Hawai'i Space Grant College, Hawai'i Institute of Geophysics and Planetology, University of Hawai'i, 1996

# Cake Batter Lava

Teacher Page

## Purpose

To understand some of the geological processes and the structures that form as lava flows across planetary landscapes by using cake batter as an analog for lava.

## Background

In this activity students will use cake batter to simulate surface lava flows. The experiment demonstrates many of the key features of a'a flows, though not of whole pahoehoe flow fields, which are fed by lava tubes.

Real a'a lava flows are complicated. They are characterized by a prominent lava channel confined between levees. Shear zones, places where one portion of the flow is moving faster than an adjacent portion, usually occur. Small flows of pahoehoe lava also become channelized, but on a much smaller scale than a'a flows.

As cake batter is poured onto an inclined surface, the first and foremost thing to do is to observe the formation of distinct features in the flow. Levees form on the outer part of the flow. These are not quite the same as levees on lava flows because the latter build up levees by overflowing the banks. Inside the levees the batter moves downhill. Ridges might develop in the flowing portions, analogous to large ridges in lava flows. The thickness of the flow varies with slope, time, position in the flow, and amount of batter poured. These variables can be tested by measuring width and thickness as functions of time, as described in the procedure.

## Preparation

Review and prepare materials listed on the student sheet. Begin with a standard, boxed cake mix, preferably without pudding added. Mix the dry cake mix with water only. Smooth the mixture with a wire whisk to the consistency of thick cream.

The final mixture should be fairly uniform, with only a few lumps. If the mixture is too runny, then it will pour like water. In this case, add flour to the mixture. If it is too thick, then it will mound up (though that is interesting and somewhat resembles some very viscous lava flows). In fact, at the end of the experiment, you may choose to use a very thick batter for comparison purposes.

A baking sheet is an excellent surface to use for the experiment, though any smooth, surface will do fine, such as a wooden drawing board.

Draw a grid with 10-cm spacing onto a paper taped to the baking sheet or wooden board, then cover with plastic wrap.

# In Class

Using a protractor and plumb line, the baking sheet or board is propped up to an angle of 15 degrees for the procedure, then to an angle of 25 degrees for a repeat of the procedure.

Students should pour the batter slowly and at a constant rate down the inclined board. The bucket should be held about 10 cm from the high end of the board.

At each 10 cm mark, the students will:

1. record the time the flow front passes the mark,
2. measure the length of the flow,
3. measure the width of the flow,
4. measure the center depth of the flow.

"Data Tables" are provided for recording these values. Space is provided for sketches of the flow outline.

When the batter is flowing down the slope, look for areas near the edges where the flow rate is low or zero; these are the levees of the channel. The part in the middle that is moving faster is called the channel interior. You may try sprinkling red confetti onto the flow to get a better view of the relative movement between the interior and levees.

# Wrap-up

1. How do the two flows compare?
2. Is the ratio of channel width to flow width the same? Presumably the batter volumes were the same for both slopes, but the flow areas could be determined and multiplied by the average depths as an exercise just to check.

# Extensions

1. Use a ruler with a grid to slice into the flow at each 10 cm mark to get cross sections.
2. Can you see the levee margins in the cross sections?
3. How do the cross sections change down the length of the flow?
4. Add more flour to the batter to see the behavior of a thick flow.
5. Videotape the activity.

6.

Use the batter in an "Impact Craters" activity.

## Pictures

---

Go to Data Tables.

---

Go to Cake Batter Lava **Student Pages.**

---

Return to Volcanology Activity Index.

---

Return to Hands-On Activities home page.
http://www.spacegrant.hawaii.edu/class_acts/

Hawai'i Space Grant College, Hawai'i Institute of Geophysics and Planetology, University of Hawai'i, 1996

# Cake Batter Lava Data Tables

| angle | Time at 0 | at 10 | at 20 | at 30 | at 40 | at 50 | at 60 | at 70 | at 80 | at 90 | Time stopped pouring |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 deg. | | | | | | | | | | | |
| 25 deg. | | | | | | | | | | | |

| angle | Width at 0 | at 10 | at 20 | at 30 | at 40 | at 50 | at 60 | at 70 | at 80 | at 90 | Total length |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 deg. | | | | | | | | | | | |
| 25 deg. | | | | | | | | | | | |

| angle | Center-line depth at 0 | at 10 | at 20 | at 30 | at 40 | at 50 | at 60 | at 70 | at 80 | at 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| 15 deg. | | | | | | | | | | |
| 25 deg. | | | | | | | | | | |

| angle | Channel width at 0 | at 10 | at 20 | at 30 | at 40 | at 50 | at 60 | at 70 | at 80 | at 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| 15 deg. | | | | | | | | | | |
| 25 deg. | | | | | | | | | | |

Go to Cake Batter Lava **Student pages.**

Go to Cake Batter Lava **Teacher pages.**

Return to Volcanology Activity Index.

Return to Hands-On Activities home page.
http://www.spacegrant.hawaii.edu/class_acts/

Hawai'i Space Grant College, Hawai'i Institute of Geophysics and Planetology, University of Hawai'i, 1996

# Cake Batter Lava

## Purpose

To understand some of the geological processes and the structures that form as lava flows across planetary landscapes by using cake batter as an analog for lava.

## Key Words

lava flows

channels and levees

pressure ridges

## Materials

cake batter

large mixing bowl, preferably with handle and pouring spout

wire whisk

large spatula

large baking sheet or wooden drawing board with a 10-cm grid on it

protractor with plumb line

stopwatch

"DataTables"

tape measure or ruler

## Procedure

1. Stir the mixture of **dry cake mix** and **water** in the **bowl**. A few lumps are acceptable.

2. Prop up one end of the **board** at an angle of about 15° (use the **protractor** and **plumb line** to determine the angle). Make sure the board does not sag.

3. Hold the bowl of cake batter about 10 cm down-slope from the high end of the board. This will help prevent batter from spilling accidently onto the floor.

   Keep the bucket about 10 cm above the board. Pour the batter slowly. It is important to keep the pour rate as constant as possible.

   Start the **stopwatch** when the flow front passes the zero line.

4. Watch the flow as it goes downhill and spreads out, and record the time it reaches each 10 cm mark. How far behind the flow front does the distinct channel become apparent?

5. Record the time when you stopped pouring (the flow will continue to move). Fill in the "**Data Tables**."

6. Note the channel and levees as well as shear zones within the levees. Does the channel extend the entire length of the flow?

7. Using the **tape measure**, measure the length, width, and center depth of the flow and the channel width at each 10 cm mark. Fill in the "**Data Tables**."

8. Draw the outline of the flow using the grid as a guide.

9. When you are finished studying the flow, use the **spatula** to scrape the batter back into the bowl. The board should be clean and ready for the next procedure.

10. Now prop the board up higher to an angle of about 25° and repeat the experiment. The batter may flow off the end of the board this time, so make sure the flat underlying surface is washable or protected with plastic. How do the flow structures in this flat part compare to those on the slope?

11. Repeat all the measurements and fill in the "Data Tables."

12. How do the two experimental flows compare? Is the ratio of channel width to flow width the same?

---

Go to Data Tables.

Go to Cake Batter Lava **Teacher pages.**

Return to Volcanology Activity Index.

Return to Hands-On Activities home page.
http://www.spacegrant.hawaii.edu/class_acts/