

FYLOGENEZE

- **metody konstrukce fylogenetického stromu**
- **systematika a taxonomie, taxonomické školy**
- **historie života na Zemi**

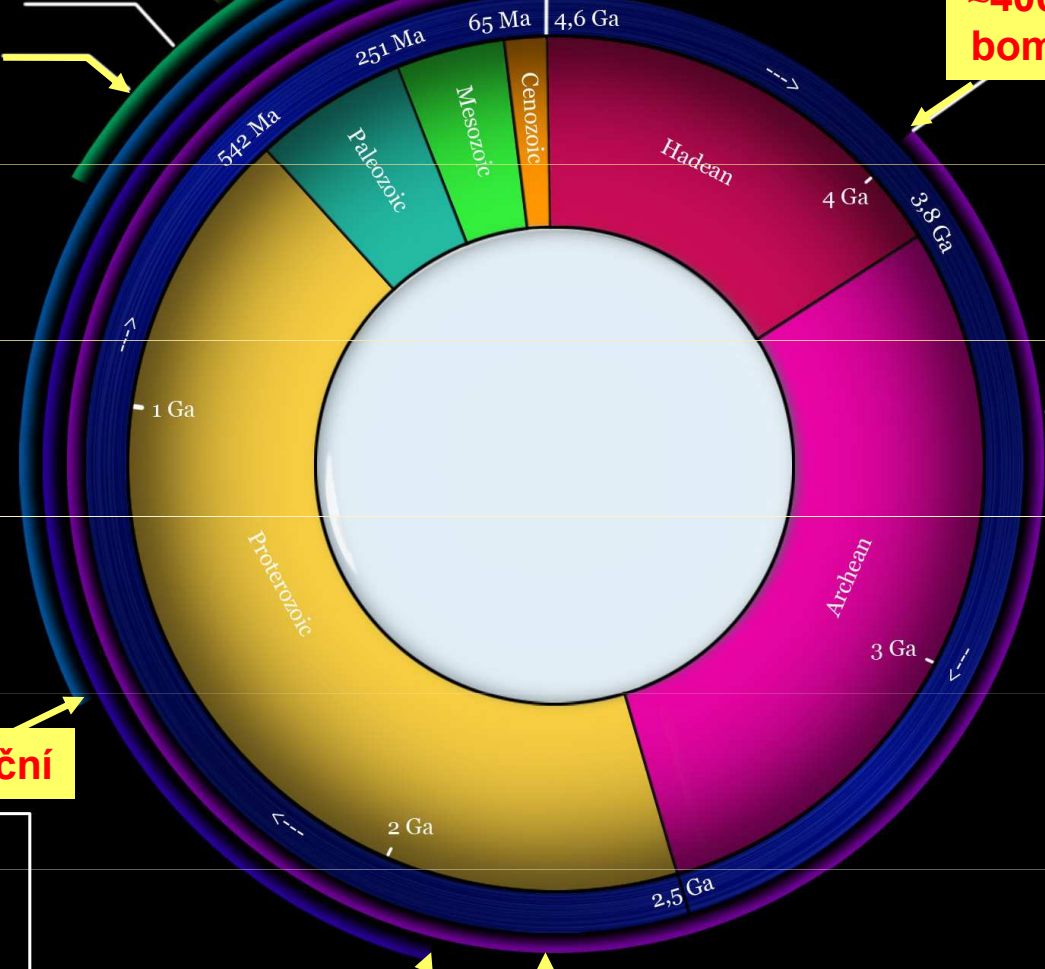
4550 M vznik Země

2 Ma: first humans of the Earth 4527 Ma: formation of the Moon

230 - 65 Ma: Dinosaurs
ca. 380 Ma: First vertebrate land animals
ca. 530 Ma: Cambrian

~4000 M konec bombardování

750-635 M Země 2x zaledněná



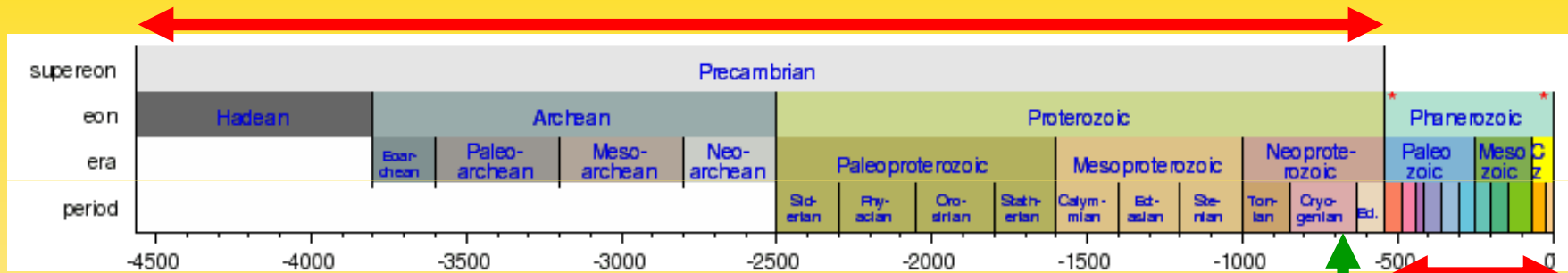
mnohobuněční

- Legend
- Humans
 - Mammals
 - Land plants
 - Animals
 - Multicellular life
 - Eukaryotes
 - Prokaryotes

Eukaryota

~2300 M atmosféra bohatá na kyslík, Země zaledněná

Prekambrium



eon

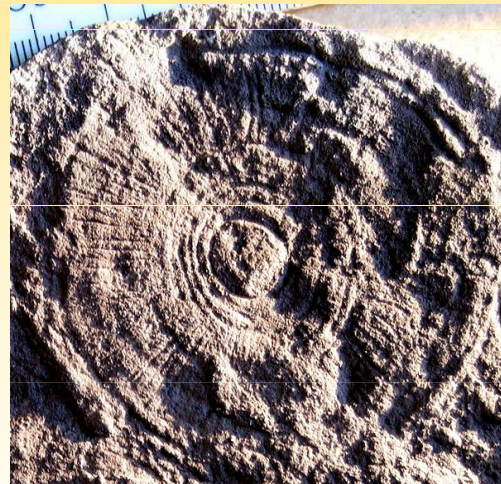
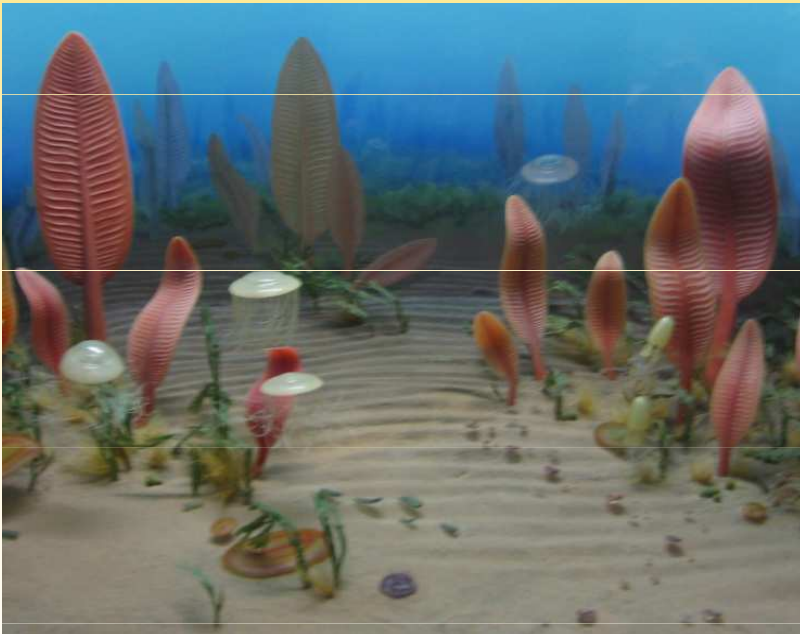
**Hadaikum
(Hadean)**

