

Introduction to Biology. Lecture 35

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- 1 Where we are?
- 2 Mesozoic-Cenozoic extinction
 - The raise and fall of giant reptiles



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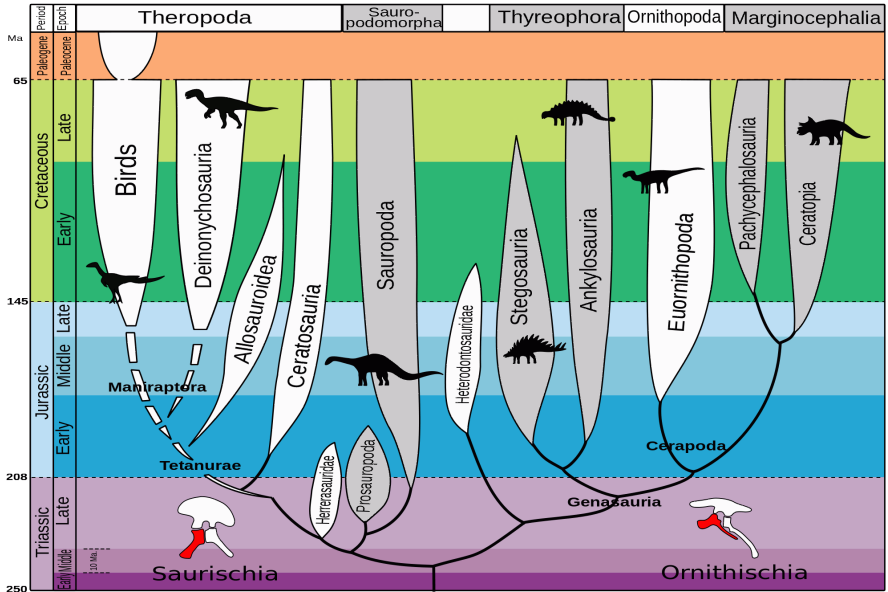


Archosauromorph reptiles

- Crocodylomorpha: advanced behavior, four-chambered heart
- Pterosauria: archosaur “bats”, some with fur-like cover
- Dinosauria: bipedal archosaurs:
 - Ornithischia: “bird-hipped”, include ankylosaurs, stegosaurs, ornithomimids, ceratopsia
 - Saurischia: “lizard-hipped”:
 - A Theropoda: true bipedal, carnivorous or insectivorous, mostly feathered
 - B Sauropodomorpha: secondary quadrupedal, small heads, long necks, long tails; largest dinosaurs



Dinosaurs in time

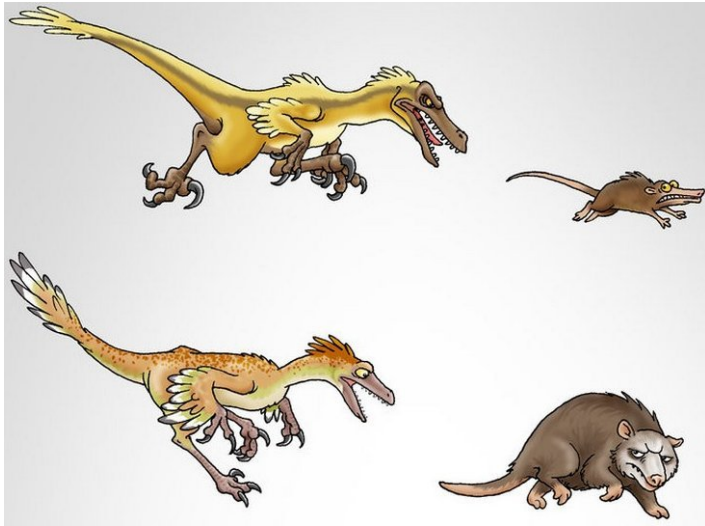


Mesozoic-Cenozoic extinction

The raise and fall of giant reptiles



Reptiles and mammals cartoon, part I



Reptiles and mammals cartoon, part II



Mesozoic-Cenozoic extinction

Two extinctions:

- Most of large archosauromorphs, plus plesiosaurs and ichthyosaurs. Crocodiles, birds, mammals, amphibians survived.
- Shelled cephalopods (belemnites, ammonites) and many other marine groups

Plants and insects were not affected at all.



