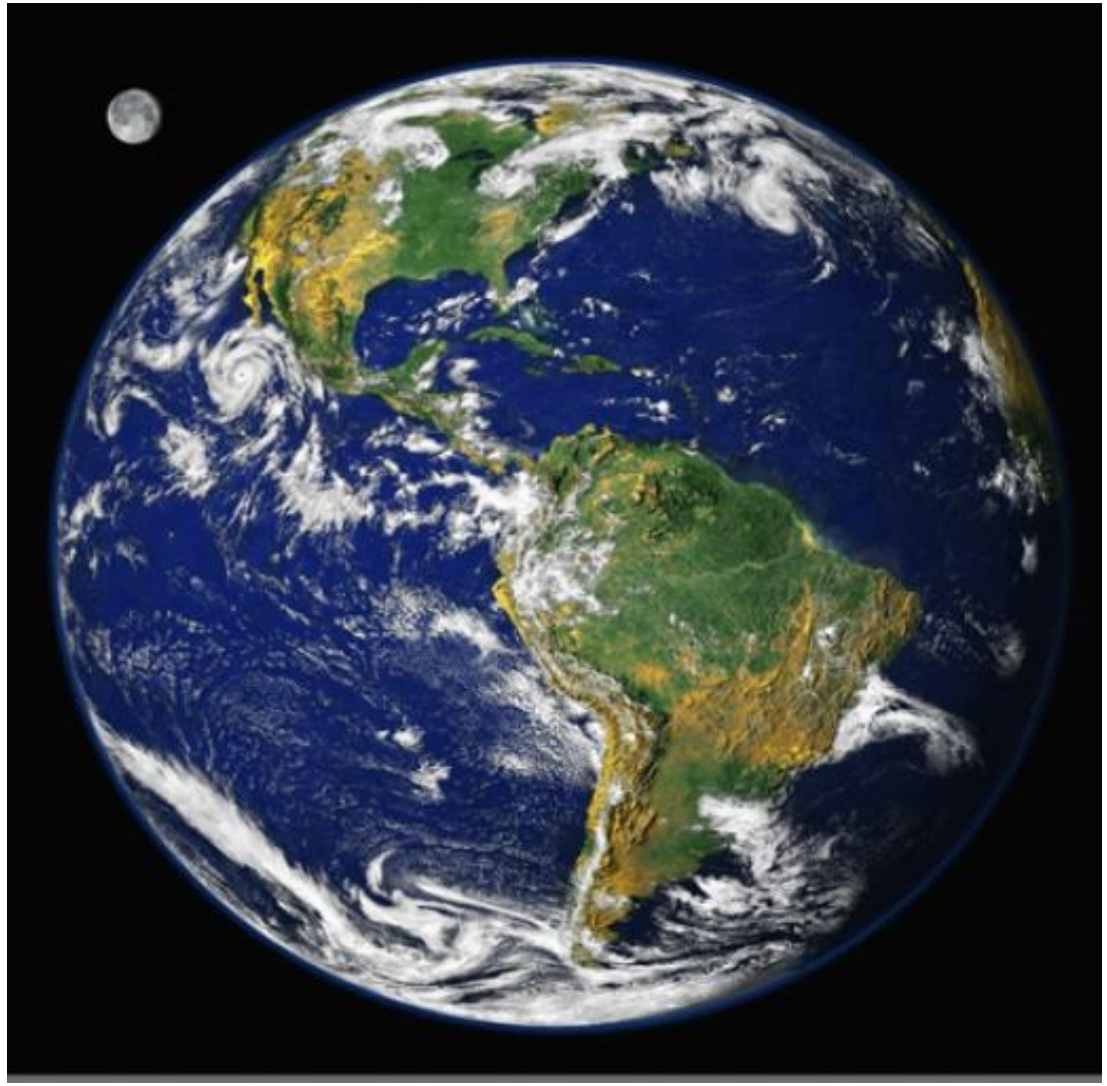
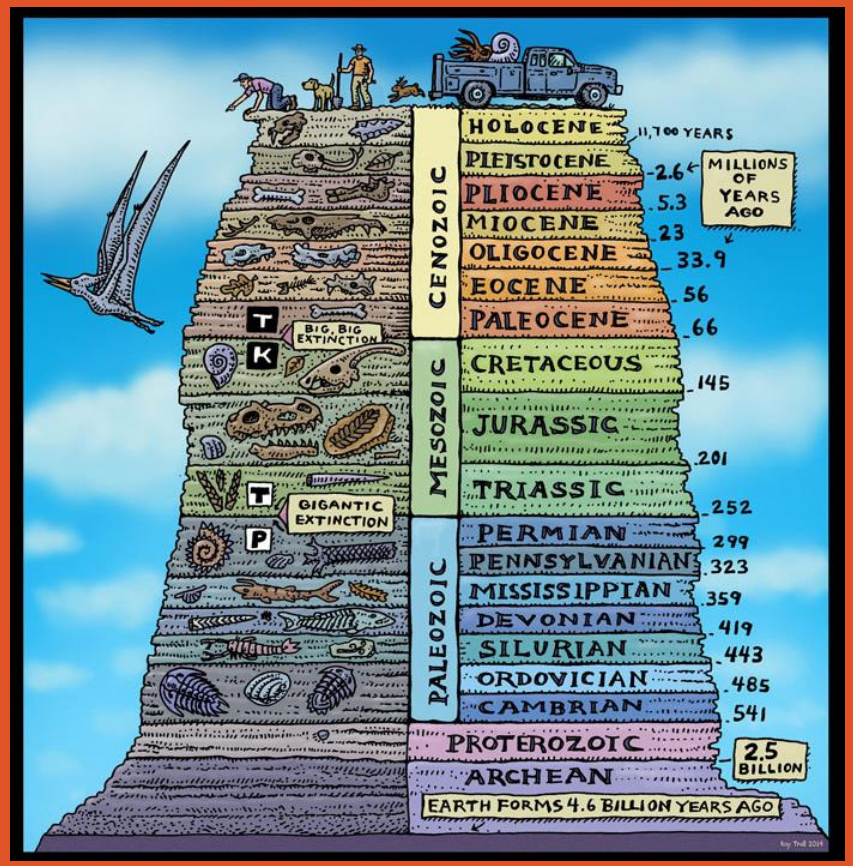
