Plate Tectonic Cycle

Earth's Moving Force

FIRST GRADE

PLATE TECTONICS

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 - PLATE TECTONICS (1)

PRE LAB

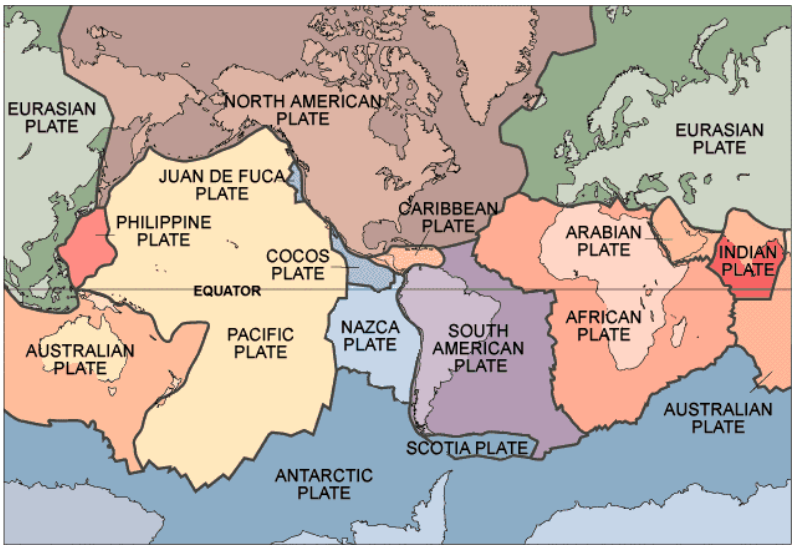
Students demonstrate plate motion through movement.

OBJECTIVES:

1. Learning that the Earth's outer surface is under stress.
2. Discovering that this stress has made the continents and oceans move through millions of years.

VOCABULARY:

continents
converge
crust
diverge
earth
plates
transform



A map of the plates

MATERIALS:

Inflatable World Globes

BACKGROUND:

According to the theory of plate tectonics, the Earth's crust and upper mantle are broken into moving plates of "lithosphere." The lithospheric plates are solid rock. There are several very large plates, each consisting of both oceanic and continental portions. There are a dozen or more smaller plates. The plates average about 80 kilometers (50 miles) in thickness.

All of the plates are moving. They are slow, moving at speeds of centimeters to tens of centimeters per year. They slide along on top of an underlying mantle layer called the asthenosphere, which contains a little magma (molten rock). The plates have been moving for millions and millions of years.

As they move, plates interact at their edges or boundaries. There are three basic directions or types of boundary interactions. In some places, two plates move apart from each other; this is called a diverging plate boundary. Elsewhere two plates move together; this is a converging plate boundary. Finally plates can also slide past each other horizontally. This is called a transform plate boundary.

The movement of the plates generates stress at plate boundaries. The type of stress is different at each type of plate boundary. At converging plate boundaries rocks are squeezed, at diverging plate boundaries they are stretched, and at transform

boundaries they are pushed past each other. Because the plates are rigid rock, they resist this motion until they break, creating earthquakes.

PROCEDURE:

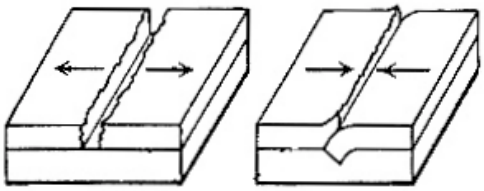
In this activity you will introduce the terms of movement of the outer portion of the Earth and explain that these movements cause stress at plate boundaries.

1. Explain to the class that the Earth's outermost layer is made of rock, and is called the crust. Make sure that the students understand that continental crust or land is mostly above water, and oceanic crust is land that is below water. Illustrate these areas on an inflatable globe. Explain that the crust is the top part of the plates.

2. Explain to the students that the plates are moving. Explain the three types of motion between plates. Introduce the words converge, diverge, and transform (slip/slide) to the class. Have the students repeat the words several times while you demonstrate the motions with your hands. Explain that stress is generated where the plates touch and move past each other, at their boundaries.

3. Have the students illustrate these words with a motor activity. Tell them that they will be able to demonstrate plate movement in other ways during lab.

Have the students stand shoulder to shoulder in two lines facing each other. Have the lines move toward each other. Explain that this is like when two plates move toward each other (this illustrates a CONVERGING plate boundary). Have the lines move away from each other (this illustrates a DIVERGING plate boundary). Have the students in one line take one step to the right while the students in the second line take one step to the left (this illustrates a TRANSFORM plate boundary).



