ACTIVITY: Using Fossils as Evidence

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Objective: Learners will relate the traits of organisms to what environmental conditions may have existed and/or what behavioral traits the organism may have had.

Introduction: By studying fossils found in different National Parks and Monuments, scientists can compare the ages of fossils and how different ecosystems have changed over time, including changes in biodiversity. Fossils can also reveal interactions between ancient organisms, which gives insight into organism behavior and details about the environment.

Have learners:

1. Print out the complete **geologic time scale**. Cut apart the four columns that represent the four major divisions of geologic time.

   a. Tape the columns together so they are stacked vertically in time order, with the present day on top.

   b. Tape your vertical geologic time scale onto poster paper.

   ▸ *Did each of these divisions last the same amount of time? How can you tell?*

   ▸ *If you found rock layers from each division, in which age do you think you would find the most fossils: Cenozoic, Mesozoic, Paleozoic, or Precambrian? Why do you think this?*

2. Visit **Fossils Through Geologic Time** to read short descriptions of the organisms that lived in each of the four major divisions of the geologic time scale.

   a. Click on each major division to learn more about organisms that lived in each time range and the parks that have fossils from each division.

   b. Choose 4–6 national parks or monuments (other than Florissant Fossil Beds National Monument and Grand Canyon National Park, which are used later in this activity) and determine the age range of fossils that have been found at each of them.

   c. Label the age range of the fossils from each park you chose on the geologic time scale you assembled in Step 1. (You may want to **view an example** of a diagram like the one you are constructing, but please note that it is not updated for recent findings).

   d. For the parks or monuments that you chose labeled on your diagram:

   ▸ *Which has fossils that represent the longest timespan? What has the shortest? What factors could affect the age range of fossils within an NPS unit?*

- ▸ *Which is most likely to have fossils that look similar to the organisms that exist within the area today? Which is least likely? Explain your answer.*

3. Study the diagrams of fossils found within rock layers at Florissant Fossil Beds National Monument.

a. Identify the oldest and youngest layers that contain fossils.

b. Add the time range of fossils found at Florissant Fossil Beds National Monument to your geologic time scale diagram.

4. Observe and discuss an **outcrop diagram of the Grand Canyon** (created by Anne Miller, paleontologist at Grand Canyon National Park) that shows layers of rock that were deposited over 1.5 billion years.

- ▸ *Note the four geologic times indicated on the left side of the diagram. Which section has the most differences compared to the other times)?*

- ▸ *View an* **image of the outcrop** *and compare the diagram to it. The red line represents a non-conformity where erosion has worn away rocks so that part of the geologic history of the Grand Canyon is missing. You may also want to view a* **close-up image of the non-conformity** *in another part of the canyon. How do the rocks below the non-conformity differ from those above it?*

- ▸ *Where on the outcrop diagram do you think this non-conformity is located? Explain your reasoning.*

- ▸ *In which rock layer(s) do you think fossils might be found? Why do you think this?*

a. Optionally, view another image that **relates the outcrop diagram to the rock layers of the Grand Canyon**.

b. Look at the names of specific rock layers (called formations) within the **Grand Canyon Outcrop**, then view images of select layers. Consider which rocks you think might contain fossils and why.

- **Basement rock (specifically, the Elves Chasm pluton)**
- Two layers within the Unkar Group: **stromatolites in the Bass Limestone** (the bottom layer of this group), and **ripples preserved in the Dox Formation** (near the top of this group)
- **Chuar Group**
- **Bright Angel Shale**
- **Redwall Limestone**
- **Surprise Canyon Formation**
- **Hermit Siltstone** (the layer above the researcher's head), and **raindrop impressions in the Hermit Formation**
- **Coconino Sandstone**

c. Optionally, you may want to read about the formation of some of these layers in the article, **Numeric Ages of Grand Canyon Rocks**.

d. Cut apart and make observations of the images of fossils found in Grand Canyon National Park.

e. Arrange the fossils in the order in which you think the organisms lived in the area that is now the Grand Canyon.

f. Consider grouping organisms that you think lived at the same time.

g. Discuss your chosen order, and if possible, compare it to the order that others decided on.

h. Obtain a copy of the **Grand Canyon outcrop diagram with stars** to match the images to the rock layer that each specimen is from.

▸ *How did your original order compare to the actual order?*

▸ *Explain your thinking for one specimen you got incorrect—why did you think it was older or younger than it turned out to be?*

i. Add the time range of fossils found at Grand Canyon National Park to your geologic time scale diagram.

