



WASHINGTON STATE DEPT OF
**NATURAL
RESOURCES**
WASHINGTON
GEOLOGICAL SURVEY

VOLCANOES

An Interactive Web Guide
for Middle Schoolers



Introduction and Overview

There are thousands of volcanoes on Earth, and hundreds in the United States. There are even volcanoes on other planets, some of which erupt ice (for example, Jupiter's moon, Europa) instead of lava!

Washington State has a handful of active volcanoes, some of which you may already be familiar with. This interactive web guide will lead you through videos, graphics, and pictures on the Washington Geological Survey (WGS) website and our interactive Geologic Information Portal. You will learn what defines a volcano, the different types of volcanoes and their eruptive materials, volcanic hazards, volcano lifespans, and how to be prepared for volcanic hazards when they occur.

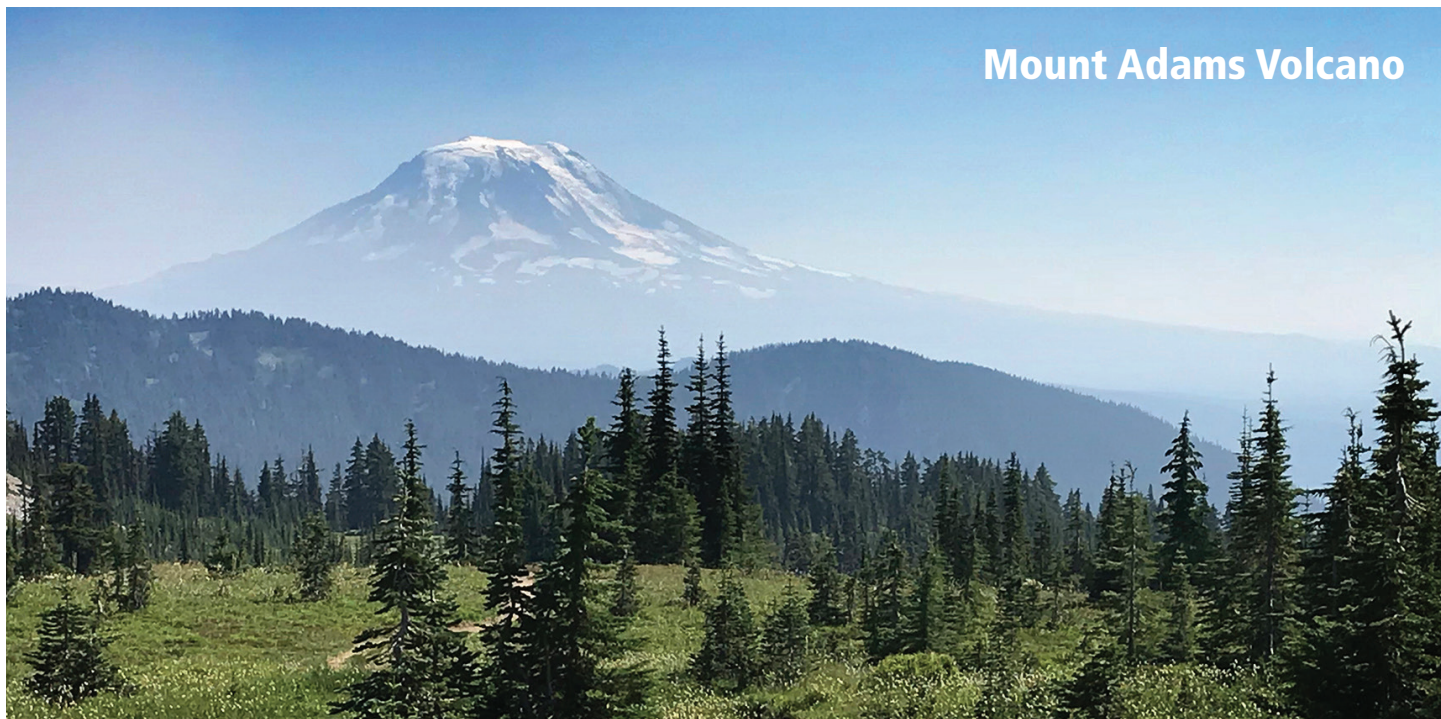
This interactive web guide is aimed at students in grades 6 and up but is useful for all ages. The content includes four sections, anticipated to be worked through in multiple sessions. Each section is 3 to 4 pages long.

