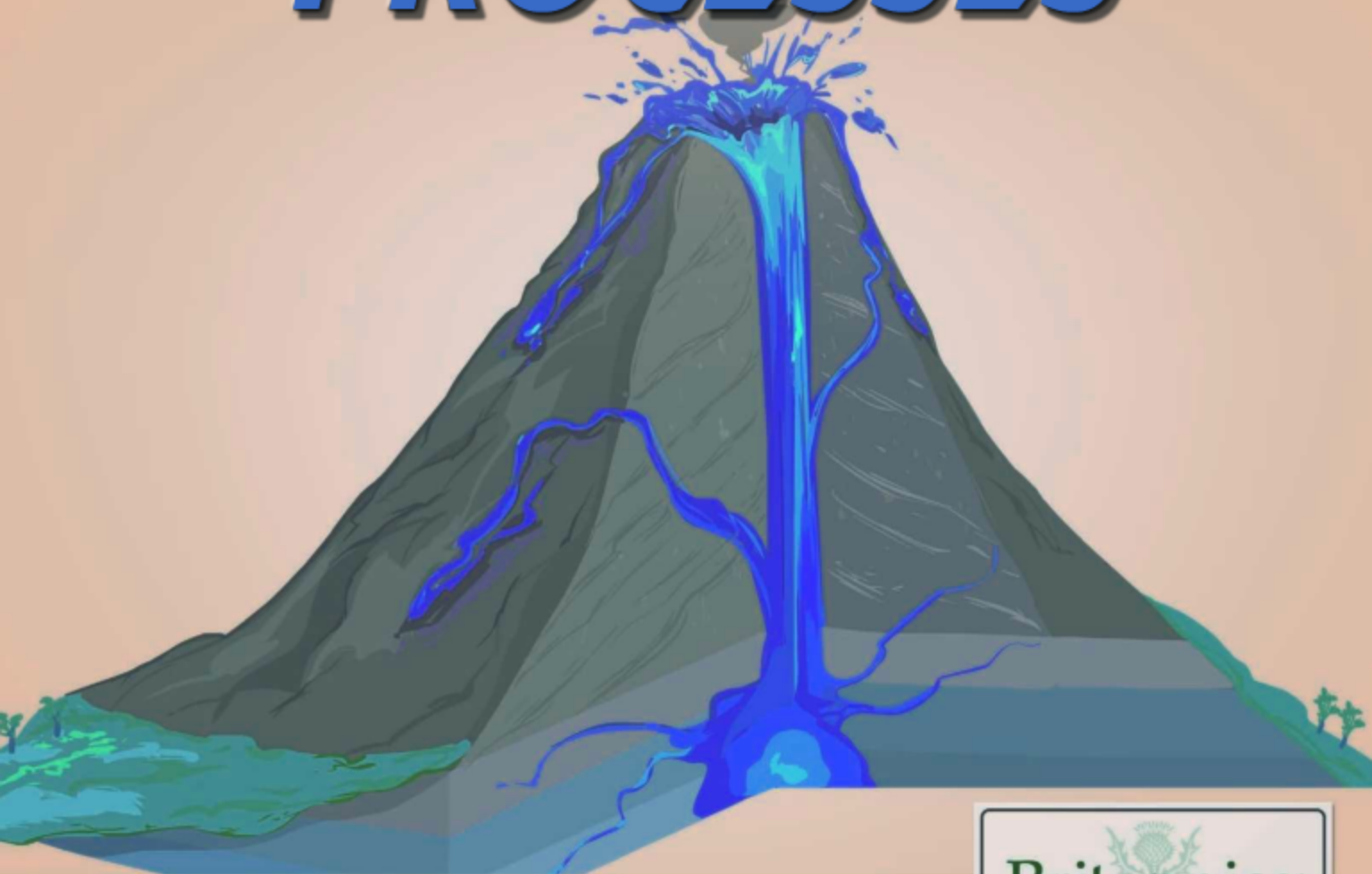


**LET'S FIND OUT! OUR DYNAMIC EARTH**

# **VOLCANIC PROCESSES**



LAURA LORIA

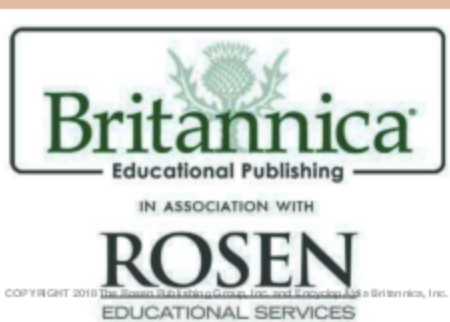
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**LET'S FIND OUT! OUR DYNAMIC EARTH**

# ***VOLCANIC PROCESSES***

LAURA LORIA



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# EXPLOSIVE EARTH

When you think of a **volcano**, what do you picture in your mind? Most people would say they see a large, gray mountain spitting out red streams of lava and huge clouds of smoke. However, this is just one type of volcano. Volcanoes can take different forms and behave in different ways.

