THE GREAT NORTHWEST

VOLCANOES CAST *LONG* SHADOWS

a lesson about the volcanoes of the Northwest

INTRODUCTION: The Pacific Northwest has many features, but none more important than its legacy of volcanic activity. Much of the region is covered by a very thick layer of basalt, formed from lava flows millions of years ago. It is known as the Columbia Plateau, since this mighty river has cut a gorge through it. The action today, however, lies in the Cascade and Klamath Mountains, home to a long chain of active and dormant volcanoes. In this activity, we will be looking at some of these volcanoes, and the processes by which they were made.

PART ONE: *Plate tectonics*

Look over the National Geographic map "Living on the Edge". The Pacific Northwest is near the boundary of two tectonic plates. What are they?_____and _____.

According to the map, what is happening on this boundary? _____

_____.

You should also notice a long chain of volcanoes running north to south about 100 miles from the coastline. Name three of these volcanoes: _____

Describe briefly how the volcanoes are connected to the plate movements nearby? _____

_____

_____

_____

Make a sketch here of how the subduction of an oceanic plate beneath a continental plate produces volcanic activity. Refer to the USGS article, "Understanding Plate Tectonics" for assistance.

The volcanoes of the Cascade Range of the Pacific Northwest have a reputation of violent eruptions, and they are very destructive. Why are they are so explosive? Why aren't they "quiet" eruptions like the volcanoes of Hawaii?

_____

_____

_____

PART TWO: *The 1980 Eruption of Mt. St. Helens*

Probably the most famous eruption of a Pacific Northwest volcano is that of Mt. St. Helens. (It is by no means the only one we know about, however). Since it happened in recent times, we have many images of the eruption so we can compare the mountain before and after this event.

Log on to the internet and go to the Earthshots website:
http://edcwww.cr.usgs.gov/earthshots/slow/tableofcontents

Once there, scroll and find the link for Mt. St. Helens. Click on it. Briefly read over the description of the eruption and the images shown. Make sure that you know what the different colors represent. List them here:

_____

_____

Look at the satellite images of Mt. St. Helens and the surrounding landscape for the three years shown (1973, 1983, 1996). You can zoom in for a more detailed view. Sketch here what the volcano looks like before and after the eruption:

Observe the differences in color, especially in the valleys around the volcano. What do you see and what does it tell you?

1973: _____

_____

1983: _____

_____

1996: _____

_____

Now look at some of the ground photos taken. What additional information do they give you about this eruption? _____

_____

_____

_____

_____

The mountain was greatly changed by this eruption. In the next part of this lesson, you will make profiles of the volcano as it looked before and after the eruption. And then we will look at the most destructive event of the 1980 eruption - the mudflows.

PART THREE: The United State Geoglogical Survey (USGS) has produced some topographic maps of Mt. St. Helens before and after the 1980 eruption. By matching up contour lines with the vertical axis of a graph, you can produce a **profile** of the volcano. They have done most of the work for you on the pre-eruption map. All you have to do is to connect the dots on the graph.

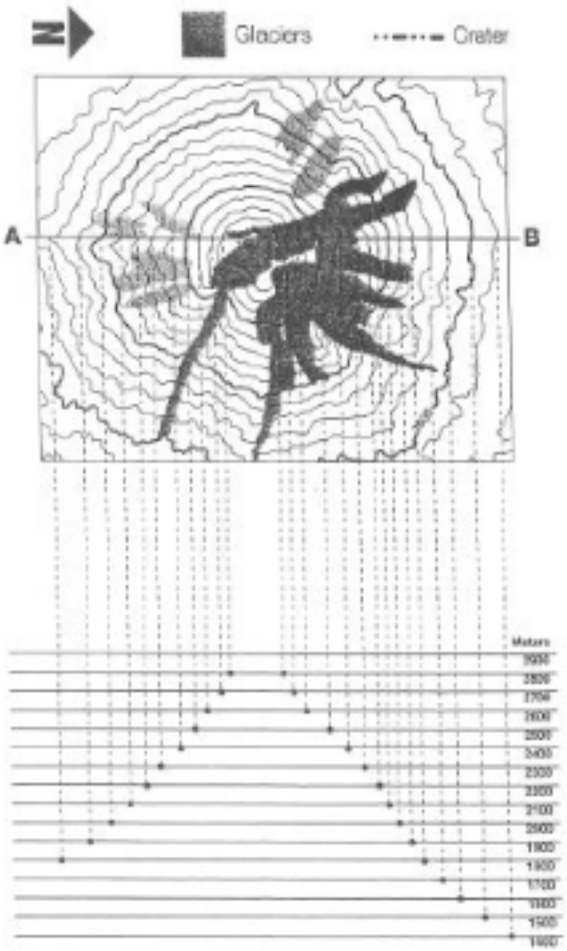
The shape of this volcano is _____.

