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Lesson # 37

Fossils, Casts, and Molds

Grade Level: 3-4

Overall educational objectives: Students will be able to:

1. Describe what animals and plants left behind to make fossils.
2. Create a “fossil” impression or mold.
3. Examine fossils and casts and identify characteristics of various fossils.
4. Define the following words: fossil, paleontologists, cast, and mold.

Associated Standard and CORE objective:

3040-0405 Collect and analyze data about Utah fossils and infer how fossils are formed. Record observable features of fossils. Make inferences about origin of fossils. Predict where fossils might be found, based on inferences. Construct a model of a fossil.

Materials list:

- Worksheet Master “Can You Find The Fossils?” (at end of lesson plans)
- Bryozoan and Brachiopod Data Sheet (at end of lesson plans)
- 6 - Fossil display boards
- 1 - Edmontosaurus foot cast
- 1 - Wood Round (cross section of tree trunk)
- 1 - Photo of a paleontologist
- 1 - Measuring cup - Balls of clay in cups
- Shells
- 1 - Tarp
- 1 - Bird with feathers cast, in box
- 4 - Bryozoan and Brachiopod containers
- 1 - Pink rubber footprint mold
- 1 - Photo of workers digging fossils at a field site
- 1 - Edmontosaurus Poster - Bags of casting plaster (5½ cups per 2 cups water)

Lesson activities:

A. Discuss fossils and fossil hunters.

1. Bring the children together into a semicircle around the table on which you will be making the cast.
2. Ask the children what normally happens when a living thing, or organism, dies. Usually scavengers eat the flesh, and bacteria decompose the rest. After the flesh is stripped off, the exposed bones are broken down by processes such as crushing, chewing, freezing, and thawing.

3. Explain that once in a while parts or traces of an organism are preserved or “fossilized.” To become fossilized, an organism must be quickly buried in order to protect it from bacteria and oxygen that would destroy it. Ask the children what the word fossil means. The word fossil means “something dug up.” A fossil is a remain or trace of an organism from the ancient past, usually preserved in rock.
4. Ask the children what kinds of fossils they have seen. Explain that fossils are not only actual bones and teeth but also imprints of leaves, footprints, tracks, and burrows. Ask the students where we go to find fossils. Fossils are found in mountains, swamps, and other places.
5. Ask the children what kinds of people look for fossils. Show the photo of Jack Horner, a Montana paleontologist. Explain that paleontologists are scientists who study fossils in order to study ancient life. Show the photo of the workers digging fossils at a field site.
6. Tell the children that they will be paleontologists for the day and study different ways that fossils are made and replicated.

B. Pour a cast.

1. With the children still in a semicircle, show them the dinosaur footprint cast. Ask what they think it is. Explain that it is a dinosaur footprint that was found on the roof of a Utah coal mine. Ask the students how they think the footprint was formed. Ask the students what happens when they run across a muddy field after a rainstorm. Their feet press down and leave impressions in the wet mud, which later dries. Explain that that is one way a fossil is created. A natural cast, similar to this manufactured cast, is made by sand or mud filling into a dried depression of a footprint of a dinosaur.
2. Tell the children that another kind of fossil is a mold. For example, a fish dies, falls to the bottom of a lake, and mud fills in around the fish. Later, the fish body dissolves and leaves a hollow depression called a mold. If the mold fills in with minerals or mud, the fill-in material is a cast. Show the students the pink rubber mold. Tell the children that this is an artificial mold of a dinosaur foot. Explain how paleontologists often make artificial molds and casts of fossils using rubber or plaster. Describe how they can then display, study, or sell the cast and molds. **Molds are expensive; Please be careful!** Tell the children that you are going to create a cast right now using the mold.
3. Spread the tarp over the table. Place the pink foot mold on a flat surface. Pour 1 1/4 cups of water into a bag of plaster. Mix the plaster and water in the bag until the mixture is smooth, then immediately pour it into the mold. Fill the mold to the top but do not overfill. Gently tap the mold to remove air bubbles. After 20 minutes or when the plaster has partially set, use the plastic knife to etch in the name of the students’ teacher and the date into the plaster cast. After 30 minutes, when the cast is warm and hard (at the end of class), separate the sides of the mold from the plaster. Carefully remove the cast, starting from the “heel” of the

plaster foot. Let the children put their hands over the top of the plaster foot and feel the heat of the chemical reaction. (If the plaster is not hard enough to take out at the end of class, show the students the demo plaster foot and take their plaster foot out after class.) **Once the foot has been removed, allow it to dry for at least a day before giving it to the childrens' teacher.** Once completely dried, the mold can be finished with acrylic paint. Rinse all containers thoroughly. Do not pour the excess plaster down the sink.

