

Mass Extinctions in Earth's History

INTRODUCTION



At least five times in Earth's past, most of the plant and animal species have been annihilated in a geologic instant. What triggered these dramatic events, and what might they tell us about the fate of our world? What do we know about Earth's past history, and what does science tell us about the coevolution of Earth's life?

For this activity, you will use an interactive application known as EarthViewer

https://media.hhmi.org/biointeractive/earthviewer_web/earthviewer.html

*****Please use a different color font for your answers.*****

PROCEDURE

1. Watch the following video: <https://www.youtube.com/watch?v=03UOhWKaru0>
2. **Write down any questions you have about the video. Be prepared to discuss!**
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3. Launch and explore the features of EarthViewer <https://www.biointeractive.org/classroom-resources/earthviewer>
 - Click, hold, and drag to rotate the planet.
 - Click, hold, and drage down the horizontal silver slider on the timeline; watch what happens to the planet and the data indicators as you move backward and forward in time.
 - Position the silver timeline slider at 0 MYA. Click on "charts" at the bottom of the screen. Choose a chart. Now click on the left "play" button at the bottom of the timeline. Watch what happens on your chosen chart as the slider moves down the timeline.
 - Click "pause" before the slider reaches the bottom of the timeline. Note that your chosen cart will show information for that point in time.
 - Close your chart in EarthViewer by clicking on the "X" in the upper right hand corner.
4. Make sure the timeline displays 0-540 million years and then click on "view" at the bottom of the scree; turn on "Mass Extinctions." Click "view" again to minimize the menu.
5. Note the five yellow triangles that appear on the right side of the timeline. These correspond to mass extinctions.
6. Gather data: Drag the slider of the Ordovician extinction, 440 MYA. Use the features on the simulator to fill in the following data chart. For Biodiversity, you will need to move the slider carefully and record in the same manner for the remaining four mass extinction.

Mass Extinction	MYA	What was Earth's surface like?	Avg. Temp. °C	Oxygen (%)	Luminosity (light)	Biodiversity (before dip/after dip)
Ordovician	440	Several land masses, little land, mostly water	25	18.3%	96.16	1,358/869
Devonian	365	More land, lots of water	16.9	27.5	96.85	1,552/985
Permian	250	More land, one land mass	17.6	26.4	97.82	1,999/377
Triassic	205	One larger mass, less water	14.9	20.8	98.24	759/577
Cretaceous	70	Mass gets larger and some separation	15.8	22.7	99.48	2209/1401
Present	0	Separate continents, water in between	14.5	21	100	2622/2470

- Do you notice any patterns from the chart? Do your data suggest an explanation of why a mass extinction occur at that time?
- Based on these data, could we be in the middle of an extinction event? Why?
- Calculate the biodiversity loss in each extinction and report in terms of percent. Use the following formula:

$$\text{(BIODIVERSITY BEFORE - BIODIVERSITY AFTER) / BIODIVERSITY BEFORE X 100 = \% OF LOSS}$$

	Ordovician	Devonian	Permian	Triassic	Cretaceous
% of Biodiversity Lost	$(1358 - 869) / 1358 \times 100 = 36\%$ of species went extinct.	37%	74%	24%	37%

- Compare extinction event to data table, do you notice any patterns in the percentage of biodiversity lost? Explain
- Write down three questions you now have about mass extinctions?

ELABORATE 1

- Return to EarthViewer. Move the slider down to "Cretaceous extinction" and click on the link. Read the information about this extinction.

2. The information tells you that “overwhelming evidence suggests that the extinction was caused by a 10-km asteroid that struck Earth.” **Suggest at least two lines of evidence from your data that support this conclusion.**
3. **Explain how these pieces of evidence support the theory that the extinction was caused by a massive asteroid.**

ELABORATE 2

1. Return to EarthViewer. Move the slider down to “Permian extinction” and click on the link. Read the information about this extinction.
2. The information tells you that “it is thought that massive eruptions of Siberian volcanoes caused catastrophic global warming and a widespread lack of oxygen.” **List two pieces of evidence from your data table that support this idea.**
3. **Explain how these pieces of evidence support the theory that the extinction was caused by a massive asteroid.**
4. **How do you think the things that happen during these extinctions affect how the rock layers (strata) look?**