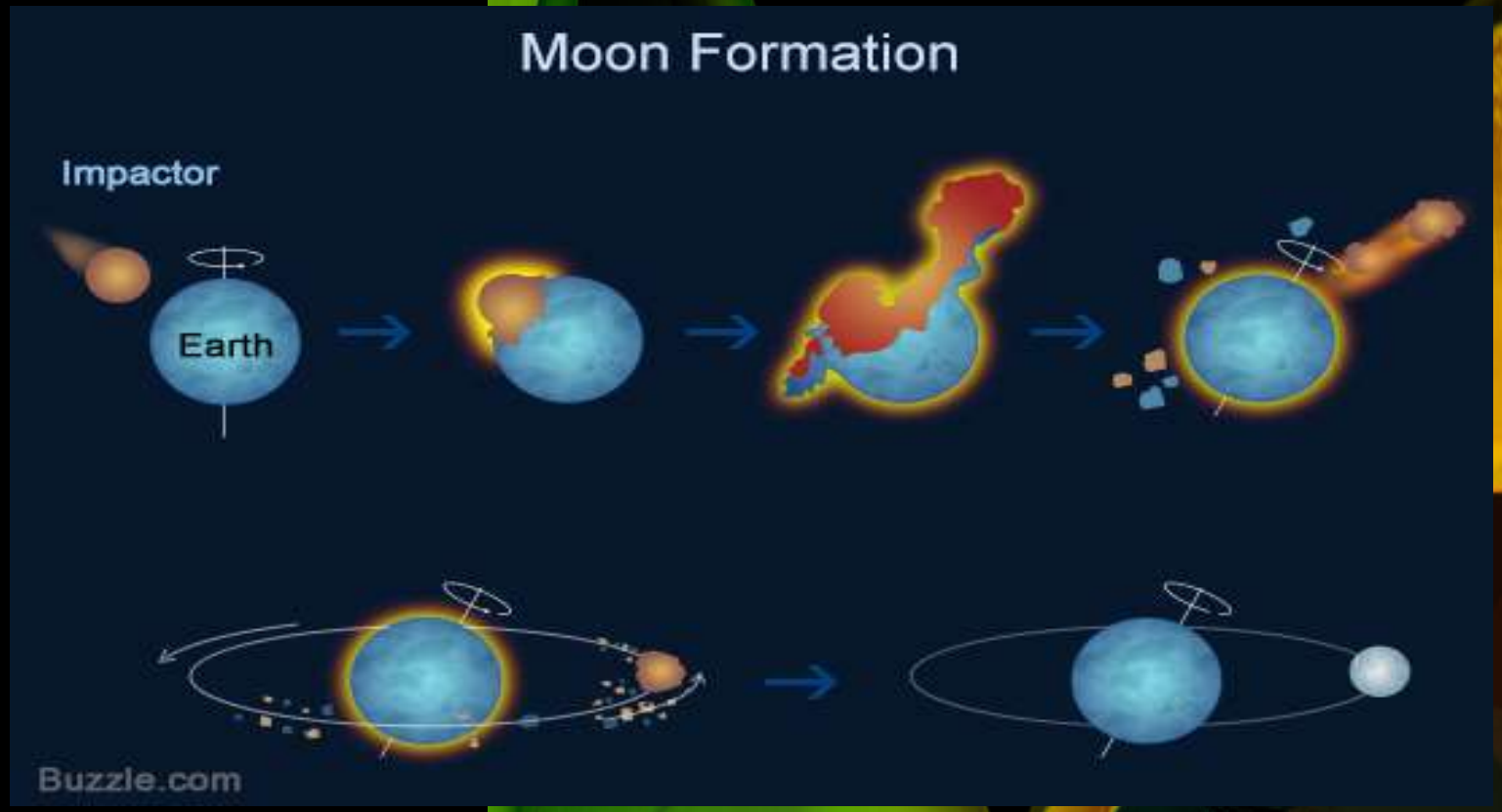
METEORITES & BIRTH OF THE EARTH

- A **meteoroid** is a small

HOW DO YOU THINK THE BIRTH OF THE EARTH AND METEORITES ARE CONNECTED?

