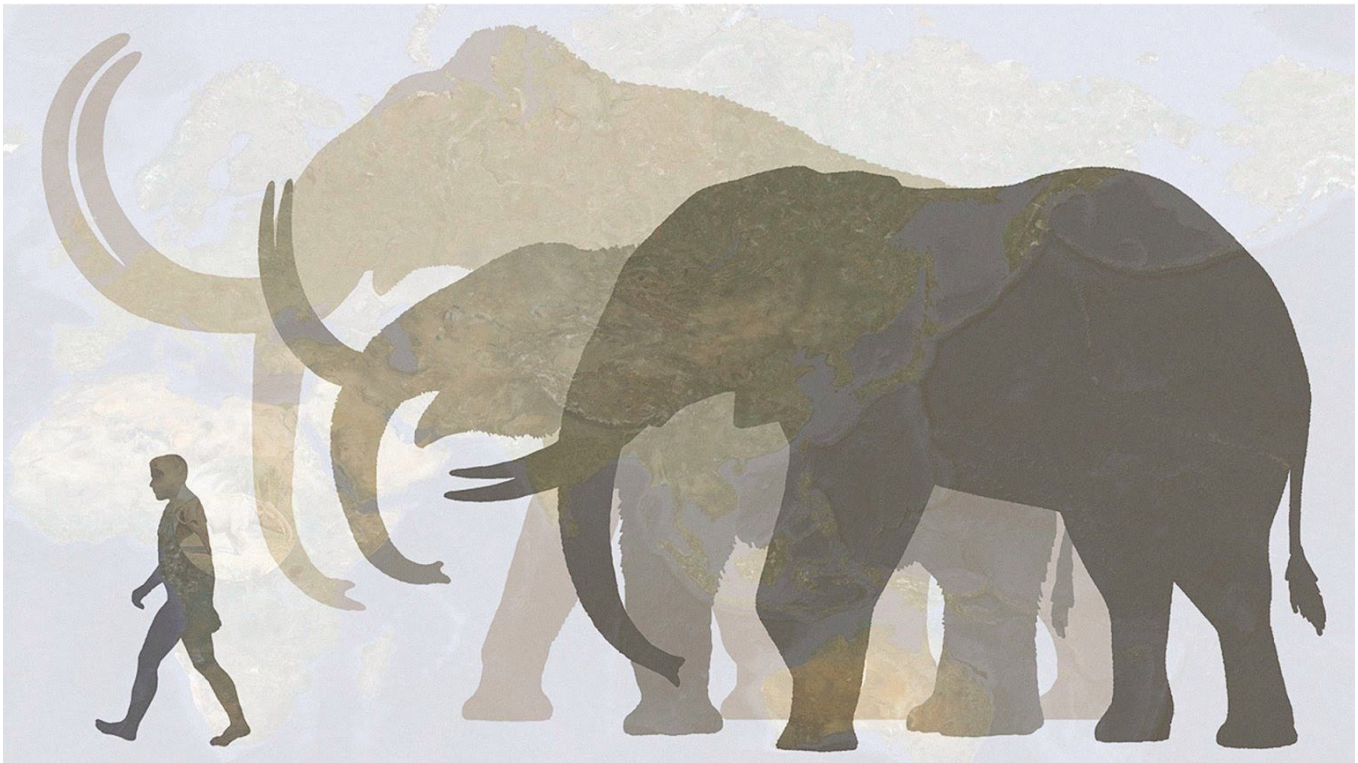
Virtual Field Trips

Ancient Animals

Investigating Earth and Sky Virtual Field Trip



"Bring back the woolly mammoth!" - Hendrik Poinar, TEDxDeExtinction

This is a supplementary educator guide to assist parents and teachers with the asynchronous portion of the virtual field trip. To reserve your virtual exhibit exploration experience, please fill out the Virtual Field Trip Request Form.

All associated activity guides can be found with the attached documents found on our website.
Additional resources can be found at the end of this guide.

This virtual field trip experience was generously funded by the General Motors Company.

How do scientists use evidence from the past and present to find out about the prehistoric organisms and ancient environments?

There is an entire field of science devoted to the study of ancient Earth. Paleontology is more than just the study of fossils, but the geologic processes and the biological mechanisms that allowed organisms to exist and thrive. Scientists have been able to create and refine a timescale of Earth, which include specific time periods marked by mass extinction events. The discovery and analysis of fossils fills in the gaps to our understanding of how these ancient organisms lived and ultimately died. As more and more fossilized remains are recovered, our understanding of how organisms evolved continues to adapt to this new information. Most notably, the discovery of feathers on dinosaurs, like the velociraptor.

