

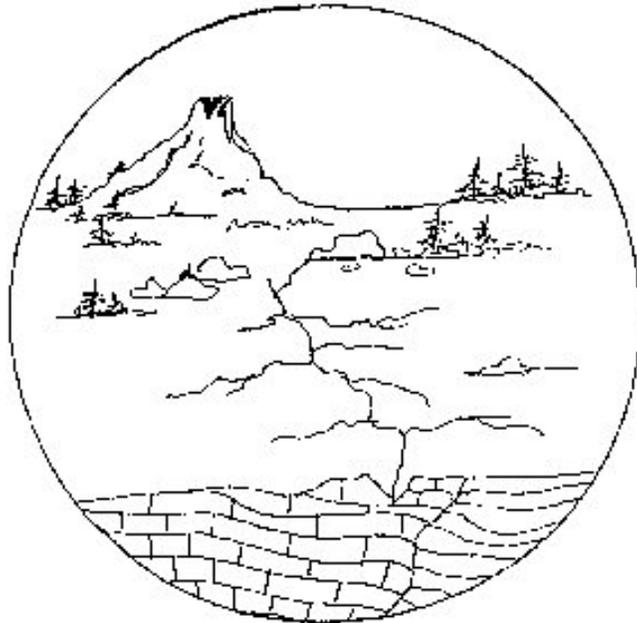


Plate Tectonic Cycle

Earth's Moving Force

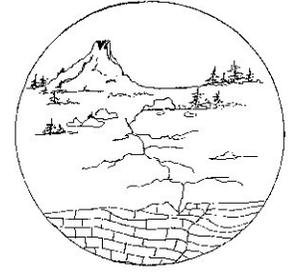


SIXTH GRADE VOLCANOES



1 WEEK
LESSON PLANS AND
ACTIVITIES

PLATE TECTONIC CYCLE OVERVIEW OF SIXTH GRADE



VOLCANOES

WEEK 1.

PRE: *Comparing the structure of different types of volcanoes.*

LAB: *Plotting 3 different types of volcanoes on a globe.*

POST: *Researching where volcanoes occur around the world.*

EARTHQUAKES

WEEK 2.

PRE: *Comparing energy waves from earthquakes.*

LAB: *Experimenting with energy waves through different substances.*

POST: *Observing fault movements.*

PLATE TECTONICS

WEEK 3.

PRE: *Locating different plates.*

LAB: *Illustrating the difficulty in defining and counting plates.*

POST: *Observing the movement of the Earth's crust.*

HAZARDS

WEEK 4.

PRE: *Comparing earthquakes in Alaska and Hawaii.*

LAB: *Designing structures that withstand different earthquake intensities.*

POST: *Comparing earthquake dangers in different areas.*

PLATE TECTONIC CYCLE - VOLCANOES (6)

PRE LAB

Students review different types of volcanoes.

OBJECTIVES:

1. Plotting volcanoes to help locate certain plate boundaries.
2. Comparing the structure of different types of volcanoes.

VOCABULARY:

cinder cone
composite
crater
lava
magma
shield
vent



Mt. St. Augustine in Alaska

MATERIALS:

world map placemats
inflatable world globe

BACKGROUND:

The Plate Tectonic Cycle begins with the study of volcanoes. Plate Tectonics is a theory developed by geologists that explains the movements of the Earth's crust and outer mantle. These two layers make up the Earth lithosphere or the outer shell of solid rock. The lithosphere is about 100 kilometers thick. Plate Tectonics also explains the origin of many geologic phenomena, including volcanoes and earthquakes. Conversely, the

occurrence of both volcanoes and earthquakes provide data for understanding more about Plate Tectonics. In the sixth grade labs, students will focus on plotting data and interpreting results.

The theory of plate tectonics helps explain why and where volcanoes occur. The plates move, and interact at their edges, or boundaries. This creates melting, especially at convergent (where two plates come together) and divergent

