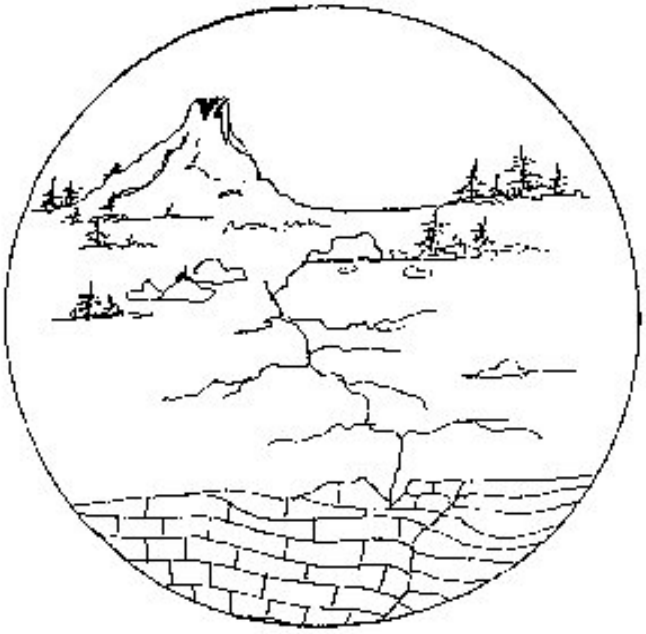
Plate Tectonic Cycle

Earth's Moving Force

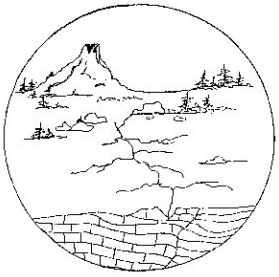
FIRST GRADE

VOLCANOES



1 WEEK
LESSON PLANS AND ACTIVITIES

PLATE TECTONIC CYCLE
OVERVIEW OF FIRST GRADE



VOLCANOES

WEEK 1.
PRE: *Learning the shapes of volcanoes.*
LAB: *Experimenting with "lava."*
POST: *Comparing parts of an erupting volcano.*

EARTHQUAKES

WEEK 2.
PRE: *Demonstrating how energy can be released from an earthquake.*
LAB: *Simulating how an earthquake shakes an area.*
POST: *Learning about what happens when the earth shakes.*

PLATE TECTONICS

WEEK 3.
PRE: *Learning about stress within the Earth's crust.*
LAB: *Demonstrating features caused by stress.*
POST: *Comparing the shapes of South America and Africa.*

HAZARDS

WEEK 4.
PRE: *Investigating hazards caused by volcanoes.*
LAB: *Plotting different volcanoes in the west coast.*
POST: *Learning more about Mt. Shasta in California.*

PLATE TECTONIC CYCLE - VOLCANOES (1)

PRE LAB

Students look at the different shapes of volcanoes.

OBJECTIVES:

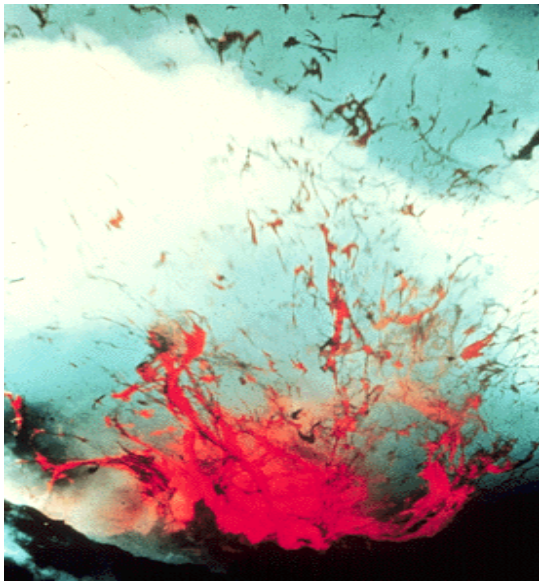
1. Learning the shapes of volcanoes.
2. Discussing why volcanoes only have a few shapes.

VOCABULARY:

lava
magma
mountain
shape
volcano
viscous

MATERIALS:

pictures or posters of volcanoes
books on volcanoes (optional)
world map or globe



Molten lava that is very fluid.

BACKGROUND:

The Plate Tectonic Cycle focuses on how data from volcanoes and earthquakes helps us to understand the Earth. Children are fascinated with this subject, mainly because of what we call the "disaster factor." Disasters of all kinds seem to captivate children's attention, especially those with death and destruction. Plate Tectonics is a subject with all these factors. As a teacher tells stories, we have found that students will remember a specific volcano or earthquake more if you include how many people died, how they died, and a visual look at the extent of the disaster without bodies.

