



SHOEBOX MIDDEN DIG

GRADE LEVEL: 6–12

TIME REQUIRED: Two class periods

SETTING: Classroom

GOAL: To create and excavate a fossil/archaeology site

OBJECTIVES: At the end of this lesson the student will be able to:

- define the Principle of Superposition,
- define the Principle of Original Horizontality,
- state how these two principles apply to paleontology,
- describe the process of stratification,
- differentiate the roles of the archaeologist, paleontologist, and the historian, and
- describe some techniques used by archaeologists and paleontologists.

KERA GOALS: Meets KERA goals 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.10, 1.11, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.9, 2.10, 2.11, 2.19, 2.20, 2.23, 3.4, 3.7, 4.1, 4.2, 5.1, 5.2, 5.3, 5.4, 6.1

BACKGROUND INFORMATION

The 4.6 billion-year history of the earth is divided into eras, periods, and epochs that are based on the type of life that existed during each of these time frames. The geologic processes and scientific laws operating today also operated in the past.

The Earth's atmosphere and surface water act together to decompose and wear away the rocks on the surface of the planet. The sediments formed by this erosional process are deposited in horizontal layers. This process is called the **principle of horizontality**. Over time, these sediments harden and bond together and become the rock layers of today. Because the first, or oldest, sediments are found on the bottom layer, the age of sediments and rocks becomes progressively younger from bottom to top. This is called the **principle of superposition**. Sedimentary rocks tell the story of destruction and rebuilding. Geologists study sedimentary rocks to understand the past. They use a relative time scale which places rocks and events in the chronological order in which they formed. Using these principles, scientists can use fossils to establish the age of the rock.

Archaeologists and paleontologists are scientists who look at the early history of our planet. **Paleontologists** study the fossil remains of various organisms and use the clues they find to describe the earliest plant and animal life found in an area. By comparing these early species to those found today, the paleontologist can draw some conclusions about the prehistoric climate of that era.

Archaeologists look at the life of early human beings. Starting approximately 12,000 years ago, early humans left behind objects, or artifacts, which tell about the daily life and environment of the people who inhabited this area of Kentucky. These ancient trash piles are called middens. The clues that archaeologists uncover tell us how these early people survived, what they ate, what their homes were like, and what games and jobs they enjoyed. Both archaeologists and paleontologists use similar techniques to uncover clues of the past.

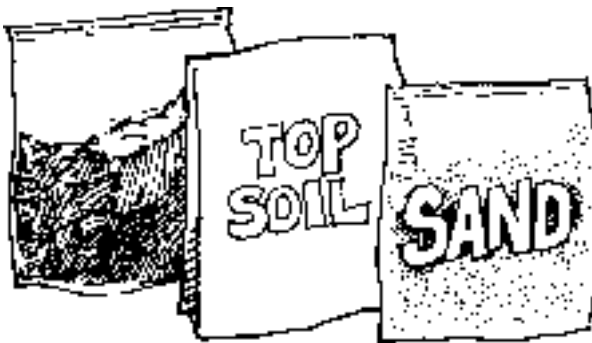
An archaeological or paleontological survey is a systematic examination of the land. When a site is discovered the boundaries are defined and mapped. All specimens within these boundaries are mapped and recorded. Specimens are then collected and taken to a laboratory where they are cleaned and analyzed. It is important for these scientists to keep detailed notes about the surrounding landscape and to note exactly where each specimen was located because the surroundings and relative location of various artifacts can often be a more important clue than the item itself.

