

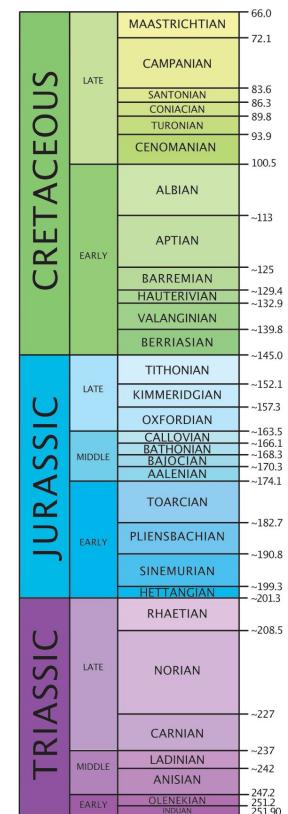
Lecture 10: Triassic 1



Lystrosaurus by Mark Hallett ([source](#))

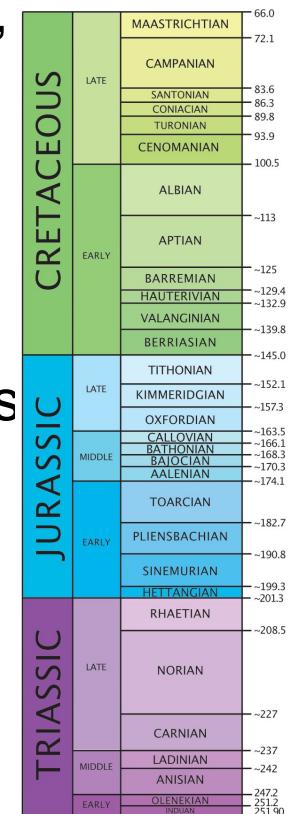
The Mesozoic Era

- We will now be going through the Mesozoic Era, telling the story of dinosaurs
- The Mesozoic is divided into three Geologic Periods:
 - **Triassic (252-201 Mya)**: first and oldest period
 - **Jurassic (201-145 Mya)** Second, middle period
 - **Cretaceous (145-66 Mya)** Third and final period



The Mesozoic Era

- The Mesozoic Era is often called the “Age of Dinosaurs” or the “Age of Reptiles”
- Both are somewhat misleading:
 - Dinosaurs do not become the dominant land animals until the Jurassic
 - Mesozoic “reptiles” are a **paraphyletic clade** that includes things we don’t normally consider reptiles (such as the ancestors of mammals)

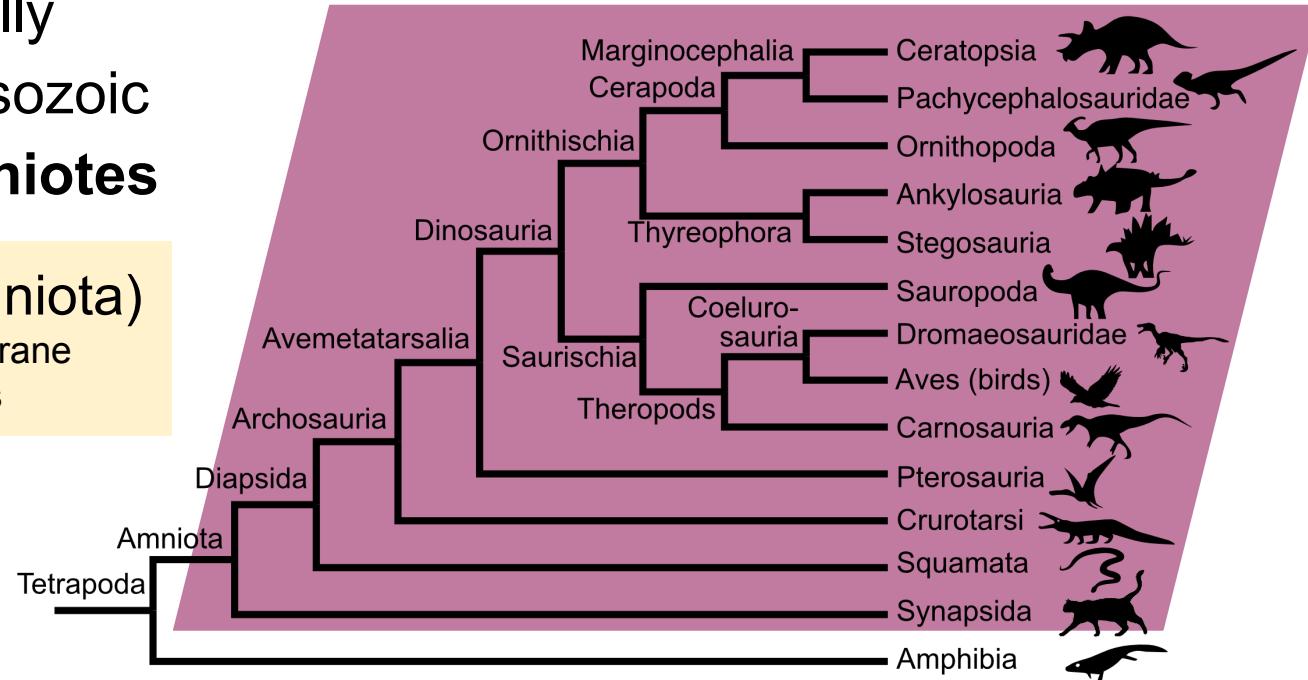


The Mesozoic: the age of “reptiles”

