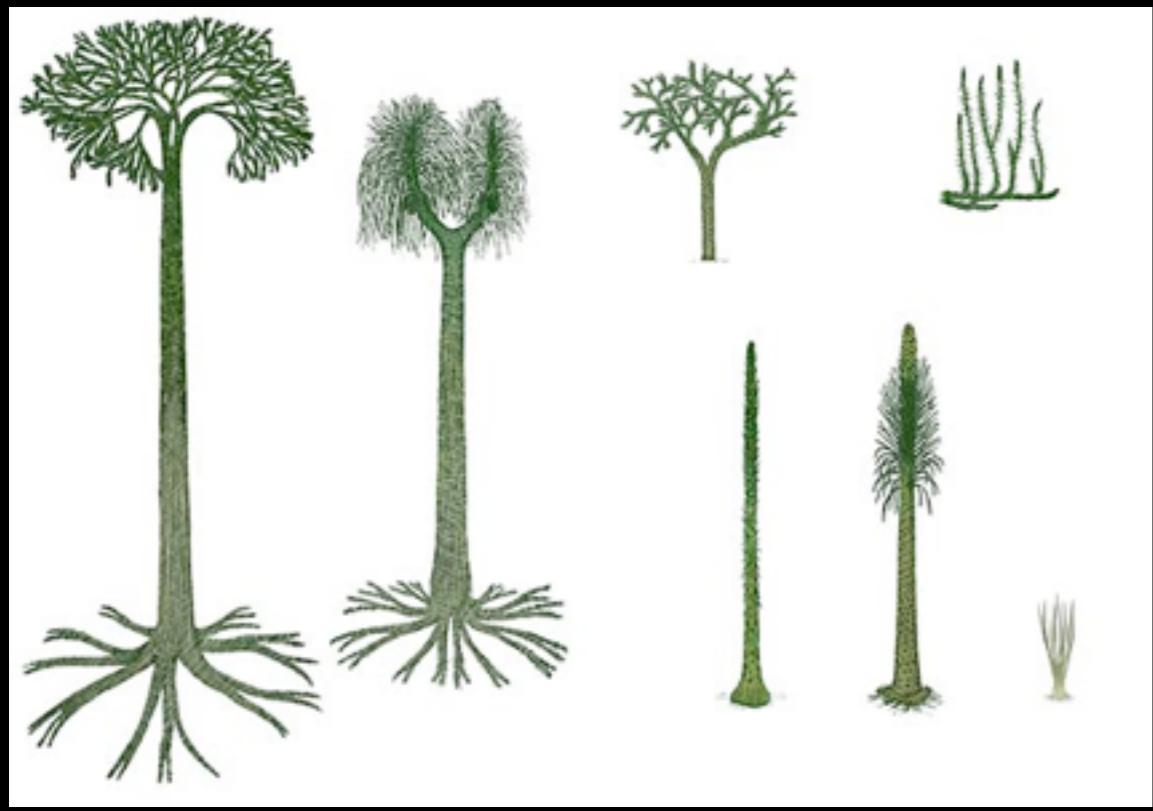


Monotypic riverside stands



Diverse arthropod  
communities





Lycopsids



*Asteroxylon*

On land, rhizomatous plants begin colonizing stream and lake banks



"Devonian canopy"

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<http://www.arcadiastreet.com>

*Archaeopteris* canopy (progymnosperm)