**Archaikum
(Archean)**

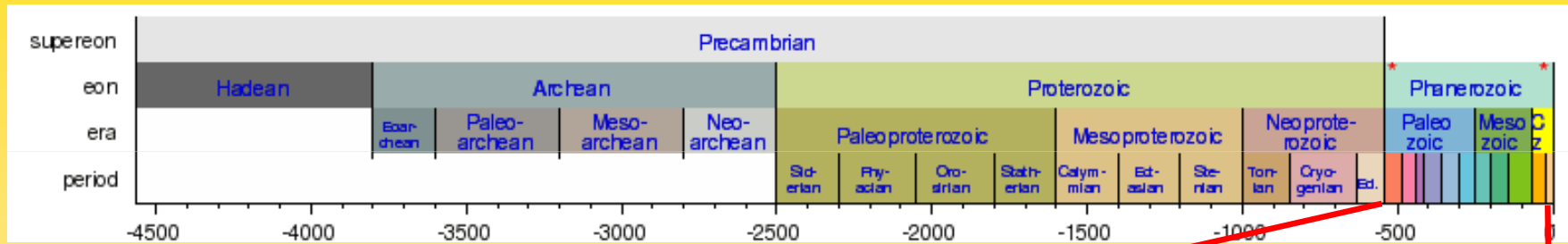
**Proterozoikum
(Proterozoic)**

Fanerozoikum

**Ediakaranská fauna
(Vendian) ~635 M**



Fanerozoikum

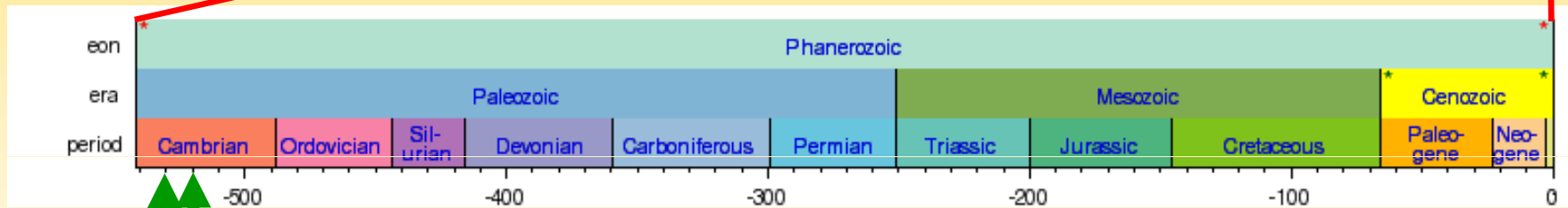


éra

Paleozoikum

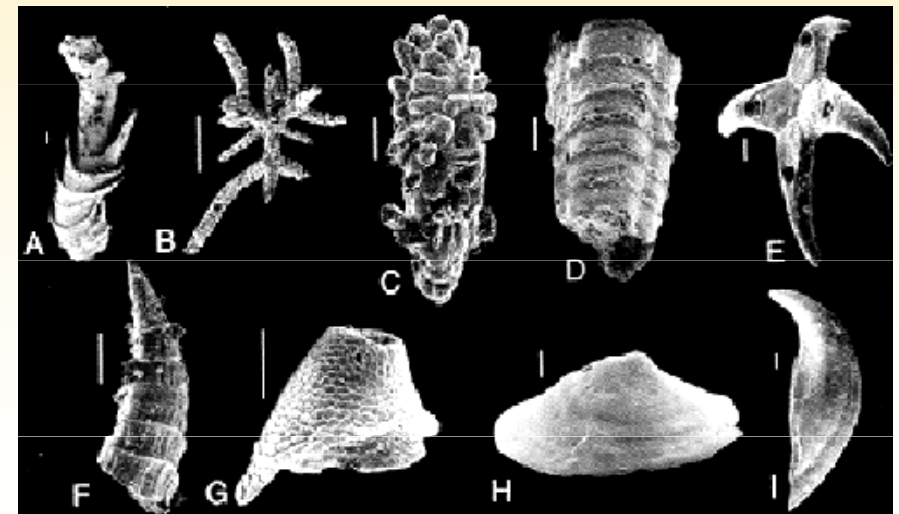
Mesozoikum

Kenozoikum

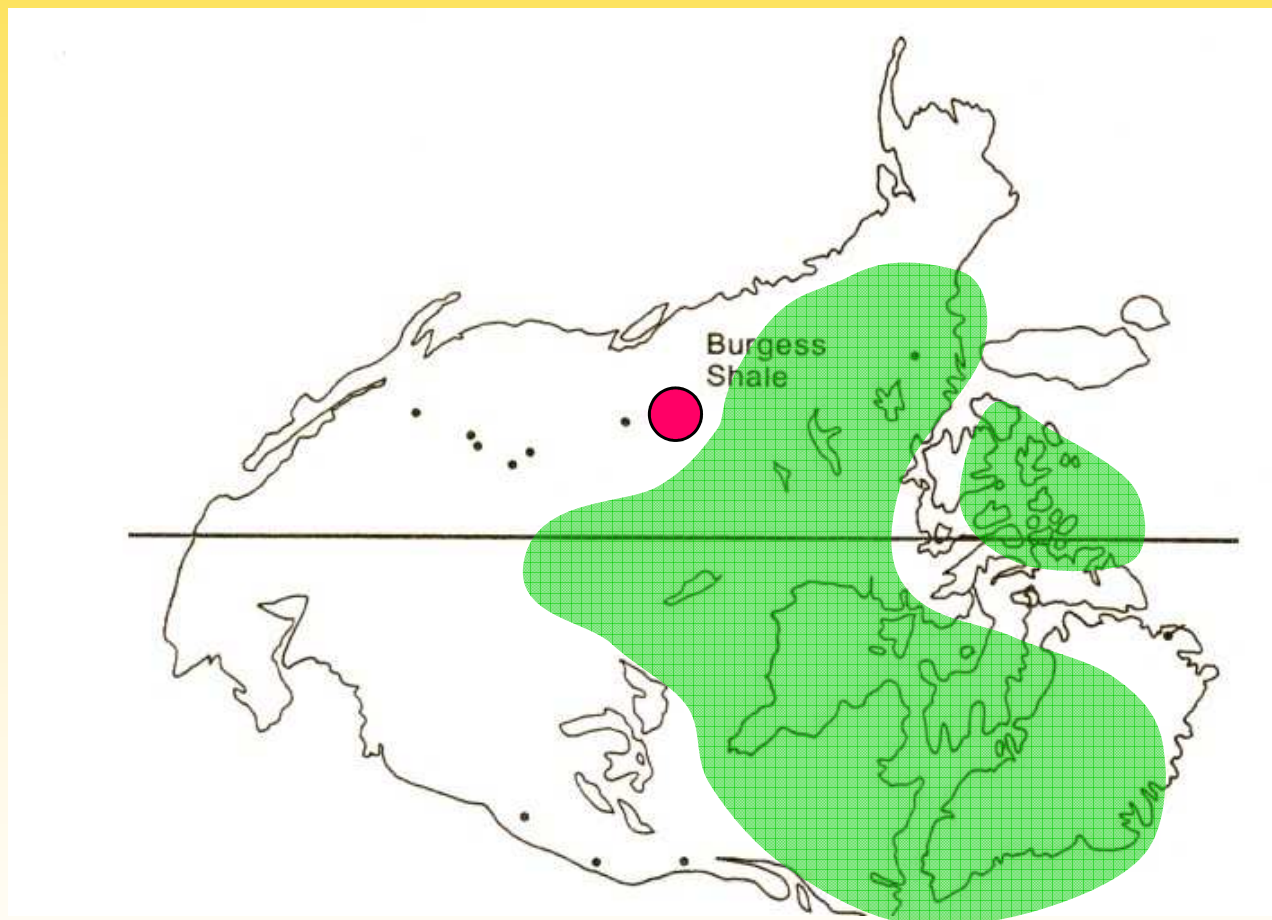


Tommotiánská fauna
(Tommotian) ~530 M

Burgessova břidlice
(Burgess Shale) ~520 M



Kambrická exploze

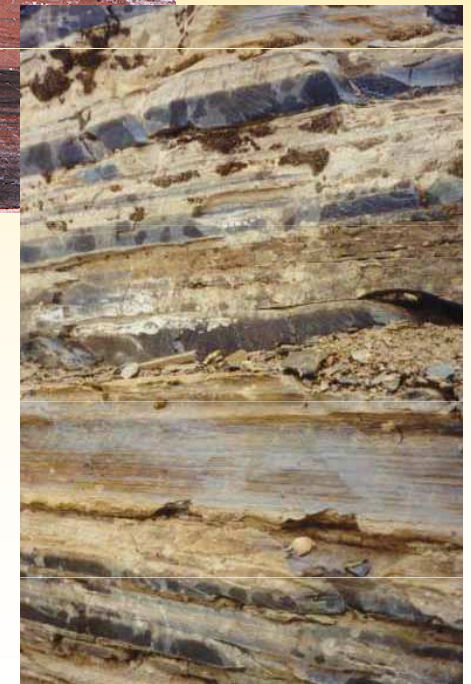
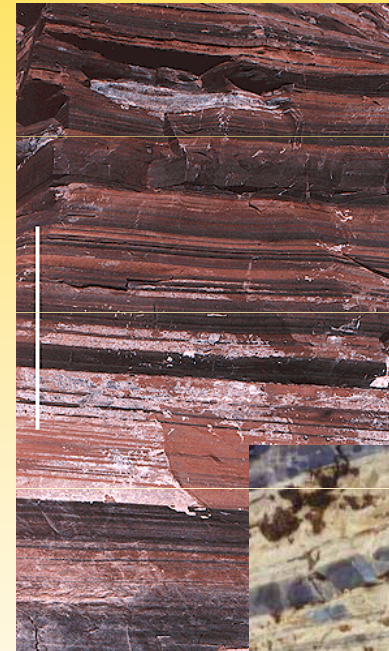
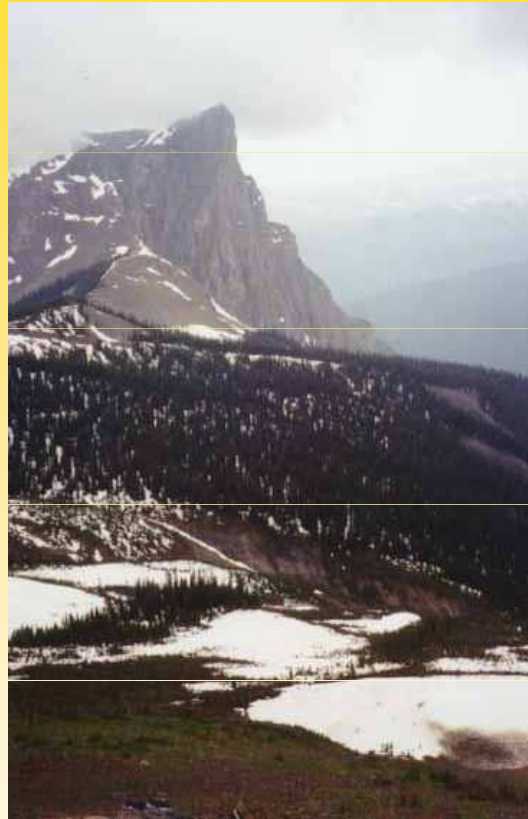


Kambrická exploze

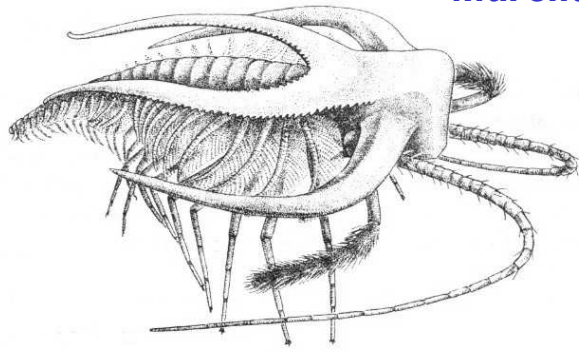
Burgessova břidlice Canadian Rockies



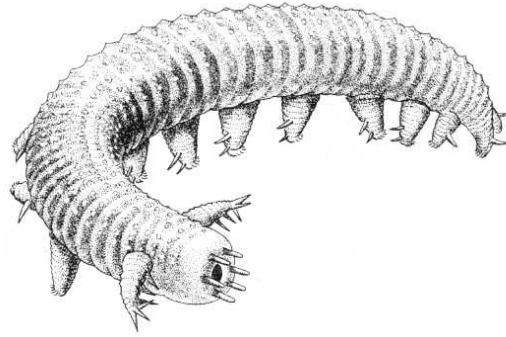
Charles D. Walcott (1909)