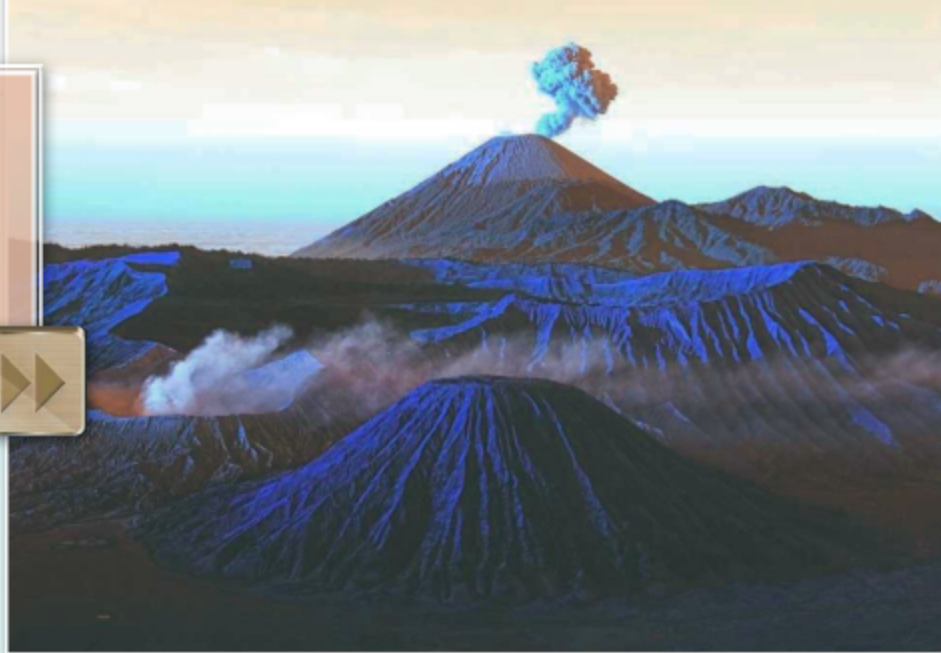
## VOCABULARY

A **volcano** is an opening in Earth's crust. Lava, gas, and ashes come out of the opening.

This is an eruption of the volcano Tungurahua, in Ecuador. The fiery streams of lava it is spewing out are just one type of volcanic eruption.



Some volcanic eruptions, like this one in Indonesia, release mainly gas and ashes.



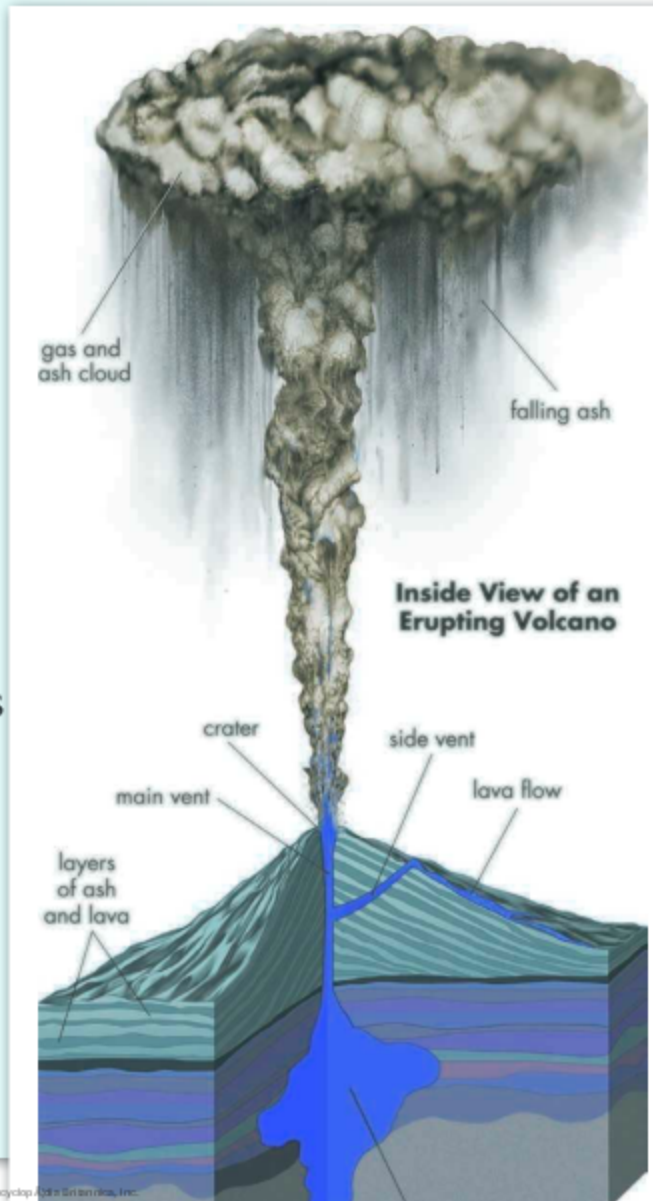
The moment when material comes out from an opening in Earth's surface is called an eruption. This is the part of the volcanic process that we can observe. However, there are many things that happen underground, before the eruption.

Earth looks and feels solid to us here on the surface. However, the planet is actually always changing. Pieces of Earth's solid, rocky surface shift. Some pieces rise up, while others settle down. As rock moves deep underground, it sometimes becomes molten (or melted) and rises up to the surface. Once it comes out it cools and hardens, making new rock.

# BENEATH THE SURFACE

Deep under Earth's surface, it can be very hot. The temperature is so high that it can melt rock. This melted rock is called magma. Magma is located deep below Earth's surface. It forms in the lower part of the planet's crust and in the upper part of the planet's mantle. The mantle is the layer of Earth that lies beneath the planet's solid crust and above the core.

As magma heats up, it rises. Gas bubbles form and grow. The gas makes the magma rise faster until it breaks through the surface.