Now match up points on the post-eruption map and graph, and connect the dots together. Compare the two graphs. State two ways the post-eruption mountain looks different from the pre-eruption one: _____

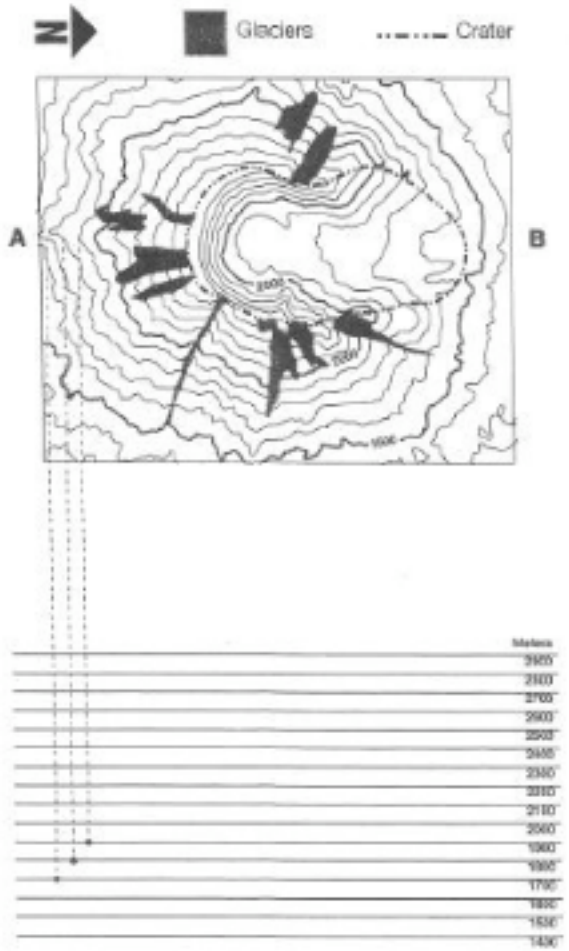
_____

_____

PRE-ERUPTION MAP



POST-ERUPTION MAP



PART FOUR: *The Destructive Force of the Blast*

As you showed on the last part of this activity, much of Mt. St. Helens disappeared during the 1980 eruption. What happened to it?
Look at the photographs taken during different stages of the eruption, as well as diagrams of what was going on beneath the Earth's surface. Describe what you see here:

_____

_____

_____

_____

Like many high peaks, Mt. St. Helens was covered by glaciers at the time of the eruption. The combination of melting ice and hot cinders produced catastrophic mudflows. We will model what happened, using a tarp and a slurry of sand and gravel. **Read** the directions now:

1. Crumple up newspapers and pile them into a conical shape, modeling a volcano, like Mt. St. Helens.
2. Place a tarp over the newspapers. Make sure the tarp is large enough to produce a flat area at the volcano's base. Also, create "hills" and "valleys" on the sides of the volcano.
3. Place bricks or rocks on the base to hold the tarp in place.
4. Create an **avalanche** by filling paper cups with sand. Pour the contents over the top of the volcano. Try it with gravel, and then a mixture of gravel and sand.
5, Now produce a **mudflow**. Mix sand, gravel, and water to make a slurry. Fill the paper cups with the slurry and pour them over the volcano model. Note the path of the mudflow.