# What's so interesting about the Devonian?



Modern Ecosystems



Rare top predators



Few meso-predators

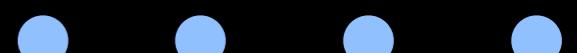


Many herbivores

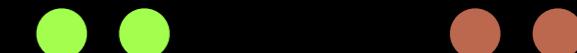


Devonian Ecosystems

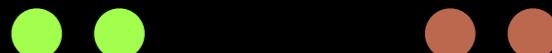
Abundant top predators



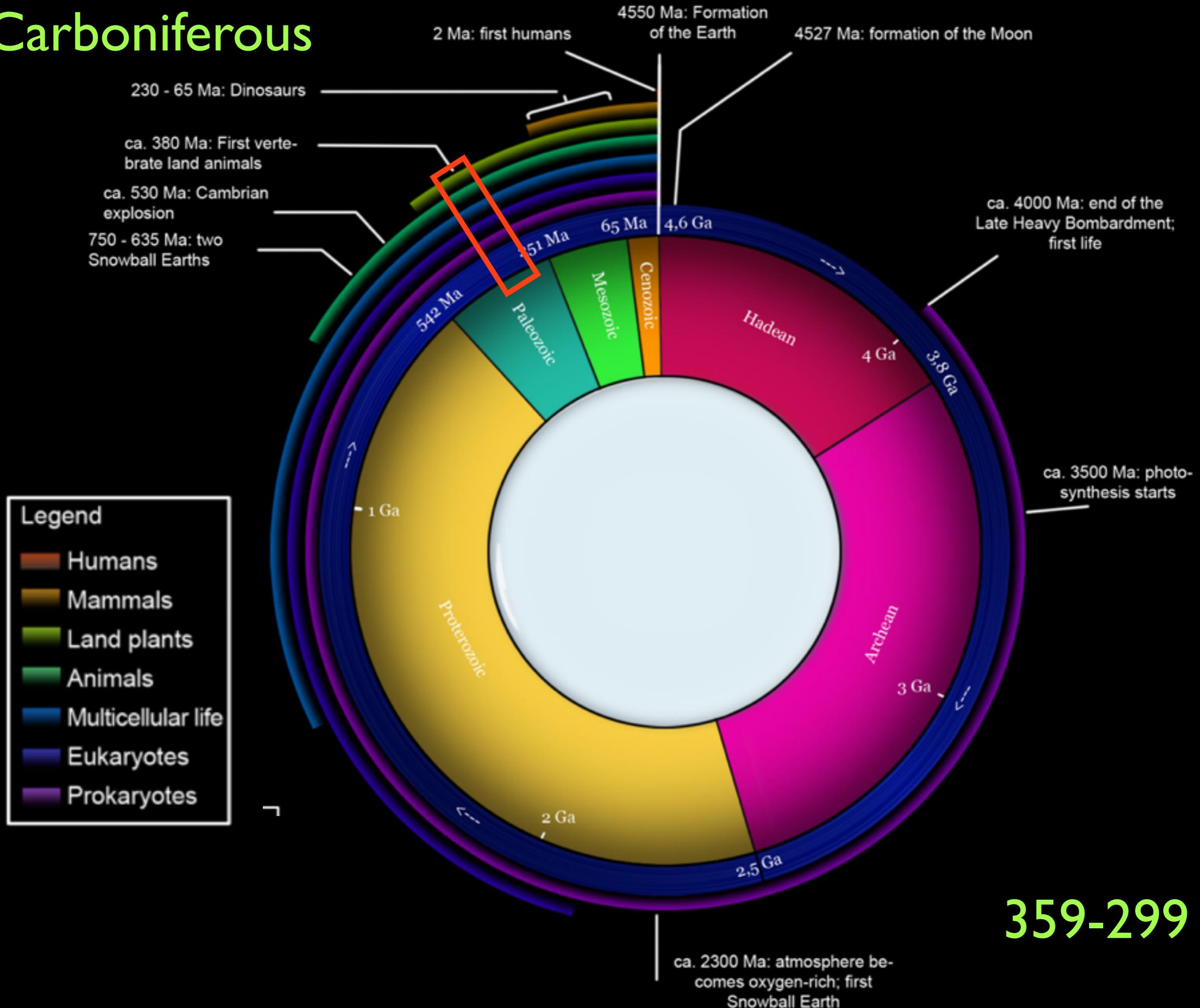
Abundant meso-predators



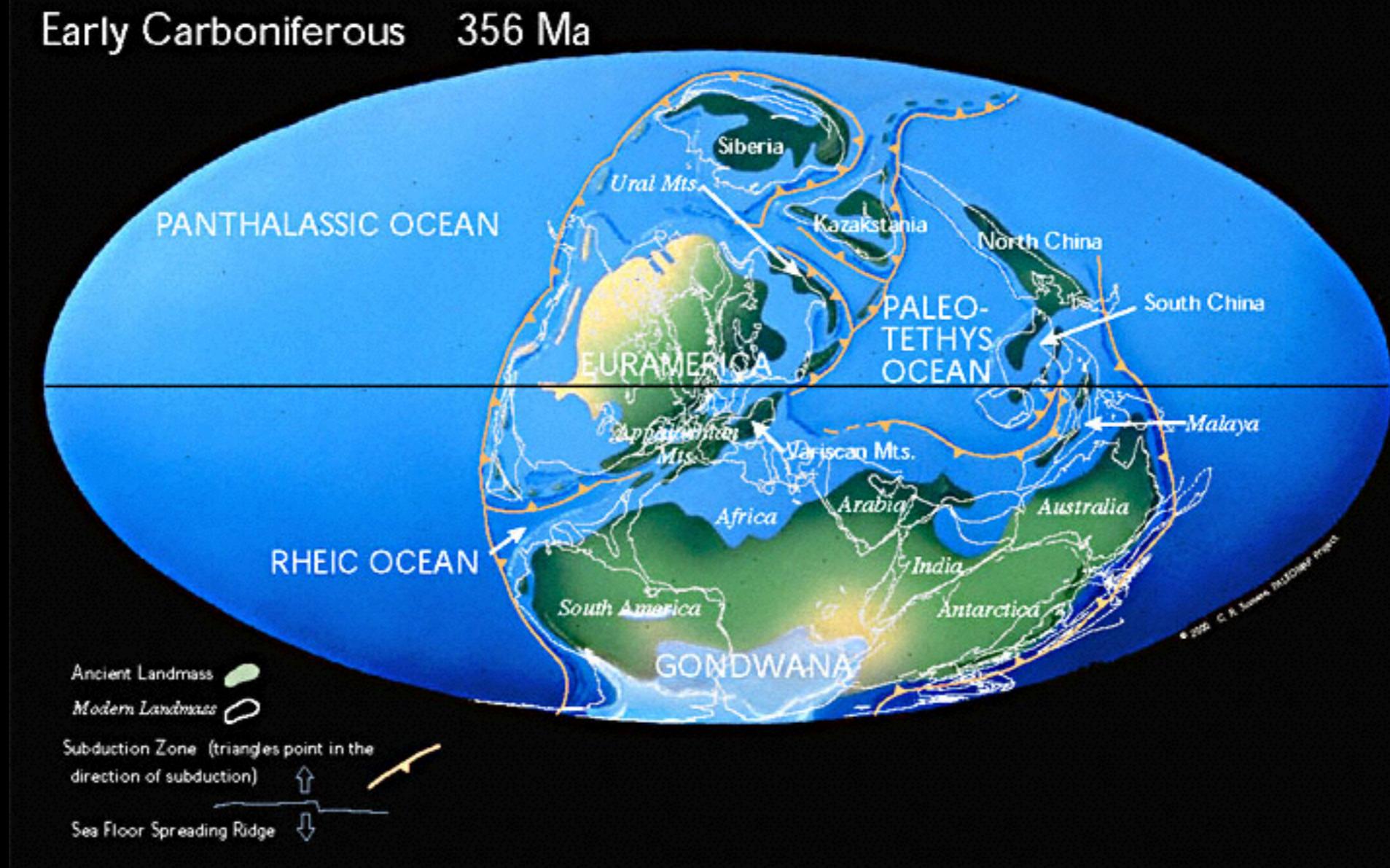
Rare herbivores Detritivores



# Carboniferous



Early Carboniferous 356 Ma





The Carboniferous  
High temperatures  
High humidity  
High O<sub>2</sub>  
Low CO<sub>2</sub>



Enourmous Lepidodendron forests



Meganeura: 75 cm wingspan



[O<sub>2</sub>]<sub>atm</sub> = 35%



Carboniferous swamps:  
Refugia for older plant forms

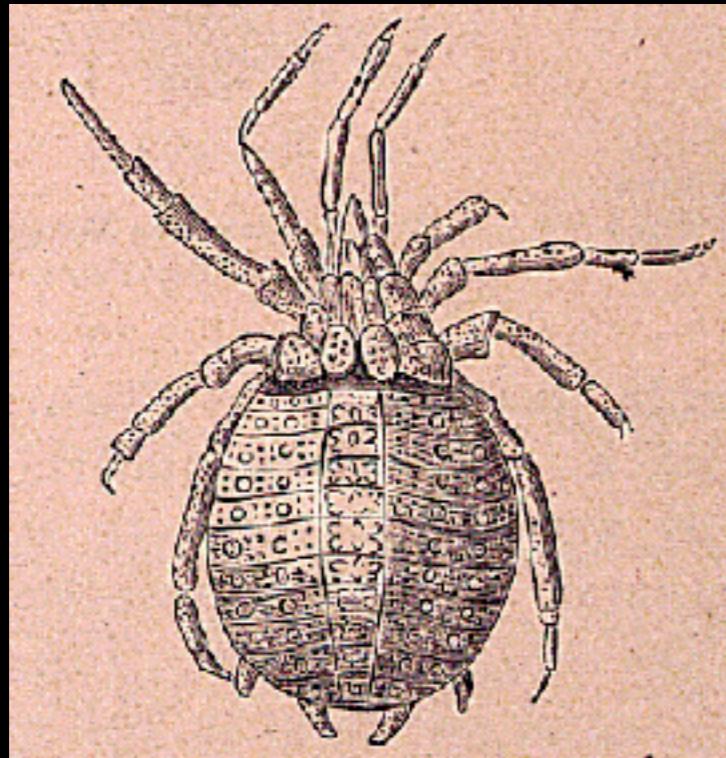


Open 'Niches'

Carboniferous drylands:  
Sites of evolutionary innovation  
i.e. seed-producing plants