- To be scientifically precise, the Mesozoic is an age of **amniotes**

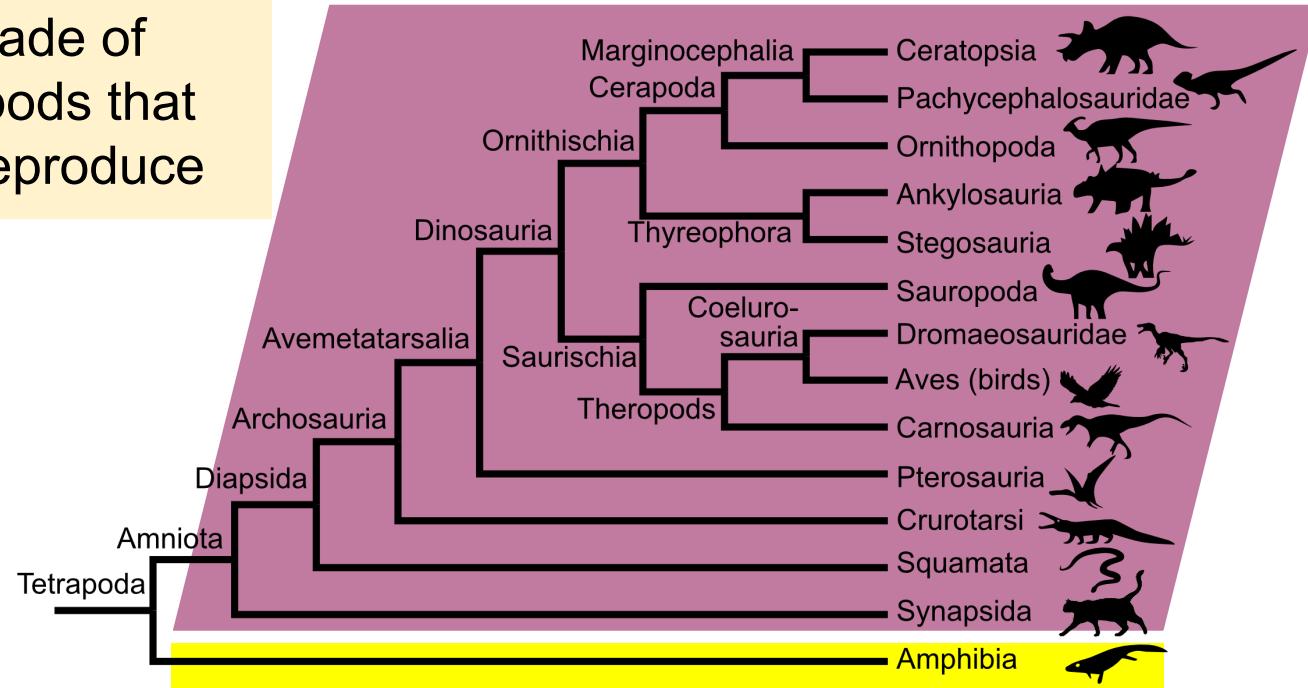
amniotes (clade Amniota)

Greek: “amnion” = membrane surrounding the fetus



The earliest vertebrates on land were amphibians

- **Amphibians:** a clade of ectothermic tetrapods that require water to reproduce



The earliest vertebrates on land were amphibians

- Living amphibians includes ~8000 species of frogs, salamanders, & newts
- Obtain oxygen through gills and/or the skin as well as lungs



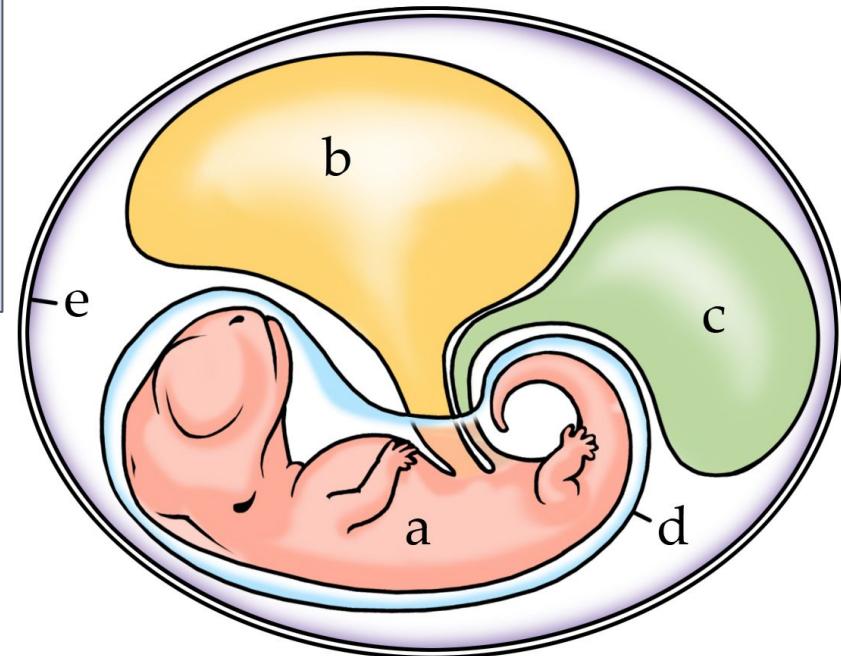
Early amphibians



Anthracosaurus From "Life on Earth" (Netflix, 2023)

