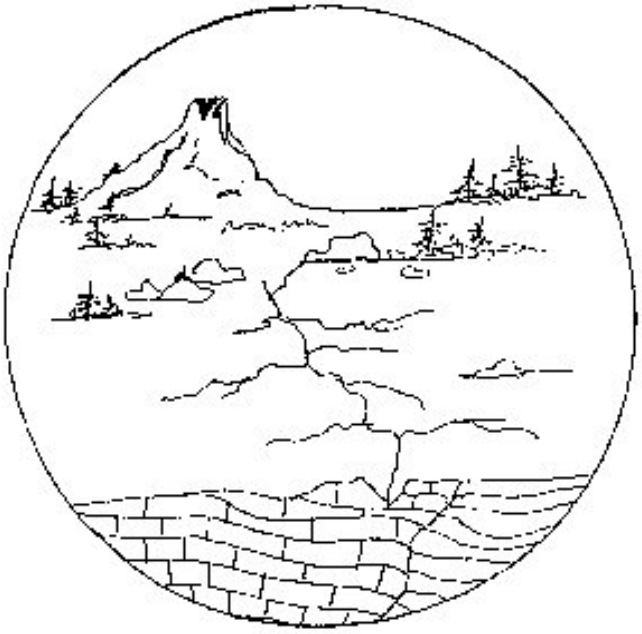
Plate Tectonic Cycle

Earth's Moving Force

SECOND GRADE

VOLCANOES



1 WEEK
LESSON PLANS AND
ACTIVITIES

PLATE TECTONIC CYCLE
OVERVIEW OF SECOND GRADE

VOLCANOES

WEEK 1.
PRE: *Investigating the parts of a volcano.*
LAB: *Comparing the parts of a volcano to different types of models.*
POST: *Discovering that volcanoes occur around the world.*

EARTHQUAKES

WEEK 2.
PRE: *Discovering earthquake faults.*
LAB: *Tracing a fault map of the San Francisco Bay Area.*
POST: *Exploring how deep you can drill into the Earth.*

PLATE TECTONICS

WEEK 3.
PRE: *Exploring how the Earth's outermost portion moves.*
LAB: *Exploring the results of movement on the Earth's crust.*
POST: *Exploring how plates have moved through time.*

HAZARDS

WEEK 4.
PRE: *Discovering how to think during an earthquake.*
LAB: *Assessing what a mayor should do during a strong, moderate, and weak earthquake.*
POST: *Analyzing earthquake safety at home.*

PLATE TECTONIC CYCLE - VOLCANOES (2)

PRE LAB

Students draw and compare parts of volcano.

OBJECTIVES:

1. Investigating the parts of a volcano.
2. Distinguishing between magma and lava.

VOCABULARY:

crater
lava
magma
vent

MATERIAL:

paper
crayons

Ponza, Italy, remnants of ancient volcanic eruptions.

BACKGROUND:

Volcanic eruptions provide clues for understanding what is happening to the outer part of the Earth. Volcanoes are evidence that the Earth is restless, especially within the crust and upper mantle. The source of the molten rock, which geologists call magma, is actually not the center of the Earth, but primarily the top 100 km (crust and upper mantle) of the planet. Since we cannot drill holes this deep, volcanic rocks provide important information about rocks and processes on the outer portion of the Earth.

Most volcanoes help geologist define the edges of plate boundaries. The plates are the outer, rigid, solid rock skin of the Earth. They are composed of the Earth's crust and upper mantle. The plates move through time. Plates have moved together, away, and slide past each other. These motions generate volcanoes and earthquakes. Volcanoes are most common where plates come together (converging) and pull apart (diverging).

The parts of a volcano include a reservoir of magma inside the Earth, called a magma chamber. The magma chamber is connected to the surface of the Earth by one or more vents. The magma moves upward through the vent because the magma is less dense than the surrounding rock. It breaks through the surface of the Earth at the volcano's crater. If the lava is liquid enough it will cause a lava flow.

There are many different types of volcanoes, reflecting the different compositions of magma and types of eruptions. Different vulcanologists (people who study volcanoes) sometimes classify them differently. In our scheme we use the simplified U.S. Geological Survey classification.

