



## **Lava Flow or Lava Flows?**

### Lava Canyon Trail Activity

#### Teacher Information:

Time Commitment: 1 hour

Location: Lava Canyon

Students use observation skills to determine if one or two separate lava flows entered Lava Canyon.

Students will be better served if they have prior knowledge of the following vocabulary words:

- 1) Magma: molten rock beneath the surface of the earth.
- 2) Lava: molten rock that has erupted on to the earth’s surface through a volcanic vent.
- 3) Basalt: volcanic rock low in silica, usually dark in color because it is generally rich in iron and magnesium. This runny lava typically flows great distances from its source.
- 4) Rhyolite: volcanic rock rich in sodium, potassium and silica. Because they are stiff and pasty when erupted, rhyolite lava normally does not flow far its source.
- 5) Andesite: volcanic rock intermediate in composition between basalt and rhyolite.
- 6) Silica: A glass-like building block of minerals.

#### **Goal:**

- 1) Students will be able to use imaginative and analytical skills to develop and evaluate models about an andesite lava flow in Lava Canyon and the features within it.

#### **Objectives:**

- 1) Students will be able to describe the differences between basalt, andesite, and rhyolite lavas.
- 2) Students will be able to identify the Crust or cap on a lava flow, and describe its role in insulating the lava flow.
- 3) Students will be able to identify columns and describe that they indicate areas of slow cooling of a lava flow.
- 4) Students will remain on the trail at all times.

# Lava Flow or Lava Flows?

## Lava Canyon Trail Activity

**Your Mission: (purpose)** To use your observation skills, and the “case facts” to determine if one or two separate lava flows entered Lava Canyon.

**Possible Explanations: (hypothesis)**

#1: The black rock formation was deposited by a single andesite lava flow. The two parts look different, because they cooled at different rates.

#2: The black rock formation was deposited by two separate andesite lava flows. You can determine this, because there are two parts of the rock formation that look different.

**Case Facts (record data) and Evidence Evaluation (procedure)**

**A.** Observe the black lava flow before you. To determine if the lava flow was thick or runny, consider the following true statements about andesite lava flows. Mark an X beside the statement you think is more correct in the canyon before you.

\_\_\_\_ The cooled surface of runny andesite lava forms a hardened crust or cap that insulates the lava beneath it.

\_\_\_\_ The cooled surface of thick pasty andesite lava is covered with large rocks and looks like a field of boulders.

**B.** Observe the black lava flow before you. To determine if the lava flow cooled quickly or slowly, consider the following true statements about andesite lava flows. Mark an X beside the statement you think is more correct in the canyon before you.

\_\_\_\_ Lava Flows that cool very slowly can form four, five and eight sided columns.

\_\_\_\_ Lava flows that cool quickly do not form columns.

**C.** Observe the black lava flow before you. To determine if there were one or two separate lava flows consider the following true statements about the color of volcanic rocks. Mark an X beside the statement you think is more correct in the canyon before you.

\_\_\_\_ A thin red layer of re-melted lava is formed when new lava flows over another already hardened lava flow.

\_\_\_\_ Ancient volcanic rocks can weather to bright orange and yellow colors.

**Conclusion:**

a) I think that explanation # \_\_\_\_\_ is best. ; OR

b) I have reached a different conclusion

In complete sentences, explain the evidence you used to support your conclusion.

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# Answer Sheet to Lava Flow or Lava Flows?

## Lava Canyon Trail Activity

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#1: The black rock formation was deposited by a single andesite lava flow. The two parts look different, because they cooled at different rates.

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Case Facts (record data) and Evidence Evaluation (procedure)

A. Observe the black lava flow before you. To determine if the lava flow was thick or runny, consider the following true statements about andesite lava flows. Mark an X beside the statement you think is more correct in the canyon before you.

The cooled surface of runny andesite lava forms a hardened crust or cap that insulates the lava beneath it.

The cooled surface of thick pasty andesite lava is covered with large rocks and looks like a field of boulders.

B. Observe the black lava flow before you. To determine if the lava flow cooled quickly or slowly, consider the following true statements about andesite lava flows. Mark an X beside the statement you think is more correct in the canyon before you.

Lava Flows that cool very slowly can form four, five and eight sided columns.

Lava flows that cool quickly do not form columns.

C. Observe the black lava flow before you. To determine if there were one or two separate lava flows consider the following true statements about the color of volcanic rocks. Mark an X beside the statement you think is more correct in the canyon before you.

A thin red layer of re-melted lava is formed when new lava flows over another already hardened lava flow.

Ancient volcanic rocks can weather to bright orange and yellow colors.

Conclusion:

a) I think that explanation # 1 is best. ; OR

b) I have reached a different conclusion

In complete sentences, explain the evidence you used to support your conclusion.

The crust on the top of the lava flow shows that the surface cooled first. The columns under the cap show that it cooled second. There is no red layer of re-melted lava between the columns and cap. This evidence indicates that this was one lava flow that cooled at different rates.

