



Lesson: Flour Powered Supervolcano

Grade Level: K-12

Activity Duration: 30 minutes

Objectives:

- Students will understand the basic concepts behind how a volcano works
- Students will be able to identify the role of magma in a volcanic eruption
- Students will recognize that Yellowstone is a supervolcano
- Students will understand the connection between Yellowstone's thermal features and the fact that it is a supervolcano
- Students will learn the terms "caldera" and "crater"

Kit Materials:

- Balloon
- Plastic tub
- Tube

Classroom Materials:

- Flour

Lesson Procedure:

1. Ask students if they know what a supervolcano is (for very young students, you can ask if they know what a volcano is and take some time to do a quick drawing on the whiteboard of how a volcano works).
2. Prepare the demonstration by attaching a balloon to the rubber tubing and placing it in the supervolcano box.
3. Cover the deflated balloon with flour, fill the box about half way and pack it down.
4. Sprinkle a thin layer of cocoa powder on top of the flour. (Optional, but it looks neat during the eruption)
5. Facilitate a brief discussion about the magma plume that sits underneath Yellowstone National Park
6. Begin to SLOWLY pump the balloon up. The balloon will expand and push up the flour and cocoa.
7. Ask students if they can explain what's happening and why is this like a volcano.
8. Keep pumping the balloon until it pops! Or use a skewer or pencil to pop it, if you prefer.
9. You can push up the tube and install a new balloon. Bury it again and repeat!

Variation: (Takes some practice)

1. Inflate the balloon a tiny bit and then let the air out by removing the air pump.
2. Inflate the balloon just a little bit more, then let the air out again.
3. Inflate the balloon even more, and then pop it or deflate it.
4. This will create an excellent visual representation of fault lines, and both the caldera and the crater.



What's Happening? And How is This Like a Real Supervolcano?

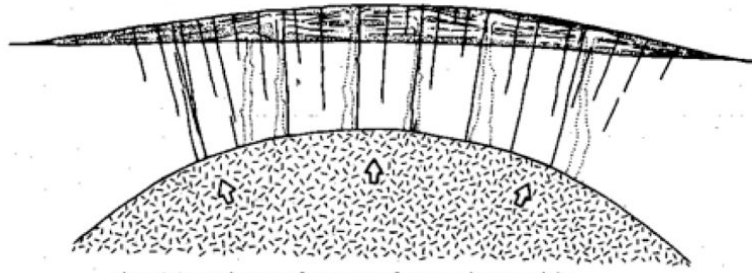
In a real supervolcano, the crater and caldera are formed by a collapse more than the explosion! When a magma "bubble" pushes up into the crust, it fractures and displaces the crust, forming ring fractures and faults (and many earthquakes). Over many thousands of years, magma will create a chamber underground and press upward on the earth's crust. Our balloon is like that underground magma chamber, and the packed flour is like the crust!

Over thousands of years, the underground magma chamber (balloon) keeps pushing upward on the crust, creating a dome. Yellowstone Park has two domes right now: Mallard Lake Dome and Sour Creek Dome. They move up and down a few inches each year as the underground magma chamber fills and empties of magma.

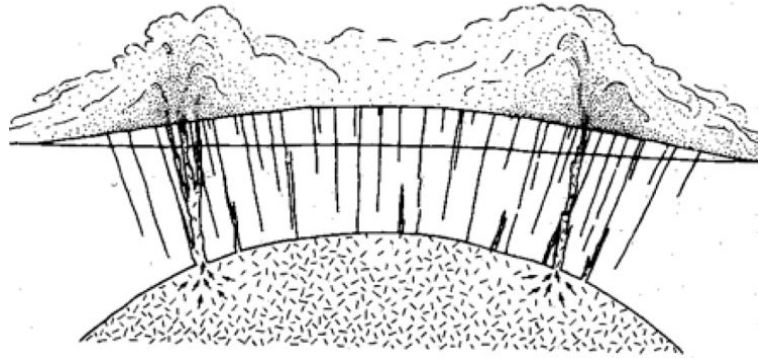
Eventually, the underground magma chamber can erupt onto the surface. A mild eruption will just result in a lava flow across the surface, and Yellowstone Park had a lava flow 70,000 years ago. Part of the Yellowstone caldera is filled with this newer lava.

If the eruption is large enough (like in a supervolcano eruption), the chamber is partially emptied, and then can no longer support the earth's crust above it. The crust then collapses down into the magma chamber, creating a large caldera or crater. This can happen both during a large eruption or afterwards, and can collapse in stages as a series. It can be hundreds or thousands of square miles in area!

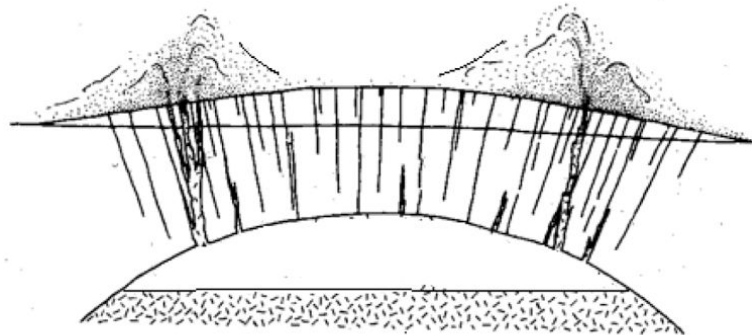
The Yellowstone Hotspot has erupted many times over the past 15 million years. The most recent eruptions were 2.1 million years ago, 1.3 million years ago, and 640,000 years ago. There's no evidence that Yellowstone is going to erupt again any time soon, though.



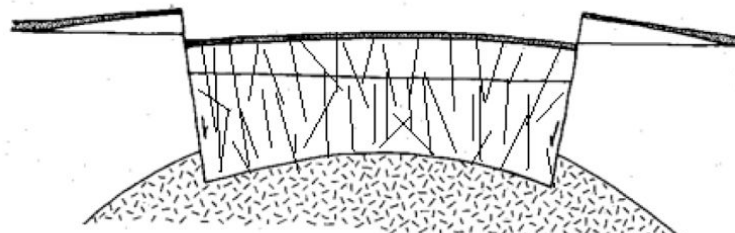
The rising plume of magma forces the Earth's crust upward, forming a dome and cracking the surface.



The volcano erupts! Magma is forced to the surface in pyroclastic flows, lava flows, and explosions of gas and rock.



As the eruption occurs, the magma chamber is emptied. The magma chamber no longer supports the crust above it.



Since the magma chamber no longer supports the dome, the dome collapses and crashes into the magma chamber, creating a volcanic caldera.