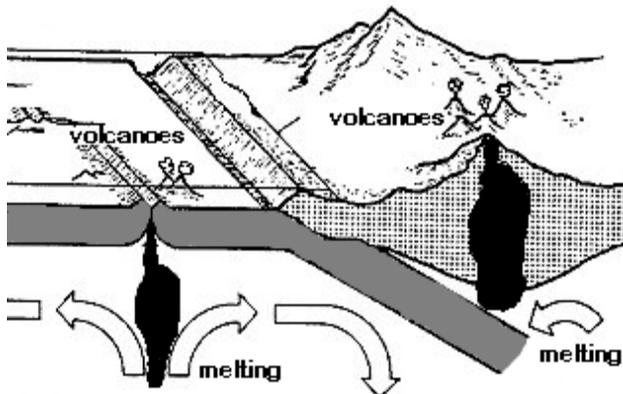
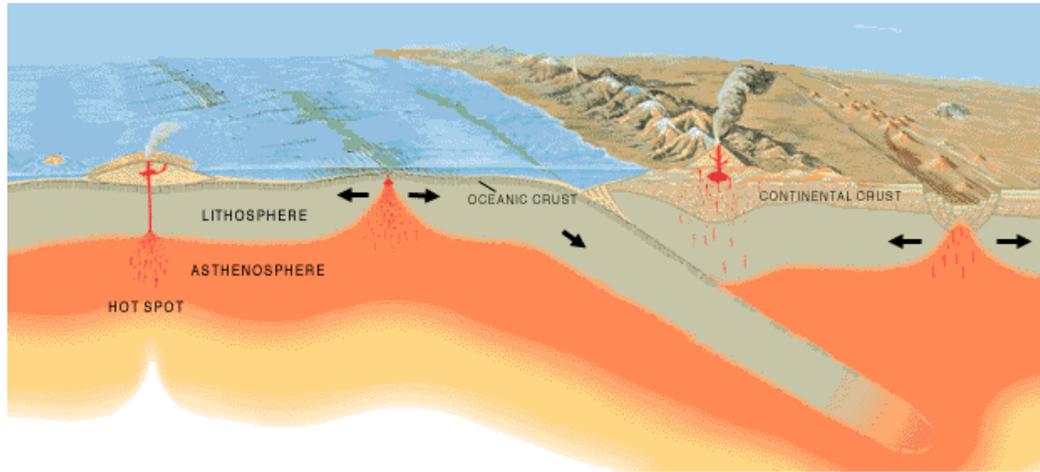


Figure 1.

(where two plates move apart) plate boundaries, as shown in figure 1. . Magma is less dense than solid rock, so it will rise towards the Earth's surface. When it reaches the surface, it causes an eruption.



However, some volcanic action, such as that in the Hawaiian Islands, does not fit the plate tectonics model. Hawaii is in the middle of the Pacific Plate, not at a plate boundary. This and other volcanoes that occur within the plate and not at the edges (intraplate) are probably caused by hotspots, which are magma sources in the Earth's mantle below the plates. Hotspot magma generation is not fully understood. In the lab, the students will plot the locations of several volcanoes at convergent plate boundary and intraplate settings.

We distinguish three shapes of volcanoes. First, a shield volcano is composed of lava. The name shield describes the low, broad structure of the volcano, like an inverted shield. The Hawaiian volcanoes are shield volcanoes. Second, a cinder cone is a steeper structure and is composed of cinders (or finely pulverized rock) that were explosively erupted from the volcano. Finally, a composite volcano is composed of mixed layers of ash and lava. Composite volcanoes are frequently much higher than shield volcanoes, but not as steep as cinder cones. Mt. Shasta in California, and Mt. Fuji in Japan are examples of composite volcanoes.

PROCEDURE:

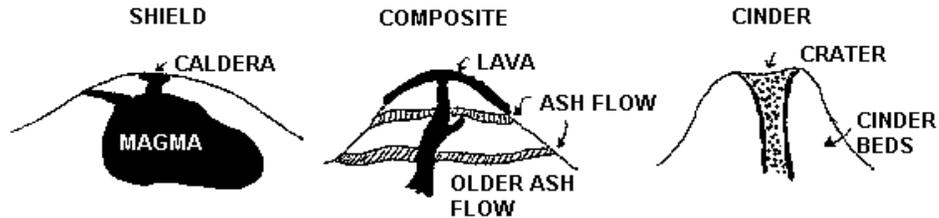
1. Review with the class that earthquakes and volcanoes provide data for geologists that can be used to interpret the Earth's processes, such as plate movement. Have the students locate the following states and countries on their map or globe: Oregon,



Parcutin, Mexico.

Washington, California, Italy, Philippines, Japan, Hawaii, Iceland, Alaska, Indonesia, Arizona, Nicaragua, Mexico, and Chile. This will help them locate them quickly when they complete the lab.

2. Discuss the 3 types of volcanoes by going over the diagrams shown below. See if students can name the parts of the volcanoes before you label them. Ask them to think



about whether there is a distribution pattern of volcanoes or do these different types occur in the same places. In lab, they will discover there is no pattern that can be found. Let them discover this in lab. This lab is an example of a "null" hypothesis, a problem whose answer is no.

3. Review with students the different types of eruptions that they may have learned from previous years. The following pictures may be helpful.