## Instructional Sequence for “Lava Flow or Lava Flows?”:

1. Proceed on Forest Road 83 directly to the Lava Canyon trail if you do NOT want to study the May 18, 1980 lahar (Go to instructional sequence #2).

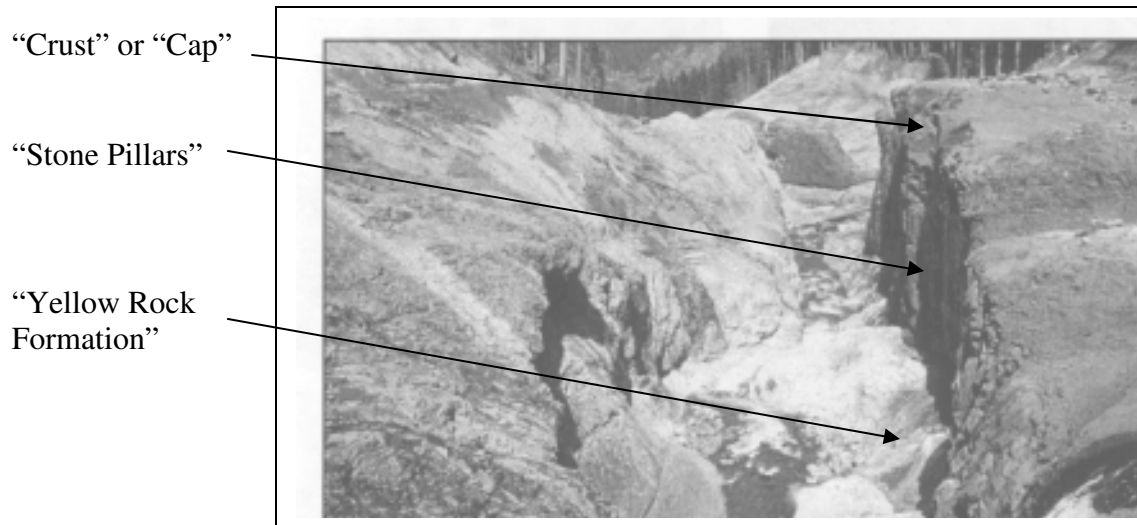
OR

Stop at the oversized vehicle parking area just past the Moss Springs Viewpoint entrance sign if you would like to learn about the 1980 lahar. This pullout is located ½ mile from the Lava Canyon Trailhead. Do NOT pull into the parking lot, because it cannot accommodate oversized vehicles.

- A. Explain that in order to appreciate Lava Canyon’s appearance today that students must first understand the shoestring glacier story. If the volcano is visible point to the deep trough running down from the crater rim to the base of the volcano. The glacier carved the canyon holding Shoestring glacier, not by the 1980 eruption. The glacier use to stretch another 1300 feet upward from the current summit.
  - B. Explain that within seconds after the eruption began on May 18, 1980 an enormous, turbulent dark cloud surged down all sides of the volcano. The cloud reached the base of Shoestring Glacier in 90 seconds. This hot cloud melted 27’ of ice from the glacier, creating a mudflow—a flow of mud, rock, trees and debris. This mudflow, called a lahar, looked and moved like wet flowing concrete.
  - C. The lahar, traveling nearly 60 mph, grew as it surged down slope scouring away the forest. When the lahar reached the site where your school bus is parked it was nearly 15’ deep. You can see how deep it was by looking at standing dead trees along the edges of the lahar. The bark was removed when boulders inside the lahar bashed against the tree. Some trees on the hillside behind us also have ‘flow marks” on them, where the bark was removed by the abrasive flow. Large rocks like those scattered around us actually floated on the surface of the wet-concrete-like flow. These are not new rocks, rather, this is old material from the former summit.
  - D. Part of the lahar flowed down the Pine Creek drainage (the ridge line behind the bus) but the rest of the it was deflected down Lava Canyon to our right. The lahar scoured out the canyon—removing the forest, exposing a lava flow and an ancient rock formation that we will be hiking over.
  - E. By 9:00 am, 17 million cubic yard of debris, enough to fit on a football field nearly 3,000’ high, had entered Swift Reservoir--the large body of water your bus passed just outside of Cougar. This debris also raised the water level of the reservoir two and a half feet. This lahar was impressive, but it wasn’t the largest mudflow on May 18<sup>th</sup>. A lahar that went down the North Fork of the Toutle River was four times larger in volume!
2. Drive to the Lava Canyon trailhead, disembark and provide a bathroom break.
  3. Gather students at the Lava Canyon trailhead. Explain that the students will be conducting an activity near a fast-moving, cold river (glacial melt water) and cliff faces. It is imperative that students stay on the trail and remain with their adult

chaperone at all times. Fatal accidents have occurred in Lava Canyon when people got off the trail. Set clear expectations for student conduct along the trail—anyone caught off trail or who does not listen to their chaperone will be sent back to the bus and receive a failing grade.

