
Plate Tectonics



Topic: Earth's crustal plates and their motion

Objective: Students will be introduced to the topic of Earth's crustal plates and how their motion has changed the surface features we see today.

Background: Scientists have gathered evidence which shows that the Earth's crust is broken into sections, much like the cracked shell of a hard-boiled egg. The crust is actually very thin compared to the rest of the Earth. If the shell were removed from the hard-boiled egg and the egg sprayed with paint, the thin layer of the paint would closely resemble the depth of the crust relative to the internal sections of the planet.

When equipment made it possible to map the ocean floor and dive to the great depths, another world opened to scientists. High ridges and deep trenches were discovered on the ocean floor. Molten lava was seen pouring from cracks in the ocean floor. This added to the knowledge of the Earth's crust and helped support the theory of Continental Drift. The crust is constantly being recycled as new, molten material rises through cracks and pushes aside old material before solidifying.

Edges of some of the crustal plates are diving beneath others, creating earthquakes and volcanic activity. An example of this is the Pacific Plate. The collision of these plates also causes uplifting of mountain ranges. This can be seen along the western edge of South America as the Nazca Plate pushes under the South America Plate, lifting up the Andes Mountain range along the coastline.

As a plate dives beneath another, it begins to melt down when it comes in contact with the hotter mantle lying under the crust. The result of all this is the slow but continuous recycling of the Earth's crust, continents relocating, and mountains rising.

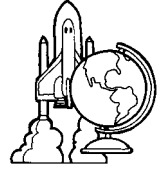
Materials:

- transparency of Earth's Plates Puzzle (page 70)
- sets of Earth's Plates Puzzle cut into puzzle pieces
- The Earth's Fractured Surface (see Resources section) or other map of Earth's plates
- large world map
- Plates on the Move (page 71) data sheet
- hard-boiled egg
- overhead projector

Preparation:

- Make copies of Earth's Plates Puzzle and cut the pieces apart. Put the pieces for each puzzle in a separate envelope. Make a transparency of this page and cut them apart.
- Hard-boil an egg, crack the shell in several places, and then outline the edges of these cracks with permanent black-felt pen.
- Display the maps in the classroom.

Plate Tectonics *(cont.)*



Procedure:

- Show the students the hard-boiled egg with the cracked shell. Explain how it is like the crust of the Earth (see Background).
- Show the students The Earth's Fractured Surface map. Point out the ridges and trenches in the ocean floor which form the boundaries of the crustal plates.
- Use the background information from page 68 to describe what happens as these plates push against each other.
- Divide the students into small groups and give each group an envelope with the Earth's Plates Puzzle pieces. Have them put the puzzle together, using a world map to assist them.
- Distribute the data sheet to each group for them to complete.
- Provide for the students reference books which will help them answer the information on the data sheet.

Discussion:

Discuss the data sheet with the students.

Follow Up:

This activity is continued in the simulation "Off to the Future" (page 78).

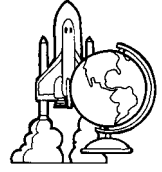
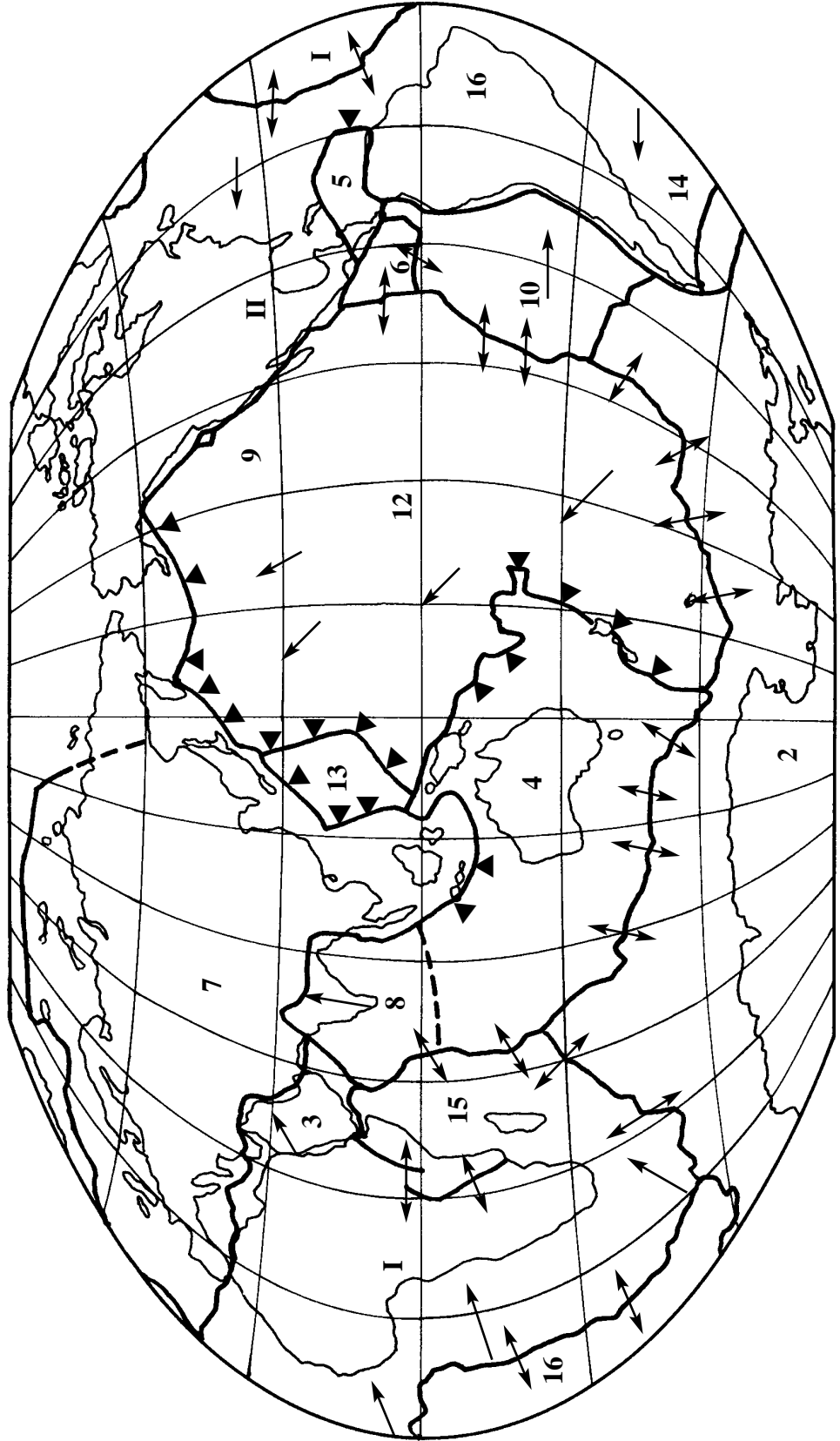