Volcanoes form when molten rock, created inside the crust or upper mantle of the Earth, moves upward and erupts on the Earth's surface. Molten rock is less dense than the surrounding rock, so it is buoyant and rises, just like hot air. Each eruption can produce layers of lava that will later become volcanic rock. These layers build the volcano.

Volcanoes have several shapes, which are controlled by the composition of the magma and the nature of its eruption. If a volcano produces very fluid lava (low in the compound SiO_2, or silica), the magma flows a long distance before it cools, making a flat, shield-shaped volcano. If the volcano produces very sticky magma (high in silica) it tends to have an explosive eruptive style that includes lava, pyroclastic flows, and ash. This material piles up right around the volcano, forming a steep cone, a classic volcano shape. Volcanoes that are a built from ash and cinders usually have steep sides, but tend to

erode quicker than volcanoes built from lava.

PROCEDURE:

1. Review that 1) all mountains are not volcanoes and 2) volcanoes produce one type of igneous rock (volcanic rocks). Students will learn that all volcanoes have just a few shapes, and volcanoes grow from the inside outward. Ask students if they have ever seen a round volcano (they should answer no).

2. Show students pictures of volcanoes. You may use the pictures enclosed or pictures of volcanoes. Display them for your students, so that they can see the many different types of eruptions and shapes of volcanoes. You may want to glue them on tag board, so that you can display them for the next few weeks. If you don't have access to pictures, use library books or the Internet. You may want to tell students where the volcanoes are from, and locate them on a world map or a globe. Here are some recommended websites:

www.meto.umd.edu/~jose/VOLCANOES/volcpage.html
This site has good pictures, including a simulated 3-D volcano plume.
http://volcano.und.nodak.edu/vwdocs/current_volcs/current.html
Current volcanoes erupting around the world with links to each site.
http://www.geo.mtu.edu/volcanoes/
University of Michigan volcano sites around the world.
http://www.usgs.gov
Click on the volcano section for pictures and information.

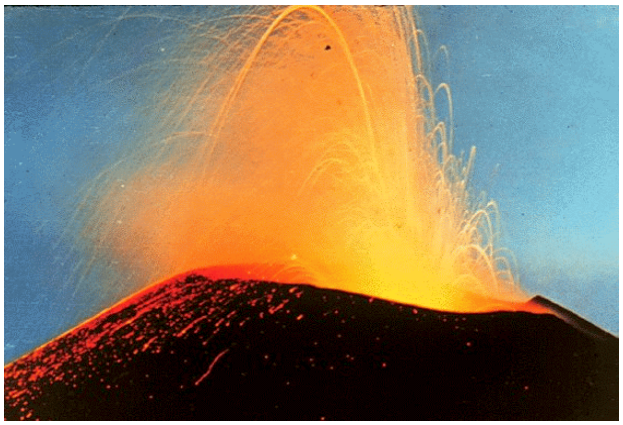
3. Draw the shapes below on the board.

Ask the students which shapes a volcano can take. Ask them why only A, B, and F can be real volcanoes. Discuss that lava can be a thick (viscous) liquid (like honey) or it can be very fluid like water, and that this is the main control on the shape of a volcano. You may say that the thickness (viscosity) of the lava depends on what chemical composition (ingredients) the lava is made of, and how hot the lava is when it erupts at the surface. When it comes out of the ground it flows and builds a mountain-shaped structure. The thicker (more viscous) the lava the more mountain-like it is, like in A and F. Examples include Mt. St. Helens and Mt. Lassen. The thinner (less viscous) the lava, the more the mountain will look like B. An example would be one of the Hawaiian volcanoes. The shape of a volcano is also determined by gravity, and the stability of the walls of the existing volcano.

Students do not need to understand the why or how volcanoes have different shapes, just that there are just a few characteristic shapes of a volcano. During the lab the students will experiment with different types of shapes from different viscosities.

PLATE TECTONIC CYCLE - VOLCANOES (1) - PRE LAB

Types of Volcanoes



Mt. Etna - an erupting volcano in Italy - explosive magma

Mt. Lassen - a eroded volcano in California - built from thick, sticky magma

Mt. St. Helens - a volcano in Washington, before it erupted

Mt. St. Helens during its eruption!

A Hawaiian volcano - built from fluid lava flows

A fluid lava flow in Hawaii

PLATE TECTONIC CYCLE - VOLCANOES (1)

Students experiment with different liquids to simulate lava.

LAB

OBJECTIVES:

1. Experimenting with different types of "lavas"
2. Exploring how liquids flow.

VOCABULARY:

Hawaii
Kilauea
lava
liquid
viscous
volcano

Vulcanologist sampling hot magma in Hawaii.