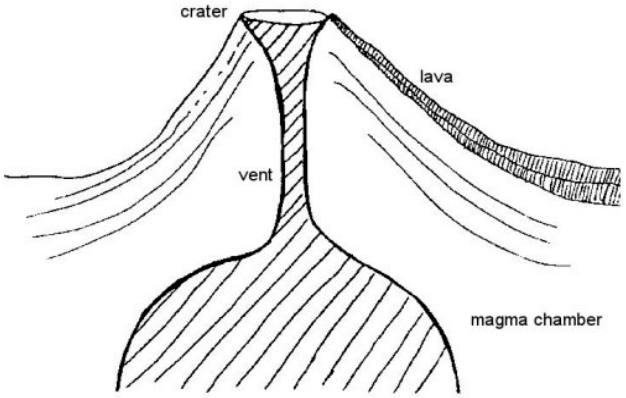
A volcano that is composed completely of lava is called a shield volcano. Kilauea in Hawaii is an example. A composite volcano, like Mt. St. Helens in Washington is composed of lava and other volcanic rocks like scoria, ash, and volcanic breccia that are formed by explosive eruptions. A cinder volcano is composed of just scoria (cinder is an old term for scoria) and ash.

PROCEDURE:

1. Inform students that this lesson will start a unit on Plate Tectonics, or the study of earthquakes, volcanoes, and moving plates. Ask the students if they remember what a plate is. If they do not know, tell them that over the next few weeks they will learn! Explain that a plate is a part of the crust and upper mantle that "floats" on a layer of more liquid rock (asthenosphere). Remind students that the plates move, and that plate motion causes volcanoes, earthquakes, and mountain ranges. This happens most often at the edges of plates, at plate boundaries.

2. Draw the picture on the right. Explain the different parts of a volcano to the class.

Have the students copy the words onto the picture on their worksheet. Have them color their pictures. Ask them to use their imaginations. Hang their completed pictures around the classroom.



3. The main concept for the students to learn is that hot molten rock is called magma when it is inside the Earth, and that when the hot molten rock reaches the surface of the Earth it is called lava. They should also learn the other parts of a volcano described above.

4. Ask the children if there are any major chemical differences between magma and lava from the same volcano. The answer is "no." Geologists give magma and lava separate names to signify whether the molten rock is located inside or outside of the earth. The difference between magma and lava is apparent when the molten rock cools. When magma cools inside the Earth, it has large minerals, because it cools slowly. Lava has very small minerals because it cools quickly.

5. To help the students understand the difference in appearance between lava and magma, use an analog that they can relate to. For example, an unfrosted chocolate cake looks different on the inside than on the outside. The inside of the cake is airy and full of holes, this can be related to magma. The outside of the cake is solid and dry, this can be related to lava. However, even though the inside and outside appear different, they both come from the same recipe, as did both the magma and lava.

PLATE TECTONIC CYCLE - VOLCANOES (2) PRE LAB

LABEL THE PARTS OF A VOLCANO AS YOUR TEACHER WRITES THEM ON THE BOARD. COLOR THE VOLCANO.

