Glaciers and Ice Wedging
4th Grade
Daniel F. Fink, Lashonda Orrell, Lila Levendoski

Note that this lesson takes two days as the ice wedging portion of the experiment needs to be left in the freezer to work.

References:

• Columbus Public Schools SLC Guide
• GK-12 Fellow Eddie Pauline

Benchmarks:

SLC 15: Identify evidence and show example of changes in Earth’s surface.

Objectives:

Students will observe and identify the effects of weathering and geological activities in their environments as well as in the reports of events such as storms, floods, earthquakes, or volcanoes.

Materials:

• Plastic cups with lids [or film canisters with lids [verify that this works first! It should, but it is untested as of the writing of this lesson]
• Ice cube trays
• Water
• Sand
• Freezer [Ice cubes with sand in them]
• Paper towels
• Clay with a smooth surface

Initial Demonstration:

Take a look at [or talk about it if time/opportunity is lacking] buckling sidewalks and potholes. Ask the students what causes this?

Target Observations:

• Sidewalks buckle and break, potholes form in streets, rocks sometimes break in half.
• All of these things have pores in them in which water might be able to enter.
**Target Model:**

- Water seeps into/under hard structures and then freezes.
- When water freezes it expands. This expansion can cause things to break.

**Procedure:**

1. Fill the plastic cups all the way to the top with water. Make sure that there is no air space.
2. Put on the lids and place in a freezer until frozen solid.
3. Take out and observe that the ice has enough force to pop the lid and in some cases to crack the containers.
4. As a variant, sometimes placing the cups upside down will cause them to crack and burst more dramatically than just popping off the lids.

   The force of the expanding ice is sufficient to push off the lids. It is also often strong enough to burst the cups [especially if the cups are placed lids down and if the cups are not very stretchy.

Now picture this expansive force in a rock or under a sidewalk in the street to understand how ice wedging can be a force of weathering.

**Target Observations:**

- When the ice froze, it got bigger [expanded].
- The cup lids were pushed off by the ice.

**Target Revised Model:**

- The force of expansion was strong enough to push the lids off the cups.

**Procedure:**

1. Prepare ice cubes with sand in the bottom. Do this the day before you intend to do the lesson.
2. Make smooth tubes or blocks of clay. It is easy to make smooth tubes by rolling bits of clay over a desk or smooth trey.
3. Have the students rub the “glaciers” [the ice cubes] over the clay and make observations [note: this seems to work much better if the glaciers are slightly melted. This exposes the sand a little more, increasing the amount of abrasive surface.] The students should see that grooves and holes are formed. They should also witness that chunks of sand are left behind.
4. You can also show how glaciers can create lakes by letting the glaciers melt into the holes that you have created.
The glaciers provide an abrasive and erosive force to the surface of Earth, as represented by the clay. These grooves and holes can be filled in by the melting glacier water to form lakes. [Sometime you need to ask the question, “and what is a hole in the surface of Earth with water in it called?”]

**Target Observations:**

- The ice cubes changed the shape of the clay surface.
- The cubes made grooves and holes as they moved across the clay.
- As they melted, the cubes filled in some of the holes and grooves with water.

**Target Revised Model:**

- Glaciers can be a source of erosion and abrasion.
- They can also provide the water necessary to fill in a created groove or depression with water and play a large role in the process of lake creation.

**Summary:**

Students have seen how erosion and weathering can be accomplished by ice, using glaciers and frozen cracks as examples. These processes can take some time to happen, but they are very powerful.