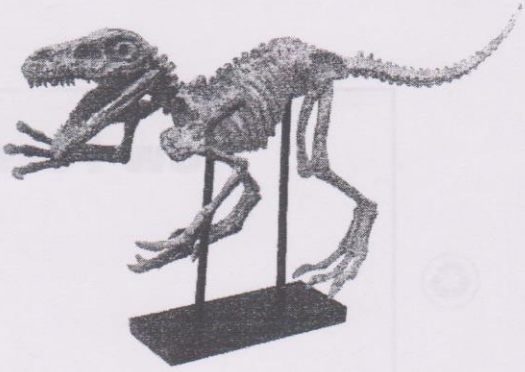
# NOTES – 6.1

Chapter 6 – The Environment and Change Over Time
Lesson 1 – Fossil Evidence of Evolution



**Fossil Formation**

Some of the most important clues to Earth's past are fossils.

Q: What is a fossil?
A: the preserved remains or evidence of once-living organisms

Ex. bones, teeth, shells, footprints, animal burrows, leaves, stems etc.

Only the hard parts of organisms are preserved in fossils.

Most fossils form when organisms that die become buried in sediments.

Q: What are sediments?
A: particles of soil and rock

Layers of sediments build up and cover the dead organism. Over millions of years, the layers harden to become sedimentary rock.

Q: What is sedimentary rock?
A: a type of rock that forms when particles from other rocks or the remains of plants and animals are pressed and cemented together

Focus – How Fossils Form

Classwork – Q: What is one way in which a buried fossil can become uncovered?
A: (answer on your **CW** sheet)

There are **5** forms fossils can take –

1. Mineralization

Q: What are mineralized fossils?
A: a fossil in which minerals (rock) replace all or part of an organism

Ex. dinosaurs

2. Mold and Casts

Q: What is a mold?
A: a fossil formed when the impression of an organism is left in rock

Q: What is a cast?
A: a fossil that is a copy of an organism's shape

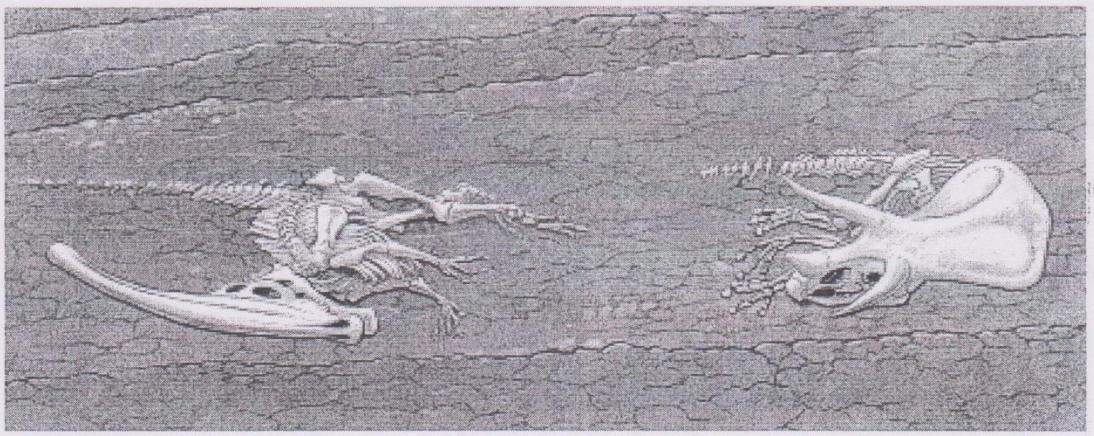
Ex. shells, plant parts etc.

3. Carbonization

Q: What are carbonized fossils?
A: a fossil formed when a dead organism is compressed over time and pressure releases liquid and gas from decomposing tissues

# How Fossils Form

1. Two dinosaurs are buried by ash from an erupting volcano.



2. Minerals gradually replace the remains. Over millions of years, the fossils become buried by sediments.

3. Running water cuts through the sedimentary rock layers, exposing the fossils.

4. trace fossils

Q: What is a trace fossil?
A: the preserved evidence of the activity of an organism

Ex. animal tracks

5. original material

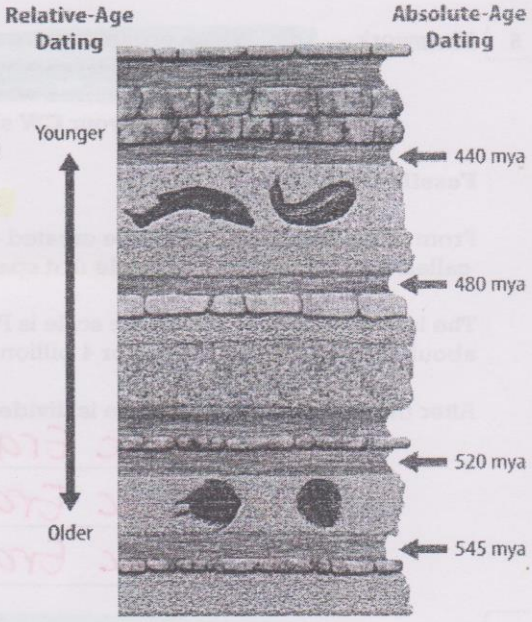
Q: What are preserved remains?
A: remains of any organism not preserved in traditional rock but another substance

