

STEAM Subject: Geology

Lab: Topographic Map

Grades: 4th-8th

Learning objective:

Students will be able to:

- make a model of a mountain and a topographic map using a 3D object and project it onto a 2D surface
- analyze and interpret data from their topographic map

ENGAGE:

Ask students the following questions:

Internet research may be required

- Do you know where the highest mountain in the world is located?
 - Mount Everest is located in Asia, on the border between China and Nepal. It stands at a staggering 29,029 feet above sea level!
- How about the highest mountain in the continental/continuous United States? What is its elevation?
 - Mount Whitney is part of the Sierra Nevada range located in California. It stands at a whopping 14,505 feet above sea level!
- Where is the lowest point in the United States? What is its elevation?
 - Badwater Basin is located in Death Valley, California. It sits 282 feet below sea level!
- What is the difference in elevation between the highest and lowest places in the United States?
 - $14,505\text{ft} - (-282\text{ft}) = 14,787\text{ft}$. These two record setting places are located just 80 miles apart from each other!

EXPLORE:

Intro to Surface Topography:

- Water, wind, and sun play a role in shaping rock formations and causing erosion.
- Weathering is the physical breakdown and chemical alteration of rocks at the Earth's surface.
- A famous weathered landscape is the Grand Canyon.
 - Watch video: How was the Grand Canyon formed?
https://youtu.be/-v_RLRT9930
- Topography describes the physical features of an area of land. These features typically include natural formations such as mountains, rivers, lakes, and valleys. Manmade features such as roads, dams, and cities may also be included. Topography records the various elevations of an area using a topographical map.

Build a mountain and create a topographic map activity

Materials needed per student:

- 2 $\frac{1}{4}$ cups flour
- 1 $\frac{1}{4}$ cups salt
- Food coloring (for a mountain color use 4 drops yellow, 2 drops red, and 2 drops of blue)
- 1 cup water
- Piece of dental floss ~24 inches long
- Ruler
- 1 Piece of plain white paper
- 2 long pencils

Directions:

1. First make the dough by combining 2 $\frac{1}{4}$ cups flour and 1 $\frac{1}{4}$ cup salt in a bowl
2. In a separate bowl combine food coloring and 1 cup water
3. Add the water mixture to the flour and salt and knead until well mixed.
4. Shape the dough into a mountain on top of a blank sheet of paper. ***Dough will keep in an airtight container for up to one week, but will dry if it is left out***
5. Use two pencils to poke two holes straight down through the center of the mountain. Make sure your two holes go all the way through the mountain.
6. Twist the pencils to make two dots on your paper, these dots are a marker for where to lay your dough after you cut it.
7. Using the ruler, mark 3 small lines where the dough can be divided into 4 equal parts (mark a line on the dough every 1-2 inches)
8. Stretch the dental floss out and gently wrap the ends around your fingers so you have a good grip on it. Use the dental floss to cut all the way through the mountain at top-most mark you made by making a circle around the dough and pulling the floss in opposite directions.
9. Remove this clay slice and place it on the paper, line the two holes up with the dots on the paper. Use the pencil to trace all the way around your mountain's slice. Put the slice aside, but don't squash it.
10. Cut a second slice at your next mark down from the top. Lay the second slice over the tracing of the first one, being careful to line the slice up with the dots on your paper. Trace around the second slice.
11. Repeat by cutting and tracing the remaining slices.
12. Restack your mountain slices.

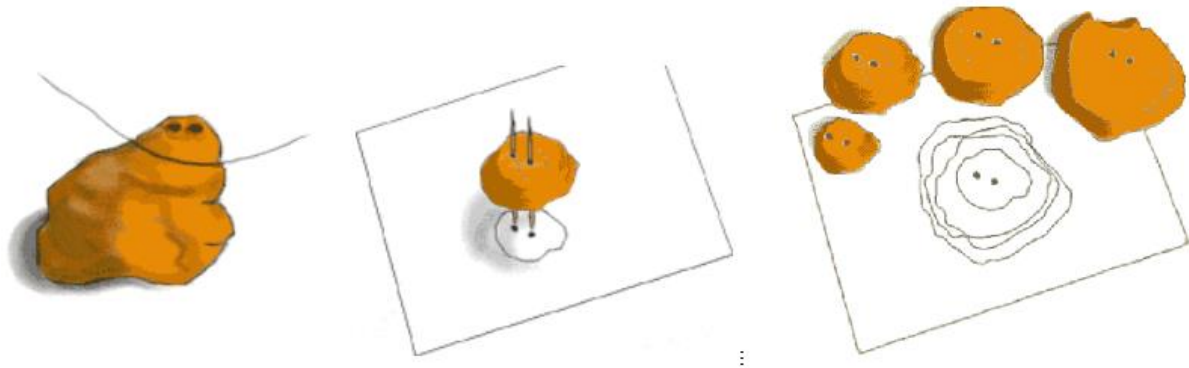


Image credit and more information: <https://spaceplace.nasa.gov/topomap-clay/en/>

EXPLAIN:

- A topographic map or “topo map” is a way to show mountains and valleys (3D) on a flat piece of paper (2D). Topo maps are necessary for navigating when hiking or when investigating where to build buildings, roads, and bridges. The map shows elevation numbers for the hills and valleys to show how steep they are.
- Review STEAM Vocabulary:
 - **Chemical Weathering:** Change in chemical composition of the parent material.
 - **Elevation:** measure of height above sea level.
 - **Freeze-Thaw Cycle:** Natural processes, including freezing and thawing and the growth of roots, cause rocks to break down into smaller pieces.
 - **Mass Wasting:** Some changes in the earth due to rapid processes, such as landslides, volcanic eruptions, and earthquakes.
 - **Physical Weathering:** The breakdown of rocks into smaller particles.
 - **Topography:** a detailed representation of natural and artificial features in an area, usually displayed on a map.



Image credit:
https://en.wikipedia.org/wiki/Mount_Tremper

ELABORATE:

Additional Activities

1. When you are done, try making a stone pattern in your dough by adding additional food coloring drops and stretching your dough until you have swirls/lines. This pattern looks similar to a metamorphic rock!



Dough made by EIS Geology Instructor Laura Hampton



Image credit: <https://commons.wikimedia.org/wiki/Category:Serpentinite>

Homemade dough versus serpentinite metamorphic rock.

- Using colored pencils in the same color family, color your topographical map. See if you can make the lowest point the darkest, and color each step lighter, and lighter. The top of your mountain should be super light in color.

EVALUATE:

- Compare the topographic map you have just made to the model mountain.
- From your topo map, which circle would have the highest elevation (largest or smallest)?
- Where would be the best place to build a trail to climb to the top of the mountain?
- Draw a hiking trail along your topo map.

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