FOSSIL PREPARATION KIT

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DESCRIPTION

This kit includes a real fossil bone from a prehistoric animal and a fossil of a marine animal. A scientific label is also provided with your fossil specimens. The Fossil Preparation Kit instructs you in the cleaning and preparation of invertebrate and vertebrate fossils, following the same process used by paleontologists. By adding several common household items, you can create a fossil preparation lab in your classroom or kitchen.

In the first activity, you use basic tools to clean a marine invertebrate fossil. Using a mild household chemical, you will remove the rocky crust found on the fossil and study the details of its anatomical structures. In the second activity, you will preserve fossil vertebrate bone fragments before fitting the fragments back together to create the original structure.

GOALS

You will be able to…

- demonstrate procedures used by scientists to reconstruct fossil fragments and turn them into specimens for study or display;
- learn and implement scientific procedures used in the safe handling of chemicals used for cleaning fossils; and
- identify at least three ways in which fossils allow scientists to study life forms from the prehistoric past.

ARE YOU A TEACHER?

The subject matter in this kit is aligned with the following Sunshine State Standards:

Grades 3-5: SC. D.1.2.1, SC. D. 2.2.1 SC. H.! 2.1, SC.H.1.2.2, SC.H.2.2.1
Grades 6-8: SC.D.1.3.1, SC.h.1.3.1, SC.H.1.3.2, SC.G.2.3.1
Grades 9-12: SC.D.1.4.2, SC.D.1.4.4, SC.D.2.4.1, SC.G.2.4.1

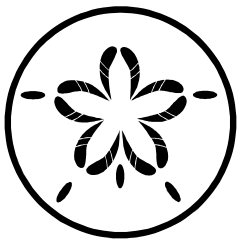
HELPFUL TIPS

To complement activities in this kit, you might want to read about prehistory and fossils before you start. When reconstructing the fossil bone specimens, you can dissolve the specimen bones in Butvar as many times as you want, especially if you don't think the specimen was put together correctly. If you become frustrated when gluing small pieces together, find someone to help you.

Not all the bones required to completely recreate the animal are found in this kit. Scientists in the field rarely find all the bones and pieces they need to completely reconstruct the animal skeleton. In a museum, professionals called "Fossil Preparation Technicians" prepare bones that are found. Because the technicians usually don't have all the bones they need to completely reconstruct the animal, they mix plaster and add it to the spaces created by the missing bone fragments. Once dry, the plaster is painted to match the color of the natural fossil bone.

ACTIVITY ONE

PREPARE MARINE FOSSIL SHELL



Materials supplied to prepare the marine fossil shell of a sea biscuit

- toothbrush
- dental tool
- fossil sea biscuit

Materials needed but *not supplied* to prepare the marine fossil shell of a sea biscuit

- 16 ounces (2 cups) of white vinegar
- paper towels or newspaper
- aluminum foil

Procedure to prepare the marine fossil shell of a sea biscuit

1. Place the fossil shell sea biscuit on a small piece of aluminum foil (Figure 1).

Figure 1

2. Pour 2 cups of white vinegar into a bowl.

3. Put the fossil sea biscuit in the bowl of vinegar to soak. The vinegar will start to foam once it touches the surface of the sea biscuit. This is a reaction between the acetic acid in the vinegar and the rocky mineral on the fossil. This chemical reaction dissolves the mineral on the surface of the fossil. Let the fossil soak in the vinegar for about two minutes.

4. After about two minutes, take the fossil sea biscuit out of the vinegar. Use the toothbrush to clean the fossil – just like you would to brush your teeth (Figure 2).

Figure 2

Procedure to prepare the marine fossil shell of a sea biscuit (cont'd)

5. If you want to clean the fossil sea biscuit even more, put it back into the vinegar. Does the vinegar foam? Repeat this step as many times as you want. You may continue to brush with the toothbrush and vinegar until the entire surface of the fossil sea biscuit can be seen. You may rinse the fossil sea biscuit with clean water at any time in this process to see results.

   If it is difficult to identify the fossil surface from the rock surface, you might want to look at the fossil and rock through a low powered magnifying glass while you work. Remember: results will vary from one specimen to another.

6. If you have chunky pieces of rock still clinging to the surface of the fossil, remove them using the dental tool provided. Be very careful. Remove very small pieces of the rock at a time. Do not remove all the chunky rock with the dental tool. Leave a thin layer of it over the fossil so you do not scratch the surface of the fossil (Figure 3).

Figure 3

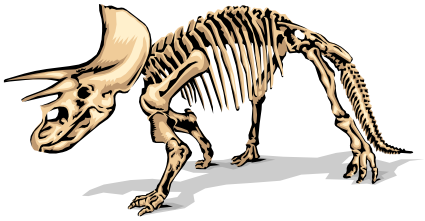
7. Do not try to over clean the fossil sea biscuit because the vinegar might dissolve more of the fossil than you meant to remove! When you have completed the cleaning of your fossil sea biscuit, rinse it with tap water and let it dry completely.