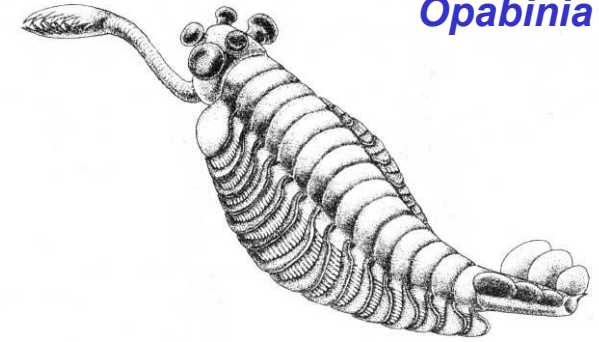
Marella



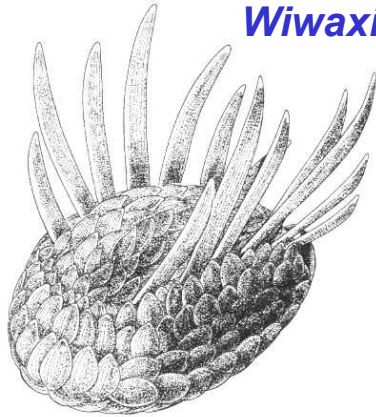
Aysheaia



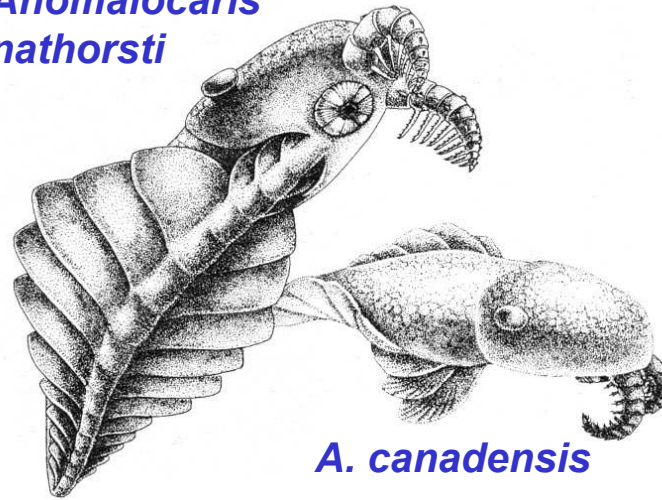
Opabinia



Wiwaxia

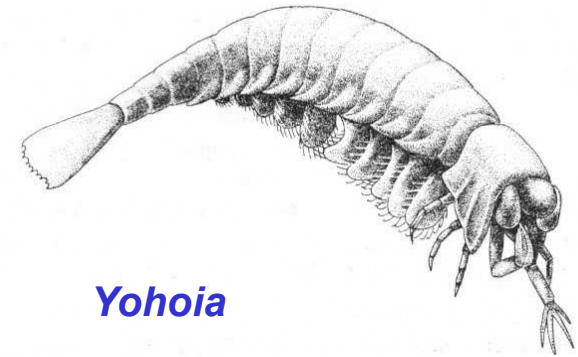


Anomalocaris nathorsti

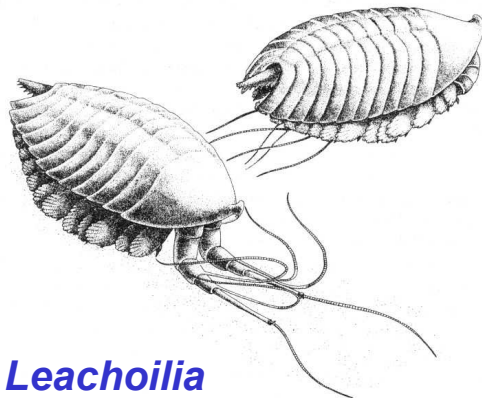


A. canadensis

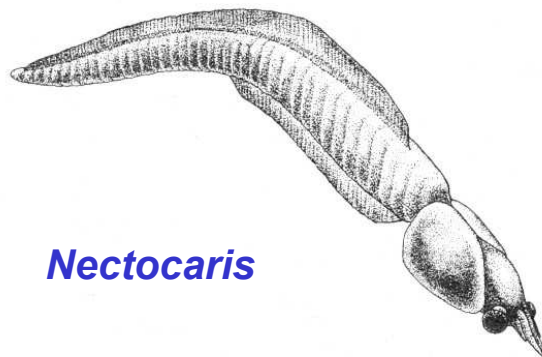
Yohoia



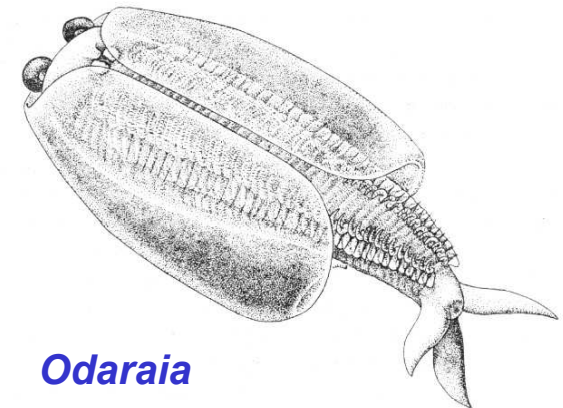
Leachoilia

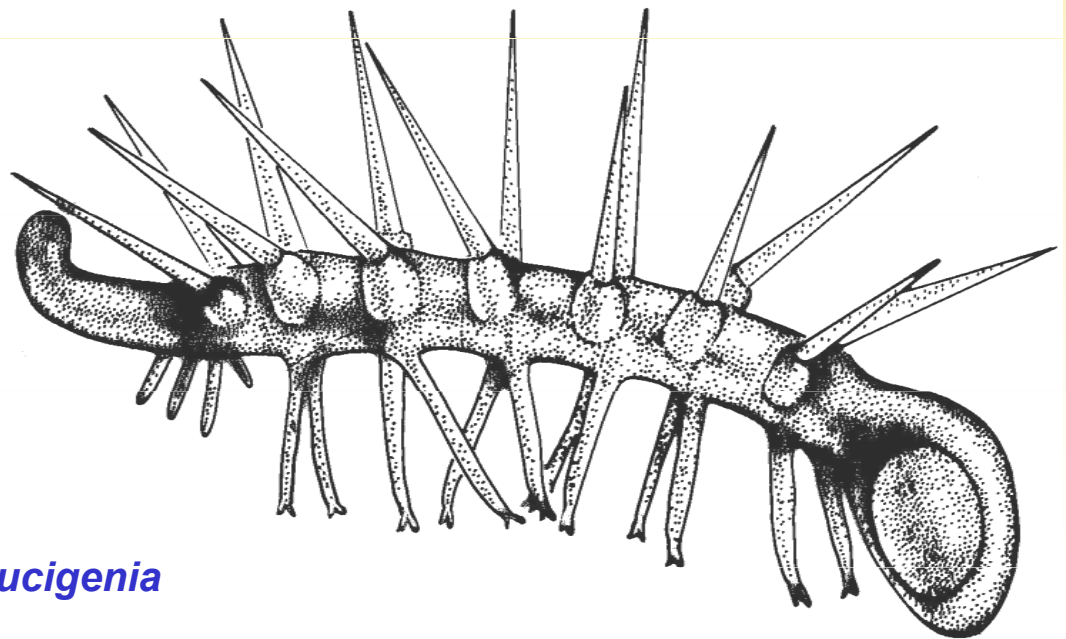
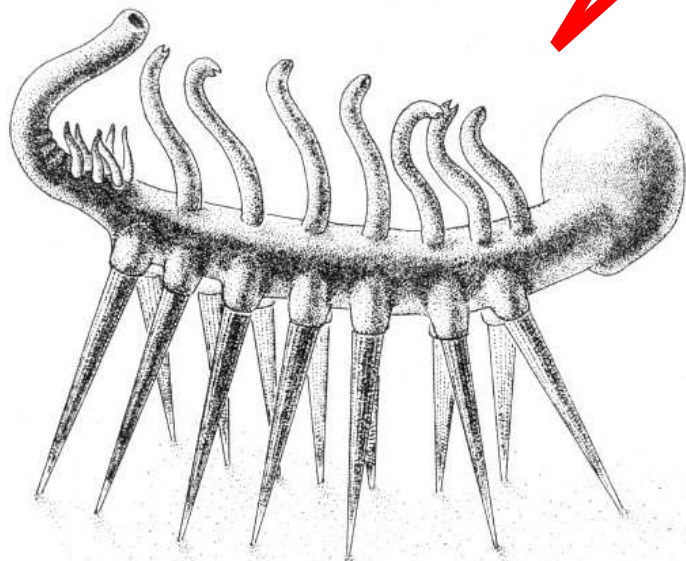


Nectocaris

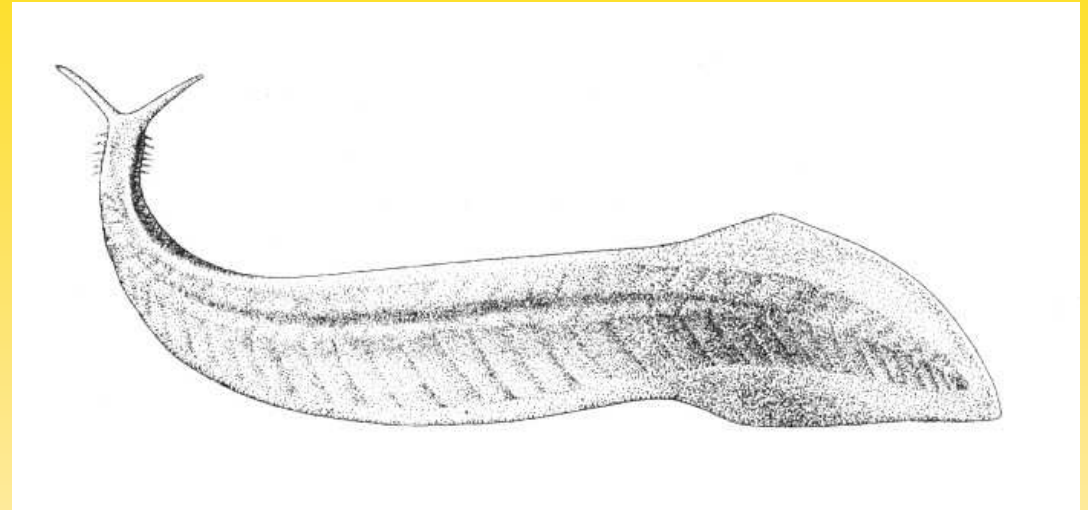
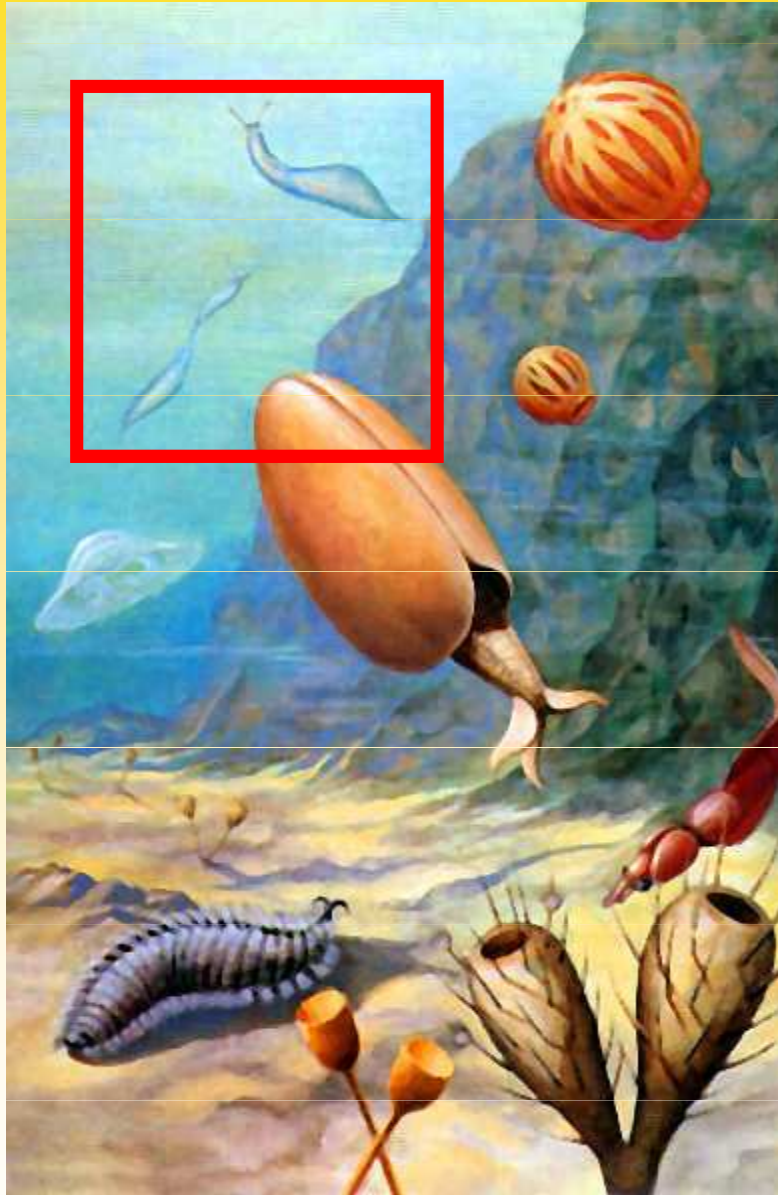