▸ *How does the age range of fossils at Grand Canyon National Park compare to the other parks on the diagram? What might this tell you about the environment of the Grand Canyon?*

▸ *Think about the climate and ecosystem that exist at the Grand Canyon today. Based on the fossil images and rock types on the outcrop diagram, has this area always had the same climate as it does now? How can you tell?*

j. Obtain images of fossils found within caves located in the Grand Canyon. Consider how they compare to the other fossil specimens and make a claim about their age, including an explanation of why you think that.

5. Optionally, complete an activity on **Biodiversity and Adaptation** to introduce or review the concepts that:
- Organisms survive best when they have traits that are suited to their environment.
- Ecosystems benefit from biodiversity, in which different species fill specific roles (niches) and interact with other species in certain ways (e.g., food chains, symbiotic relationships).

6. Read more about **fossils found in the Grand Canyon**. Discuss:

▸ *How has the climate/ecosystem of the area changed over time, and how has that affected the organisms that have lived there?*

i. Optionally, return to **Fossils Through Geologic Time** and choose at least one other park that has fossils from more than one division. Based on the types of fossils found there over time, describe (and/or research) how the climate/ecosystem around that park has changed.

ii. Alternatively, complete the activity **Tule Spring Fossil Beds National Monument Past vs. Present**.

7. Read about the **Diversification of Life**.

   a. Add the four significant evolutionary events from this article to the geologic time scale.

   b. Describe how these events relate to the divisions of time on the geologic time scale.

   c. Then, describe the spacing of these events over time and explain why you think each evolutionary shift took as long as it did.