Plate Tectonics *(cont.)*

Earth's Plates Puzzle

To the Teacher: Cut along the dark lines to make puzzle pieces of this map. Provide a set of puzzle pieces for each group of students to use. If the map is copied on cardstock, the puzzle pieces will be more durable.



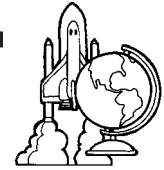


Plate Tectonics *(cont.)*

Plates on the Move

To the Student: Once you have assembled the puzzle of Earth’s plates, complete this data sheet to help you understand what is happening to the Earth’s crust.

Materials:

Earth’s Plates Puzzle, map(s) showing Earth’s crustal plates and ocean floor

Earth’s Crustal Plates Key				
Major Plates			Symbol	Definition
1 African	9 Juan de Fuca		▲	Plate pushes under another plate
2 Antarctic	10 Nazca		↕	Molten rock pushes up between plates, forcing them apart.
3 Arabian	11 North American		↑	Direction of plate’s movement
4 Australian	12 Pacific			
5 Caribbean	13 Philippine			
6 Cocos	14 Scotia			
7 Eurasian	15 Somali			
8 Indian	16 South American			

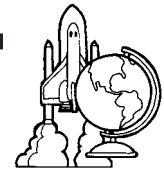
- Use the key to label the crustal plates with their names.
- Look at the northern and western edges of the Pacific Plate on a map to find out what the ocean floor is like in this area and describe it.

Why is this area called the “Ring of Fire”?

- There are ridges along the southern and southeastern Pacific Plate, as well as going down the center of the Atlantic Ocean. Find these areas on your puzzle and on a map of the ocean floor. Examine the marks on the edges of these plates and then explain what causes the ridges.

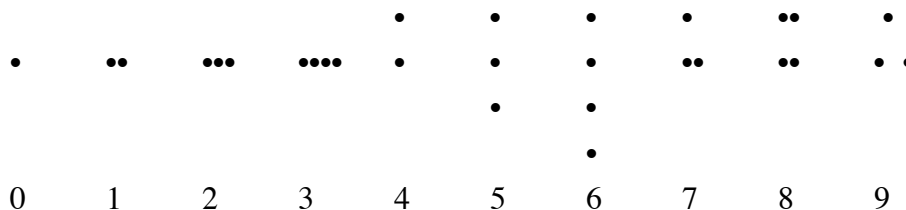
- The Himalayan Mountain range is the highest in the world and continues to rise higher. Use a map to find the location of this mountain range in India. What caused these mountains, and why are they getting higher?

Answer Key *(cont.)*



Mystery Message from Space (pages 22–24)

- The message tells the history of a planetary system in another galaxy near our Milky Way Galaxy. The span of time shown is between five billion and one billion years ago. The numerical code is given in the beginning of the message and can be interpreted as follows:



- The number system is base 10, as ours is. Applying this code, the first date depicted is
 -
 - • • • • • • • • • = 5,000,000,000 years ago.
 -
- and 4. The message shows that the sun increased in size, resulting in the destruction of the planet nearest the Sun 3.5 billion years ago. By 2,000,100,000 years ago, the expanding Sun threatens planet B, where intelligent life forms exist. They take steps to protect themselves by gradually establishing settlements on a neighboring planet. They eventually develop the technology to colonize other planets.
- The end of the message depicts the launch of an intergalactic spacecraft one billion years ago. The mission of the crew of this spacecraft is to ferry life to another planetary system in a nearby galaxy which is our Milky Way Galaxy.

Plates on the Move (page 71)

- Deep ocean trenches (i.e., Aleutian) are located along the northern and western borders of the Pacific Plate. This is an area of volcanic and earthquake activity due to the Pacific Plate diving under the adjoining plates in this area. Thus, this area is called the “Ring of Fire.”
- The ridges along the edges of the Pacific Plate and on the Atlantic Ocean floor are caused by the plates separating and magma from the mantle pushing through.
- The Himalayan Mountains were created when the Indian Plate pushed into the Eurasian plate. Since the Indian Plate is still pushing slowly northward, these mountains continue to rise.