Encyclopedic Entry

Ring of Fire

Pacific Ring of Fire, circum-Pacific belt

For the complete encyclopedic entry with media resources, visit:
http://education.nationalgeographic.com/encyclopedia/ring-fire/

The Ring of Fire is a string of volcanoes and sites of seismic activity, or earthquakes, around the edges of the Pacific Ocean. Roughly 90% of all earthquakes occur along the Ring of Fire, and the ring is dotted with 75% of all active volcanoes on Earth.

The Ring of Fire isn't quite a circular ring. It is shaped more like a 40,000-kilometer (25,000-mile) horseshoe. A string of 452 volcanoes stretches from the southern tip of South America, up along the coast of North America, across the Bering Strait, down through Japan, and into New Zealand. Several active and dormant volcanoes in Antarctica, however, "close" the ring.

Plate Boundaries

The Ring of Fire is the result of plate tectonics. Tectonic plates are huge slabs of the Earth's crust, which fit together like pieces of a puzzle. The plates are not fixed but are constantly moving atop a layer of solid and molten rock called the mantle. Sometimes these plates collide, move apart, or slide next to each other. Most tectonic activity in the Ring of Fire occurs in these geologically active zones.

Convergent Boundaries
A convergent plate boundary is formed by tectonic plates crashing into each other. Convergent boundaries are often subduction zones, where the heavier plate slips under the lighter plate, creating a deep trench. This subduction changes the dense mantle material into buoyant magma, which rises through the crust to the Earth's surface. Over millions of years, the rising magma creates a series of active volcanoes known as a volcanic arc.

If you were to drain the water out of the Pacific Ocean, you would see a series of deep ocean trenches that run parallel to corresponding volcanic arcs along the Ring of Fire. These arcs create both islands and continental mountain ranges.

The Aleutian Islands in the U.S. state of Alaska, for example, run parallel to the Aleutian Trench. Both geographic features continue to form as the Pacific Plate subducts beneath the North American Plate. The Aleutian Trench reaches a maximum depth of 7,679 meters (25,194 feet). The Aleutian Islands have 27 of the United States' 65 historically active volcanoes.

The Andes Mountains of South America run parallel to the Peru-Chile Trench, created as the Nazca Plate subducts beneath the South American Plate. The Andes Mountains include the world's highest active volcano, Nevados Ojos del Salado, which rises to 6,879 meters (over 22,500 feet) along the Chile-Argentina border. Many volcanoes in Antarctica are so geologically linked to the South American part of the Ring of Fire that some geologists refer to the region as the "Antarctandes."

Divergent Boundaries
A divergent boundary is formed by tectonic plates pulling apart from each other. Divergent boundaries are the site of seafloor spreading and rift valleys. Seafloor spreading is the process of magma welling up in the rift as the old crust pulls itself in opposite directions. Cold seawater cools the magma, creating new crust. The upward movement and eventual cooling of this magma has created high ridges on the ocean floor over millions of years.

The East Pacific Rise is a site of major seafloor spreading in the Ring of Fire. The East Pacific Rise is located on the

divergent boundary of the Pacific Plate and the Cocos Plate (west of Central America), the Nazca Plate (west of South America), and the Antarctic Plate. The largest known group of volcanoes on Earth is found underwater along the portion of the East Pacific Rise between the coasts of northern Chile and southern Peru.

Transform Boundaries

A transform boundary is formed as tectonic plates slide horizontally past each other. Parts of these plates get stuck at the places where they touch. Stress builds in those areas as the rest of the plates continue to move. This stress causes the rock to break or slip, suddenly lurching the plates forward and causing earthquakes. These areas of breakage or slippage are called faults. The majority of Earth's faults can be found along transform boundaries in the Ring of Fire.

The San Andreas Fault, stretching along the central west coast of North America, is one of the most active faults on the Ring of Fire. It lies on the transform boundary between the North American Plate, which is moving south, and the Pacific Plate, which is moving north. Measuring about 1,287 kilometers (800 miles) long and 16 kilometers (10 miles) deep, the fault cuts through the western part of the U.S. state of California. Movement along the fault caused the 1906 San Francisco earthquake, which destroyed nearly 500 city blocks. The earthquake and accompanying fires killed roughly 3,000 people and left half of the city's residents homeless.