- "Meteorites help date the Violent Birth of Earth's Moon"



- Most meteoroids originate from any one of the following three sources:

(1) interplanetary debris that was not gravitationally swept up by the planets during the formation of the solar system

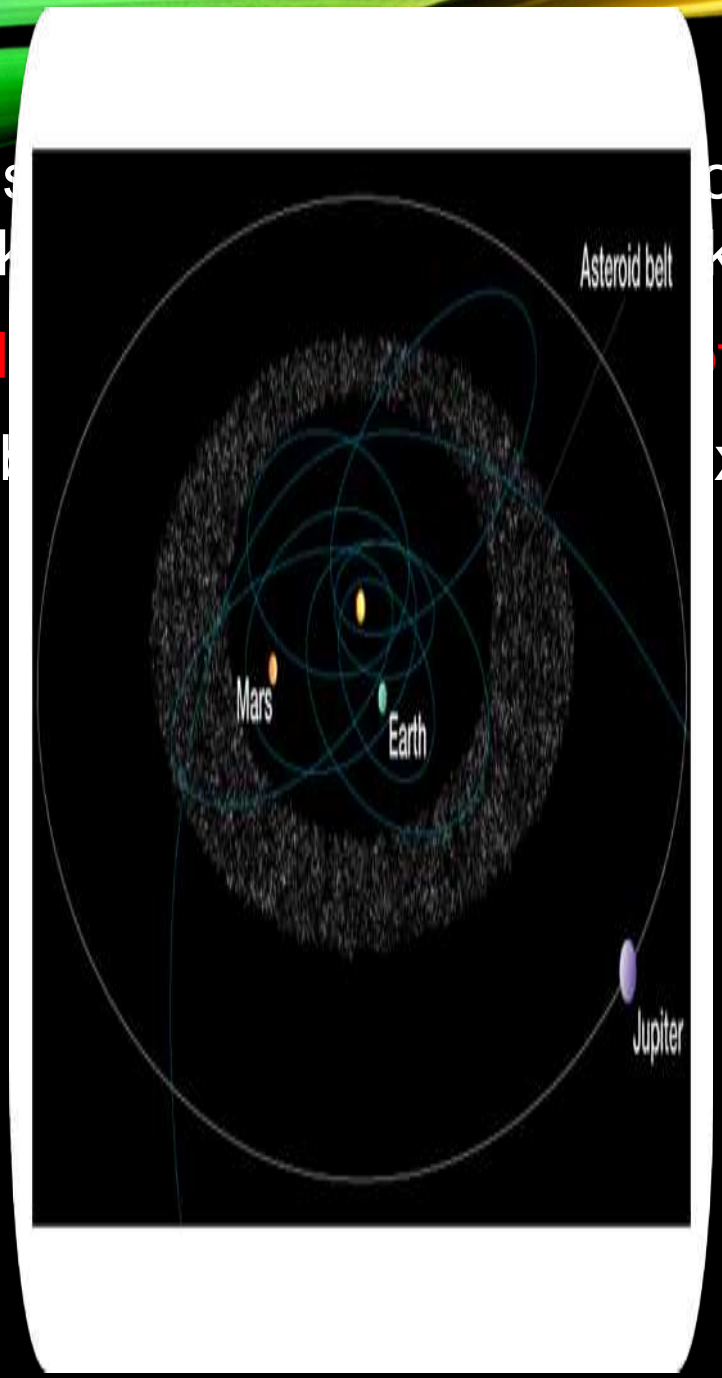
(2) material from the asteroid belt

(3) the solid remains of comets that once traveled near Earth's orbit.

- **Comets** are small bodies made of rocky and metallic pieces held together by frozen gases. Comets generally revolve about the sun in elongated orbits

The most famous short-period comet is Halley's comet. Its orbital period is 76 years.

- An **asteroid** is ose diameter can range from a few hundred k kilometer.
- Most asteroid f Mars and Jupiter.
- They have orb x years.



- **The OSIRIS-REx Mission** seeks answers to questions that are central to the human experience: Where did we come from? What is our destiny?