Volcanic bombs



Lava from a quiet eruption.



Magma with a high gas content will create vesicular volcanic rocks (with holes).



Mt. St Helens violent eruption releasing ash and volcanic bombs.

PLATE TECTONIC CYCLE - VOLCANOES (6)

LAB

OBJECTIVES:

1. Plotting 3 different types of volcanoes on a globe.
2. Determining if composite, shield, or cinder cone volcanoes have a world wide pattern.

VOCABULARY:

cinder cone
composite
shield

MATERIALS:

lab sheet
Inflatable World Globes
World Placemats
stick on dots or note paper

Students plot data to distinguish a pattern in the locations of volcanoes.

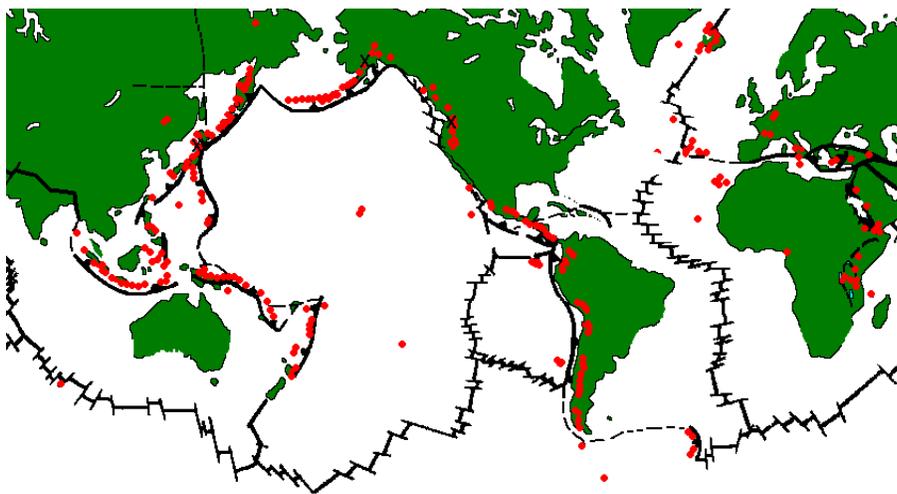


Mt. Fuji, Japan

BACKGROUND:

In the Pre Lab, students learned that there are 3 basic types of volcanoes. Cinder cones make a structure from cinders; shield volcanoes are generally made from lava; and composite volcanoes are composed of layers of cooled lava and ash.

In this lab, students plot the locations of examples of all three types of volcanoes



Ring of Fire

on a world map to see if there is a global pattern. The students should be somewhat familiar with terms like, "the Ring of Fire," the circum-Pacific area where volcanoes are more prevalent than in other areas. They should also have a feeling for where the volcanoes occur within this area. In North, Central, and South

America the volcanoes occur on the west coast of each country. In Alaska and the Asian mainland, the volcanoes are located more along the southern edges of the land. In Japan, Indonesia, and other parts of the South Pacific the volcanoes are on the eastern side of the countries. In the lab, the students will not be able to see the exact location of the volcano, so they must put a dot in its general location.

PROCEDURE:

1. Review the three types of volcanoes, and any other terminology that you feel is necessary.
2. Tell the students that they will be using a globe or map to plot the different types of volcanoes on the map. Have them blow up the globes if they are using them.
3. Instruct them to put the number of the volcano on a stick-on dot, and to plot the location of the volcano on the globe or placemat.
4. Ask the students if there is a visible pattern in the locations of the three types of volcanoes, or if they are randomly dispersed. The answer is no, the 3 different types of volcanoes have no pattern. The only pattern is that many volcanoes occur along the "Ring of Fire" in the Pacific Ocean.
5. A map which shows the locations of the volcanoes in the lab is on the next page. Use this to guide the students' answers.

