[Template:About](/wiki/Template:About" \o "Template:About) [Template:Pp](/wiki/Template:Pp) [Template:Use mdy dates](/wiki/Template:Use_mdy_dates) [Template:Broader](/wiki/Template:Broader) [thumb|](/wiki/File:MtCleveland_ISS013-E-24184.jpg)[Cleveland Volcano](/wiki/Mount_Cleveland_(Alaska)) in the [Aleutian Islands](/wiki/Aleutian_Islands) of [Alaska](/wiki/Alaska) photographed from the [International Space Station](/wiki/International_Space_Station), May 2006 [thumb|](/wiki/File:Pinatubo_ash_plume_910612.jpg)[Ash](/wiki/Volcanic_ash) plumes reached a height of [Template:Convert](/wiki/Template:Convert) during the climactic [explosive eruption](/wiki/Explosive_eruption) at [Mount Pinatubo](/wiki/Mount_Pinatubo), Philippines in 1991. [thumb|right|A 2007 eruptive column at](/wiki/File:04Sep2007_Etna_from_SE_Crater.jpg) [Mount Etna](/wiki/Mount_Etna) producing volcanic ash, pumice and lava bombs [thumb|](/wiki/File:Ubinas_ali_2010205.jpg)[Ubinas Volcano](/wiki/Ubinas) [thumb|Aerial view of the](/wiki/File:Ile_Barren,_1995.jpg) [Barren Island, Andaman Islands](/wiki/Barren_Island_(Andaman_Islands)), [India](/wiki/India), during an eruption in 1995. It is the only active volcano in South Asia. [thumb|](/wiki/File:Mount_Shasta_satellite_view_Jan_2014_-_Zoomed.jpg)[Mount Shasta](/wiki/Mount_Shasta) [thumb|](/wiki/File:Santa_Ana_Volcano.USAF.C-130.3.jpg)[Santa Ana Volcano](/wiki/Santa_Ana_Volcano), [El Salvador](/wiki/El_Salvador). A close-up aerial view of the nested summit calderas and craters, along with the crater lake.

A **volcano** is a [rupture](/wiki/Rupture_(engineering)) in the [crust](/wiki/Crust_(geology)) of a [planetary-mass object](/wiki/Planetary-mass_object), such as [Earth](/wiki/Earth), that allows hot [lava](/wiki/Lava), [volcanic ash](/wiki/Volcanic_ash), and [gases](/wiki/Volcanic_gas) to escape from a [magma chamber](/wiki/Magma_chamber) below the surface.

Earth's volcanoes occur because its crust is broken into 17 major, rigid [tectonic plates](/wiki/Plate_tectonics) that float on a hotter, softer layer in its mantle.[[1]](#cite_note-1) Therefore, on Earth, volcanoes are generally found where tectonic plates are [diverging](/wiki/Divergent_boundary) or [converging](/wiki/Convergent_boundary). For example, a [mid-oceanic ridge](/wiki/Mid-oceanic_ridge), such as the [Mid-Atlantic Ridge](/wiki/Mid-Atlantic_Ridge), has volcanoes caused by divergent tectonic plates pulling apart; the [Pacific Ring of Fire](/wiki/Pacific_Ring_of_Fire) has volcanoes caused by convergent tectonic plates coming together. Volcanoes can also form where there is stretching and thinning of the crust's [Template:Clarify span](/wiki/Template:Clarify_span), e.g., in the [East African Rift](/wiki/East_African_Rift) and the [Wells Gray-Clearwater volcanic field](/wiki/Wells_Gray-Clearwater_volcanic_field) and [Rio Grande Rift](/wiki/Rio_Grande_Rift) in North America. This type of volcanism falls under the umbrella of "plate hypothesis" volcanism.<ref name=Foulger>[Template:Cite book](/wiki/Template:Cite_book)</ref> Volcanism away from plate boundaries has also been explained as [mantle plumes](/wiki/Mantle_plume). These so-called "[hotspots](/wiki/Hotspot_(geology))", for example Hawaii, are postulated to arise from upwelling [diapirs](/wiki/Diapir) with magma from the [core–mantle boundary](/wiki/Core–mantle_boundary), 3,000 km deep in the Earth. Volcanoes are usually not created where two tectonic plates slide past one another.

Erupting volcanoes can pose many hazards, not only in the immediate vicinity of the eruption. One such hazard is that volcanic ash can be a threat to aircraft, in particular those with [jet engines](/wiki/Jet_engine) where ash particles can be melted by the high [operating temperature](/wiki/Operating_temperature); the melted particles then adhere to the [turbine](/wiki/Turbine) blades and alter their shape, disrupting the operation of the turbine. Large eruptions can affect temperature as ash and droplets of [sulfuric acid](/wiki/Sulfuric_acid) obscure the [sun](/wiki/Sun) and cool the Earth's lower atmosphere (or [troposphere](/wiki/Troposphere)); however, they also absorb heat radiated up from the Earth, thereby warming the upper atmosphere (or [stratosphere](/wiki/Stratosphere)). Historically, so-called [volcanic winters](/wiki/Volcanic_winter) have caused catastrophic [famines](/wiki/Famine).

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## Etymology[[edit](/index.php?title=(none)&action=edit&section=1)]

The word *volcano* is derived from the name of [Vulcano](/wiki/Vulcano), a volcanic island in the [Aeolian Islands](/wiki/Aeolian_Islands) of Italy whose name in turn comes from [Vulcan](/wiki/Vulcan_(mythology)), the god of fire in [Roman mythology](/wiki/Roman_mythology).[[2]](#cite_note-2) The study of volcanoes is called [volcanology](/wiki/Volcanology), sometimes spelled *vulcanology*.

## Plate tectonics[[edit](/index.php?title=(none)&action=edit&section=2)]

[thumb|374x374px|Map showing the divergent plate boundaries (OSR – Oceanic Spreading Ridges) and recent sub-aerial volcanoes](/wiki/File:Spreading_ridges_volcanoes_map-en.svg) [Template:Main](/wiki/Template:Main)

### Divergent plate boundaries[[edit](/index.php?title=(none)&action=edit&section=3)]

[Template:Main](/wiki/Template:Main) At the [mid-oceanic ridges](/wiki/Mid-oceanic_ridges), two [tectonic plates](/wiki/Tectonic_plate) diverge from one another as new [oceanic crust](/wiki/Oceanic_crust) is formed by the cooling and solidifying of hot molten rock. Because the crust is very thin at these ridges due to the pull of the tectonic plates, the release of pressure leads to [adiabatic](/wiki/Adiabatic_process) expansion and the partial melting of the [mantle](/wiki/Mantle_(geology)), causing volcanism and creating new oceanic crust. Most [divergent plate boundaries](/wiki/Divergent_boundary) are at the bottom of the oceans; therefore, most volcanic activity is submarine, forming new seafloor. [Black smokers](/wiki/Black_smoker) (also known as deep sea vents) are an example of this kind of volcanic activity. Where the mid-oceanic ridge is above sea-level, volcanic islands are formed, for example, [Iceland](/wiki/Iceland).