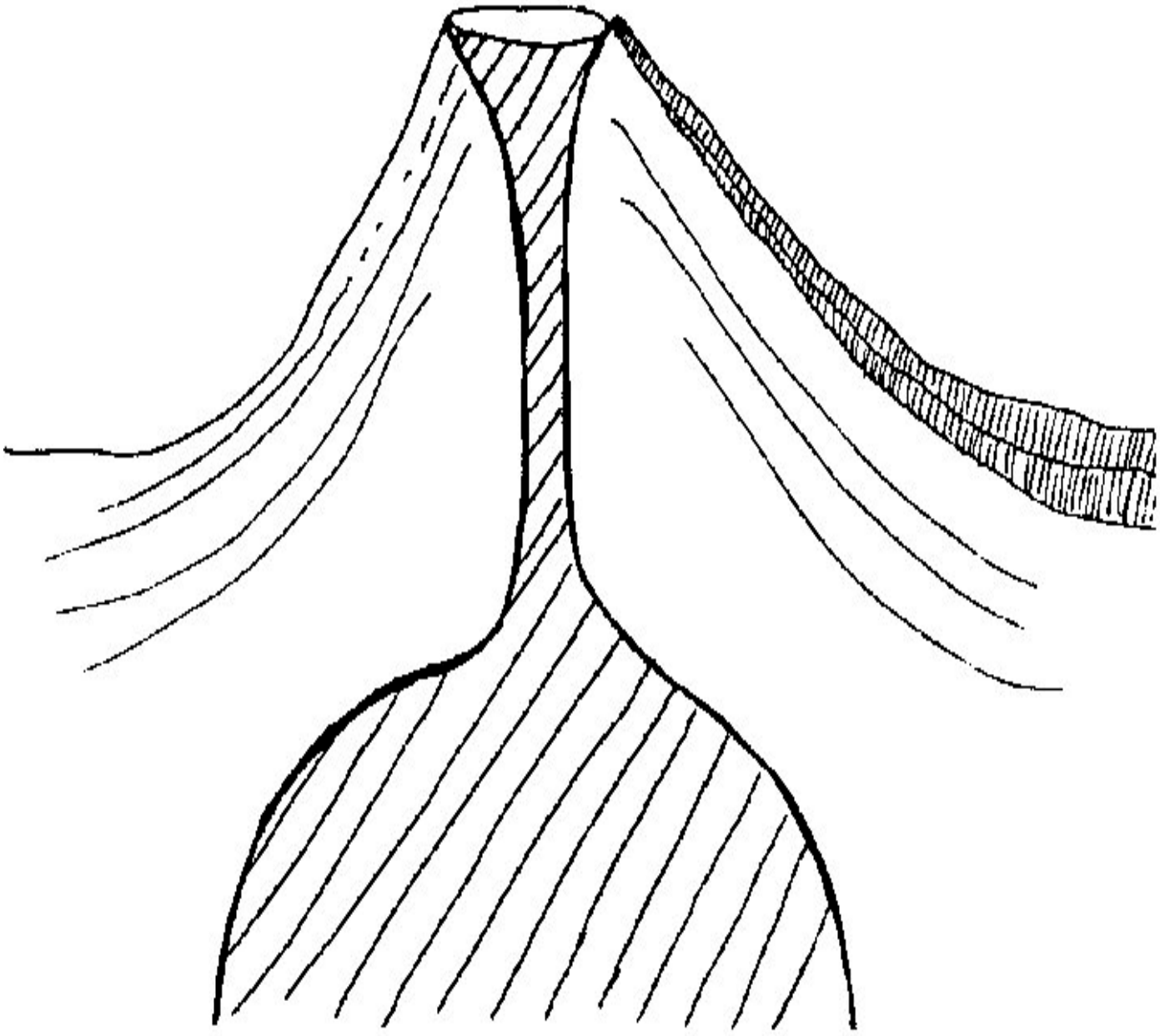


PLATE TECTONIC CYCLE - VOLCANOES (2)

LAB

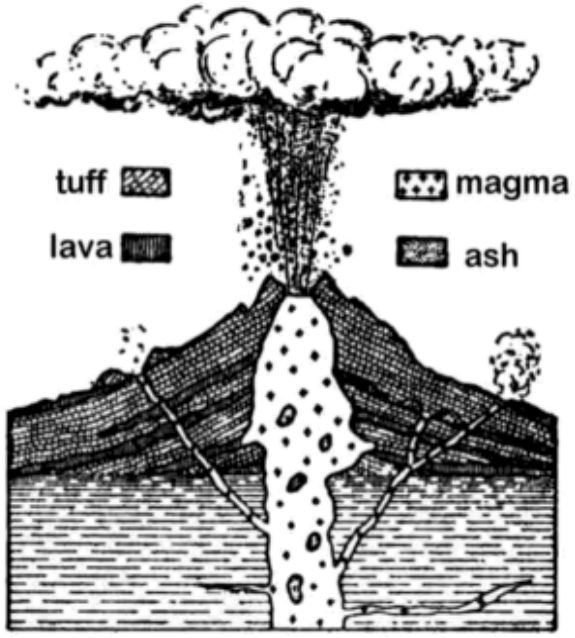
Students create analogs for lava and magma.

