Plate Tectonic Cycle

Earth's Moving Force

KINDERGARTEN

PLATE TECTONICS

1 WEEK
LESSON PLANS AND
ACTIVITIES

PLATE TECTONIC CYCLE
OVERVIEW OF KINDERGARTEN

VOLCANOES

WEEK 1.
PRE: *Learning that all mountains are not volcanoes.*
LAB: *Investigating rocks that come from volcanoes.*
POST: *Discovering how volcanoes grow.*

EARTHQUAKES

WEEK 2.
PRE: *Learning that earthquakes cause the Earth to shake.*
LAB: *Discovering that earthquakes cause different types of shaking.*
POST: *Dramatizing different types of earthquake intensities.*

PLATE TECTONICS

WEEK 3.
PRE: *Learning that the crust of the Earth moves.*
LAB: *Analyzing a puzzle of the Earth.*
POST: *Comparing the continents with plate boundaries.*

HAZARDS

WEEK 4.
PRE: *Learning to critically think during an earthquake.*
LAB: *Analyzing the sounds created by earthquakes.*
POST: *Exploring dangers in the classroom.*

PLATE TECTONIC CYCLE - PLATE TECTONICS (K)

PRE LAB

Students complete a puzzle illustrating plate tectonics.

OBJECTIVES:

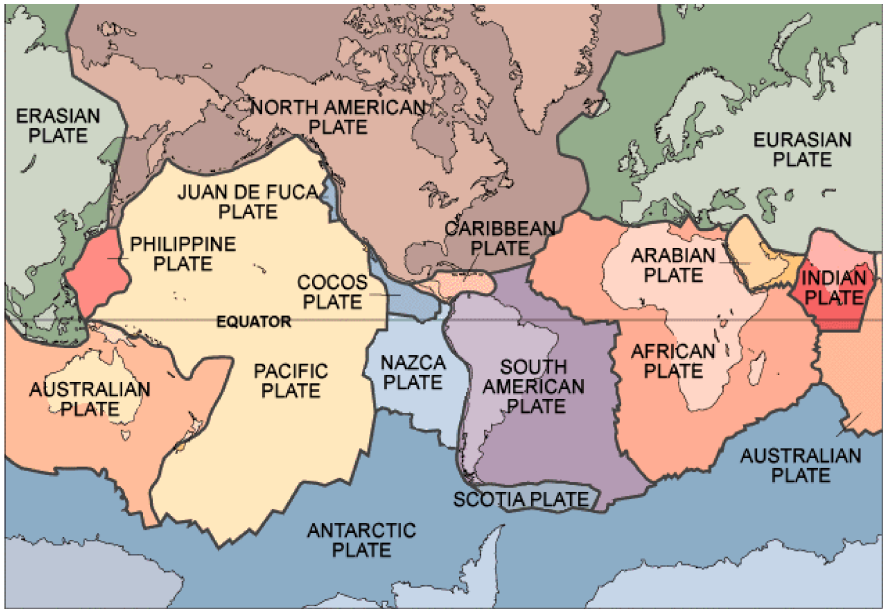
1. Exploring the movement of the outer portion of the Earth.
2. Introducing plate tectonics.

VOCABULARY:

continent
crust
movement
plate tectonics
plates

MATERIALS:

worksheet
crayons
world globe
scissors



A map of the plates

BACKGROUND:

Understanding the movement and behavior of the Earth's outermost layers has been a painstakingly long scientific process. The theory of plate tectonics is our current “best explanation” and working model. Plate tectonic theory has developed slowly and progressively since it was developed in the 1960s. It is a theory that truly has the entire world as its experiment.

According to the theory of plate tectonics, the Earth's crust and upper mantle are broken into moving plates of "lithosphere." The Earth has two types of crust. Continental crust underlies much of the Earth’s land surface. The ocean floors are underlain by oceanic crust. These material have different compositions. The continental crust is lighter, similar to granite, and the oceanic crust is denser like basalt, another igneous rock. Continental and oceanic crust can both be part of the same plate. For example, the North American plate has continental crust (essentially the land area of North America) at its core; this is surrounded on most sides by oceanic crust. A geographic "continent" does not equal a plate.