Ex. fossils preserved in ice, tar pits, amber (mosquito in 1st Jurassic Park)

**Determining a Fossil's Age**

Scientists can determine a fossil's age in one of 2 ways –

- Relative-Age Dating
- Absolute-Age Dating (numerical dating)




Scientists use relative – age dating to determine which of two fossils is older.

In a sequence of rock layers, the layers at the top are younger than the lower layers.

Therefore, fossils found in top layers are younger than fossils found in bottom layers.

- can only be used when the rock layers have been preserved in their original sequence
- used to determine whether one fossil is older than another
- **DOES NOT** determine actual age

2 Classwork – Q: Which rock layers contain younger fossils?
A: (answer on your **CW** sheet)

Another technique, called absolute – age dating, allows scientists to determine the actual age of fossils.

The rocks that fossils are found near contain radioactive elements.

Q: What are radioactive elements?
A: unstable elements that decay, or break down, into different elements

The half-life of a radioactive element is the time it takes for half of the atoms in a sample to decay.

Scientists can compare the amount of a radioactive element in a sample to the amount of the element into which it breaks down to calculate the age of the rock and thus the age of the fossil.

3 Classwork – Q: What is half-life?
A: (answer on your **CW** sheet)

4 Classwork – A radioactive element has a half-life of 713 million years.
Q1: After 2,139 million years, how many half-lives will have gone by?
Q2: How much of a 16-gram sample of the element will remain after 2,139 million years?
A: (answer on your **CW** sheet)

**The Fossil Record**

Scientists have calculated the ages of many different fossils and rocks using the fossil record.

Q: What is the fossil record?
A: an incomplete record of all of the fossils ever discovered on Earth

Despite gaps in the fossil record, it has given scientists a lot of important information about past life on Earth because nearly all of the species preserved as fossils are now extinct.

Q: What does it mean to be extinct?
A: when no members of that species are still alive

Scientists use fossils of bones, teeth, and footprints to construct models of extinct animals.

5 Classwork – Q: Which organisms are most likely to be found as fossils –
A. Those that lived when much of Earth was covered by shallow seas?
B. Those that lived when Earth's mountain ranges were being formed?
A: (answer on your **CW** sheet)

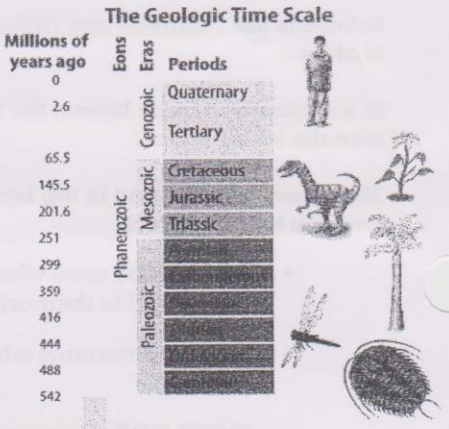
**Fossils Over Time**

From this information, they have created a "calendar" of Earth's history – called the **Geologic Time Scale** that spans more than 4.6 billion years.

The largest length of time in the scale is Precambrian Time – about 87% of Earth's history – or 4 billion years!

After the Precambrian, the scale is divided into **3** major eras –

- Paleozoic Era
- Mesozoic Era
- Cenozoic Era




6 Classwork – Q1: When did the 1st land plants appear?
A1: (answer on your **CW** sheet)

Q2: When did the 1st dinosaurs evolve?
A2: (answer on your **CW** sheet)

Q3: What eon did the 1st bacteria evolve?
A3: (answer on your **CW** sheet)

Q4: What period did humans evolve?
A4: (answer on your **CW** sheet)

Q5: What era did the 1st insects evolve?
A5: (answer on your **CW** sheet)

Q6: What eon did the 1st cells evolve?
A6: (answer on your **CW** sheet)

Q7: What era did the 1st inverts (jellyfish) evolve?
A7: (answer on your **CW** sheet)

Q8: What do the terms *Paleozoic*, *Mesozoic*, and *Cenozoic* mean?
A8: (answer on your **CW** sheet)