*Pteridosperms*



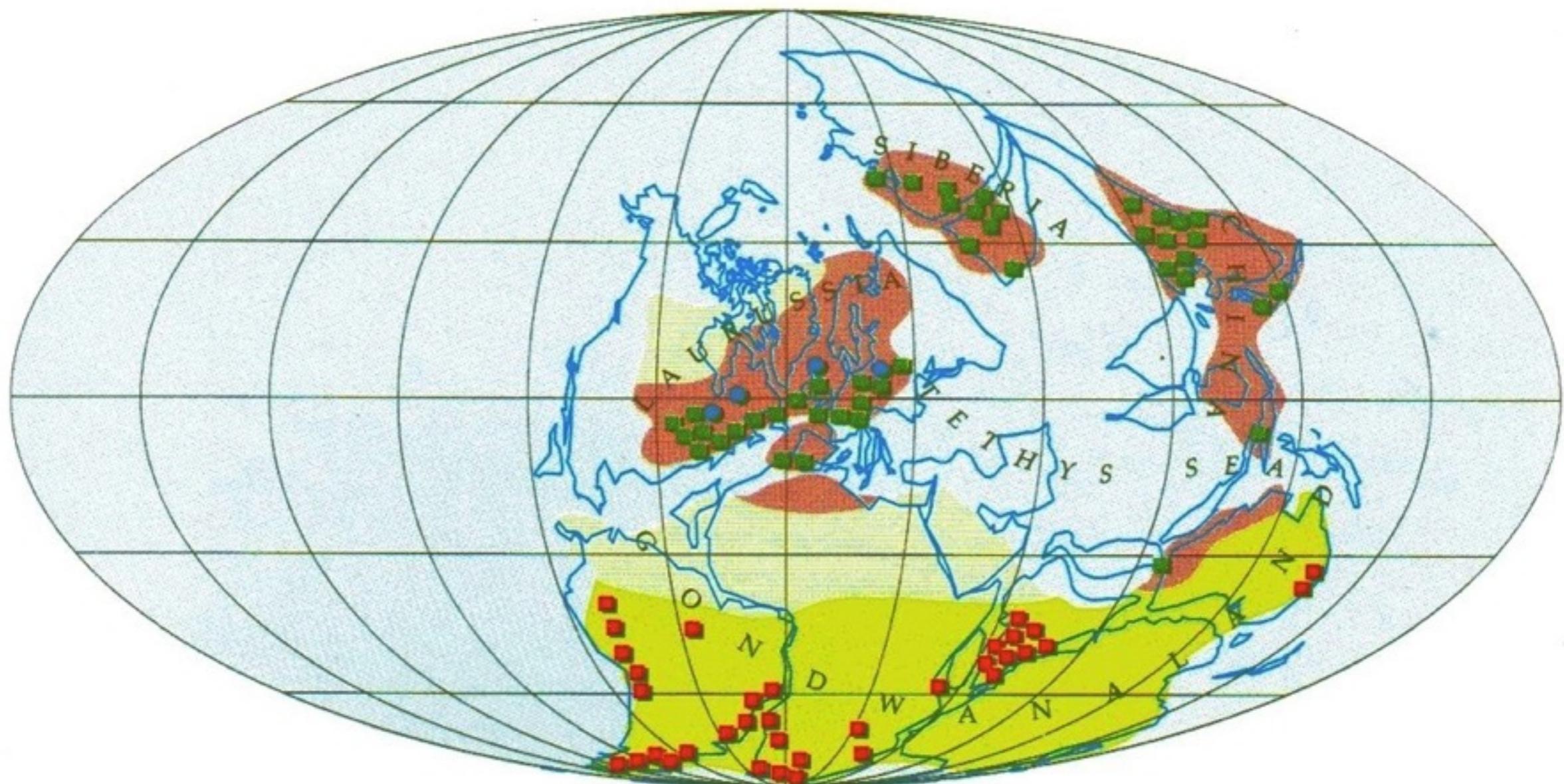
Evolution of hard seeds suggests that herbivorous arthropods became a major selective factor on plants, even without a good fossil record of herbivorous arthropods

(the first herbivorous vertebrate doesn't show up until the early Permian: *Diadectes*)

- Tillites (glacial deposits)
- Coal deposits
- Vertebrate fossil sites

- Humid conditions
- Glaciated cold
- Arid desert

*America and Europe), and Siberia. The two northern continents combined to create Laurasia.*



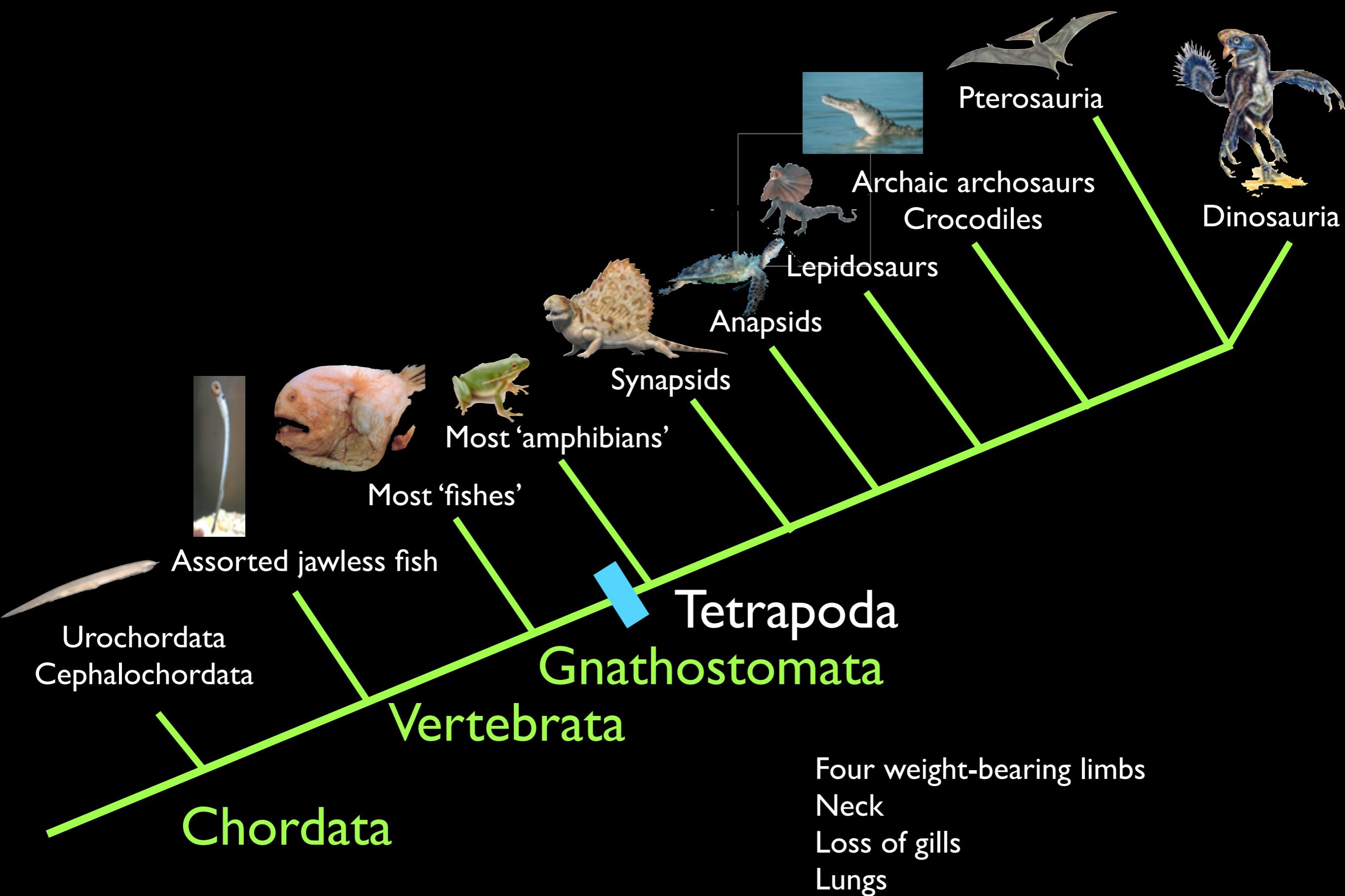
# The Carboniferous:Tetrapod Expansion



"Carboniferous forest"

