

# History of Life *Scope*

Topic	Breakdown of topic
<b>History of life on earth</b>  <b>28 Marks</b>	<p><u>Life's History</u> Different representations of the history of life on earth. The relationship to changes in climate (e.g. Increase in oxygen levels, ice ages) and geological events (e.g. movement of continents; introduction to biogeography)</p> <p><u>The three eras:</u> Paleozoic, Mesozoic and Coenozoic. Each era divided into periods (names of periods not to be memorized).</p> <p><u>Geological timescale</u> Meaning and use of timescales (details not to be memorized)</p> <p><u>Cambrian explosion</u> Origins of early forms of all animal groups. Life-forms have gradually changed to become present life-forms. In the last four million years significant changes have occurred in species occurring in Africa (e.g., humans)</p> <p><u>Mass extinctions</u> There have been five, two of which are particularly important: 250mya (resulted in the extinction of about 90% of all life on Earth) and 65mya (resulted in the extinction of many species, including the dinosaurs) The rate extinction on the Earth at present is higher than at any time in the past. <i>The present time has been called the sixth extinction</i></p> <p><u>Fossil formation</u> and methods of dating e.g. radiometric dating and relative dating</p>

# Life's history

Notes

The Earth is about 5 billion years old.

However, life began about 3,5 million years ago(MYA).

Life's history can be explained using three concepts:

- Rise in oxygen levels
- Climate change
- Geological events

## Rise in oxygen levels

- The first life forms were unicellular prokaryotes
- They respired anaerobically (without oxygen)
- As they evolved and photosynthesised, oxygen levels began to rise.
- The rise in oxygen led to the formation of multicellular organisms
- Algae were the first plant life forms
- Animals then followed

## Geological events

The **continental drift theory**:

- The earth was one big mass called Pangaea(a super continent)
- Due to shift in techtonic plates, it was split into two (Laurasia & Gondwanaland)
- Laurasia is now the northern hemisphere, while Gondwanaland is the southern hemisphere.
- Biogeography supports this theory

Evidence: Distribution of flightless birds

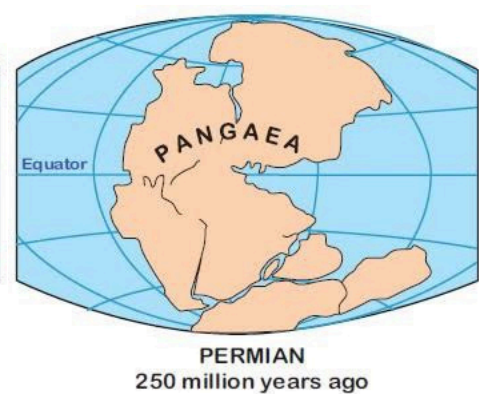
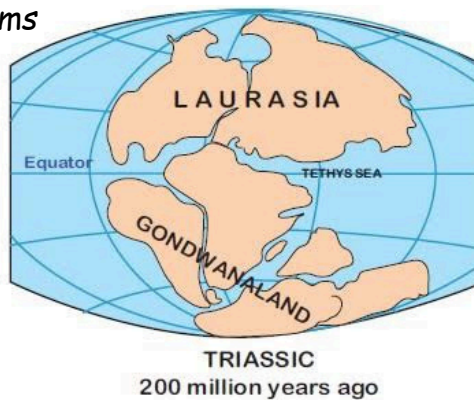
South African ostrich, Australian Emu, American Rhea, New Zealand's Moa

The **Plate tectonic theory** suggests that the earth's plate fit like a jigsaw puzzle

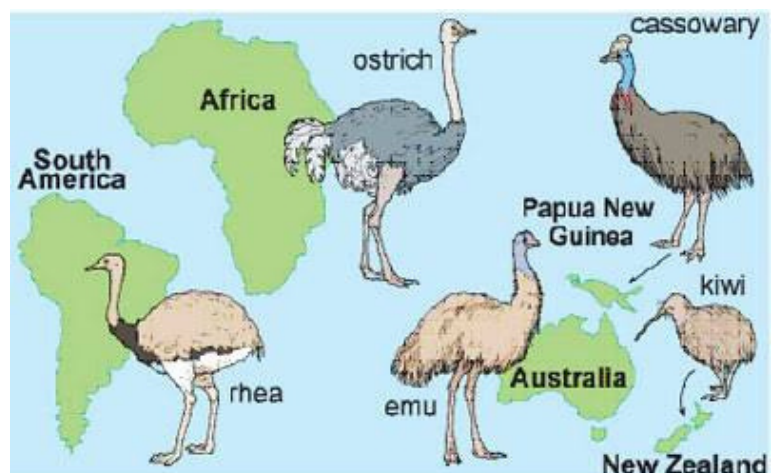
## Climate change

The **Ice age** is described as a long period of time where the earth experienced extreme cold.

