

Name:

Date:

How Earth Changes

The Ring of Fire

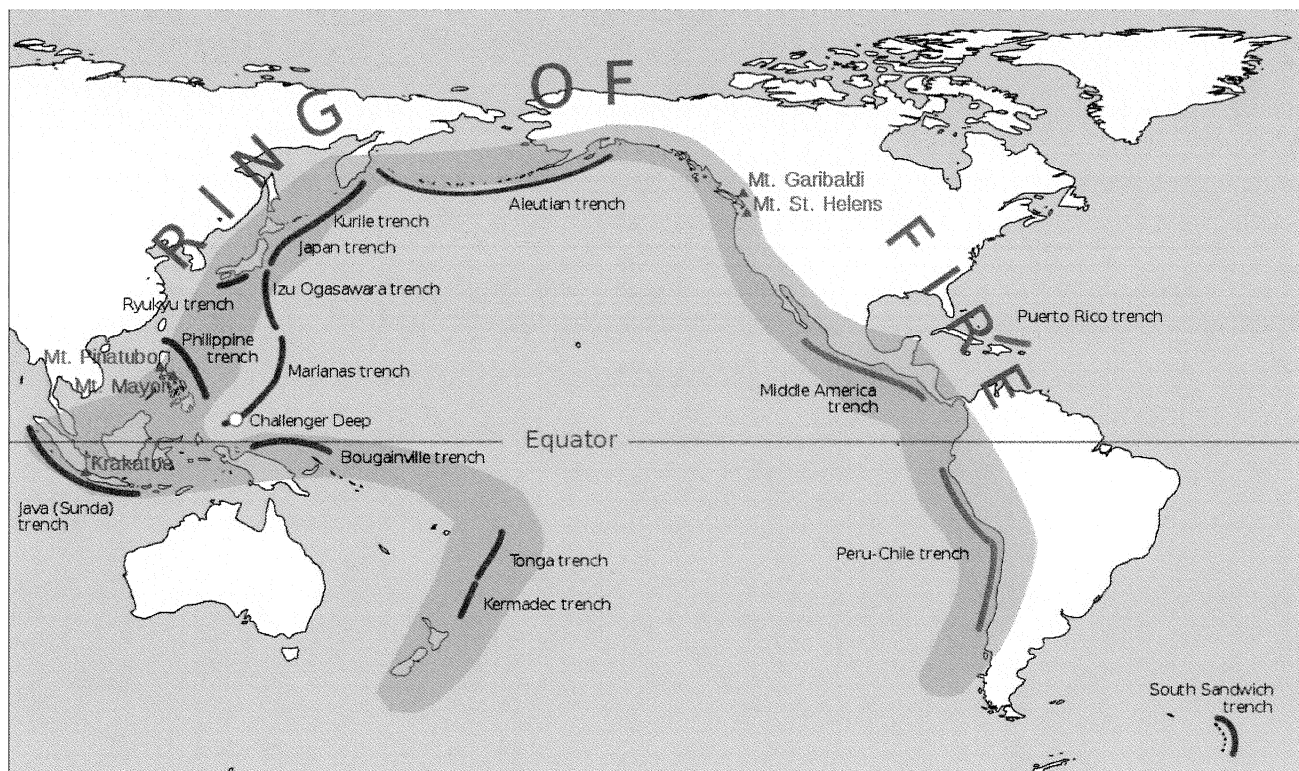
The Ring of Fire is an area where there are more earthquakes and volcanoes than in other parts of the Earth.

There are 452 volcanoes in the Ring of Fire. This is more than 75% of all the volcanoes on Earth. 90% of the world's earthquakes are in the Ring of Fire. About 80% of the world's large earthquakes occur in the Ring of Fire.

The Ring of Fire is at the edges of the Pacific Plate.

The Pacific Plate is a piece of the surface of the Earth. Earth is made up of layers in the same way a cake has layers. The hard, rocky top layer of the Earth is broken into pieces. These pieces are called **plates**. The Pacific Plate is under the Pacific Ocean.

The Ring of Fire is 40,000 kilometers long. In miles, that is 25,000 miles. The Ring of Fire is shaped like a U that is upside-down. The map below shows the Ring of Fire.