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MATERIALS NEEDED

Each group of three students will need one set of the following items:

- 2 cups of dirt found locally
- 2 cups of bagged topsoil
- 2 cups of sand
- Spray bottle of water
- Permanent marker
- Ruler marked in millimeters
- Graph paper, 3 sheets per group
- "Curator Work sheet," 3 per group (two-sided)
- Pencil
- Paper plates, 3 per group
- One styrofoam tray
- Clear plastic shoebox marked in millimeters on the side (starting with "1" at the top)
- Plastic spoon
- Small paintbrush
- "Prehistoric" fragments, including: Shells or coral fragments, fish bones
- "Ancient" artifacts, including: Small chicken bones, pieces of charred wood, burnt rocks, arrowheads, or rocks which look like scrapping stones
- "Modern" artifacts, such as: Ticket stubs, small toys, fast-food, gum, or candy wrappers



SHOEBOX MIDDEN DIG – ACTIVITY ONE

PROCEDURE

MAKING THE BOXES:

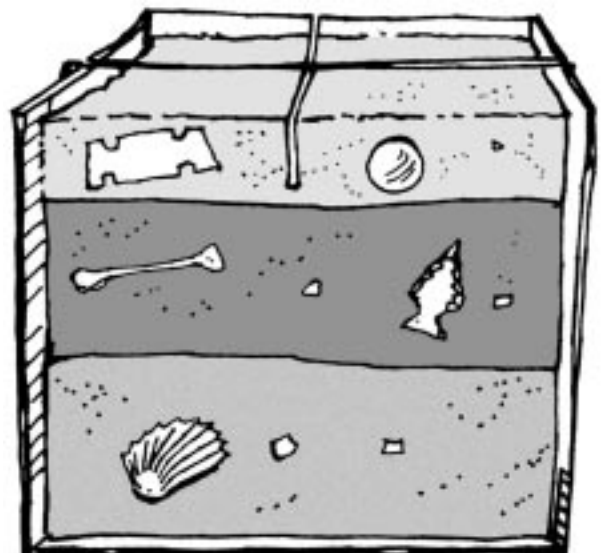
1. Divide the students into groups of three.
2. Provide each group with the materials needed to construct a shoebox midden: a clear plastic shoebox; black permanent marker; a ruler marked in millimeters; 2 cups each of local dirt, topsoil and sand; spray bottle of water; and three collections of artifacts. Each artifact collection will represent an activity or event during each of three different time periods.
3. Tape or draw a millimeter ruler down one side of the box. If drawing, have the students mark horizontal lines spaced one millimeter apart down one corner of their box. Label each line. The number 1 should be located at the top of the box.
4. Instruct the students to place a small amount of the local dirt on the bottom of the shoebox. Place the “Prehistoric” fossil remains on the top of the soil and cover the remains with the rest of the locally obtained dirt.
5. Spray water over this layer until it becomes sticky and adheres to the “fossils”.
6. Begin the next layer by placing a small amount of topsoil over the previous layer. Place the “Ancient” artifacts on the topsoil and cover these artifact pieces with the rest of the topsoil. Spray lightly with water to compact the soil.
7. Spread a small layer of sand on top of the topsoil. Place “Modern” artifacts in the shoebox and cover with additional sand. Spray lightly with water to compact the sand.
NOTE: Each layer should be approximately 2-inches deep.
8. Place two pieces of colored string or tape across the top layer of the sand to produce a grid that divides the shoebox into fourths.

9. **NOTE:** Choose articles for each layer which will “tell a story”. For example, the bottom, or “Prehistoric”, layer should consist of shells (sea environment) or bones (landmass). The middle layer of “Ancient” artifacts could consist of items found in a rockshelter, a hunting area, or a cave. The rockshelter artifacts may include cooking items, charred wood or stone, scrapping stone, bone fragments, or pottery fragments. In a hunting area there might be arrowheads, bones, sharp stones, or rock tools. In a cave environment there could be twine fragments, cane reed fragments, and pieces of gourds. Students might also use sunflower seeds, hickory nut shells, or mussel shells. The top layer of “modern” artifacts could represent a movie theatre area and include ticket stubs, and wrappers of fast food, gum, or candy. A playground area might include small toys, Popsicle sticks, and a penny. What could they use for a classroom, bedroom, or summer camp area? Encourage each group to be creative in developing their time capsule activities.