Odaraia

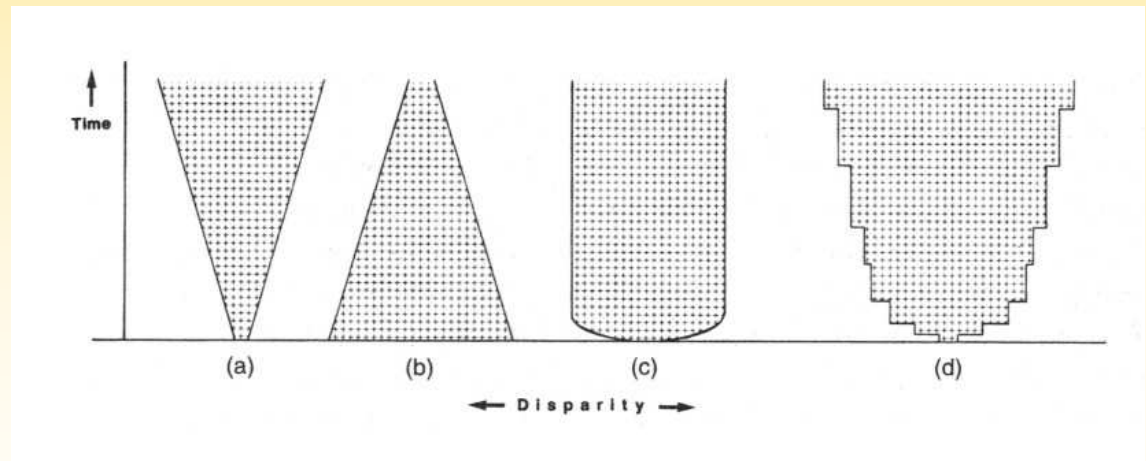




Hallucigenia



Pikaia gracilens
(Chordata)

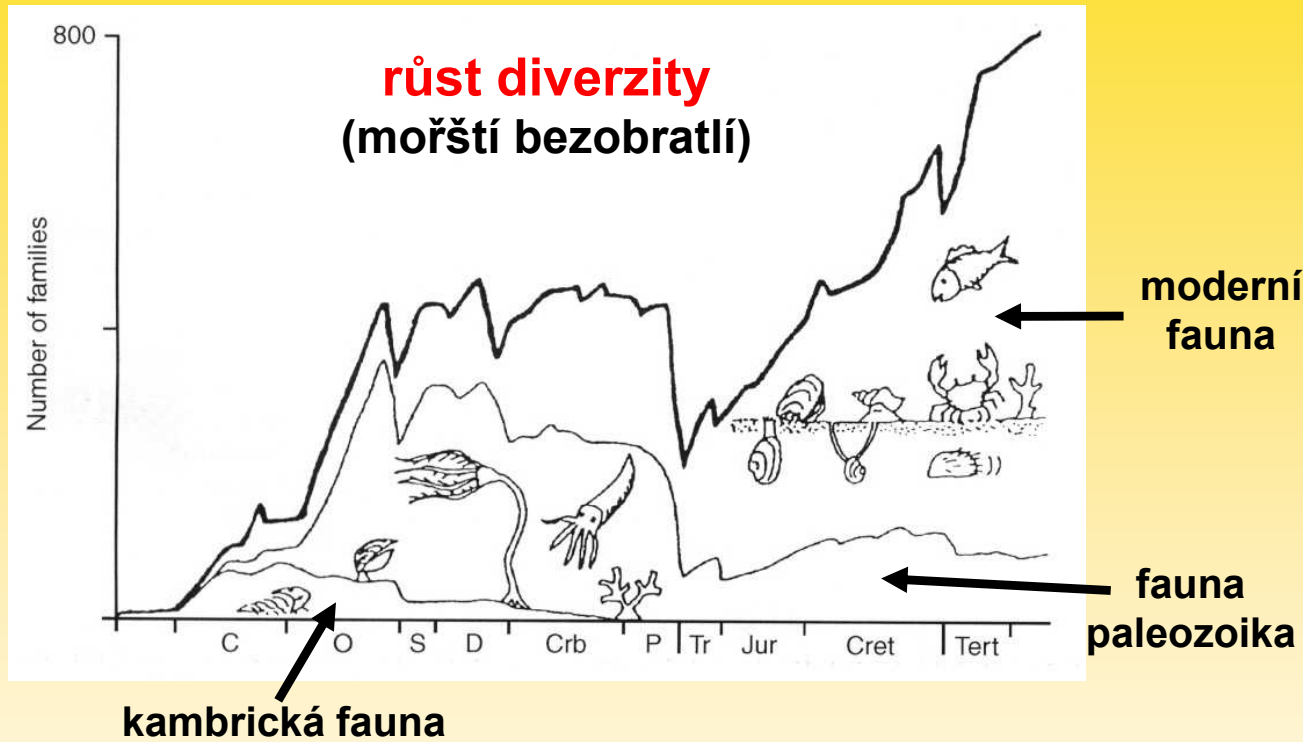


tradiční Gould

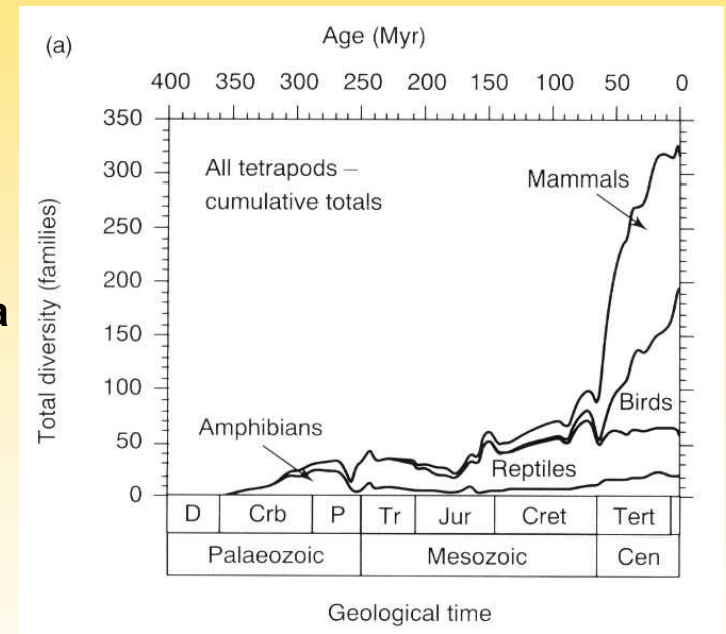
Conway Morris

diverzita a disparita

Fanerozoikum



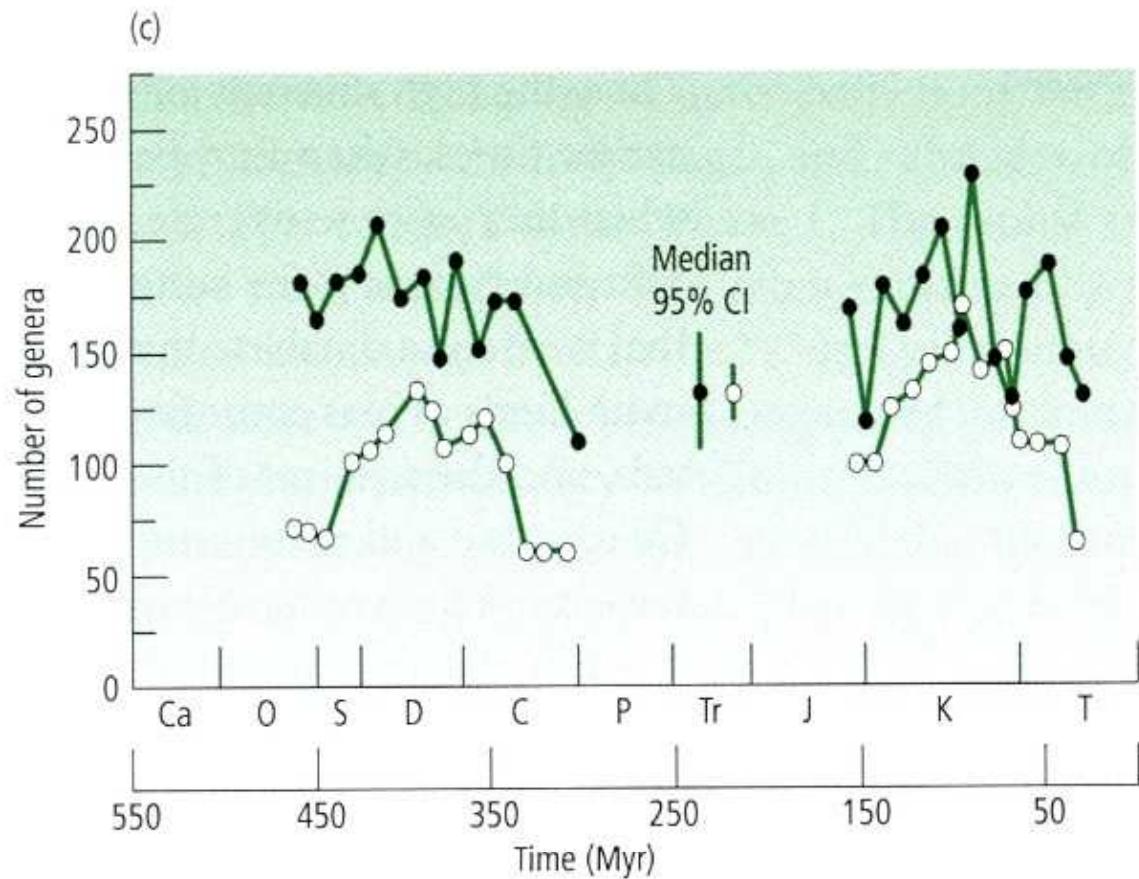
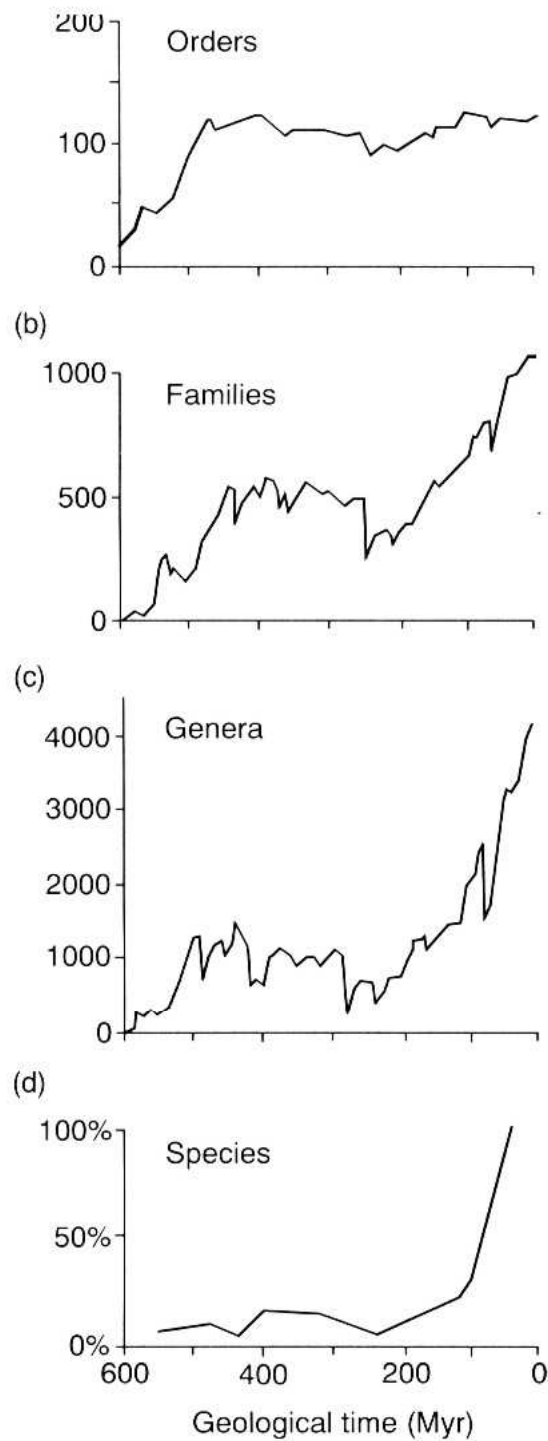
J. J. Sepkoski (1981): logistický model