Hot Spots

The Ring of Fire is also home to hot spots, areas deep within the Earth's mantle from which heat rises. This heat facilitates the melting of rock in the brittle, upper portion of the mantle. The melted rock, known as magma, often pushes through cracks in the crust to form volcanoes.

Hot spots are not generally associated with the interaction or movement of Earth's tectonic plates. For this reason, many geologists do not consider hot spot volcanoes part of the Ring of Fire.

Mount Erebus, the most southern active volcano on Earth, sits over the eruptive zone of the Erebus hot spot in Antarctica. This glacier-covered volcano has a lava lake at its summit, and has been consistently erupting since it was first discovered in 1841.

Active Volcanoes in the Ring of Fire

Most of the active volcanoes on The Ring of Fire are found on its western edge, from the Kamchatka Peninsula in Russia, through the islands of Japan and Southeast Asia, to New Zealand.

Mount Ruapehu in New Zealand is one of the more active volcanoes in the Ring of Fire, with yearly minor eruptions, and major eruptions occurring about every 50 years. It stands 2,797 meters (9,177 feet) high. Mount Ruapehu is part of the Taupo Volcanic Arc, where the dense Pacific Plate is subducting beneath the Australian Plate.

Krakatau, perhaps better known as Krakatoa, is an island volcano in Indonesia. Krakatoa erupts less often than Mount Ruapehu, but much more spectacularly. Beneath Krakatoa, the denser Australian Plate is being subducted beneath the Eurasian Plate. An infamous eruption in 1883 destroyed the entire island, sending volcanic gas, volcanic ash, and rocks as high as 80 kilometers (50 miles) in the air. A new island volcano, Anak Krakatau, has been forming with minor eruptions ever since.

Mount Fuji, Japan's tallest and most famous mountain, is an active volcano in the Ring of Fire. Mount Fuji last erupted in 1707, but recent earthquake activity in eastern Japan may have put the volcano in a "critical state." Mount Fuji sits at a "triple junction," where three tectonic plates (the Amur Plate, Okhotsk Plate, and Philippine Plate) interact.

The Ring of Fire's eastern half also has a number of active volcanic areas, including the Aleutian Islands, the Cascade Mountains in the western U.S., the Trans-Mexican Volcanic Belt, and the Andes Mountains.

Mount St. Helens, in the U.S. state of Washington, is an active volcano in the Cascade Mountains. Below Mount St. Helens, both the Juan de Fuca and Pacific plates are being subducted beneath the North American Plate. Mount St. Helens lies on a particularly weak section of crust, which makes it more prone to eruptions. Its historic 1980 eruption lasted 9 hours and covered nearby areas in tons of volcanic ash.

Popocatépetl is one of the most dangerous volcanoes in the Ring of Fire. The mountain is one of Mexico's most active

volcanoes, with 15 recorded eruptions since 1519. The volcano lies on the Trans-Mexican Volcanic Belt, which is the result of the small Cocos Plate subducting beneath the North American Plate. Located close to the urban areas of Mexico City and Puebla, Popocatépetl poses a risk to the more than 20 million people that live close enough to be threatened by a destructive eruption.

VOCABULARY

Term	Part of Speech	Definition
accompany	*verb*	to join with someone or something.
active volcano	*noun*	volcano that has had a recorded eruption since the last glacial period, about 10,000 years ago.
Anak Krakatau	*noun*	active volcanic island on the site of the former island of Krakatoa in the Sunda Strait in Indonesia.
Andes Mountains	*noun*	mountain range extending along the western coast of South America.
Bering Strait	*noun*	narrow body of water connecting the Bering Sea and the Arctic Ocean, separating the continents of North America and Asia.
brittle	*adjective*	fragile or easily broken.
buoyant	*adjective*	capable of floating.
Cascade Range	*noun*	mountains extending along the northwest coast of North America.
city	*noun*	large settlement with a high population density.
coast	*noun*	edge of land along the sea or other large body of water.
collide	*verb*	to crash into.
consider	*verb*	to think about.
consistent	*adjective*	maintaining a steady, reliable quality.
continent	*noun*	one of the seven main land masses on Earth.
convergent plate boundary	*noun*	area where two or more tectonic plates bump into each other. Also called a collision zone.
correspond	*verb*	to match or be similar to.
crust	*noun*	rocky outermost layer of Earth or other planet.
dense	*adjective*	having parts or molecules that are packed closely together.
destructive	*adjective*	harmful.
divergent boundary	*noun*	area where two or more tectonic plates are moving away from each other. Also called an extensional boundary.
dormant volcano	*noun*	volcano that has erupted in the past but is unlikely to erupt soon.
earthquake	*noun*	the sudden shaking of Earth's crust caused by the release of energy along fault lines or from volcanic activity.
East Pacific Rise	*noun*	mid-ocean ridge where several tectonic plates are moving apart from one another.
erupt	*verb*	to explode or suddenly eject material.
eruption	*noun*	release of material from an opening in the Earth's crust.