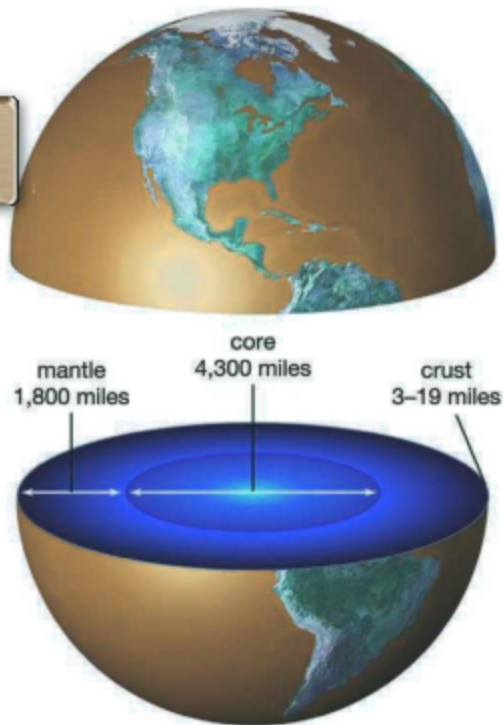




The three layers of Earth are the core, the mantle, and the crust. The crust is the thinnest layer.

If the magma cools, it turns back into solid rock. However, if the magma continues to heat up, it begins to rise. It may slip through cracks in Earth's surface. Sometimes it collects in a space called a magma chamber.

As the magma rises, gas bubbles are made. As they grow, they make the magma move up faster. Pressure builds and builds, and the magma keeps rising until it breaks through the surface. Once it reaches the surface, magma is called lava.



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### COMPARE AND CONTRAST

How are magma and lava the same? What is the difference between them?

# BREAKING THROUGH

When a volcano erupts, hot gases and melted rock from deep within Earth find their way up to the surface. This material may flow slowly out of a fissure, or crack, in the ground, or it may explode suddenly into the air. Volcanic eruptions may be very destructive.

During a volcanic eruption, lava escapes from a vent, or opening, in Earth's surface. Fresh lava is extremely hot. It ranges from 1,300 to 2,200 °F (700 to 1,200 °C) in temperature. It glows red as it flows out of the

**Some volcanic eruptions are explosions of heat that look like fireworks displays.**



## THINK ABOUT IT

How might volcanic ash affect plants, animals, and people in the area of an eruption?

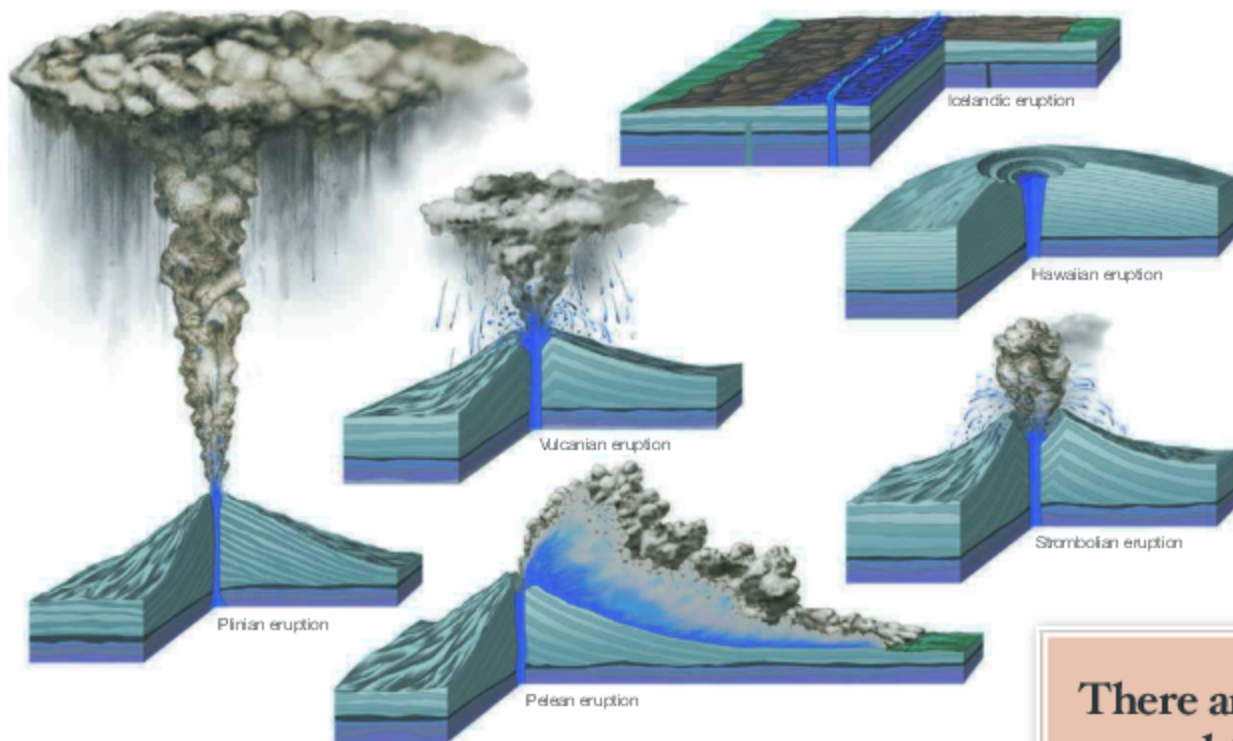
Some volcanoes release so much ash into the air that the sky darkens and day seems like night.



volcano's opening. As it cools, it hardens into rock.

Strong eruptions throw bits of magma into the air. These bits cool into tiny pieces of rock, called volcanic dust or ash. Wind can carry the dust thousands of miles away. Volcanic ash can coat the land for miles around the volcano.