### Convergent plate boundaries[[edit](/index.php?title=(none)&action=edit&section=4)]

[Template:Main](/wiki/Template:Main) [Subduction](/wiki/Subduction) zones are places where two plates, usually an oceanic plate and a continental plate, collide. In this case, the oceanic plate subducts, or submerges under the continental plate forming a deep ocean trench just offshore. In a process called [flux melting](/wiki/Flux_melting), water released from the subducting plate lowers the melting temperature of the overlying mantle wedge, creating [magma](/wiki/Magma). This magma tends to be very [viscous](/wiki/Viscous) due to its high [silica](/wiki/Silica) content, so often does not reach the surface and cools at depth. When it does reach the surface, a volcano is formed. Typical examples of this kind of volcano are [Mount Etna](/wiki/Mount_Etna) and the volcanoes in the [Pacific Ring of Fire](/wiki/Pacific_Ring_of_Fire).

### "Hotspots"[[edit](/index.php?title=(none)&action=edit&section=5)]

[Template:Main](/wiki/Template:Main) "[Hotspots](/wiki/Hotspot_(geology))" is the name given to volcanic areas believed to be formed by [mantle plumes](/wiki/Mantle_plume), which are hypothesized to be columns of hot material rising from the core-mantle boundary in a fixed space that causes large-volume melting. Because tectonic plates move across them, each volcano becomes dormant and is eventually reformed as the plate advances over the postulated plume. The [Hawaiian Islands](/wiki/Hawaiian_Islands) have been suggested to have been formed in such a manner, as well as the [Snake River Plain](/wiki/Snake_River_Plain), with the [Yellowstone Caldera](/wiki/Yellowstone_Caldera) being the part of the North American plate currently above the hot spot. This theory is currently under criticism, however.[[3]](#cite_note-3)

## Volcanic features[[edit](/index.php?title=(none)&action=edit&section=6)]

[right|thumbnail|](/wiki/File:Lakagigar_Iceland_2004-07-01.jpg)[Lakagigar](/wiki/Laki) fissure vent in [Iceland](/wiki/Iceland), source of the [major world climate alteration of 1783–84](/wiki/Laki#Consequences_in_Iceland) [right|thumbnail|](/wiki/File:Skjaldbreidur_Herbst_2004.jpg)[Skjaldbreiður](/wiki/Skjaldbreiður), a shield volcano whose name means "broad shield" The most common perception of a volcano is of a [conical](/wiki/Cone_(geometry)) mountain, spewing [lava](/wiki/Lava) and poisonous [gases](/wiki/Volcanic_gas) from a [crater](/wiki/Volcanic_crater) at its summit; however, this describes just one of the many types of volcano. The features of volcanoes are much more complicated and their structure and behavior depends on a number of factors. Some volcanoes have rugged peaks formed by [lava domes](/wiki/Lava_dome) rather than a summit crater while others have [landscape](/wiki/Landscape) features such as massive [plateaus](/wiki/Plateau). Vents that issue volcanic material (including [lava](/wiki/Lava) and [ash](/wiki/Volcanic_ash)) and gases (mainly [steam and magmatic gases](/wiki/Volcano#Effects_of_volcanoes)) can develop anywhere on the [landform](/wiki/Landform) and may give rise to smaller cones such as [Pu](/wiki/Pu'u_'Ō'ō)[Template:Okinau](/wiki/Template:Okina) [Template:Okina](/wiki/Template:Okina)Ō[Template:Okina](/wiki/Template:Okina)ō on a flank of Hawaii's [Kīlauea](/wiki/Kīlauea). Other types of volcano include [cryovolcanoes](/wiki/Cryovolcano) (or ice volcanoes), particularly on some moons of [Jupiter](/wiki/Jupiter), [Saturn](/wiki/Saturn), and [Neptune](/wiki/Neptune); and [mud volcanoes](/wiki/Mud_volcano), which are formations often not associated with known magmatic activity. Active mud volcanoes tend to involve temperatures much lower than those of [igneous](/wiki/Igneous) volcanoes except when the mud volcano is actually a vent of an igneous volcano.

### Fissure vents[[edit](/index.php?title=(none)&action=edit&section=7)]

[Template:Main](/wiki/Template:Main) Volcanic **fissure vents** are flat, linear fractures through which [lava](/wiki/Lava) emerges.

### Shield volcanoes[[edit](/index.php?title=(none)&action=edit&section=8)]

[Template:Main](/wiki/Template:Main) **Shield volcanoes**, so named for their broad, shield-like profiles, are formed by the eruption of low-viscosity lava that can flow a great distance from a vent. They generally do not explode catastrophically. Since low-viscosity magma is typically low in silica, shield volcanoes are more common in oceanic than continental settings. The Hawaiian volcanic chain is a series of shield cones, and they are common in [Iceland](/wiki/Iceland), as well.

### Lava domes[[edit](/index.php?title=(none)&action=edit&section=9)]

[Template:Main](/wiki/Template:Main) **Lava domes** are built by slow eruptions of highly viscous lava. They are sometimes formed within the crater of a previous volcanic eruption, as in the case of [Mount Saint Helens](/wiki/Mount_Saint_Helens), but can also form independently, as in the case of [Lassen Peak](/wiki/Lassen_Peak). Like stratovolcanoes, they can produce violent, explosive eruptions, but their lava generally does not flow far from the originating vent.

### Cryptodomes[[edit](/index.php?title=(none)&action=edit&section=10)]

**Cryptodomes** are formed when viscous lava is forced upward causing the surface to bulge. The [1980 eruption of Mount St. Helens](/wiki/1980_eruption_of_Mount_St._Helens) was an example; lava beneath the surface of the mountain created an upward bulge which slid down the north side of the mountain.

### Volcanic cones (cinder cones)[[edit](/index.php?title=(none)&action=edit&section=11)]

[Template:Main](/wiki/Template:Main) [thumb|](/wiki/File:Green_Izalco_Volcano.JPG)[Izalco (volcano)](/wiki/Izalco_(volcano)), located in the [Cordillera de Apaneca](/wiki/Cordillera_de_Apaneca) volcanic range complex in El Salvador. Only a few generations old, Izalco is the youngest and best known cone volcano. Izalco erupted almost continuously from 1770 (when it formed) to 1958, earning it the nickname of "Lighthouse of the Pacific".

**Volcanic cones** or **cinder cones** result from eruptions of mostly small pieces of [scoria](/wiki/Scoria) and [pyroclastics](/wiki/Pyroclastics) (both resemble cinders, hence the name of this volcano type) that build up around the vent. These can be relatively short-lived eruptions that produce a cone-shaped hill perhaps 30 to 400 meters high. Most cinder cones erupt only [once](/wiki/Monogenetic_volcanic_field). Cinder cones may form as [flank vents](/wiki/Parasitic_cone) on larger volcanoes, or occur on their own. [Parícutin](/wiki/Parícutin) in Mexico and [Sunset Crater](/wiki/Sunset_Crater) in [Arizona](/wiki/Arizona) are examples of cinder cones. In [New Mexico](/wiki/New_Mexico), [Caja del Rio](/wiki/Caja_del_Rio) is a [volcanic field](/wiki/Volcanic_field) of over 60 cinder cones.

