Why do some things become fossils, but others do not?

Teaching and Learning Focus

It is very likely that any organism on Earth will be either eaten by scavengers or decomposed by microorganisms after it dies. Organisms decompose more quickly when they are in contact with oxygen. Most environments exposed to the open air are in contact with plenty of oxygen, so the soft tissues of dead organisms, whether plants or animals, decay quickly. Many, if not most, underwater environments also have a lot of oxygen, since water can dissolve oxygen from the atmosphere.

For an organism to become a fossil, it must not decompose completely or be eaten. This can happen if the organism either lives within or is moved to a place where it can be buried and kept from decaying. When an organism is buried quickly, there is less decay and the better the chance for it to be preserved. The hard parts of organisms, such as bones, shells, and teeth have a better chance of becoming fossils than softer parts. One reason for this is that scavengers generally do not eat these parts. Hard parts also decay more slowly than soft parts, giving more time for them to be buried.

In this investigation, students think about what it takes for a plant or animal to become a fossil. Students explore decomposition by studying fresh fruit and decomposing fruit. They test the ability of different materials such as sand, soil, and plaster of Paris to preserve pieces of banana. They observe that the finer the material and the more the banana pieces are cut off from the air, the more the banana is preserved.

Materials Needed

For the class:

- Flip chart or whiteboard and markers
- Images of Fish
- A piece of fruit (peach, apricot) that has decomposed for ten days in a clear glass or plastic container. Leave it in a warm area to speed up decomposition. Bring to class a fresh sample of the same fruit for comparison on the day of the investigation.

Per group:

- A firm banana
- Plaster of Paris (mix as needed using three heaping teaspoons to two teaspoons of water)
- sand
- gravel
- soil
- medium-size paper cups

- plastic spoons
- popsicle sticks for stirring
- water
- hammer
- eye protection, such as goggles
- newspaper or newsprint for covering desk

Safety

Remind students not to eat any food used in the investigation. Use disposable craft sticks for mixing the plaster of Paris and do not let the students do the mixing. Do not pour unused portions of plaster of Pairs, or water mixed with plaster of Paris into the sink or drain. Dispose of them in the trash instead. Review the investigation for your specific setting, materials, students, and conventional safety precautions.

Setting the Scene

Students should know that fossils are typically limited to hard materials, such as bones and shells. Start by asking students to think about this question: *"What kinds of things become fossils?"*

Show students the piece of decaying fruit and the fresh fruit sample. Tell them how long the fruit has been decomposing. Ask them the following:

1. Describe the changes that seem to be happening to the decomposing fruit.
2. What do you think is causing these changes?
3. How long will the fruit continue to decompose?
4. What will eventually happen to the fruit?
5. What do you think is the likelihood of the fruit becoming a fossil, either all of it or part of it?
6. When would the fruit be more likely to become a fossil – if it decomposed quickly, decomposed slowly, or did not decompose at all?

Have students discuss these questions, first in pairs, then groups and then as a whole class. Record their answers on a flipchart that you can refer to throughout the investigation. Guide students to understand that the soft parts of plants and animals, and eventually the hard parts, will decay after the organisms have died in nature.

Presenting the Investigation Question

After the scene is set, introduce your students to the investigation question: *"Why do some things become fossils, but others do not?"*

Have students discuss the question in pairs, then in groups, and then as a whole class. Record their answers on a flipchart.

Have your students brainstorm ideas about how to investigate this question:

1. What materials would be needed?
2. What would you have to do?
3. What would be measured?
4. How long would the experiment take?

Tell students that they will be investigating this question and at the end of their study they will be able to provide reliable answers.

Assessing What Your Students Already Know

Students generally know that things decay, especially food. They will probably have had some experiences with rotting fruit, especially bananas. They probably recognize that when food begins to decompose, it changes color and texture, and mold begins to grow. They probably do not know what causes matter to decay or where the matter goes.

