

Investigation Two - Simulating Fossil Formations in Sedimentary Rocks

Standard IV Students will understand how fossils are formed, where they may be found in Utah, and how they can be used to make inferences.
Objective 1 Describe Utah fossils and explain how they were formed.
Intended Learning Outcomes <ol style="list-style-type: none">1. Use science process and thinking skills2. Manifest scientific attitudes and interests3. Understand science concepts principles4. Communicate effectively using science language and reasoning

Standard
IV
Objective
1

Background Information

In this investigation students will investigate four different ways fossils are made in sedimentary rock: impression, trace, preserved, and mineral replacement (petrification) fossils.

- I. **Impression Fossils:** These fossils are made by organisms that are left in sediments. If a small soft, organism is completely covered with sediments, the organism will leave its body prints on the surrounding mud. It will eventually decay with only the prints left on the sediments. Impression fossils are broken down into two categories: (1) imprint fossils and (2) mold and cast fossils.
 - **Imprint:** These are impressions of thin organisms such as feathers, leaves, or fish that had fallen into sediment before the sediment hardened. Later the organisms decomposed leaving only the carbon remains of the organisms on the sedimentary rock.
 - **Mold and Cast:**
 1. Mold fossils are impressions made from larger organisms. When an organism dies and is covered by sediments, it decomposes slowly, but eventually decays completely. The cavity left in the rock will retain the exact shape and size and is called the mold.
 2. The cavity in the sedimentary rock may later fill with sediments and may take the shape of the mold. This is the cast. It looks just like the original organism on the outside.
 - **Trace Fossils:** These fossils are marks or tracks left by ancient organisms that have been preserved in sedimentary rock. These are fossils that show organisms were once in the area and then went on their way. They include:
 - Tracks or footprints made in soft mud.
 - Trails or paths left by a moving body in soft mud.

- Burrows made in soft mud.
- Coprolites - dinosaur dung.
- Eggshells.
- Gastroliths - digestive stones.
- Body imprints.

II. Preserved Fossils: These are fossils that are unaltered and the original organism stays intact. The soft body parts as well as the hard parts are preserved. Here are different ways preservation happens:

- Freezing- Sometimes whole organisms will be encased in ice or snow and the ice or snow never melts. The freezing of an organism prevents decaying and preserves the organism.
- Amber- Sometimes an insect gets trapped in tree sap. Over time the sap fossilized to amber.

III. Mineral Replacement: The fossils that students are most familiar with are mineral replacement fossils (also known as mineralized, petrified, and fossilized). When an animal is buried in sediments, the soft parts of the organism decay quickly. The hard parts such as bones, teeth, and claws will not decay right away in the sediments. Since they stay in the sediments unchanged for many years, they have a chance of becoming mineralized. For example, when the original bone is buried, water must seep through the sediment and pass through the bone. At this point mineral replacement can take place. The seeping water dissolves the bone, but as the water is dissolving it, the minerals in the water replace the bone one cell at a time changing it into stone.

Wood changes to stone in the same way except that wood is often covered with volcanic ash instead of sediments. When a volcano explodes and sends ash into the air, it lands in thick layers. If a forest is nearby, it will cover the trees and prevent the wood from rotting. Rainwater falls on the ashes for many years and seeps through the ash to the wood. The water dissolves the wood and replaces each cell with minerals changing it to stone.

There are activities in this investigation that simulate the ways nature makes the fossils described above. All students don't have to do all the simulations to understand how fossils are made. You can break the students up into groups and have each group make a simulated fossil. Have the students keep a journal of what they do to make these fossils.

Pre-Assessment/Invitation to Learn

Before you show the students these fossils, ask them again what fossils are. Tell students that today they are going to learn how nature makes fossils. Let them see the five examples of fossils. Tell them the name of each fossil. Let them speculate as to how these fossils were made by the name that is given to each fossil.