ACTIVITY TWO

BONE PRESERVATION and RECONSTRUCTION

Materials supplied to preserve the fossil bone

- **do *not* use water anywhere near this activity; do activity *only* in dry area**
- 1 ounce of Butvar
- ½ inch wide, straight tip camelhair paintbrush
- ½ inch (marble size) of bone wax
- pair of disposable / surgical / rubber / plastic gloves
- fossil bone specimen
- 3 ounce size glass jar with lid



Materials needed *but not supplied* to preserve the fossil bone

1. 8-ounce bottle of Acetone or finger nail polish

2. roll of paper towels or several newspapers (do not use rags because lint will get on the fossil; acetone will soak through rags and create a mess)

Procedure to preserve fossil bone and reconstruct the specimen

1. Lay the fossil bone specimen fragments on *several* layers of clean, dry paper towels or newspapers. **CAUTION: The preservation fluid, acetone, used will melt plastic and ruin wood surfaces** (Figure 4).

Figure 4

Procedure to preserve fossil bone and reconstruct the specimen (cont'd)

2. Solve the puzzle! Start to fit the broken pieces of bone together. You will need to manipulate each piece against the others to determine which pieces fit together. Look carefully at each surface of the specimen to find the bone fragments that match (Figure 5).

Figure 5

3. Once you have fit the pieces together, place each bone fragment on the paper towel in the order in which it will be glued together (Figure 6).

Figure 6

Procedure to preserve fossil bone and reconstruct the specimen (cont'd)

4. Now, fill the glass jar half full of acetone.

5. Open the Butvar packet and quickly pour this white powder into the glass jar filled halfway with acetone. Close the jar lid quickly and shake vigorously, but carefully, until all the Butvar has dissolved in the acetone. You have just made the glue with which you will stick the specimen together!

6. Find the first two specimen surfaces you want to glue together. Dip the paintbrush into the Butvar solution. Dab lightly onto each surface to be glued together (Figure 7).

Figure 7

7. Firmly press the two bone fragments together. Hold the two bones together for several minutes. Be careful not to jiggle or move the bones.

   NOTE: Make a small ball out of the bone wax from the kit. If you have difficulty holding the bone fragments together once you have glued them, put the small ball of bone wax on the side, where the two pieces come together. This should hold them in place (Figure 8).

   NOTE: Do not get bone wax on any of the bone surfaces you are trying to stick together. The bone wax will prevent the glue from sticking to the bone.

Figure 8

8. Once all of the bone fragments are glued together, the specimen has been reconstructed! Let the glue dry for at least 15 minutes.

9. Once dry, apply a coat of Butvar solution over the entire surface of the specimen. This will protect the entire specimen from falling apart.

10. Take a look at your reconstructed fossil. Does it look like it should?
If, for any reason, you are not happy with your results, you can carefully put the specimen into a glass jar filled with acetone. The acetone will dissolve the glue and you can start reconstructing the fossil all over again.

Once you have completed the fossil bone preservation, you should clean your camelhair brush with some of the remaining acetone that is left from this activity.

CREATING LABELS FOR YOUR SPECIMEN

If you want to create your own label for fossils you find, the following information should be included on each label:

- the scientific name of the animal or plant;
- a description of the plant or animal structure that was found (e.g., shell, leaf impression, arm bone); and
- a note where the fossil was discovered. This may be the town or county in which it was found and the rock layer, if known. Rock layers are known as "formations" to paleontologists and geologists. If you do not know the rock layer names in your area, you might find them by checking with someone from a local museum or geological department in a museum.

FUN FACTS

Fossils are rare, which means you don't find them too often. It is very rare to find a complete skeleton or a whole, complete bone. Therefore, most of the skeletons we see in museums are made up of bones that have been broken and fragmented during fossilization.

Because of this, it is necessary for scientists to use techniques to preserve as much of the bone as it was found as they can. Scientists in the United States started doing this as early as the 1850s, when they found large prehistoric animal bones and reconstructed the skeletons. By reconstructing the skeletons, scientists had a better idea of how the animal may have looked.

This was the beginning of the science of paleontology. Joseph Leidy was the first scientist to accurately reconstruct a duckbilled dinosaur in 1858 from pieces of fragmented bones.

There have been two key changes in the last 150 years about how fossil bones are pieced back together. Butvar solution is now used to clean fossil bones. In the 19th and 20th centuries, people used to use shellac, but the bone deteriorated.

Before, scientists used dental tools to clean the surface of fossil bone. Now, chemicals such as mild hydrochloric acid and acetic acid (vinegar) are used. This results in a cleaner surface with fewer scratches.

EXTENSION ACTIVITIES

1. Check Internet sites that display fossils. The University of Florida and the University of Nebraska have excellent sites.

2. Create a sand box, with fossils scattered around in the sand, at school or at home. Make a map of where the fossils are found.

3. Find bones from animals in your community (or from food you might eat). Try making a new creature using the different bones you find!

4. Find a drawing of a dinosaur skeleton. Now find some chalk. Go outside. In the driveway or sidewalk, use the chalk to draw the dinosaur bones – life size!

