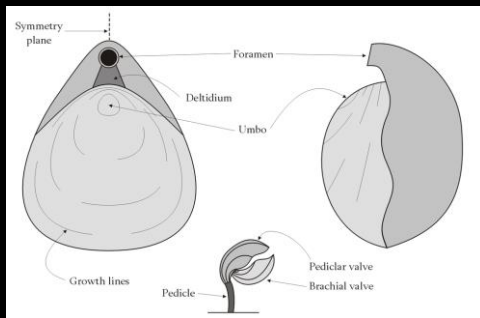


## Phylum Brachiopoda

### Lophophorate 'lamp-shells'



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## Lophophore



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## Fossils - Spiriferida



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## Fossils - Strophomenida



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## Fossils - Terebratulida



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## Brachiopods vs bivalves

Symmetrical, unequal  
valves



Asymmetrical, equal  
valves



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## ECHINODERMS



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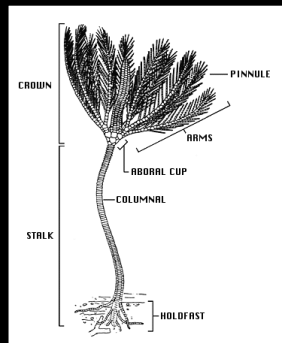
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## Crinoids



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## Crinoidal grainstone



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## Echinoids



Regular



Irregular

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## Phylum Chordata



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## Early chordate



*Pikaia gracilens* (c. 505 Ma)

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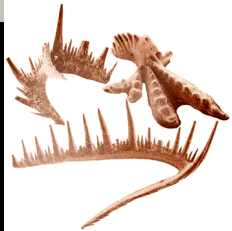
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## Agnatha – jawless fish



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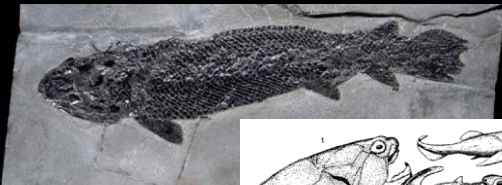
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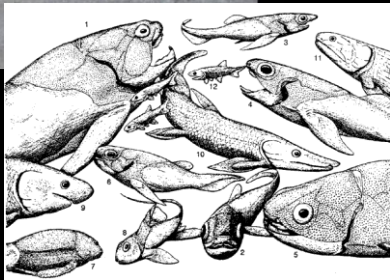
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## The Age of Fish



Devonian:  
marine and  
freshwater  
fish



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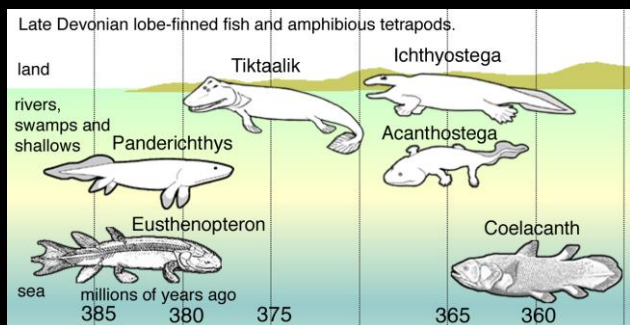
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## Devonian diversification



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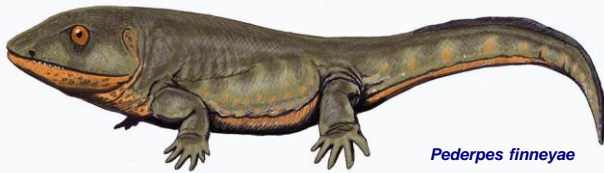
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## Amphibians



*Pederpes finneyae*

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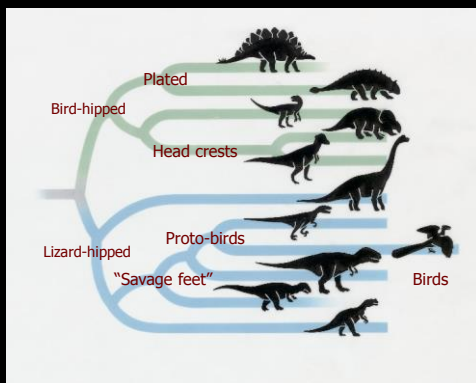
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## Rise of the Reptiles



