Science Unit: ***Fossils***

Lesson # 8: ***Making Fossils***

School Year:	2015/2016
Developed for:	George T. Cunningham, Vancouver School District
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Grade level:	Presented to grade 5-7; appropriate for grades 1-9 with age appropriate modifications
Duration of lesson:	1 hour
Notes:	This lesson has three stations; An adult or older student will be needed to supervise each station. For younger students, who need more supervision when examining fossils, this lesson can be combined with lesson 4, "Examining Fossils," and set up as 4 stations: 1. Examining Fossils, 2. Making cast and mold fossils, 3., Making "amber" fossils, and 4. Tasting groundwater.

Objectives

1. Investigate the process of fossilization by making two different types of fossils - cast and mold, and "amber."
2. Explore the concept of dissolved minerals in groundwater and petrification by making observations about the taste of Evian, and observing a sponge soaked in borax.

Background Information

Fossils can be formed in many different ways, for example:

- **Freezing** (Example: woolly mammoths frozen in glacial ice)
- **Entrapment** (Example: insect trapped in amber),
- **Carbonization** (Heat and pressure underground transform plant parts to a black, charcoal-like residue. Example: leaf fossils).
- **Petrification (or Permineralization)** Example: Dinosaur bones, shark teeth, fossil wood).
- **Cast and Mold** (Example: Shell fossils)

In this activity, students investigate three of these fossilization methods: entrapment, petrification, and cast and mold fossils.

Vocabulary

Amber:	Hardened tree resin; usually a golden colour
Cast and mold	A fossil in which an animal or plant dissolves away, leaving a space (mold), which is then filled with minerals (cast)
Entrapment	A fossil in which an animal or plant is encased in a preserving material, such as amber or tar.
Groundwater	Water found underground in the spaces in soil and rock
Petrification	A fossil in which minerals deposit in the tiny spaces of a plant or animal and harden it

Materials

- Cast and Mold station: molds, vaseline, quick dry clay, paper and pens (for students to label their casts)
- Amber station: Mod Podge super gloss, dyed with tumeric and red food colouring, hot glue gun (optional), mold trays, bottle caps and/or bezels (blank pendants), tweezers, and natural materials like insects, cedar branches, flowers
- Ground water station: Evian, cups, borax soaked sponge and control
- Station Instruction sheets (Appendix A) and student worksheet (Appendix B)

In the Classroom

Introductory Discussion

1. Discuss the different ways that fossils can form
    - Cast and Mold (show the students a modern clam shell, a piece of pyrite, and a pyrite-replaced brachiopod).
    - Petrification (show students a modern piece of wood, a piece of quartz, and a piece of petrified wood).
    - Amber (show students some modern tree resin, and a piece of amber - and ideally a piece of amber with plants parts or an insect)
2. Explain the concept of groundwater
3. Explain fossil making activity
    - The activity is set up into 3 stations: Cast and Mold fossils, amber fossils, and groundwater. Explain briefly what to do at each table.
    - Students can work at their own pace
    - If they finish early, work on the discussion questions
4. Safety guidelines.
    - Only the teacher/adult handles the hot glue gun
    - Students should wash their hands after handling the borax crystals.

Science Activity/Experiment

Activity Title: Making Fossils
Methods and Instructions:

Set-up prior to experiment:
Station 1: Cast and Mold fossils.

- Print out the instructions (Appendix A) and tape to the table.
- Set out fossil molds. It helps to rub a bit of vaseline inside the molds; this makes removing the clay casts easier. The molds can be bought, or made from real fossils or modern items (such as shells and pine cones) using Amazing Mold Putty.
- Set out quick dry clay. (Crayola quick dry clay works well with the Amazing Mold Putty molds).
- Have paper and pens available so students can label their “fossils” and set them aside to dry.

Station 2: Amber

1. Before the lesson, dye some Mod Podge (Super Gloss formula works well) with turmeric and a drop of red food colouring. This makes a beautiful amber colour. Collect some small plant parts - cedar or juniper leaves are ideal - or small dried flowers, or dead insects. Tape theinstructions (Appendix A) to the table.

2. Set out small paint pallettes for molds (again rub vaseline in the molds), or you can use bottle caps or bezels (available at craft stores) and tweezers for handling the plant parts and/or insects. Have paper and pens for labelling fossils.

3. Heat up hot glue gun, if you are using it. Note the glue gun should be run by an adult. This is best used with the bottle caps or bezels, as the glue will tend to stick to the molds.

Station 3: Petrification

1. The day before the lesson, add 3 Tb Borax to 1 c of boiling water. Cut a small strip of sponge, and punch a hole in one end. Thread string through the hole, and suspend the sponge in the saturated water. Let sit. The next day, the sponge will be coated with borax crystals, making a nice model of a petrified bone or piece of wood.

2. On the day of the lesson, Set out the sponge that was soaked in Borax and an untreated piece of sponge for comparison.

3. Set out the Evian water and cups. Depending on the local tap water, you may be able to use tap water for the "pure" water comparison, or you may need to buy distilled water. If you wish, you can disguise which water is the mineral water, and/or have students record their observations.

Handout

Some students will finish this activity early. You may wish to have a handout with discussion questions for them to work on while the other students are finishing, or a station with books the students can look through.

Closure Discussion

1. Make sure students understand the important steps in fossil formation:
   - **a.** It helps to have hard parts
   - **b.** Get buried or frozen
   - **c.** If buried, get surrounded by mineral rich ground water.

2. Which tye of fossils tend to have the best preservation? How is the insect in amber different than the piece of petrified wood? What about wooly mammoths frozen in ice?