- Section 1** "Understanding Volcanoes" covers the basics of volcanoes, and begins on page 2.
- Section 2** "Volcanic Hazards", covers types of volcanic hazards, and begins on page 6.
- Section 3** "Geologic Information Portal", uses the interactive data portal, and begins on page 10.
- Section 4** "Evacuation and Preparation", covers evacuation routes and begins on page 13.

To begin, go to the **Volcanoes and Lahars¹ webpage**, here:



<https://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/volcanoes-and-lahars>



Mount Adams Volcano

¹A lahar is a dangerous mudflow or debris flow, a mix of water and volcanic material that can travel very fast and far.



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What is a volcano?

In this section you will read about different geologic settings where volcanoes are found, compare different types of volcanoes, and learn about volcano life spans. Go to the following webpage:



<https://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/volcanoes-and-lahars#understand-volcanoes.9>

Scroll down and **READ** the information under the tab **What is a volcano?**

- 1) Use the areas below to draw and label a diagram of the Earth's crust at the three types of geologic settings where magma can make it to the surface. *Bonus question: Can you think of a real life example (geographic location) where each of these volcanic settings exist?*

1

2

3

Bonus





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Types of volcanoes

Click on the tab for **Types of Volcanoes** found on the webpage lined above. **READ** about the many kinds of volcanoes and where this variety comes from. **WATCH** the video and read the subsequent sections.

- 2) Take notes below on the properties of each type of volcano you learn about. For example, what is the size and shape of the volcano? What type of lava does it erupt? What are the major hazards from the volcano?

Properties of cinder cone volcanoes

Properties of composite volcanoes

Properties of shield volcanoes

Volcanoes and Lahars

Scroll up to the top of the page and **READ** the text under **Volcanoes and Lahars**, then **WATCH** the video **"How dangerous are the Northwest's volcanoes?"** and answer the following questions. You may need to pause and rewind the video to answer the questions.

- 3) What is an "active" volcano?





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4) How does a volcano life span compare to a human's?

5) Rank the most recent eruptions from the volcanoes in Washington, from youngest to oldest.

Volcanoes: *Mount Baker, Glacier Peak, Mount Rainier, and Mount St. Helens*

Youngest:

2nd Youngest:

2nd Oldest:

Oldest:

6) Which of the volcanoes ranked in the previous question is considered the most active?

7) What was Mount Mazama and what happened to it?





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- 8) What is a “volcano baseline”, also referred to as a volcano’s vital signs, and why is this important?

- 9) When did Mount St. Helens last erupt?



Mount St. Helens
volcano



SECTION 1: Understanding Volcanoes



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Hazard types

In this section, you will learn that every volcano and every eruption is different. Volcanoes can produce eruptions of different sizes, and eruptions can produce different types of hazards. Go to the following webpage:



<https://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/volcanoes-and-lahars#volcanic-hazards.7>

READ the text and answer the questions below.

- 1) Examine the diagram "How much magma erupts?" and click on it to expand it. The largest eruption is from Toba volcano in Indonesia. What was the volume of material involved in the eruption of Toba, in cubic kilometers (km^3) and in cubic miles (mi^3)?

- 2) On the same diagram, find the eruption of Mount St. Helens in 1980. How much material was involved in this eruption? Again, provide your answer in cubic kilometers and cubic miles.

- 3) Based on your answers to the previous questions, how many times larger was the eruption from Toba in question 1 versus the eruption from Mount St. Helens in question 2?





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4) Define the following terms.

Eruption column

Volcanic ash (a type of tephra)

Lava flows

Pyroclastic flows

Lahars

Volcanic landslides

Volcanic gas



SECTION 2: Volcanic Hazards



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- 5) After you've read about the principle types of volcanic products and hazards, think about how far from the volcano they can reach. Separate the types of hazards into two categories, near volcano hazards (those within 10 kilometers/6 miles of the volcano) versus distant volcano hazards (those further than 10 kilometers/6 miles from the volcano).

Volcanic hazards: *Ash, Lava Flows, Pyroclastic Flows, Lahars, Volcanic Landslides, Volcanic Gas*

Near volcano hazards

Distant volcano hazards

- 6) Were any of the hazards you read about surprising or unexpected? Why?

Who is at risk?

Click on the tab for **Who is at risk?** **READ** the text under the header and look at the image.

- 7) Compare the volcanoes in Washington according to the sizes of their hazard zones shown on the map. Do not include the Mount St. Helens 1980 ash plume path for this exercise. You may find that some of the volcano hazard zones are similar sizes. Use the following symbols: = (equals), < (left is smaller, right is larger), > (left is larger, right is smaller) to compare the sizes of the volcano hazard zones to each other. For example: Mount St. Helens = Mount Rainier > Mount Adams.