After experimenting with "mudflows", write down your conclusions:

(1) Where does most of the mudflow go? _____

_____

(2) How does the mudflow behave differently from an avalanche? _____

_____

(3) How does the size of the particles in an avalanche effect how far it moves? _____

_____

_____

(4) When the avalanche hits a flat area, it _____. How about the mudflow? _____

_____

(5) Why do you think mudflows are so dangerous to areas around the volcano? _____

_____

_____

Where did the mudflows go after Mt. St. Helens erupted? Make your prediction on the map on page 6.

First, you know that the blast was not vertical but directed toward the _____.

That means that most of the material that mixed with the melting ice also went in that direction.

Now shade in the parts of the volcano and valleys below that were affected most by the very dangerous mudflows.

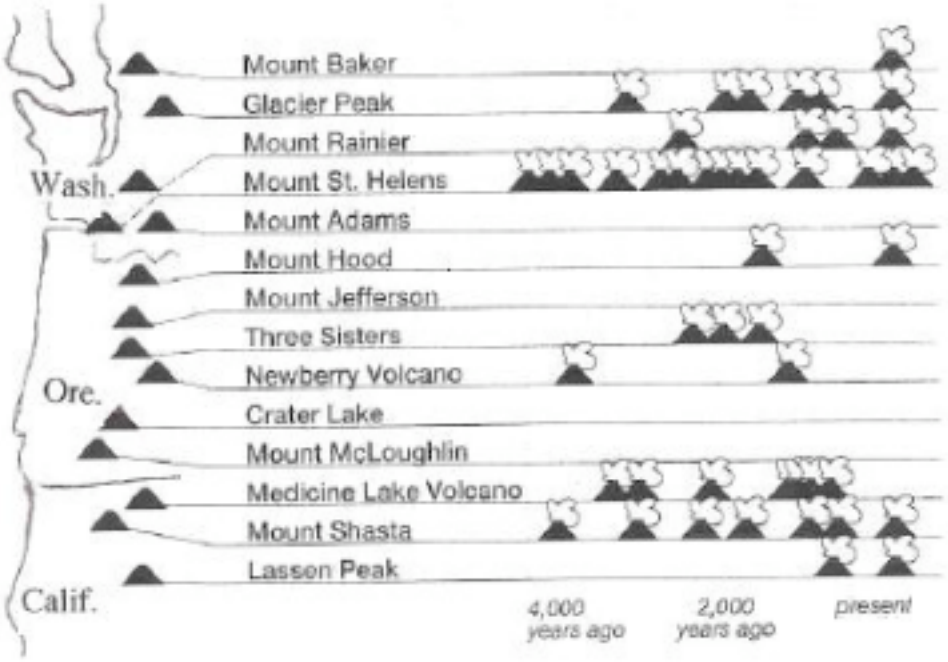
Justify your answer here: _____

_____

_____

PART FIVE: *The Threat from Mt. Rainier*

Mt. St. Helens is only one of many active volcanoes in the Cascade Range. Look at the pictogram below that shows these volcanoes and dates of their eruptions.



What are the four most active volcanoes in the Cascades? _____

_____

Perhaps the most dangerous in the long run is Mt. Rainier due to its location near Seattle and Tacoma, Washington (total population of 2,500,000 people). Its last eruption was around 150 years. In addition, Mount Rainier has five times as much snow and ice as all the other Cascades volcanoes *combined!*

At the end of this packet is a map showing Mt. Rainier and two of its most destructive mudflows from the past, the Osceola and the Electron. Both occured long before cities were built in this region.

Read the map and answer these questions:

Osceloa Mudflow: What valley did this mudflow follow? _____
How many kilometers did it travel? _____ km
Electron Mudflow: What valley did this mudflow follow? _____
How many kilometers did it travel? _____ km

If Mt. Rainier erupted today, what cities would be in grave danger and why? _____
_____
_____

What do you think would be some of the effects on the Seattle-Tacoma region? List them here:
_____
_____
_____
_____
_____

As you have seen, the volcanoes of the Cascades have a great impact on life in the Pacific Northwest. As you will see in math class, they affect climate too. And, as you will see in social studies, people want to live near these volcanoes, despite the dangers. You will try to answer the question "why".