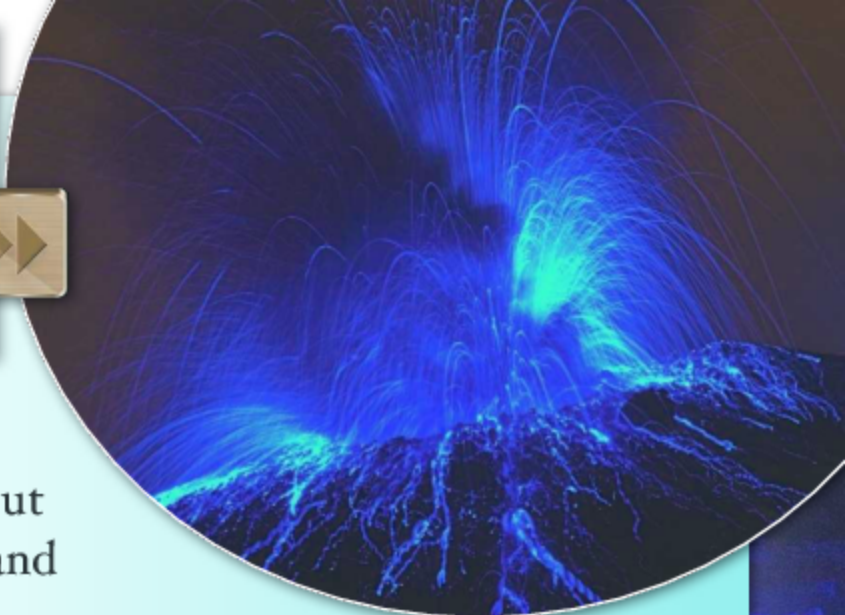
**There are several types of eruptions.**

Steam and poisonous gases also escape from volcanoes. Sometimes these gases are mixed with ash and other hot debris. This mixture travels outward in destructive fiery clouds, called pyroclastic flows.

There are several different types of volcanic eruptions. One of the strongest types is called a Plinian eruption. In this type, the lava flows very quickly,



**Strombolian eruptions are named after the very active Stromboli volcano in Italy, shown here spraying lava.**



because the lava is not too thick. It also lets out lots of smoke, steam, and even chunks of rock!

Hawaiian and Strombolian eruptions are not as strong. They shoot out sprays of lava high into the air. These eruptions look like water fountains you might find in an amusement park or in a big city.

An Icelandic eruption is very mild. The lava doesn't shoot into the air. It flows over the vent and runs downhill.

### **COMPARE AND CONTRAST**

**What do the various kinds of eruptions have in common? How are they different?**

# LIQUID ROCK

Fresh lava flows red hot to white hot as it flows. Some lava is thin enough to flow downhill at 35 miles (56 kilometers) per hour. Other kinds of lava move at the rate of only inches per day. The speed of the flow depends on the temperature of the lava and what it contains.

All lava contains a high percentage of silica. Silica is a compound made up of the chemical elements silicon and oxygen. Lavas are divided into three types, based on how much silica they



The surface of a slow-moving lava flow cools quickly. This lava is from an eruption of Tolbachik, a volcano in eastern Russia.

This basaltic lava is flowing downhill from Kilauea, a volcano in Hawaii.

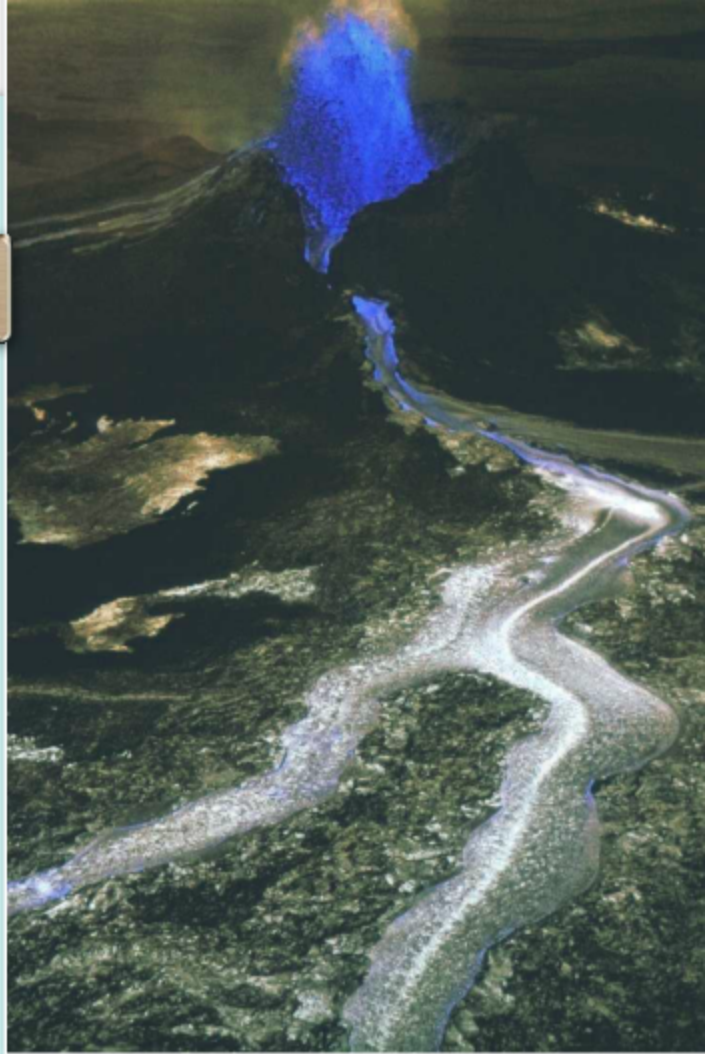


### THINK ABOUT IT

What happens to lava after it cools?

contain. The types are rhyolites, andesites, and basalts. Basalts are the most common type. They flow smoothly and contain chunks of rock. A skin forms over the lava, which can keep it hot for months or even years.