HANDOUT: Using Fossils as Evidence

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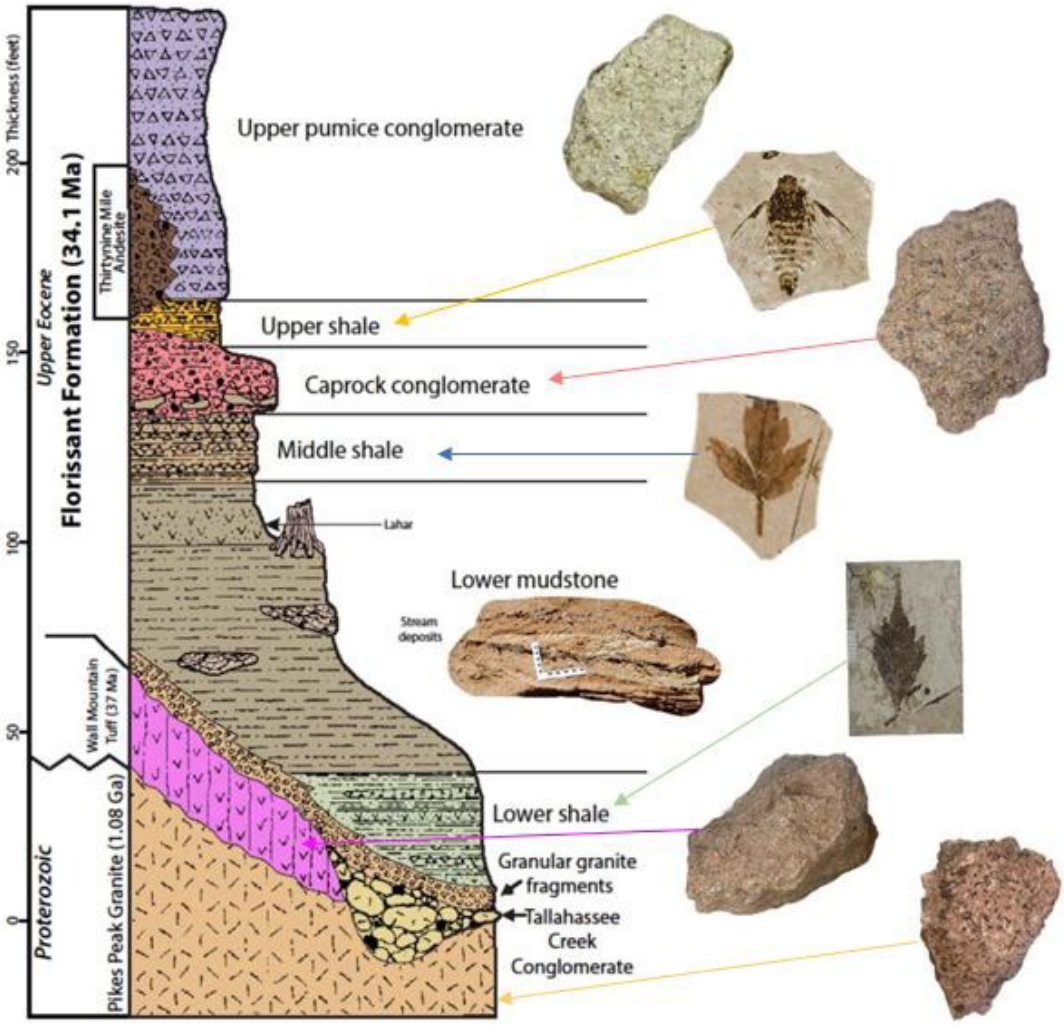
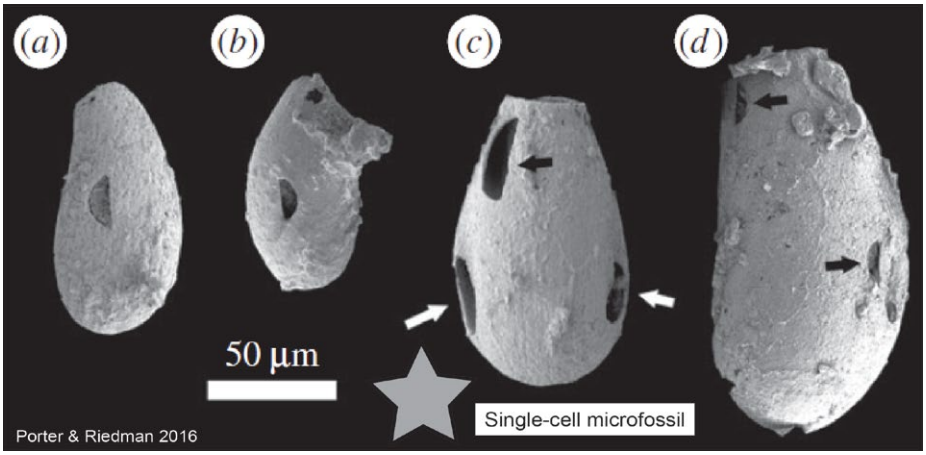
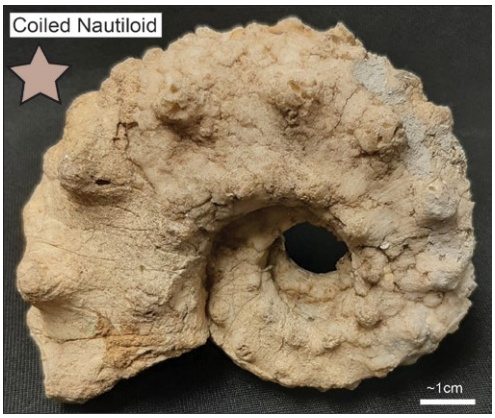
Make observations of the partial geologic time scale and compare the age range of fossils from select National Parks.

