



What Starts an Eruption?

Narrative

Gases, such as water vapor, CO₂, SO₂, and other rarer gases, are the driving forces that power explosive volcanic eruptions. However, gases are not the only players in a volcanic eruption. The size and explosiveness of an eruption are also controlled by the amount of magma in the magma chamber, the magma's chemical composition, and the pressure change in the narrow conduit that leads to Earth's surface.

Magma

Deep below the surface of the earth, the subducting plate's temperature increases. Water rises out of the sinking slab, migrates into the surrounding hotter mantle rock, and initiates melting. The molten rock is called magma.

Pressure

Within the Earth, the weight of rock causes pressure to increase with depth (imagine the weight, or pressure, on your body if a million rocks were sitting on top of you!). The greater the depth, the greater the pressure. Pressure can cause gases such as water vapor and carbon dioxide to dissolve in magma at great depth, and then to come out of the magma to form bubbles, like those in a carbonated drink, as the magma rises and pressure decreases.

Magma Chamber

The magma chamber is a zone of molten and partially molten rock that exists beneath a volcano. The top of the magma chamber at Mount Rainier is about eight kilometers (five miles) below the Earth's surface and is only a few kilometers wide. As gas bubbles accumulate, the upward pressure increases, forcing cracks in the rocks to widen, often in the direction of Earth's surface. For magma to erupt from a volcano, this upward pressure must exceed the downward pressure that is exerted by the eight-kilometer (five mile) thick load of rock overhead.

Magma Conduit

With the accumulation and rise of bubbles through the magma chamber, the pressure increases and will eventually become great enough to break through overlying roof rocks, creating a conduit to the surface. Magma escapes through the "super highway" of the volcano, known as the magma conduit or throat. This long, narrow opening leads from the top of the magma chamber to the Earth's surface. Near the surface, the throat of Mount Rainier is only ten to fifteen meters (33 to 50 feet) wide and is currently filled with solid rock.



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Narrative—continued...

As gas bubbles rush up the magma conduit, the pressure declines, causing the bubbles to expand rapidly. They can expand to thousands of times their original size! The rapid expansion of gas bubbles propels the magma and gas up the conduit. Within minutes, the volcano erupts, explosively spewing hot lava and tephra into the air. Lava can be jetted thousands of feet into the air. Eventually, if the magma is “runny enough,” the gas bubbles escape easily; and instead of exploding, magma pours down the flanks of volcano as a lava flow.

Vents and Fumaroles

Vents and fumaroles in the rock surrounding the conduit can also allow gases to escape from the magma through vents and fumaroles. If enough gas escapes, the character of the eruption will be changed from explosive to non-explosive.