The amniotic sac is a synapomorphy of amniotes

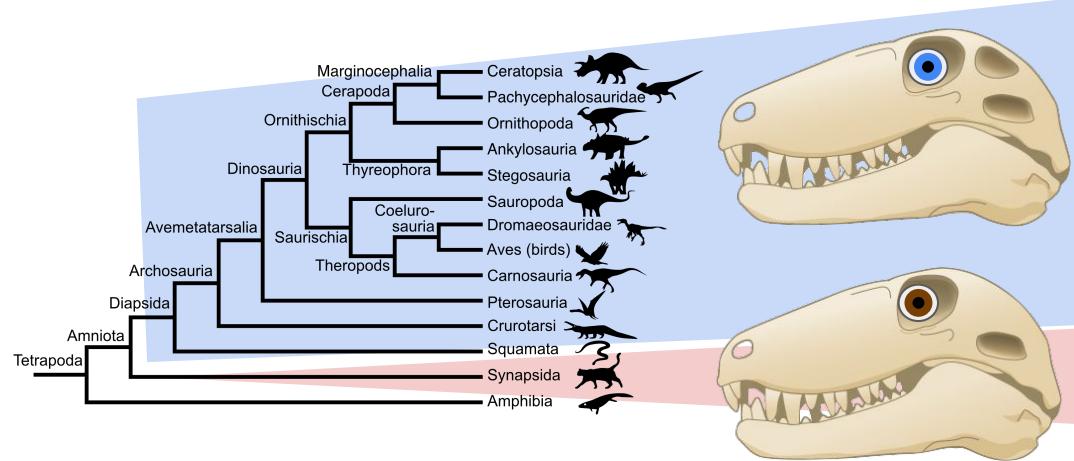
- **Synapomorphy:** a trait that is ubiquitous and unique to a clade (i.e. a shared, derived trait)
- Protects the embryo from desiccation
- Allows vertebrates to colonize the land



Archetypal amniote. The amniotic sac is labeled with an "e" (source)

Two major clades of amniotes are the Diapsida (diapsids) and Synapsida (synapsids)

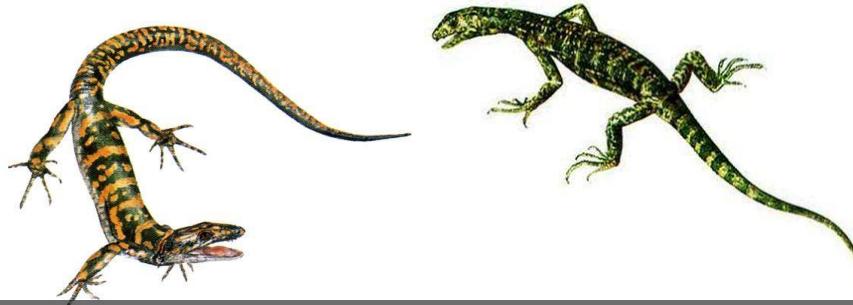
- The number of **postorbital fenestra** is a synapomorphy of synapsids / diapsids
- These two groups evolved earlier in time



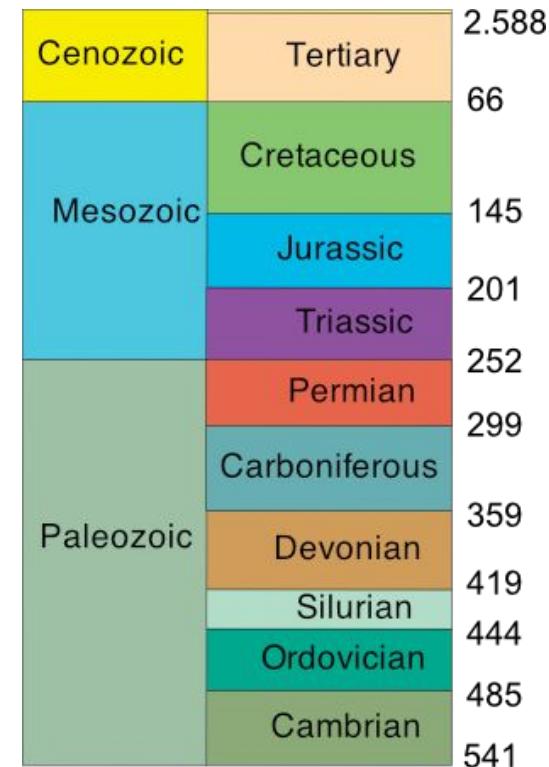
Skulls adapted from [CNX OpenStax](#).