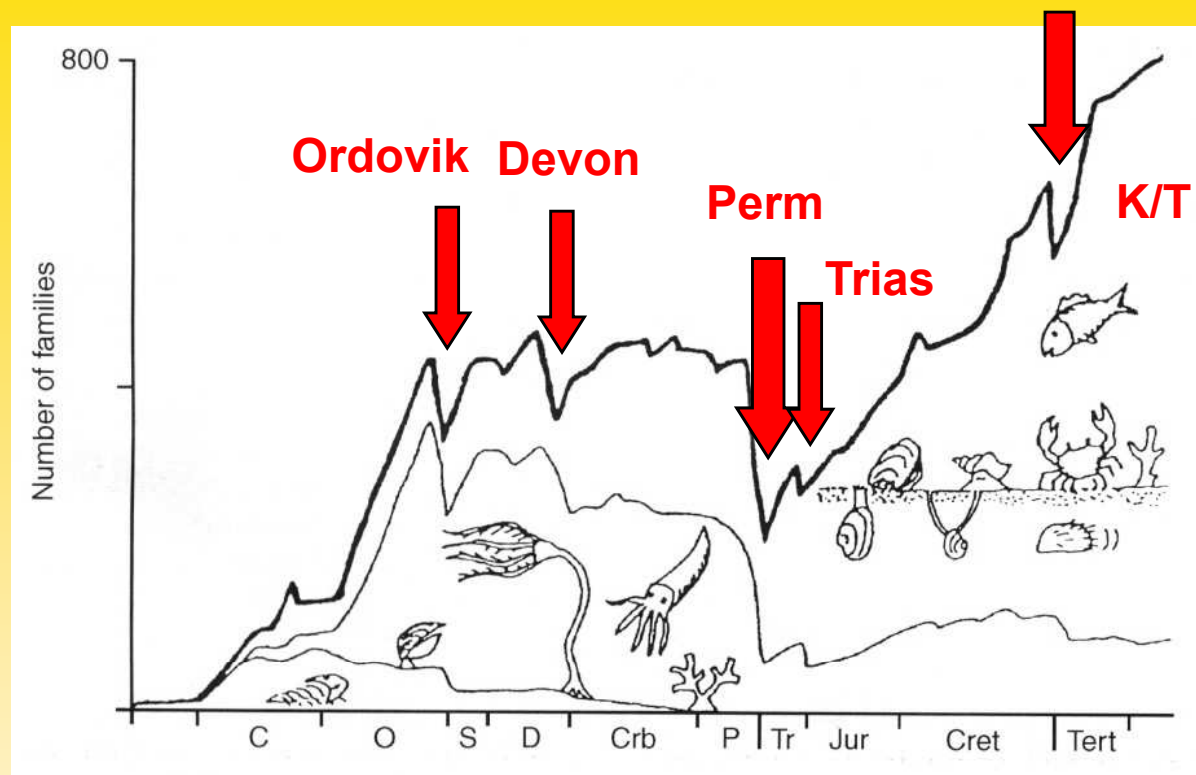
M. J. Benton (1997): křivka pro suchozemské organismy odlišná exponenciální model

Fanerozoikum

M. J. Benton (1997)

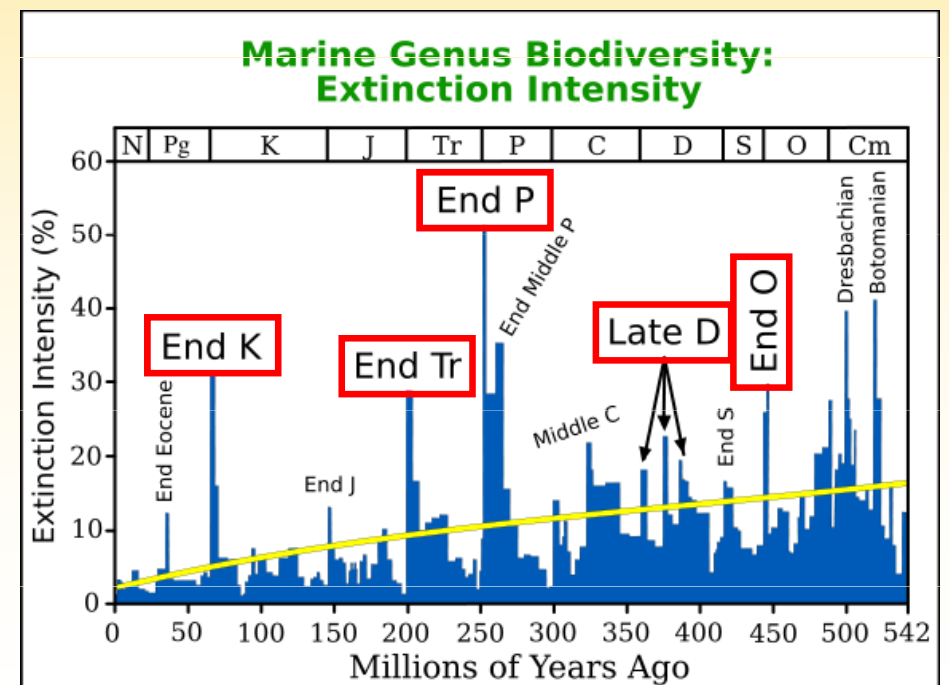


bereme-li v úvahu nekompletnost fosilního záznamu → žádný trend?

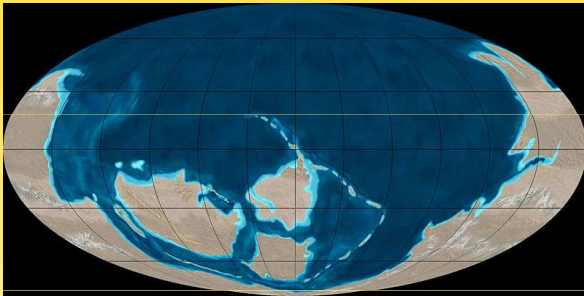


Extinkce:

- background extinctions („šum“)
- masové extinkce → „Velká pětka“
- největší: konec Permu

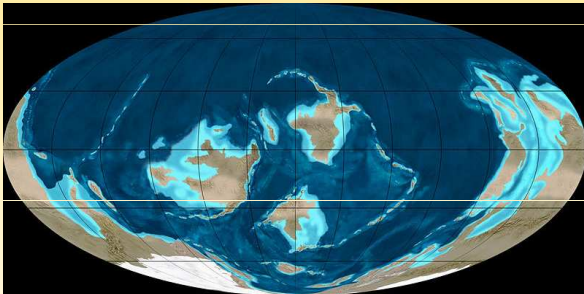


Paleozoikum



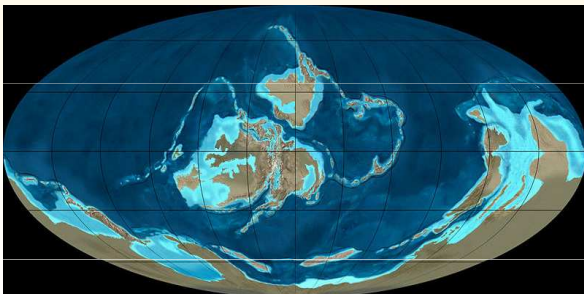
Kambrium:

jediný superkontinent Rodinia (Proterozoikum) → Gondwana, Laurentia, Baltica, Angara (Siberia), Avalonia ...



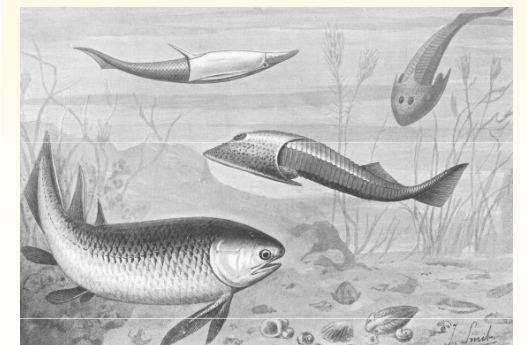
Ordovik:

růst diverzity (mořské o.)
na konci 1. masová extinkce

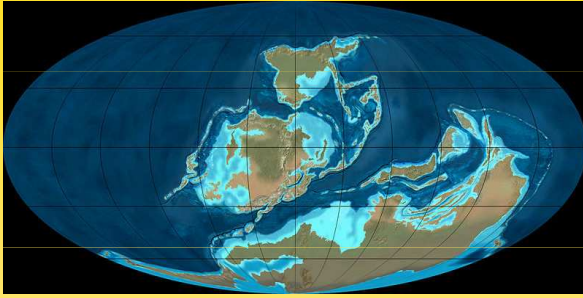


Silur:

čelistnatci
první suchozemské o.
(rostliny, štíři)



Laurentia+Baltica = Laurasia



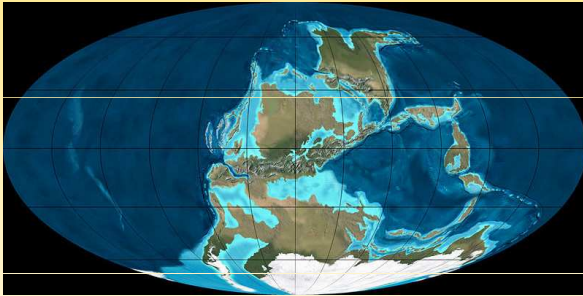
Devon:

radiace ryb, první žraloci, lalokoploutví, obojživelníci
na konci 2. masová extinkce



Ichthyostega

Acanthostega

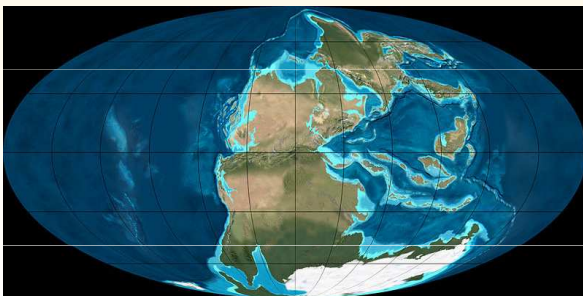


Karbon:

přesličky, hmyz, první plazi



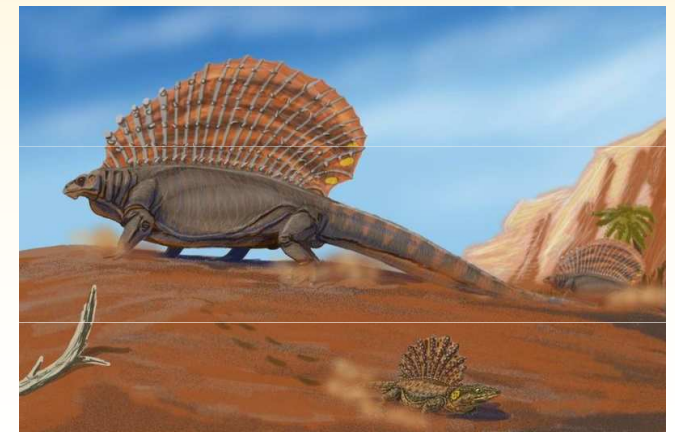
Archaeothyris
(synapsida)