MATERIALS:

vegetable oil
water with red food coloring in it
sand
liquids of 2 different viscosities, such as 40 weight motor oil, Karo Syrup, honey, syrup, or ketchup
water with blue coloring in it
Video tape of volcanoes or any other short clip that shows flowing lava

BACKGROUND:

Rock is the solid state of matter, while lava (outside the Earth) or magma (inside the Earth) is the liquid state of matter. Cooling of the lava will change the state of matter to solid.

Students at this grade are familiar with water, honey, vinegar, and syrup, but not molten rock. Molten rock is a liquid. The thickness of a fluid is called its viscosity. Viscosity is technically defined as the amount of internal resistance to flow in a liquid, which depends of how “sticky” the molecules and atoms in the fluid are. Water, a fluid we are all used to has relatively high viscosity. Molten rock has a low viscosity; it is much thicker, more like wet concrete or cold honey. Lava (molten rock that flows on the surface of the Earth), actually has many different viscosities, which are largely controlled by the temperature of the lava and its composition.

Students are familiar with how water flows, but they sometimes don't realize that other substances like oil or sand can also flow. This activity familiarizes the students with the concept of viscosity. The class should first watch parts of a video which show real

viscous lava flows.

PROCEDURE:

1. Set up 5 stations. At each station have 2 cups and a different material: red water, blue water, oil, syrup, or sand. In the lab, the students will pour the contents of one cup into another. You may want to put trays, buckets, wax paper, or newspaper under the experiment in case a spill occurs.

2. Show the class portions of the Kilauea video tape that illustrate flowing lava. A good section to use is the point at which the lava flow engulfs the schoolhouse. Emphasize the movement of the lava and point out the different speeds of the lava flow. Describe the movement of the lava as “viscous flow”. Although this is an unfamiliar word for the students, it correctly labels the lava flow as having a slower rate of flow than water.

3. Divide the class into groups. Have the groups move from station to station. They should pour the liquid at each back and forth, mentally noting its viscosity. When they have completed all 5 stations, have them return to their seats and discuss which liquid most closely resembled the lava seen in the video and why. Remind them not to think of color, but how the liquid moves (how viscous a substance is).

4. Take a poll of the students to see which liquid they observed to be most similar to the lava flow. They might choose the water with red food coloring because of the red color. Try to illustrate that the motor oil or syrup is more viscous, and therefore similar to the lava. The point is not to convince the students of the right answer, but to get them thinking!

PLATE TECTONIC CYCLE - VOLCANOES (1)

POST LAB

Students draw an erupting volcano.

OBJECTIVES:

1. Learning the components of volcanoes.
2. Comparing parts of an erupting volcano.

Cooled lava in Hawaii

VOCABULARY:

gases
hot
lava
magma
molten
mountain
steaming
volcano

MATERIALS:

worksheet
pictures of volcanoes
Internet

BACKGROUND:

Volcanoes form when molten rock, or magma, erupts onto the Earth's surface. Most magma forms at plate boundaries within the Earth's crust or upper mantle. The molten rock migrates upward, coming to reside in a "magma chamber" or reservoir below the surface. Magma periodically rises from the magma chamber to the surface, causing eruptions.

Pressure builds up inside the Earth before an eruption takes place. This pressure causes earthquakes, as the rock around the rising magma shifts. Earthquakes in volcanic areas are thus often precursors to eruptions.

Different types of volcanoes have different eruptive styles, depending on the composition of the magma, its temperature, and how fast it moves to the surface. Some volcanoes erupt very violently, spewing pieces of ash, lava, and rock hundreds of meters into the atmosphere. For example, Stromboli is a volcano in Sicily, Italy noted for its violent eruptions. In contrast, Kilauea, a volcano in Hawaii has a quiet eruptive style, lava slowly pours from its vents, flowing downhill.

In addition to lava, mudflows sometimes form during eruptions. Mt. St. Helens, a volcano in Washington that erupted in 1980, is a good example. Mt. St. Helens erupted

violently. It literally "blew its top off." However, there was a large amount of snow on top of Mt. St. Helens, when it erupted. The heat of the explosion caused the snow to melt. The resulting water mixed with the ash produced by the eruption, and preexisting loose rock. The resulting mudflows cascaded down the slopes of the volcano at over 120 miles per hour. They caused much damage in the surrounding areas.

PROCEDURE:

1. Show the students pictures of erupting volcanoes. You may want to use the images or websites mentioned in the Pre Lab.