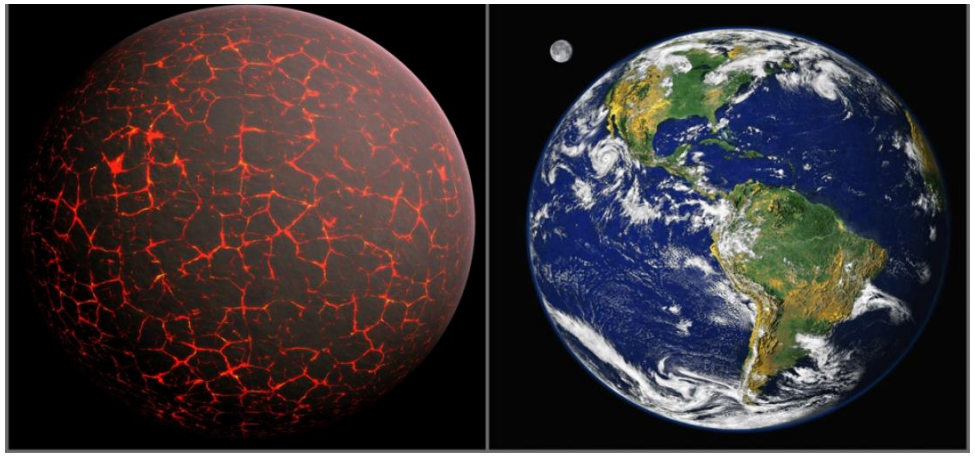