NOTE: The assembled boxes will be exchanged so that each group will have a different box to excavate than the one they assembled.

Questions to be answered:

1. Which is the oldest layer? How did you arrive at that answer?
2. What are the principles demonstrated in this model?



SHOEBOX MIDDEN DIG – ACTIVITY TWO

PROCEDURE

THE MIDDEN DIG:

1. Have the class get back into groups of three. Each group should be given three sheets of graph paper, 3 copies of the Curator Worksheet, a pencil, three paper plates, one styrofoam tray, a plastic spoon, and a small paintbrush. Have the groups exchange midden boxes.
2. Explain that each group is made up of three professionals: An excavator, a mapper, and a curator. Explain the duties of each. The excavator will patiently uncover any artifacts found only in the top layer of soil. Once the top layer of soil is removed and all artifacts have been mapped and curated, the students should exchange professions prior to excavating the second layer. Once the second layer has been excavated, the students exchange jobs a third time. In this way each student has an opportunity to experience each profession.

Excavator – in charge of uncovering the remains. The plastic spoon is to be used to carefully remove dirt from the site. Once an artifact is noticed, the excavator should use the paintbrush to remove the surrounding sand or dirt. The excavator must be extremely careful not to damage, tear, break, or mar the discovered artifact. The excavator continues working until the item is completely exposed. Each layer of excavated sand or dirt is to be placed on a separate paper plate. Once a large artifact is uncovered, the surrounding dirt or soil is usually sifted to find smaller artifacts or fossil remains which will present a more complete picture of the site. (NOTE: Students can be instructed to sift their dirt piles if you have fine mesh wire frames available. Charcoal fragments, charred wood, or small seeds should be saved.)



Mapper – in charge of mapping the excavation site and noting the exact location of each item uncovered. Two maps will be made. The first map will be a top view of the excavation site and will show the exact location of each artifact as it is uncovered. This map will use



the surface grid for guidance. The second map will be a stratigraphic cross-section and will show the elevation (depth) of each artifact. The second map will use the millimeter ruler on the side of the shoebox for guidance. The two maps may be drawn on the same sheet of paper. The top view should be shown on the top half of the paper. The cross-sectional (side) view should be shown on the bottom half of the paper.

Curator – removes the artifact from the excavation site, cleans the specimen with the paintbrush, and displays it on a styrofoam tray. Each artifact should be recorded on the Curator Work Sheet. The work sheet will have a space for description, measurement, grid number and a drawing of the fossils your group finds.