- This led to glaciation (the formation of glaciers) A glacier is a large sheet of ice.
- Extreme cold temperatures did not support life leading to death of many organisms.
- Scientists believe glaciers were formed as a result of continental drift



**Biogeography** is the study of the distribution of organisms around the world.





# Geological time scale

The earth's history has been divided into a series of time intervals called the **Geological Timescale**.

## The three eras

The Phanerozoic eon is divided into three eras, the **Cenozoic**, **Mesozoic** and the **Paleozoic** eras. The divisions between these eras is determined by very significant events in the history of the Earth.

Table summarising the Geological Time Scale

EON	ERA	PERIOD	Date (mya)	Plants and micro-organisms Including major events	Animals
PHANEROZOIC	COENOZOIC (AGE OF MAMMALS)	Quaternary (Recent)	0.01	Decline of the woody plants and the increase in angiosperms. Extinction of many species (from 4 ice ages).	Age of <i>Homo sapiens</i> . Humans dominate. Extinction of many large mammals (from 4 ice ages).
		Tertiary	2	Development of grasslands and the decline of forests and flowering plants.	Large carnivores; many grazing mammals; first known human-like primates.
			6	Forests and flowering plants.	Many modern mammals evolve.
			25	Spread of forests; flowering plants - rise of monocotyledons.	Apes evolve; all present mammal families evolve; saber-toothed cats.
			38	Gymnosperms common; angiosperms dominate.	Beginning of the age of mammals; modern birds.
			55	Gymnosperms and angiosperms.	Evolution of primate mammals.
	MESOZOIC (AGE OF REPTILES)	Cretaceous	65	Rise of angiosperms; decline of gymnosperms.	Dinosaurs reach peak and then become extinct; toothed birds become extinct; first modern birds; primitive mammals.
		Jurassic	140	Ferns and gymnosperms common.	Large, specialised dinosaurs; insectivorous marsupials.
		Triassic	210	Gymnosperms and ferns dominate.	First dinosaurs; egg-laying mammals.
			250	Gymnosperms evolve.	Many insects, first reptiles; extinction of many Paleozoic invertebrates.
	PALEOZOIC (AGE OF ANCIENT LIFE)	Carboniferous	285	Forests of ferns and gymnosperms; swamps; club mosses and horsetails.	Modern insects; extinction of many Paleozoic invertebrates.
		Devonian	360	Terrestrial plants established; first forests; gymnosperms appear.	Age of fishes; amphibians; wingless insects and millipedes appear.
		Silurian	410	Vascular plants appear; algae dominant.	Fishes evolve; marine arachnids dominant; first insects; crustaceans.
		Ordovician	430	Marine algae dominant; terrestrial plants first appear.	Invertebrates dominant; first fishes appear.
		Cambrian	500	Algae dominant	Age of marine invertebrates.
			570	Bacterial cells; then primitive algae and fungi; marine protozoans.	Marine invertebrates at end of period.
	PRE-CAMBRIAN		3800		
ARCHAEN			4590	Origin of Earth; formation of crust, oceans and atmosphere.	

You should be able to analyse a geological time scale as well as calculating how long different periods lasted

# The Cambrian explosion

The **Cambrian Explosion** is a relatively short period of time marking the origins of early forms of all animal groups. It is when there was a sudden appearance of the major groups of animals.

Although many life forms came about, there was a series of extinctions that took place.

## Mass extinctions

There were FIVE MASS EXTINCTIONS:

**Ordovician** (444 million years ago) - caused by climate changes, many trilobites became extinct

**Devonian** (383-359 million years ago)- ice ages, global cooling, glaciations - almost all life forms died out

**Permian** (252 million years ago)- most severe of all caused by volcanic eruptions- reptiles and frogs died

**Triassic** (201 million years ago)- caused by acid rain and drop in oxygen in water, more marine life form destroyed

**Cretaceous** (66 million years ago)- all dinosaurs died out caused by asteroid impact and blotting out of sunlight

Sixth Mass Extinction:

We are in the crisis of the sixth mass extinction caused by human activities such as illegal veld-fires which consume large amounts of valuable oxygen and release smoke and carbon dioxide resulting in global warming and climate change; illegal hunting and habitat destruction