Based on satellite images it was suggested that cinder cones might occur on other terrestrial bodies in the Solar system too; on the surface of Mars and the Moon.[[4]](#cite_note-4)[[5]](#cite_note-5)[[6]](#cite_note-6)[[7]](#cite_note-7)

### Stratovolcanoes (composite volcanoes)[[edit](/index.php?title=(none)&action=edit&section=12)]

[thumb|300px| {| ! colspan="2" | **Cross-section through a**](/wiki/File:Volcano_scheme.svg) [**stratovolcano**](/wiki/Stratovolcano) **(vertical scale is exaggerated)**: |- valign="top" | 1. Large magma chamber  
2. Bedrock  
3. Conduit (pipe)  
4. Base  
5. Sill  
6. Dike  
7. Layers of ash emitted by the volcano  
8. Flank | 9. Layers of lava emitted by the volcano  
10. Throat  
11. Parasitic cone  
12. Lava flow  
13. Vent  
14. Crater  
15. Ash cloud |} [Template:Main](/wiki/Template:Main) **Stratovolcanoes** or **composite volcanoes** are tall conical mountains composed of lava flows and other ejecta in alternate layers, the [strata](/wiki/Stratum) that gives rise to the name. Stratovolcanoes are also known as composite volcanoes because they are created from multiple structures during different kinds of eruptions. Strato/composite volcanoes are made of cinders, ash, and lava. Cinders and ash pile on top of each other, lava flows on top of the ash, where it cools and hardens, and then the process repeats. Classic examples include [Mount Fuji](/wiki/Mount_Fuji) in Japan, [Mayon Volcano](/wiki/Mayon_Volcano) in the Philippines, and [Mount Vesuvius](/wiki/Mount_Vesuvius) and [Stromboli](/wiki/Stromboli) in Italy.

Throughout [recorded history](/wiki/Recorded_history), [ash](/wiki/Volcanic_ash) produced by the [explosive eruption](/wiki/Explosive_eruption) of stratovolcanoes has posed the greatest volcanic hazard to civilizations. Not only do stratovolcanoes have greater pressure build up from the underlying lava flow than shield volcanoes, but their fissure vents and [monogenetic volcanic fields](/wiki/Monogenetic_volcanic_field) (volcanic cones) have more powerful eruptions, as they are many times under [extension](/wiki/Extension_(geology)). They are also steeper than shield volcanoes, with slopes of 30–35° compared to slopes of generally 5–10°, and their loose [tephra](/wiki/Tephra) are material for dangerous [lahars](/wiki/Lahar).[[8]](#cite_note-8) Large pieces of tephra are called [volcanic bombs](/wiki/Volcanic_bomb). Big bombs can measure more than 4 feet(1.2 meters) across and weigh several tons.[[9]](#cite_note-9)

### Supervolcanoes[[edit](/index.php?title=(none)&action=edit&section=13)]

[Template:Main](/wiki/Template:Main) [Template:See also](/wiki/Template:See_also) A **supervolcano** usually has a large [caldera](/wiki/Caldera) and can produce devastation on an enormous, sometimes continental, scale. Such volcanoes are able to severely cool global temperatures for many years after the eruption due to the huge volumes of [sulfur](/wiki/Sulfur) and ash released into the atmosphere. They are the most dangerous type of volcano. Examples include: [Yellowstone Caldera](/wiki/Yellowstone_Caldera) in [Yellowstone National Park](/wiki/Yellowstone_National_Park) and [Valles Caldera](/wiki/Valles_Caldera) in [New Mexico](/wiki/New_Mexico) (both western United States); [Lake Taupo](/wiki/Lake_Taupo) in New Zealand; [Lake Toba](/wiki/Lake_Toba) in [Sumatra](/wiki/Sumatra), Indonesia; and [Ngorongoro Crater](/wiki/Ngorongoro_Crater) in Tanzania. Because of the enormous area they may cover, supervolcanoes are hard to identify centuries after an eruption. Similarly, [large igneous provinces](/wiki/Large_igneous_province) are also considered supervolcanoes because of the vast amount of [basalt](/wiki/Basalt) lava erupted (even though the lava flow is [non-explosive](/wiki/Effusive_eruption)).

### Submarine volcanoes[[edit](/index.php?title=(none)&action=edit&section=14)]

[Template:Main](/wiki/Template:Main) [Template:See also](/wiki/Template:See_also) **Submarine volcanoes** are common features of the ocean floor. In shallow water, active volcanoes disclose their presence by blasting steam and rocky debris high above the ocean's surface. In the ocean's deep, the tremendous weight of the water above prevents the explosive release of steam and gases; however, they can be detected by [hydrophones](/wiki/Hydrophone) and discoloration of water because of [volcanic gases](/wiki/Volcanic_gas). [Pillow lava](/wiki/Pillow_lava) is a common eruptive product of submarine volcanoes and is characterized by thick sequences of discontinuous pillow-shaped masses which form under water. Even large submarine eruptions may not disturb the ocean surface due to the rapid cooling effect and increased buoyancy of water (as compared to air) which often causes volcanic vents to form steep pillars on the ocean floor. [Hydrothermal vents](/wiki/Hydrothermal_vent) are common near these volcanoes, and [some support peculiar ecosystems](/wiki/Black_smoker) based on dissolved minerals. Over time, the formations created by submarine volcanoes may become so large that they break the ocean surface as new islands or floating [pumice rafts](/wiki/Pumice_raft).

### Subglacial volcanoes[[edit](/index.php?title=(none)&action=edit&section=15)]

[Template:Main](/wiki/Template:Main) **Subglacial volcanoes** develop underneath [icecaps](/wiki/Ice_cap). They are made up of flat lava which flows at the top of extensive pillow lavas and [palagonite](/wiki/Palagonite). When the icecap melts, the lava on top collapses, leaving a flat-topped mountain. These volcanoes are also called [table mountains](/wiki/Tuya), [tuyas](/wiki/Tuya), or (uncommonly) mobergs. Very good examples of this type of volcano can be seen in Iceland, however, there are also tuyas in [British Columbia](/wiki/British_Columbia). The origin of the term comes from [Tuya Butte](/wiki/Tuya_Butte), which is one of the several tuyas in the area of the [Tuya River](/wiki/Tuya_River) and [Tuya Range](/wiki/Tuya_Range) in northern British Columbia. Tuya Butte was the first such [landform](/wiki/Landform) analyzed and so its name has entered the geological literature for this kind of volcanic formation. The [Tuya Mountains Provincial Park](/wiki/Tuya_Mountains_Provincial_Park) was recently established to protect this unusual landscape, which lies north of [Tuya Lake](/wiki/Tuya_Lake) and south of the [Jennings River](/wiki/Jennings_River) near the boundary with the [Yukon Territory](/wiki/Yukon_Territory).

### Mud volcanoes[[edit](/index.php?title=(none)&action=edit&section=16)]

[Template:Main](/wiki/Template:Main) **Mud volcanoes** or **mud domes** are formations created by geo-excreted liquids and gases, although there are several processes which may cause such activity. The largest structures are 10 kilometers in diameter and reach 700 meters high.