Based on what we know about ancient animals, we can start to make conclusions about how those organisms functioned in their environments. Analyzing these interactions can help us understand how or why descendents of these ancient species exist today. Using Michigan's state fossil, the mastodon, and state stone, the Petoskey stone, as examples, students will draw conclusions based on evidence provided about the ancient species and their current living relatives.

Connection to the Next Generation Science Standards

During this virtual field trip, your young scientists will make observations about current and ancient species, and how environmental changes in Michigan have led to the extinction of species who otherwise could not adapt.

After this field trip, your 3rd grader should be able to explain these endpoints in their own words: Animals are adapted for the environment they live in; as environments change, the animals that cannot adapt quick enough may die out; the leading cause of extinction is due to climate change.

3-LS4-1. Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.

Disciplinary Core Ideas: LS4.A

Organisms that have since gone extinct may be preserved as fossils and can be studied to learn more about ancient Earth.

Science & Engineering Practices: Analyzing and Interpreting Data

Students will **analyze** the fossils of mastodons and corals (Petoskey stones) and **interpret** additional information provided to create an image of the environment at the time the organisms lived.

Crosscutting Concepts: Scale, Proportion, and Quantity

From millions of years ago in the Devonian period to just thousands of years ago in the Pleistocene epoch, animals that once existed are now extinct. Descendents of these ancient species also face extinction as climate change continues to shape the biodiversity of Earth.

Nearpod Field Trip Outline

1. Welcome and Introduction to your Virtual Field Trip - Ancient Animals (Slides 1-3)

   To start, we meet Shannon, an educator at the Michigan Science Center, and she poses the Driving Question, "How do scientists use evidence from the past and present to find out about prehistoric organisms and ancient environments?" Students will explore this question using two examples that are familiar to Michigan and additional information about current (extant) species that are related to them.

*Press the play button in the bottom left corner to play an audio transcription of the text on the slide.

2. What are fossils? (Slides 4-16)

   a. **Collaborate**

      What do you know about fossils?

      Share your thoughts or cool facts about fossils!

      - Students are asked to share their thoughts and think aloud. Other students who participate in the lesson can also leave their thoughts and compare their answers to the ones that are posted.

   b. Fossils can be the preserved remains of organisms, or the traces left behind of organisms that lived long ago.

      - **Preserved remains** are the fossilized body parts of organisms, including plants, animals, and bacteria.
      - **Trace fossils** provide information about an organism's behavior, such as how it lived, if it traveled in herds or packs, and what it ate.

   c. Fossil Feast

      - Shannon shows students how fossils are formed using pudding and cookies as substrate.
      - It is encouraged that students follow along with the demonstration; however, students can explore the model separately after completing the lesson.
      - The *Fossil Feast* activity guide can be downloaded from the Additional Resources under this Virtual Field Trip.

   d. Where do we find fossils?

      - Fossils are found all over the world, including Antarctica and the Sahara desert.

e. What can fossils tell us?

- Fossils can tell us about the environment at the time that the organism lived.
- Fossils can also tell us about the adaptations that animals had to survive in their environments.

f. Who are paleontologists?

- Paleontologists are scientists that study fossils to figure out how animals from the past survived in their habitats.
- Paleontologists also use what they know about animals that live today to help them understand how animals lived long ago.

g. Who was Mary Anning?

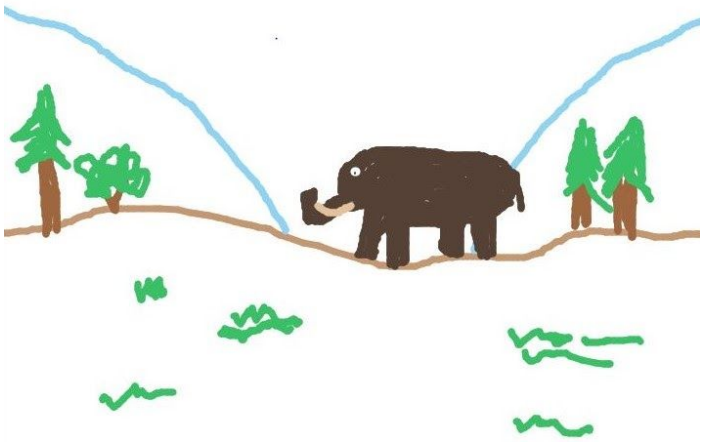
- Mary Anning was a paleontologist whose discoveries provided evidence of animals that lived long ago and have since gone extinct.
    - The idea of extinction was not widely recognized or considered a possibility until the mid-1800s.
- Over her years of fossil hunting, she unearthed the remains of:
    - the first correctly identified ichthyosaur skeleton
    - the first two nearly complete plesiosaur skeletons
    - the first pterosaur skeleton located outside of Germany
    - She also helped to identify "bezoar stones" as coprolites

h. **Open Ended Question**:

Why do you think we see more squirrels than stegosauruses?