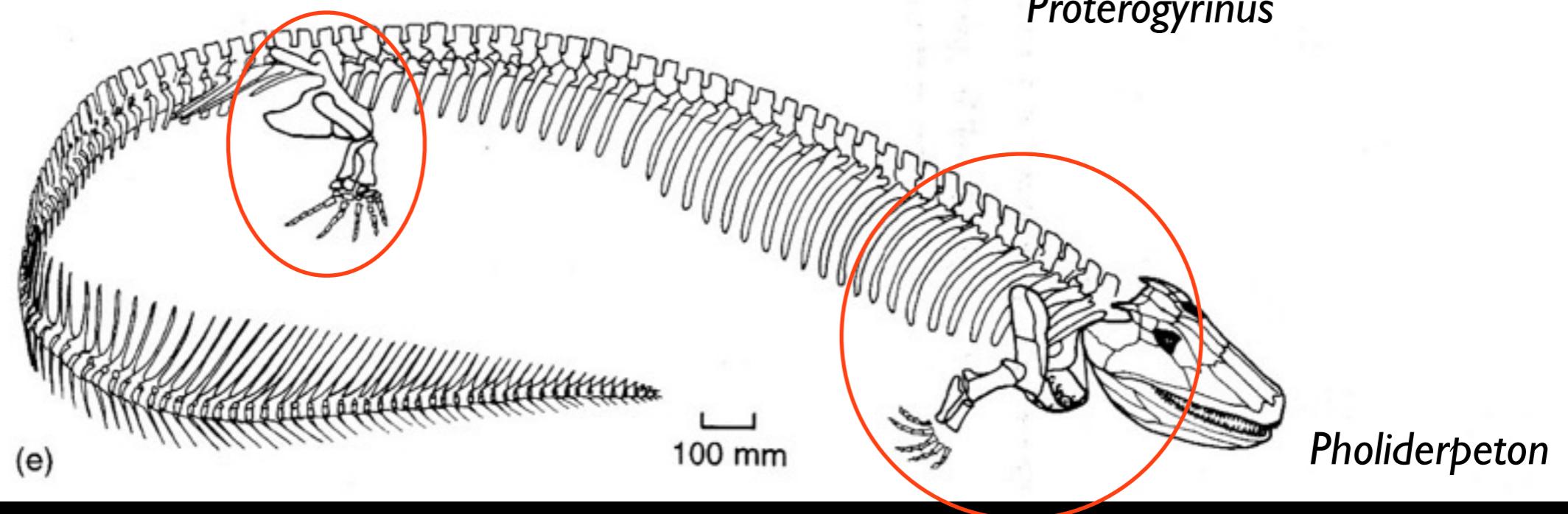
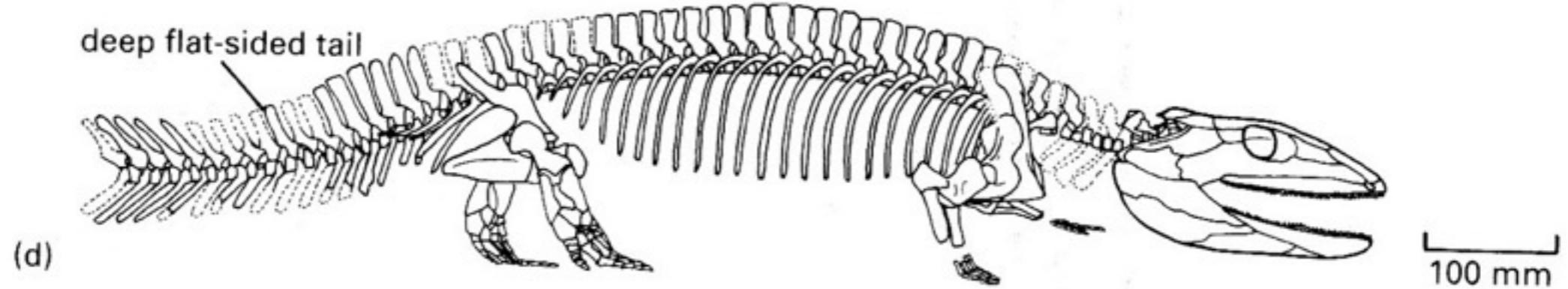
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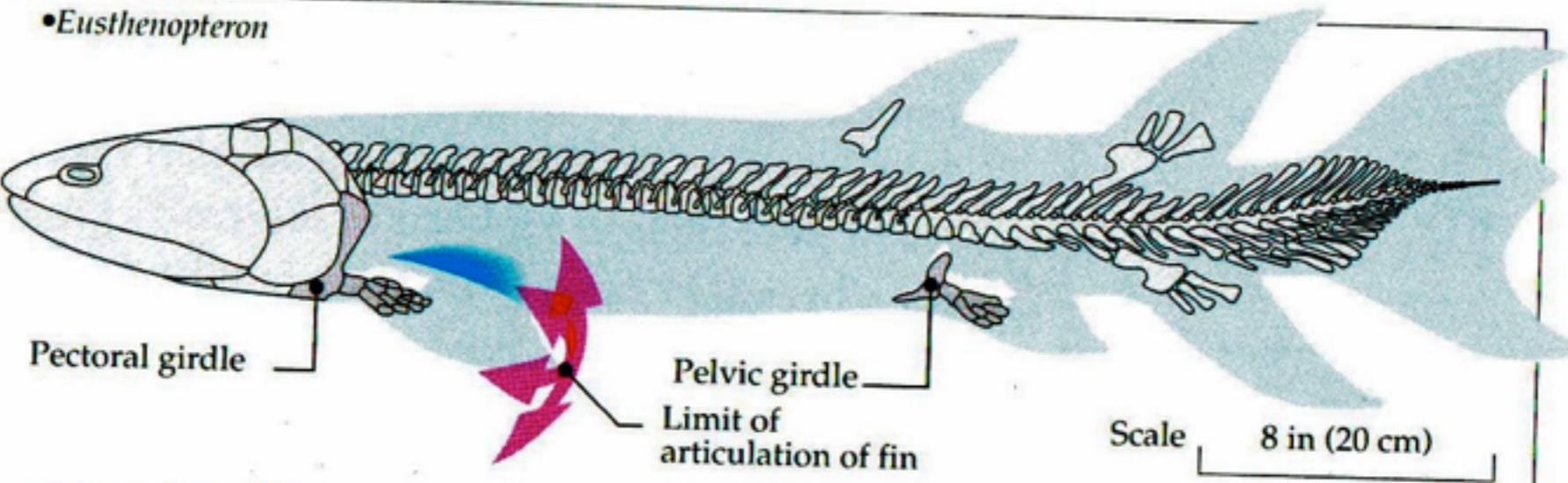


