

Biogeography. Lecture 6

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January 27, 2016



Outline

Most important geological periods

Carboniferous and Permian: first biogeography

Mesozoic era: from Triassic to Cretaceous

Cenozoic era



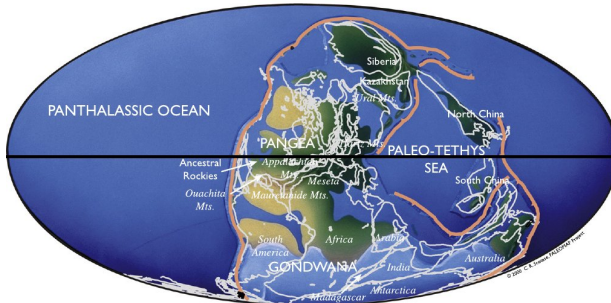
Most important geological periods

Carboniferous and Permian: first biogeography



Carboniferous period

306 Ma Carboniferous

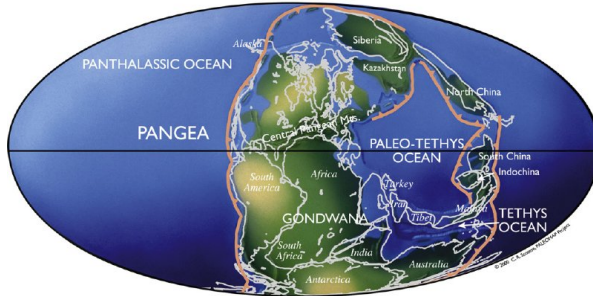


- ▶ Hot, wet tropical climate in Europe and North America (Laurasia), dry arctic forests in Siberia (Angarida)
- ▶ Pteridophyte and primitive seed plants forests dominated tropics, insects started to fly
- ▶ Reptiles appeared



Permian period

255 Ma Permian



- ▶ Last period of Paleozoic era, ended with a mass extinction in the sea and also on land
- ▶ Pangea formed, with a giant central desert
- ▶ Primitive synapsid reptiles dominated the land



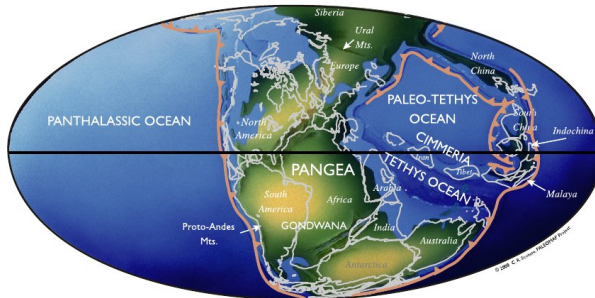
Most important geological periods

Mesozoic era: from Triassic to Cretaceous



Triassic period

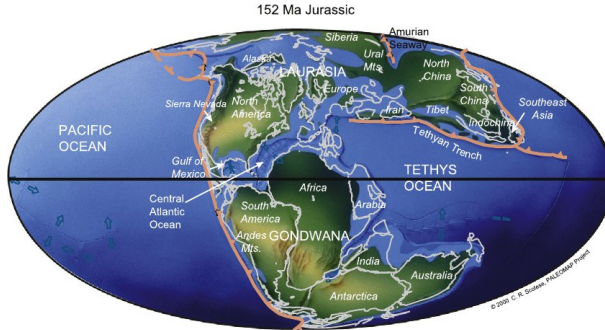
237 Ma Triassic



- ▶ Pangea broke (part of Africa adhered to North America)
- ▶ Climate becoming wetter
- ▶ Grasshopper-like insects radiated
- ▶ Synapsid reptiles declined, dinosaurs and pterosaurs appeared



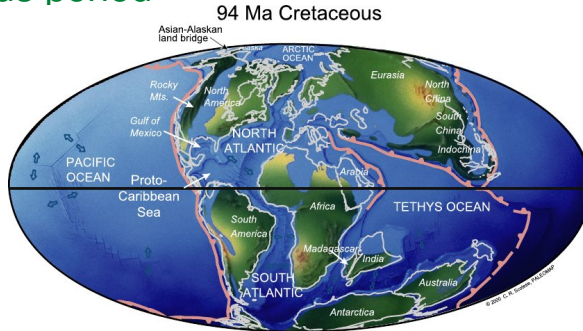
Jurassic period



- ▶ Atlantic ocean and Rocky mountains appeared
- ▶ Peak of dinosaur diversity
- ▶ Birds appeared as a lineage of small flying dinosaurs
- ▶ In the sea, ammonites and primitive fish dominated