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## Synapsida

Our reptilian ancestors



Reptile Ancestor  
From T. L. Smith

Gorgonopsid

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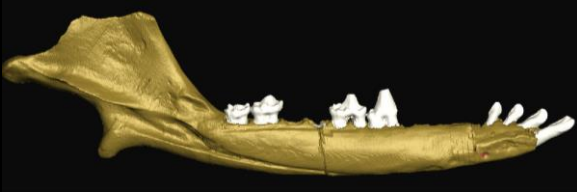
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## From gorgons to Glamorgan



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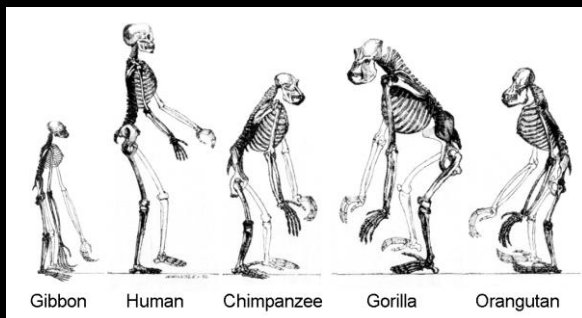
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## Hominoidea



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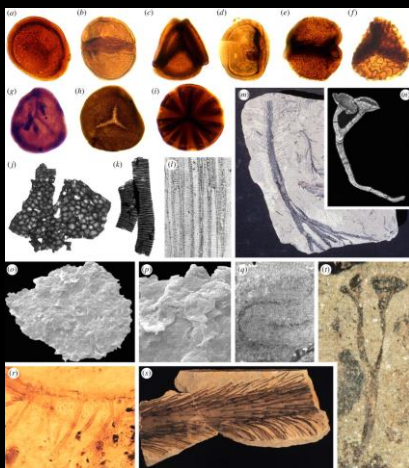
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## First land plants: the fossils



Ordovician spores;  
Silurian & Devonian  
roots, cuticle, tubes

Kenrick et al. (2012)

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## Early land plants



*Cooksonia* – late Silurian, Wales

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## Vascular plants

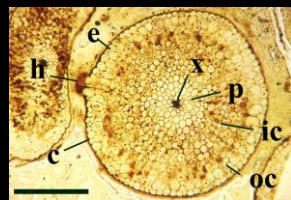
### Tissues:

#### Xylem (wood)

- transports water primarily

#### Phloem (bark)

- transports sugars primarily



Internal structure of early Devonian vascular plant

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## Carboniferous!



Dominated by gymnosperms

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## The 'Mesophytic' Era

Permian-  
Triassic-  
Jurassic

'Seed ferns'  
dominant

+ conifers



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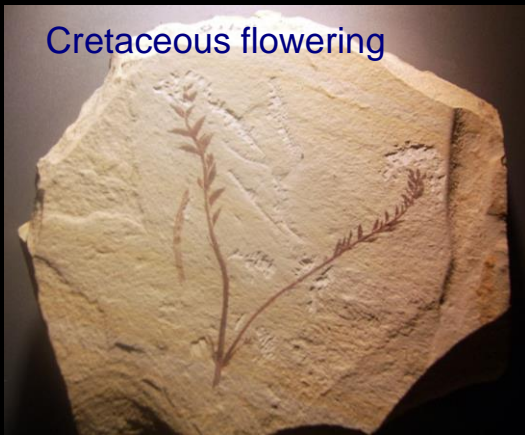
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## Cretaceous flowering



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## Trace fossils



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## Correlating strata

- Biostratigraphy
  - “life layer writing”
- Principle of superposition
- Relative dating
  - Use fossils to tell the time

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## The bio-stratigrapher

William Smith  
(1769-1839)