Instructional Procedure

Activity One - Make an Imprint Fossil (Impression Fossil)

1. Review what an imprint fossil is and give examples. Tell students they are going to make something that is similar to an imprint fossil to understand howbit happens.
2. Mix up some Plaster of Paris, enough for each student. (It should have the consistency of a milkshake.)
3. Pour about an inch into each plastic cup.
4. Right after the Plaster of Paris is poured into each cup, have each student place his/her leaf, vein side down, on top of the plaster. Have them press it so the whole leaf is in contact with the plaster, but it is still lying on top. (It must cure for a couple of hours so it doesn't break.)
5. Ask the students or have them write their answers in their journals:
 - What do you think the plaster will look like when you take the leaf off tomorrow? (It will have a leaf print on it.)
 - Why do you think this is? (Because the plaster became hard while the leaf was still on it, leaving the leaf design.)
 - Why is this like a fossil? (It shows what a leaf looks like even though the leaf is no longer there.)

Activity Two - Make a Mold and Cast Fossil (Impression Fossil)

1. Review what mold and cast fossils are and give examples. Tell students they are going to make something similar to mold and cast fossils to see how they are formed.
2. Have the students coat the bottom of their sea shells (rib side) with petroleum jelly. (This will make it so the shell doesn't stick to the plaster.)
3. Mix up some Plaster of Paris, enough for each student. (It should have the consistency of a milkshake.)
4. Pour about an inch into each plastic cup.
5. Have each student place his/her shell, rib side down, on top of the plaster. Press the sea shell so about 3/4 of it goes into the plaster.
6. When the plaster is almost hard, have the students pull the shell out. It will leave an impression in the plaster of what the shell looks like. This is the mold.
7. Let the plaster harden for the next part of the activity. Ask the students these questions :
 - What does taking the shell away from the plaster represent? (It represents the shell decaying and disappearing.)
 - Why did the plaster take on the design of the shell? (When it was placed on the plaster the plaster turned hard and was able to take on the shape and design of the shell.)

Materials

Have pictures of these fossils, actual or made:

- ☐ Leaf imprint in stone (impression)
- ☐ Cast fossil (impression)
- ☐ Footprint in stone (impression)
- ☐ Insect in amber (preserved)
- ☐ Petrified wood or bone (mineral replacement)

Materials

for each student:

- ☐ Plaster of Paris (or modeling clay)
- ☐ Leaf
- ☐ Short plastic cup with a large opening (wedding cup)

Materials

for each student:

- ☐ Plaster of Paris (or modeling clay)
- ☐ Short plastic cup with a large opening (wedding cup)
- ☐ 1 Seashell
- ☐ Petroleum jelly
- ☐ Talcom powder

- Why is this like a fossil? (It shows what a shell looked like even though it is no longer there.)
8. Put a thin layer of talcum powder on top of the plaster so it is evenly sprinkled everywhere.
 9. Mix up some more Plaster of Paris, enough for each student. (It should have the consistency of a milk shake.)
 10. Pour some more Plaster of Paris on top of the mold of the shell. (This will be the cast. It must cure for a couple of hours so it doesn't break.)
 11. Ask the students these questions:
 - What do you think the cast will look like when the two pieces of plaster are separated tomorrow? (It will take on the design and shape of the mold.)
 - Why will it look like this? (Because the plaster was liquid when it was poured onto the mold. When it hardened it took the shape of the mold.)
 - Why is this like a fossil? (The cast shows the outside design, the shape, and the outline of what the shell looked like.)

Activity Three - Make Trace Fossils (Impressions Fossil)

Materials

for each student:

- Small, paper plate
- Plaster of Paris
- Few toothpicks
- (just in case they break)
- Paper mat
- (made out of butcher paper)

1. Review with students what a trace fossil is and how they are made.
2. Gave each student a small paper plate, paper mat for spills, and a toothpick.
3. Make some Plaster of Paris for each student.
4. Pour some plaster in each plate.
5. Before the plaster hardens have the students make animal tracks, animal trails, skin prints (fingerprints), and burrows in the plaster with toothpicks.
6. When they are done making the trace marks, explain to them that they have done a simulation. They made marks made by animals and then they left the area, leaving only traces that they were there.