- This question is meant to engage learners and learn more about your student's prior knowledge.
    - The ancestors of squirrels, like the Juramaia, were able to adapt to the changing climate at the end of the Jurassic. Other organisms, like the Stegosaurus, could not adapt quickly enough and subsequently went extinct.
- Sample response: squirrels were able to adapt and the stegosaurus couldn't.

2. Michigan's Fossils (Slides 17-41)
    a. The Mastodon: Michigan's state fossil (Slides 18-28)
        - What do we know about mastodons?
            - Mastodons had a prehensile (grasping) trunk, small ears, curved tusks, and were covered in thick fur.
        - Mastodons are related to woolly mammoths
            - Both animals were herbivores, but their teeth were adapted based on the plant materials they chose to eat.
        - What happened to the mastodons?
            - Mastodons went extinct around 10,000 years ago, shortly after the end of the last Ice Age.
                - climate change
                - human hunting
                - disease
    b. **Draw It**
        - Students will draw a picture of what they think the mastodon's environment looked like.
        - Mastodons lived during the Ice Age, but they fed on trees and bushes. The environment should have evidence of plant life, but snow banks or glaciers can also be depicted.
        - Sample response:



c. What animal alive today is related to the mastodon?

- The *Elephants* PDF is embedded for the students to read, and it has been included separately so that the document can be printed. The document can be downloaded from the Additional Resources under this Virtual Field Trip.

d. While mastodons look a lot like modern elephants, they are not closely related.

- Mammoths and elephants are more closely related to each other than they are to the mastodon.
- The ancestors of modern elephants and mammoths branched from the evolutionary tree about 5 million years ago. Mastodons branched off even earlier, about 25 million years ago.

e. **Open Ended Question**:

What evidence do we have to support the claim that mastodons and elephants are related?

- Students are asked to recall some of the information that has been presented on both the mastodons and the elephants.
- Sample response: mastodons and elephants both have large bodies, trunks and tusks.

Need a break?
This is a great time during the virtual field trip to take a break if you or your students need to get away from the screen. Don't worry, when you return, we will pick up where we left off and jump back into the virtual field trip!

f. The Petoskey Stone: Michigan's state stone (Slides 29-41)

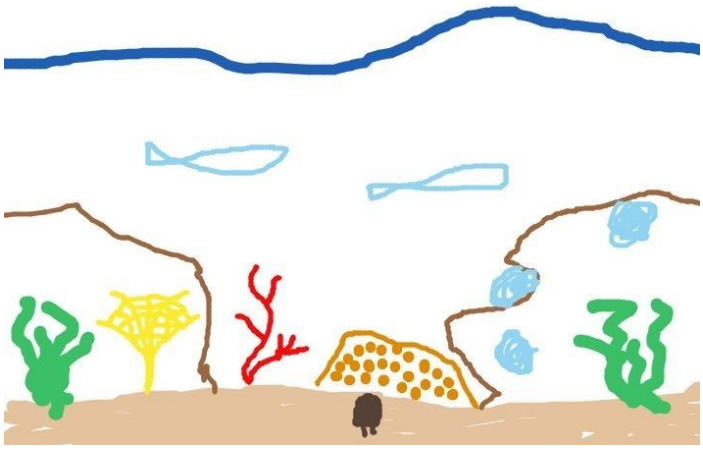
- What do we know about Petoskey stones?
  - Petoskey stones are fossilized coral called *Hexagonaria percarinata* that lived around 400 million years ago during the Devonian period.
- Michigan's shallow sea
  - This is what the Earth might have looked like in the Devonian period. The circle is where what is now Michigan would have been – under water south of the equator.
  - This warm, sunny sea was an ideal habitat for marine life. In fact, many of the fossils that are found in Michigan are of ancient marine life.

- Marine fossils of Michigan
    - There are a variety of marine fossils in Michigan, including bryozoans, other species of coral, and crinoids ("sea lilies").
    - There is a *Make Your Own Crinoid Model* activity included under the Additional Resources section in this Educator Guide.
- What happened to the *Hexagonaria* coral?
    - The Hexagonaria corals and around 75% of the Earth's animals went extinct about 360 million years ago.
        - global cooling
        - sea-level fall
        - anoxic water

g. **Draw It**

- Students will draw a picture of what they think *Hexagonaria* coral's environment looked like.
- The *Hexagonaria* coral lived during the period of time when Michigan was covered in a shallow, tropical sea. The picture should clearly show an underwater environment with lots of different marine organisms.

h. Sample response:



i. What animal alive today is related to the *Hexagonaria* coral?