Why they were so big

- To digest plants (cellulose), higher temperature will help. Dinosaurs developed size-related **endothermy**.
- To escape from predators, the prey should grow big.
- As a result, in Jurassic park all herbivores were giants.
- Turtles are an exception, but they live on a very little fuel and are over-armored to escape predators.



Mammals in Jurassic

- They fed mostly on insects
- Their chewing system is not yet developed to the level when they can live on plants
- As a result, **small predator ecological niche was empty: there was no constant supply of food**



“Every worm has his weak spot”: egg problem

- Eggs need warming. Physical laws allow egg to be warmed to the center only if it is not exceed ≈ 0.5 m in diameter.
- Forces of evolution pushed dinosaurs to grow as big as possible, but egg size was limited.
- As a result, dinosaur young were vulnerable to everybody who would want to feed on them. Fortunately, the small predator did not exist.

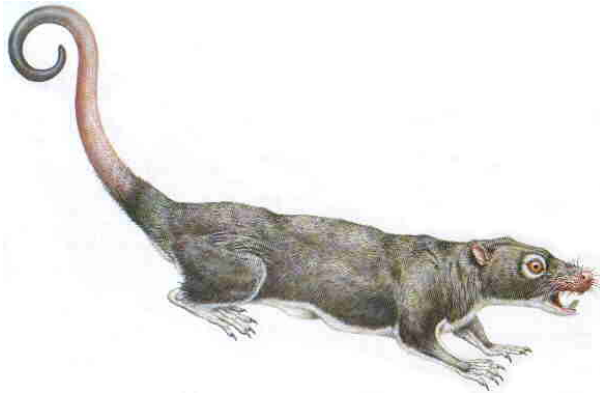


How small predator niche was finally filled

- First herbivorous mammals (multituberculates) appeared in the Middle Cretaceous
- From that point, small predators will have the constant food source
- As a result, they appeared shortly after. They were not only mammals but also snakes and small archosauromorphs.



Multituberculate mammal: first small herbivore

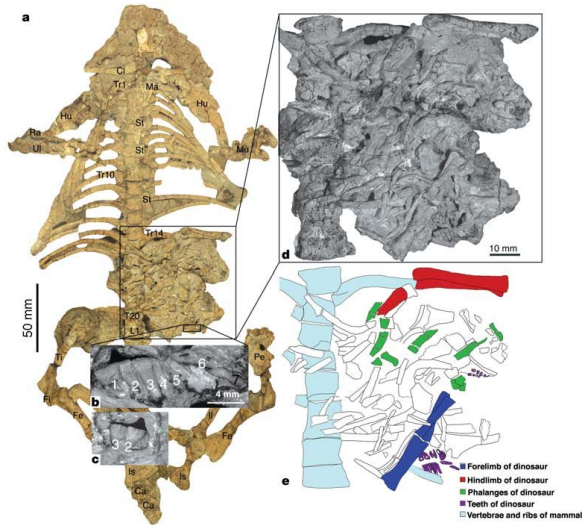


Dinosaurs decline: the theory

- Small predator will occasionally feed on dinosaur young which turn many species to the route of extinction. Moreover, new species do not appear.
- Dinosaur lineages slowly declined towards the late Cretaceous.



Dinosaurs decline: the proof



In 2005, Chinese paleontologists find the tricodont mammal skeleton
with young dinosaur in the stomach



The hero: *Repenomamus robustus* (reconstruction)



Pterosaurs?

- To escape the competition with better organized birds, they also pushed to be larger and larger.
- At some point, they faced the same “dinosaur problem”: they cannot defend their young...



Asteroid?

- Impact theories are mentally attractive but do not explain slow and “blurred” extinction as well as existence of “untouchable” groups like plants and insects.
- Ecological palaeontology states that most mass extinctions were results of **biological crises**. The nature of these crises was internal.



What about the ocean?

- Marine fauna typically “sits below the salt” on the “ecological dining table”: they feed on nutrients which are left from terrestrial biota
- Every significant change in land flora resulted in mass extinction in the sea.
- In the end of Cretaceous, **grasses** changed the flow of minerals from land to sea completely.
- Dinosaur decline and marine extinction simply coincided.



"Sitting below the salt"



Why dinosaurs did not decrease a size?

- They did. They are birds now.
- However, terrestrial lineages did not withstand competition with mammals.



Summary

Well, I am responsible
for the dinosaur
extinction...



For Further Reading



Ecological crisis.

http://en.wikipedia.org/wiki/Ecological_crisis