Scientists explain three theories for what caused these extinctions

## The three Theories

**Volcanic activity** - around India released dust particles into the atmosphere caused global cooling

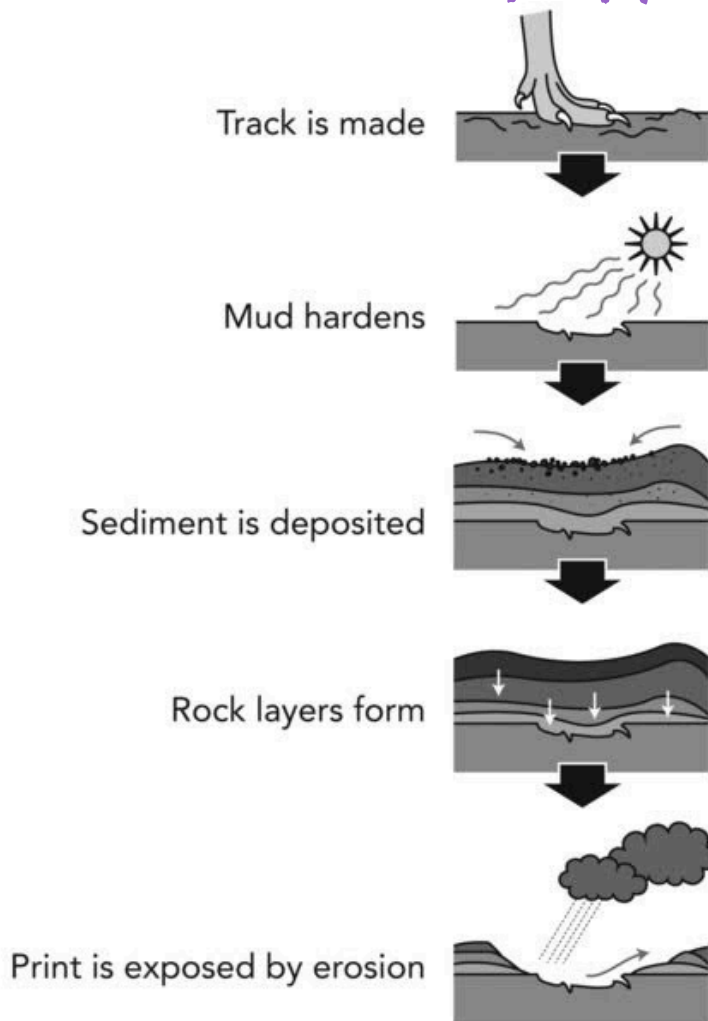
**Asteroid impact** - large dust clouds blocked out the sun caused global climate change

**Continental drift** - as continents move away from each other caused climate change

# Fossil formation

**Fossils** are the remains of once living things that are usually preserved in rock.

## How fossils form



### 1. Sediment

An animal is buried by sediment such as volcanic ash or silt, shortly after it dies. The bones are protected from rotting by the of **sediment**.

### 2. Layers

More sediment layers accumulate above the animal's remains and minerals such as silica slowly replace the calcium phosphate in the bones.

### 3. Movement

Movement of tectonic plate or giant rock slabs that make up the Earth's surface, lifts the sediments and pushes the fossil closer to the surface.

### 4. Erosion

**Erosion** from the rain, rivers and wind wears away the remaining rock layers. Eventually, erosion or people digging for fossils will expose the preserved remains

## EXAMPLES OF FOSSILS

- Bones
- Shells
- Tracks (footprints), hardened faeces of animals
- Petrified tree trunks
- Imprints of leaves and small animals

## EXAMPLE OF FOSSILS THAT OCCUR IN TAR AND ICE

- Fossils of woolly mammoth (ice)
- Pits of tar contained bones of the sabre toothed cats
- Some insects