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.

PROCEDURE:

1. Introduce the phrase "plate tectonics" to the class. Explain that it describes the movement of the Earth's outer portion (the crust and upper mantle). Illustrate the crust of the earth by using a globe or an orange (the peel is the crust and the fruit inside is the rest of the Earth.)

2. Show the students a globe. Point out the continents on the Earth's surface. Explain that scientists have evidence that the continents have moved great distances during the course of the Earth's history. Ask the students this question: if one continent broke up and moved apart, would the pieces resemble one another and fit together? They may answer yes or no. Both answers are actually correct; sometimes split continents still match up, i.e., South America and Africa. In other cases, such as Europe, Greenland, and North America, the match-up is very obscure.

3. To understand plate tectonics, students must be familiar with the globe. Point out the continents and the oceans by making the class repeat the names of the continents. Explain that the continents are merely the crust exposed above sea level, and that the solid surface of the Earth below sea level is also crust. Tell the class that the crust is broken into pieces which are called "plates." The continents are the exposed portions of the Earth's plates. However, some continents may be composed of the exposed sections of more than one plate. Therefore "continent" does not equal a plate. This may be a confusing point for adults and children alike.

4. Have the students complete the worksheet. Instruct them to color Moppy and Moppa, the continents, and the oceans. When they have finished coloring they should cut Moppy and Moppa out and fit them together once again. You can create a story about Moppy and Moppa being together on a continent that was riding on a single plate. The plate broke apart when they had a fight. Now Moppy and Moppa have made up and want the plate to come together again.

5. Have the students observe that the edges of the plates fit. Make sure they see that there is only one part of the plate on which Moppy and Moppy can meet (the continent).

PLATE TECTONIC CYCLE - PLATE TECTONICS (K) - PRE LAB

HOW CAN YOU BRING MOPPY AND MOPPA TOGETHER?