# The Basal Tetrapods

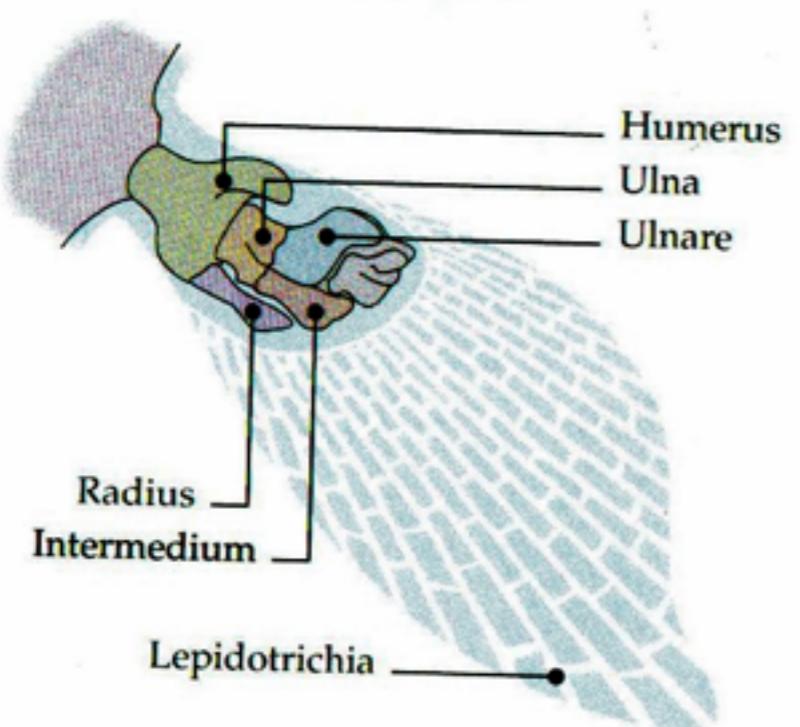
Early Anthracosaur



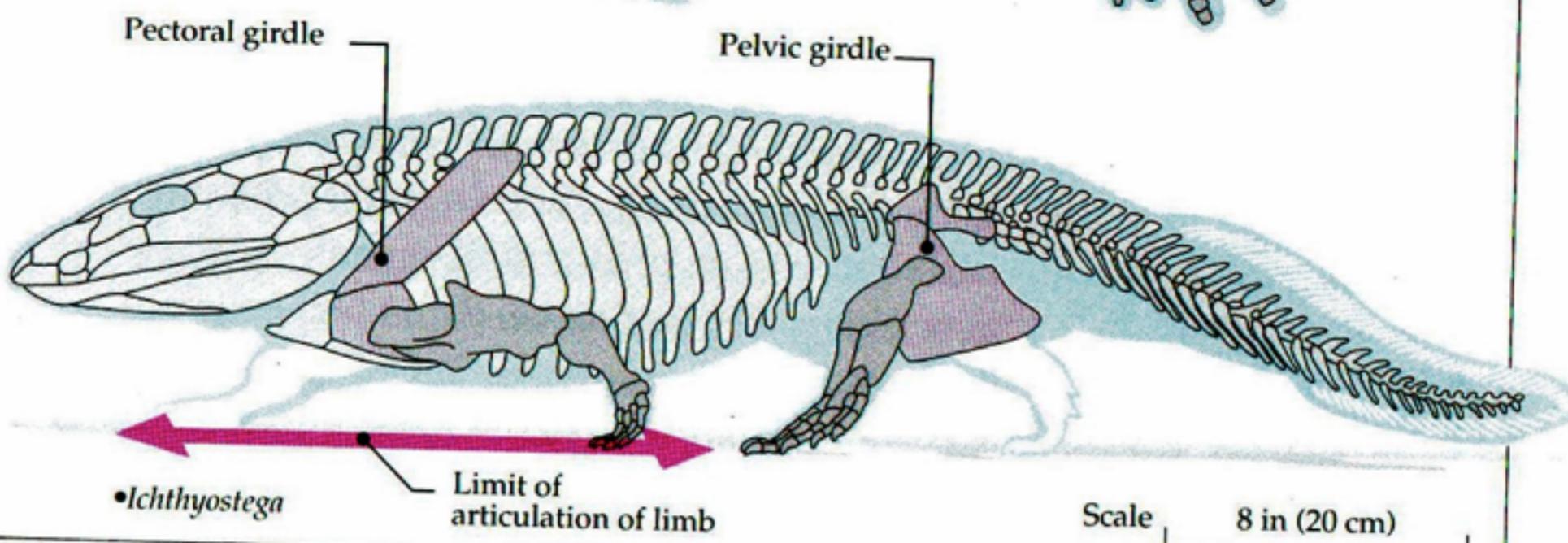
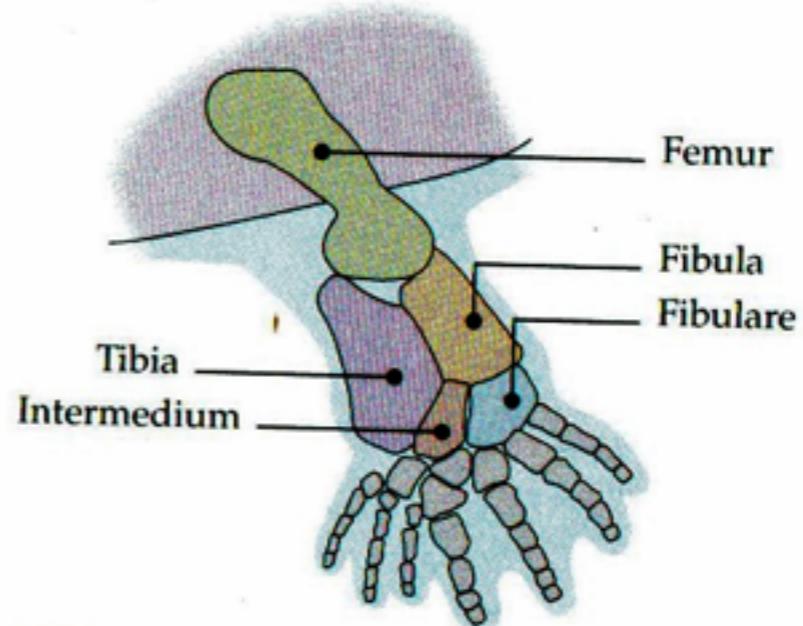
•*Eusthenopteron*