## Erupted material[[edit](/index.php?title=(none)&action=edit&section=17)]

[thumb|Pāhoehoe lava flow on](/wiki/File:Lava_channel_overflow.JPG) [Hawaii](/wiki/Hawaii_(island)). The picture shows overflows of a main [lava channel](/wiki/Lava_channel). [thumb|The](/wiki/File:DenglerSW-Stromboli-20040928-1230x800.jpg) [Stromboli](/wiki/Stromboli) stratovolcano off the coast of [Sicily](/wiki/Sicily) has erupted continuously for thousands of years, giving rise to the term [strombolian eruption](/wiki/Strombolian_eruption). [thumb|](/wiki/File:Vulkan_Chaparrastique,_El_Salvador_2013_01.JPG)[San Miguel (volcano)](/wiki/San_Miguel_(volcano)), El Salvador. On December 29, 2013, San Miguel volcano, also known as "Chaparrastique", erupted at 10:30 local time, spewing a large column of ash and smoke into the sky; the eruption, the first in 11 years, was seen from space and prompted the evacuation of thousands of people living in a 3 km radius around the volcano. [thumb|Ash plume from](/wiki/File:Sanmiguel_amo_2013363_lrg.jpg) [San Miguel (volcano)](/wiki/San_Miguel_(volcano)) "Chaparrastique", seen from a satellite, as it heads towards the Pacific Ocean from the El Salvador [Central America](/wiki/Central_America) coast, December 29, 2013

### Lava composition[[edit](/index.php?title=(none)&action=edit&section=18)]

Another way of classifying volcanoes is by the *composition of material erupted* (lava), since this affects the shape of the volcano. Lava can be broadly classified into 4 different compositions (Cas & Wright, 1987):

* If the erupted [magma](/wiki/Magma) contains a high percentage (>63%) of [silica](/wiki/Silica), the lava is called [felsic](/wiki/Felsic).
  + Felsic lavas ([dacites](/wiki/Dacite) or [rhyolites](/wiki/Rhyolite)) tend to be highly [viscous](/wiki/Viscous) (not very fluid) and are erupted as domes or short, stubby flows. Viscous lavas tend to form [stratovolcanoes](/wiki/Stratovolcano) or lava domes. [Lassen Peak](/wiki/Lassen_Peak) in California is an example of a volcano formed from felsic lava and is actually a large lava dome.
  + Because siliceous magmas are so viscous, they tend to trap [volatiles](/wiki/Volatiles#Igneous_petrology) (gases) that are present, which cause the magma to erupt catastrophically, eventually forming stratovolcanoes. [Pyroclastic flows](/wiki/Pyroclastic_flow) ([ignimbrites](/wiki/Ignimbrite)) are highly hazardous products of such volcanoes, since they are composed of molten volcanic ash too heavy to go up into the atmosphere, so they hug the volcano's slopes and travel far from their vents during large eruptions. Temperatures as high as 1,200 °C are known to occur in pyroclastic flows, which will incinerate everything flammable in their path and thick layers of hot pyroclastic flow deposits can be laid down, often up to many meters thick. [Alaska's](/wiki/Alaska) [Valley of Ten Thousand Smokes](/wiki/Valley_of_Ten_Thousand_Smokes), formed by the eruption of [Novarupta](/wiki/Novarupta) near [Katmai](/wiki/Mount_Katmai) in 1912, is an example of a thick pyroclastic flow or ignimbrite deposit. Volcanic ash that is light enough to be erupted high into the [Earth's atmosphere](/wiki/Earth's_atmosphere) may travel many kilometres before it falls back to ground as a [tuff](/wiki/Tuff).
* If the erupted magma contains 52–63% silica, the lava is of *intermediate* composition.
  + These "[andesitic](/wiki/Andesite)" volcanoes generally only occur above [subduction zones](/wiki/Subduction_zone) (e.g. [Mount Merapi](/wiki/Mount_Merapi) in Indonesia).
  + Andesitic lava is typically formed at [convergent boundary](/wiki/Convergent_boundary) margins of [tectonic plates](/wiki/Tectonic_plate), by several processes:
    - Hydration melting of peridotite and fractional crystallization[thumb|right|220px|](/wiki/File:Sarychev_Peak_eruption_on_12_June_2009,_oblique_satellite_view.ogv)[Sarychev Peak](/wiki/Sarychev_Peak) eruption, [Matua Island](/wiki/Matua_Island), oblique satellite view
    - Melting of subducted [slab](/wiki/Slab_(geology)) containing sediments[Template:Citation needed](/wiki/Template:Citation_needed)
    - Magma mixing between felsic rhyolitic and mafic basaltic magmas in an intermediate reservoir prior to emplacement or lava flow.
* If the erupted magma contains <52% and >45% silica, the lava is called [mafic](/wiki/Mafic) (because it contains higher percentages of [magnesium](/wiki/Magnesium) (Mg) and iron (Fe)) or [basaltic](/wiki/Basalt). These lavas are usually much less viscous than rhyolitic lavas, depending on their eruption temperature; they also tend to be hotter than felsic lavas. Mafic lavas occur in a wide range of settings:
  + At [mid-ocean ridges](/wiki/Mid-ocean_ridge), where two oceanic plates are pulling apart, basaltic lava erupts as [pillows](/wiki/Lava#Pillow_lava) to fill the gap;
  + [Shield volcanoes](/wiki/Shield_volcanoes) (e.g. the [Hawaiian Islands](/wiki/Hawaiian_Islands), including [Mauna Loa](/wiki/Mauna_Loa) and [Kilauea](/wiki/Kilauea)), on both [oceanic](/wiki/Oceanic_crust) and [continental crust](/wiki/Continental_crust);
  + As continental [flood basalts](/wiki/Flood_basalt).
* Some erupted magmas contain <=45% silica and produce [ultramafic](/wiki/Ultramafic) lava. Ultramafic flows, also known as [komatiites](/wiki/Komatiite), are very rare; indeed, very few have been erupted at the Earth's surface since the [Proterozoic](/wiki/Proterozoic), when the planet's heat flow was higher. They are (or were) the hottest lavas, and probably more fluid than common mafic lavas.

### Lava texture[[edit](/index.php?title=(none)&action=edit&section=19)]

Two types of lava are named according to the surface texture: [Template:OkinaATemplate:Okinaa](/wiki/Template:Okina) (pronounced [Template:IPA-haw](/wiki/Template:IPA-haw)) and [pāhoehoe](/wiki/Pāhoehoe) ([Template:IPA-haw](/wiki/Template:IPA-haw)), both [Hawaiian](/wiki/Hawaiian_language) words. [Template:OkinaATemplate:Okinaa](/wiki/Template:Okina) is characterized by a rough, clinkery surface and is the typical texture of viscous lava flows. However, even basaltic or mafic flows can be erupted as [Template:OkinaaTemplate:Okinaa](/wiki/Template:Okina) flows, particularly if the eruption rate is high and the slope is steep.

Pāhoehoe is characterized by its smooth and often ropey or wrinkly surface and is generally formed from more fluid lava flows. Usually, only mafic flows will erupt as pāhoehoe, since they often erupt at higher temperatures or have the proper chemical make-up to allow them to flow with greater fluidity.

## Volcanic activity[[edit](/index.php?title=(none)&action=edit&section=20)]

[thumb|left|upright|](/wiki/File:Pompeii_-_Casa_del_Centenario_-_MAN.jpg)[Fresco](/wiki/Fresco) with [Mount Vesuvius](/wiki/Mount_Vesuvius) behind [Bacchus](/wiki/Bacchus) and [Agathodaemon](/wiki/Agathodaemon), as seen in [Pompeii's](/wiki/Pompeii) [House of the Centenary](/wiki/House_of_the_Centenary)

### Popular classification of volcanoes[[edit](/index.php?title=(none)&action=edit&section=21)]

A popular way of classifying magmatic volcanoes is by their frequency of [eruption](/wiki/Types_of_volcanic_eruptions), with those that erupt regularly called **active**, those that have erupted in historical times but are now quiet called **dormant** or **inactive**, and those that have not erupted in historical times called **extinct**. However, these popular classifications—extinct in particular—are practically meaningless to scientists. They use classifications which refer to a particular volcano's formative and eruptive processes and resulting shapes, which was explained above.