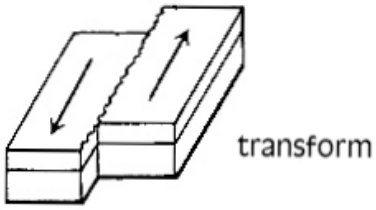


PLATE TECTONIC CYCLE - PLATE TECTONICS (1)

LAB

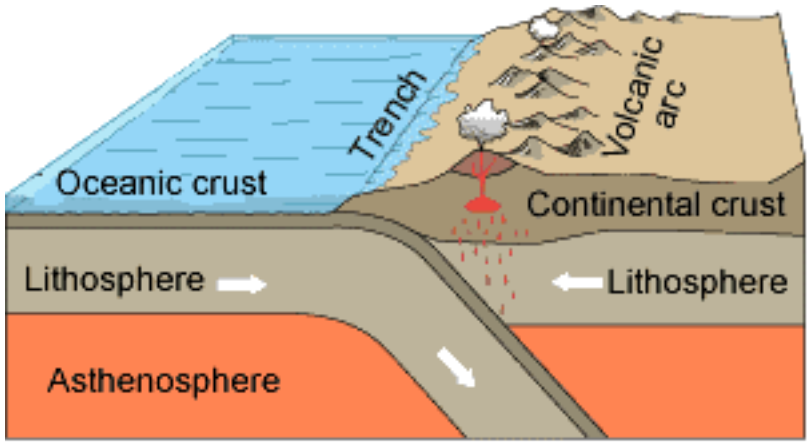
Students demonstrate the stresses that occur at plate boundaries.

OBJECTIVES:

1. Demonstrating features caused by stress.
2. Explaining that stress in the Earth causes earthquakes.

VOCABULARY:

converging
diverging
mountain
slip/slide
valley



A convergent plate boundary

MATERIALS:

5 lb. bag of flour
sealable plastic bags
water
plastic spoons
measuring cups
containers for mixing

BACKGROUND:

As they move, plates interact at their edges or boundaries. As described in the Pre Lab, in some places two plates move apart from each other; this is a diverging plate boundary. In other areas, two plates move together; this is a converging plate boundary. Finally plates can also slide past each other horizontally. This is called a transform plate boundary.

Plate movement generates stress in the rocks at plate boundaries. The type of stress is different at each type of plate boundary. At converging plate boundaries rocks are squeezed (compression), at diverging plate boundaries they are stretched (tension or extension), and at transform boundaries they are pushed past each other (shear). Because the plates are rigid rock, they resist this motion until they break, creating earthquakes. The compression at converging plate boundaries also creates mountains; all of the worlds large mountain ranges formed at this type of boundary.

This exercise allows the students to experience how stress on the outer portion on the Earth effects the plates. They will deform, or stress, "plastic" earth with converging, diverging, and transforming motions.

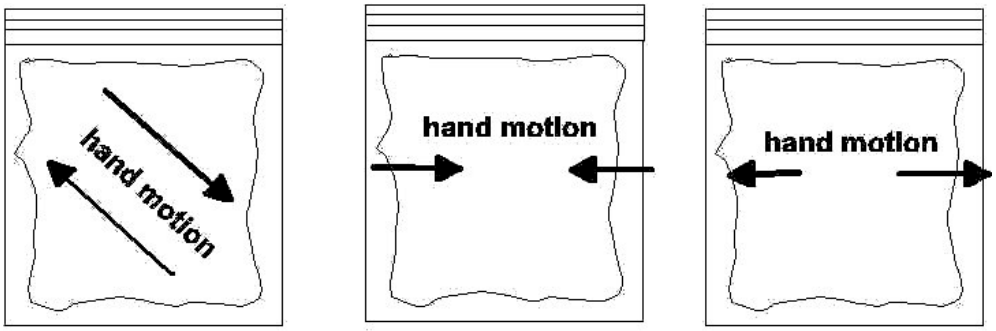
PROCEDURE:

1. Explain to the class that plate motion causes stress at plate boundaries. Remind students of the three ways plates interact: converging, diverging, and transform motion. You may wish to demonstrate these motions with your hands.

2. Tell the students that they will be making mountains and valleys in the same way that plate movements form these features. Be sure to compare mountains and valleys with the students. Explain that mountains form at converging plate boundaries, where plates squeeze together, and valleys are more common where plates move apart, at diverging plate boundaries. Transform plate boundaries often form a combination of small mountains and valleys.