Cretaceous period



- ▶ High level of water (second high after Devonian), warm climate even on North and South poles, sea in North Dakota
- ▶ Flowering plants appeared and rapidly colonized all land
- ▶ Butterflies and flies appeared
- ▶ Terrestrial dinosaurs slowly declined and finally disappeared in the very end of period



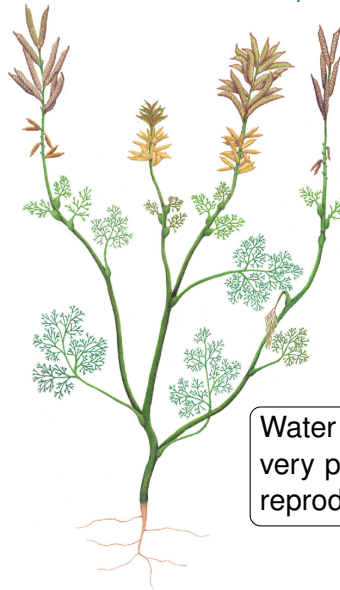
Subdivisions of Cretaceous

System	Series	Stage
Paleogene	Paleocene	Danian
Cretaceous	Upper	Maastrichtian
		Campanian
		Santonian
		Coniacian
		Turonian
		Cenomanian
	Lower	Albian
		Aptian
		Barremian
		Hauterivian
		Valanginian
		Berriasian
Jurassic	Upper	Tithonian

- ▶ Hauterivian: first flowering plants (pollen)
- ▶ Barremian/Aptian: Famous Yixian formation (China)
- ▶ Maastrichtian: end of dinosaur age



Archaeofructus (discovered in 2002, Yixian)



Water plant with
very primitive
reproductive organs

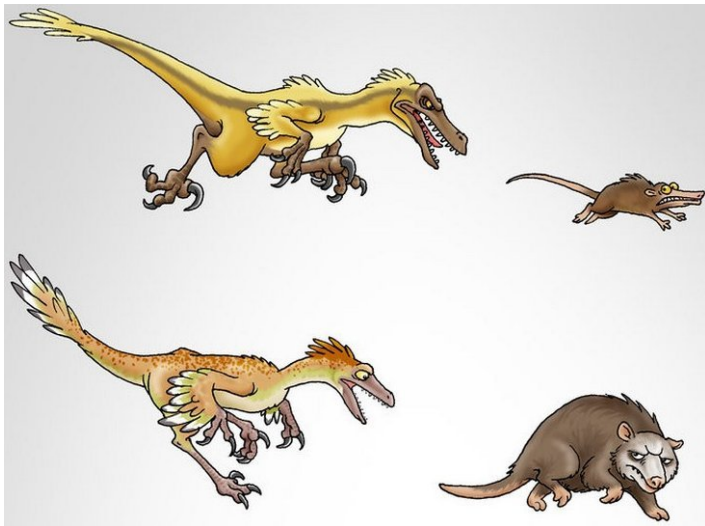
Yutyrannus from China, newest reconstruction



feathered, warm-blood, social



From Jurassic...



... to Paleogene



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.



The mammal hero: *Repenomamus robustus*



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



Most important geological periods

Cenozoic era



From Paleogene to Quaternary

Cenozoic era:

- ▶ Paleogene: starts 66 Mya

Includes:

- ▶ Paleocene
- ▶ Eocene
- ▶ Oligocene

- ▶ Neogene: starts 23 Mya

Includes:

- ▶ Miocene
- ▶ Pliocene

- ▶ Quaternary: starts 2.5 Mya

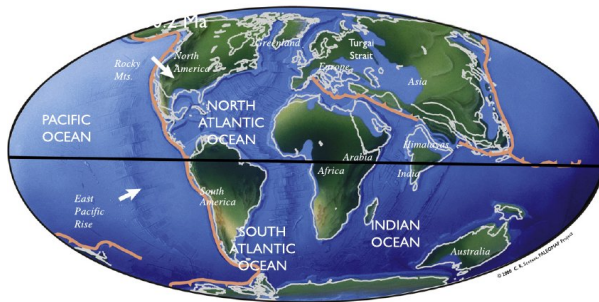
Includes:

- ▶ Pleistocene
- ▶ Holocene



Paleogene

50.2 Ma Paleogene

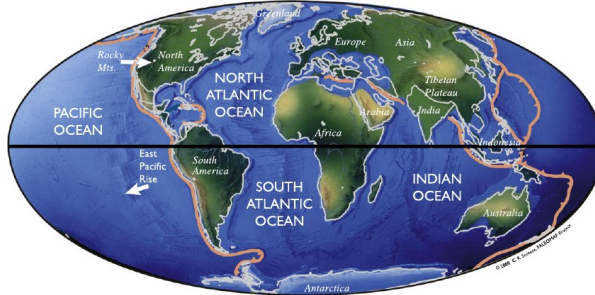


- ▶ Warm, even climate
- ▶ South America isolated, Tethys sea is slowly closing, India moves to Asia
- ▶ Mammals fill the big size class



Neogene

14 Ma Neogene



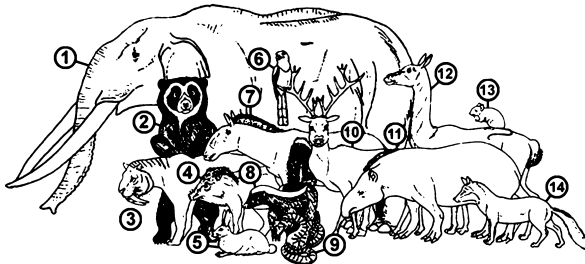
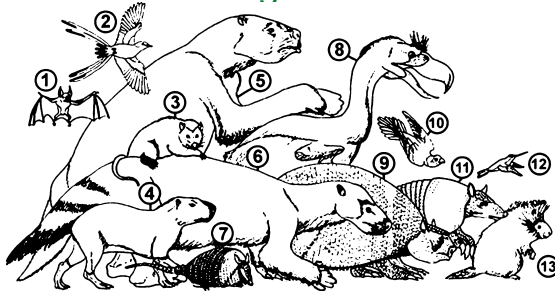
- ▶ Colder and drier
- ▶ Ice covers Antarctic, Americas united
- ▶ Grasses and hoofed mammals together form grasslands

Great American Interchange

- ▶ Before Neogene, South America was an isolated continent like Australia now and keeps very unusual fauna
- ▶ Formation of the Isthmus of Panama led to the dramatic exchange in fauna between South and North Americas
- ▶ More advanced northern animals invaded South America but some of southern species (like armadillo, porcupines, opossums, giant sloth) became very successful on the North.

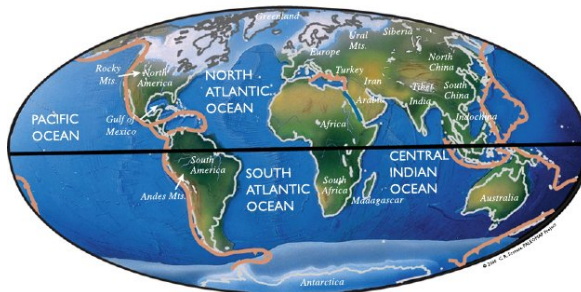


Great American Interchange: north and south



Quaternary

21000 Years Quaternary



- ▶ Great glaciation again (the last was in Carboniferous), many species escaped in refugia
- ▶ Rocky Mountains and Himalayas
- ▶ Humans



Summary

- ▶ At the end of Permian, all continents formed equatorial super-continent Pangea
- ▶ Jurassic period was a peak of dinosaur diversity
- ▶ 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 is internal.



For Further Reading



A. Shipunov.

Biogeography [Electronic resource].

2014—onwards.

Mode of access:

http://ashipunov.info/shipunov/school/biol_330



Dinosaurs.

<http://en.wikipedia.org/wiki/Dinosaur>



Great American Interchange.

[http://en.wikipedia.org/wiki/Great_American_
Interchange](http://en.wikipedia.org/wiki/Great_American_Interchange)