#### Active[[edit](/index.php?title=(none)&action=edit&section=22)]

There is no consensus among volcanologists on how to define an "active" volcano. The lifespan of a volcano can vary from months to several million years, making such a distinction sometimes meaningless when compared to the lifespans of humans or even civilizations. For example, many of Earth's volcanoes have erupted dozens of times in the past few thousand years but are not currently showing signs of eruption. Given the long lifespan of such volcanoes, they are very active. By human lifespans, however, they are not.

Scientists usually consider a volcano to be *erupting* or *likely to erupt* if it is currently erupting, or showing signs of unrest such as unusual earthquake activity or significant new gas emissions. Most scientists consider a volcano *active* if it has erupted in the last 10,000 years ([Holocene](/wiki/Holocene) times) – the Smithsonian [Global Volcanism Program](/wiki/Global_Volcanism_Program) uses this definition of *active*. Most volcanoes are situated on the [Pacific Ring of Fire](/wiki/Pacific_Ring_of_Fire).<ref name=esa/> An estimated 500 million people live near active volcanoes.<ref name=esa>[Template:Cite web](/wiki/Template:Cite_web)</ref>

*Historical time* (or recorded history) is another timeframe for *active*.<ref name=Decker/>[[10]](#cite_note-10) The *Catalogue of the Active Volcanoes of the World*, published by the [International Association of Volcanology](/wiki/International_Association_of_Volcanology_and_Chemistry_of_the_Earth's_Interior), uses this definition, by which there are more than 500 active volcanoes.<ref name=Decker/> However, the span of recorded history differs from region to region. In China and the [Mediterranean](/wiki/Mediterranean), it reaches back nearly 3,000 years, but in the Pacific Northwest of the United States and Canada, it reaches back less than 300 years, and in Hawaii and [New Zealand](/wiki/New_Zealand), only around 200 years.<ref name=Decker>[Template:Cite book](/wiki/Template:Cite_book)</ref>

[thumb|right|Kīlauea lava entering the sea.](/wiki/Image:Lava_entering_sea_-_Hawaii.png) [thumb|right|Lava flows at](/wiki/Image:Bárðarbunga_Volcano,_September_4_2014_-_15145875322.jpg) [Holuhraun](/wiki/Holuhraun), [Iceland](/wiki/Iceland#Geology), September 2014 As of 2013, the following are considered Earth's most active volcanoes:[[11]](#cite_note-11)

* [Kīlauea](/wiki/Kīlauea), the famous [Hawaiian](/wiki/Hawaii) volcano, has been in continuous, [effusive eruption](/wiki/Effusive_eruption) since 1983, and has the [longest-observed](/wiki/Halemaumau_Crater#Early_history) [lava lake](/wiki/Lava_lake).
* [Mount Etna](/wiki/Mount_Etna) and nearby [Stromboli](/wiki/Stromboli), two [Mediterranean](/wiki/Mediterranean_Sea) volcanoes in "almost continuous eruption" since [antiquity](/wiki/Classical_antiquity).
* [Mount Yasur](/wiki/Mount_Yasur), in [Vanuatu](/wiki/Vanuatu), has been erupting "nearly continuously" for over 800 years.[Template:Citation needed](/wiki/Template:Citation_needed)

The longest currently ongoing (but not necessarily continuous) volcanic eruptive phases are:[[12]](#cite_note-12)

* Mount Yasur, 111 years
* Mount Etna, 109 years
* Stromboli, 108 years
* [Santa María](/wiki/Santa_María_(volcano)), 101 years
* [Sangay](/wiki/Sangay), 94 years

Other very active volcanoes include:

* [Mount Nyiragongo](/wiki/Mount_Nyiragongo) and its neighbor, [Nyamuragira](/wiki/Nyamuragira), are Africa's most active volcanoes[thumb|](/wiki/File:Lava_Lake_Nyiragongo_2.jpg)[Nyiragongo's](/wiki/Mount_Nyiragongo) lava lake.
* [Piton de la Fournaise](/wiki/Piton_de_la_Fournaise), in [Réunion](/wiki/Réunion), erupts frequently enough to be a tourist attraction.
* [Erta Ale](/wiki/Erta_Ale), in the [Afar Triangle](/wiki/Afar_Triangle), has maintained a lava lake since at least 1906.
* [Mount Erebus](/wiki/Mount_Erebus), in Antarctica, has maintained a lava lake since at least 1972.
* [Mount Merapi](/wiki/Mount_Merapi)
* [Whakaari / White Island](/wiki/Whakaari_/_White_Island), has been in continuous state of smoking since its discovery in 1769.
* [Ol Doinyo Lengai](/wiki/Ol_Doinyo_Lengai)
* [Ambrym](/wiki/Ambrym)
* [Arenal Volcano](/wiki/Arenal_Volcano)
* [Pacaya](/wiki/Pacaya)
* [Klyuchevskaya Sopka](/wiki/Klyuchevskaya_Sopka)
* [Sheveluch](/wiki/Sheveluch)

#### Extinct[[edit](/index.php?title=(none)&action=edit&section=23)]

[thumb|](/wiki/File:Fourpeaked-fumaroles-cyrus-read1.JPG)[Fourpeaked volcano](/wiki/Fourpeaked_Mountain), [Alaska](/wiki/Alaska), in September 2006 after being thought extinct for over 10,000 years [thumb|Mount](/wiki/File:Rinjani_1994.jpg) [Rinjani](/wiki/Rinjani) eruption in 1994, in [Lombok](/wiki/Lombok), [Indonesia](/wiki/Indonesia) Extinct volcanoes are those that scientists consider unlikely to erupt again, because the volcano no longer has a magma supply. Examples of extinct volcanoes are many volcanoes on the [Hawaiian – Emperor seamount chain](/wiki/Hawaiian_–_Emperor_seamount_chain) in the Pacific Ocean, [Hohentwiel](/wiki/Hohentwiel), [Shiprock](/wiki/Shiprock) and the [Zuidwal volcano](/wiki/Zuidwal_volcano) in the [Netherlands](/wiki/Netherlands). [Edinburgh Castle](/wiki/Edinburgh_Castle) in Scotland is famously located atop an extinct volcano. Otherwise, whether a volcano is truly extinct is often difficult to determine. Since "supervolcano" [calderas](/wiki/Caldera) can have eruptive lifespans sometimes measured in millions of years, a caldera that has not produced an eruption in tens of thousands of years is likely to be considered dormant instead of extinct. Some volcanologists refer to extinct volcanoes as inactive, though the term is now more commonly used for dormant volcanoes once thought to be extinct.

#### Dormant[[edit](/index.php?title=(none)&action=edit&section=24)]

[thumb|](/wiki/File:Narcondam_island.jpg)[Narcondam Island](/wiki/Narcondam_Island), India, is classified as a dormant volcano by the [Geological Survey of India](/wiki/Geological_Survey_of_India) It is difficult to distinguish an extinct volcano from a dormant (inactive) one. Volcanoes are often considered to be extinct if there are no written records of its activity. Nevertheless, volcanoes may remain dormant for a long period of time. For example, [Yellowstone](/wiki/Yellowstone_Caldera) has a repose/recharge period of around 700,000 years, and [Toba](/wiki/Toba_Lake) of around 380,000 years.<ref name=chesner1991>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> [Vesuvius](/wiki/Vesuvius) was described by Roman writers as having been covered with gardens and vineyards before its [eruption of AD 79](/wiki/Eruption_of_Mount_Vesuvius_in_79), which destroyed the towns of Herculaneum and Pompeii. Before its catastrophic eruption of 1991, [Pinatubo](/wiki/Pinatubo) was an inconspicuous volcano, unknown to most people in the surrounding areas. Two other examples are the long-dormant [Soufrière Hills](/wiki/Soufrière_Hills) volcano on the island of [Montserrat](/wiki/Montserrat), thought to be extinct before activity resumed in 1995 and [Fourpeaked Mountain](/wiki/Fourpeaked_Mountain) in [Alaska](/wiki/Alaska), which, before its September 2006 eruption, had not erupted since before 8000 BC and had long been thought to be extinct.

