

PALEO SLEUTHS

— DIGGING DEEPER —

Fascinating Fossils

Grades 4-8



This activity introduces students to a variety of fossils: large animal bones, small fragment pieces, and microfossils. Students will analyze fossils like that of a field paleontologist by drawing and describing their observations. Students will begin to understand that by investigating fossils, a broader history emerges to tell the story about what inhabited the Earth, the landforms and seas that existed, and that the tiniest of fossils, microfossils, can reveal more evidence through scientific research about Earth's climate history.

Teacher Background Information

1. Activity length: 50-60 minutes
2. Grades 4 - 8 can experience this activity. Some extensions for Grades 6 - 8 have been noted.
3. This activity uses the 5 E Instructional Model:
 - Engage - create curiosity, access prior knowledge, ask open-ended questions
 - Explore - examine thinking and understanding, test predictions and hypothesis
 - Explain - share possible solutions, explain evidence, develop new understandings
 - Elaborate - add new information and build new explanations, propose solutions
 - Evaluate - answer open-ended questions, demonstrate and communicate understanding
4. This activity uses a science and engineering format found in *A Vision and Plan for Science Teaching and Learning, An Educator's Guide to a Framework for K-12 Science Education, Next Generation Science Standards, and State Science Standards* which involves Gathering, Reasoning, and Communicating.
 - Gathering - defining a problem, asking questions, using models to organize data
 - Reasoning - evaluating data, constructing ideas using math to solve a problem, using evidence as support for or against an explanation
 - Communicating - using written or oral forms to explain how evidence supports the reason
5. Vocabulary:
 - Geology - the study of the physical structure of the Earth and the processes that act on it
 - Fossil - the remains or impression of a prehistoric organism preserved in petrified form or as a mold or cast in rock, remains or traces of ancient living things
 - Paleontologist - a scientist who works with preserving and studying animal and plant fossils and the traces they leave behind
 - Paleontology - is the study of fossils of animals and plants, microorganisms, and the traces they leave behind. Paleontologists study fossils to understand past life forms and changes through time. With the study of fossils, paleontologists can reconstruct the past history of the earth, animals and plants that lived in those times, and the environment that impacted those organisms. They study the evolution and extinction of organisms through the fossil record they encounter.

The following excerpt was found in - "Fossilization and Adaptation Activities in Paleontology" by Brent H. Breithaupt "Fossilization is a rare event. The chances of a given individual being preserved in the fossil record are very small. Some organisms, however, have better chances than others because of the composition of their skeletons or where they lived. This also applies to the various parts of organisms. For example, plants and vertebrates (animals with bones) are made up of different parts that can separate after death. The different parts can be transported by currents to different locations and be preserved separately. A fossil toe bone might be found at one place and a fossil rib at another location. We could assume that they are from different animals when, in fact, they came from the same one."

Teacher Materials:

1. Large fossil bones accessed from a local Parks Department and or museum trunk
(Use Resource list)
2. Small fragment fossils (Use Resource list- Aurora Fossil Museum Website)
3. Small hand-held strainers for sifting
4. Microfossil prepared slides (order diatom, foraminifera microfossils through science catalog/online)
5. Microscopes
6. Magnifying lenses
7. Sand

Teacher Procedures:

1. Set up stations around the classroom of the 3 types of fossils, large, fragments, and microfossils
 - The large fossils can be placed on rugs or blankets on the floor in the room.
 - The sand should be put into two separate trays with the fossil fragments mixed in along with strainers and information about the types of fragments (use resource Aurora Fossil Museum website for information).
 - Several compound and stereo microscopes should be set up around the room with diatom and foraminifera type microfossils for observation (if these can't be obtained, locate website photos).
2. Before beginning this activity, take an open class survey of the question; "What is a fossil?" To determine prior knowledge from the class. (Engage).
3. Introduce and define the term paleontologist.
4. Students answer the question: What is a fossil? By:
 - Being paleontologists as they gather data observing, drawing, labeling, and describing various fossils as they rotate through fossil stations. (Engage).
 - Gather data using a science journal or the attached worksheet. (Explore).
 - They can attach the fragment fossils with tape to their journal as they label and describe them.
 - The data becomes evidence in support of their reasons for "What is a fossil?"
5. Activity closure includes:
Grades 4-5
 - Project 3 part Venn diagram on a dry erase board or screen and mark 3 types of fossils, one for each circle
 - Elicit answers to "What is a fossil?" during a class discussion. (Explain)
 - Reasons based on gathered evidence.
 - Compare and contrast evidence in Venn diagram.
 - Note: highlight adjectives students used when describing fossils (detailed descriptions).
 - Students answer the fossil worksheet questions in their own words defining, "What is a fossil?" (Explain, Elaborate)
 - Share answers in class discussion.
 - Share definition for the term fossil.

Grades 6-8

- Students in groups of 3-4 use the 3 part Venn diagram chart to compare and contrast written observations, then as a group, make a determination about the fossil question worksheet (Explain, Elaborate).
- Groups share their explanations with their peers.
- Questions for further examination (Elaborate):
 - What other information would be helpful to collect about fossils?
 - How does a living organism become a fossil?
 - What kinds of descriptions are important for a paleontologist to include when gathering data?
 - What have you discovered about fossils from this activity?

Extension for Grade 6-8

1. Students investigate two types of microfossils: diatoms and foraminifera (forams).

These tiniest of fossils tell a much deeper story through scientific research about the climate of the Earth over millions of years.

2. Teacher can make available access to PBS Learning Media Library for *Antarctica's Climate Secrets* - 5 videos on the research in Antarctica to uncover its climate history and the microfossils that are involved. (See Resource List):

- *Reading Antarctica's Rock Cores* - scientists demonstrate how they read climate evidence in rock cores.
- *Tiny Clues to Antarctica's Past* - cores are examined to find climate clues in diatoms and forams.

3. With each video, there are teacher resource activities to highlight the background about microfossils that can be extensions to this activity.

4. Teacher can make available access-to-access <http://joidesresolution.org/node/794> about microfossils or plan for the following activity found under Resources, Educator, at Deep Earth Academy page titled "Mohawk Guy and his band of Neogene Planktic Foraminifera Friends" at <http://joidesresolution.org/educators/activities/>

National and State Standards

Next Generation Science Standards

Grade 4	4-ESS1-1.	Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.
Middle Level	MS-LS4-1.	Analyze and interpret data for patterns in the fossil record that document the existence, diversity extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
	MS-LS4-2.	Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
	MS-ESS1-4.	Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

Nebraska State Standards

Grade 3-5	SC5.1.1	Students will plan and conduct investigations that lead to the development of explanations.
	SC5.1.2	Students will describe how scientists go about their work.
	SC5.1.2.a	Recognize that scientific explanations are based on evidence and scientific knowledge
Grades 6-8	SC8.1.1	Students will design and conduct investigations that will lead to descriptions of relationship between evidence and explanations.
	SC8.1.2	Students will apply the nature of science to their own investigations.
	SC8.1.2.a	Recognize science is an ongoing process and the scientific community accepts and uses explanations until they encounter new experimental evidence not matching existing explanations
	SC8.4.4	Students will use evidence to draw conclusions about changes in Earth.
	SC8.4.4.a	Recognize that Earth processes we see today are similar to those that occurred in the past (uniformity of processes)
	SC8.4.4.b	Describe how environmental conditions have changed through use of the fossil record