3. Do you think that cloning dinosaurs, like in Jurassic Park, is possible? What about cloning frozen mammoths?

4. Did the groundwater taste different than the pure water? Why?

References

1. <http://www.ucmp.berkeley.edu/education/explorations/tours/fossil/index.html> Getting Into the Fossil Record. University of California Museum of Paleontology, [Slide show for students on the fossil record and fossilization] Accessed March, 2016.
2. <http://www.livescience.com/37781-how-do-fossils-form-rocks.html> How do Fossils Form? Live Science [article on different types of fossils] Accessed March, 2016.
3. <http://www.bbc.co.uk/nature/fossils> Fossils. BBC Nature [discussion of different aspects of paleontology] Accessed March, 2016.
4. <http://www.ucmp.berkeley.edu/paleo/fossilsarchive/permin.html> Fossils. Windows to the Past. University of California Museum of Paleontology. [description of different types of fossils].

Cast & Mold fossils

How they form:
An animal dies and is buried under mud or sand - maybe it fell in a lake or ocean, or there was a flood, or a volcano erupted. Over time, more and more sediment is deposited; the weight of all this hardens the mud and sand around the animal. Groundwater dissolves the animal away, leaving a **mold**, and then that space fills with mineral crystals, making a **cast**. Note: cast and mold fossils can also form from something an animal leaves behind, like a footprint, burrow….or poop! These are called **trace fossils**.

Making your cast and mold fossil (4-5 per person):

1. **Choose one of the yellow molds.**
2. **Take some clay and roll it into a smooth ball or cylinder, about the size of the mold**
3. **Press the clay into the mold. Make sure it fills the entire mold.**
4. **GENTLY peel the mold off. If you are not happy with how your cast looks, you can go back to step 2.**
5. **Put your fossil on a piece of paper and label it with your name. It will take a couple of days to dry.**

Entrapment fossils - Amber

How they form:

Some trees produce resin if their bark is damaged. This resin is thick and sticky; as it slowly flows down the trunk of the tree it can trap insects as well as seeds and flowers. If the resin is then buried underground, heat and pressure from overlying sediments transform it to a hard substance: amber.

Making your amber fossils:

Amber (1 per person)

1. Coat the mold with a small bit of vaseline. This will make your fossil easier to remove when dry.
2. Squeeze a small bit of Mod Podge in the bottom mold.
3. Place your flower or plant part in the Mod Podge either with your fingers or the tweezers.
4. If you used the tweezers, wipe them clean.
5. Cover your plant part completely with Mod Podge. But don't use too much, or it will take a very long time to dry.
6. Use the sharpie to label your mold and set aside for a couple of days to dry.
7. When dry, you may need to use a knife to pry the amber out.
8. Only 1 per person, please.

Pendant or Bottle Cap (1 per person)

1. You can choose to use Mod Podge or the hot glue gun:
   - For Mod Podge - use the same steps as for the mold trays.
   - For the hot glue gun - the helper will place the glue for you.

   Use CAUTION around the glue gun - the glue and the metal tip of the gun is HOT and can burn your fingers.

2. Choose a pendant or bottle cap.
3. Then choose a plant part or flower to encase.

4. Ask the helper to squeeze a small bit glue in the bottom.
5. Quickly place your flower or plant part in the hot glue with the tweezers (not your fingers! Trust me, the glue will burn!). Once the glue is placed, it will set very quickly.

6. Clean the tweezers with towel.
7. Ask the helper to use the glue gun to cover the rest of your pendant or bottle cap.

8. Set aside for 5 minutes to cool.
9. Only 1 bottle cap or pendant per person, please.

Petrified Fossils

How they form

An animal or plant dies and is buried under mud or sand - maybe it fell in a lake or ocean, or there was a flood, or a volcano erupted. Over time, more and more sediment is deposited; the weight of all this hardens the mud and sand around the organism. Groundwater (see below) soaks into all the tiny pores and spaces in the organism and deposits mineral crystals.

Activity - Can you taste the minerals in the groundwater?

There is water underground almost everywhere on earth; this water is called groundwater. Groundwater fills any spaces between grains of soil and sediment in the ground - and it will also fill the tiny spaces in a buried piece of wood or animal bone.

Groundwater is often rich in minerals dissolved from the surrounding rocks and soil. In contrast, the tap water that we drink in Vancouver does not have many minerals at all; it is rainwater that has been stored in a reservoir.

1. **Pour a small cup of Evian water (only 1 per person, please). This is groundwater, and has lots of dissolved minerals.**

2. **Taste the water. Does it taste different than Vancouver tap water, which does not have many minerals?**

Demonstration - How do crystals form from groundwater?

To make mineral-rich “groundwater”, I poured 3 tablespoons of Borax, a naturally occurring mineral that is used for cleaning, into a cup of hot water and mixed to dissolve it. Then I added some blue food colouring, and suspended a sponge animal “bone” in the mixture.

As the water cools and evaporates, borax crystals form in the spaces in the sponge. This is similar to how a dinosaur bone or piece of wood is petrified.

Compare the sponge that sat in borax with the fresh piece of sponge. How are they different?

Making Fossils Lab-Discussion Questions

1.Explain briefly the important steps in becoming a fossil. You can check the station instructions if needed.

2.You investigated three types of fossils today: Cast and Mold, Amber (entrapment), and Petrified. Of these three types of fossils, which type do you think tend to have the best preservation, that is, what type of fossil is most like the original living plant or animal?

3.Did the groundwater taste different than the pure water? Why?

4.How did they clone dinosaurs in the movie Jurassic Park? Do you think cloning a dinosaur would be possible in real life?