

# A Tale of Two Volcanoes



In 79 AD, 20,000 Romans lived in the town of Pompeii, near present-day Naples. Many were farmers, working the fertile soil that, unbeknownst to them, came from previous eruptions of nearby Mount Vesuvius.

Then in August, the top of that mountain exploded 10 miles into the atmosphere! Ash and stone rained down on Pompeii for a day. Most residents fled.

The 2,000 who stayed thought they had escaped the worst of it—then a cloud of hot gas rolled down the mountain, suffocating them. Their bodies were encased in ash, to be found almost 2,000 years later.

There are two main types of lava, and Vesuvius has the more dangerous kind. It's high in silica, making it very viscous, or thick, so that it traps the gases that were responsible both for the mountain's explosion and its deadly clouds.

Conversely, Hawaii's Kilauea has been continuously erupting since 1983. Its lava is high in iron and magnesium, flows easily, and therefore traps less gas, making it much less explosive. Scientists can walk right up to it and sample lava.

Since 79 AD, Vesuvius has erupted 30 more times. It remains the only active volcano in Europe.

Scientists know that it will erupt again but can't be sure when or how dramatic it will be.

Some expect soon, and they're keeping a close eye on this lightly sleeping giant.

Left: Geologist collecting a fresh sample of slow-moving lava flow at Kilauea volcano in Hawaii.

Credit: USGS

Right: October 1974 eruption of fast-moving pyroclastic flows from the Volcán de Fuego in Guatemala.

Credit: Paul Newton, Smithsonian Institution (public domain), via Wikimedia Commons

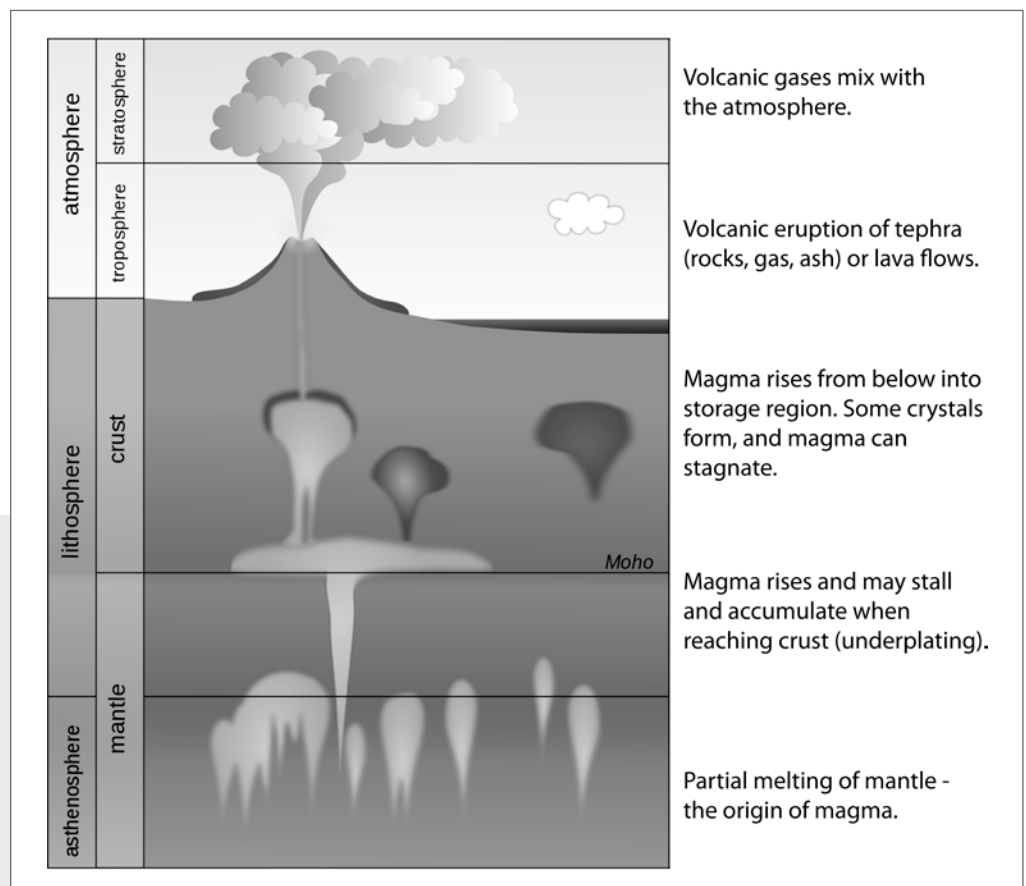


# Background: A Tale of Two Volcanoes

**Synopsis:** Why are some volcanoes like Guatemala's Fuego catastrophically deadly, while Hawaiians can walk up and sample flowing lava from Kilauea's active eruption?

