



Considering the Evidence for Mass Extinctions

INTRODUCTION

At least five times in Earth's past, the vast majority of 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 systems and life?

ABOUT THIS WORKSHEET

Students will use two BioInteractive resources to explore the science of mass extinctions. *Mass Extinction: Life at the Brink* is a feature film available at <http://www.hhmi.org/biointeractive/mass-extinction-life-brink>. It can be streamed for free only until June 30, 2016, but a free DVD copy can be ordered at any time. EarthViewer is an application that is available for [download for computers](#) or it can be installed on [tablet devices](#) (iPad or Android).

ENGAGE AND EXPLORE

1. Watch the introduction to the film, [Mass Extinction: Life at the Brink](#) (0:00 – 1:55).
2. Turn to a partner and share any questions this brief film clip generates in your mind. Record your ideas as instructed by your teacher.
3. Launch and explore the features of [EarthViewer](#):
 - Click, hold, and drag to rotate the planet.
 - Click, hold, and drag 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 (top of the timeline). Click on the left "play" button at the bottom of the timeline; watch what happens. When the silver bar stops at the bottom, click on the right "play" button and watch again.
 - 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 chart will show a demarcation in the data 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 screen; 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 to the Ordovician extinction, 440 MYA. Use the EarthViewer features to fill in the following chart. For Biodiversity, you will need to move the slider carefully and record the number of marine genera present just before and just after the extinction event. Gather data in the same manner for the remaining four mass extinctions.

| Mass Extinction | MYA | What was Earth's surface like? Landmasses? Proportion of land to water? | Avg. Surface Temp., °C | O ₂ (%) | CO ₂ (ppm) | Day Length | Luminosity | Biodiversity (# of genera just before & just after extinction) |
|-----------------|-----|---|------------------------|--------------------|-----------------------|------------|------------|--|
| Ordovician | | | | | | | | |
| Devonian | | | | | | | | |
| Permian | | | | | | | | |
| Triassic | | | | | | | | |
| Cretaceous | | | | | | | | |
| Present | | | | | | | | |

a. Do any patterns and correlations emerge from your chart? Does any of the data suggest an explanation for the occurrence of mass extinctions?

b. Calculate the biodiversity loss in each extinction and report in terms of percent.

| | Ordovician | Devonian | Permian | Triassic | Cretaceous |
|------------------|------------|----------|---------|----------|------------|
| % of Genera Lost | | | | | |

c. What questions do you now have about mass extinctions?



ELABORATE, PART 1

- Return to EarthViewer. Move the slider down to "Cretaceous extinction" and click on the link. Read the information about this extinction (formally known as the Cretaceous-Paleogene or sometimes the Cretaceous-Tertiary extinction).
- The information tells you that "overwhelming evidence suggests that the extinction was caused by a 10-km-diameter asteroid that struck Earth." Suggest at least three lines of evidence that might have led scientists to this conclusion. Discuss your predictions with your table partner and record your ideas in the space below.
- Together with your class, continue watching the film, *Mass Extinction: Life at the Brink* (1:55 - 21:00). As you watch, record the kinds of scientific evidence that support the asteroid impact hypothesis.
- How does your predicted evidence compare with the actual evidence used to support the asteroid impact hypothesis?

ELABORATE, PART 2

- Return to EarthViewer. Move the slider down to "Permian extinction" and click on the link. Read the information about this extinction (formally known as the Permian-Triassic extinction).
- The information tells you that "it is thought that massive eruptions of Siberian volcanoes caused catastrophic global warming, ocean acidification, and widespread lack of oxygen in the oceans." Predict what kinds of evidence might have led scientists to this conclusion. What kind of evidence would suggest the existence of volcanoes? What kinds of evidence might suggest global warming, ocean acidification, or lack of oxygen in the oceans? Discuss your predictions with your table partner and record your ideas in the space below.



Mass Extinctions in Earth History

Student Worksheet

- Why do you think that scientists do NOT hypothesize that an asteroid impact caused the Permian-Triassic extinction? Discuss your thoughts with your table partner and record your ideas in the space below.

- Together with your class, continue watching the film, *Mass Extinction: Life at the Brink* (21:00-37:00). As you watch, record the answers to the two questions above.

- How does your predicted evidence compare with the actual evidence used to support the massive eruption hypothesis?