- **OSIRIS-REx is going to Bennu**, a carbon-rich asteroid that records the earliest history of our Solar System, and will be bringing a piece of it back to Earth.

- Bennu may contain the molecular precursors to the origin of life and the Earth's oceans.

- Bennu is also one of the most potentially hazardous asteroids and has a relatively high probability of impacting the Earth late in the 22nd century.

- OSIRIS-REx will determine Bennu's physical and chemical properties, which will be critical for future scientists to know when developing an impact mitigation mission.

Clip: How Mercury, Venus, & Earth Formed (1:38)

http://www.space.com/19175-how-was-earth-formed.html

Clip: Creation of the Moon (2:48)

http://www.history.com/shows/the-universe/videos/creation-of-the-moon?cdn_provider=auto

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After reading the article and watching the video clips, fix and/or add to your original answer for the question –

How do you think the birth of the Earth and Meteorites are connected?
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- Direct terrestrial evidence about the formation of Earth and its early history is rare, leading scientists to look to evidence from other planetary bodies and extraterrestrial materials to help them build a more complete picture of the early solar system.
- An important tool for understanding the early history of the solar system is the use of isotopic ratios, where the amount of different isotopes of an element in rocks or meteorites is compared. The ratio of isotopes of some elements is set once a planetary body is formed and does not change over time, creating an isotopic ratio that is unique to that planetary body. Conversely, the ratio of isotopes of other elements is set at the time the planet forms but then changes as the planet changes, such as when a planetary core forms or when the rocks melt and reform during igneous processes.
- The isotopes of some elements are radioactive and unstable; these isotopes break down to other isotopes of the same element or different elements at specific rates that can be used to measure the passage of time since a rock or mineral formed. Because we understand isotopic behaviors so well, we can use patterns we observe in isotopic ratios to determine the age of a rock from a planetary body, how a planetary body may have changed since its formation, and whether planetary bodies that are now separate were once part of a single, larger planetary body.

- Scientists also compare other planetary bodies with Earth to find evidence for Earth's early history. If a feature is present on other planetary bodies in the solar system, then scientists can use that as evidence supporting the possibility of the same feature once being present on Earth's surface. For example, if craters are found on the surface of other planetary bodies in the inner solar system, then it is very likely that Earth also experienced cratering in its early history. Even differences between planetary bodies can be useful if those differences can be accounted for by such things as differences in the size of the planetary bodies or their location in the solar system.

