Moving Plates

Activity Description & Estimated Class Time

In this class-period activity, students return to the puzzles they assembled in the Plate Tectonics activity and use puzzle pieces to simulate the movements of plates. In doing this, students understand why volcanoes and earthquakes are often found near plate boundaries.

Correlations to NC Science Standards

ESS.6.2.2 Construct an explanation to illustrate how the movement of lithospheric plates can create geologic landforms and cause major geologic events such as earthquakes and volcanic eruptions.

Learning Target

Students will demonstrate knowledge and understanding of:

- the movements of plates
- how plate movements create geologic events

Brief Science Background

Earthquakes and volcanoes provide evidence that tectonic plates continually move and change. The movement of semi-liquid molten rock (magma) beneath the surface slowly shifts tectonic plates. The molten rock rises toward the surface and falls back toward the core, producing slow currents that move the plates. As a result of this motion, some plates separate; some collide; some slide over or under one another; and some move sideways against each other. Where upwelling magma moves plates apart under the sea, we find volcanic activity and sea floor ridges. Even though plates may be separating on the sea floor, ridges can form there instead of cracks because molten rock solidifies in these places and builds up. Elsewhere on Earth, volcanoes occur wherever magma penetrates the crust. Plate motion also lifts up mountains and even moves continents. Earthquakes occur where adjacent plates collide, slide under one another, or slip from side to side. Some earthquakes that are not directly on plate boundaries arise from cracks in the crust (faults) caused by moving plates. Plate movement builds up pressure along faults until the two sides of the fault suddenly shift to release it. The result is earthquakes and tsunamis.

Moving Plates

Materials

Materials for the whole class

- Ability to project Tectonic Plate with Continents, SD 1
- Ability to project YouTube video located at www.ciblearning.org
- Moving Plates Google Slides

Materials for groups of 2 students

- puzzle from the Plate Tectonics activity
- Tectonic Plate with Continents, SD 1
- Moving Plates Student Activity Sheet, SD 2, one per student
- Two raw spaghetti noodles, one per student

Preparation

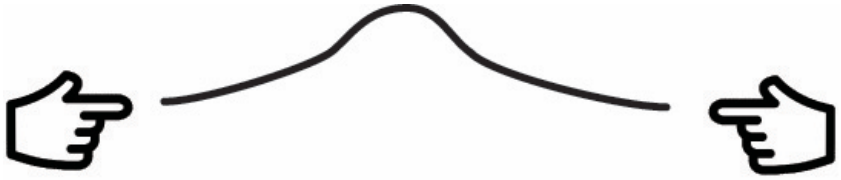
Preview the YouTube video on www.ciblearning.org showing how magma moves tectonic plates.

Procedure

1. Ask the class to summarize what we know so far about tectonic plates, earthquakes, and volcanoes. Earth's surface is made up of plates. Some geologic activity occurs along the edges of these plates, and we see mountains and ocean ridges that align with them. Remind students to reflect on the activities they completed in the Plate Tectonics and Where the Action Is lessons.
2. Ask the following: "Why do you think some volcanoes and earthquakes are near plate boundaries?" Accept students' ideas and let them know they will investigate these ideas in this lesson.
3. Show YouTube video on www.ciblearning.org. You may choose to show it more than once so students can notice all the details. Explain that this video is much faster than real time. The video shows plates moving hundreds of miles in a few seconds, but they actually move only inches per year. Ask students to answer questions 1 and 2 on their Moving Plates Student Activity Sheet, SD 2. Discuss their ideas as a class.
4. Give out the puzzles and ask students to assemble them shiny-side-up.
5. After puzzles are assembled, project the map of the world with tectonic plate lines, SD 1, and ask students to find the part of the Pacific Plate that runs along the west coast of the US.
6. Project Google Slide Deck and explain that the Pacific Plate is moving northwest and the North American plate is moving southwest. The two plates slide past each other along the west coast. Ask students to push their Pacific and North American plates together and slide one North and one South to copy this action. Ask what happens to the edges where the plates grind together. Students should record the directions and results in the chart on SD 2. In fact, the Pacific Plate moves about 3-4 inches (7-10 cm) per year to the northwest, and the North American plate moves about an inch (2.5 cm) per year to the southwest. If students rub hard, the edges fray a little. Rock at the edges of faults breaks like the fraying cardboard of the puzzle piece. In the western US, edges of rocky crust catch against each other, build up pressure, break, and suddenly slip in opposite directions, causing earthquakes. Places where this happens are called **faults**. Students should also label this in the results column.
7. Give each student one stick of spaghetti and warn them not to break it. Ask students to hold both ends of the spaghetti in two hands, with the stick straight. Ask them to bend the stick just slightly, the smallest amount that they can see. Afterward, ask them to slowly continue bending the stick to see how far they can bend it without it breaking. As the sticks break, explain that slowly moving plates create sudden earthquakes because the movement slowly builds up pressure on both sides of the fault, until the fault breaks like the spaghetti stick. The fault holds until the pressure builds up enough to cause an earthquake.
8. Ask students to find the South American and African plates. Explain that these are moving apart in the middle of the Atlantic Ocean. Ask students to move these two plates slightly apart. Ask what is happening to the far sides of these plates? Record this information in the chart on SD 2. They are moving into other plates. This is how trenches are made.

