

EXPLORE: PLATE TECTONICS

ASKING QUESTIONS AND DEFINING PROBLEMS

Article (2010): “Chain Reaction? Is there an underlying connection between this year’s rash of natural disasters?”

1. When was this article published, and what is the article about?
2. What main question does the article attempt to address?
3. What is the relationship between earthquakes and volcanoes? Can earthquakes cause volcanoes, or vice versa? Why or why not?
4. In 2010, seismic and volcanic activity caused significant damage to cities and made headlines worldwide. According to the author, are these types of natural disasters becoming more frequent or more powerful? Why or why not?

OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Playposit: BrainPop Plate Tectonics

ANALYZING AND INTERPRETING DATA

Map of Seismic and Volcanic Activity

1. What patterns can be identified from the blue (earthquake) and red (volcanic) dots on this map?
2. What can you infer about these patterns?
3. How are earthquakes distributed on the map? Are they scattered evenly over Earth’s surface? Are they concentrated in definite zones?
4. How are volcanoes distributed? Are they scattered evenly or concentrated in zones?
5. From your data, what can you infer about the relationship between earthquakes and volcanoes?

DEVELOPING AND USING MODELS

Website: <https://www.nationalgeographic.com/science/earth/the-dynamic-earth/plate-tectonics/> (link on class webpage)

Website: <https://oceanexplorer.noaa.gov/facts/plate-boundaries.html> (link on class webpage)

Create a model of each type of plate boundary: transverse, convergent, and divergent. The following elements should be included in at least one of the three models:

volcano, subduction, mountain range, continental crust, oceanic crust, mid-ocean ridge, trench, earthquake, fault.

ENGAGING IN ARGUMENT FROM EVIDENCE

Map of Seismic and Volcanic Activity
Topographic Map

Look at the maps and discuss where you think the plate boundaries are. Using evidence from seismic activity, volcanic activity, geological features such as mountain ranges and mid-ocean ridges, develop an argument that identifies these plate boundaries as convergent or divergent.

CHAIN REACTION? IS THERE AN UNDERLYING CONNECTION BETWEEN THIS YEAR'S RASH OF NATURAL DISASTERS?

CURRENT SCIENCE, A WEEKLY READER PUBLICATION. (SEPT. 17, 2010) COPYRIGHT 2010 SCHOLASTIC, INC.

What's up with the world? On January 12, a devastating earthquake shook Haiti, killing more than 200,000 people. On February 27, an even stronger earthquake struck Chile. On April 4, a big quake hit Mexico. And on April 13, yet another shook China.

As if that weren't bad enough, Iceland's Eyjafjallajokull (ay-yah-FYAH-plah-yer-kuh-duhl) volcano blew its top in mid-April. The thick cloud of ash shut down European air travel for days.

By May, people around the world couldn't help but wonder whether all those natural disasters were somehow related. Did one disaster trigger the next?

BIG JERKS

Earthquakes and volcanoes are related. Both occur because of plate tectonics, the gradual movement of the enormous jigsaw-like pieces that make up Earth's outer layer. Those pieces, called tectonic plates, extend downward through the crust and include part of the upper mantle. Wherever two tectonic plates border each other, they interact in one of three ways: They either pull apart, collide, or grind past each other.

The movement of tectonic plates fractures the ground at and near their edges. Those fractures are called faults. The ground normally moves along the two sides of a fault, but that movement isn't always smooth and gradual. The two sides of a fault can get hung up against each other. Stress builds up there until--snap!--the fault slips with a jerk and an earthquake happens.

Many volcanoes also occur along plate boundaries. Some form where magma (molten rock) rises from the mantle into the seam between two splitting plates. Others pop up where an oceanic plate collides with a continental one and the ocean plate dives beneath the continental one. The sinking plate melts in Earth's hot interior, and the melted rock rises to the surface as volcanic eruptions.

Haiti happens to be situated where the Caribbean and the North American plates slide past each other. Chile is located where the Nazca Plate dives under the South American Plate. And China is located where the Indian Plate collides with the Eurasian Plate. Iceland straddles the Mid-Atlantic Ridge, a long boundary between the North American Plate and the Eurasian Plate.

REALITY CHECK

Has 2010 been an unusual year for big earthquakes? And did each big quake trigger the next? Seismologists (scientists who study earthquakes) say no. "The number of large earthquakes was not unusual," explains Michael Blanpied, a

seismologist with the United States Geological Survey (USGS). About 12,000 earthquakes occur each year. Of those, about 16 are considered large.

What made the first months of 2010 unusual, says Blanpied, was the number of large quakes in populated areas. When an earthquake hits a populous area, it's big news. That's especially true if many people die. Chile's earthquake actually released hundreds of times more energy than Haiti's quake did. But the Haiti quake made more headlines because many of the buildings in the nation's densely populated capital couldn't withstand the shaking. Chile's better-designed architecture saved thousands of lives.

Hours before the Chile quake, a big one shook southern Japan. It did very little damage and no one died, so there was almost no news coverage of it.

WAVE ACTION

All earthquakes send pulses of energy called seismic waves speeding around the world. Fifteen minutes after the April 4 quake in Mexico, its seismic waves sloshed a swimming pool in Seattle.

Seismic waves aren't strong enough to trigger earthquakes elsewhere in the world, says John Bellini, another USGS seismologist. But big quakes can help kick off more quakes in the form of aftershocks. Remember: An earthquake occurs when the ground along a fault suddenly shifts. That shift can create new stresses along other parts of the same fault or along nearby faults. For days or weeks after a big quake, aftershocks are common as those stresses are released.

Can earthquakes trigger volcanic eruptions? David Pyle, a volcanologist at the University of Oxford in England, has explored that question in Chile. He says that the seismic waves from very large earthquakes can shake the magma under a region's volcanoes. That may lead to a burst of small eruptions for a year or so. Pyle is now keeping an eye on Chile. So far, though, nothing new has popped up since February.

Once again, though, any effect that an earthquake might have on a volcano is strictly local. There's no way that the quakes in Haiti and Chile could have fired off the eruption in Iceland. "Volcanoes erupt only after they have enough magma in their magma chamber and they build up enough pressure," says Bellini. That process can take years.

INSTANT COMMUNICATION

If 2010 has seemed an unusual year for earthquakes, that may be because people are more aware of them than ever before, says Bellini. Eighty years ago, just 350 seismic stations worldwide recorded quakes. Today, more than 4,000 of them monitor Earth's every tremble.

There are more people on Earth to be affected by quakes too. And with 24-7 Internet, texting, and Twitter, bad news travels very, very fast.