Canal surveyor

The Law of Faunal  
Succession



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## Using Fossils To Tell The Time

John Phillips  
(1800-74)

Palaeozoic – 'old life'  
Mesozoic – 'middle life'  
Cainozoic – 'new life'



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## Earth = Life = Time

### PALAEOZOIC:

Cambrian  
Ordovician  
Silurian  
Devonian  
Carboniferous  
Permian

### MESOZOIC:

Triassic  
Jurassic  
Cretaceous  
CAINOZOIC  
Palaeogene  
Neogene

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## Fossil time

CENOZOIC ERA (Age of Recent Life)	Quaternary Period	<i>Pecten gibbus</i>	<i>Neptunea tabulata</i>
	Tertiary Period	<i>Calyptraphorus velatus</i>	<i>Venericardia planicosta</i>
MESOZOIC ERA (Age of Medieval Life)	Cretaceous Period	<i>Scaphites hippocrepia</i>	<i>Inoceramus labiatus</i>
	Jurassic Period	<i>Perisphinctes tiziani</i>	<i>Nerinea trinodosa</i>
	Triassic Period	<i>Trochites subbullatus</i>	<i>Monotis subcircularis</i>
PALEOZOIC ERA (Age of Ancient Life)	Permian Period	<i>Leptodus americanus</i>	<i>Parafusulina boseri</i>
	Pennsylvanian Period	<i>Dictyoclostus americanus</i>	<i>Lophophyllidium proliferum</i>
	Mississippian Period	<i>Cactocrinus multibrachiatus</i>	<i>Prolecanites gurleyi</i>
	Devonian Period	<i>Mucrospirifer mucronatus</i>	<i>Palmatolepus unicornis</i>
	Silurian Period	<i>Cystiphyllum niagarense</i>	<i>Hexamoceras hertzeri</i>
	Ordovician Period	<i>Bathyrus extans</i>	<i>Tetragraptus fruticosus</i>
PRECAMBRIAN	Cambrian Period	<i>Paradoxides pinus</i>	<i>Billingsella corrugata</i>

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## Palaeoecology

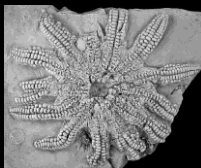
### ■ Compare fossil assemblages...



Sea lily



Trilobite



Starfish



Coral

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## Palaeoecology

### ■ ...with modern ecosystems



Tropical reef

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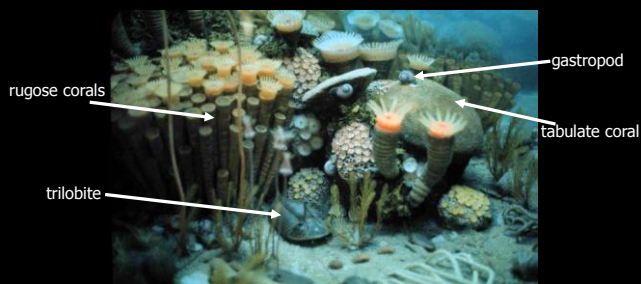
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## Palaeoecology

### ■ The present is the key to the past



Silurian reef ecosystem?

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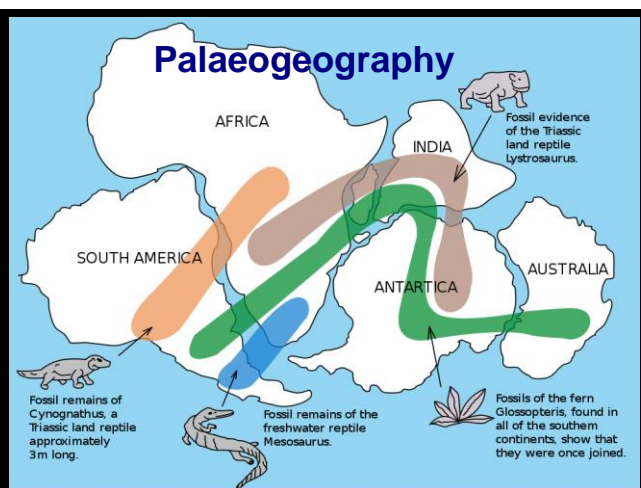
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## Palaeogeography