Origins of diapsids and synapsids

- The earliest diapsid and synapsid fossils are from the late Carboniferous (~300 Mya)
- Both looked a lot like modern lizards



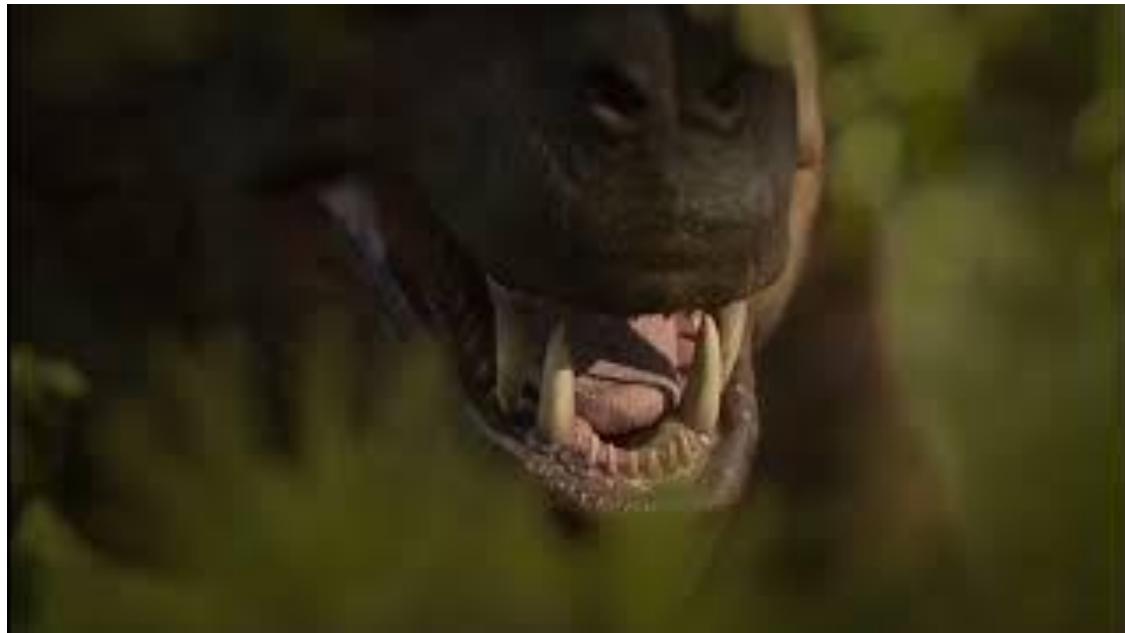
Archaeothyris (left) ([source](#)) and Petrolacosaurus (right) ([source](#))



Rise of synapsids

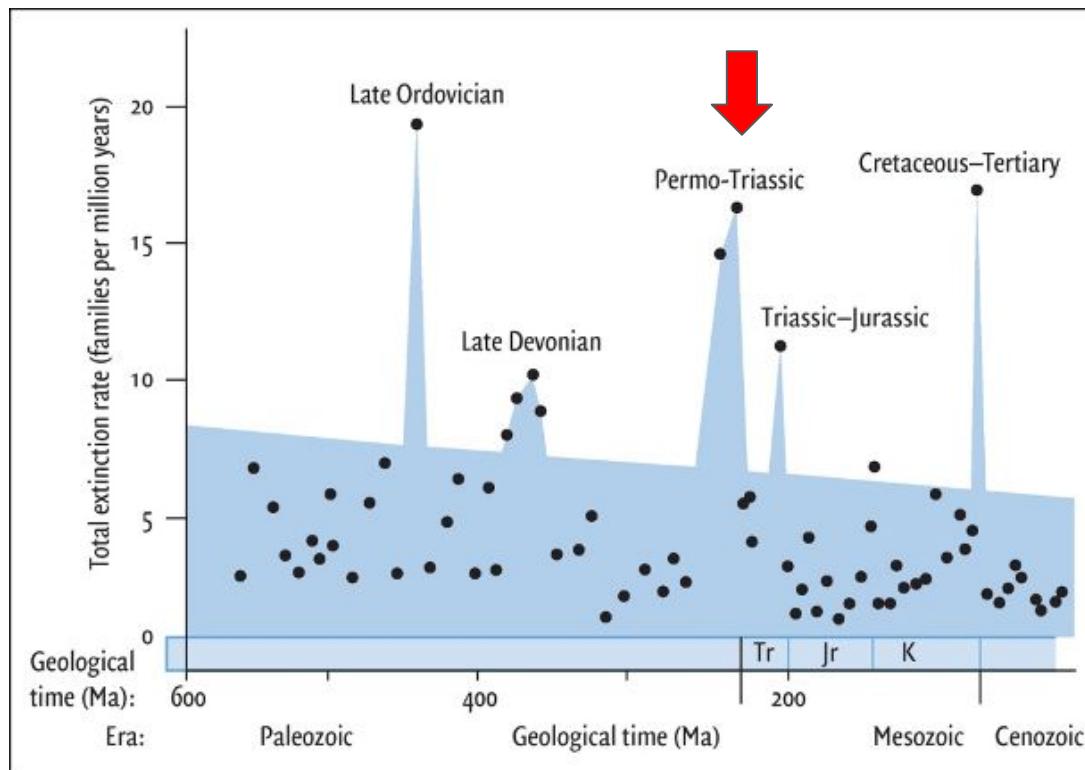


Rise of synapsids



Scutosaurus and *Inostrancevia*, “Life on our Planet” © Netflix, 2023 ([source](#))