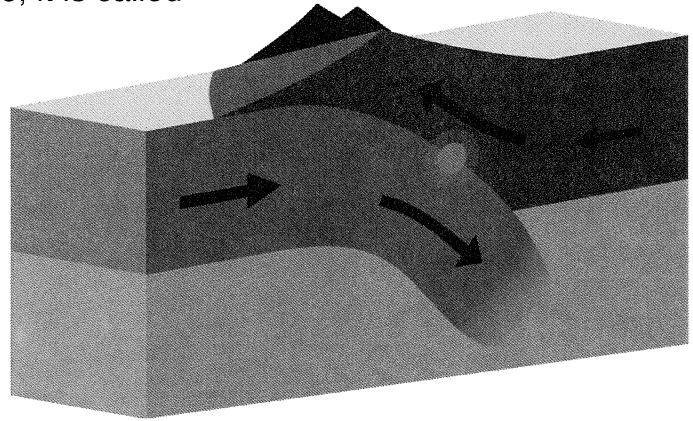


The Ring of Fire has many earthquakes and volcanoes because of the way it moves.

Earth's plates are always moving. The plates move because of the heat inside the Earth. The Pacific Plate moves toward the plates that are next to it. The Pacific Plate is bumping into other plates. The Pacific Plate is **dense**. That means that the rock it is made of sinks. The Pacific Plate is sinking under the plates that are next to it.

When a plate sinks under another plate, that is called **subduction**. Subduction causes volcanoes. Subduction causes volcanoes because the inside of the Earth is hot. When the Pacific Plate sinks down, it melts. The rock of the Pacific Plate mixes with seawater and changes into magma. **Magma** is soft, very hot rock. Magma is less dense than other rock. It rises to the surface. A volcano erupts when the magma breaks through the surface. After magma leaves Earth's surface, it is called **lava**.

Subduction causes earthquakes, too. When the Pacific Plate moves under the plates next to it, it gets stuck. The plates keep trying to move. Pressure and energy build up. When the pressure breaks the rock, it moves suddenly. That is an earthquake.



Check your understanding (use extra paper if you need to):

1. Write definitions of Ring of Fire, plates, subduction, magma, and lava. Use the information near where you find the word in **bold**.
2. Explain how subduction causes volcanoes.
3. Explain how subduction causes earthquakes.

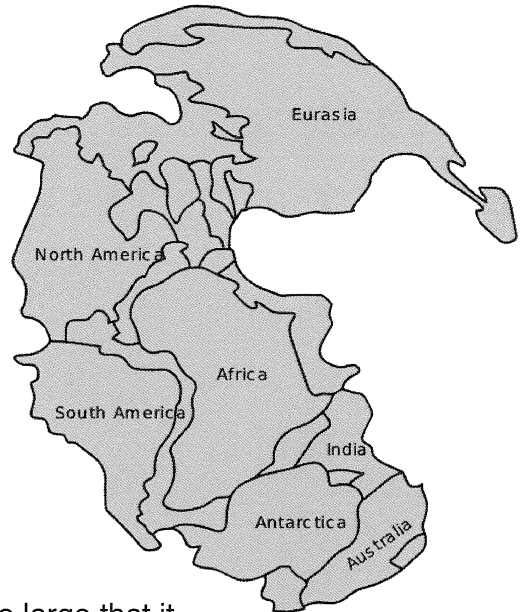
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The Supercontinent Pangaea

Pangaea was a “supercontinent” that contained all of Earth’s land.

It might be hard to believe, but Earth’s continents are always moving. The continents have not always been in the locations where they are today. Europe and North America were once together. South America and Africa were joined together, too. Long ago, before the dinosaurs walked the Earth, Europe, Asia, North America, Africa, South America, Australia, and Antarctica were all together. This giant landmass was called Pangaea.