•Pectoral fin of *Eusthenopteron*

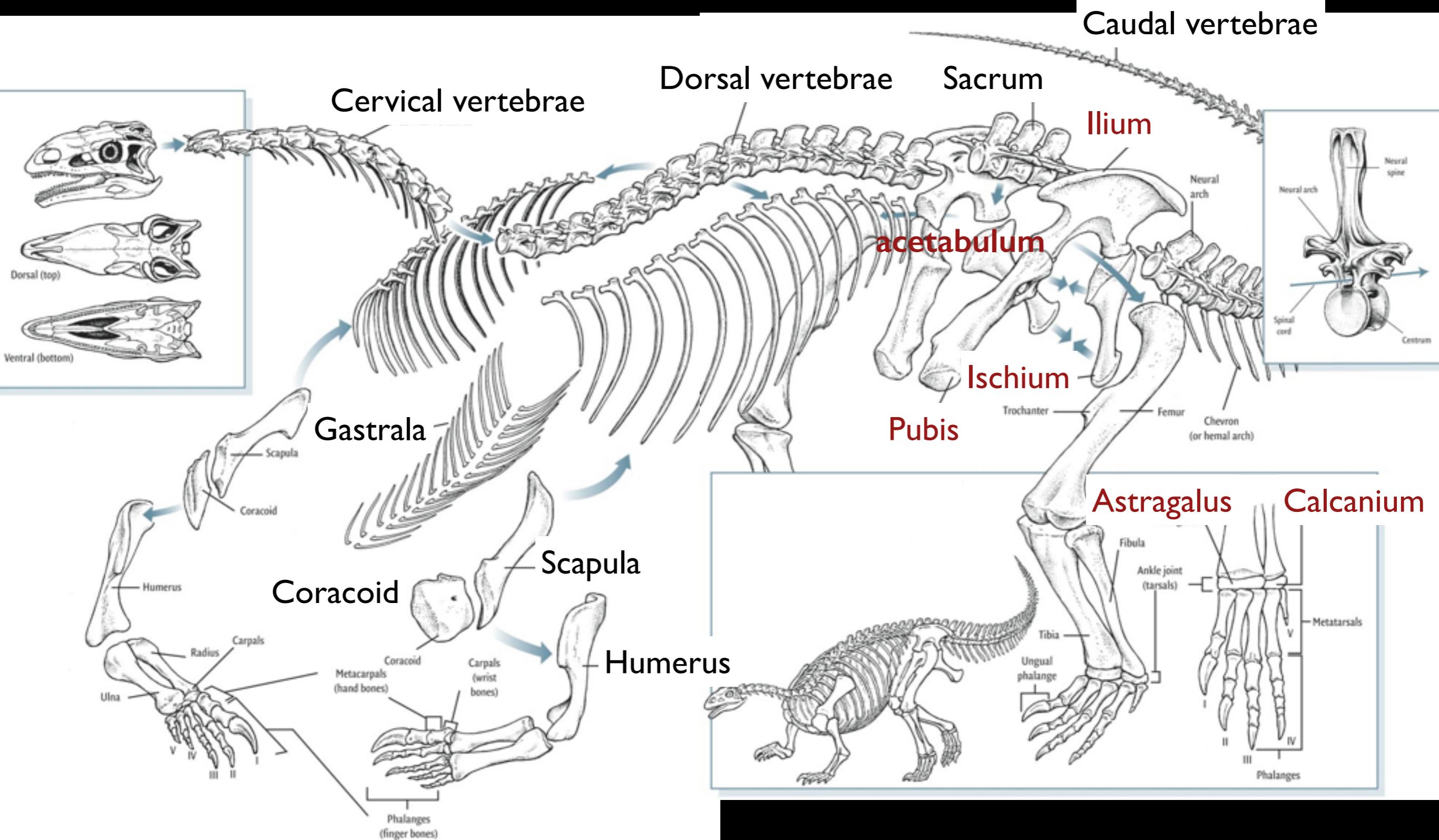


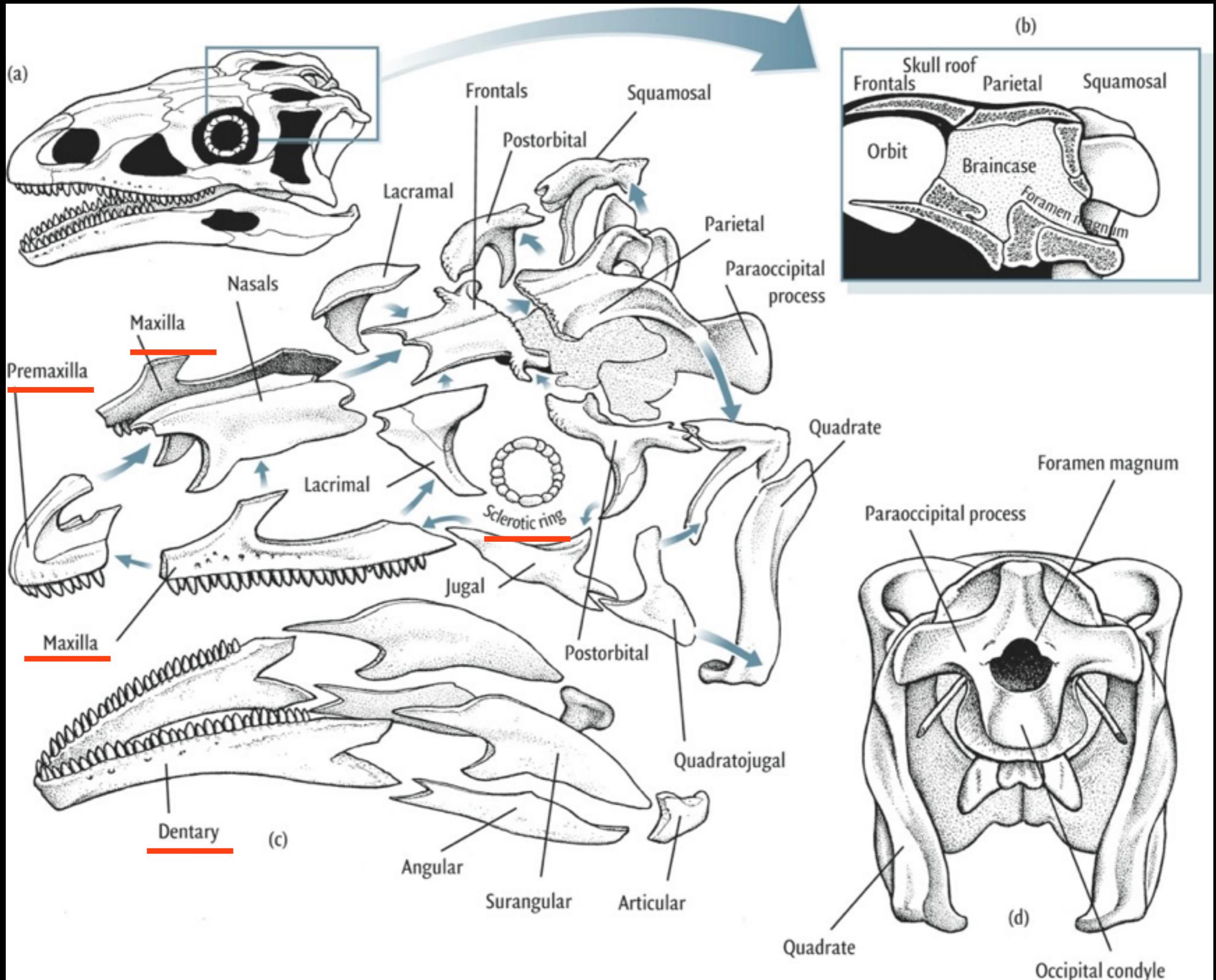
•Hind limb of *Ichthyostega*



# The Tetrapod Body Plan

Learn this- in Fastovsky





# Late Carboniferous (ca. 290 Ma)



Dominated by Anthracosaurs & Temnospondyl amphibians



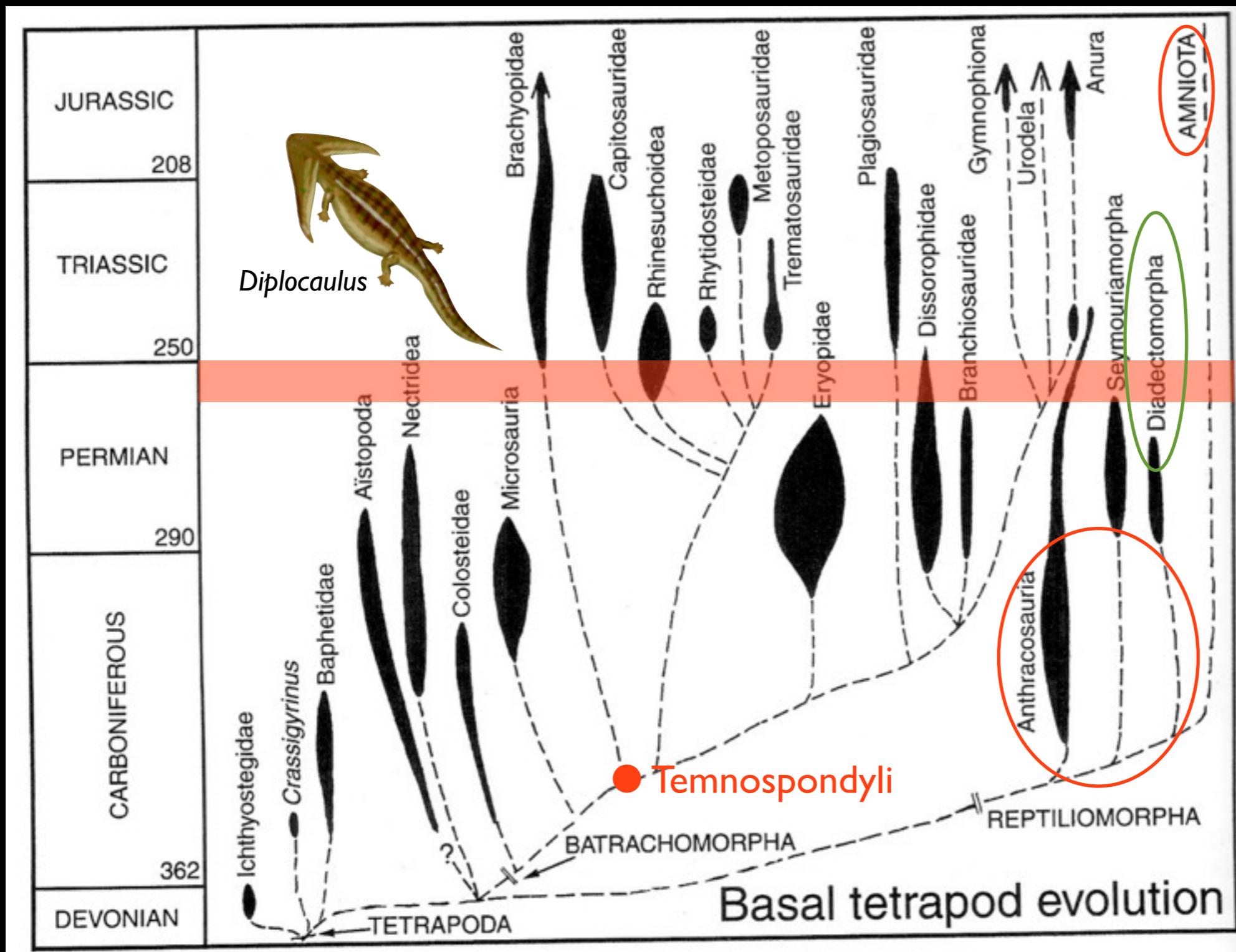
Gymnophiona  
(Caecilians)