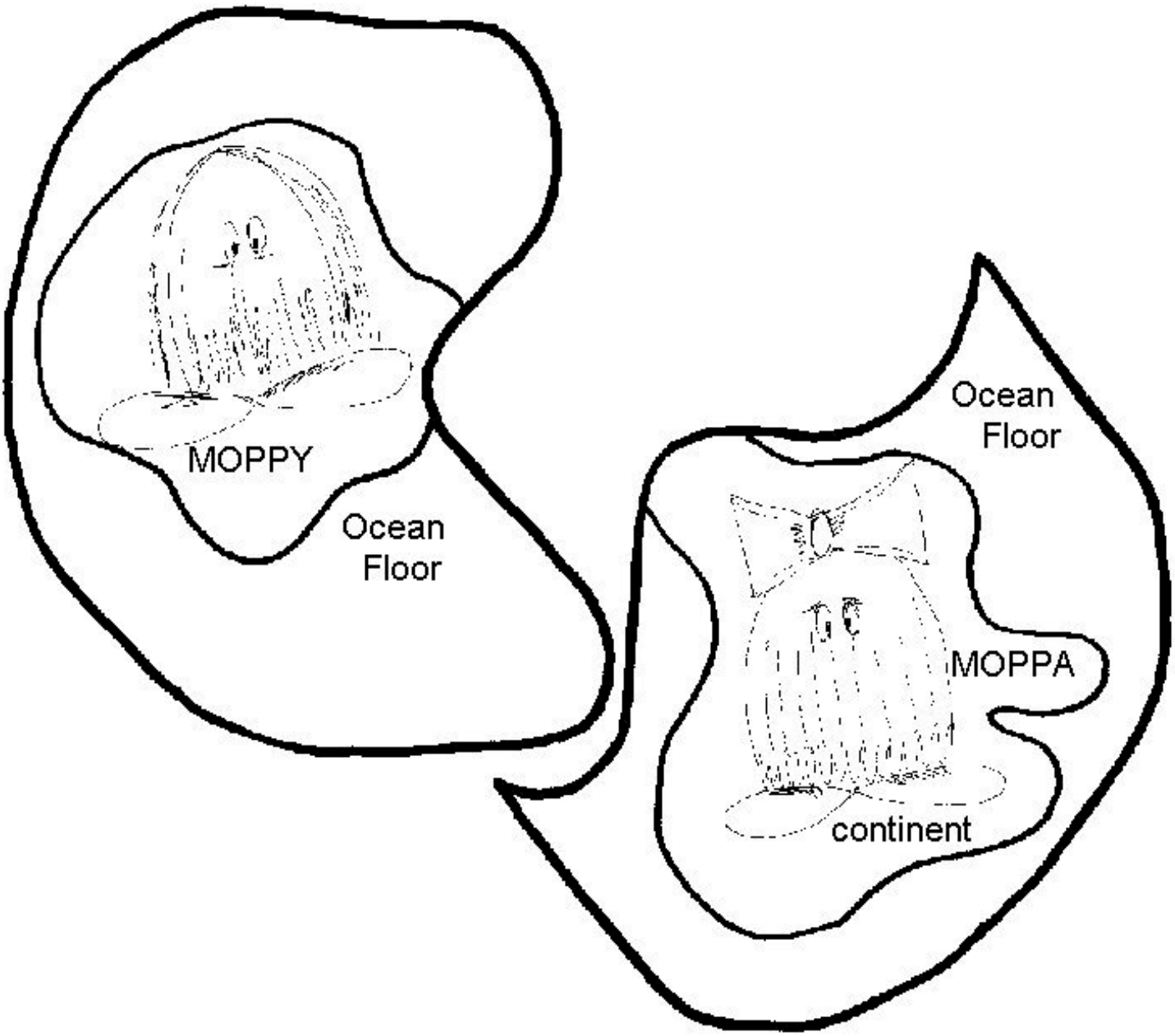


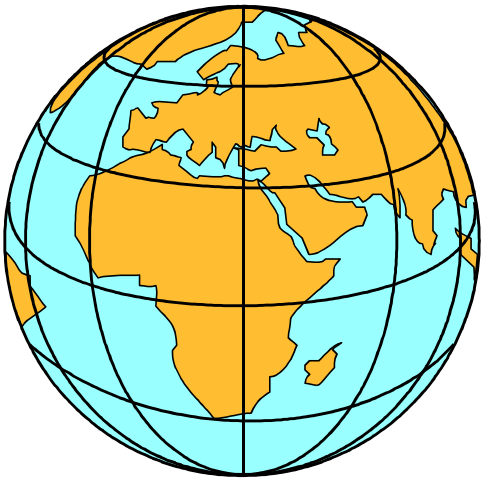
PLATE TECTONIC CYCLE - PLATE TECTONICS (K)

LAB

Students make a plate puzzle.

OBJECTIVES:

1. Analyzing a puzzle of the Earth.
2. Coloring the continents.



VOCABULARY:

continent
crust
earthquake
oceans
plates

MATERIALS:

puzzle pieces (make prior to activity) or
puzzle worksheet (students make)
World Map Placemat (optional)
worksheet
crayons
scissors

BACKGROUND:

Volcanoes and earthquakes provide evidence that the Earth is "cracking" in certain areas. These areas are almost exclusively plate boundaries, where plates come together, spread apart, or slide past each other. Other areas, i.e., the middles of plates, have very few volcanoes or earthquakes. These areas move as a single rigid body so they do not show signs of stress.

Students are often confused by the terms "plate" and "continent". This is for a very good reason. A geographic continent has a clearly defined edge where the land meets the ocean. Plate boundaries, however, are sometimes fuzzy and not sharp. Plates may include both continental and oceanic crust, and may end in the middle of oceans. In some areas, such as parts of Indonesia, it is almost impossible to define plate boundaries; there are too many small pieces involved.