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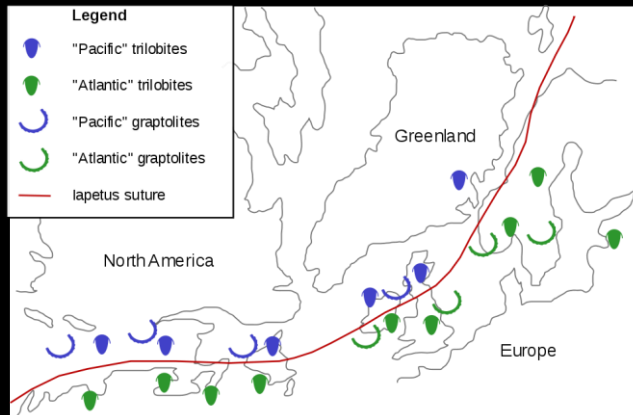
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## Palaeogeography




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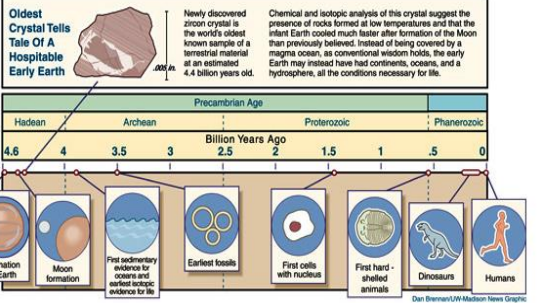
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## Very early life?




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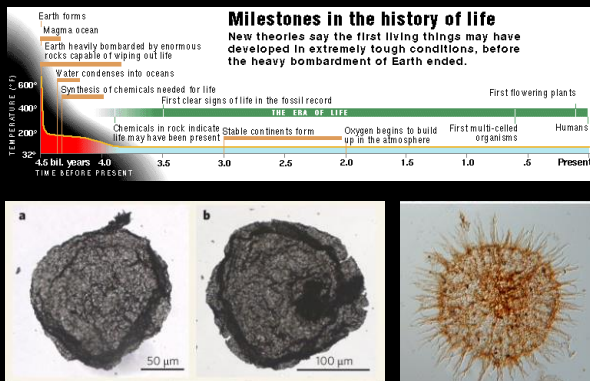
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## Very simple for a very long time




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## Beginnings of animal life




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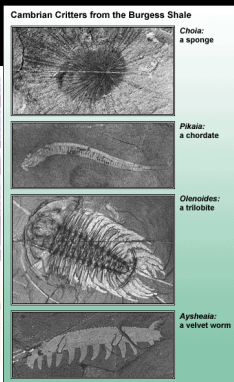
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## Cambrian Explosion




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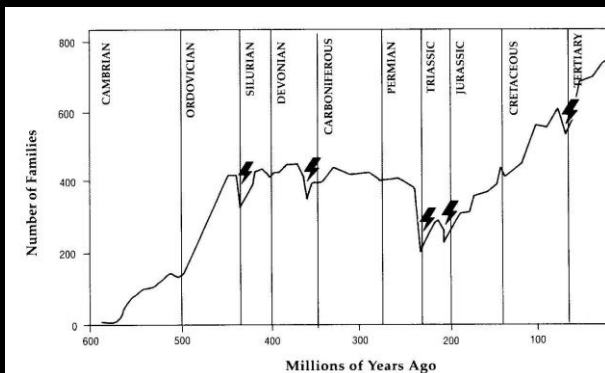
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## Increasing diversity




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## Useful links

Notes and links from today's course:

[www.fossilhub.org](http://www.fossilhub.org)

Natural History Museum

[www.nhm.ac.uk](http://www.nhm.ac.uk)

Palaeontology Online:

<http://www.palaeontologyonline.com/>

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