Urodea  
(Salamanders)



Anura  
(Frogs/Toads)



**Anthracosauria:**  
Sometimes used to refer to 'reptile-like amphibians'

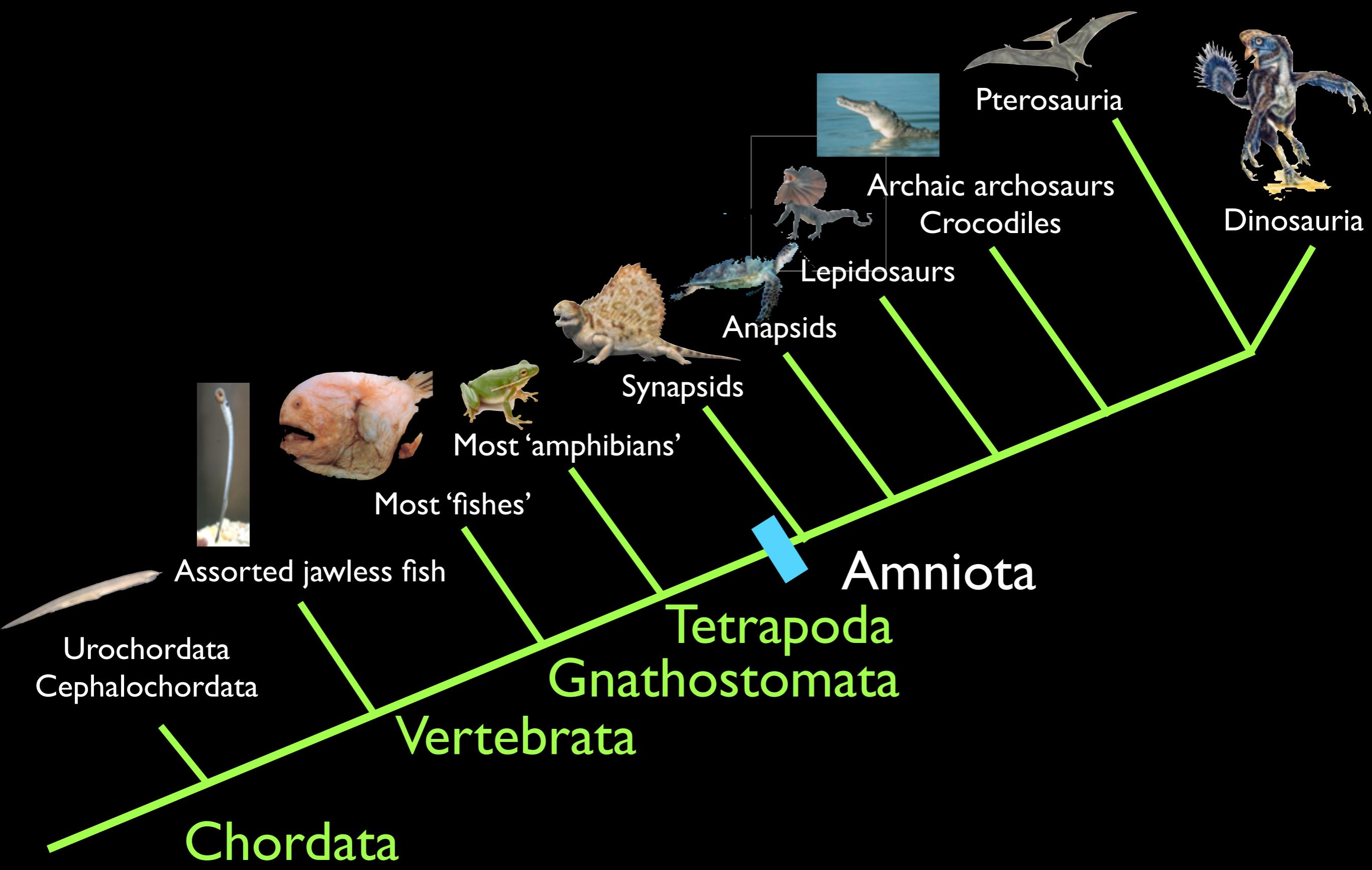
**Diadectes:**  
First herbivorous land vertebrate!



