



STARBASE Challenge: Layers of Lava

For this challenge, you are going to explore how volcanoes form not only here on Earth, but other rocky planets like Mars. You will create a model of a shield volcano by mapping how it grows after each eruption. See if another family member can build a volcano if you want to study your volcano through some of the same techniques geologists use!

Part 1: Meet the Volcanoes

Watch this NOVA video about volcanoes to get some background information: [Meet the Volcanoes](#) or <https://tinyurl.com/sbctvolcanoes>

1. What are the three main types of volcano?

2. How does each type of volcano form?

3. Which type do you think is the most interesting? Why do you think so?

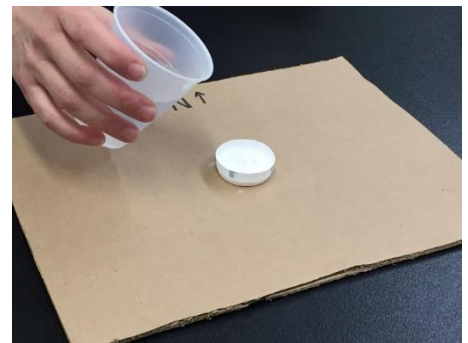
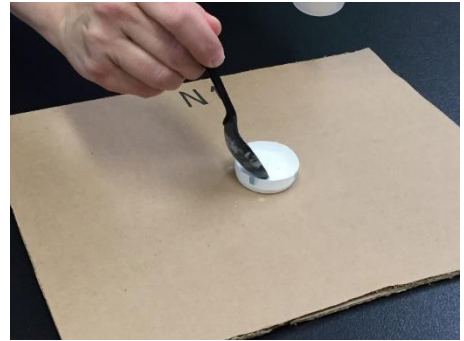
Part 2: Creating a Volcano

Materials:

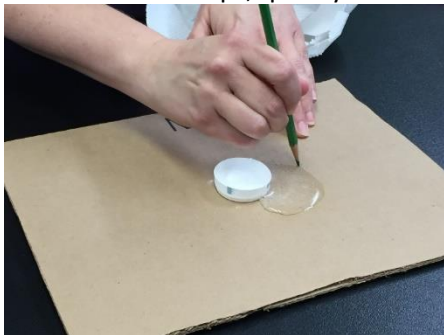
- 1 paper cup, 100 mL (4 oz) size – cut down to a height of 2.5 cm
- 2 paper cups, 150-200 mL (6-8 oz) size – 1 for baking soda, 1 for vinegar
- Cardboard (or cookie sheet, box lid, etc.) about 45 cm²
- At least 3 colors (preferable 4-6) of play dough or soft clay in fist-size pieces ([play dough recipe link](#) or https://www.jpl.nasa.gov/edu/pdfs/volcano_resource.pdf)
- Tape
- Plastic spoon
- Baking soda (4-10 spoonfuls)
- Vinegar (100-150 mL)
- Paper towels
- Colored pencils (preferable matching the colors of the play dough)
- 1 sheet of graph paper size 8.5" x 11"

Create your own volcano model using the directions below:

1. Cut the top of the small paper cup so that the cup is 2.5 cm high.
2. Place the small paper cup in the center of each piece of graph paper and trace around it with a pencil.
3. Secure the small paper cup (right-side up) onto the cardboard using a small loop of tape on the bottom of the cup. This short cup is your eruption source (eventual caldera) and the cardboard is the original land surface.
4. Mark north, south, east, and west on the edges of the cardboard and the graph paper, orienting them similarly on the table.
5. Fill about half of a large paper cup with baking soda.
6. Place one spoonful of baking soda in the short cup.
7. Pour some vinegar into a second large paper cup.
8. You are now ready to create an eruption. Slowly pour a small amount of vinegar into the small, source cup and watch the eruption of simulated lava.



9. When the lava stops, quickly draw around the flow edge with a pencil.



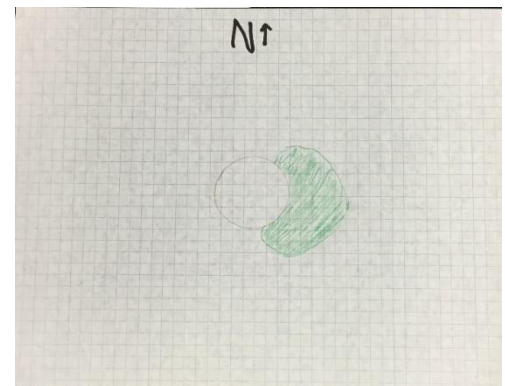
10. Dab up the fluid with paper towels.



11. As best you can, use a thin layer of play dough to cover the entire area where lava flowed.



12. On one piece of graph paper, use a colored pencil that matches the play dough color to draw an outline representing the edge of the play dough, being sure to maintain the cardinal orientation (north, south, east, west) of the paper with the orientation of the volcano. Shade in this lava flow drawing. Make a note on the graph paper regarding the order of eruptions (which color came first).



13. On one piece of graph paper, use a colored pencil that matches the play dough color to draw an outline representing the edge of the play dough, being sure to maintain the cardinal orientation (north, south, east, west) of the paper with the orientation of the volcano. Shade in this lava flow drawing. Make a note on the graph paper regarding the order of eruptions (which color came first).



Part 3: Investigating a Volcano (Optional)

Materials

- Plastic knife
- Metric ruler
- Tape
- 1-3 clear drinking straws – cut into thirds
- Colored pencils (preferable matching the colors of the play dough)
- 1 sheet of graph paper size 8.5" x 11"

Use someone else's volcano to complete the activities below.

1. Use colored pencils to make a map on graph paper of the volcano model as seen from above. Label flows and features.
2. How many flows can you see?
3. In addition to the map, make a list of the lava flows below, starting with the youngest flow at the top and finishing with the oldest flow at the bottom. Example: "Top flow is a long, skinny, green flow."
4. Can you easily determine the sequence of flows (which came first, which came last) or are there some flows where you can't say which are younger or older? Put a question mark by the uncertain flows in the list on the map.
5. Are there parts of any flows that might be covered? Which ones?
6. What would you need to figure out the sequence and shape of each flow? How could you get that information without lifting the play dough?

Geologists use a variety of techniques to investigate volcanoes including taking core samples, erosion cuts, road cuts, earthquakes, surface-penetrating radar and more. In this case, you can use try several different methods:

- Remove a **core sample** by pushing a straw vertically into the play dough until encountering the cardboard surface, twisting if necessary, and withdrawing the straw. The various layers of play dough will be visible in the core sample inside the straw. Lay the straw containing the core sample next to the hole from which it was taken.
 - **River valleys** may be made by cutting and removing a V-shape in the side of the volcano (open part of the "V" facing down slope).
 - To make **road cuts**, use a plastic knife or dental floss to cut and remove a strip about 1-cm wide and as deep as you want from any part of the volcano.
 - To make **earthquake exposures**, make a single cut and lift or drop one side of the fault line. Some support will be necessary.
7. Document why each proposed experiment will be helpful in revealing information about your volcano. Conduct the experiments and record locations and information gained in the space below.
8. Finish your map.
9. Describe the sequence of flows that tells the history of the volcano. How well does your map and description match your partner's observations?
10. Why would it be harder to map lava flows on Mars using images taken by spacecraft?