QUESTION OF THE DAY

How old is the Earth?



GEOLOGICAL TIME SCALE



Geological Time Scale

A record of Earth's history from it's origins 4.6 billion years ago to the present.

Divided into eons

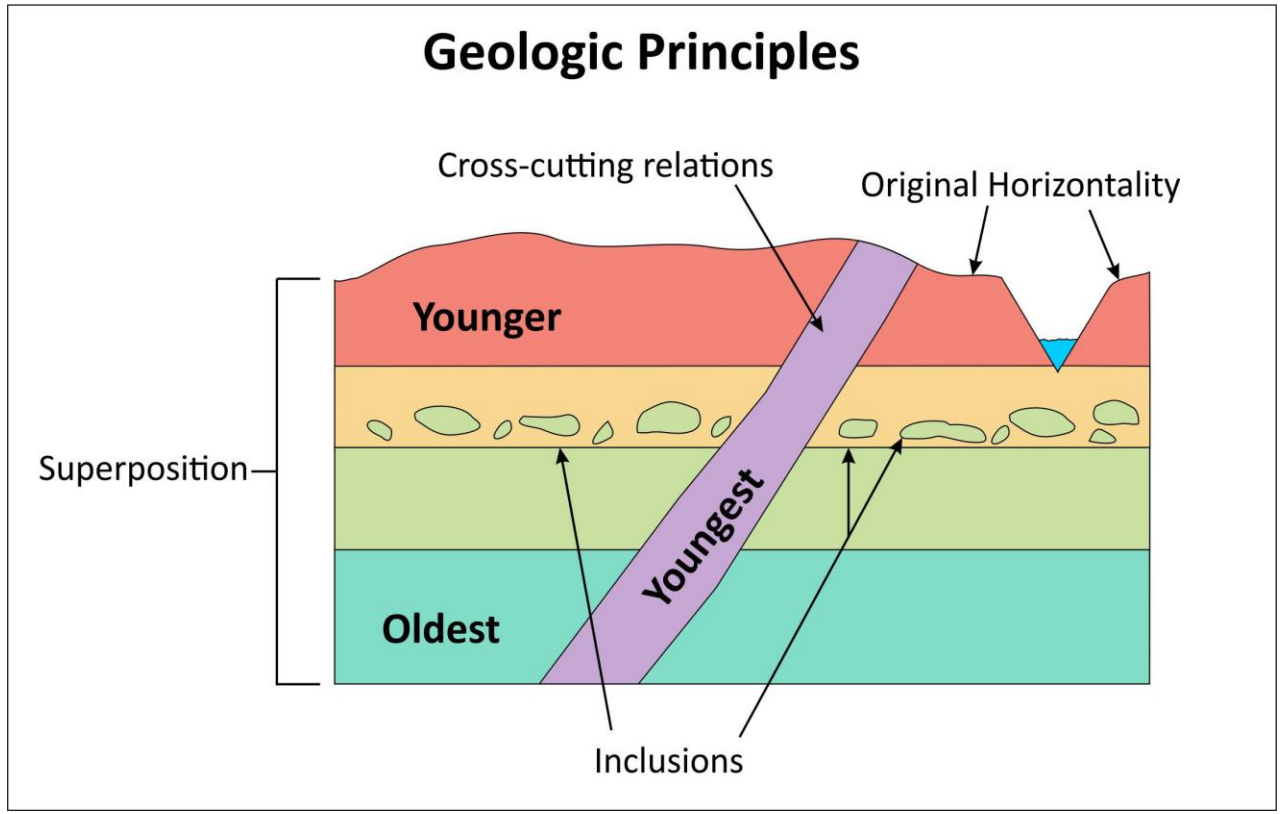
- Eons are divided into eras
- Eras are divided into periods
- Periods are divided into epochs

Unlike divisions of time such as days or minutes, the divisions of the geological time scale have no fixed lengths

- Instead, they are based on changes or events recorded in rocks and fossils

What are some things you know about Earth's history?