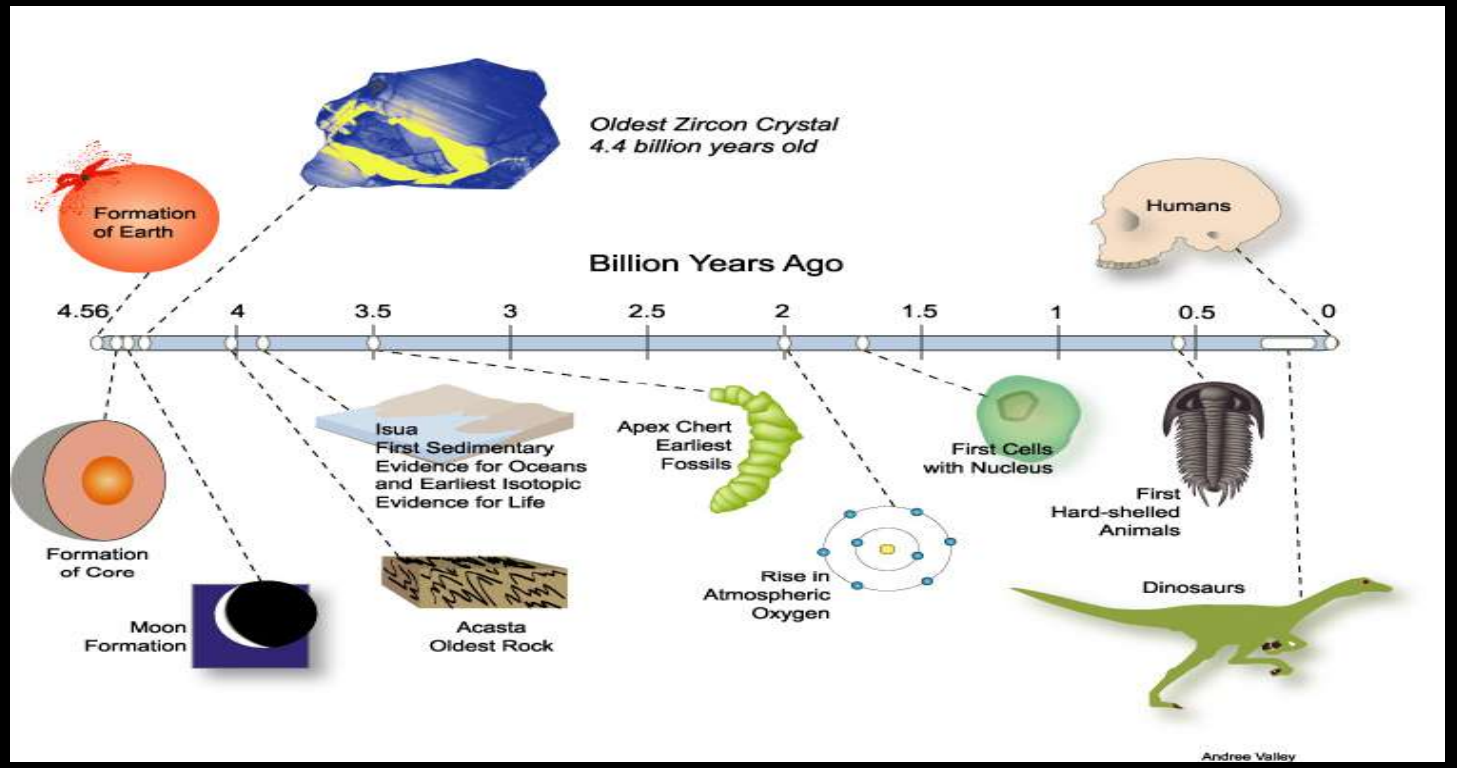
- Questions:
  - Underline the Topic Sentence
  - How do radioactive isotopes help us understand the early history of the Earth?
  - Apart from radioactive isotopes, what eveidence can be used toi describe Earth's early history?
  - What is the goal of this Task?

