



Mount St Helens National Volcanic Monument – Teacher’s Corner 2003
Gifford Pinchot National Forest
USDA Forest Service

The Tree Mold Maze

Outdoor Activity

Teacher Information:

Time Commitment: 45 minutes to 1 hour

Location: Trail of Two Forests

There are two components to this activity. Students simulate the formation of a tree mold in order to gain a better understanding of the processes that formed them. Through small group exploration, students observe, identify geological features, and develop models about the formation of “The Crawl” (three interconnecting tree molds) along the Trail of Two Forests. Students will be better served if they have prior knowledge of the following vocabulary words:

- 1) Lava: molten rock that has erupted on to the earth’s surface through a volcanic vent.
- 2) Basalt: volcanic rock usually dark in color that contains 45 to 54% silica, and is generally rich in iron and magnesium. Typically flows great distances from its source.
3. Tree Mold: a cylindrical hole in a lava flow, created by the combustion or decay of a tree when it was surrounded by a lava flow that formed a hollow impression of the tree trunk.

Goal:

- 1) Students will make observations, analyze facts, and use creative interpretation to reveal a geological mystery at “The Crawl” along the Trail of Two Forests.

Objectives:

- 1) Students will be able to describe how a tree mold forms.
- 2) Students will be able to identify and describe how three separate trees were engulfed by lava and became three interconnecting tree molds.
- 3) Students will protect fragile plant growth by staying on the boardwalk trail
- 4) Students will understand why the collection rocks, plants or animals is prohibited, and will abide by the Monument regulations.

Essential Materials Needed:

- 1) Student worksheets on clipboards covered by plastic bags (cave ceiling drips).
- 2) Pencils (pens stop writing when they get wet)
- 3) One flashlight for each student.

The Tree Mold Maze

Your Mission: (*purpose*) To determine how many tree molds make up “the crawl”.

Possible Explanations: (*hypothesis*)

#1: The crawl is one vertical tree mold connected to two horizontal tree molds.

#2: The crawl is one vertical tree mold connected to three horizontal tree molds.

Case Facts: (*materials*)

- Before the basalt lava flow 1900 years ago, an old growth forest grew at this site.
- Basalt lava flows around upright trees and over fallen trees
- Trees trunks engulfed in lava burn furiously leaving few remains
- The burning trunks of upright trees can collapse and fall into lava flows.
- When basalt lava cools around upright and fallen tree trunks it cools and hardens leaving impressions of the trees in the lava flow.

Evaluate the Evidence: (*procedure*)

Use your observation skills to evaluate the evidence inside the crawl. After documenting and describing your observations, choose the best possible explanation (#1 or #2) that describes how many tree molds make up “the crawl”.

Observations: (*record data*)

- 1) Climb down the ladder and look at the bottom edges of the tree mold. Describe what you see, what you think it was, and what happened to it. Is this a vertical or horizontal tree mold?

- 2) Climb into the next tree mold, turn **right**, and crawl. Describe what you see and feel, and what you think it was? Is this a vertical or horizontal tree mold?

- 3) Crawl forward until you reach a small drop off, creep down and stop at the intersection. Describe what you see and what you think happened here? How many different tree molds are here?

Conclusions: (*results*)

- 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.

Teacher Answer Sheet for The Tree Mold Maze

Your Mission: (*purpose*) To determine how many tree molds make up “the crawl”.

Possible Explanations: (*hypothesis*)

- #1: The crawl is one vertical tree mold connected to two horizontal tree molds.
- #2: The crawl is one vertical tree mold connected to three horizontal tree molds.

Case Facts: (*materials*)

- Before the basalt lava flow 1900 years ago, an old growth forest grew at this site.
- Basalt lava flows around upright trees and over fallen trees
- Trees trunks engulfed in lava burn furiously leaving few remains
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- When basalt lava cools around upright and fallen tree trunks it cools and hardens leaving impressions of the trees in the lava flow.

Evaluate the Evidence: (*procedure*)

Use your observation skills to evaluate the evidence inside the crawl. After documenting and describing your observations, choose the best possible explanation (#1 or #2) that describes how many tree molds make up “the crawl”.

Observations: (*record data*)

- 1) Climb down the ladder and look at the bottom edges of the tree mold. Describe what you see, what you think it was, and what happened to it. Is this a vertical or horizontal tree mold?
This is a vertical tree mold, because it stands straight up. The trunk of this tree mold is widest at the bottom, exposing octopus-like molds of tree roots where lava melted soil, engulfing the roots. Charcoal found in tree root molds was radiocarbon dated to determine the age of this lava flow.
- 2) Climb into the next tree mold, turn **right**, and crawl. Describe what you see and feel, and what you think it was? Is this a vertical or horizontal tree mold?
This is a horizontal tree mold, because it lays sideways. This tree fell onto the flow and was later engulfed in lava. Small ridges inside this tree mold are painful to crawl on. The ridges reveal where lava flowed between cracks in the bark, and into cracks as the wood split due to the intense heat.
- 3) Crawl forward until you reach a small drop off, creep down and stop at the intersection. Describe what you see and what you think happened here? How many different tree molds are here?
The tree mold I just crawled through continues straight ahead, and another tree mold veers off to the left at a 90-degree angle. It appears as if 1900 years ago that a tree fell on top of another fallen tree, and that both fallen trees were engulfed in the lava flow forming two horizontal tree molds.