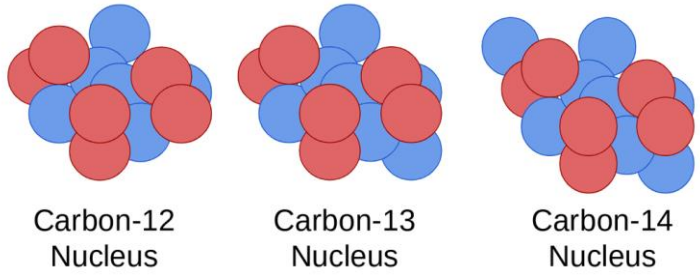
Relative-Age Dating



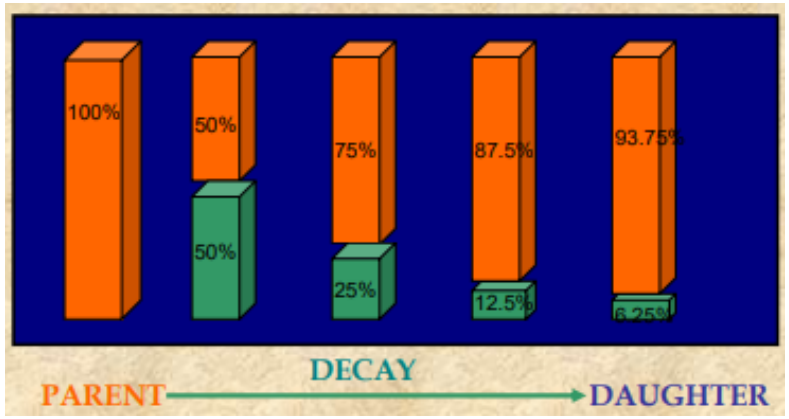
- **Relative-Age Dating** – Places the ages of rocks and events that formed them in order, but without exact dates.

1. Principle of Original Horizontality – Sedimentary rocks are deposited in horizontal or nearly horizontal layers.
2. Principle of Superposition – In an undisturbed sedimentary rock sequence, the oldest rocks are at the bottom and each successive layer is younger than the layer beneath
3. Principle of Cross-Cutting Relationships – An intrusion or a fault is younger than the rock it cuts across. (Rocks must exist before something happens to them)
4. Principle of Inclusions – Small fragments of one type of rock but embedded in a second layer of rock must have formed first.

Absolute-Age Dating



- **Absolute-Age Dating** – Identifies the actual age of rocks, fossils or other geologic events using radioactive decay.
  - Radioactive decay is the constant rate of decay for radioactive parent isotopes into daughter isotopes. These isotopes can be found in igneous rock, metamorphic rock, some fossils, and organic remains.



- Half- life of an isotope is the time it takes for ½ of the parent atoms in the isotope to decay.
  - If an isotope has a half-life of 4000, then after 4000 years ½ of the parents isotope will remain. After another 4000 years ½ of the ½ remains, or ¼.
  - If a scientist knows the half-life of an isotope and measures the proportion of parent to daughter isotopes, they can calculate the absolute age of the rock.

Commonly used radioactive isotopes

Parent	Daughter	half-life	Mineral or Material
Uranium238	Lead 206	4.56 BY	Zircon, Uraninite, Pitchblende
Uranium 235	Lead 207	704 MY	Zircon, Uraninite, Pitchblende
Potassium 40	Argon 40	1.251 BY	Muscovite, biotite, hornblende, K-feldspar, volcanic rock, glauconite, conodonts
Rubidium 87	Sr 87	48.8 BY	K-mica, K-feldspar, Biotite, Metamorphics
Thorium 230	Lead 206	75 KY	Ocean sediments
Thorium 232	Lead 208	1.39 BY	Zircon, Uraninite, Pitchblende
Carbon 14	Nitrogen 14	5730 yr	Wood, bone, shell