Children sometimes have difficulty using volcanoes and earthquakes to define plate boundaries. Volcanoes provide structural evidence for plate boundaries. They leave evidence in the form of rocks, ash, and in most cases a mountain (a pile of lava and ash). Earthquakes give geophysical evidence for plate boundaries. Each earthquake is a

release of energy, which may be recorded by a seismograph. Earthquakes do not always leave a physical trace, as do volcanoes. Sometimes all that is visible is a crack in the land surface, which is quickly destroyed by weathering and erosion.

Nonetheless, if the locations of earthquakes and volcanoes are plotted on a map, they clearly recur in the same areas. These areas are almost always plate boundaries.

PROCEDURE:

1. Decide which version of the plate puzzle you wish to use. One version (worksheet C) is on a single piece of paper. You can use this as a coloring exercise if you do not wish to make the puzzle pieces prior to the activity. Your students can cut this version out and have their own puzzle.

The longer version is composed of 2 sheets (worksheet A and B) that should be seamed together on a larger piece of paper. This is the ideal version for making the puzzle, since it has "letters" to help the students match the correct edges. This version also can be placed over the world placemat.

NOTE: the student workbook contains only worksheet C.

2. Remind students that they have studied earthquakes and volcanoes. Explain that earthquakes and volcanoes help scientists (geologists) to study how the Earth works. Through looking at patterns in where earthquakes and volcanoes occur, they have found that the Earth's surface seems to move as large masses of the rock, which are called plates.

3. Introduce maps to the students. Make sure that you state that the continents are part of the plates, but that plates extend underneath the oceans as well. Tell the class that the plates have moved for millions and millions of years.

4. Pass out the puzzles to the students. Point out that continents and plates are different.

5. Another way to point out the difference between plates and continents is for you to draw the continents on the shell of a hard boiled egg. When you crack the egg, the students can see that the shell forms plates separate from the continents ... and have a healthy snack!

PLATE TECTONIC PUZZLES
prior to the lab

MATERIALS: Copies of whichever puzzle you wish to use.
hard stock paper (make 2 copies for each set)
scissors
large ziplock baggies
contact paper or laminator

PROCEDURE: Worksheets A and B

Tape worksheets A and B together so that they match the picture below. Copy or mount the them onto hard stock paper. Laminate one copy or cover it with clear contact paper. This uncut version will be your key for the puzzle. Divide the other copy into pieces to the puzzle by cutting along the heavily marked lines. These pieces represent the actual large plates of the Earth's lithosphere. The dotted lines show additional small plates, but should not be cut out. Assemble the puzzle on top of the uncut version of the plate tectonic puzzle. Put all the pieces for one puzzle in a baggie for storage.