Activity Four - Make an "Amber" Fossil (Preserved Fossil)

Materials

- Glue gun
 - Glue sticks
- for each student:*
- Small plastic item
 - 3x5 index card
 - Pencil

1. Review with the students ways animals can be preserved for thousands and many years.
2. Tell them they are going to do a simulation of an ant getting stuck in tree sap.
3. Give each student a small plastic item representing an ant and a 3 x 5 index card.
4. Have each student put the item on the left half of the card.
5. Have the students bring their cards, with the "ants" on them, up to you so you can encase the "ants" in hot glue (sap).
6. After everyone is done, explain to the students that over a period of millions of years, the sap fossilized to amber and the "ant" is preserved.
7. Have them write on the right side of the card the process of how the "ant" was preserved.

Activity Five - Compare and Contrast a Fresh Bone with a Fossil Bone (Mineral Replacement)

1. Allow the students to handle the real bone and fossilized bone.
2. Hand out the paper with the Venn Diagram.
3. Have students discuss similarities and differences of two items and fill out the Venn Diagram.

Materials

for each student:

- Real dried bone
- Fossilized bone
- Hard lenses
- Venn Diagram

Curriculum Extensions

Language Arts-

- Have the students find books about fossils. Have them read about the fossil they made. (Standard VII, Objectives 2, 3)
- With the knowledge the students have about these fossils, have them write a fictional essay about the journey of an animal or plant becoming a fossil.
 - Ask them to pick an animal or plant they want to turn into a fossil.
 - Ask them to write it in the form of an adventure.
 - The essay should have a beginning, middle, and end.
 - The beginning introduces the character(s), setting, and problem.
 - The middle tells of problems getting worse, actions taken by the character, and decisions that have to be made.
 - The end tells how the fossil was formed and discovered in our day.
 - As they write, they need to use vocabulary words about fossils, and use the ideas they learned of when they write about the fossil.(Standard VIII, Objectives 1, 2, 3, 4, 5, 6)
- Have the students read their stories in class or in groups. (Standard I, Objective 2)

Fine Arts/ Visual Arts-

- Have the students draw pictures of each of the fossils they made. Have them write underneath the pictures how the fossils are formed. (Standard III, Objective 2)

Science-

- Jell-O Simulating Amber Fossils (ILOs 1, 2, 3, 4)

Instructions:

1. Heat water to boiling.
2. Measure out 2 1/2 cups water and stir in both packages of Jell-O.
3. Stir until completely dissolved. (Do not add ice to the gelatin mix.)
4. When the mixture is thick syrupy, pour half of it into a 9" x 13" pan.
5. Refrigerate until the surface is nearly firm. Press the gummy candy shapes into the surface, being careful not to push them through to the bottom. Keep the gummy shapes suspended in the gelatin.
6. Pour in the remainder of the gelatin mix, covering the gummy candy.

Materials

- 3 oz package of orange Jell-O
- 3 oz package of yellow Jell-O
- Gummy candies

Discussion

1. What kind of fossil does this represent? (Amber)
2. How is this type of fossil different from other types that have been talked about?
3. The Jell-O was once liquid. What does this represent? (The sap.)
4. How would it encase the insect? (It ran onto it and covered it up.)
5. The Jell-O was put in the refrigerator to harden. What does this represent? (The sap hardening and changing in amber.)
6. What happens to the insect inside? (It stays the same. It is preserved.)

Assessment Suggestions

- Have the student correctly identify the type of impression fossil that is shown to them with pictures, real fossil, and /or made fossils.
- Read students' journals to see if they answered the questions correctly that were asked about the fossil they made.
- Using their own words, have the students write how their fossil is made. Students should write in expository style with the words they should know and understand.

Resources

- See the Resources List at the end of these investigations.

Homework and Family Connections

- Send home with the students the name of the fossil they made (with pictures if possible). Have them explain to their families how this fossil was formed and how they simulated making them in class.
- Have the students take home the fossil they made in school. have them explain to their families how they made each fossil and how it represents the way nature makes these types of fossil.
- If they wrote stories, have them take the stories home to read to their families.
- Send home the directions to the "Jell-O Simulating Amber Fossils" directions. Have them make the "amber" with their parents. After they are made, have the students tell their families what type of fossil this is. The students should explain to their families how this type of fossil was formed and how it is different from other fossils. They need to compare the representations of each stage of the Jell-O to the stages of sap turning into amber. Have them report back to the class how their demonstration went.

Compare and Contrast

Real Bone

Fossil Bone