Lava contains gas as well as rock. Sometimes the gases are released slowly or trapped as bubbles when the lava hardens.





# THE AFTERMATH

When a volcanic eruption occurs, there can be devastating effects. The environment around the site is changed forever. Property is destroyed, and lives can be lost. Usually, people **evacuate** the area when they know a volcano is going to erupt.

One event that can happen after a volcano is a landslide. A landslide is a large amount of rock and

## VOCABULARY

To **evacuate** is to leave an area quickly, due to an emergency.

The 1980 eruption of Mount St. Helens, in Washington State, caused great destruction.



Lago del Sol (“Lake of the Sun”) is one of the two lakes inside the crater of Nevado de Toluca, a volcano in central Mexico.



dirt that falls downhill. In a volcanic eruption, the gases released can weaken the rock on the surface, causing it to become claylike and slippery. The weight of the lava flow can carry the rocks and dirt downhill. One volcanic landslide was recorded traveling between 100 and 180 miles (160–290 km) per hour. The material of a landslide collects in valleys, changing the landscape. Small hills form, and the material can form dams that block streams and create lakes.



**Lahars can be powerful and deadly. Some may destroy entire towns.**

From a volcanic landslide, lahars can form. These are streams of rushing muddy water. A lahar

can start out thin like regular water, which flows quickly. As it picks up more material, it becomes thick like oatmeal, flowing slowly. A lahar can move heavy objects, like boulders and bridges, in its path. Lahars also form when an eruption melts snow very quickly, or when the eruption changes the landscape of a lake.

Volcanic eruptions produce great amounts of ash and tephra, pieces of rock that are blasted from the vent. It fills the sky. Winds can carry ash for many miles. Aircraft





Ash from the 2010 eruption of Eyjafjallajökull, a volcano in Iceland, delayed air traffic for weeks.

cannot navigate in these areas. As the ash settles to

the ground, it coats everything. It makes water unfit to drink and makes it difficult for plants to grow. If people accidentally eat or breathe in the tiny ash particles, it can cause health problems.

### **COMPARE AND CONTRAST**

Which do you think would be more difficult to deal with—a landslide or a lahar? Why?

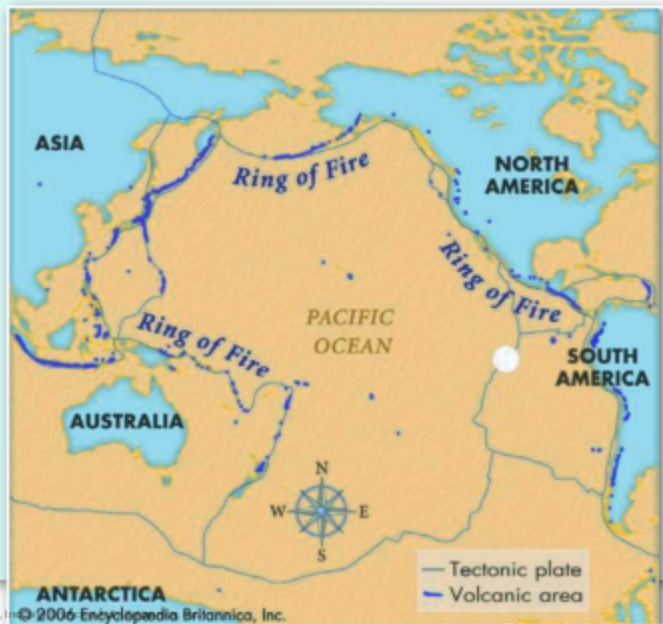


# WHERE IN THE WORLD?

Earth's crust is made up of huge, rocky pieces called plates. The plates move slowly over a layer of melted rock. Most volcanoes lie along the boundaries between these plates.

Some of the most violent eruptions take place where the edge of one plate is forced beneath the edge of another. Most volcanoes of this type are found around the edges of the Pacific Ocean. This huge circle of volcanoes is known as the Ring of Fire. Volcanoes also form in places

The Ring of Fire is located near four continents and is very active.