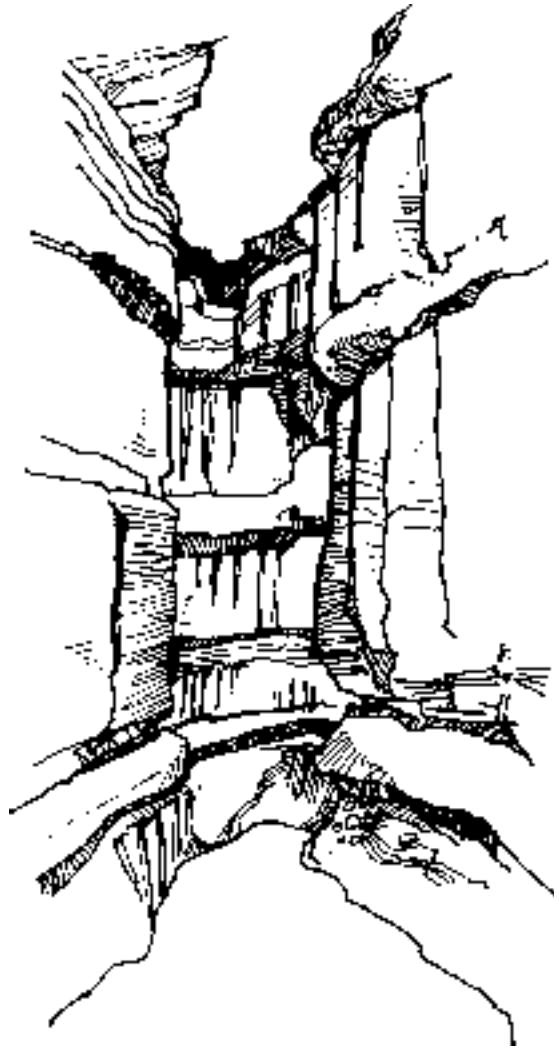


3. Each group will excavate, map and curate as detailed, exchanging occupations each time the sediment layer changes.
4. Each group will develop a site report. This report should describe the different levels excavated and draw some conclusions concerning the environment of each. For each level, the report should describe, explain, and draw conclusions from the assembled facts. Each report should include: 1) the types and descriptions of remains; 2) the activities that occurred at this site; 3) a list of inferences that can be drawn from the artifacts collected at each level; and 4) predict what future historians will be able to tell us about the modern era based upon the artifacts discovered in the top layer.
5. Have the students respond to the following questions either orally or within their report:
 - In which of the three rounds is the excavator called an archaeologist?
 - In which of the three rounds is the excavator called a paleontologist?
 - In which of the three rounds would you call the excavator a historian?
 - What is the difference between an archaeologist and a paleontologist?
 - Which occupation appealed to you the most? The least? Why?
 - Would you have the patience to be an archaeologist or paleontologist?

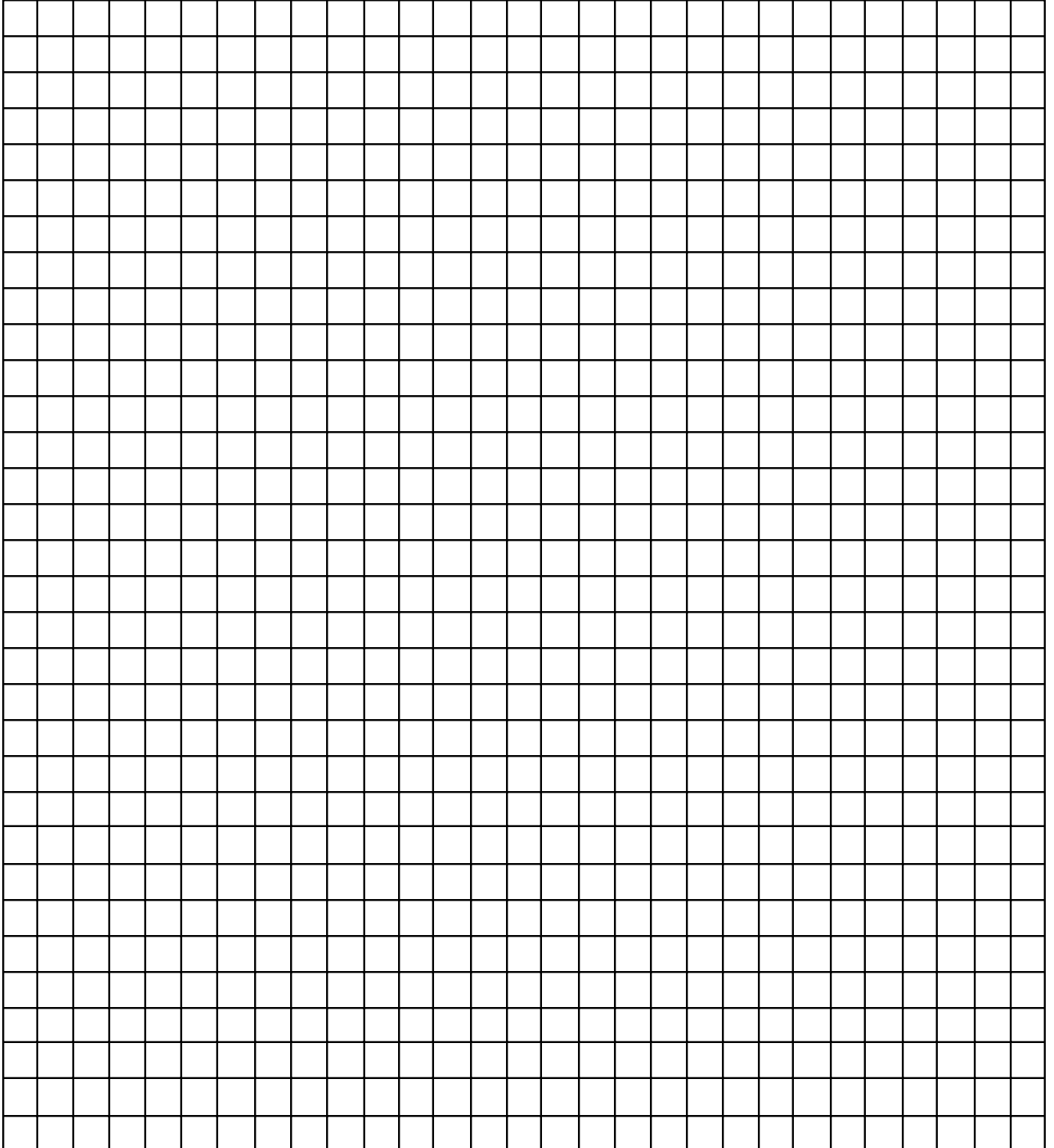
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EXTENSION