3. Have the students make a flour and water mixture. Have them mix 2 parts of flour with 1 part of water in small containers (Cool Whip or margarine containers work well). They should blend the mix with a spoon until it becomes pasty. Check the mixture before the students put it into the plastic bags, making sure that is neither too wet nor too dry. Have the students pour their mixtures into the plastic bags. Make sure each baggy is "zipped" tightly or you will end up with a mess on your hands. If the bags are sealed correctly the mixture will remain pliable for up to 5 months. You may wish to have the students take the plastic bags home to demonstrate what they did to their parents.

4. Demonstrate converging, diverging, and transform plate boundary motions to the students. Have the students stress the bags as shown in the diagrams below. Tell the students to observe what happens as they apply each type of stress. Go around to each of the students, making sure they can point out mountains and valleys. When the students try to "diverge", they should not apply a lot of pressure because the paste will not gush up. In a real diverging zone, however, lava fills in the void.



5. In conclusion, discuss that when the outer portion of the Earth is under stress, earthquakes take place to relieve the stress.

PLATE TECTONIC CYCLE - PLATE TECTONICS (1)

POST LAB

Students examine geographic evidence for plate tectonics.

OBJECTIVES:

1. Comparing the shapes of South America and Africa.
2. Locating South America and Africa on a globe.

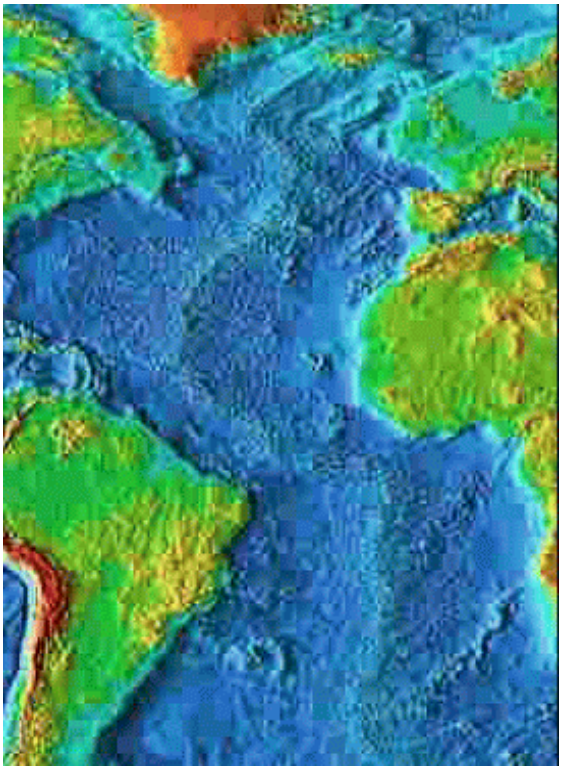
VOCABULARY:

Africa
continent
South America

MATERIALS:

worksheet

BACKGROUND:


Notice the fit of Africa and South America

The Plate Tectonic Cycle exercises stress the information that earthquakes and volcanoes give us about plate boundaries and plate motions. However, many other types of evidence also support the theory of plate tectonics.

One of the first observations used to suggest that the outer portion of the Earth is mobile is the fit of the continents, particularly the west coast of Africa against the east coast of South America. This observation predates plate tectonics. It was first noticed in the 18th century, and most recently proposed by a German scientist, Alfred Wegener in 1912. Wegener called his theory the "continental drift" theory, referring to the apparent movement of continents alone. However, “continental drift” is a historical term that may give the wrong notion to children. We now know it is not the continents that move, but the plates, in which the continents are embedded. South America and Africa were once together, but were split apart by the formation of a diverging plate boundary. This is confirmed by matches between the rocks and fossils of the two continents. Plate motion, not continents drifting, explains this. The two continents are still moving away from each other today.

In this handwriting, coloring, and cutting exercise the students will discover that South America fits into Africa, much like a jigsaw puzzle.

PROCEDURE:

1. Remind your students that the continents riding on the backs or top parts of the plates. Show them a map of South America and Africa, or use the presentation image below. Ask your students if they believe these two continents were joined together. Hopefully they will see the geometric fit. Remind the class that this is one piece of evidence for plate tectonics. Many other pieces of information were needed to "prove" the theory.

2. If you have a large world map in your room, go over the different continents with your students and have them try to fit other continents and areas together. If you rotate North America toward the right it fits against Europe. The south coast of Australia fits against Antarctica. India fits between Africa and Australia.

3. Have the students complete the worksheet. They should trace the names of the continents first, to practice their writing skills. Have them color the continents before they cut them out.

PLATE TECTONIC CYCLE - PLATE TECTONICS (1) POST LAB

LABEL AND COLOR AFRICA AND SOUTH AMERICA. CAN YOU MAKE A PUZZLE?
CUT OUT THE PIECES AND FIND OUT!