

Marine Fossils

Dating the Earth to 4.5 billion-years of Age

Relative vs. Absolute Dating

- ~ Relative Dating refers the determination of the age of a geological sample by comparing its position to the position of other samples
- ~ Absolute Dating refers to the determination of the age of a geological sample by calculations of radiometric decay and/or its position in relation to other samples

Dating Techniques

1. Radiometric Dating is the process of determining the age of rocks by observing the ratio of unstable radioactive elements to stable decay products
 - ~ Radiometric decay occurs when unstable atomic nuclei break apart.
 - ~ Every radioactive element has a unique half-life
 - ~ A half-life is the time it takes for one half of all the unstable nuclei in a sample to decay. During this decay process the radioactive element becomes a new element.
 - ~ Rocks can be determined with an accuracy of 1-2% of its actual age.
 - ~ Uranium decays into lead and has a half-life of 4.5×10^9 and potassium has a half-life of 8.4×10^9 .
2. Paleomagnetism is the remnant magnetic field of a rock
 - ~ Tiny particles of iron-bearing magnetic minerals are found in basaltic rock.
 - ~ These particles act as compass needles that align with the Earth's magnetic field at the time the rocks are formed.
 - ~ These miniature compasses freeze in this position as the rock solidifies.
 - ~ The ocean floor shows a banding pattern based on magnetic orientation alternating between pointing towards the magnetic north as it is today and towards the south.
 - ~ It is used to measure the spreading rate of the continental crusts, to calibrate the geological time scale, and to reconstruct continents (i.e. how the continents fit together to form Pangaea).
 - ~ In the last 26 million years, the pole has reversed 48 times.
3. Law of Superposition states that lower layers of strata are older than those that are located above them (younger sediments are laid down on older deposits).
 - ~ This information can determine whether a group of rocks or fossils are older or younger than a different group of rocks or fossils close by.
 - ~ The actual age of the assemblage is not determined.

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Geological Timeline (BYA = billion years ago & MYA = million years ago)

4.5 BYA – Formation of the Earth

3 BYA – First Life Appears

450 MYA – First Fish Appear

200 MYA – Break up of Pangaea

190 MYA – Dinosaurs appear

10 MYA – Uplift and Erosion of the Grand Canyon

5 MYA – Formation of the Gulf of California

2.5 MYA – Humans Appear