Activity Resources

1. Nebraska Games and Parks Commission: Search Education Trunks-reserve ahead, (no cost to reserve).
2. Education Trunks - Morrill Hall- <http://museum.unl.edu/index.html> - Education, Elephant Trunk (there is a cost to borrow the trunk).
3. Bucket of Fossils- Contact Debbie Hetzel, Customer Service, at Potash Corporation, North Carolina, (847) 849-4389 or email dahetzel@potashcorp.com with your name, school address to request a free 5 gal. Bucket of Fossils, small fragment fossils of parts of vertebrae, and shark teeth. Ms. Hetzel will send your request to the Aurora Quarry Plant and they will send you the fossils.
4. Access Aurora Fossil Museum Website to identify most of the fossil fragments from the Bucket of Fossils in resource list at <http://aurorafossilmuseum.org/> - choose Learning link, Educational Materials - Fossil Identification Key.
5. NEBRASKAland Magazine's *The Cellars of Time* - Paleontology and Archaeology in Nebraska
6. Ashfall Fossil Beds State Historical Park Website: <http://ashfall.unl.edu>
 - Book: *ASHFALL Fossil Beds* - State Historical Park & National Natural Landmark, Present View of an Ancient Past, found on website: <http://ashfall.unl.edu/>
 - *Ashfall Fossil Beds* Brochure
 - *Ashfall Skeleton Map*
7. PBS Learning Media Library.
8. Museum of Paleontology fossil photos <https://umorf.ummp.lsa.umich.edu/wp/>
9. Animal Diversity Web fossil photos <http://animaldiversity.org/>
10. PBS Learning Media: Antarctica Climate Secrets - 5 video segments plus teacher resources:
 - *Antarctica Today* - polar searchers share why they want to study the climate history of Antarctica.
 - *Antarctica's Ice On the Move* -find out how ice and rocks hold clues to Antarctica's climate past.
 - *Reading Antarctica's Rock Cores* - scientists demonstrate how they read climate evidence in rock cores.
 - *Tiny Clues to Antarctica's Past* - cores are examined to find climate clues in diatoms and forams.
 - *Decoding Antarctica's Climate History* - geologists and climate modelers examine cores, greenhouse gases, Earth's orbit as evidence for Antarctica.
11. JOIDES Resolution, joidesresolution.org, or JR - an ocean core drilling scientific research ship - this website has numerous educator resources about core samples, climate change activities, videos of the work on the ship, activities about microfossils.

Fascinating Fossils

Activity



What stories can fossils offer about the Earth? Be a paleontologist and dig into fossils to find out. In this activity, you will investigate a variety of fossils, making observations, drawing, labeling, and describing your fossil finds. Then you will share what you have discovered about fossils with your class.

Objectives:

Students will

- Gather observations; conduct investigations leading to evidence and explanations about fossils
- Draw conclusions about your investigations and share reasons about changes over time in the fossil record
- Communicate evidence to support reasons about the fossils that were observed

Materials:

1. 3 stations of various fossils:
 - Large fossil bones
 - Sand boxes with small fragments of fossils
 - Microscopes with slides of microfossils
2. Small hand-held strainers for sifting sand for small fragments fossils
3. Magnifying lenses
4. Science journal or worksheet

Student Procedures:

Engage:

1. Use a science notebook or worksheet to write down observations, drawings, and descriptions about all 3 types of fossils.

Explore:

2. Rotate through fossils stations collecting observations.

Explain:

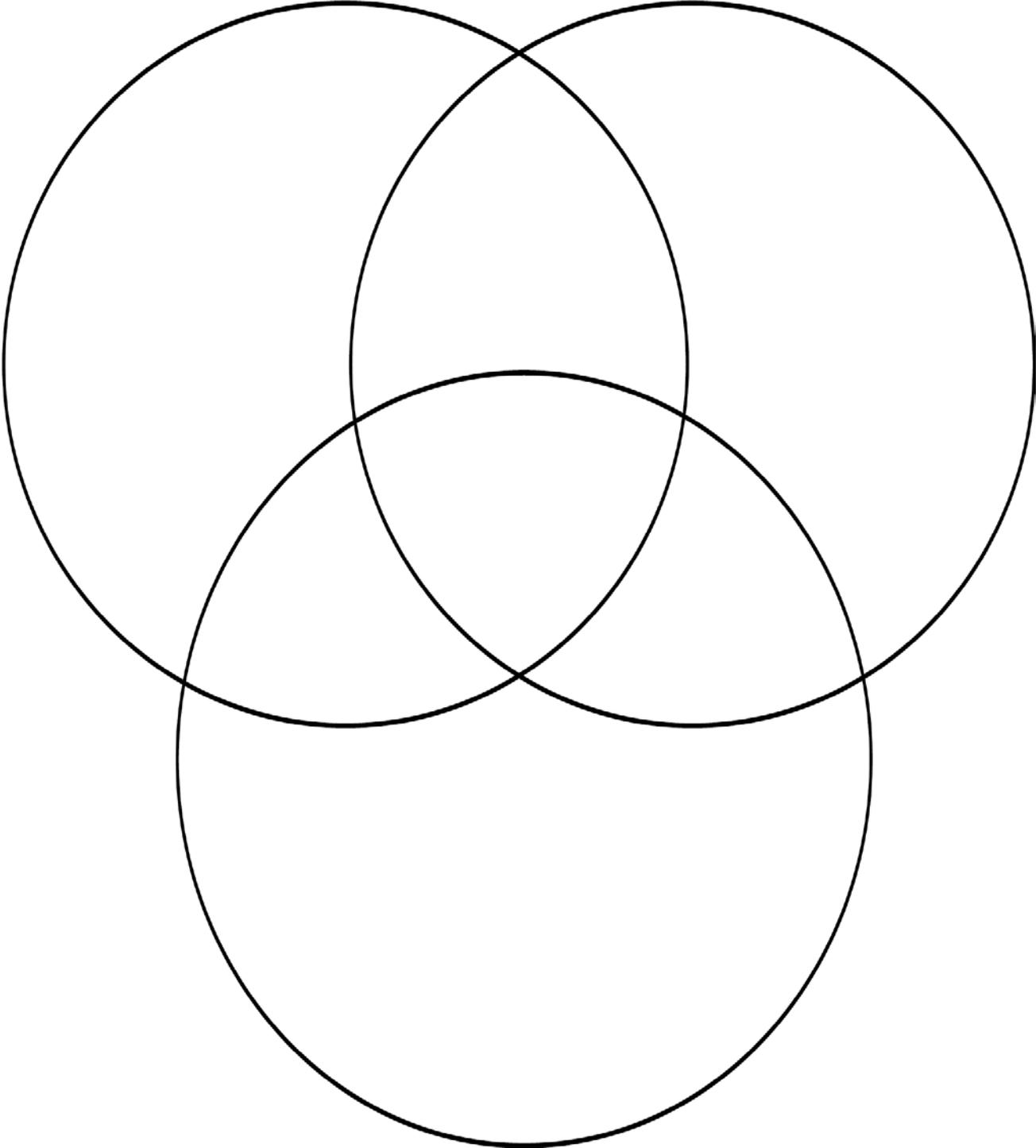
4. Answer questions in their own words.

Elaborate:

5. Use a 3-part Venn Diagram to compare and contrast the 3 types of fossils, sharing descriptions with your peers.
6. Make a list of adjectives used in the descriptions.
7. Identify vocabulary from the introduction list as well as any other terms used during discussion as a group.
8. **Evaluate:** Conclude by discussing questions on the worksheet providing background knowledge for future activities.

Fascinating Fossils

Compare and Contrast Fossils



Fascinating Fossils

Describe, Draw and Label

Large Fossils	Sand Fossil Fragments
Microfossils	

Fascinating Fossils Questions

What is a fossil? _____

How do you think a living organism becomes a fossil?

What environmental conditions could have been in place for fossils to form?

What conclusions can you draw from your investigation about the fossils you observed and described?