### Technical classification of volcanoes[[edit](/index.php?title=(none)&action=edit&section=25)]

#### Volcanic-alert level[[edit](/index.php?title=(none)&action=edit&section=26)]

The three common popular classifications of volcanoes can be subjective and some volcanoes thought to have been extinct have erupted again. To help prevent people from falsely believing they are not at risk when living on or near a volcano, countries have adopted new classifications to describe the various levels and stages of volcanic activity.[[13]](#cite_note-13) Some alert systems use different numbers or colors to designate the different stages. Other systems use colors and words. Some systems use a combination of both.

#### Volcano warning schemes of the United States[[edit](/index.php?title=(none)&action=edit&section=27)]

The United States Geological Survey (USGS) has adopted a common system nationwide for characterizing the level of unrest and eruptive activity at volcanoes. The new volcano alert-level system classifies volcanoes now as being in a normal, advisory, watch or warning stage. Additionally, colors are used to denote the amount of ash produced. Details of the U.S. system can be found at [Volcano warning schemes of the United States](/wiki/Volcano_warning_schemes_of_the_United_States).

## Decade volcanoes[[edit](/index.php?title=(none)&action=edit&section=28)]

[thumb|](/wiki/File:Koryaksky_volcano_Petropavlovsk-Kamchatsky_oct-2005.jpg)[Koryaksky](/wiki/Koryaksky) volcano towering over [Petropavlovsk-Kamchatsky](/wiki/Petropavlovsk-Kamchatsky) on [Kamchatka Peninsula](/wiki/Kamchatka_Peninsula), Far Eastern [Russia](/wiki/Russia) [Template:Main](/wiki/Template:Main) The Decade Volcanoes are 17 volcanoes identified by the [International Association of Volcanology and Chemistry of the Earth's Interior](/wiki/International_Association_of_Volcanology_and_Chemistry_of_the_Earth's_Interior) (IAVCEI) as being worthy of particular study in light of their history of large, destructive eruptions and proximity to populated areas. They are named Decade Volcanoes because the project was initiated as part of the United Nations-sponsored [International Decade for Natural Disaster Reduction](/wiki/International_Decade_for_Natural_Disaster_Reduction). The 17 current Decade Volcanoes are

|  |  |
| --- | --- |
| * [Avachinsky](/wiki/Avachinsky)-[Koryaksky](/wiki/Koryaksky) (grouped together), [Kamchatka](/wiki/Kamchatka_Peninsula), Russia * [Nevado de Colima](/wiki/Colima_(volcano)), [Jalisco](/wiki/Jalisco) and [Colima](/wiki/Colima), Mexico * [Mount Etna](/wiki/Mount_Etna), Sicily, Italy * [Galeras](/wiki/Galeras), [Nariño](/wiki/Nariño), Colombia * [Mauna Loa](/wiki/Mauna_Loa), Hawaii, USA * [Mount Merapi](/wiki/Mount_Merapi), [Central Java](/wiki/Central_Java), Indonesia * [Mount Nyiragongo](/wiki/Mount_Nyiragongo), Democratic Republic of the Congo * [Mount Rainier](/wiki/Mount_Rainier), [Washington](/wiki/Washington_(state)), USA | * [Sakurajima](/wiki/Sakurajima), [Kagoshima Prefecture](/wiki/Kagoshima_Prefecture), Japan * [Santa Maria/Santiaguito](/wiki/Santa_María_(volcano)), Guatemala * [Santorini](/wiki/Santorini), [Cyclades](/wiki/Cyclades), Greece * [Taal Volcano](/wiki/Taal_Volcano), [Luzon](/wiki/Luzon), Philippines * [Teide](/wiki/Teide), Canary Islands, Spain * [Ulawun](/wiki/Ulawun), [New Britain](/wiki/New_Britain), Papua New Guinea * [Mount Unzen](/wiki/Mount_Unzen), [Nagasaki Prefecture](/wiki/Nagasaki_Prefecture), Japan * [Vesuvius](/wiki/Vesuvius), [Naples](/wiki/Province_of_Naples), Italy |

## Effects of volcanoes[[edit](/index.php?title=(none)&action=edit&section=29)]

[thumb|left|Schematic of volcano injection of aerosols and gases](/wiki/File:Volcanic_injection.svg) [thumb|Solar radiation graph 1958–2008, showing how the radiation is reduced after major volcanic eruptions](/wiki/File:Mauna_Loa_atmospheric_transmission.png) [thumb|right|](/wiki/File:SO2_Galapagos_20051101.jpg)[Sulfur dioxide](/wiki/Sulfur_dioxide) concentration over the [Sierra Negra Volcano](/wiki/Sierra_Negra_(Galápagos)), [Galapagos Islands](/wiki/Galapagos_Islands), during an eruption in October 2005

There are many different [types of volcanic eruptions](/wiki/Types_of_volcanic_eruptions) and associated activity: [phreatic eruptions](/wiki/Phreatic_eruptions) (steam-generated eruptions), explosive eruption of high-[silica](/wiki/Silica) lava (e.g., [rhyolite](/wiki/Rhyolite)), effusive eruption of low-silica lava (e.g., [basalt](/wiki/Basalt)), [pyroclastic flows](/wiki/Pyroclastic_flow), [lahars](/wiki/Lahar) (debris flow) and [carbon dioxide](/wiki/Carbon_dioxide) emission. All of these activities can pose a hazard to humans. Earthquakes, [hot springs](/wiki/Hot_spring), [fumaroles](/wiki/Fumarole), [mud pots](/wiki/Mud_pot) and [geysers](/wiki/Geyser) often accompany volcanic activity.

### Volcanic gases[[edit](/index.php?title=(none)&action=edit&section=30)]

The concentrations of different [volcanic gases](/wiki/Volcanic_gas) can vary considerably from one volcano to the next. [Water vapor](/wiki/Water_vapor) is typically the most abundant volcanic gas, followed by [carbon dioxide](/wiki/Carbon_dioxide)[[14]](#cite_note-14) and [sulfur dioxide](/wiki/Sulfur_dioxide). Other principal volcanic gases include [hydrogen sulfide](/wiki/Hydrogen_sulfide), [hydrogen chloride](/wiki/Hydrogen_chloride), and [hydrogen fluoride](/wiki/Hydrogen_fluoride). A large number of minor and trace gases are also found in volcanic emissions, for example [hydrogen](/wiki/Hydrogen), [carbon monoxide](/wiki/Carbon_monoxide), [halocarbons](/wiki/Halocarbon), organic compounds, and volatile metal chlorides.