PLATE TECTONIC CYCLE - VOLCANOES (6)
LAB

VOLCANOES OF THE WORLD

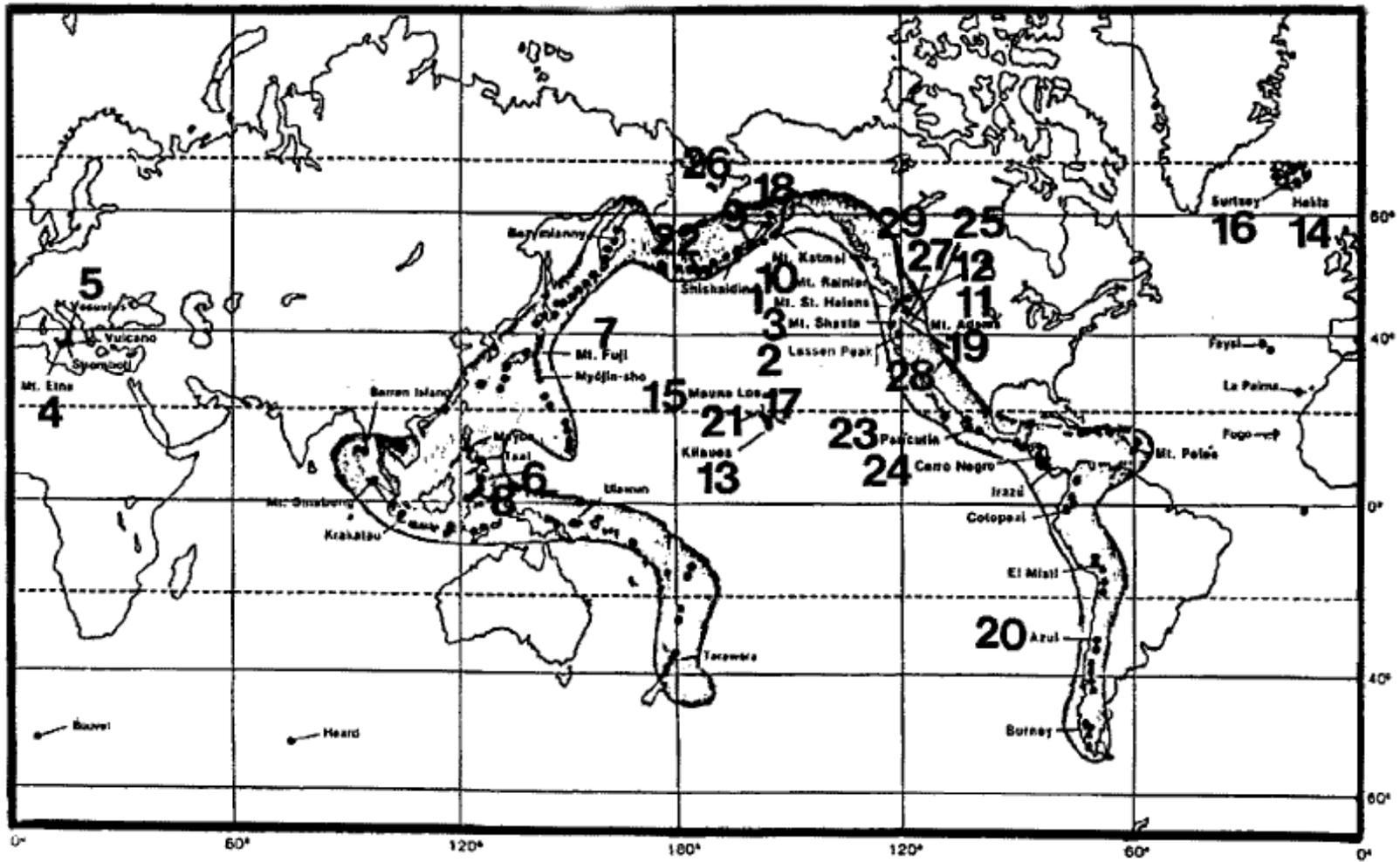


PLATE TECTONIC CYCLE - VOLCANOES (6) LAB

PROBLEM: Do the different types of volcanoes occur in certain areas around the world?

PREDICTION: _____

PROCEDURE:

Locate the following volcanoes on the map or globe provided. Use three colors of stick-on dots, use one color for composite, one for shield, and one for cinder cone. Put the number of the volcano you are plotting on the dot, and then locate the dot on the map or globe and decide if you can see a pattern. The class will then discuss this to see if there is a world wide pattern.

COMPOSITE
COLOR OF DOT

1. Mt. St. Helens, Washington
2. Mt. Lassen, California
3. Mt. Shasta, California
4. Mt. Etna, Italy
5. Mt. Vesuvius, Italy
6. Camignin, Philippines
7. Mt. Fuji, Japan
8. Lado, Philippines
9. Mt. St. Augustine, Alaska
10. Mt. Rainier, Washington
11. Mt. Adams, Washington
12. Glacier Peak, Washington

SHIELD
COLOR OF DOT

13. Kilauea, Hawaii
14. Helka, Iceland
15. Mauna Loa, Hawaii
16. Surtsey, Iceland
17. Mauna Kea, Hawaii
18. Level Mt., Alaska
19. Newberry, Oregon
20. Azul, Chile
21. Hualalai, Hawaii
22. NunNak Island, Alaska

CINDER CONE
COLOR OF DOT

23. Parcutin, Mexico
24. Cerro Negro, Nicaragua
25. Brown Mt., Oregon
26. St. Paul Is., Alaska
27. Sand Mt. Field, Oregon
28. Sunset Crater, Arizona
29. Jordon Craters, Oregon

Type of map projection used. _____

CONCLUSION:

Do you see a pattern? _____ Explain in detail. _____

After the class discussion, did you see a pattern? _____

PLATE TECTONIC CYCLE - VOLCANOES (6)

POST LAB

Students research active volcanoes.

