Interpreting and Modeling Mount St. Helens with Visible Geology

Standards

NGSS

- PE: HS-ESS2-1
- DCI: Earth's Materials and Systems; The History of Planet Earth; Plate Tectonics and Large-Scale System Interactions
- SEP: Developing and Using Models
- CCC: Stability and Change; Energy and Matter

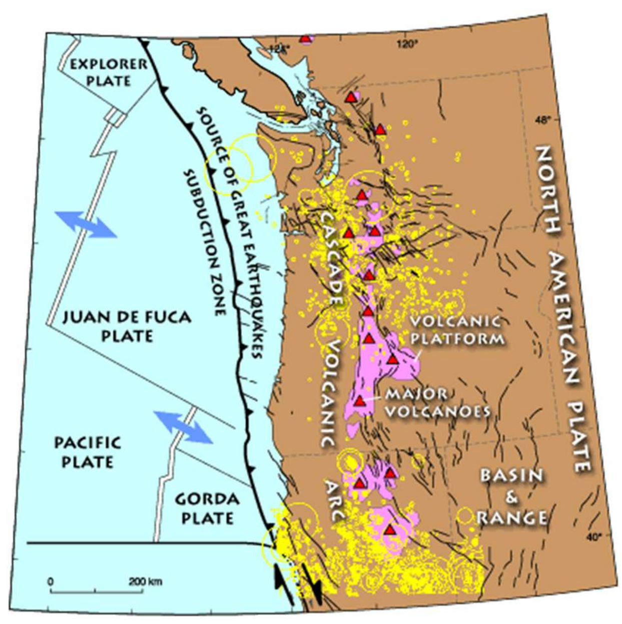
SDGs

- 4: Quality education
- 7: Affordable and clean energy

Background

Mount St. Helens is part of the Cascade Range, a chain of volcanoes formed by the subduction of the Juan de Fuca Plate beneath the North American Plate. This process allows heat from the upper mantle to melt the rock of the subducting plate, creating magma. Because the magma is silica-rich and gas-charged, it builds up pressure and tends to erupt explosively, as it did during the dramatic 1980 eruption.

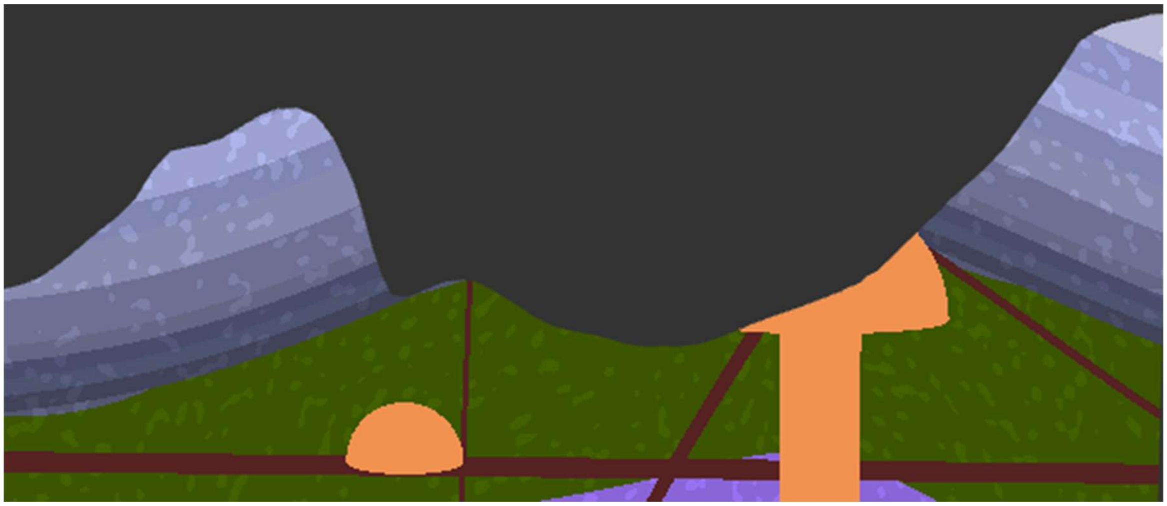
Beneath the surface, magma also intrudes into older rock layers without erupting. These intrusions form plutons (large bodies of magma that cool underground) and dikes (thin sheets that cut across layers). Plutons and dikes can deform or fracture surrounding rock, forming faults or cap rocks that trap underground fluids. These features are not only evidence of past volcanic activity, but they also suggest geothermal energy potential, since heat remains trapped within intrusive rocks long after they solidify.



Detailed geological map of the Cascade Range and the surrounding area. Yellow rings indicate recorded earthquakes, with the size of the rings corresponding to earthquake intensity. Black lines show faults active within past 10,000 years. *Image Credit: U.S. Geological Survey*

Procedure

1. Examine the model cross section of Mount St. Helens:



Based on your observations, do you think the dikes (dark red) and plutons (orange) formed at the same time? Why or why not? How can you tell?

2. Infer the sequence of events using the cross section by numbering each feature below (1 = occurred first, 10 = occurred most recently).

___Beds	___Dike 3	___Pluton 1
___Dike 1	___Dike 4	___Pluton 2
___Dike 2	___Dome	___Unconformity

How confident are you in your answers? Which features were the most difficult to place in the sequence, and why? What additional information or tools would help you feel more confident in determining the correct order?

3. Test your initial interpretation by creating a 3D geologic model in Visible Geology.

    a. Log in to https://www.visiblegeology.com/. If you do not already have a Seequent ID, creating one is quick and free, select 'Create Seequent ID' in the top right-hand corner.

    b. Select "Geology Explorer" once you have logged in.

    c. Use the tools on the left panel to practice creating a geologic model:
        - Layers
        - Events (e.g., dikes, plutons, domes)
        - Topography (select 'new' when in the topography tool to create your own!)

If you need help using the tools in Visible Geology, check out the online help & resources.

    d. Once you are comfortable with the tools, attempt to recreate the simplified model of the Mount St. Helens on the previous page.

    e. Make a cross section of the model using the "xSection" button on the left panel.
        - Select "New." The cross section will appear above your model.
        - Move the red markers around until you are satisfied with where the cross section is taken.

4. Enter a name for the cross-section and select "Apply."

? As you build the Mount St. Helens model, revisit your earlier sequence. Does the modeling process change your interpretation?

5. See how your model compares to a prebuilt, detailed Mount St. Helens model.

6. Open the model with this link: https://bit.ly/VisibleGeology-MtStHelens.

    a. Rotate and examine the model.

How does this model compare to the basic model you created in step 3d?

b. Use the "history" tool on the left panel to review the sequence of events in the model.

How does this sequence compare to the order you proposed earlier? What does this reveal about interpreting geologic time and structure?

Synthesis

Geothermal energy is often found near active volcanoes. Underground magma can heat water and create natural reservoirs of steam. Based on your Visible Geology model and what you have learned about Mount St. Helens, evaluate whether this area could support a geothermal power plant. What evidence suggests geothermal potential? What geologic or environmental challenges might make energy extraction difficult in this location?