The Permo-Triassic (PT) Mass Extinction



Fastovsky, David E., and David B. Weishampel. *Dinosaurs: a concise natural history*. Cambridge University Press, 2016.

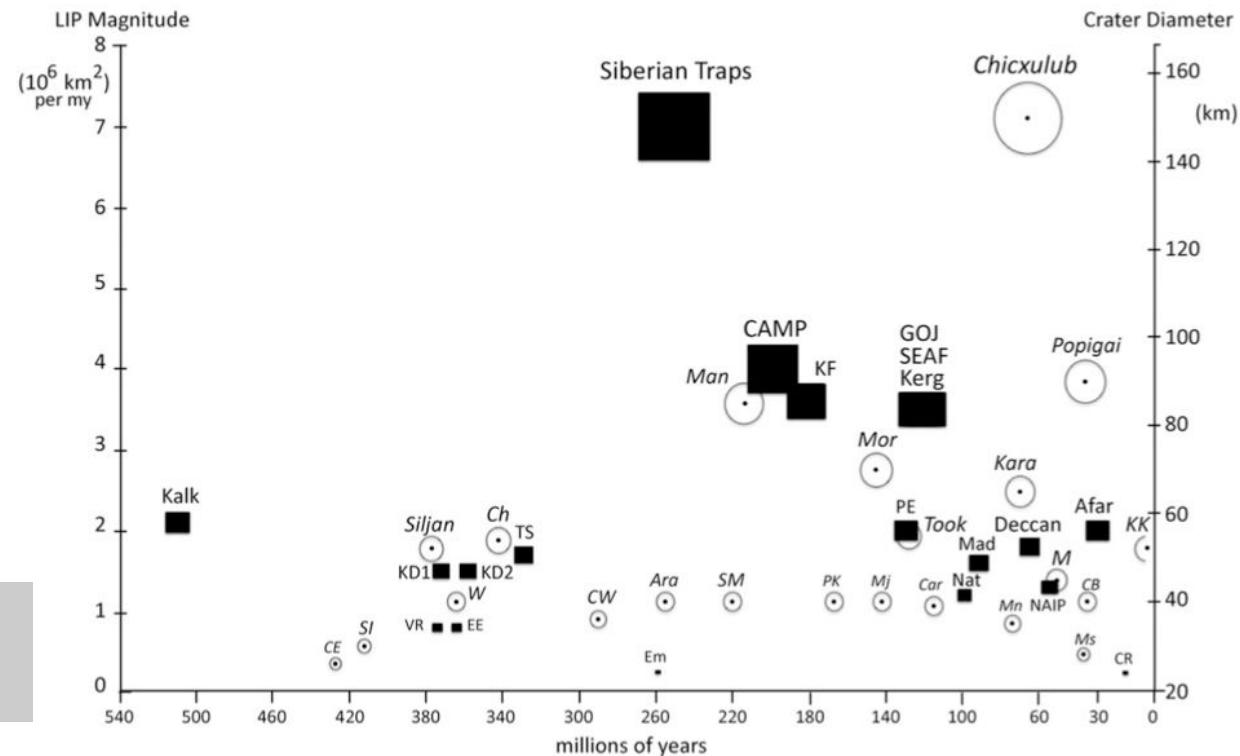
The Permo-Triassic (PT) Mass Extinction

- Correlates with the Siberian Traps, a huge deposit of igneous (volcanic) rock
- ~3 million sq mi of basaltic rock, with eruptions continuing for ~2My



Retallack GJ, Jahren AH. Methane release from igneous intrusion of coal during Late Permian extinction events. J Geol. 2008;116:1–20.

The Permo-Triassic (PT) Mass Extinction



Scotese, Christopher R., et al. "Phanerozoic paleotemperatures: The earth's changing climate during the last 540 million years." *Earth-Science Reviews* 215 (2021): 103503.