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Now scroll down to the section **Volcano Hazard Maps**. Pick one of the volcanoes listed on the left and click on its corresponding Simplified Hazard Map.

- 8) You will look at each volcano's hazard map in turn and fill out the table below. Use the scale bar on each individual map to estimate distances.

Volcano Name	How far does the volcanic material spread?	What are the volcanic hazards?

- 9) After looking at all the maps, are there any patterns in the spread of the volcanic material? Are there any geographic features that channel the volcanic materials?





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Geologic Information Portal

You will explore the Geologic Information Portal, an interactive map for displaying different types of geologic data. Go to the following webpage:



https://geologyportal.dnr.wa.gov/#natural_hazards



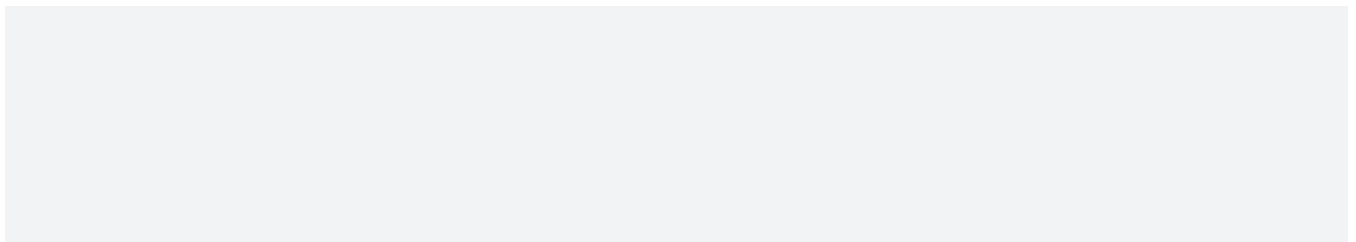
This will take you to the **Geologic Information Portal**. When the portal loads, you will see a box on the left called **Table of Contents**. You can scroll down to see all the different map layers in this box. Be sure to uncheck the Surface Geology layer to remove that information from the map. Then, scroll down to the **Volcanoes** tab and click on the arrow next to the tab to expand it. Turn on the **Volcanic Vents** layer by checking the circle to the left of the name.

Use the + and – symbols in the top left corner or use your mouse to scroll in and out of the map area. Click on the plotted features (the stars) to learn more about them. Once you're done exploring the controls, look to the toolbar on the bottom of the portal. Hover over the tools and click on the one that says **Legend**. It looks like the picture to the right.

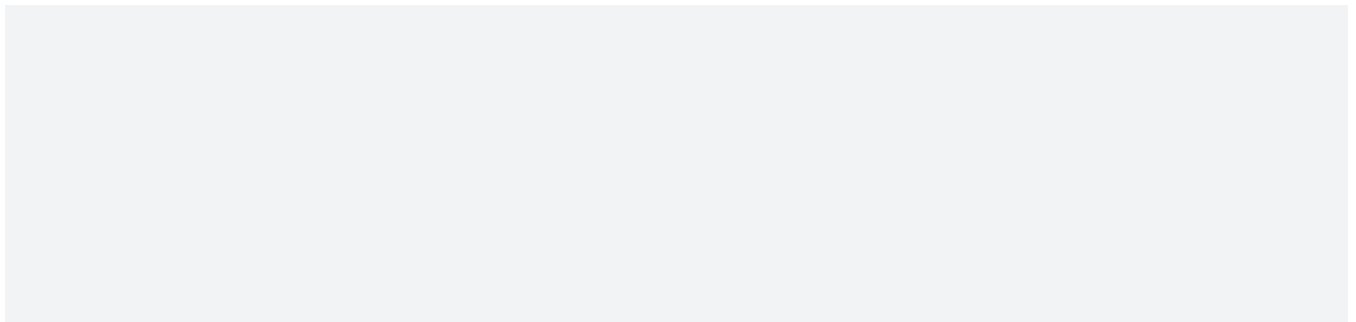


This will help you understand the layer you are looking at and what the colors and symbols mean. For this layer, the symbols are all the same but the colors are different. The different colors group the volcanic vents (recall that a volcanic vent is an opening where magma erupts) into different time intervals.

- 1) Can you figure out by looking at the map whether red is the oldest or youngest time interval?
Explain your reasoning.



- 2) Do you notice any patterns in the arrangement of these vents?