OBJECTIVES:

1. Researching where volcanoes occur around the world.
2. Comparing the different areas where volcanoes occur.

VOCABULARY:

converging
diverging
plate tectonics

MATERIALS:

worksheet
relief map of the world
Internet
other publications that list
volcanic eruptions



BACKGROUND:

Volcanic eruptions occur continuously around the world. They have also occurred throughout geologic time. The Earth has been restless since it was created 4.5 billion years ago, so we can assume that volcanoes were a basic building unit of the original Earth. Volcanoes were and are important to the development of the Earth. Lava produced the crust when the Earth was forming. Volcanoes also produced much of the Earth's water. Hydrogen and oxygen chemically combined inside the Earth, and the resulting water molecules "outgassed" from volcanoes as steam into the atmosphere.

The Post Lab is a research activity. The students will find recent eruptions listed in reference material or on the Internet. They will then plot their findings on a classroom map. The pattern that they will find is that most volcanoes are created at diverging and converging plate boundaries.

As described in the Pre Lab background, most volcanoes occur at convergent or divergent plate boundaries, and at a few intraplate settings. Only convergent boundaries where subduction (one plate sinks beneath another, creating much magma) produce volcanoes. Convergent boundaries where collisions take place produce little magma. Divergent plate boundaries probably have the most volcanic activity in the world, but most of these are located within the oceans, and are unknown. Intraplate volcanoes are caused by hotspots, and can occur anywhere.

There are many ways to format this assignment. Enclosed is an example of how the students can collect the data from their reference material. Alternatively, you may want the students just to find locations on a map, and not to copy all the information down.

PROCEDURE:

1. Review the settings of volcanoes with the class.

2. Give the class their assignment. Have each group of students find 3-5 volcanoes in the library or on the Internet. You may want to assign particular geographic areas to different students or student groups. If you assign Internet research, here are a few sites to start with or have students conduct their own search.

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/>

Michigan Technological University - volcano sites from around the world.

<http://www.usgs.gov>

The US Geological Survey website. Excellent information on US volcanoes, as well as plate tectonics and geologic hazards.

3. Have each student group share their information with the rest of the class. Have the students plot their findings on the classroom map. If you are using the relief map, make sure that the students notice that volcanoes are usually on mountainous areas, but that not all mountains are volcanoes.

The students will notice that volcanoes are more abundant in the circum-Pacific region and the Mid-Atlantic Ridge area. These are primarily convergent and divergent settings, respectively. However your students will have also have plots of areas like Hawaii, that are intraplate volcanoes. Explain that these do not fit the plate tectonic model for the formation of volcanoes, but are still fairly well understood by geologists.

PLATE TECTONIC CYCLE - VOLCANOES (6)

POST LAB

DIRECTIONS: Find the active volcanoes in the area assigned by your teacher. Record the following information about each volcano. Plot the location of each volcano the map.

1. NAME OF VOLCANO: _____
WHERE LOCATED: _____
TYPE OF PLATE BOUNDARY _____
WHEN IT ERUPTED _____
COMPOSITION OF LAVA ERUPTED _____
WHAT HAPPENED: How long did the eruption last, what was erupted, what kind of property damage (if any) occurred _____

2. NAME OF VOLCANO: _____
WHERE LOCATED: _____
TYPE OF PLATE BOUNDARY _____
WHEN IT ERUPTED _____
COMPOSITION OF LAVA ERUPTED _____
WHAT HAPPENED: _____

3. NAME OF VOLCANO: _____
WHERE LOCATED: _____
TYPE OF PLATE BOUNDARY _____
WHEN IT ERUPTED _____
COMPOSITION OF LAVA ERUPTED _____
WHAT HAPPENED: _____

4.. NAME OF VOLCANO: _____
WHERE LOCATED: _____
TYPE OF PLATE BOUNDARY _____
WHEN IT ERUPTED _____
COMPOSITION OF LAVA ERUPTED _____
WHAT HAPPENED: _____

PLATE TECTONIC CYCLE - VOLCANOES (6)

PLOT YOUR VOLCANOES ON THE WORLD MAP