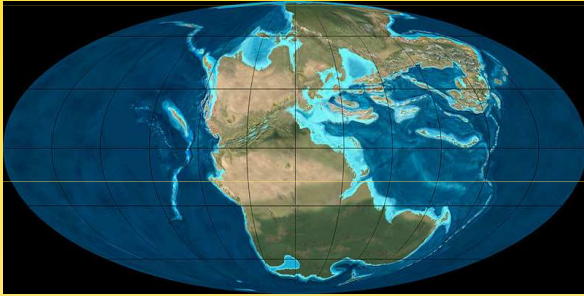
Perm:

Pangea
Therapsida (→ savci)
na konci 3. masová extinkce

Edaphosaurus



Mesozoikum



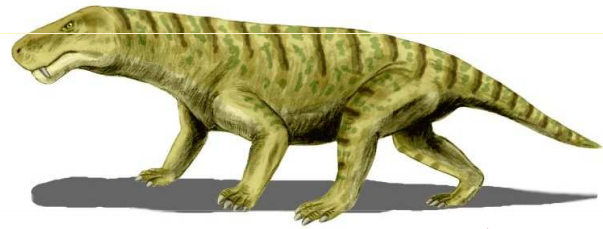
Trias:

motýli, dvojkřídli

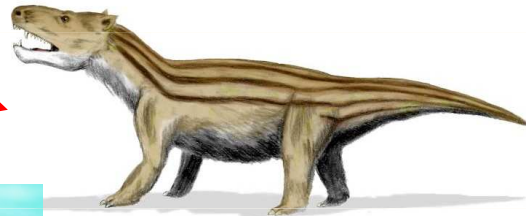
radiace plazů (želvy, ichthyosauři, plesiosauři, pterosauři, archosauři)

konec triasu: dinosauři, savci, 4. extinkce

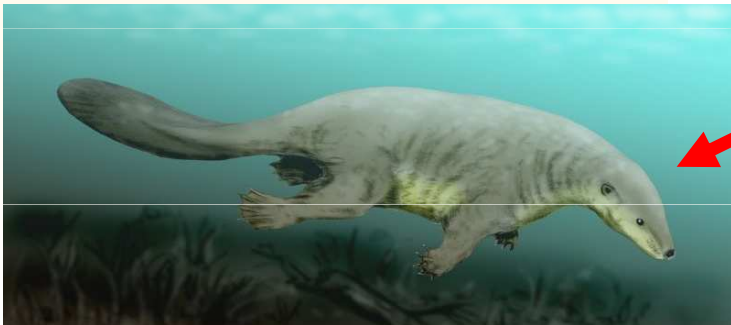
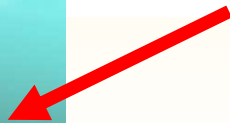
synapsidní plaz
Pelycosauria
(*Palaeohatteria*)



Therapsida



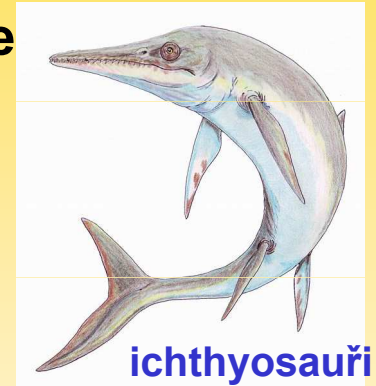
cynodont
(*Cynognathus*)



primitivní savec (*Castorocauda*)



archosauři



ichthyosauři

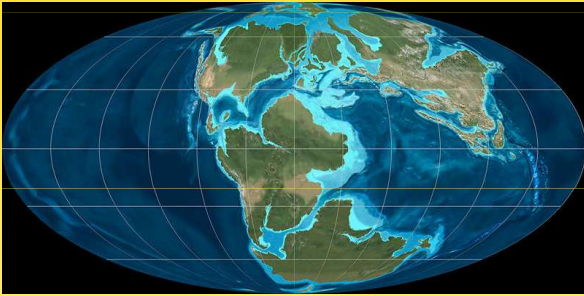


plesiosauři



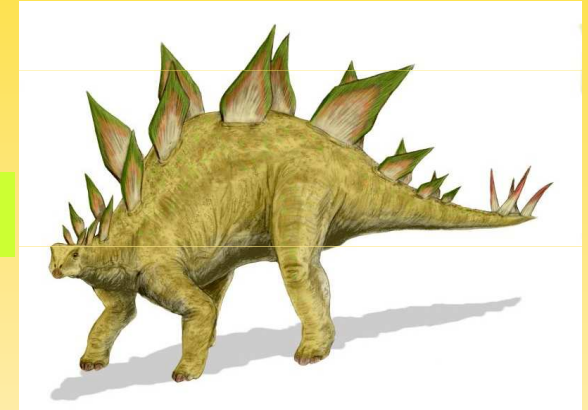
pterosauři

Mesozoikum



Jura:
kostnaté ryby
evoluce ptáků

Stegosaurus



Saurischia

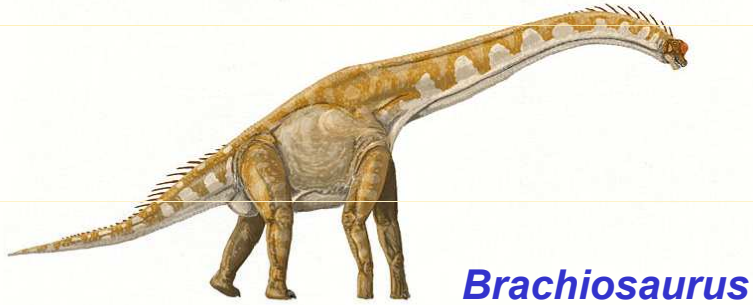
dinosauři

Ornithischia

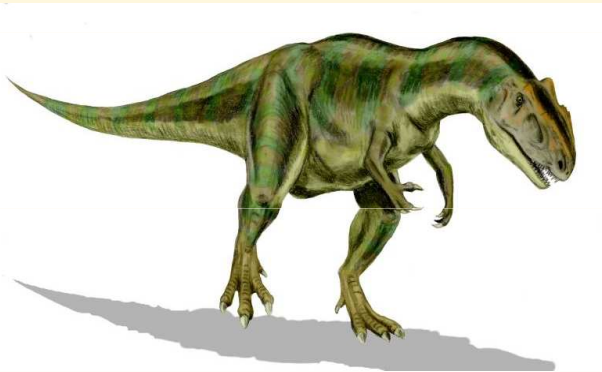
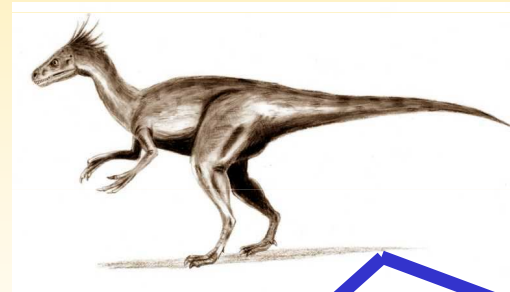
theropodní dinosauři

Maniraptora

tyrannosauři
(křída)



Brachiosaurus

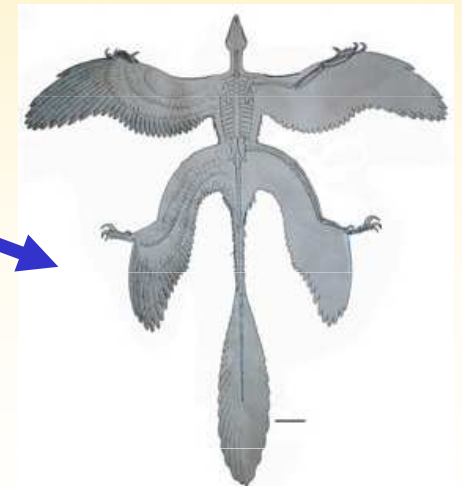


Allosaurus



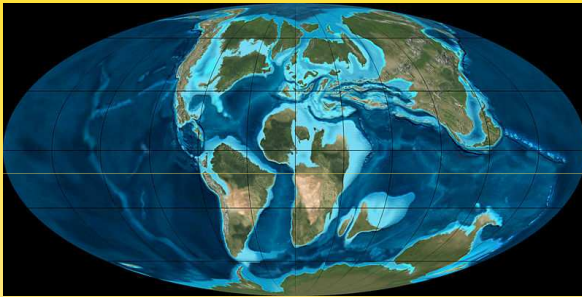
Archaeopteryx

ptáci



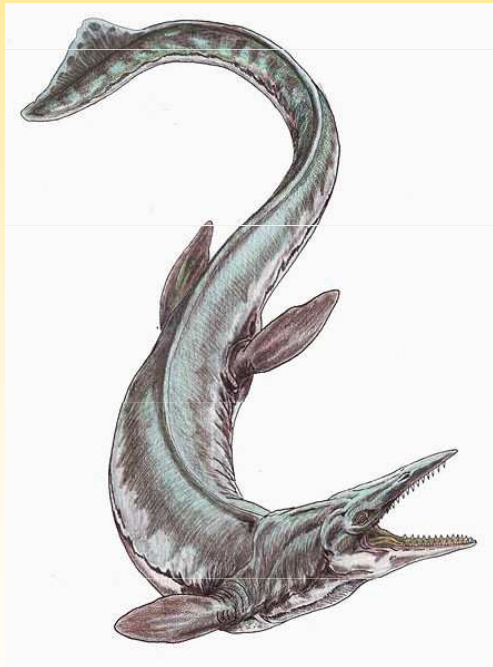
Microraptor gui

Mesozoikum

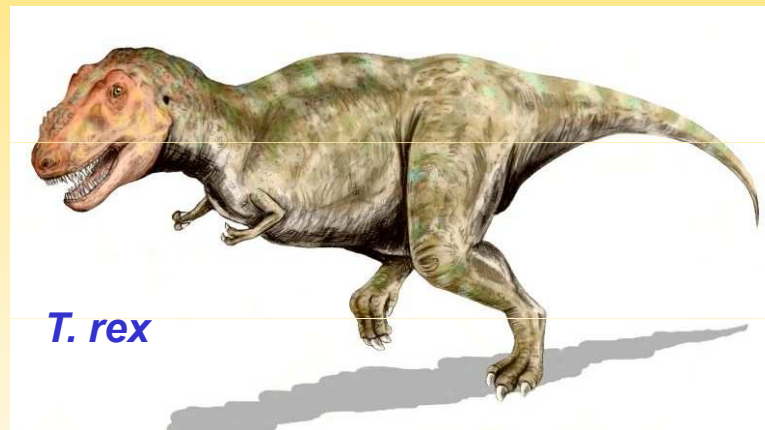


Křída:

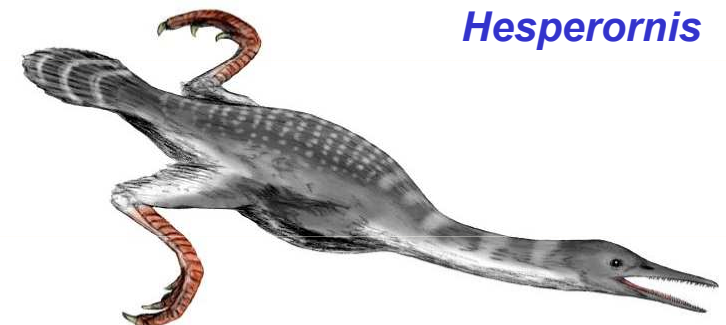
krytosemenné rostliny
moderní žraloci a rejnoci, mosasauři, první hadi, ptáci
savci: divergence vačnatců a placentálů



mosasauři



T. rex



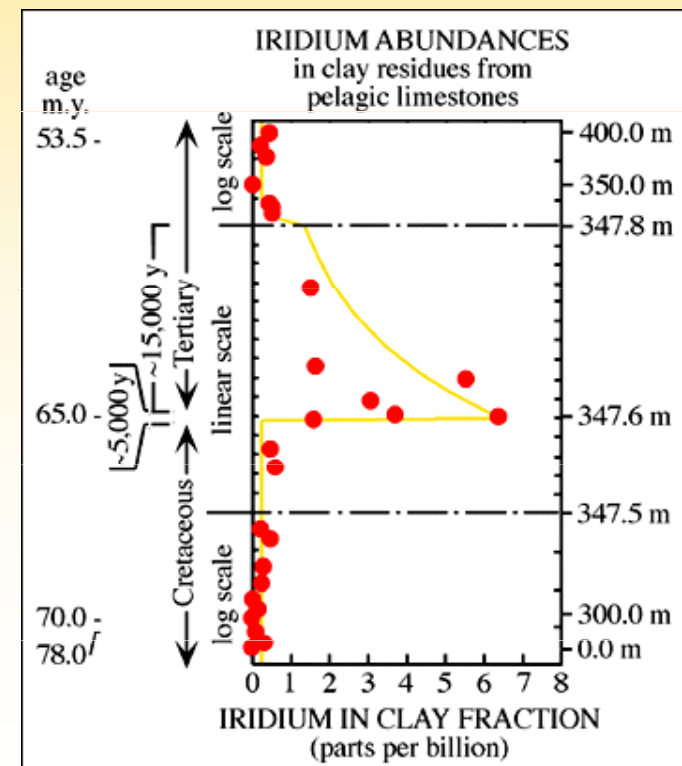
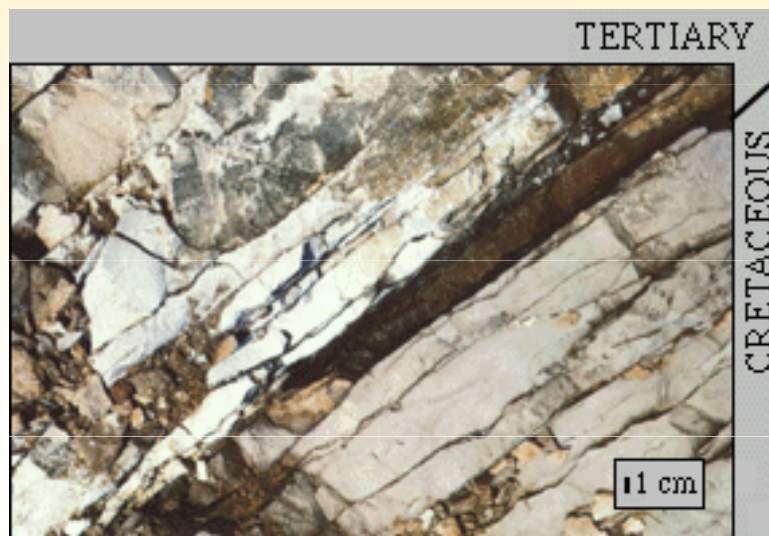
Hesperornis

na konci křidy: 5. extinkce, 65 M

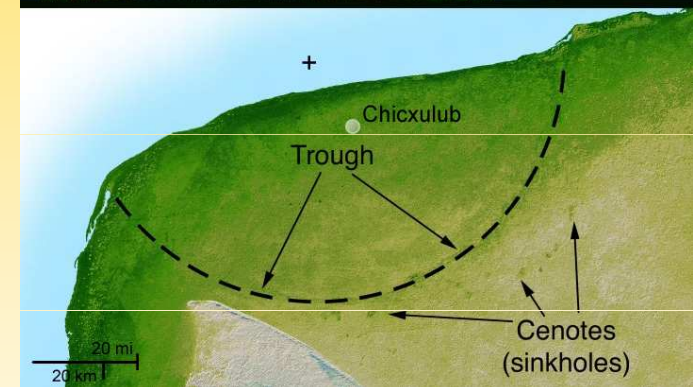
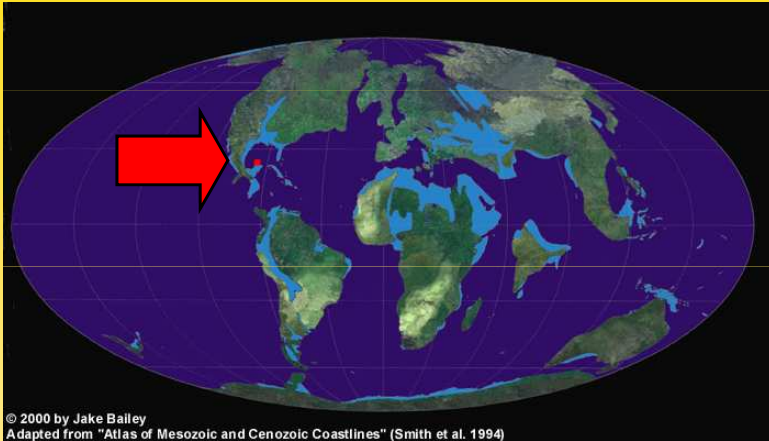
→ otázka příčiny

Extinkce na K/T hranici:

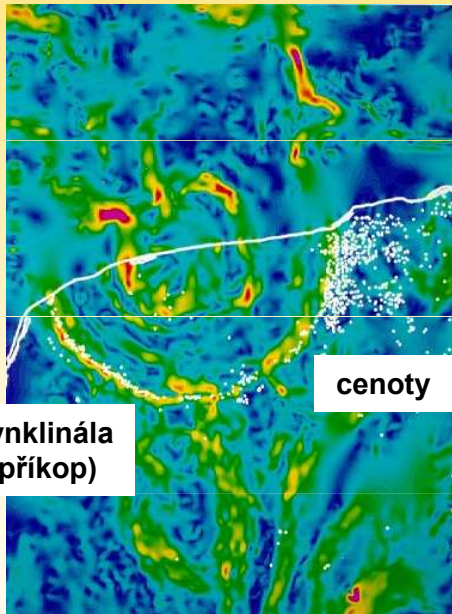
- 1980 Louis Alvarez a kol.: katastrofická hypotéza
- iridium na K/T rozhraní



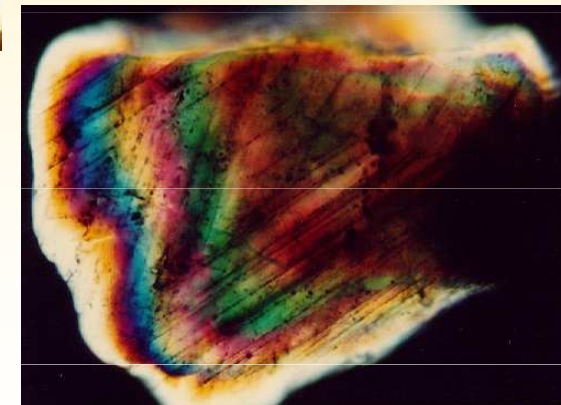
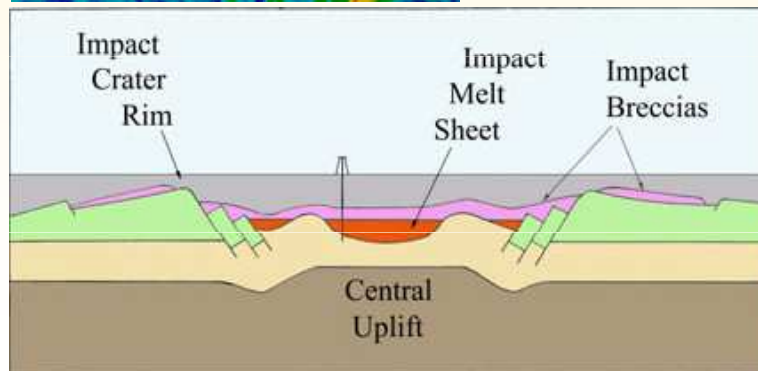
kráter Chicxulub, Yucatán, Mexiko



mapa gravitačního pole



tektity z K/T rozhraní



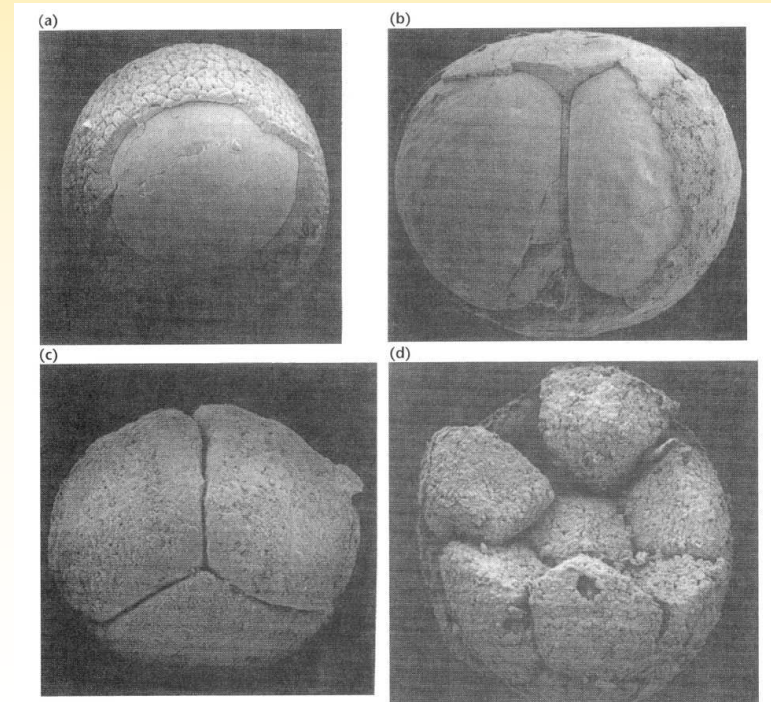
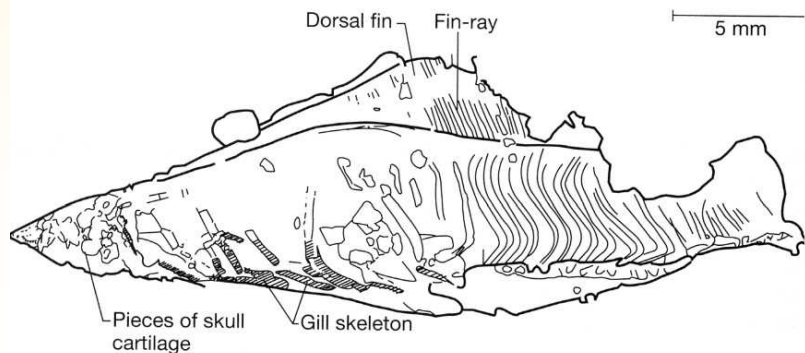
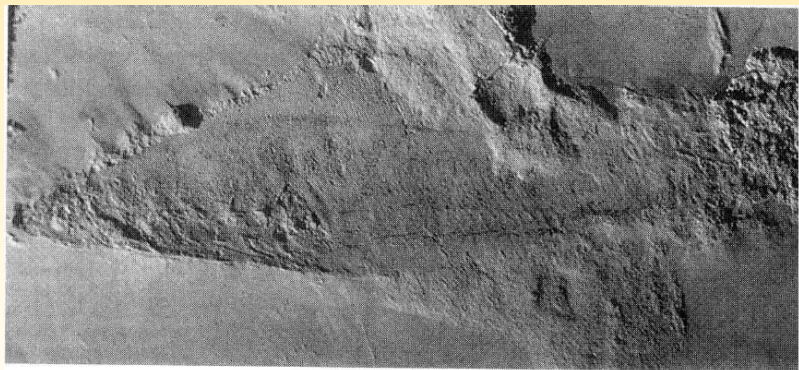
šokový krystal

Paleontologická vs. molekulární data

otázka vzniku živočišných kmenů a savčích a ptačích řádů

1. kambrická exploze?