Large, explosive volcanic eruptions inject water vapor (H2O), carbon dioxide (CO2), sulfur dioxide (SO2), hydrogen chloride (HCl), hydrogen fluoride (HF) and ash (pulverized rock and [pumice](/wiki/Pumice)) into the [stratosphere](/wiki/Stratosphere) to heights of 16–32 kilometres (10–20 mi) above the Earth's surface. The most significant impacts from these injections come from the conversion of sulfur dioxide to [sulfuric acid](/wiki/Sulfuric_acid) (H2SO4), which condenses rapidly in the stratosphere to form fine [sulfate](/wiki/Sulfate) [aerosols](/wiki/Aerosols). It is worth mentioning that the SO2 emissions alone of two different eruptions are sufficient to compare their potential climatic impact.[[15]](#cite_note-15)</ref> The aerosols increase the Earth's [albedo](/wiki/Albedo)—its reflection of radiation from the [Sun](/wiki/Sun) back into space – and thus cool the Earth's lower atmosphere or troposphere; however, they also absorb heat radiated up from the Earth, thereby warming the [stratosphere](/wiki/Stratosphere). Several eruptions during the past century have caused a decline in the average temperature at the Earth's surface of up to half a degree (Fahrenheit scale) for periods of one to three years – sulfur dioxide from the eruption of [Huaynaputina](/wiki/Huaynaputina) probably caused the [Russian famine of 1601–1603](/wiki/Russian_famine_of_1601–1603).[[16]](#cite_note-16)

### Significant consequences[[edit](/index.php?title=(none)&action=edit&section=31)]

One proposed [volcanic winter](/wiki/Volcanic_winter) happened c. 70,000 years ago following the [supereruption](/wiki/Supervolcano) of [Lake Toba](/wiki/Lake_Toba) on Sumatra island in Indonesia.[[17]](#cite_note-17) According to the [Toba catastrophe theory](/wiki/Toba_catastrophe_theory) to which some anthropologists and archeologists subscribe, it had global consequences,[[18]](#cite_note-18) killing most humans then alive and creating a [population bottleneck](/wiki/Population_bottleneck) that affected the genetic inheritance of all humans today.[[19]](#cite_note-19) The 1815 eruption of [Mount Tambora](/wiki/Mount_Tambora) created global climate anomalies that became known as the "[Year Without a Summer](/wiki/Year_Without_a_Summer)" because of the effect on North American and European weather.[[20]](#cite_note-20) Agricultural crops failed and livestock died in much of the Northern Hemisphere, resulting in one of the worst famines of the 19th century.[[21]](#cite_note-21) The freezing winter of 1740–41, which led to widespread [famine](/wiki/Irish_Famine_(1740–1741)) in northern Europe, may also owe its origins to a volcanic eruption.[[22]](#cite_note-22) It has been suggested that volcanic activity caused or contributed to the [End-Ordovician](/wiki/Ordovician-Silurian_extinction_events), [Permian-Triassic](/wiki/Permian-Triassic_extinction_event), [Late Devonian](/wiki/Late_Devonian_extinction) [mass extinctions](/wiki/Mass_extinction), and possibly others. The massive eruptive event which formed the [Siberian Traps](/wiki/Siberian_Traps), one of the largest known volcanic events of the last 500 million years of [Earth's geological history](/wiki/Earth's_geological_history), continued for a million years and is considered to be the likely cause of the "[Great Dying](/wiki/Permian–Triassic_extinction_event)" about 250 million years ago,[[23]](#cite_note-23) which is estimated to have killed 90% of species existing at the time.[[24]](#cite_note-24)

### Acid rain[[edit](/index.php?title=(none)&action=edit&section=32)]

[thumb|right|Ash plume rising from](/wiki/Image:Eyjafjallajokull-April-17.JPG) [Eyjafjallajökull](/wiki/Eyjafjallajökull) on April 17, 2010 The sulfate aerosols also promote complex [chemical](/wiki/Chemical) reactions on their surfaces that alter chlorine and [nitrogen](/wiki/Nitrogen) chemical species in the stratosphere. This effect, together with increased stratospheric [chlorine](/wiki/Chlorine) levels from [chlorofluorocarbon](/wiki/Haloalkane) pollution, generates chlorine monoxide (ClO), which destroys [ozone](/wiki/Ozone) (O3). As the aerosols grow and coagulate, they settle down into the upper troposphere where they serve as nuclei for [cirrus clouds](/wiki/Cirrus_cloud) and further modify the Earth's [radiation](/wiki/Radiation) balance. Most of the hydrogen chloride (HCl) and hydrogen fluoride (HF) are dissolved in water droplets in the eruption cloud and quickly fall to the ground as [acid rain](/wiki/Acid_rain). The injected ash also falls rapidly from the stratosphere; most of it is removed within several days to a few weeks. Finally, explosive volcanic eruptions release the greenhouse gas carbon dioxide and thus provide a deep source of [carbon](/wiki/Carbon) for biogeochemical cycles.[[25]](#cite_note-25) Gas emissions from volcanoes are a natural contributor to acid rain. Volcanic activity releases about 130 to 230 [teragrams](/wiki/Yottagram) (145 million to 255 million [short tons](/wiki/Short_ton)) of [carbon dioxide](/wiki/Carbon_dioxide) each year.[[26]](#cite_note-26) Volcanic eruptions may inject [aerosols](/wiki/Aerosols) into the [Earth's atmosphere](/wiki/Earth's_atmosphere). Large injections may cause visual effects such as unusually colorful sunsets and affect global [climate](/wiki/Climate) mainly by cooling it. Volcanic eruptions also provide the benefit of adding nutrients to [soil](/wiki/Soil) through the [weathering](/wiki/Weathering) process of volcanic rocks. These fertile soils assist the growth of plants and various crops. Volcanic eruptions can also create new islands, as the magma cools and solidifies upon contact with the water.

### Hazards[[edit](/index.php?title=(none)&action=edit&section=33)]

Ash thrown into the air by eruptions can present a hazard to aircraft, especially [jet aircraft](/wiki/Jet_aircraft) where the particles can be melted by the high operating temperature; the melted particles then adhere to the [turbine](/wiki/Turbine) blades and alter their shape, disrupting the operation of the turbine. Dangerous encounters in 1982 after the eruption of [Galunggung](/wiki/Galunggung) in Indonesia, and 1989 after the eruption of [Mount Redoubt](/wiki/Mount_Redoubt) in Alaska raised awareness of this phenomenon. Nine [Volcanic Ash Advisory Centers](/wiki/Volcanic_Ash_Advisory_Center) were established by the [International Civil Aviation Organization](/wiki/International_Civil_Aviation_Organization) to monitor ash clouds and advise pilots accordingly. The [2010 eruptions of Eyjafjallajökull](/wiki/2010_eruptions_of_Eyjafjallajökull) caused major disruptions to air travel in Europe.

## Volcanoes on other planetary bodies[[edit](/index.php?title=(none)&action=edit&section=34)]

[Template:See also](/wiki/Template:See_also) [left|thumb|The](/wiki/File:Tvashtarvideo.gif) [Tvashtar](/wiki/Tvashtar_Paterae) volcano erupts a plume 330 km (205 mi) above the surface of [Jupiter's](/wiki/Jupiter) moon [Io](/wiki/Io_(moon)).

The Earth's [Moon](/wiki/Moon) has no large volcanoes and no current volcanic activity, although recent evidence suggests it may still possess a partially molten core.[[27]](#cite_note-27) However, the Moon does have many volcanic features such as [maria](/wiki/Lunar_mare) (the darker patches seen on the moon), [rilles](/wiki/Rille) and [domes](/wiki/Lunar_dome).