The Permo-Triassic (PT) Mass Extinction



- The lava mixed with rich coal deposits, setting off 1 trillion tonnes of carbon dioxide
- Global temperatures max out at ~10°C hotter than present

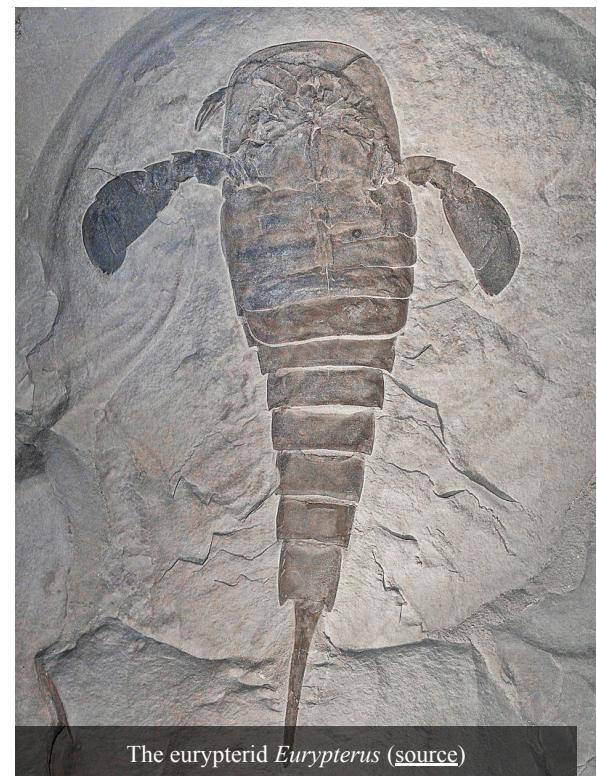
Retallack GJ, Jahren AH. Methane release from igneous intrusion of coal during Late Permian extinction events. *J Geol.* 2008;116:1–20.
Ogden, Darcy E., and Norman H. Sleep. "Explosive eruption of coal and basalt and the end-Permian mass extinction." *Proceedings of the National Academy of Sciences* 109.1 (2012): 59–62.

The Permo-Triassic (PT) Mass Extinction

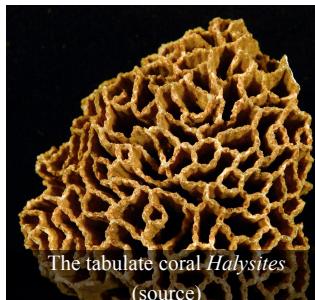
- Also known as the “Great Dying”
- Up to 95% of marine species and 80% of land animals perished



The trilobite *Trochurus* ([source](#))



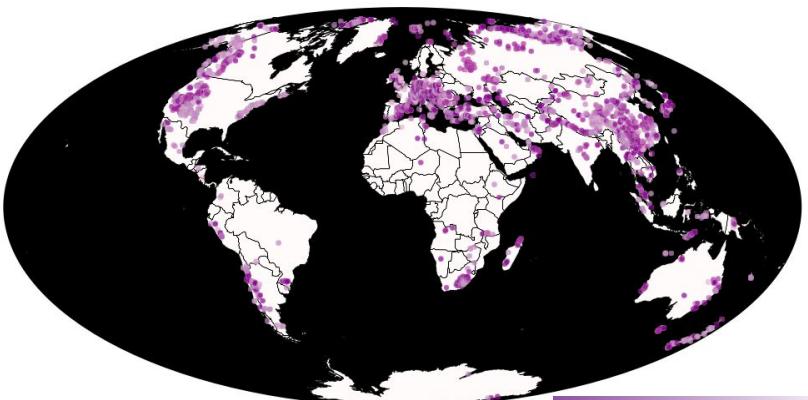
The eurypterid *Eurypterus* ([source](#))



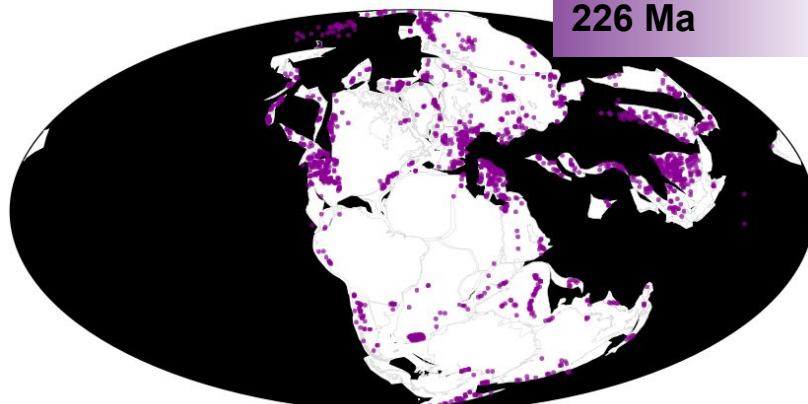
The tabulate coral *Halysites* ([source](#))