facilitate	*verb*	to help or make easier.
fault	*noun*	a crack in the Earth's crust where there has been movement.
geologic	*adjective*	having to do with the physical formations of the Earth.
geologist	*noun*	person who studies the physical formations of the Earth.
glacier	*noun*	mass of ice that moves slowly over land.
horizontal	*adjective*	left-right direction or parallel to the Earth and the horizon.
horseshoe	*noun*	C-shaped thick metal sheet nailed to a horse's foot to protect it from damaging surfaces.
hot spot	*noun*	intensely hot region deep within the Earth that rises to just underneath the surface. Some hot spots produce volcanoes.
infamous	*adjective*	having a very bad reputation.
interaction	*noun*	relationship between two or more forces, objects, or organisms.
island	*noun*	body of land surrounded by water.
Krakatoa	*noun*	island in Indonesia, site of major volcanic eruption in 1883. Also called Krakatau.
lava lake	*noun*	lava pooled in the center of a volcano's caldera or crater.
lurch	*verb*	to suddenly stagger or sway.
magma	*noun*	molten, or partially melted, rock beneath the Earth's surface.
mantle	*noun*	middle layer of the Earth, made of mostly solid rock.
molten	*adjective*	solid material turned to liquid by heat.
mountain range	*noun*	series or chain of mountains that are close together.
parallel	*adjective*	equal distance apart, and never meeting.
peninsula	*noun*	piece of land jutting into a body of water.
plate tectonics	*noun*	movement and interaction of the Earth's plates.
prone	*adjective*	vulnerable or tending to act in a certain way.
region	*noun*	any area on the Earth with one or more common characteristics. Regions are the basic units of geography.
resident	*noun*	person who lives in a specific place.
rift valley	*noun*	depression in the ground caused by the Earth's crust spreading apart.
Ring of Fire	*noun*	horseshoe-shaped string of volcanoes and earthquake sites around edges of the Pacific Ocean.
rock	*noun*	natural substance composed of solid mineral matter.
seafloor spreading	*noun*	rift in underwater mountain range where new oceanic crust is formed.
seawater	*noun*	salty water from an ocean or sea.
seismic	*adjective*	having to do with earthquakes.
spectacular	*adjective*	dramatic and impressive.

stress	*verb*	to strain or put pressure on.
subduct	*verb*	to pull downward or beneath something.
subduction zone	*noun*	area where one tectonic plate slides under another.
summit	*noun*	highest point of a mountain.
tectonic plate	*noun*	large, moveable segment of the Earth's crust.
threaten	*verb*	to scare or be a source of danger.
transform boundary	*noun*	site of tectonic plates sliding next to each other in opposite directions. Also called a transform fault.
trench	*noun*	long, deep depression, either natural or man-made.
triple junction	*noun*	region where the boundaries of three tectonic plates meet and interact.
urban area	*noun*	developed, densely populated area where most inhabitants have nonagricultural jobs.
volcanic arc	*noun*	chain of volcanoes formed at a subduction zone.
volcanic ash	*noun*	fragments of lava less than 2 millimeters across.
volcanic gas	*noun*	gas such as water vapor or carbon dioxide that is released into the atmosphere by a volcano.
volcano	*noun*	an opening in the Earth's crust, through which lava, ash, and gases erupt, and also the cone built by eruptions.
well up	*verb*	to swell or build up.

For Further Exploration

Articles & Profiles

- National Geographic News: Deadly Java Quake Highlights Ring of Fire Dangers

Maps

- NG MapMaker Interactive: Ring of Fire
- USGS: Ring of Fire

Video

- National Geographic Channel: Ring of Fire