Here are some initial questions that your students can discuss, in pairs, then in groups:

1. What happens when a living thing rots or decays?
2. Why do some things, like fruit, rot or decay?
3. Do all living things decay? Why or why not?
4. Do all parts of living things decay? Why or why not?
5. How could the decay of a living thing be slowed down or stopped?
6. What impact does decay have on how a fossil forms?

Have your students share their ideas with the class and record them on a flipchart.

Exploring the Concept

1. Have students cover their desks with newspaper or newsprint.
2. Explain to students that they will be exploring different ways to preserve a piece of plant material, in this case, slices of banana. Tell them that they will be placing the banana slices in paper cups and covering them with different materials. They will let them sit overnight. The next day, they will look for any changes that may have occurred.

3. Slice each group's banana into five pieces, leaving the skin intact, immediately before the students need them. Since the students are attempting to "preserve" the slices of banana, you do not want them exposed to the air too long before they begin.
4. Present to students the different materials for preserving the banana slices: soil, sand, gravel, and plaster of Paris.
5. Have students predict how the slices will change in each of the materials. Record predictions on the whiteboard or flipchart.
6. Ask students to write their names on each of the cups.
7. Ask students to partly fill the cups with each of the materials. They should then place banana slices in each cup and cover them with more of each material. Have students use a marker to indicate the depth at which they placed the banana piece for easier retrieval.
8. Have students place one slice of banana in an empty cup to be used as a control to compare with the other samples.
9. Have students place their cups where they will not be disturbed for 24 hours. It may be helpful if they are in an area that gets sunlight for part of the day.
10. The next day, have students remove the slices from each of the materials. The plaster of Paris will have to be cracked open with a hammer. Be sure that students wear impact goggles when doing this, or you should do this yourself.
11. Discuss the following:
    - How does each slice compare to the slice left unprotected?
    - Which of the materials worked best in preserving a slice of banana?
    - Based on the evidence from this investigation, what conditions are needed to best preserve a living thing?

(They should have observed that the Plaster of Paris worked best at preserving the slices. Help students to understand that fossils can be formed only when a living thing is buried soon after it dies. If it is not buried soon enough, it decays. Quick burial is most likely to happen in body of water. In most bodies of water, there are almost always sediments like mud, sand, and gravel settling to the bottom. These sediments can quickly cover any remains that sink to the bottom. For this reason, most fossils are found in sedimentary rocks that were once underwater.)

Applying Students' Understanding

Show students the Images of Fish which show pictures of fish in various states of decay. Ask them to answer the following questions:

1. What do the images show?
2. How likely are the first two images to fossilize like the third image? Explain your thinking.

Revisiting the Investigation Question

Complete this investigation by asking your students: *"How have your ideas about why some things become a fossil and others do not changed as a result of this investigation?"*

As a result of this investigation, students should be able to describe some of the conditions that are needed to preserve a plant or animal as a fossil. They should note that the soft parts of plants and animals decompose quickly. The hard parts (bones and shells) of animals and the hard, woody parts of plants take the longest to decompose. The less a living thing decomposes, the more likely it is to become fossilized. Decomposition is reduced when a living thing is buried quickly and cut off from an oxygen source.

Digging Deeper

The following passage provides more detailed information related to this investigation that you may choose to explain to your students.

The Likelihood of Fossilization

Bones, teeth, shells, and other hard body parts can be fairly easily preserved as fossils. However, they might become broken, worn, or even dissolved before they are buried by sediment. The soft bodies of organisms, on the other hand, are relatively hard to preserve. There need to be special conditions to preserve organisms like jellyfish. Sometimes these organisms fall to the muddy sea bottom in quiet water and are buried rapidly by more mud. For that reason, the fossil record of soft-bodied organisms is much less well known than the record of hard-bodied organisms. Other organisms or their hard body parts have a better chance of becoming part of the fossil record.

Images of Fish

A fish that washed up on shore after harmful algae have grown in the water (red tide).

Judy Baxter, CC BY-NC-SA 2.0, via Flicker.

A fish that has been on the beach for a few days.

Mahalie Stackpole, CC BY-SA 2.0, via Wikimedia Commons.

A fish fossil found in rock in an area that used to be covered by a body of water.

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