OBJECTIVES:

1. Exploring the products of a volcano.
2. Comparing the parts of a volcano to different types of models.

VOCABULARY:

ash
crater
lava
magma
vent
volcanic mud



MATERIALS:

lab sheet
toothpaste
vinegar
baking soda
flask (or graduated cylinder)
pan
model volcano
pictures of recent volcanoes (Internet)

BACKGROUND:

Volcanoes are a subject that fascinate young and not so young students alike. The power and the mystery of a volcanic event is truly an earthy phenomena. Students sometimes have a difficult time understanding that the shape of a volcano grows or builds up through time and it builds from the inside out. Eruption after eruption builds a mountain like structure,

The various styles of eruptions and magma compositions build different types of volcanoes. Young children have a difficult time understanding how an eruption occurs. In this lab, students are asked to look at analogs for a couple of eruptive styles that may be more familiar to them. In later grades, students will be exposed to other eruptive styles

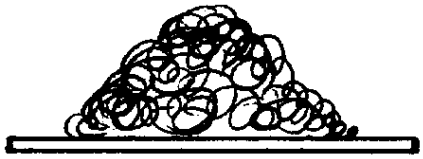
Models can help students understand a subject if used correctly. However, most models are not to scale nor totally correct. In this exercise students will look at different "models" of a volcano and try to decide which parts are analogous to a real volcano.

PROCEDURE:

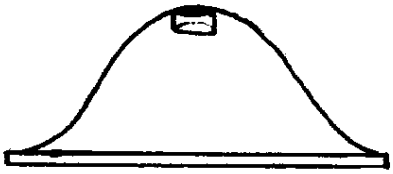
1. Build a large volcano model prior to lab.

MATERIALS: large flat wooden surface (2'x 2'), newspaper, Plaster of Paris(5-7 lbs.), old plastic bucket, spray paint, empty tuna can or jar with lid. If you wish to make a smaller model, reduce the amount of materials.

STEP 1. Crumple up newspapers into balls, and tape them to the wooden surface in the shape and size of the volcano you plan to build, as drawn to the right.



STEP 2. Mix about 5-7 lbs of Plaster of Paris in the bucket with enough water to form a pasty texture. Mold the Plaster of Paris over the crumpled paper into the shape of a volcano. Place the tuna can inside the top of the volcano. See figure to the left. **Note** - Plaster of Paris dries very quickly. You have approximately 15-25 minutes to work with it before it becomes hard.



STEP 3. Allow the volcano to dry completely, then paint and create your own volcanic scenery.

2. Show the students different pictures of volcanoes around the world. You may use the pictures provided or find pictures from the internet.The following sites may be helpful:

www.meto.umd.edu/~jose/VOLCANOES/volcpage.html

This site has good pictures, including a simulated 3-D column of ash erupted out of a volcano.

http://volcano.und.nodak.edu/vwdocs/current_volcs/current.html

Information on currently erupting volcanoes around the world, with links to each site.

http://www.geo.mtu.edu/volcanoes/

University of Michigan volcano sites around the world.

http://vulcan.wr.usgs.gov/home.html

Excellent information on US volcanoes, as well as plate tectonics and geologic hazards.

http://www.norvol.hi.is/

The volcanoes of Iceland and their eruption histories.

3. As you show the images, review the parts of volcano. A crater is the large area at the top; ash is pulverized volcanic rock which can either be in the air or a coating on the surrounding area, lava flows down the sides of the volcano; magma is molten rock while it is inside the volcano; and the vent is the actual opening by which the lava and ash come out.

4. The vocabulary words reflect the different parts of a volcano and some of the

volcanic materials that are erupted. However, note that not all volcanoes show all of these characteristics at one time. For example, in 1980 Mt. St. Helens ejected ash and volcanic mud, not lava. In contrast, the ongoing eruptions at Kilauea in Hawaii produce mainly lava.

5. Set up the following items at each student station: a) a realistic model of a volcano; b) toothpaste; c) vinegar, baking soda, and a small flask in a pan. The realistic model should be made before hand using the instructions on the following page.

6. Demonstrate an “eruption” to the students with the large model. Erupting the volcano requires that you place about 3 tablespoons of baking soda in the "crater". Pour about 1/4 cup of vinegar onto the baking soda in the “crater”. The mixture will foam vigorously, and produce a strong smell.

Another chemical that can be used for the eruption is ammonium dichromate. This compound must be ignited. It is more visual and a much better eruption analog, but some scientists feel it maybe carcinogenic. It can be purchased at a chemical supply house. The ammonium dichromate produces ash and fire, but also produces a mess!

