

Flour Box Calderas

Overview:

Calderas are large depressions near the top of a volcano that can be a few hundred to several thousand feet deep. They form when a magma reservoir drains, causing the ground above to collapse. In this demonstration, students will see how pressure buildup in a simulated magma reservoir causes the ground above it to rise and how calderas can be formed by the rapid loss of pressure in the reservoir.

Objectives:

The student will:

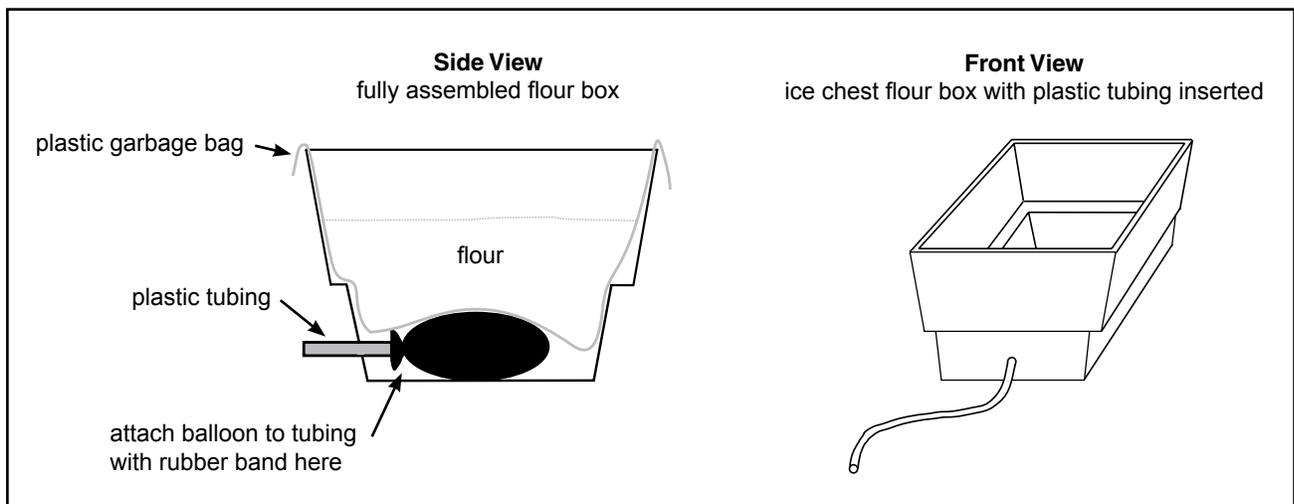
- describe how a caldera forms;
- view a model of how a caldera is formed; and
- record observations.

Materials:

- Styrofoam ice chest (with a small hole in one end)
- Flour (apx. 20 pounds)
- Garbage bag (to hold the flour in the ice chest)
- Plastic tubing (3/8" or 1/2" approximately 3 feet in length)
- Rubber bands
- 12" round balloon
- Student Worksheet: "Flour Box Calderas"

Answers to Student Worksheet:

- 1 - 4. Answers will vary
 5. b) a magma reservoir drains, causing the ground above to collapse.



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Activity Procedure:

1. In preparation for this activity, assemble the ice chest flour box. Refer to the diagram on the previous page for assistance. Cover the box overnight so the flour does not absorb moisture.
 - a) Make a small hole in one end of the ice chest and insert the tubing.
 - b) Use the rubber band to secure the balloon to the end of the tubing inside the ice chest. Make sure you can inflate the balloon by blowing into the tubing. Reduce the amount of flour as needed.
 - c) Line the ice chest with a garbage bag and pour in the flour.
2. Before starting the activity, explain the four steps that will occur during the demonstration and instruct students to draw observations of each step on their worksheets. The steps include:
 - a) the balloon will be partially inflated;
 - b) the balloon will be slowly deflated;
 - c) the balloon will be fully inflated; and
 - d) the balloon will be rapidly deflated.
3. Distribute the Student Worksheet: “Flour Box Calderas” and ask students to write a prediction of what will happen when the balloon is inflated to the maximum, then deflated rapidly.
4. Begin the demonstration. In a large class, a live-feed video setup can help all students view the demonstration. Inflate the balloon to about half its maximum size. Ask students to draw and describe their observations of the flour on their worksheet. Encourage students to label bulges, cracks, etc.
5. Slowly deflate the balloon. Ask students to draw and describe their observations on the worksheets. Students should label bulges, cracks, etc.
6. Inflate the balloon again, this time to its maximum. Ask students to draw and describe their observations again.
7. Allow the balloon to deflate rapidly. For maximum effect, suck the air out of the balloon. Ask students to draw and describe their observations of the flour in the box. Explain that this step demonstrates how a caldera is formed when a magma reservoir rapidly drains.

Note: 1) A magma reservoir is not necessarily round. It can be web like. 2) The level of magma in the reservoir can go up or down. 3) There can be more than one reservoir. 4) When a reservoir drains rapidly the top can collapse, forming a crater (less than 1 mile across) or a caldera (greater than 1 mile across). 5) Several craters can join to make a caldera. 6) Pressure changes cause the level of magma in the reservoir to increase or decrease.

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Directions: Your teacher has created a model to demonstrate how a caldera is formed. Carefully observe the model. Record your observations of each step.

1. List observations you made of the flour when the balloon was partially inflated. Draw a diagram of what the flour looked like from above and what it probably looked like from the side.

Observations:

Top Side View



2. List observations you made when the balloon was partially inflated then deflated slowly. Draw a diagram of what the flour looked like from above and what it probably looked like from the side.

Observations:

Top Side View



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3. List observations you made when the balloon was completely inflated. Draw a diagram of what the flour looked like from above and what it probably looked like from the side.

Observations:

Top Side View



4. List observations you made when the balloon was completely inflated then deflated rapidly. Draw a diagram of the flour's appearance from above and what it probably looked like from the side.

Observations:

Top Side View



5. Calderas are large depressions near the top of a volcano that can be a few hundred to several thousand feet deep. They form when a magma reservoir drains, causing the ground above to collapse. In this demonstration, the balloon acted as a magma reservoir, causing the ground above it to rise when inflated, and collapse into a caldera when deflated.

A caldera forms when:

- a) a magma reservoir fills, causing the ground above to bulge.
- b) a magma reservoir drains, causing the ground above to collapse.