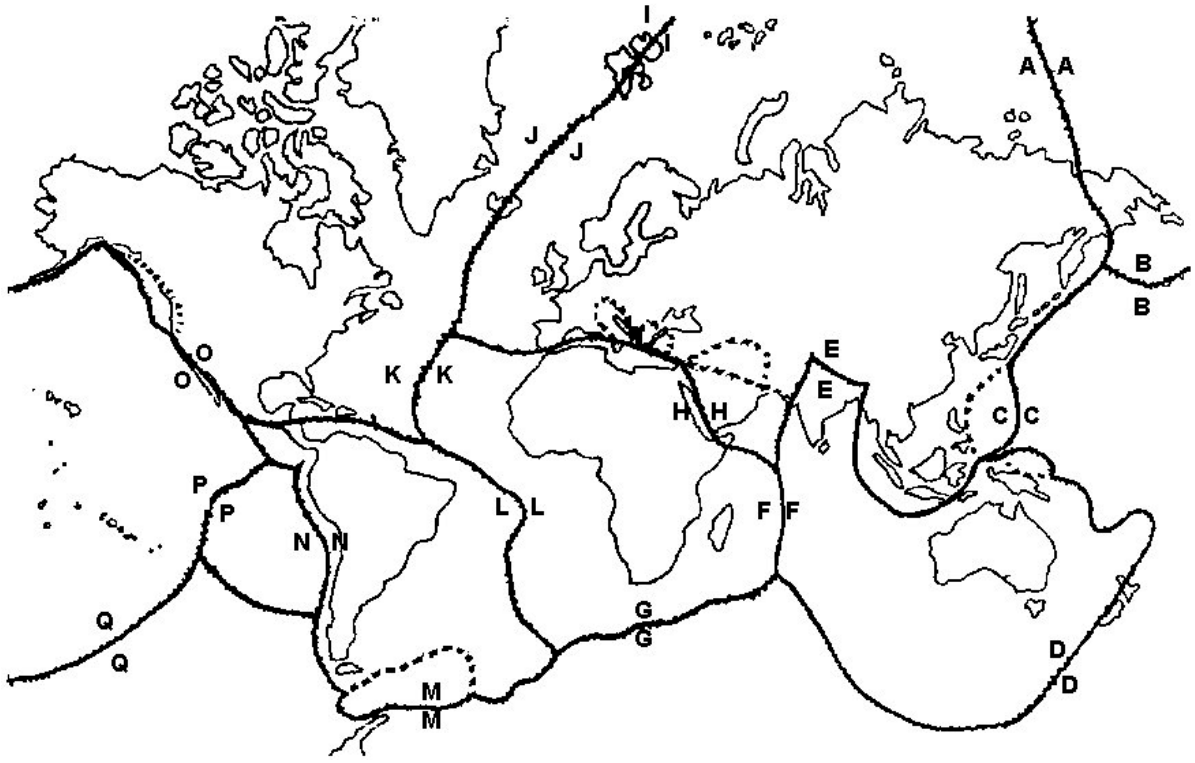


PLATE TECTONIC CYCLE - PLATE TECTONICS (K) - Worksheet A

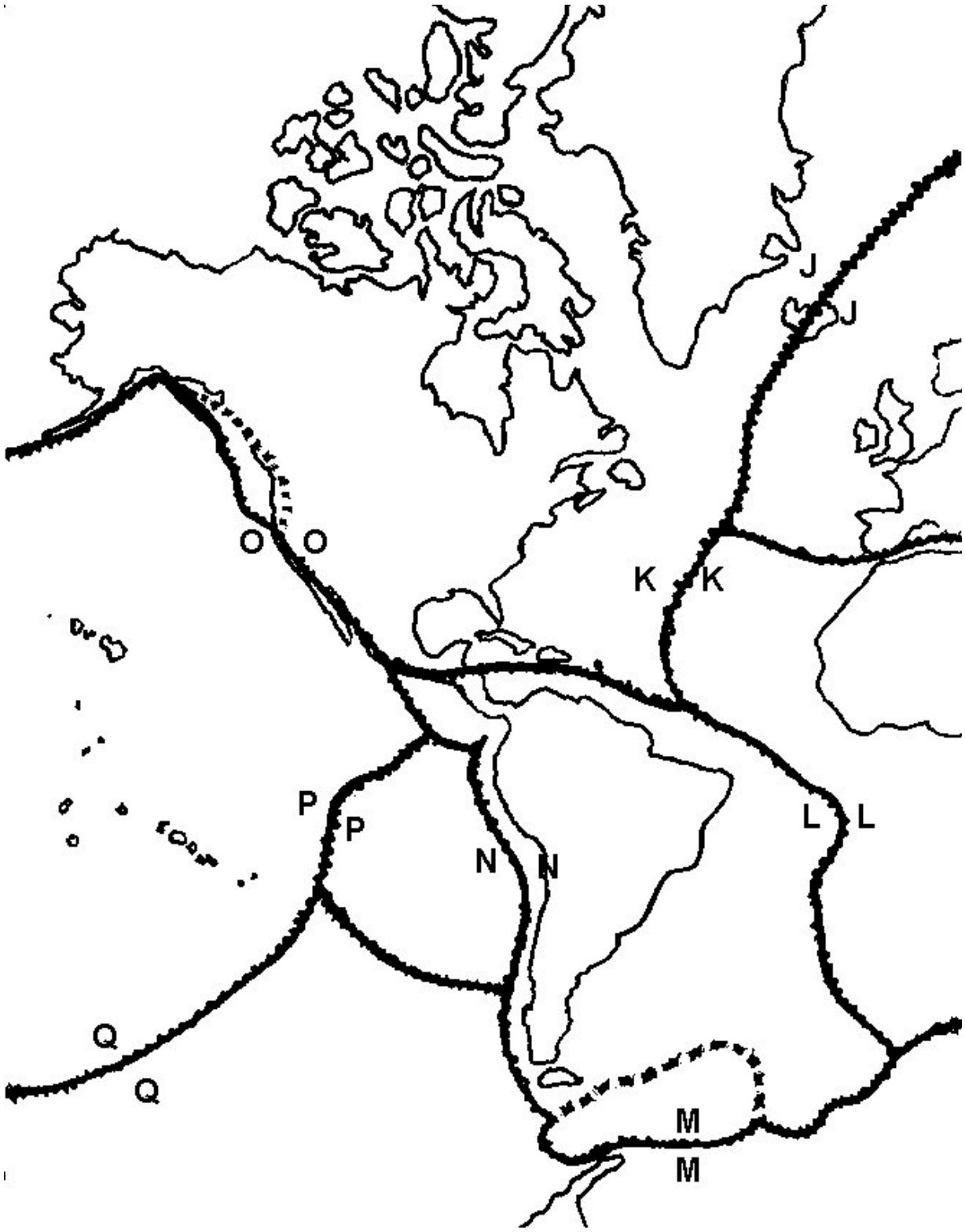


PLATE TECTONIC CYCLE - PLATE TECTONICS (K) - Worksheet B

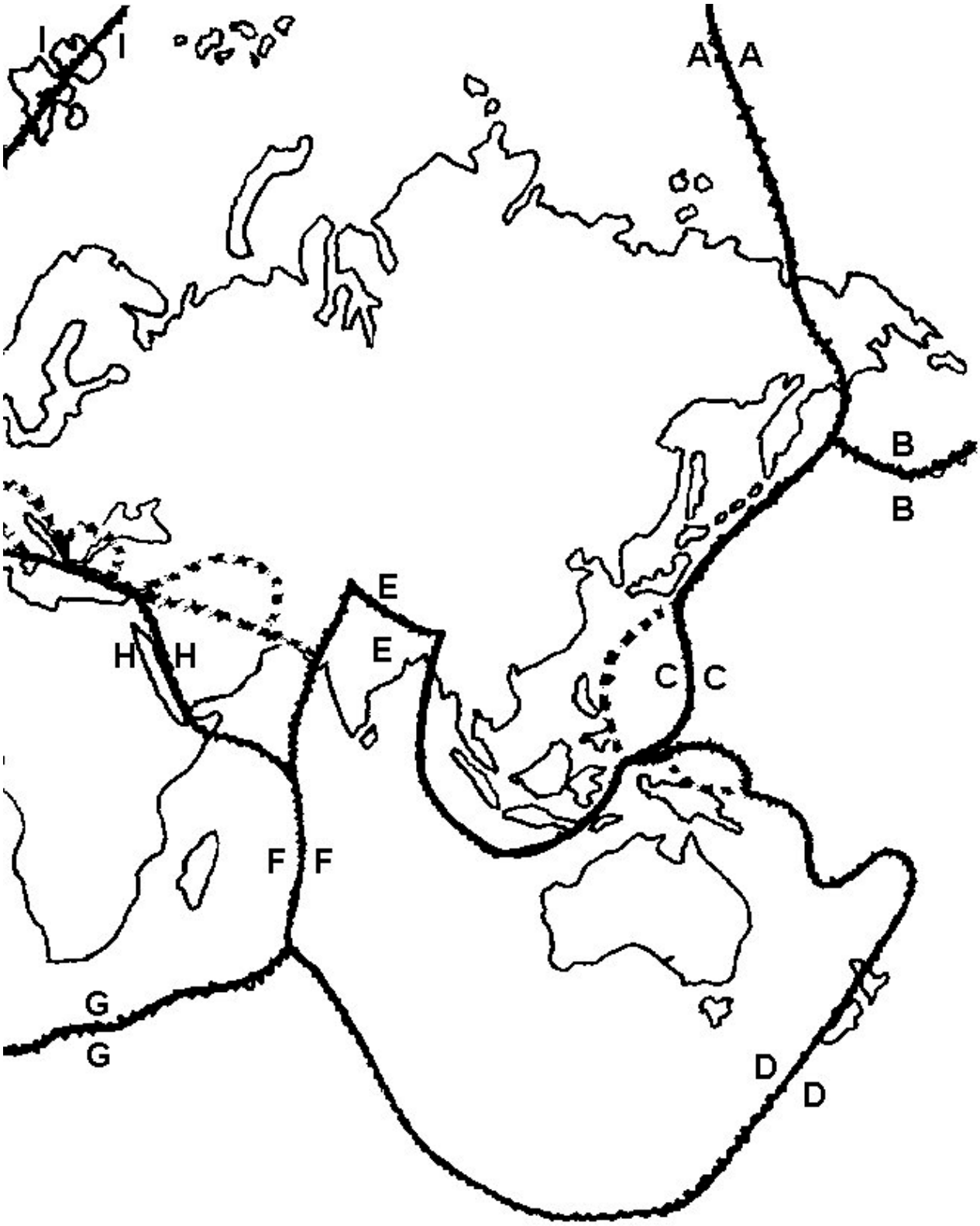


PLATE TECTONIC CYCLE - PLATE TECTONICS (K) - Worksheet C

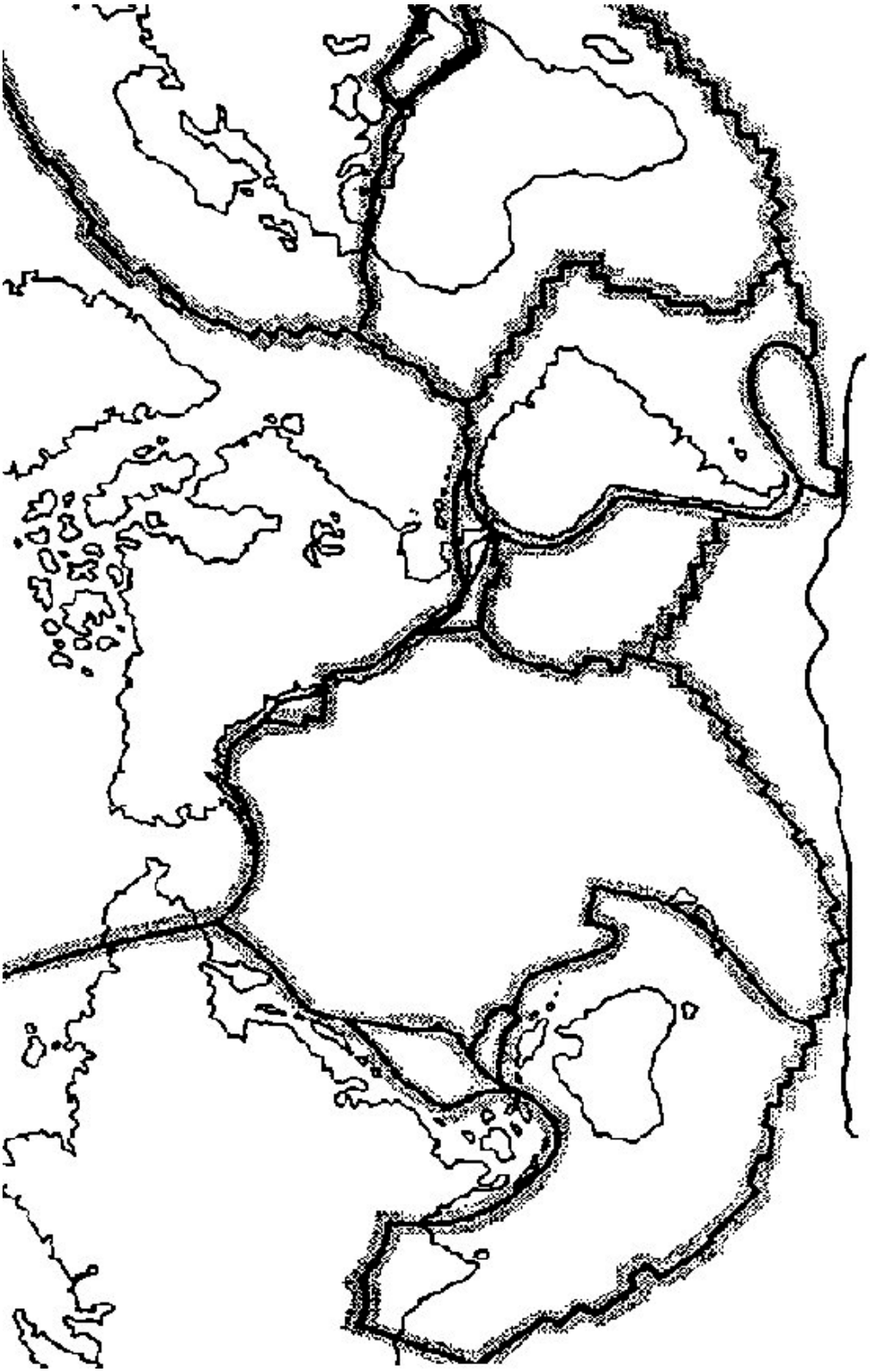


PLATE TECTONIC CYCLE - PLATE TECTONICS (K)

POST LAB

Students compare continents with plates.

OBJECTIVES:

1. Comparing the continents with plate boundaries.
2. Locating continents on a world map.

VOCABULARY:

continents
plate

MATERIALS:

Look Inside the Earth by G. Ingoglia
world placemat

BACKGROUND:

The surface of the Earth seems to be divided into water and land. Islands look disconnected, and many children even think that they are floating on the water. Many books describe plate