A hostile world: Triassic paleogeography

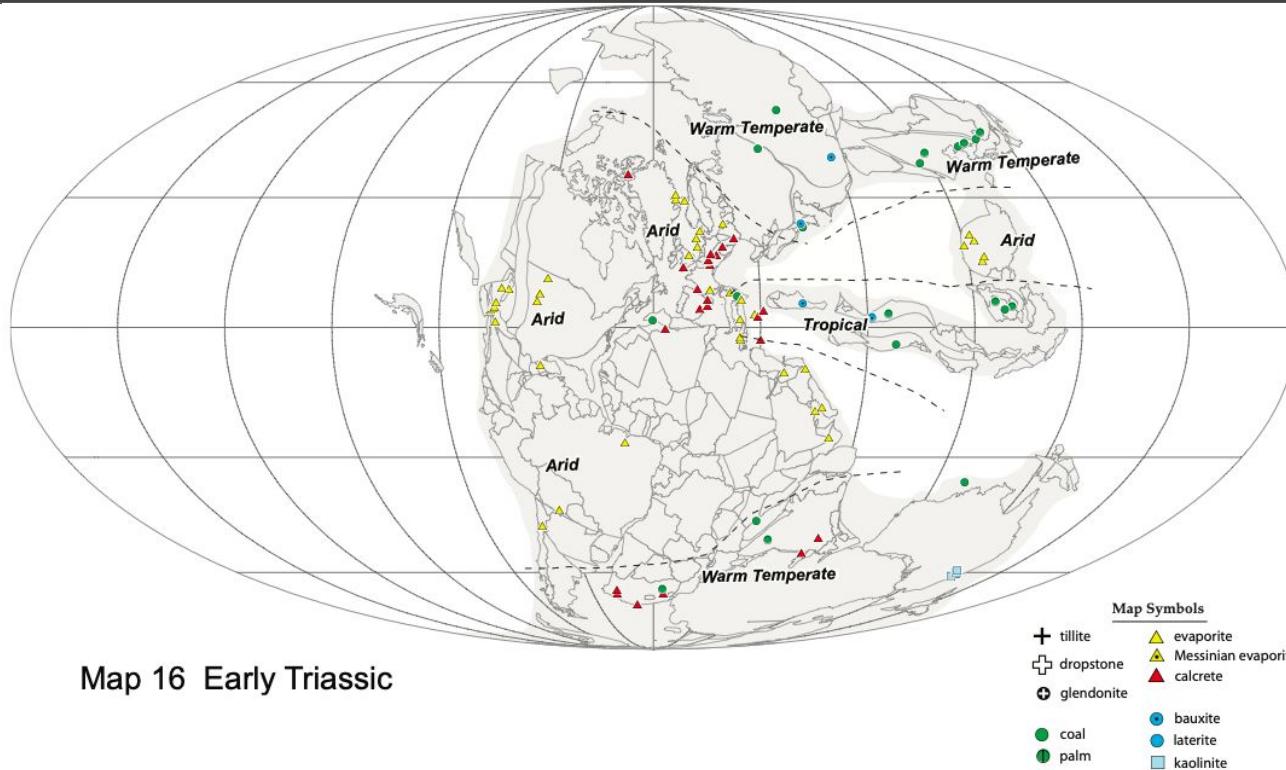
- Triassic fossils have been found all over the world
- When these fossils are overlaid on the continents as predicted in the Triassic, you can see that there are few inland fossils



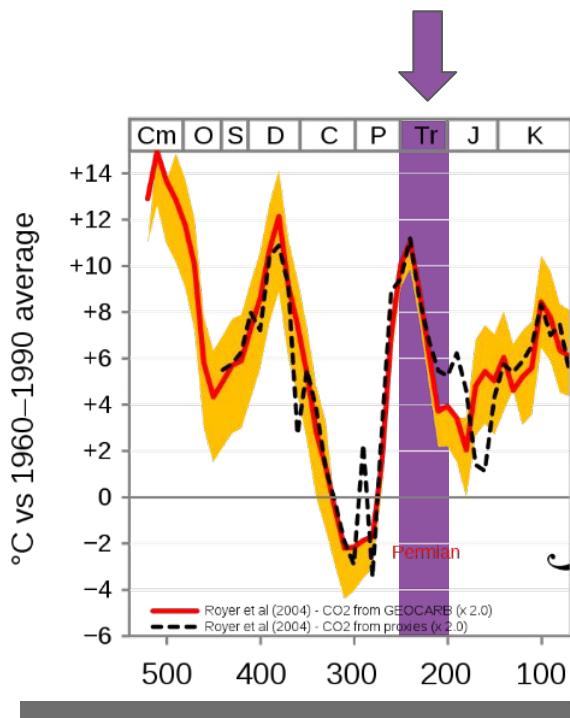
226 Ma



Triassic paleoclimate



Triassic paleoclimate



- Temperatures cool following the end-Permian extinction event, but are still significantly hotter than the previous ~100 My
- Continent interiors were particularly arid