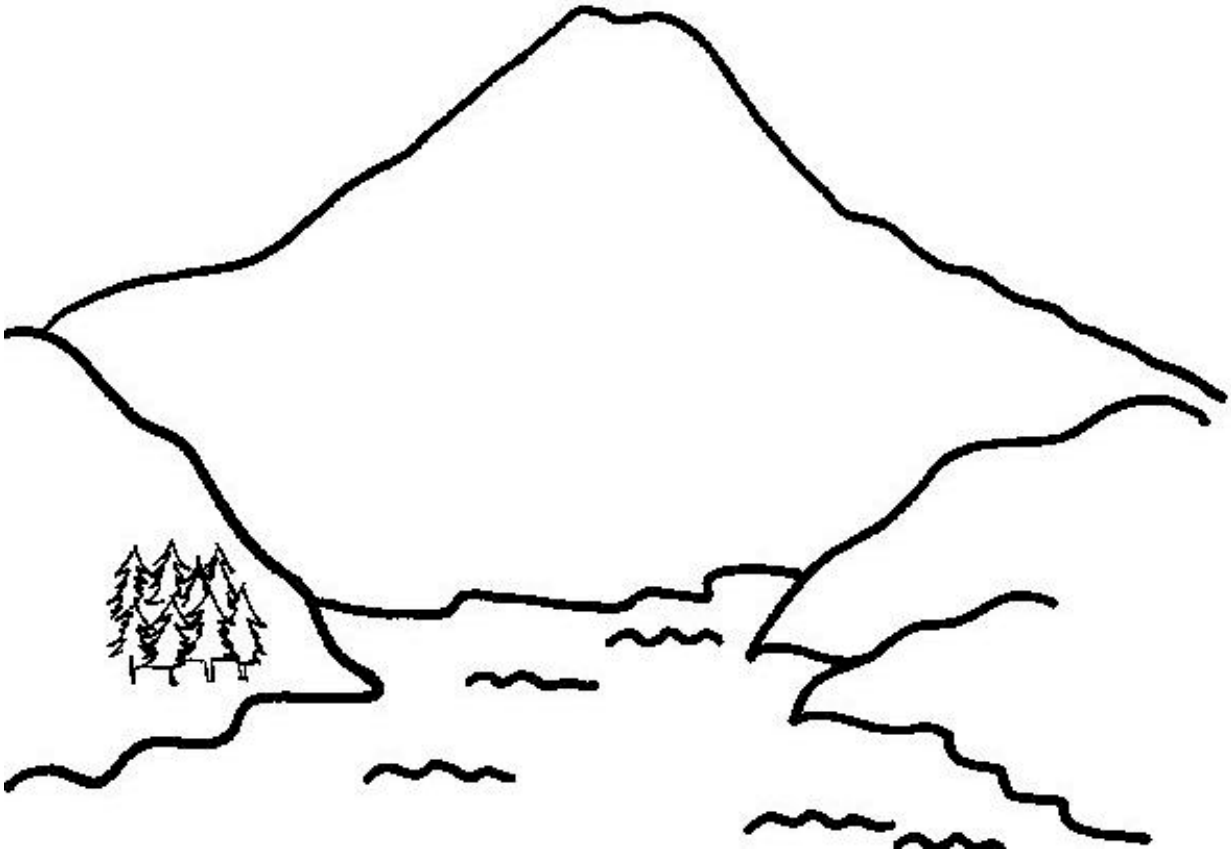
2. This exercise gives students skills in drawing an erupting volcano. Before giving them the worksheet, discuss what an erupting volcano looks like. Many times lava will cascade down the volcano and steam will come from the erupting vent. You may also want to discuss the shape the volcano will take after an eruption. It will be similar to the shape before the eruption, but will be larger. (Note: there are exceptions to this rule; some volcanoes are so explosive that the initial eruptions actually blow parts of the volcano away, making it smaller).

3. Instruct the students to draw an erupting volcano. In the picture, they should draw the hot lava streaming down the sides of the volcano, and the steam coming from its top. Help the students to draw the lava and steam by putting the guide below on the board or projection screen. When they have finished their drawing, have the students write a sentence about their volcano in the space provided.

4. You may wish to discuss the origin of lava, using the information in the Background. Alternatively, you may want to read a short book on volcanoes to the class, or show them a picture book about volcanoes. If your book describes real volcanoes, make sure you point out on a globe where the volcano is located.

5. Also explain that when a volcano erupts there are great pressures inside the upper portion of the Earth (crust and upper mantle), and the release of these pressures causes volcanoes and earthquakes. In the next lab the students will start learning about earthquakes.

PLATE TECTONIC CYCLE - VOLCANOES (1)
POST LAB



WRITE A SENTENCE ABOUT THE VOLCANO.

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