- molekulární data: např. Protostomia-Deuterostomia ~ 1200 M
Chordata-Echinodermata ~ 1000 M (Wray et al. 1996)
- „fylogenetická pojistka“?
- divergence možná ne tak starobylé, ale...
- fauna z Chengjiang (Čína): 2 druhy bečelistných ryb ~ 530 M
formace Doushantuo (J Čína), Prekambrium: časná stadia embryí?



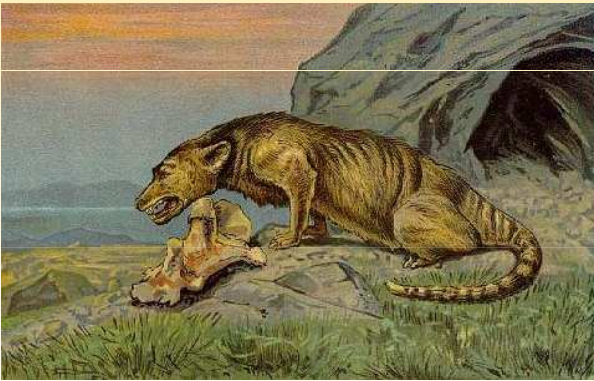
Paleontologická vs. molekulární data

otázka vzniku živočišných kmenů a savčích a ptačích řádů

1. kambrická exploze?
2. recentní skupiny savců a ptáků a K/T hranice

evoluce kytovců:

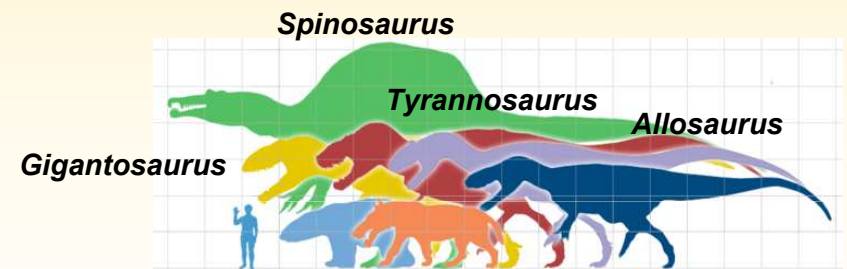
mesonychidi → přechod do vody → kytovci



Mesonyx



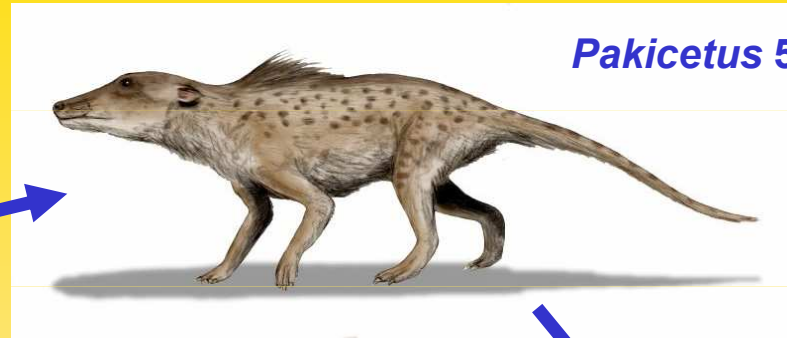
*Andrewsarchus
mongolicus*



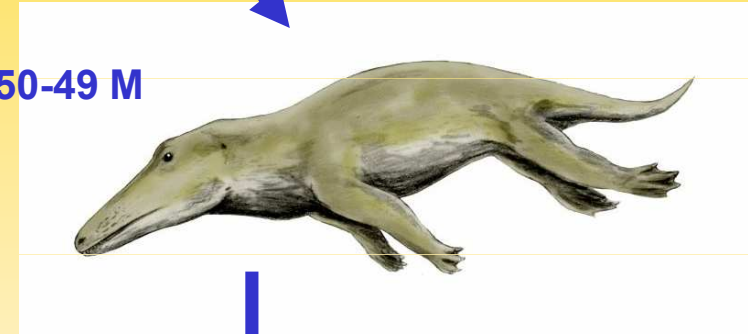
evoluce kytovců



mesonychidi ~ 56 M



Pakicetus 56-34 M



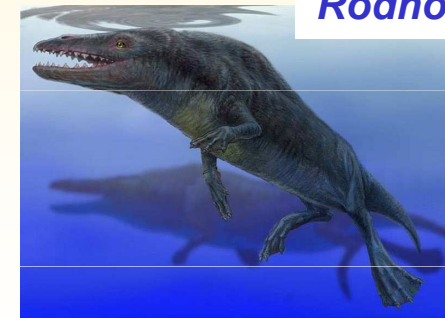
Ambulocetus 50-49 M



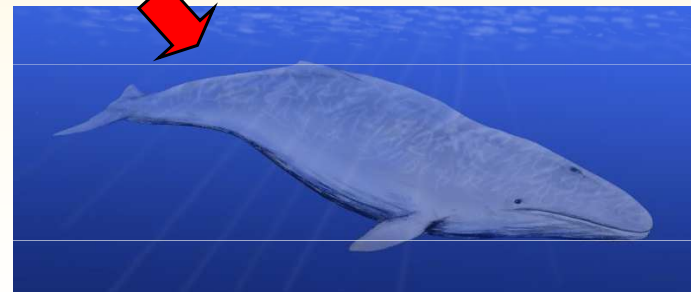
Rodhocetus 47 M



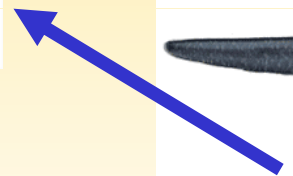
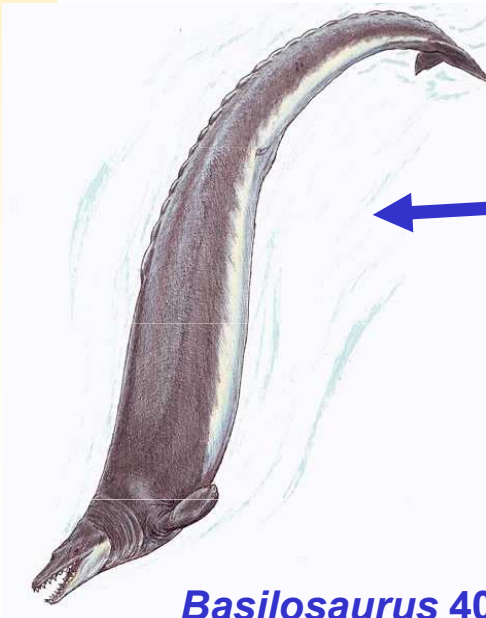
Dorudon 41-33 M



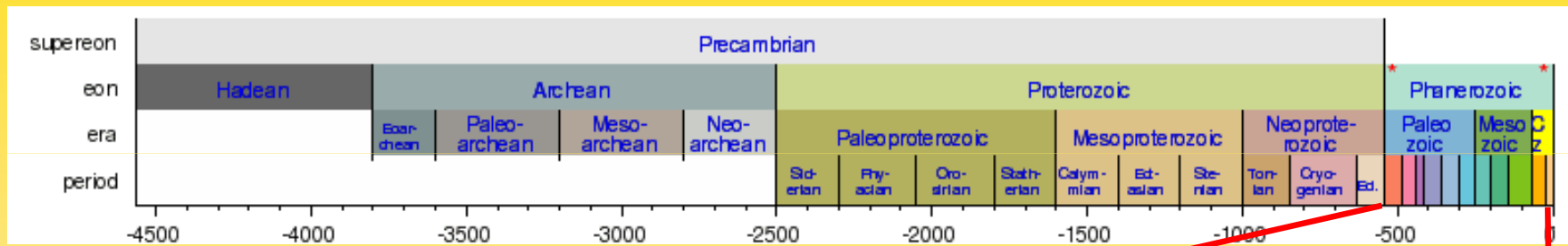
Cetotherium 15 M



Basilosaurus 40-34 M



eon: **Fanerozoikum**

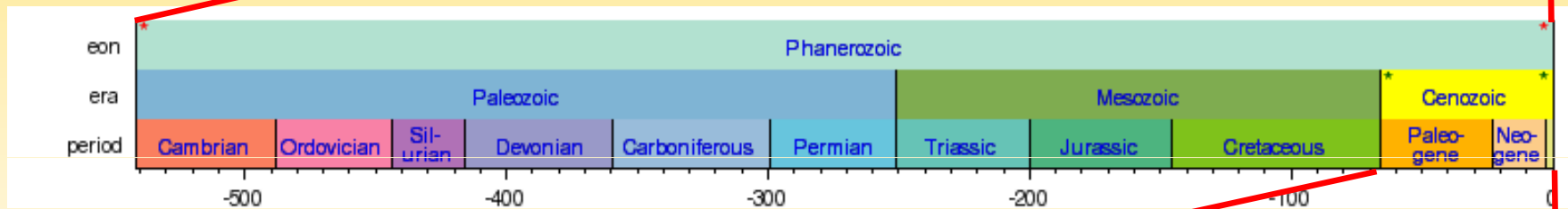


éra

Paleozoikum

Mesozoikum

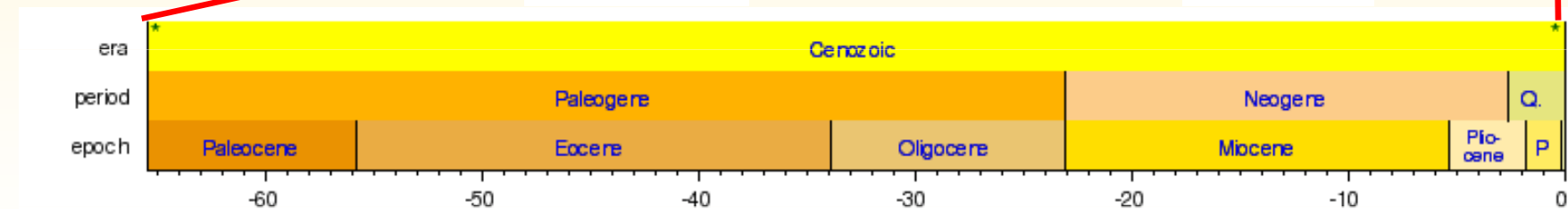
Kenozoikum



perioda

Paleogén

Neogén



epocha

Paleocén

Eocén

Oligocén

Miocén

Plio- Pleisto-

Obecné zákonitosti

- diverzita: analogie s burzou
- extinkce: model pěšáka v poli
- délka života linií: model bankrotu hazardního hráče

- D. Raup, J. Sepkoski:
periodicita? (26 M)