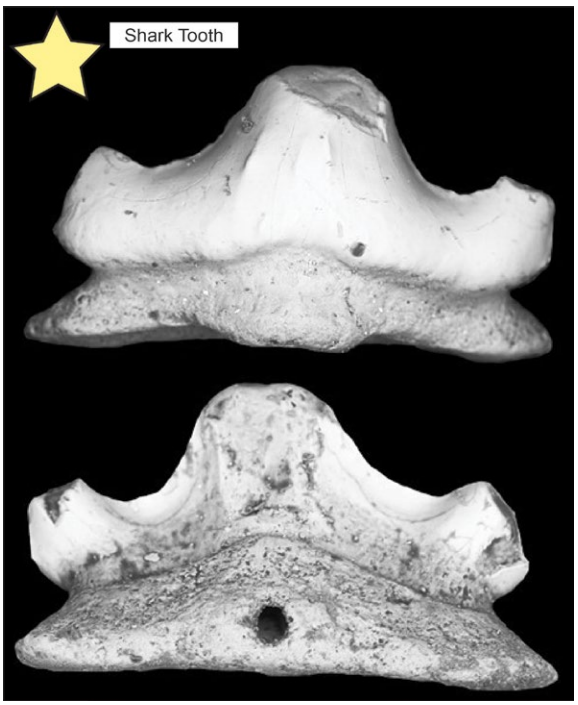


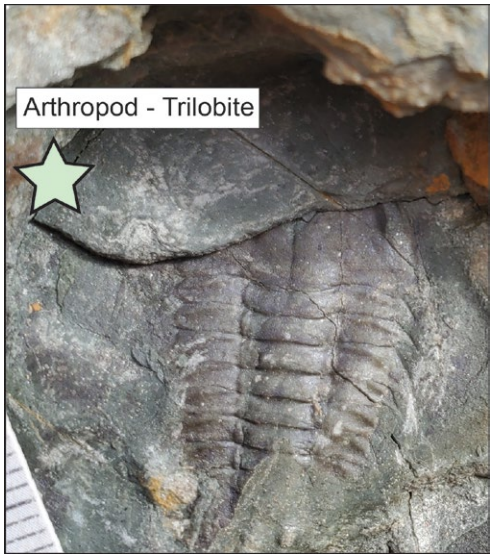
Credit: Florissant Fossil Beds National Monument



Credit: NPS-Grand Canyon National Park/Porter and Riedman







Left middle and bottom credit: NPS-Grand Canyon National Park

Right middle and bottom credit:
NPS-Grand Canyon National Park/Anne Miller

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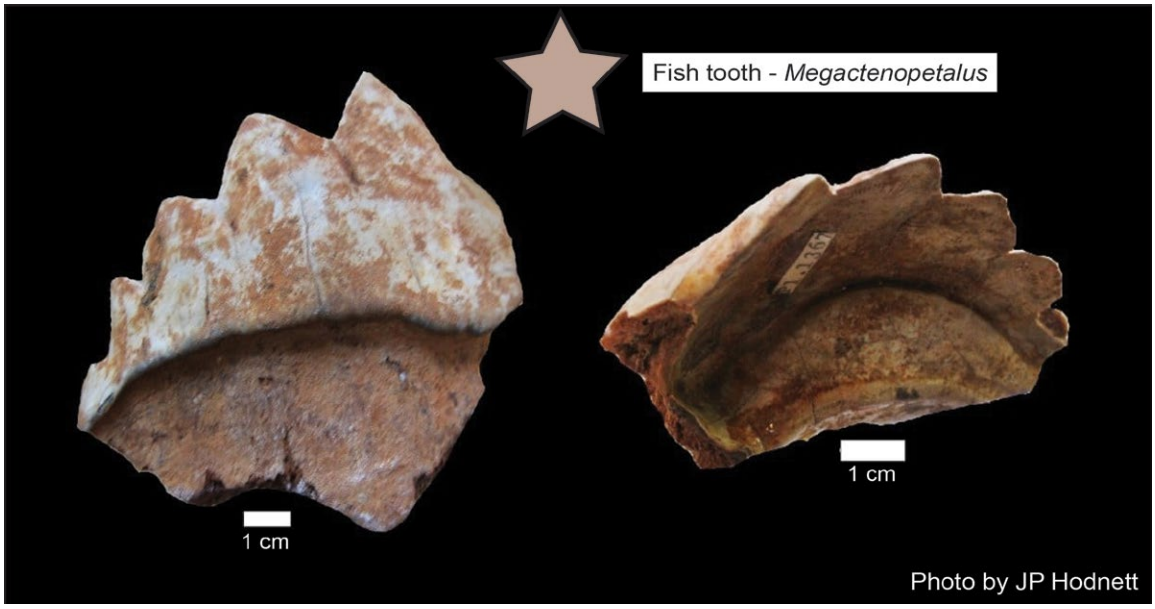

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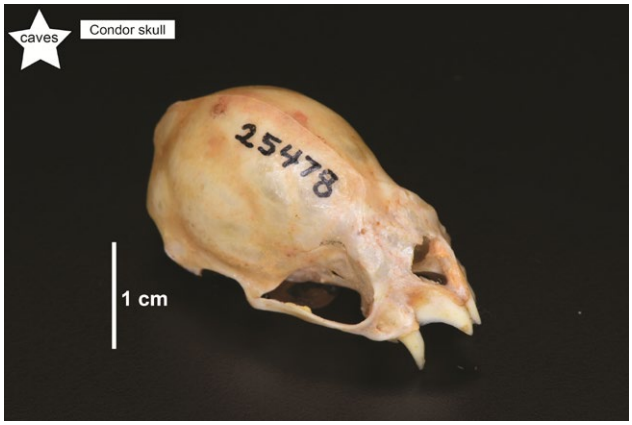

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