- The *Corals* PDF is embedded for the students to read, and it has been included separately so that the document can be printed. The document can be downloaded from the Additional Resources under this Virtual Field Trip.

j. Corals are a keystone species

- Coral reefs are home to more than 25% of the world's marine life, making it the most biodiverse ecosystem.
- Many organisms rely on coral reefs for shelter and food. If there is something wrong with the corals, the whole ecosystem is in trouble. Corals are considered a **keystone species** because so many organisms rely on them for survival.

k. Soundscape Ecology

- Scientists can tell if a coral reef is healthy by listening to it.
- Sounds can also be represented visually. Patterns in the sounds can be used to track the existence of certain species.
    - There may be many more sounds in an ecosystem that are out of our range of hearing. **Spectrograms** help to visualize all of the sounds at different frequencies to help capture more information about the species and biodiversity of an ecosystem. A simplified spectrogram is pictured on the slide.
- The specific branch of science that analyzes the sounds of an ecosystem is called **soundscape ecology**.
- Students can hear what a coral reef sounds like.
    - You may want to have them try to write down all of the sounds they can hear. Just like in the graphic on the previous slide, they can use whatever words they want to describe the sound.
        - There are at least 4 distinct noises: crackling, purring, knocking, buzzing.
    - Encourage your students to think about the animals that are making those noises.

l. **Open Ended Question**:

What evidence do we have to support the claim that the Hexagonaria corals and stony corals we see today are related?

- Students are asked to recall some of the information that has been presented on both the *Hexagonaria* corals and the stony corals.
- Sample response: both corals build reefs.

3. Environmental change and adaptation (Slides 42-44)

    a. **Poll**

        - The main reason species have gone extinct is…

            - **Climate change**

            - This is the primary reason that both the mastodons and the *Hexagonaria* corals went extinct. Their environments changed due to either global cooling or global warming, which made it difficult for the organisms to adapt quickly. Other factors contributed to the already at-risk populations that eventually caused entire species to become extinct.

    b. **Open Ended Question**:

    Do elephants and corals today face the same challenges today as their ancestors did years ago? Why or why not?

        - Students are asked to reflect on the challenges that both the ancient (extinct) species and current (extant) species face.

        - Sample response: Yes, elephants and mastodons were hunted by humans; both corals were stressed by climate change.

    c. **Open Ended Question**:

    Make a claim about how the organisms that lived a long time ago were adapted to their environment at the time, but ultimately became extinct when their environment changed. Use the evidence you've been given to support your answer.

        - Students are asked to construct an argument using the information that they have been given. It should include a summary of at least one organism (the mastodon or the *Hexagonaria* coral).

        - Sample responses:

            - Mastodons had thick fur to help them survive during the Ice Age. When the climate got warmer, they overheated because their fur was so thick. They couldn't lose their body heat fast enough, so they died out.

            - The Hexagonaria corals lived in the ocean that covered Michigan, but global cooling and falling sea-levels made it harder for the corals to survive.

Additional Resources

Use the interactive Paleobiology Database Navigator to explore fossils from around the world.

Continue to explore the relationship between extinct species and their extant relatives with A Fossil From the Jurassic Period in this interactive story from MyLearning.

BioNinja provides an excellent summary of the different types of Species Interactions.

Learn more about how the Petoskey stone got its name and additional activities, information, and resources about Michigan geology, review the Michigan *Department of Environmental Quality's 2013 Annual Directory.

* This department was renamed the Michigan Department of Environment, Great Lakes, and Energy in 2019.

For more information about soundscape ecology and coral reef sounds, check out these articles:

- Sounds of the reef | The Natural History Museum, UK
- Healthy coral reef sounds attract fish searching for a home | Science News for Students

Video Links

- How does a dinosaur become a fossil? | The Dinosaur Show
- The true story of Mary Anning: The girl who helped discover dinosaurs | BBC Ideas
- The Evolution of Elephants, Mammoths and Mastodons - Proboscidean Family Tree | Kobean History
- Bring back the woolly mammoth! | TEDxDeExtinction
- Coral Reefs 101 | National Geographic
- What Exactly Is Coral? | ABC Science

Activity Guides

The following Activity Guides have been included with the Virtual Field Trip. We recommend that you look through them and decide how and when to incorporate them within your schedule.

Fossil Feast 10 Minutes

Materials:

- Clear cup
- Spoons
- Bowls
- Vanilla and chocolate pudding
- Blue food coloring
- Sprinkles and/or animal crackers
- Graham crackers
- Oreos

Additional Activity Guides

- Egg Carton Mammoth & Mastodon Molar Models | Michigan DEQ
- Make Your Own Crinoid Model | USGS
- Dinosaurs and Evolution | The Field Museum

Curriculum Connections

This virtual field trip can be paired with the Mystery Science: Animals Through Time curriculum.

L4.3 Fossils: Making Claims With Evidence - additional fossils specific to Michigan can be found here: Michigan Fossils

- Guide to Michigan Fossils