KY- thousand years. MY- million years. BY- billion years

Eons

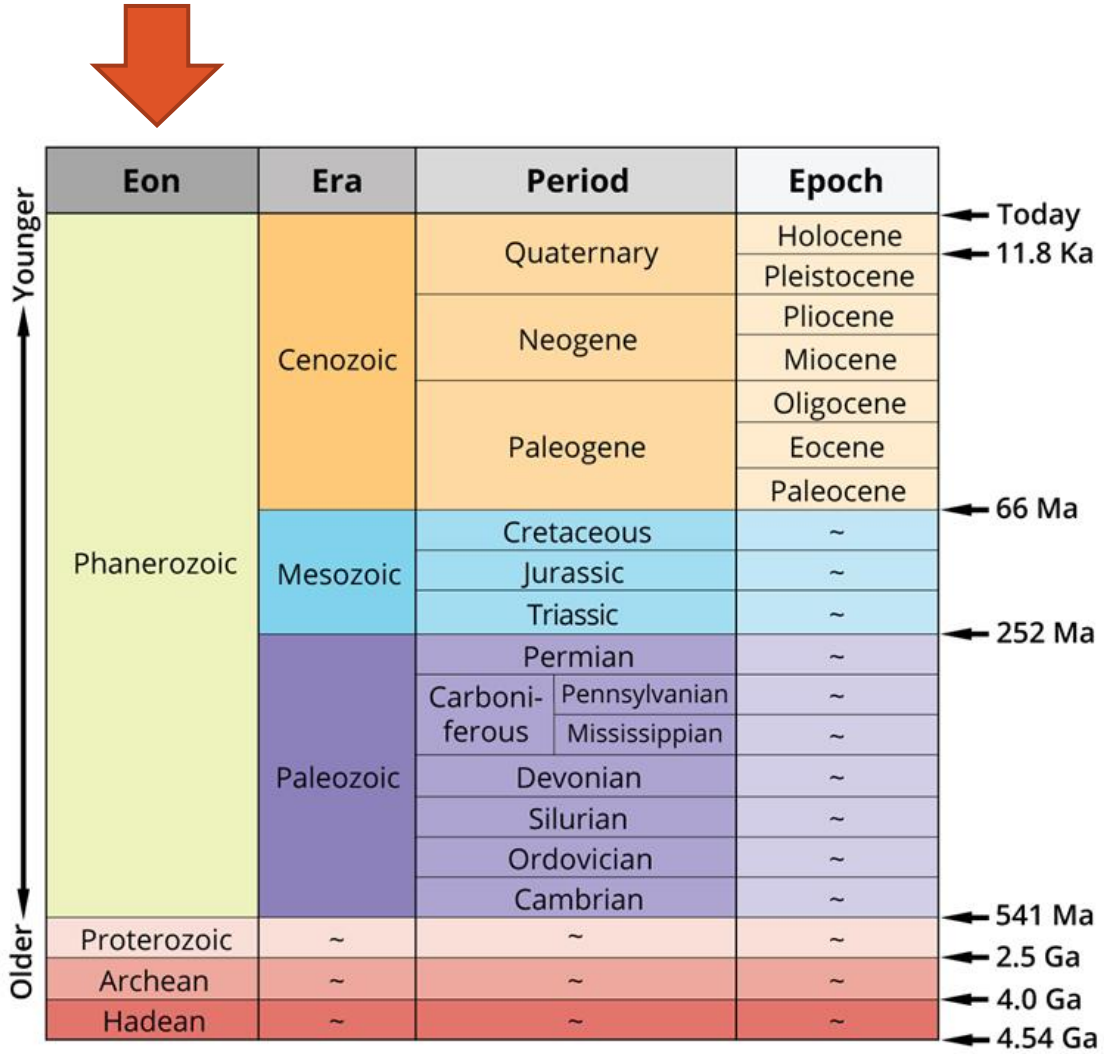
An eon is the longest subdivision and is based on the abundance of certain fossils

The first 3 eons make up Precambrian Time

- Makes up 88% of the history of the Earth.
- "Supereon"
- Relatively little is known about this time

4 main eons

- **Hadean (PT)** - 4600 to 4000 mya
  - No rocks on Earth are known to be this old
  - Meteorites and the moon
- **Archean (PT)** - 4000 to 2500 mya
  - Oldest known rocks
  - Life first appears
  - Earth cools enough to form rocks and oceans
- **Proterozoic (PT)** - 2500 to 542.0 mya
  - Cyanobacteria start to produce oxygen
- **Phanerozoic** - 542.0 mya to present
  - Began with the Cambrian Explosion



Eras

An era is the next-longest subdivision. It is marked by major changes in the fossil record.

3 eras

- **Paleozoic (old life)** - 542.0 to 251.0 mya
  - Age of Invertebrates
  - Life comes up on land
- **Mesozoic (middle life)** - 251.0 to 65.5 mya
  - Age of Reptiles
  - Dinosaurs
- **Cenozoic (recent life)** - 65.5 mya to present
  - Age of Mammals