After you create the volcanic eruption, explain to the students that the explosion was a model of how some volcanoes erupt. Emphasize that volcanoes are not all the same. The following diagram can help show students how to compare the model with a real volcano.

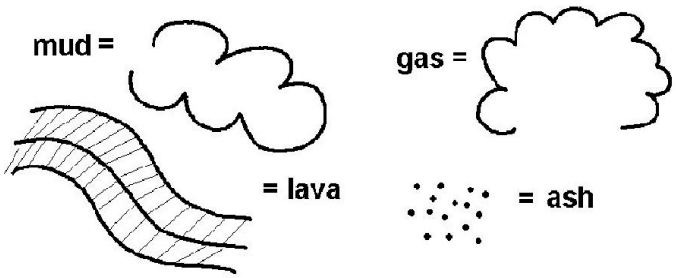
MODEL (ammonium dichromate)	MODEL (vinegar+ baking soda)	MT. ST. HELENS	HAWAII
emits gas	emits gas	emits gas	emits gas
smells	smells	sulfur odor	sulfur odor
sound	fizz	violent	quiet
no fire	no fire	no fire	red hot lava
ash	no ash	lots of ash	little ash
cone shape	no shape	ash cone	lava cone

7. Tell the students that they are going to make their own volcanic eruptions, using the materials at their stations. Instruct them to squeeze the tube of toothpaste to cause an “eruption”. The toothpaste inside the tube represents magma, outside it is “lava”. The students should only "erupt" the tube of toothpaste once.

Next, have the students place a little baking soda in the flask, and then pour in an appropriate amount of vinegar. The mixture will foam vigorously, like an explosive eruption. Test this procedure in advance with your materials; this will determine the

appropriate measurements for baking soda and vinegar to give to your students.

8. After they have completed these experiments, have the students draw a line connecting the words magma, lava, ash, or mud to its appropriate part of the picture on their worksheets. On the 4th diagram, have the students draw a volcano with all of its components. Assist their drawing skills by putting the symbols to the right on the board.



9. The important point to emphasize is that models are used to help understand how real volcanoes work. It will be difficult for the students to determine whether the right answer in some cases. The exercise should get students to think about and justify their answers.

A fluid lava flow in Hawaii

Mt. St. Helens during its eruption!

A fountain of very hot magma.

Mt. St. Augustine erupting in 1986.

PLATE TECTONIC CYCLE - VOLCANOES (2) - LAB

ash crater

mud

vent

magma lava

ash crater

mud

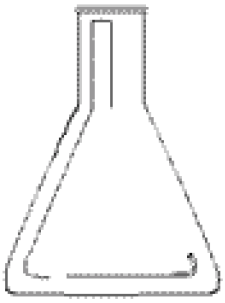
vent

magma lava

(draw)

ash crater

mud



vent

magma lava

(draw)

ash crater

mud

vent

magma lava

PLATE TECTONIC CYCLE - VOLCANOES (2)

POST LAB

Students look at a map and locate volcanoes.

OBJECTIVES:

1. Discovering volcanoes that occur around the world.
2. Identifying volcano parts.

VOCABULARY:

crust
erupt
mantle
volcano

Mt. Fuji in Japan

MATERIALS:

worksheet
crayons
world map
Physiographic Relief Globe

BACKGROUND:

The fire and flames that are associated with volcanoes have always fascinated children and adults alike. How can the Earth produce such spectacular scenes? Where does it all come from? Do all volcanoes produce fire? These are complex questions that need much more science background than your children have at this grade. However, you can explain that the Earth is restless inside (not in the center of the Earth, but in the outer portion of the crust and mantle) and has to "relieve" itself in some way. Just like people burp, The Earth burps volcanoes because its internal stomach is upset. Some volcanoes have lava that is so hot it looks like flames as it erupts from the volcano. The "fire" is actually molten rock, or magma.

All volcanoes do not create lava flows. Some produce finely broken up rocks or ash. This ash sometimes mixes with melted ice, resulting in large mudflows. This happened when Mt. St. Helens erupted in 1980.