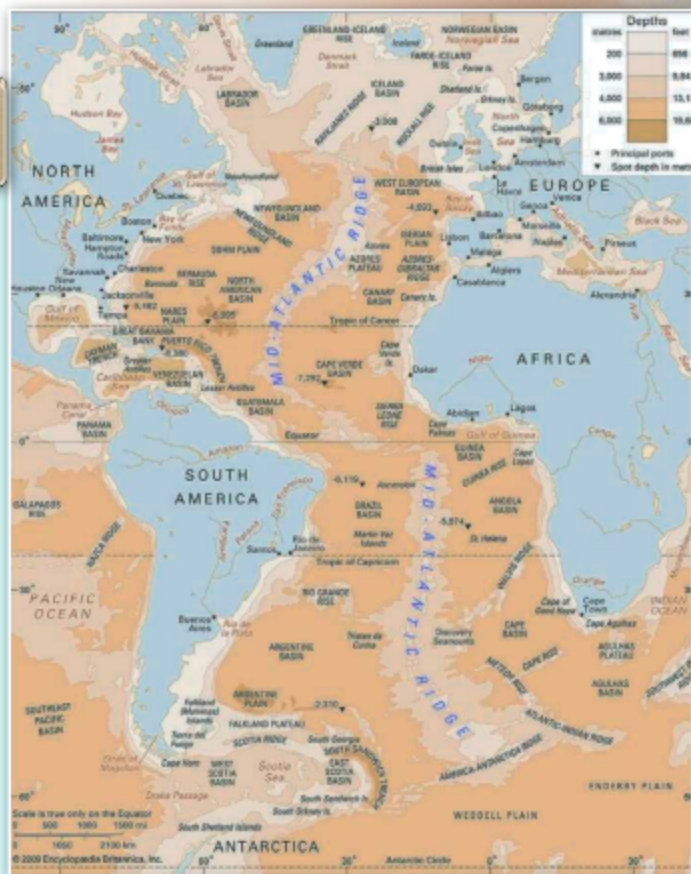
The Mid-Atlantic Ridge runs north-south along the middle of the Atlantic Ocean's floor.

### THINK ABOUT IT

Why do you think the most violent volcanic eruptions are found where plates move together—rather than where plates pull apart or at hot spots?

where two plates slowly pull apart. Some are located along the Mid-Atlantic Ridge, a mountain chain under the Atlantic Ocean.

A few volcanoes are not located along the edges of plates. They form at hot spots in Earth's crust. At a hot spot, molten rock rises from deep below the crust. The volcanoes of Hawaii are the best examples of hot-spot volcanoes.



# VOLCANIC LANDFORMS

## VOCABULARY

**Landforms** are natural features of the land's surface.

Volcanic eruptions create new **landforms** that are also called volcanoes. The two most common types are stratovolcanoes and shield volcanoes.

Stratovolcanoes, also called composite volcanoes, are mountains shaped like cones.

They have a narrow top with steep sides and a wide bottom. A crater, or bowl-shaped pit,

Stratovolcanoes, like Popocatépetl in Mexico, look the way most people expect volcanoes to look.



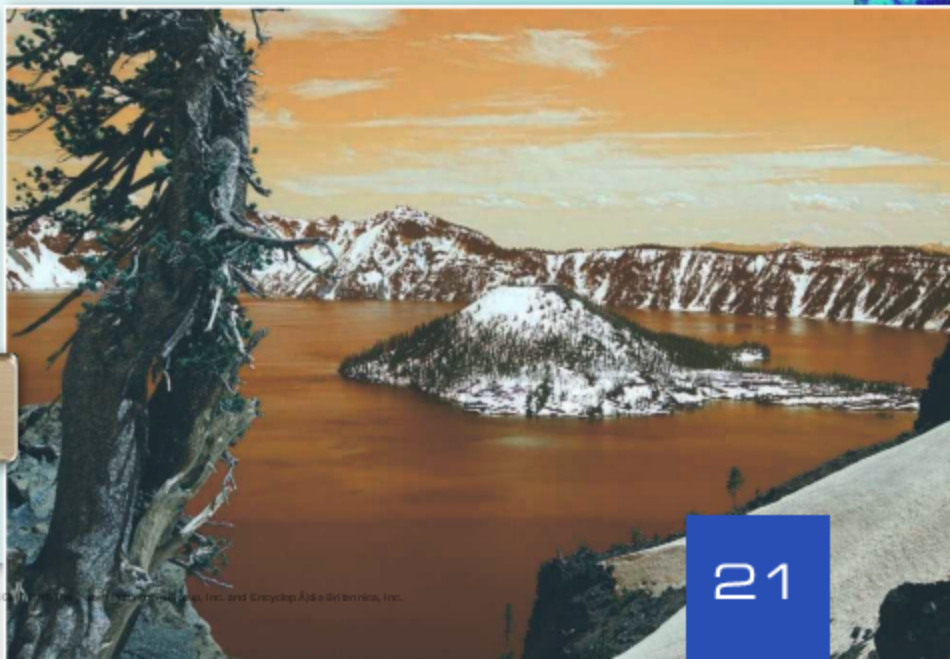


usually lies at the top. Stratovolcanoes are made up of layers of hardened lava and ash.

Shield volcanoes are dome-shaped mountains built by lava flows. They are not as steep as stratovolcanoes, though they can be quite large. Some shield volcanoes that erupt under the sea grow high enough to create islands.

Sometimes the top of a volcano collapses and forms a pit called a caldera. A caldera is larger than a crater. Some calderas fill up with water to form lakes. A somma volcano forms when a new volcanic cone partially fills a caldera.