Conclusions: (*results*)

- 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 crawl is not one, but actually three separate tree trunks that were submerged in the lava flow. The entrance (located at the ladder) was created when one tree fell against the side of a standing tree. The side passage is the top of the fallen tree. The exit passage is an additional tree that fell against the fallen tree. The base of the standing tree and both of the fallen trees were completely engulfed by lava. The charcoal remnants of the trees eventually decomposed, leaving the molds of three trees.

Instructional Sequence for The Tree Mold Maze:

1. Have students bring their flashlights, pencils, clipboards with *The Tree Mold Maze* worksheet, and gather them at the trailhead. Inform the students to stay on the trail (\$100 fine for off trail travel) in order to protect this ecologically sensitive area. There is a very thin carpet of soil and moss covering the lava flow and it is easily damaged when people walk on it. Before this trail was constructed, curious people wandered around this area and severely damaged the plant life. Dozens of “social trails” cut across the surface of the lava flow. In 1987, a prison crew constructed “The Trail of Two Forests” to protect the site and guide visitors through its geologic and ecological features. Within two years most of the “social trails” were colonized by moss, and today most are barely visible.
2. Place two groups of five students in a tight circle near the trailhead and inform them that they are a big tree in an old growth forest that lived at this site 1900 years ago. Place the other groups of students in rows of five in the parking lot and inform them that they are part of the basalt lava flow that formed Ape Cave and flowed through the forest at this site. Conduct the tree mold simulation.
 - A. Instruct the “lava flow students” to slowly advance toward the “student tree” repeating aloud “lava, lava, lava, lava, lava” as they walk. Allow half of the students to “flow” around the “student tree” before they stand still. The “tree students” should make burning noises as the “lava flow students” flow around them.
 - B. Ask the “tree students” what happened to them when the lava flowed around them? Correct answers include: Trees burst into flames. Some remained standing as they burned, while other tree trunks fell onto the surface of the lava flow. Some of the fallen tree trunks were later engulfed by lava.
 - C. Ask the “lava flow students” what happened to the lava flow over the next several months? The correct answer is that the lava flow cooled and hardened. Instruct the “lava flow students” closest to the “student tree” to raise their arms to shoulder level and hold hands to represent the cooling and hardening of the lava flow.
 - D. Ask the “tree students” what happened to them next? Most tree trunks were almost completely burned away by the intense heat. Instruct eight of the ten “tree students” to exit the circle of hardened “lava flow students”. Then explain that the charcoal remnants of the trees slowly decomposed. Instruct the two remaining “tree students” to exit the circle. Walk inside the student tree mold and explain that this is how a tree mold is made. Explain that you can see the impressions of the bark on the inside surface of the tree mold. Look down at the student’s feet and explain that you can see where the lava melted the soil, but left molds of the trees root system.
 - E. Explain that over hundreds of years, a thin layer of soil formed that now supports communities of sun loving moss, ferns and trees on the surface of the lava flow, and that shade loving mosses, ferns and insects have colonized the tree molds themselves.

3. Remain in the lead as you proceed down the Trail of Two Forests. Veer left at the intersection, and walk past the small side trail on the boardwalk that leads to the exit of “the crawl”. Stop at the crawl (look for an interpretive sign named “The Crawl” beside a tree mold with a ladder in it). Place a jacket or object over the interpretive sign to hide the map on the interpretive sign.
4. **The key to students successfully completing this worksheet lies within this portion of the instructional sequence.** Inform students that they will be exploring the crawl in order to solve a geological mystery on the student worksheet *The Tree Mold Maze*. Read aloud the mission of the activity, possible explanations, case facts, and questions on the worksheet. Inform the students to bring their flashlights and their worksheet, but to **leave their clipboards during the exploration**. Before students begin:
 - A. Inform students that they will need to answer question #1 or make observations to answer the question at the bottom of the stairwell.
 - B. Make sure that after students walk down the ladder into the first tree mold, that they turn **right** as they climb into the next tree mold. (There is a three-foot drop off if they turn left). Explain that in order to answer question #2 they will need to make observations about the surface of lava they are crawling over.
 - C. Explain that the students will reach a small drop off at an intersection. They will need to make observations about what they see around them at this site in order to answer question #3.
 - D. When the students have answered all three questions they should be able to determine which explanation is best, and document evidence used to support their conclusion.
 - E. NOTE: Students get very excited at this site and will want to repeatedly go through the crawl, consider limiting students to two explorations of “the crawl”.
5. Allow students 15 to 20 minutes to complete *The Tree Mold Maze* worksheet. Circulate among the students and encourage them to confer, share ideas, and point out discoveries to each other, but tell them they are “on their own” in terms of finding answers. Their findings, ideas and questions will be addressed in the follow-up discussion.
6. Ask several students to explain which answer they felt was correct, and to describe some of the evidence used to reach this conclusion. Explain that explanation #1 is best, “the crawl is one vertical tree mold connected to two horizontal tree molds”. A large tree fell against a standing tree (the vertical tree mold), and on top of another tree that had fallen down before it did (left turn up the tree mold to exit the crawl). All three trees were engulfed by the lava flow, which later cooled and hardened, creating three different, but interconnected tree molds.
7. Complete the Trail of Two Forests loop and return to the bus.