- Globally, more than 1,500 volcanoes on land, and even more under the oceans, may erupt in the future.
  - Over the past 100 years, 500 volcanoes have erupted.
  - Most eruptions occur around the Pacific Ocean because of plate tectonics, but some occur because of mantle hot spots, like those in Hawaii and at Yellowstone.
- A volcano is a rupture in the surface of the earth from which hot lava, steam, gases, volcanic ash, and glass issue from a magma chamber deep below Earth's surface to form a cone-shaped mountain at the surface.
  - Magma is partially molten rock that collects within Earth's crust. It contains molten rock, mineral crystals, and gas. When magma erupts onto the surface, it is called *lava*.
  - Magma is heated many miles below the ground. Because it is hot and pressurized by the gas within it, the buoyant magma makes its way upward through solid rock, eventually rupturing the surface.
  - Repeated eruptions may occur as the magma chamber refills multiple times over months, years, decades, or centuries.

The basic process of magma formation, movement to the surface, and eruption through a volcanic vent.  
Credit: USGS



## References: A Tale of Two Volcanoes

- Volcano | Wikipedia
- Volcano Hazards Program | USGS
- Types of Volcanic Eruptions | Geology.com
- Steam-Driven Blasts Last Seen at Kilauea in 1924 May Recur | Eos
- No, Kilauea Won't Cause Mass Destruction | Science News
- This Day in History: August 24 | History.com
- Contributors: Juli Hennings, Harry Lynch



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- Proportions of chemicals occurring in magma influence the type of eruption at each volcano. Typically, magmas include these chemicals in varying amounts: oxygen, silica, aluminum, iron, magnesium, calcium, sodium, potassium, titanium, and manganese.
- Some eruptions are effusive, with lava flowing out like a thick sticky fluid, often for extended periods of time.
  - The Pu'u 'Ō'ō vent of Hawaii's Kilauea volcano has been erupting black mafic lava continuously since January 1983. The eruption picked up its pace in the spring of 2018.
  - Basaltic or "mafic" lavas contain higher concentrations of iron (Fe) and magnesium (Mg) and less than 52 percent silica (Si), making them less viscous.
  - Mafic lavas are usually the highest-temperature lavas; they tend to have fewer gas buildups because the gases can escape more easily
  - These types of eruptions form broad-shield volcanoes like we see in Hawaii; flows generally move slowly enough so that people can get out of their way.
  - These volcanoes usually form over oceanic crust, which has a similar composition.
  - If magma drops below the water table and trapped steam builds up pressure, a phreatic explosive eruption may occur.
- Other eruptions are explosive, with lots of ash, noxious gases, and chunks of lava violently blasting out of vents 10–20 miles into Earth's stratosphere over a much shorter period of time.
  - The eruption of Mount Vesuvius, near Naples, Italy, began around noon on August 24, 79 AD, and lasted just 18 hours, burying Pompeii under nearly 20 ft of ash and pumice and Herculaneum under 60 ft of mud and volcanic debris, killing thousands of citizens.
  - The June 2018 eruption of Guatemala's Fuego volcano also sent hot ground-hugging pyroclastic flows of gas and ash speeding down its flanks, killing more than 69 villagers, with over 200 still missing.
  - Rhyolitic or "felsic" lava has more than 63 percent silica content, which makes it very thick and viscous, trapping gasses until they expand and explode catastrophically as they reach the surface. In some cases, these blasts produce high-velocity clouds of foamy, molten volcanic glass known as *pyroclastic flows*, which careen down the sides of the volcano, engulfing anything in their paths.
  - These types of volcanoes tend to form over silica-rich continental crust. Magma incorporates some of the solid bedrock as it moves toward Earth's surface.
  - As any magma cools, it becomes more viscous and may start crystallizing, which tends to cause explosions toward the end of an eruptive cycle as gas becomes trapped.
  - These eruptions form steeper-sided volcanoes called *stratovolcanoes*, which are composite volcanoes made of both cinder cones and lava flows. Some of these huge volcanoes have multiple magma chambers that continue to feed eruptions.



Alaska's Redoubt volcano with minor ash eruption.

Credit: Alaska Volcano Observatory staff, March 30, 2009

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