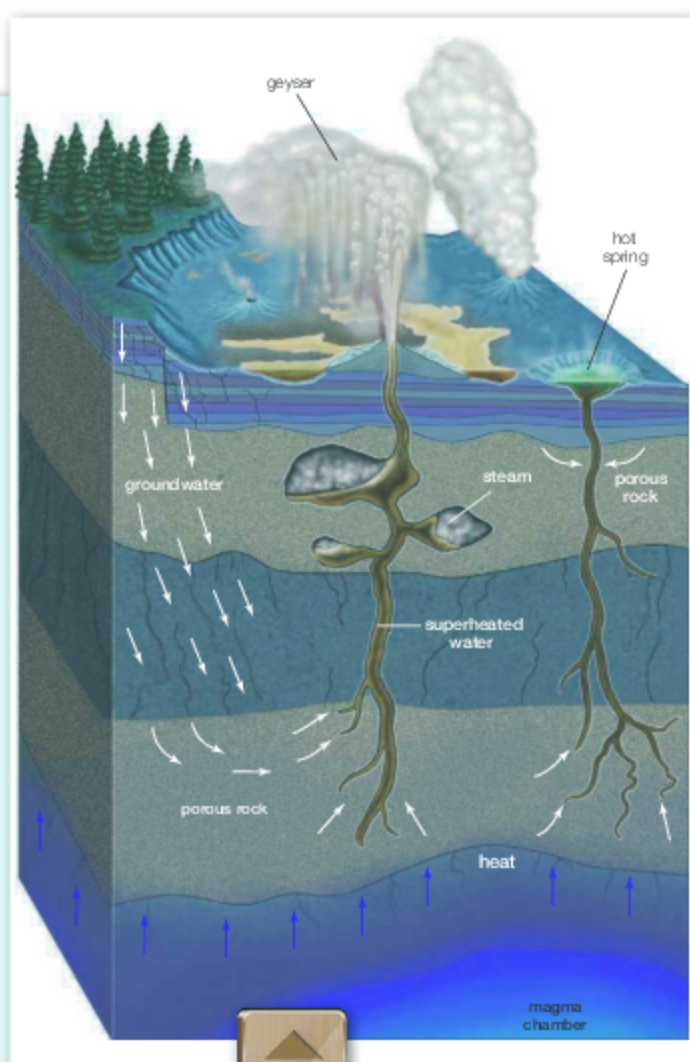
**Crater Lake in Oregon formed after a volcano's top collapsed and formed a caldera.**



# STEAM BLASTS

Hot springs, geysers, and fumaroles are other types of volcanic activity. They happen in places where magma heats water underground.

A hot spring is a place where warm water comes up through the ground. It is rainwater that has seeped underground through holes in the rock. Beneath Earth's surface, it is warmed by magma. The warmed water comes back up to fill a pool. The temperature of a hot spring depends on its location. The water is always hotter than the air around it.



**Hot springs and geysers form when water that trickles deep underground is warmed by heat deep inside Earth.**

## THINK ABOUT IT

Why would a hot spring's temperature depend on its location?

A geyser is a kind of hot spring that shoots water and steam into the air. After water rises from the ground, a lot of pressure is released. More of the deep water suddenly turns into steam. The steam then expands and blows out with great force, spraying hot water with it.

Fumaroles are vents that release gas and steam. They are caused by the same activity that creates hot springs and geysers.

**Yellowstone National Park is the home of many geysers, some of which erupt regularly.**





# VOLCANIC RESOURCES

The effects of volcanoes are not entirely harmful. Volcanic ash soil—called andisol—is good for growing crops. A volcanic glass material called obsidian has been used to make weapons, tools, and ornaments. A volcanic stone called pumice is used for cleaning surfaces and as an ingredient in building materials.

The heat that is released in volcanoes can be a source of energy. This energy, known as geothermal energy, is often difficult to control. However,

**When volcanic ash is mixed in soil, it can help plants grow well.**

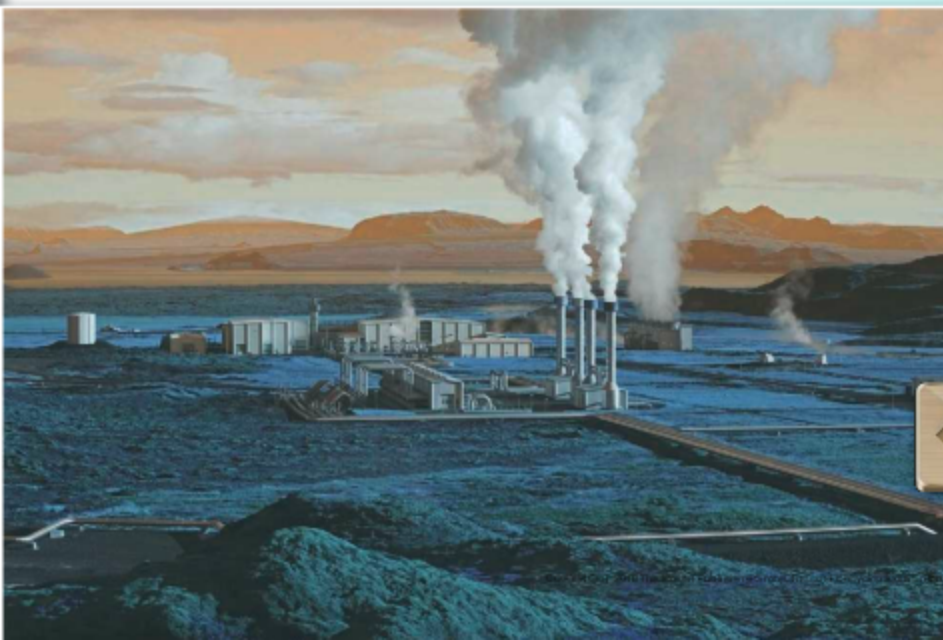




## COMPARE AND CONTRAST

What would be some benefits of living in an area with volcanoes? What would be some costs or drawbacks to living there?

hot water and steam trapped below Earth's surface have been used to heat homes and greenhouses and to produce electric power. Italy, New Zealand, Japan, Iceland, and the United States are countries that have used geothermal energy. This type of energy is referred to as clean, renewable energy because it does not cause pollution and it cannot be used up.



Geothermal power plants, such as this one in Iceland, can produce energy with very little waste.