Procedure cont.

9. Ask students to find the Nazca Plate and the South American Plate. The Nazca Plate is sliding beneath the South American Plate, causing the Andes Mountains to form. Ask students to slide their Nazca Plate under the South American Plate. What happens to the South American Plate? Students continue to complete the chart on SD 2. It is lifted up by the thickness of the puzzle piece.
10. Ask students to find the Eurasian Plate and the Indo-Australian Plate. In Tibet, north of India, these two plates are colliding without one plate sliding under the other. Both plates push against each other, forming the Himalayan Mountains. Ask students to push the edges of these two puzzle pieces together without one sliding under the other. What happens? The two plates buckle upwards. Students continue to complete the chart on SD 2. Students might find it difficult to press on the cardboard pieces to make this happen. You can demonstrate the effect of the two plates pressing against each other in this way by pushing on a piece of paper from both sides. It will create a mound in the center as shown in the diagram below.



Content Connection

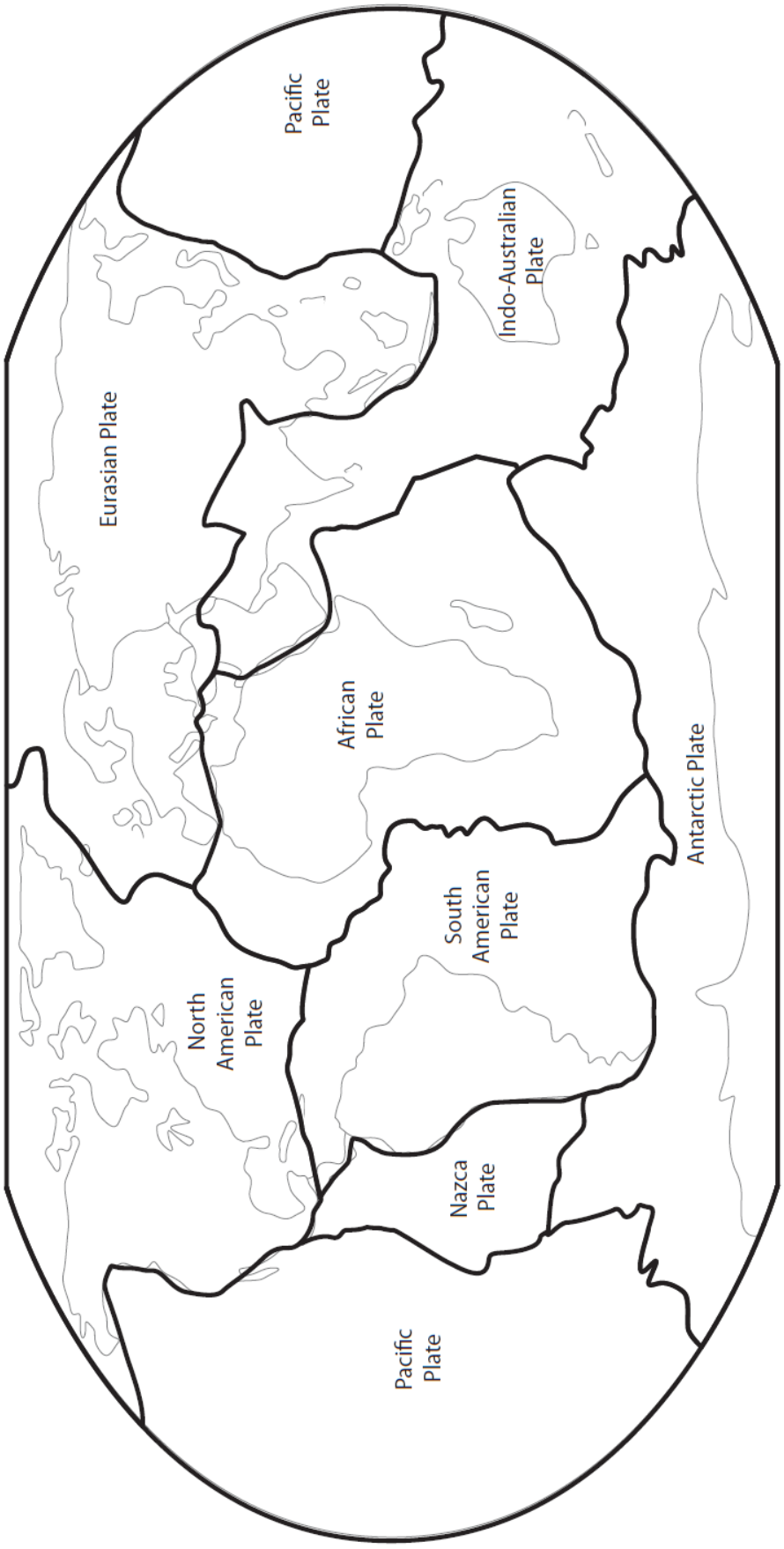
Show the YouTube video again. Ask students to make connections between the puzzle piece activity and the video. Which events are shown? Which are missing? What is causing the plate movement?
In the video, students see magma rising and plates spreading apart. They don't see the plates slide past each other. Plate movement occurs when hot magma rises and flows outward, moving the plates. As it cools, it sinks. The process is called **convection** and is a primary driver of ocean and air currents. The movement of the South American and African plates models this process. The video also shows one plate sliding under another, melting, and producing gas and a volcanic eruption. This is not shown by the puzzle pieces.