Volcanoes do not erupt randomly on the Earth's surface. If you look at a map, you can generally see a pattern. For example in the Pacific Ocean region, volcanoes seem to be along the coastal areas from the west coast of North and South America to the east coast of Asia. This area is referred to as the "Ring of Fire." Students will later understand that these volcanoes help to define plate boundaries. The Ring of Fire, for example, is a zone of convergent plate boundaries, where two plates come together. In this setting, one

plate sinks into the Earth, causing much magma, and hence volcanoes, to form.

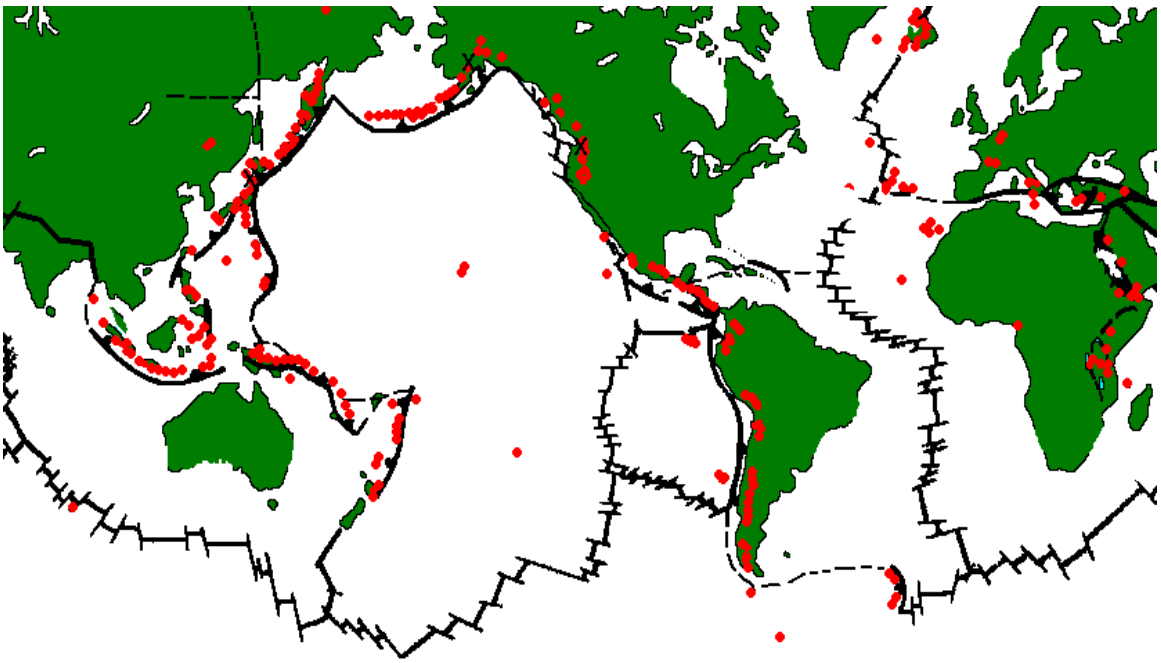
PROCEDURE:

1. Discuss the following volcanoes, each of which represents a point along the "Ring of Fire." Show the general location of these volcanoes on a world map, or use the map and images on the following pages. Explain that along the edge of the Pacific Ocean there are many active volcanoes--hence the name "Ring of Fire."

Mt. St. Helens, Washington - erupted in 1980 in western Washington, presently is building up a lava dome

Mt. Fuji, Japan - has not erupted violently in centuries, it is sleeping until it erupts one day

Mt. St. Augustine, Alaska - recently erupted in 1989 in a violent explosion, located along one of the Aleutian islands in southern Alaska



Red dots show active volcanoes throughout the world.

2. Using the dot to dot sheet that follows, have the students color in the volcano. You may want them to label the outside parts of the volcano, using the words that they discovered in lab. In this volcano there is gas, ash, and lava. Use the physiographic relief globe to show students that the magma comes from the upper mantle and crust.

3. Instruct the students to imagine that their drawing is one of the volcanoes in the "Ring of Fire." Have students make a circle (= Ring of Fire) sitting on the floor. Have them randomly "erupt." Discuss that this situation is similar to what is happening along the “Ring of Fire”.

PLATE TECTONIC CYCLE - VOLCANOES (2) POST LAB