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Now go back to the Table of Contents and turn on the **Volcanic Hazards** layer. You can keep the volcanic vents layer on as well. Look around the map, and look for where the volcanic vents lie in relation to the hazard maps. Some of the vents overlie the volcano hazard maps, but some of them don't.

3) Why do you think some of the vents aren't on the hazard maps?

4) Now turn off the volcanic vents layer so that only the volcanic hazard maps are displayed. Which volcano is the closest to your home? Is your town in the path of a volcanic hazard?

5) Look at the legend to see the types of volcanic hazards posed by each volcano, and compare these hazard types and zones to cities and other populated areas. Which of the volcanoes do you think is the most dangerous? Justify your answer.

Now leave the Portal and navigate back to the main **Volcanoes and Lahars** webpage linked above. Find the section on **Volcanic Hazards**. Click on the tab for **Prediction**. **READ** the text and look at the graph "Recent eruptive history of Washington's active volcanoes". Click the graph to expand it.





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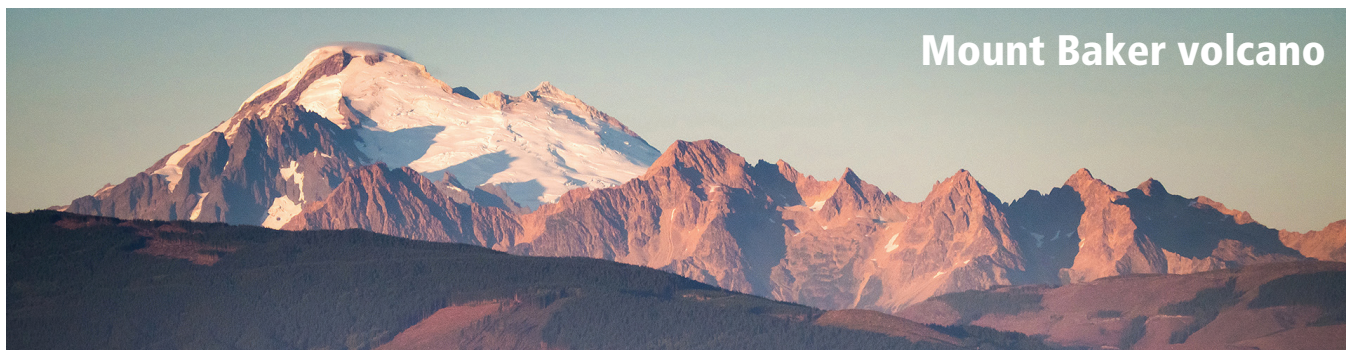


This graph compares the past 6,000 years of eruptive activity at five of Washington's volcanoes. As you already learned, these volcanoes are all older than 6,000 years. The label for "0 years ago" is the present day.

6) Comparing the histories, which volcano appears to be the most active? Why?

7) Which volcano erupted the most recently?

8) Do you still stand by your answer to question 3 in the previous section about which volcano is the most dangerous? Why or why not?



Mount Baker volcano



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Evacuation and Preparation

In this section, you will learn about how people can be resilient in the face of natural disasters. You will learn what steps you can take to prepare yourself for a volcanic emergency, and what you should do if you experience a volcanic emergency in your lifetime. Some of the exercises in this section may be best answered after discussion with your family. Go to the following webpage:



<https://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/volcanoes-and-lahars#evacuation-and-preparation>

READ the text. Fill in the sections below with steps you can take to be safe before, during, and after an eruption.

- 1) Fill in the sections below with steps you can take to be safe before, during, and after an eruption.

Before

During

After





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Now go to the section **Volcano Preparedness Products**.



<https://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/volcanoes-and-lahars#volcano-preparedness-products>



Click on the **Volcanic Hazards in Washington State** booklet to open this document. Go to page 8 of the document, titled "Become Volcano Ready". You should see many small pictures of items to include in your emergency kit.

- 2) Make a list below of these items and other items that you might want in case you need to evacuate for a volcanic emergency.

My emergency kit





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Go to page 11 of the booklet, titled "How to Stay Safe". Read about how to make a communication plan or emergency plan for your family.

- 3) Check your city, county, or tribal emergency management websites to find out what emergency plans are recommended for your area and take notes below. Even if you don't live in an area where you're at risk from volcanic hazards, you can also think about emergency planning more broadly: what if there was a landslide, an earthquake, a tsunami, a flood?

My city/county/tribal emergency management plan

- 4) Make your communication plan. List two out-of-area contacts (names and phone numbers) in case local phone lines are crowded. This commonly occurs locally within an emergency zone from too many simultaneous calls.

1

2