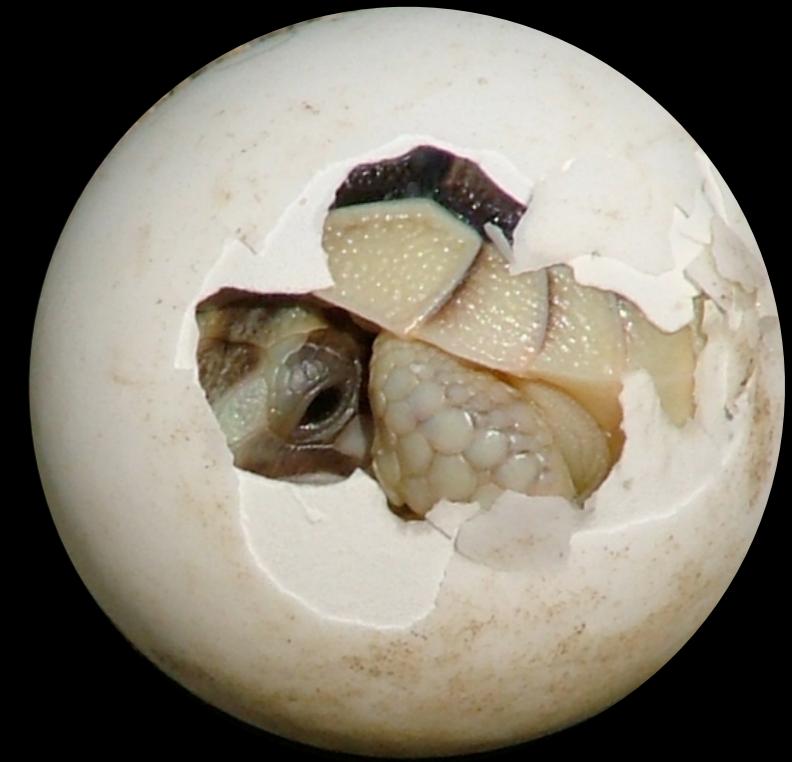
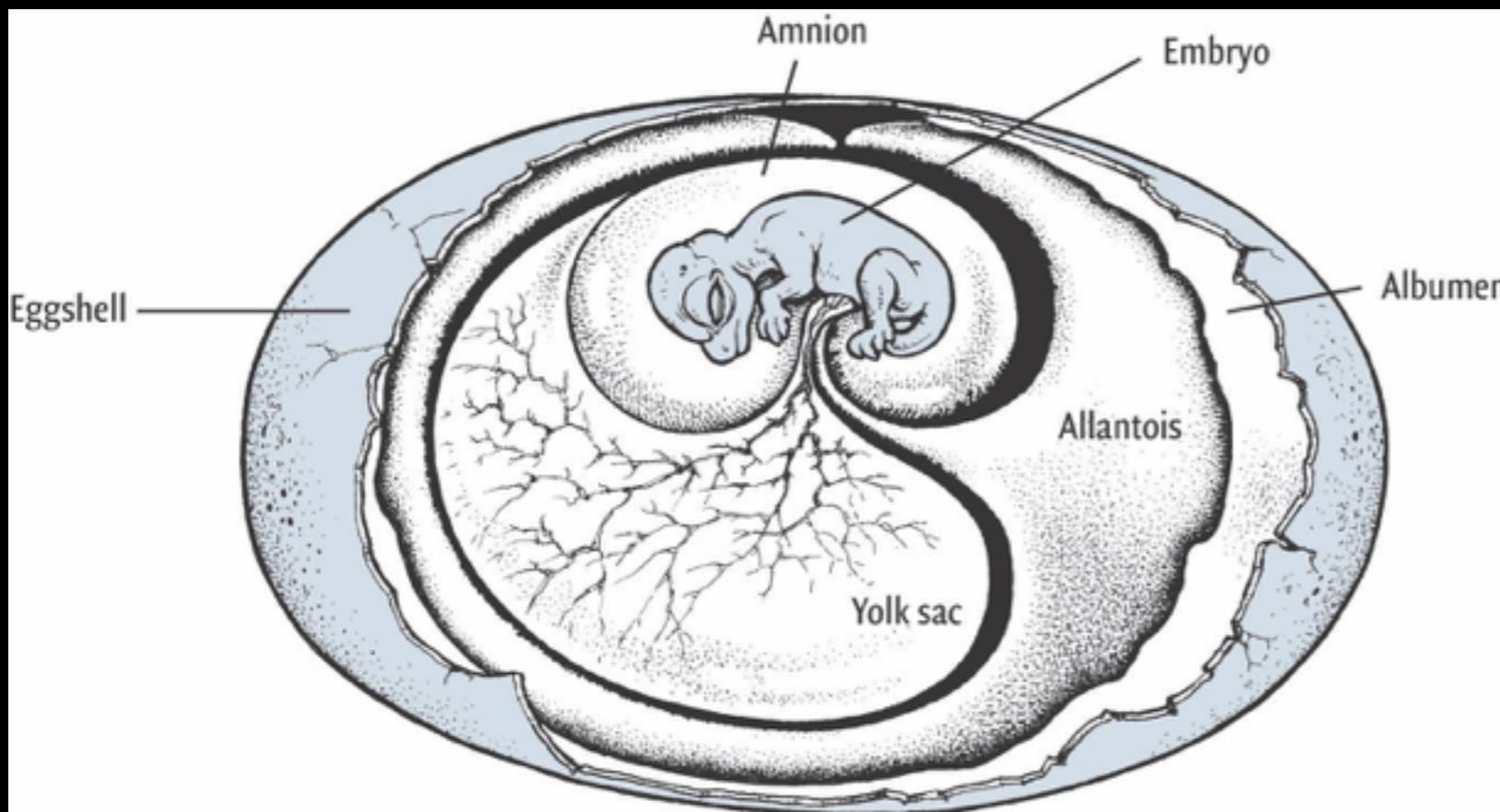
Food for thought:  
Why the radiation?

# Meet the Amniotes: The great terrestrial adaptation





# 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



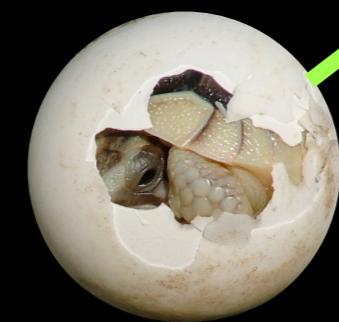
Anapsida



Lepidosauria



Archosauria



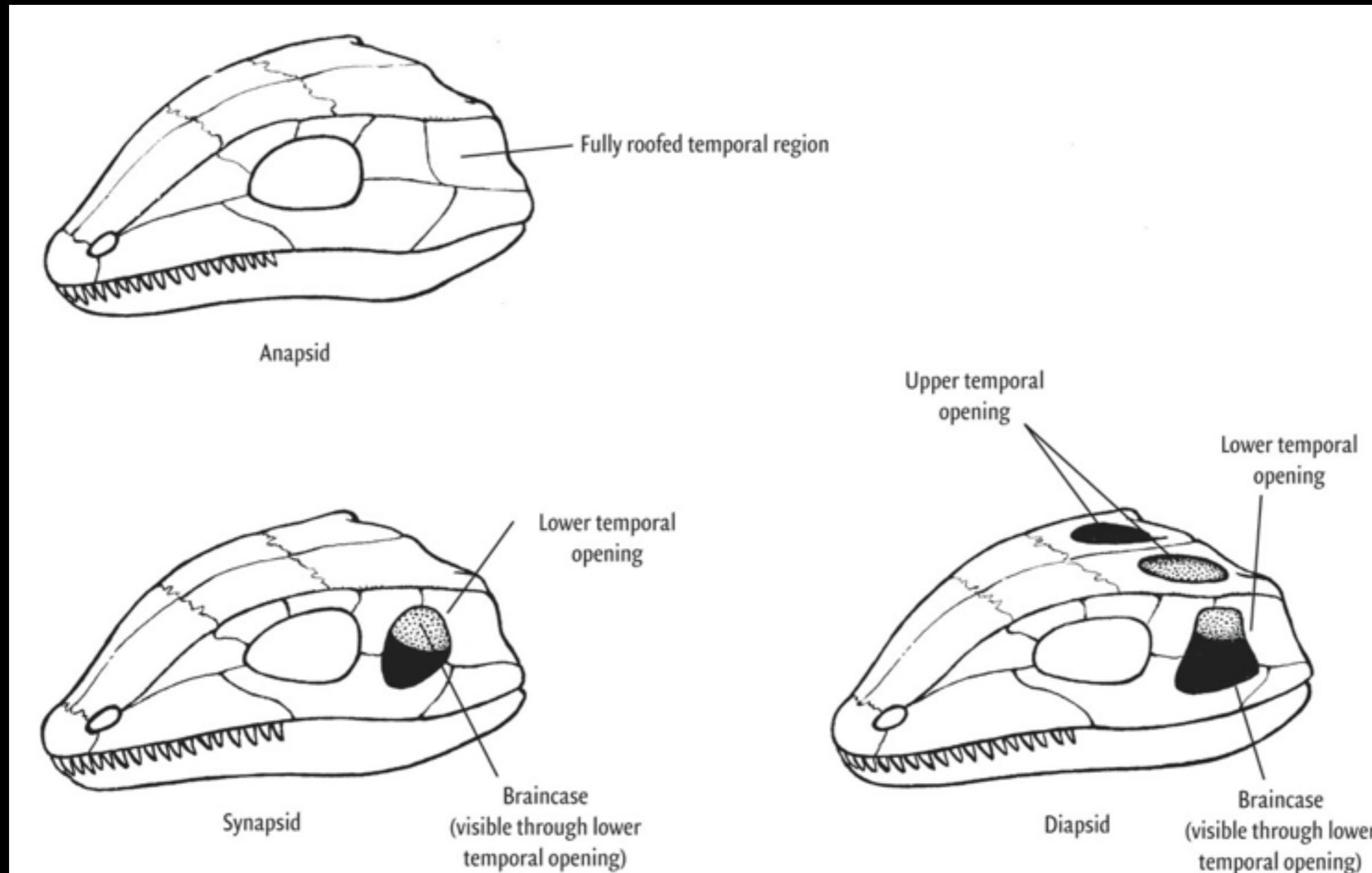
Amniotes

First amniotes  
in record (!!)

Eureptilia

Diapsida

# Meet the Amniotes



Single temporal  
fenestra

fenestra = 'window'

Upper temporal  
fenestra  
Lower temporal  
fenestra