1. At scientific conventions, written reports are always available for further study. Have each group write up a site report describing their excavations and conclusions. Produce a book of convention proceedings by placing the written reports and site drawings in a loose-leaf binder. Make the "Proceedings" available for the class to review.
2. Conduct a "Paleo-Research Convention." At this convention, each group orally presents their site report before the class. Encourage questions. Have the presenters defend their techniques and conclusions. Require explanations of conditions and events surrounding the deposition of their specimens. Questions can be written out ahead of time.
3. Visit an archaeological or paleontological site. Possibilities include Wickliffe Mounds (Wickliffe, KY), Falls of the Ohio (Clarksville, IN), or Crystal Onyx Cave (Cave City, KY).
4. Obtain information on sites that contain artifacts or fossil remains by writing for brochures, by reading newspaper articles and books obtained from your local library, or by conducting research on the Internet.
5. Attend an archaeology weekend at Mammoth Cave National Park or other site. Archaeology Weekend is held at Mammoth Cave National Park during the middle of October of each year. This is an excellent chance to listen to archaeologists and/or paleontologists as they present information about their most recent work at the national park. This is also a chance to watch archaeologists demonstrate crafts and skills of prehistoric people from the Mammoth Cave region.
6. Caves are a wonderful refuge for prehistoric and historic artifacts. The constant temperature and humidity levels work in conjunction with nitrates in the cave soil to preserve materials left behind by previous visitors. Some of this material may be very old. Plan a field trip to a cave. Notice the rock and sediment layering. Look closely at the rock layers for evidence of fossil remains. Ask about remains from people. How old are the artifacts found in this cave? Would you consider these artifacts to be "treasures" or "trash"? How would these artifacts be viewed by an archaeologist 1,000 years from now? Should these materials be preserved or cleared out of the cave? Why?



SHOEBOX MIDDEN DIG - MAPPING GRID




SHOEBOX MIDDEN DIG – CURATOR WORKSHEET

Description: _____

Measurements: _____

Grid #: _____

Drawing of fossil:




Description: _____

Measurements: _____

Grid #: _____

Drawing of fossil:



Description: _____

Measurements: _____

Grid #: _____

Drawing of fossil:



Description: _____

Measurements: _____

Grid #: _____

Drawing of fossil:



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- **Do you think all of the fossils you found are from one animal or location?**

Why or why not?

- **What do these remains have in common?**

- **Do these remains present clues to the environment of this area?**

- **HYPOTHESIS: Name of animal or how site was used:**