# Exploring Life's History (1)





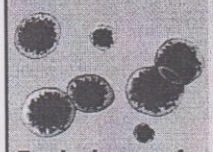
**PRE-CAMBRIAN**

**PALEOZOIC ERA**

*Millions of years ago*

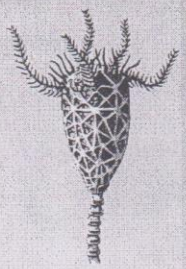
*544* *505* *438* *408* *360* *286*

**Cambrian Period** | **Ordovician Period** | **Silurian Period** | **Devonian Period** | **Carboniferous Period**



Early bacteria

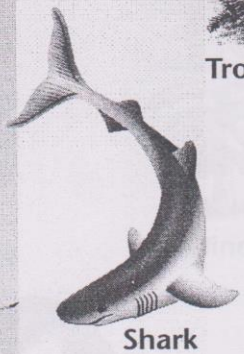
*Opabinia*



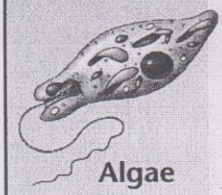
*Eumorphocystis*

Eurypterid

Tropical forest

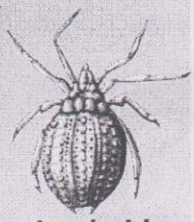


Shark



Algae

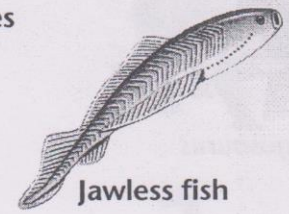
Sponges



Arachnid

*Eryops*

Jellyfish-like animal



Jawless fish

*Pterichthyodes*

Trilobite

Land plants

Cockroach

# Exploring Life's History (2)

END OF PALEOZOIC ERA

| Millions of years ago | MESOZOIC ERA | | | CENOZOIC ERA | |
|---|---|---|---|---|---|
| 286 | 245 | 208 | 144 | 66.4 | 1.6 |
| Permian Period | Triassic Period | Jurassic Period | Cretaceous Period | Tertiary Period | Quaternary Period |


Staurikosaurus


Magnolia


Saber-toothed cat


Conifer


Haramiya


Coryphodon


Megazostrodon


Crusafontia


Woolly mammoth


Stegosaurus

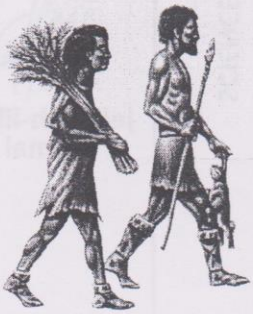

Mesohippus


Dicynodon


Cycad


Archaeopteryx


Triceratops


Homo sapiens

**Extinctions and Evolution**

Q: What is extinction?
A: when the last individual organism of a species dies

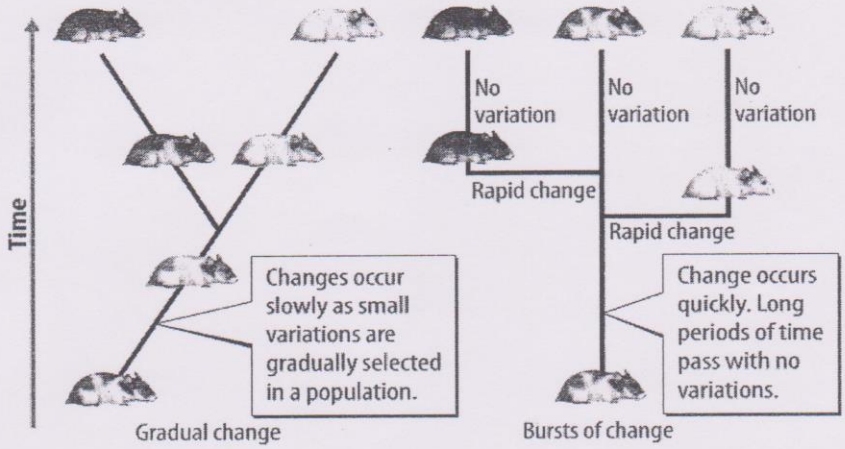
Because the fossil record is incomplete, many questions about evolution remain unanswered.
2 Theories exist –

gradualism – tiny changes in a species gradually add up to major changes over very long periods of time

- evolution occurs slowly but steadily
- contains intermediate forms

punctuated equilibrium – species evolve quickly when groups become isolated and adapt to new environments

- species evolve during short periods of rapid change
- contains no intermediate forms




Scientists think that evolution can occur gradually at some times and fairly rapidly at others, known as biological evolution.

Q: What is biological evolution?
A: the change over time in populations of related organisms

7 Classwork – Lesson 1 Review p. 198 (answer on your **CW** sheet)