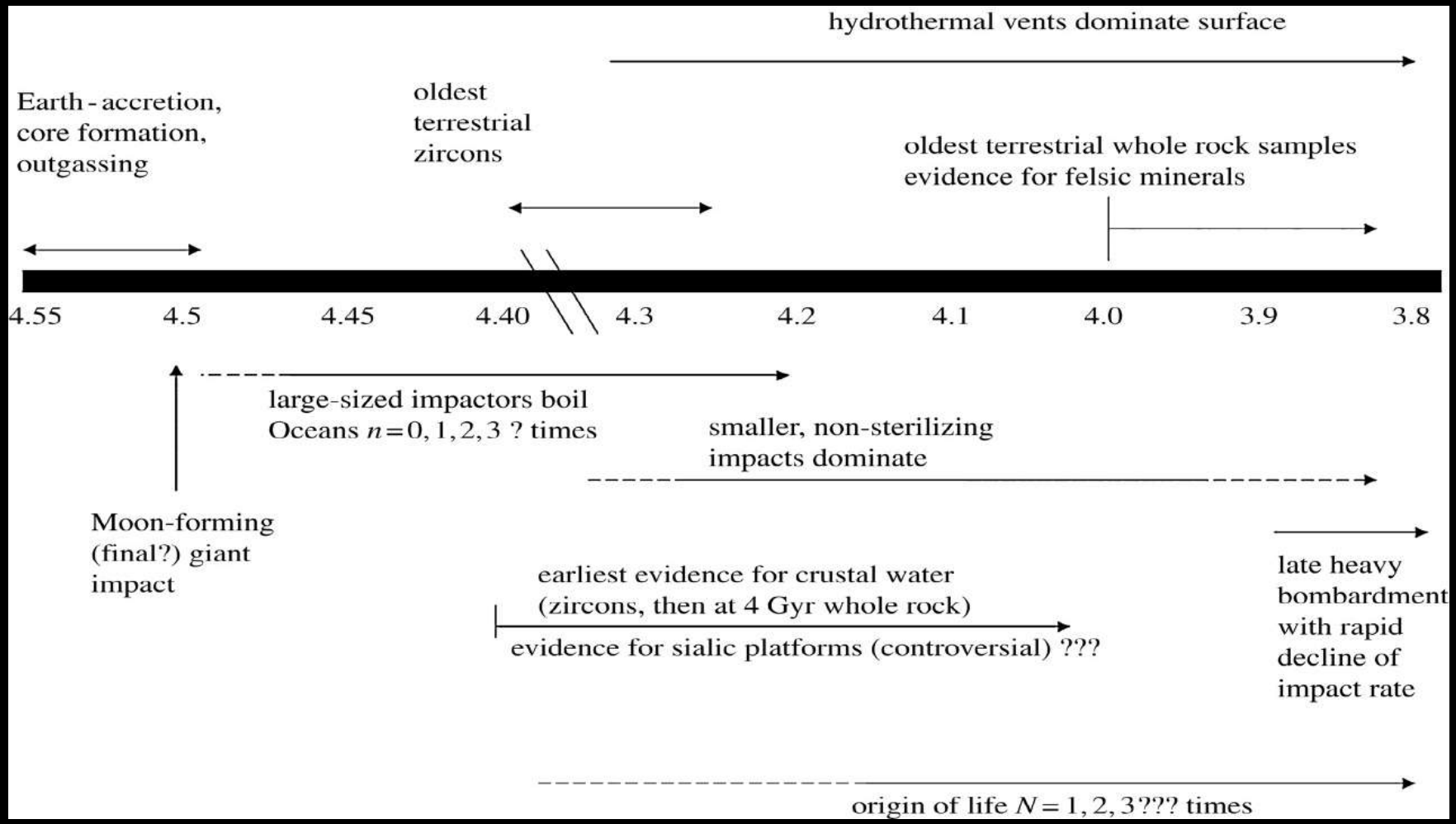
A. Using what you already know about Earth's early history, construct a basic timeline of Earth's history for the first billion years following the formation of the Solar System. Timeline will be from **5.0 to 3.0 billion years ago**.

Include on your timeline the following events:

- Planetary Accretion (4.56)
- Formation of the Moon (4.5)
- Jack Hills Sample (4.4)
- End of Heavy Bombardment (4.1 – 3.9)
- Core Formation (4.0)
- Planetary Cooling (3.8)
- Evidence of Life (3.7)
- Plate Tectonics began(3.0)

- Your timeline should have a consistent timescale throughout and include relevant information about the timing of events wherever possible.
- Legal paper – Title & Timeline 30cm long, intervals every 2cm, 5.0 3.0bya


Oldest Zircon Crystal
4.4 billion years old
Formation of Earth
Humans
Billion Years Ago
4.56
4
3.5
3
2.5
2
1.5
1
0.5
0
Isua
First Sedimentary Evidence for Oceans and Earliest Isotopic Evidence for Life
Apex Chert
Earliest Fossils
First Cells with Nucleus
First Hard-shelled Animals
Formation of Core
Moon Formation
Acasta
Oldest Rock
Rise in Atmospheric Oxygen
Dinosaurs
Andree Valley


hydrothermal vents dominate surface
Earth - accretion, core formation, outgassing
oldest terrestrial zircons
oldest terrestrial whole rock samples evidence for felsic minerals
4.55
4.5
4.45
4.40
4.3
4.2
4.1
4.0
3.9
3.8
large-sized impactors boil Oceans $n = 0, 1, 2, 3$? times
smaller, non-sterilizing impacts dominate
Moon-forming (final?) giant impact
earliest evidence for crustal water (zircons, then at 4 Gyr whole rock)
evidence for sialic platforms (controversial) ???
late heavy bombardment with rapid decline of impact rate
origin of life $N = 1, 2, 3$??? times