tectonics as if the plates are the continents. This is not true. The continents are embedded in the plates. Many continents occur in the middles of plates, not at their boundaries or edges. Plates also underlie the Earth's oceans. A single plate often includes both continental and oceanic regions. It is important that students begin to visualize or understand that the plates are a solid rock shell which includes both dry land and the "land" underneath the oceans.

Plates are composed of the Earth's crust and upper mantle, which are collectively called the lithosphere. This layer is like an eggshell compared to the total thickness of the Earth. Plates do not extend all the way to the center or the Earth.

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 are layers of rigid, solid rock. However, 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 plate move together; this is a converging plate boundary. Finally plates can also slide past each other horizontally. This is called a transform plate boundary. Volcanoes and earthquakes help define the boundaries between the plates. Volcanoes form mostly at converging and diverging plate boundaries, where much magma is generated. Earthquakes occur at all three types of boundaries.

Because the plates are rigid, they tend to stick together, even though they are constantly moving. When the strength of the rocks at the plate boundary is exceeded, they move rapidly, “catching up” with the rest of the plates. We feel this release of energy as an earthquake.

PROCEDURE:

1. The key concept for the Post Lab is to make sure that the students do not confuse the continents with the plates. The continents are part of the plates. Point out the continents to the class on a world map. Have the students repeat the names of the continents. Keep repeating to them that the continents have moved by riding on the backs (or tops) of plates for millions and millions of years.

2. Ask the students if any of the continents look like they might have been attached. Hopefully they can see that the fit between South America and Africa is very good.

3. Read *Look Inside the Earth* to the class. There is not much of a story in this book, but the pictures are useful for guiding a classroom discussion. This book peels away the Earth's layers in a way which may help children to visualize the inside of the Earth. Remember to emphasize that the plates are composed of the crust and upper mantle. The students will love to touch and play with this book.