Triassic landscape



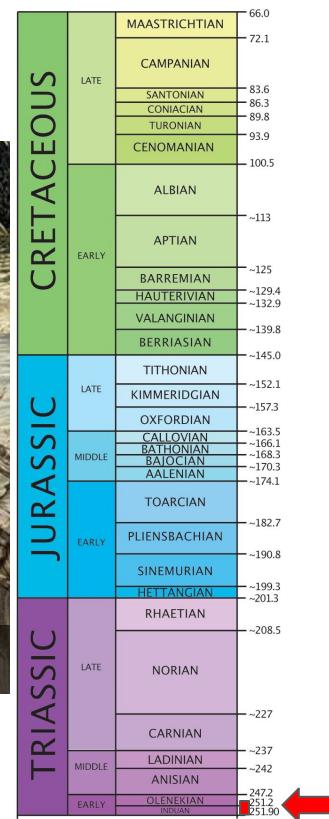
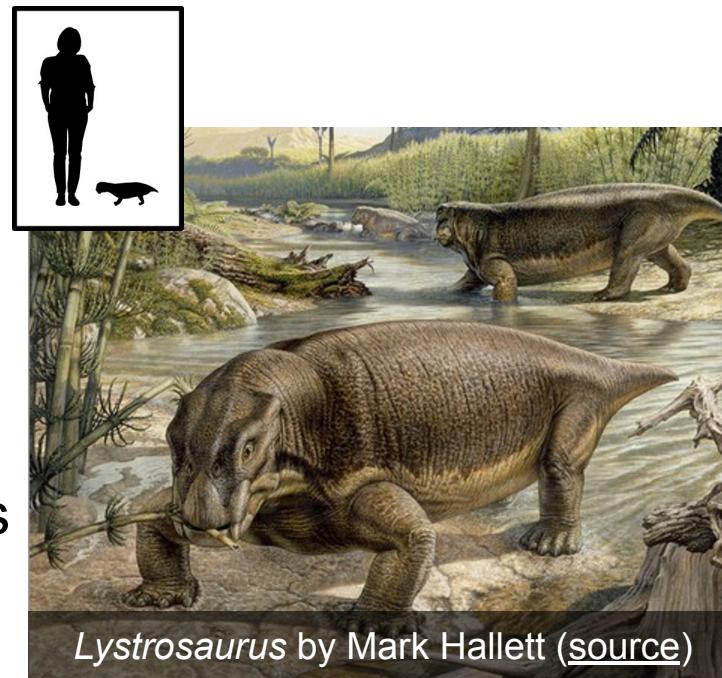
Triassic landscape by Ludek Pesek ([source](#))

Slow recovery from the PT extinction

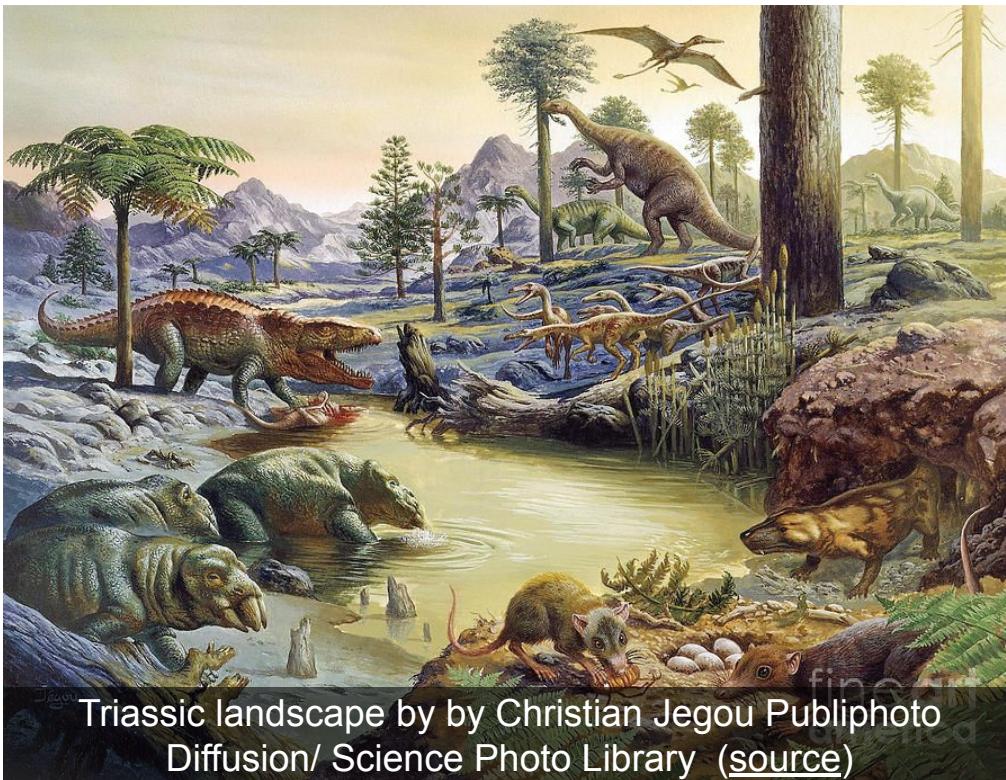
Lystrosaurus

Greek: “lystro” = tool, shovel; “saurus” = lizard

- 255-250 Ma, ~ 3ft long
- A survivor from a once-dominant group of synapsid called dicynodonts
- Primary terrestrial fossil for ~10 My



Next class: Why did dinosaurs become dominant?



Triassic landscape by Christian Jegou Publiphoto
Diffusion/ Science Photo Library ([source](#))

- Many groups of animals diversified through the Triassic
- Dinosaurs ultimately go on to be the dominant land animals for the next ~135My