C. Make a mold (Demonstrate the procedure before passing out the clay and shells.).

1. Divide the students into pairs.
2. Pass out one shell and a piece of modeling clay about the size of a student's fist to each pair of students.
3. At their desks, have each pair of students divide the clay into two equal parts. Each student gets one half.
4. Have one student press one half of the clay flat and smooth. Then have the student press the shell gently into the clay, leaving part of the shell sticking out of the clay.
5. Have the second student press out the other half of the clay and put it over the shell in the first half of clay. Have the student carefully press the two pieces of clay together.
6. Have one of the students carefully separate the pieces of clay and remove the object. The print of the object should be seen on both pieces of clay. Review how fossils can be impressions left in the rock after the original object has left or decayed away.
7. Have the students return the shells to the box and the clay to its containers.

Making a Cast From a Mold



1. Materials needed: 2 cup measuring container, Pink mold, Knife, Plaster of Paris (5 1/2 cups)



2. Add 2 cups of water, close bag and mix with hands until smooth, immediately pour into the mold.



3. Fill to the top of the mold, but do not overfill. Gently tap the mold to remove air bubbles. After 20 minutes or when the plaster has partially set, use the plastic knife to etch in name and date.



4. After 30 minutes, separate the sides of the mold from the plaster. Carefully remove the cast starting at the "heel" of the plaster foot.

D. Discover Fossils and Casts

1. Bring the children back into a semicircle. Using the attached “Teacher Guide to Fossils” sheet, read the short description to the students as you identify each fossil. Note that numbers on the teacher’s guide match the numbers painted on the fossils.
2. Next, set the fossils stations up so the children can walk around the room and look at the fossils. Make sure that the Edmontosaurus foot (#17), toe cast (#18), and poster are placed where they will not be tipped over. The petrified wood (#12 and #13) should have the wood rounds next to them for comparison.
3. Tell the students they are going on a fossil hunt. Pass out the “Can You Find the Fossils” worksheets to the students. Using the clues given on their worksheets, the students are to find the fossils that match the clues. When the students find the correct fossil, they need to write the number of the fossil next to the clue on the worksheet. Encourage the students to use their senses. If time is short, you may ask the students to find the answers for only one row of the worksheet.

E. Examine bryozoan and brachiopod fossils.

1. Display the brachiopod/bryozoan data sheet with the rocks and discuss it with your students.
2. Have students identify the fossils as either bryozoan or brachiopod.
3. Then have them examine them closely on all sides of the rock with the attached hand lense.
4. Have them discuss what type of environment these fossils lived in.

Special thanks to **Green River Laboratories** in Logan, Utah, for contributing most of the fossils and molds for this module.

Please make your students aware that this lesson relates to the following:

Career Fields: SCIENCE

Occupations: Geologist: Study the physical aspects and history of the earth. They identify and examine rocks, study information collected by remote sensing instruments in satellites, conduct geological surveys, construct maps, and use instruments to measure the earth’s gravity and magnetic field. They analyze information collected through seismic studies.

Education: Bachelor’s Degree

Paleontologist: Study fossils found in geologic formations to trace the evolution of plant and animal life and the geologic history of the earth.

Education: Bachelor’s Degree

Review Questions:

1. What is a paleontologist?
2. What is a fossil? How are they formed?
3. What do fossils tell us? What do they reveal about the past?

Teacher's Guide to Fossils - Junior Engineering Program

1. **T-rex tooth with root cast.** This is a cast of the tooth and tooth root of a Tyrannosaurus (pronounced: tyr-RAN-uh-SAWR-us) rex. The T-rex used its teeth for biting, ripping, and tearing prey. See the sharp edges on the tooth. The knife-like teeth could leave a three-foot hole.
2. **T-rex shed tooth cast.** The T-rex changed its 60 teeth constantly. The new tooth grew inside the jaw and pushed on the old tooth until the old tooth broke off.
3. **T-rex claw cast.** The T-rex used this claw like a meat hook to grasp its prey.
4. **Edmontosaurus toe bone cast.** This is a toe bone from the Edmontosaurus dinosaur. See if you can match it to the edmontosaurus foot.
5. **Velociraptor (vel-OS-ih-RAP-tore) claw cast.** The raptor probably used this sharp claw to slash its prey. Over 65 million years ago, the velociraptor roamed in packs hunting for prey. It was about six feet high and 11 feet long.
6. **Velociraptor hand.** Look at the claws and bones connected to the hand. The raptor had long arms and three fingers with sharp claws.
7. **Shark tooth.** At 40 feet long, the extinct shark, carcharodon megalodon (car-shar-o-don meg-alo-don), was two times larger than our great white shark of today. This big shark's teeth were shaped like triangles and had edges like a steak knife. As the teeth wore out, they fell out, and new teeth took their place.
8. a. **Hydracodon (hi-drac-o-don) teeth.** Slender and fast like a horse, the hydracodon looked like a small rhinoceros. The hydracodon roamed in herds and ate plants in what is now Nebraska.

