METEORITES & BIRTH OF THE EARTH

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- A meteoroid is a small, solid particle that <u>travels</u> through space.
- A meteor is the <u>luminous</u> <u>phenomenon</u> observed when a meteoroid enters Earth's atmosphere and burns up, popularly called a shooting star.
- A meteorite is any portion of a meteoroid that reaches Earth's surface.

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



READ THE ARTICLE...

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





Most meteoroids originate from any one of the following <u>three sources</u>:

 interplanetary debris that was not gravitationally swept up by the planets during the formation of the solar system
 material from the asteroid belt
 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.

HALEY'S COMET

Table 2 Major Meteor Showers

Shower	Approximate Dates	Associated Comet
Quadrantids	Jan. 4–6	
Lyrids	Apr. 20-23	Comet 1861 I
Eta	May 3–5	Halley's comet
Aquarids		
Delta	July 30	
Aquarids		
Perseids	Aug. 12	Comet 1862 III
Draconids	Oct. 7-10	Comet Giacobini-Zinner
Orionids	Oct. 20	Halley's comet
Taurids	Nov. 3-13	Comet Encke
Andromedids	Nov. 14	Comet Biela
Leonids	Nov. 18	Comet 1866 I
Geminids	Dec. 4-16	

ASTEROIDS

- An **asteroid** is a small, rocky body whose diameter can range from a few hundred kilometers to less than a kilometer.
- Most asteroids lie between the orbits of Mars and Jupiter.
- They have orbital periods of three to six years





HTTP://WWW.ASTEROIDMISSION.ORG/MISSION/

- 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.

ITINERARY			
PASSENGER NAME OSIRIS-REX ISSUE DATE 25 MAY 2011 + TICKET MUMBER-IDIRES 1999002			
FLIGHT INFORMATION	TOTAL MISSION TIME: 7 YEARS		
SCHEDULED DEPARTURE: 08 SEPT 2016			
📕 LAUNCH	SEPT 2016		
💜 OUTBOUND CRUISE	SEPT 2016 - NOV 2018		
EARTH GRAVITY ASSIST	SEPT 2017		
ASTEROID APPROACH	AUG - NOV 2018		
ASTEROID OPERATIONS	NOV 2018 - MAR 2021		
💰 SAMPLE COLLECTION	JULY 2020		
SCHEDULED RETURN: SEPT 2023			
≽ RETURN CRUISE	MAR 2021 - SEPT 2023		
DEPARTURE MANEUVER	MAR 2021		
💮 SAMPLE RETURN	SEPT 2023		
🛓 SAMPLE ANALYSIS	SEPT 2023 ONWARD		



VIDEO CLIPS...

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

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?

EARTH'S EARLY HISTORY – CONTEXT

- 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