5. Reading about fossil collectors

4th grade and up

Reading Between the Bones by Susan Clinton (1997)
This is an easy starter for young readers interested in learning about the history of famous paleontologists.

The Bone Hunters Revenge by David Rains Wallace
the early dinosaur hunters in the "Old West" and the discoveries made by Edward Drinker Cope and O.C. Marsh.

6th grade and up

The Gilded Dinosaur by Mark Jaffe (1999)
rivalry between the first great dinosaur scientists of the late nineteenth century.

Time Traveler by Michael J. Novacek
recent work by many modern scientists working from Mongolia to Montana.

Rex Appeal by Peter Larson and Kristin Dunnon
If you love T. Rex, you will love reading about Sue, the most famous dinosaur skeleton ever discovered!

FUN THINGS TO DO

1. Go on a trip with MOSI and collect fossils! Or, learn more about fossils in a MOSI program! Call 813-987-6000 to speak with a MOSI Reservationist.

2. Contact the department of archeology, anthropology or paleontology at a local college or university. Do they have any public or school fossil digs going on in which you could participate?

3. Join the Tampa Bay Fossil Club by writing to "Tampa Bay Fossil Club", P.O. Box 673, Palm Harbor, FL 34682.

4. Visit a museum that has cool fossil collections. Here are a few to get you started:

   - The Museum of Science and Industry and the Science Library at MOSI in Tampa, Florida (also has Diplodocus skeletons on display)
   - The South Florida Museum in Bradenton, Florida has many Florida fossils.
   - The Florida Museum of Natural History in Gainesville, Florida has an exhibit featuring fossil skeletons of over 20 types of extinct animals.

HOW MUCH DID YOU LEARN?

Take a look at the chart on the following two pages to identify your level of paleontology expertise! Have you become a novice, apprentice, practitioner or expert?

Exemplars Science Rubric

taken from www.exemplars.com

Level Scientific Tools and Technologies	Scientific Procedures and Reasoning	Strategies	Scientific Communication/Observations	Scientific Concepts & Related Content
Novice	• Did not use appropriate scientific tools or technologies (e.g., chemicals, hand tools, materials, etc.) to gather data (via measuring and observing).	• No evidence of a strategy or procedure sequence, or used a strategy that did not bring about successful completion of task/investigation. • No evidence of scientific reasoning used. • There were so many errors in the process of preparation that the task could not be completed.	• No explanation, or the explanation could not be understood, or was unrelated to the task/investigation. • Did not use, or inappropriately used scientific representations when questioned on observations • No conclusion related to observations.	• No use, or mostly inappropriate use, of scientific terminology. • No mention or inappropriate references to relevant scientific concepts, principles, or theories (big ideas). • Some evidence of understanding observable characteristics and properties of objects, organisms, and/or materials used.
Apprentice	• Attempted to use appropriate tools and technologies (e.g., chemicals, hand tools, materials) but some information was inaccurate or incomplete.	• Used a strategy that was somewhat useful, leading to partial completion of the task or procedure • Some evidence of scientific reasoning used. • Attempted but could not completely carry preparation procedures, state conclusions from results and question conclusions.	• An incomplete explanation or an explanation not clearly presented (e.g., out of sequence, missing step). • Attempted to use appropriate scientific representations when questioned on observations. • Conclusions not supported or were only partly supported by observations.	• Used some relevant scientific terminology. • Minimal reference to relevant scientific concepts, principles, or theories (big ideas). • Evidence of understanding observable characteristics and properties of objects, organisms, and/or materials used.
Practitioner	• Effectively used some appropriate tools and technologies (e.g., chemicals, hand tools, materials, etc.) to gather and analyze data,	• Used a strategy that led to completion of the investigation/task. • Recorded all data. • Used effective scientific reasoning. • Framed or used testable questions, conducted experiment, and supported	• A clear explanation was presented. • Effectively used scientific representations when questioned on observations. • Appropriately used observations to support	• Appropriately used scientific terminology. • Provided evidence of understanding of relevant scientific concepts, principles or theories (big ideas). • Evidence of understanding observable characteristics and properties of objects, organisms, and/or materials used.

	with only minor errors.	results with data.	conclusions.	
Expert	• Accurately and proficiently used all appropriate tools and technologies (e.g., chemicals, hand tools, materials, etc.) to gather and analyze data.	• Used a sophisticated strategy and revised strategy where appropriate to complete the task. • Employed refined and complex reasoning and demonstrated understanding of cause and effect. • Applied scientific method accurately: (framed testable questions, designed experiment, gathered and recorded data, analyzed data, and verified results).	• Provided clear, effective explanation detailing how the task was carried out. Provided effective details of observations. • Precisely and appropriately used multiple scientific representations and descriptions related to observations. • Clearly supported conclusions, and raised new questions or was applied to new contexts. • Disagreements with observations resolved when appropriate.	• Precisely and appropriately used scientific terminology. • Provided evidence of in- depth, sophisticated understanding of relevant scientific concepts, principles or theories (big ideas). • Revised prior misconceptions when appropriate. • Observable characteristics and properties of objects, organisms, and/or materials used went beyond the task/investigation to make other connections or extend thinking.