Or (depending on availability)

- b. **Merycoidodon (mur-icoyd-o-don) jaw and teeth.** Over 35 million years old, this lower jaw and teeth came from a merycoidodon, a creature that looked like part sheep and part dog. Look at the teeth. Can you tell that they were used for grinding and chewing plants?
9. **Lamna lablique (lam-na lab-lick).** More sharp shark's teeth, this time from Morocco.
10. **Fossil echnoid.** This is a fossilized sand dollar. See the hole where its mouth was.
11. **Fossil ammonite.** This fossilized shell once covered the soft insides of an extinct creature called an ammonite, which died over 65 million years ago. It is related to living animals such as the squid and octopus. The ammonite probably used its shell for floating in the ocean.

12. **Fossil cephalopod.** This 400 million-year-old cephalopod looked like a squid, except the cephalopod had a straight, pointed body.
13. **Fossil trilobite.** The extinct trilobite is related to modern bugs, spiders, and crabs. It had three parts to its body: head, tail, and chest. The trilobite could roll up like a potato bug. It was the first animal to have eyes and see the world around it.
14. **Fossil fish.** This 58 million-year-old fish came from Green River, Wyoming. When the fish died, its body fell to the bottom of a lake where its bones, skin, and scales were replaced by minerals.
15. **Polished (#20a) and unpolished amber (#20b).** Amber is a very special, rare kind of fossil. There are only about 20 places in the world that have enough amber to be mined. The amber was once sticky tree sap. Ask the students what happens when insects get caught in sticky material. Describe how the tree sap hardened and the creatures inside it were preserved. Ask the children what we can tell about the creatures trapped inside (i.e., body structure and size). **Please be careful with the polished amber, it is expensive!**
16. **Polished petrified wood.** As it soaks into the wood, water leaves minerals that replace the original wood or fill in around the tiny spaces between the wood cells. The wood becomes petrified or “turned to stone.” The wood may be a bright color, such as orange, because the minerals contain iron or other colorful elements.
17. **Petrified wood pieces.** Note how the petrified branches and wood pieces still have details like growth rings, cracks, and scars. Some of the petrified twigs have blue mineral replacements and are called “blue wood.”
18. **Dinosaur footprint cast.** This is a cast of a dinosaur footprint found on a roof of a Utah coal mine.
19. **Edmonotosaurus foot cast.** This is a cast of the foot of the huge Edmonotosaurus dinosaur, who once roamed Montana. See the poster to learn more about this dinosaur.
20. **Bird with feathers.** Can you see the outline of this bird and its feathers? Can you find the bird’s head?

BRYOZOAN AND BRACHIOPOD DATA SHEET

BRYOZOANS: \bri-a-zo-ans\



The name bryozoa stands for 'moss animals'. These small aquatic animals are usually less than 1mm long, but grow together in colonies that average about an inch (2.54cm) in length. Bryozoans still live today and are found in the oceans throughout the world down to depths of 5,500m (18,000ft). However, they are most commonly found in warm shallow seas. The oldest bryozoans found in the fossil record are about 480 million years old. Most of the colonies grow on the ocean bottom attached to objects like stones, shells, or even seaweeds. They feed primarily on microscopic floating organisms found in the ocean.

BRACHIOPODS: \brak-e-a-pods\



The name brachiopod comes from the Latin words *brachio* meaning arm and *pod* meaning foot. Brachiopods resemble clams because their soft parts are enclosed by shells (valves). Brachiopods differ from clams because the brachiopod valves are unequal in size and shape, and each valve has equilateral symmetry (right half of shell looks like left half). Brachiopods still live today and most are found on shallow ocean bottoms. Brachiopod fossils are found throughout the geologic record from about 540 million years ago to the present. There are over 200 living species of brachiopods.