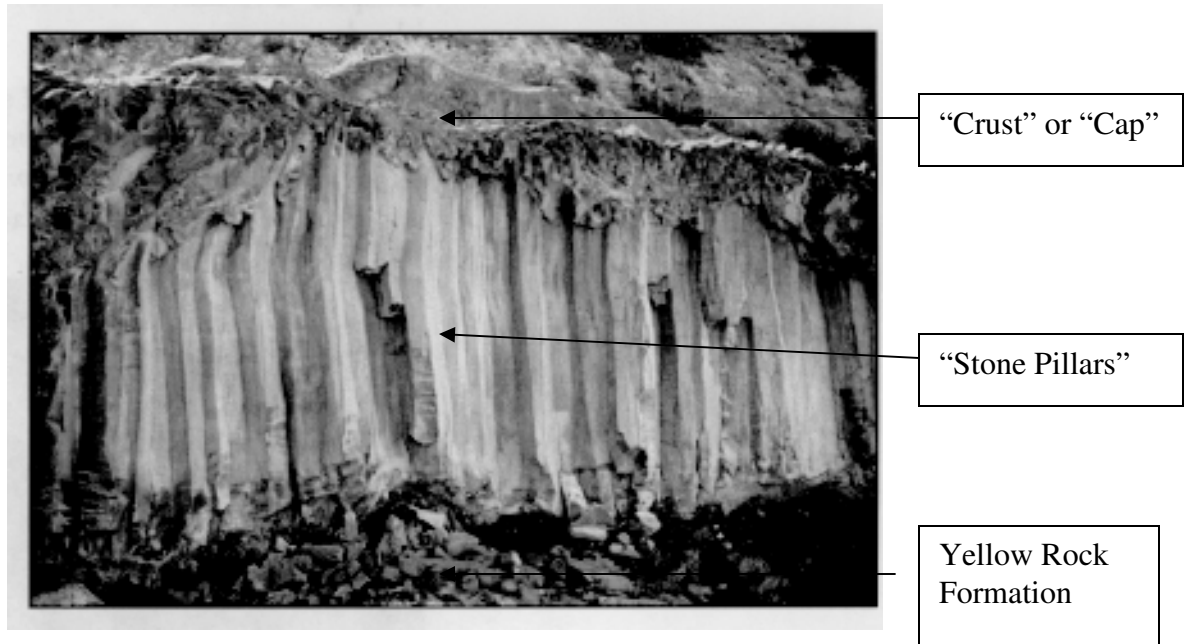
4. Walk about ½ mile on the paved section of the trail to the intermediate trail intersection. Proceed right 50-feet down the unpaved intermediate trail and stop at the waterfall viewpoint with a metal fence.



View from Waterfall Viewpoint

5. At the metal fence explain that the students are going to examine a specific type of lava flow. Explain that all magma, molten rock beneath the surface of the earth, is composed of the same basic elements, but the proportions vary from one magma to another. When it erupts onto the Earth’s surface it becomes “lava”.
  - A) Basalt: volcanic rock low in silica, usually dark in color because it is generally rich in iron and magnesium. This runny lava typically flows great distances from its source.
  - B) Rhyolite: A volcanic rock on the opposite end of scale from basalt. It is rich in silica. Rhyolite lava is stiff and pasty when erupted, and has a difficulty flowing, so it normally does not flow far from its source.
  - C) Andesite: volcanic rock intermediate in composition between basalt and rhyolite. It is not as runny as basalt, but not as thick and pasty as rhyolite.
6. Identify the long thin island of black andesite lava flow down canyon. Identify the smooth surface on the top of the flow, the “stone pillars”, and the yellow rock formation under the black lava flow. Explain how to complete the student worksheet “*Lava Flow or Lava Flows?*”. Make sure students understand that all of the answers to questions A, B, and C are true. However, they must look at evidence in the andesite lava flow to determine which answer is relevant to Lava Canyon. Explain that after they have answered all three questions, that they should be able to determine which explanation is best.

7. Allow each group of five students to reveal which explanation they thought was best and to explain how they reached their conclusion. Then describe why explanation #1 was best; The crust on the top of the lava flow shows that the surface cooled first. The columns under the cap show that it cooled second. There is no red layer of re-melted lava between the columns and cap. This evidence indicates that this was one lava flow that cooled at different rates.



8. Return to bus via the route you came. *OR:* If you want a longer hike, proceed across the footbridge another  $\frac{3}{4}$  mile on a more difficult loop trail. This trail segment includes a suspension bridge that passes over the canyon, and a more difficult trail leads you back to the paved trail. *NOTE:* There are forty to fifty foot vertical cliff faces along most of this trail segment! Station chaperones between each group of five students when hiking this trail, and instruct the chaperones not to let any students pass them. The yellow rock formation is slippery when wet. Allow an additional  $\frac{3}{4}$  hour if hiking the more difficult loop trail.