# VOLCANOLOGY

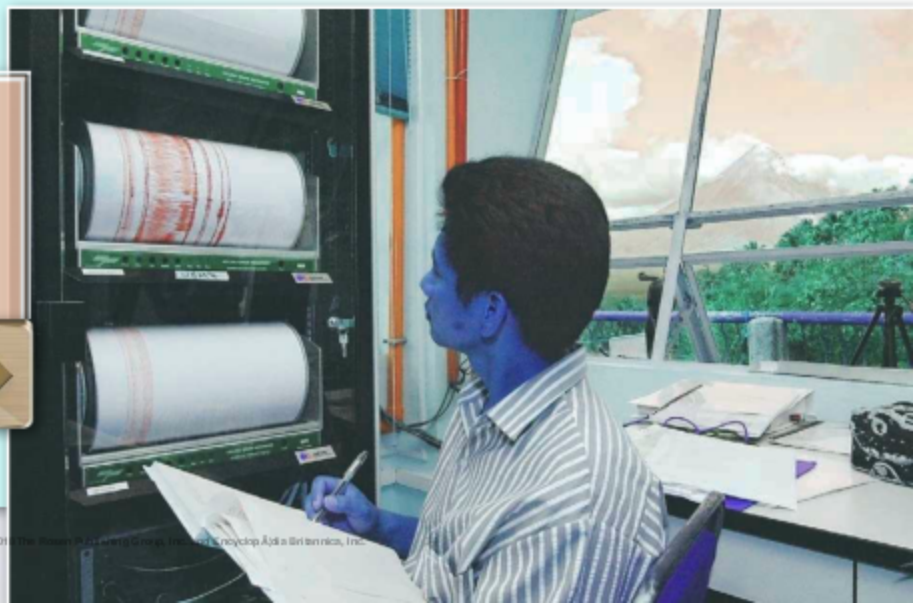
Volcanology is the branch of science that focuses on volcanoes. Many volcanologists work in observatories, where they keep track of earth tremors and other signs of volcanic activity. They also study samples taken from volcanoes.

Others go to the slopes and craters for an even closer look. This is called fieldwork. On the basis of what they measure and see, they try to **predict** when an eruption might

## VOCABULARY

To **predict** is to foretell, based on careful observation.

Volcanologists are always measuring and recording underground activity.



Some volcanologists work on the site of an active volcano, which can be very dangerous.



take place, how strong it will be, and which places will be in the danger zone. Their job is important because the information they gather can give people time to escape danger.

To become a volcanologist, a person should study geology. Geology is the study of the physical features and history of our planet. Volcanologists use tools to measure earthquakes, identify gasses, and track the movement of magma.



# FAMOUS VOLCANIC EVENTS

In the year 79 CE, Mount Vesuvius in Italy erupted. The entire city of Pompeii was buried, and thousands of people died. Archeologists uncovered the site in the 1700s. They found many buildings, objects, and bodies preserved by the ash.

Krakatoa, in Indonesia, had one of the most powerful eruptions in history. It produced so much ash that no sunlight could get through the ash cloud for two and a

This is what remains of Pompeii, where a deadly eruption took place in Italy nearly 2,000 years ago.



## THINK ABOUT IT

Would you live near a volcano that had erupted in the past?

half days. No plant or animal life could survive in the area for five years after the eruption.

The 1980 eruption of Mount St. Helens, in the US state of Washington, was one of the strongest ever in North America. Ash and stone were thrown 12 miles (19 km) from the site. The eruption destroyed the top of the mountain itself, leaving it 1,300 feet (396 meters) shorter than it had been.

The effects of Krakatoa's 1883 eruption lasted for many years in Southeast Asia.



# GLOSSARY

**caldera** A large crater formed when a volcano's cone collapses.

**crust** Earth's thin, rocky outer layer.

**debris** Fragments of rock.

**devastating** Causing much destruction.

**environment** The natural surroundings.

**erupt** To burst or explode, or to break through a surface.

**fissure** A narrow crack.

**fumarole** An opening in Earth's crust from which steam and gas escape.

**geothermal** Relating to or using heat from inside Earth.

**geyser** A spring that shoots out hot water and steam.

**hot spring** A pool of water heated by Earth's natural processes.

**lahar** A stream of rushing, muddy water.

**landslide** The slipping down of a mass of rocks or earth on a steep slope.

**lava** Melted rock coming from a volcano or such rock that has cooled and hardened.

**magma** Melted rock that moves underground.

**mantle** The layer of Earth lying between the crust and the core.

**molten** Melted by great heat.

**pressure** The force with which one object presses against another.

**tephra** Ash.

**tremor** A small movement of the ground before or after an earthquake.

**vent** An opening in Earth's surface.

# FOR MORE INFORMATION

## Books

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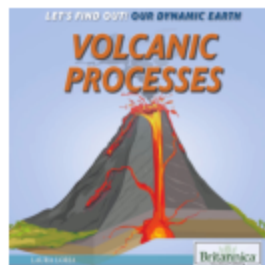
## Websites

Because of the changing nature of internet links, Rosen Publishing has developed an online list of websites related to the subject of this book. This site is updated regularly. Please use this link to access the list:

<http://www.rosenlinks.com/LFO/Volcano>



# Book Index



Volcanic Processes

**Volcanic Processes** *Laura Loria. Let's Find Out! Our Dynamic Earth*  
*New York, NY: Britannica Educational Publishing with Rosen Educational Services, 2018. 32 pp.*

This book explores the geological structure that makes volcanic activity possible and follow the sequence of events that culminate in an eruption. In addition to eruptions, it also examines other geothermal activities.



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