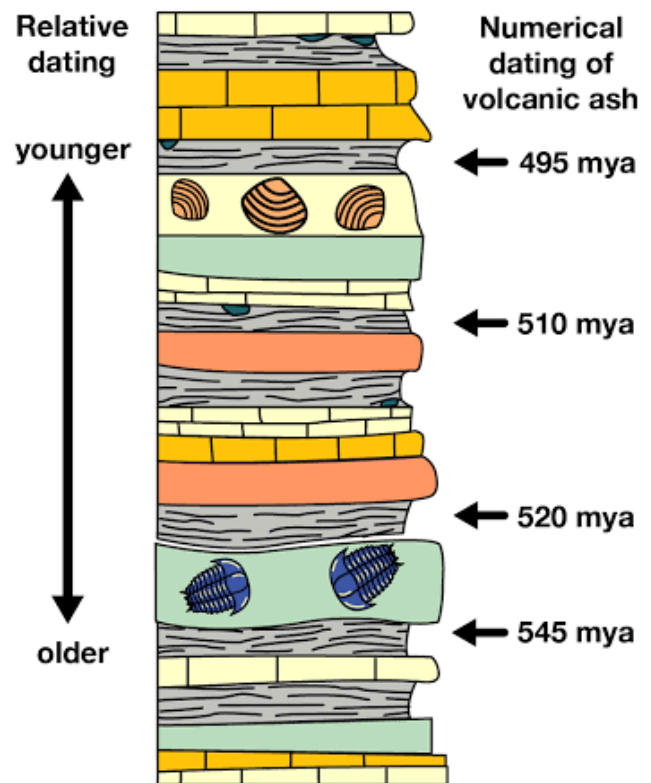
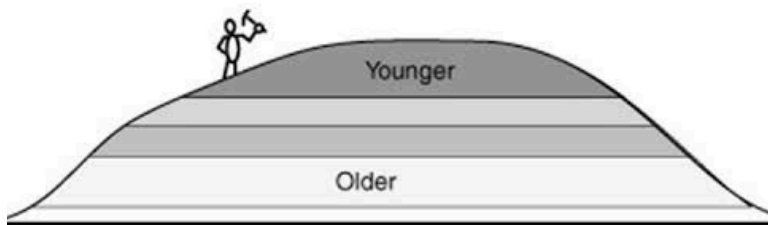
# Fossil Dating

There are two methods used by scientists to determine the age of the fossil rocks.  
The **Relative dating** and the **Radiometric dating**.

## Relative dating

In **Relative dating** - the age of the fossil is worked out by trying to find out how it is related to the age of another fossil or geological event such as volcanic eruption. It tells us whether a particular fossil was formed before or after another fossil or geological event.

By studying the position of a fossil in **sedimentary** rocks relative to others. Those at the bottom are older and we're buried first compared to the ones at the top.



## Radiometric dating

In **Radiometric dating** - it attempts to answer the question how many years ago was the fossil formed?

The answer to the question is given in 'years' rather than 'before' or 'after'.

Scientists do this by studying the isotopes formed around the fossils since they know how long it takes to form isotopes. This will determine the exact age in which the fossil formed.



# Transitional fossils

A scientist who studies fossils is called a **palaeontologist**.

**Palaentology** is the study of fossils

**Transitional fossils** are fossils of an organism between two clearly defined stages of evolutionary development

## The archeopteryx

A transition between birds and reptiles



### Bird-Like characteristics:

- Feathers
- Wishbone

### Reptile-Like characteristics:

- Long bony tail
- Wings with claws
- Sharp teeth

## The coelocanth

A transition between aquatic and terrestrial organism.

It was believed to be extinct however later a living fossil was found in South Africa(1938)



**Coelacanth**s are closely related to lungfish and tetrapods (animals with limbs that walk on land)

# Biodiversity & classification

## Terminology

Biological term	Description
<b>Archaeopteryx</b>	Transitional fossil between birds and reptiles
<b>Asteroid</b>	Large dust cloud
<b>Biogeography</b>	The study of the distribution of organisms around the world
<b>Cambrian explosion</b>	A short period of time marking the origin of early life forms
<b>Continental drift theory</b>	A theory that explains how the earth's plates move away from each other
<b>Fossil</b>	The remains or trace of an organism that lived a long time ago and has been preserved in rock
<b>Geological time scale</b>	A table that shows life's historical events
<b>Ice age</b>	Long periods of time in which the earth experienced extreme cold
<b>Paleontologist</b>	A scientist who is interested in uncovering the history of the Earth by studying fossils
<b>Paleoanthropologist</b>	A paleontologist who specializes in studying human ancestors
<b>Petrification</b>	The process by which the remains of organisms are replaced by silica or calcium and turned into stone
<b>Plate tectonic theory</b>	A theory suggesting that the earth's plate fit like a jigsaw puzzle
<b>Radiometric dating</b>	Method of dating that determines the exact age of a fossil
<b>Relative dating</b>	Method of dating that determines the relative age of a fossil
<b>Sedimentary rock</b>	A rock formed from the layers of mud, sand, salt, pebbles, or carbonate in a river, lake, sea, desert
<b>Transitional</b>	In between, a stage between one form and another