Formative Assessment/ Guided Practice

Have students complete the reflection/discussion questions at the bottom of SD 2.

SD 1

Tectonic Plates with Continents



SD 2

Moving Plates Student Activity Sheet

Name:

1. Describe how magma moved in the video.

2. What did the video show about magma, volcanoes, and plate boundaries?

Complete the chart below as you move the puzzle pieces.

Plates Moving	Type of movement	Results
Pacific Plate North American Plate	Slides past each other	

3. Describe the crust of the Earth. What do we know about its structure?

4. How would you describe the motion of the plates?

5. What causes the plates to move?

6. What are the ways that the plates interact with each other?

7. How does the interaction between plates relate to the locations of volcanoes and earthquakes?

SD 2 - KEY

Moving Plates Student Activity Sheet

1. Describe how magma moved in the video.

   Students should mention that magma rises, spreads out, and then cools and falls. The video also shows one plate sliding under another, melting, and then producing a volcanic eruption.

2. What did the video show about magma, volcanoes, and plate boundaries?

   The video shows plates spreading apart, and when one plate sinks below another and forms a volcano. It also shows how magma is heated and cooled and how this process drives plate movement.

Complete the chart below as you move the puzzle pieces.

Plates Moving	Type of movement	Results
Pacific Plate North American Plate	Slides past each other	Faults, earthquakes
South American Plate African Plate	Move slightly apart	trenches, on far sides, they are moving into other plates
Nazca Plate South American Plate	One sliding under another	Mountain formation
Eurasian Plate Indo-Australian Plate	Plates colliding	Mountain formation

3. Describe the crust of the Earth. What do we know about its structure?

   We know that the Earth has several layers. The outer crust is brittle and rocky. Below that is molten rock, and below that is another core that is much more fluid. The inner core is solid.

4. How would you describe the motion of the plates?

   The motion is slow but has dramatic results.

5. What causes the plates to move?

   The heating and cooling of magma beneath the surface drives plate movement.

6. What are the ways that the plates interact with each other?

   Plates can move apart, crash into each other, come together, and one slides under, or plates can slide past each other.

7. How does the interaction between plates relate to the locations of volcanoes and earthquakes?

   The type of plate movement predicts the formation of volcanoes and earthquakes. (See chart above for details.)