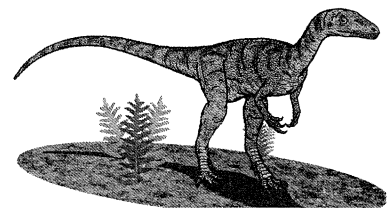
Pangaea formed 270 million years ago.¹

Pangaea was a giant, C-shaped landmass that was so large that it covered two-thirds of Earth’s surface! Pangaea extended all the way from the north pole to the south pole. When Pangea formed, continents crashed together. Large mountain chains like the Appalachian mountains formed because of the force of the collision.

Pangaea broke apart about 200 million years ago. That means that Pangaea was together for about 70 million years!

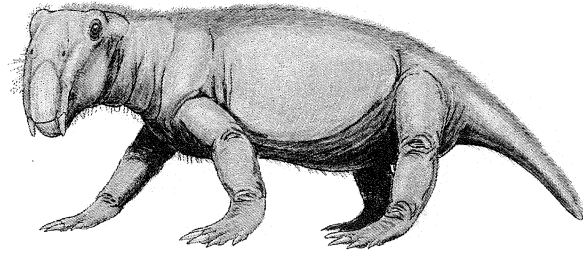
Pangaea was the birthplace of the dinosaurs.

One of the first dinosaurs, *Eoraptor* formed on Pangaea. Pangea was a small dinosaur, about 3 feet long and weighing only about 20 pounds. The largest dinosaurs appeared much later, after Pangea had broken up.



¹ Pangea map credit: en>User:Kieff Creative Commons Attribution-Share Alike 3.0 Unported license.
Eoraptor credit: Conty, Creative Commons Attribution 3.0 Unported license.

Other interesting creatures lived on Pangaea. *Lystrosaurus* were herbivores, plant-eaters, that gathered in giant herds and probably slept in burrows at night. *Lystrosaurus* fossils have been found on many parts of today's world, showing that they lived all over Pangaea. *Lystrosaurus* was from a group called the "mammal-like" reptiles, creatures that may have been as much like us - mammals - as they were like reptiles.



*Lystrosaurus*²

Pangaea eventually broke up, giving rise to today's continents.

The same process that caused Pangaea to form eventually caused it to break up. That process is called Plate Tectonics. Plate Tectonics is the slow movement of giant pieces of Earth's surface. These pieces move because Earth's core - its center - is so hot that it causes hot magma, the stuff inside volcanoes, to rise and fall. This rising and falling cracks and moves Earth's surface, moving pieces together and apart, over and over again.

Check your understanding by answering these questions:

1. What was Pangaea?
2. When did Pangaea form, and when did it break apart?
3. Name and describe two organisms that lived on Pangaea.
4. Why did Pangaea break up?

² *Lystrosaurus* image credit: Dmitry Bogdanov Creative Commons Attribution-Share Alike 3.0 Unported,

Types of Plate Boundaries

Diagram	Type of boundary	What's happening?	Landforms/features
	<p>divergent</p> <p>(also called constructive because new crust is being made or constructed)</p>	<p>Two plates are moving apart. Magma rises to the surface. The magma fills the gap between the plates. When the magma cools, it forms new crust.</p>	<p>In oceans, mid-ocean ridges</p> <p>On land, a rift valley</p>
	<p>convergent</p> <p>oceanic <—> oceanic OR oceanic <—> continental (also called destructive boundaries because crust is destroyed when it sinks down into the mantle)</p>	<p>Two plates move toward each other. The crust that is more dense will be subducted (drawn under) the plate that is less dense. Oceanic crust will always sink under continental crust.</p>	<p>Volcanoes form at the spot where the plate that is subducted melts.</p> <p>Volcanoes form at the edge of the continent (oceanic <—> continental) OR as a chain in the ocean (oceanic <—> oceanic)</p>
<p style="text-align: center;">Continental-continental convergence</p>	<p>convergent</p> <p>continental <—> continental (also called collision boundaries because two plates crash into each other)</p>	<p>Two continental plates move toward each other, and the crust between them piles up instead of sinking.</p>	<p>High, “folded” mountains form from rock and seabed that is squeezed between the two plates.</p>
	<p>transform</p> <p>(also called conservative boundary because crust is not made or destroyed)</p>	<p>Plates slide by each other, side-by-side</p>	<p>Earthquakes happen when the plates get stuck, then suddenly break free.</p>