The planet [Venus](/wiki/Venus) has a surface that is 90% [basalt](/wiki/Basalt), indicating that volcanism played a major role in shaping its surface. The planet may have had a major global resurfacing event about 500 million years ago,[[28]](#cite_note-28) from what scientists can tell from the density of impact craters on the surface. Lava flows are widespread and forms of volcanism not present on Earth occur as well. Changes in the planet's atmosphere and observations of lightning have been attributed to ongoing volcanic eruptions, although there is no confirmation of whether or not Venus is still volcanically active. However, radar sounding by the Magellan probe revealed evidence for comparatively recent volcanic activity at Venus's highest volcano [Maat Mons](/wiki/Maat_Mons), in the form of ash flows near the summit and on the northern flank.

[thumb|upright|](/wiki/File:Olympus_Mons.jpeg)[Olympus Mons](/wiki/Olympus_Mons) ([Latin](/wiki/Latin), "Mount Olympus"), located on the [planet](/wiki/Planet) [Mars](/wiki/Mars), is the tallest known mountain in our [solar system](/wiki/Solar_system). There are several extinct volcanoes on [Mars](/wiki/Mars), four of which are vast shield volcanoes far bigger than any on Earth. They include [Arsia Mons](/wiki/Arsia_Mons), [Ascraeus Mons](/wiki/Ascraeus_Mons), [Hecates Tholus](/wiki/Hecates_Tholus), [Olympus Mons](/wiki/Olympus_Mons), and [Pavonis Mons](/wiki/Pavonis_Mons). These volcanoes have been extinct for many millions of years,[[29]](#cite_note-29) but the European [*Mars Express*](/wiki/Mars_Express) spacecraft has found evidence that volcanic activity may have occurred on Mars in the recent past as well.[[29]](#cite_note-29) [Jupiter's](/wiki/Jupiter) [moon](/wiki/Natural_satellite) [Io](/wiki/Io_(moon)) is the most volcanically active object in the solar system because of [tidal](/wiki/Tides) interaction with Jupiter. It is covered with volcanoes that erupt [sulfur](/wiki/Sulfur), [sulfur dioxide](/wiki/Sulfur_dioxide) and [silicate](/wiki/Silicate) rock, and as a result, [Io](/wiki/Io_(moon)) is constantly being resurfaced. Its lavas are the hottest known anywhere in the solar system, with temperatures exceeding 1,800 K (1,500 °C). In February 2001, the largest recorded volcanic eruptions in the solar system occurred on Io.[[30]](#cite_note-30) [Europa](/wiki/Europa_(moon)), the smallest of Jupiter's [Galilean moons](/wiki/Galilean_moon), also appears to have an active volcanic system, except that its volcanic activity is entirely in the form of water, which freezes into ice on the frigid surface. This process is known as [cryovolcanism](/wiki/Cryovolcanism), and is apparently most common on the moons of the outer planets of the [solar system](/wiki/Solar_system).

In 1989 the [Voyager 2](/wiki/Voyager_2) spacecraft observed [cryovolcanoes](/wiki/Cryovolcano) (ice volcanoes) on [Triton](/wiki/Triton_(moon)), a [moon](/wiki/Natural_satellite) of [Neptune](/wiki/Neptune), and in 2005 the [Cassini–Huygens](/wiki/Cassini–Huygens) probe photographed [fountains of frozen particles erupting from Enceladus](/wiki/Enceladus_(moon)#Cryovolcanism), a moon of [Saturn](/wiki/Saturn).[[31]](#cite_note-31)[[32]](#cite_note-32) The ejecta may be composed of water, [liquid nitrogen](/wiki/Liquid_nitrogen), dust, or [methane](/wiki/Methane) compounds. Cassini–Huygens also found evidence of a methane-spewing cryovolcano on the [Saturnian](/wiki/Saturn) moon [Titan](/wiki/Titan_(moon)), which is believed to be a significant source of the methane found in its atmosphere.[[33]](#cite_note-33) It is theorized that cryovolcanism may also be present on the [Kuiper Belt Object](/wiki/Kuiper_Belt_Object) [Quaoar](/wiki/50000_Quaoar).

A 2010 study of the [exoplanet](/wiki/Exoplanet) [COROT-7b](/wiki/COROT-7b), which was detected by [transit](/wiki/Transit_method) in 2009, studied that [tidal heating](/wiki/Tidal_heating) from the host star very close to the planet and neighboring planets could generate intense volcanic activity similar to Io.[[34]](#cite_note-34)

## Traditional beliefs about volcanoes[[edit](/index.php?title=(none)&action=edit&section=35)]

Many ancient accounts ascribe volcanic eruptions to [supernatural](/wiki/Supernatural) causes, such as the actions of [gods](/wiki/Deity) or [demigods](/wiki/Demigod). To the ancient Greeks, volcanoes' capricious power could only be explained as acts of the gods, while 16th/17th-century German astronomer [Johannes Kepler](/wiki/Johannes_Kepler) believed they were ducts for the Earth's tears.[[35]](#cite_note-35) One early idea counter to this was proposed by [Jesuit](/wiki/Society_of_Jesus) [Athanasius Kircher](/wiki/Athanasius_Kircher) (1602–1680), who witnessed eruptions of [Mount Etna](/wiki/Mount_Etna) and [Stromboli](/wiki/Stromboli), then visited the crater of [Vesuvius](/wiki/Vesuvius) and published his view of an Earth with a central fire connected to numerous others caused by the burning of [sulfur](/wiki/Sulfur), [bitumen](/wiki/Bitumen) and [coal](/wiki/Coal).

Various explanations were proposed for volcano behavior before the modern understanding of the Earth's [mantle](/wiki/Mantle_(geology)) structure as a semisolid material was developed. For decades after awareness that compression and [radioactive](/wiki/Radioactive) materials may be heat sources, their contributions were specifically discounted. Volcanic action was often attributed to [chemical](/wiki/Chemical) reactions and a thin layer of molten rock near the surface.

## See also[[edit](/index.php?title=(none)&action=edit&section=36)]

[Template:Portal](/wiki/Template:Portal) [Template:Div col](/wiki/Template:Div_col)

* [Global Volcanism Program](/wiki/Global_Volcanism_Program)
* [List of extraterrestrial volcanoes](/wiki/List_of_extraterrestrial_volcanoes)
* [Maritime impacts of volcanic eruptions](/wiki/Maritime_impacts_of_volcanic_eruptions)
* [Prediction of volcanic activity](/wiki/Prediction_of_volcanic_activity)
* [Timeline of volcanism on Earth](/wiki/Timeline_of_volcanism_on_Earth)
* [Volcanic explosivity index](/wiki/Volcanic_explosivity_index)
* [Volcano Number](/wiki/Volcano_Number)
* [Volcano observatory](/wiki/Volcano_observatory)

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## References[[edit](/index.php?title=(none)&action=edit&section=37)]

[Template:Reflist](/wiki/Template:Reflist)

## Further reading[[edit](/index.php?title=(none)&action=edit&section=38)]

[Template:Refbegin](/wiki/Template:Refbegin)

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* Macdonald, Gordon and Agatin T. Abbott. (1970). Volcanoes in the Sea. University of Hawaii Press, Honolulu. 441 p.
* [Template:Cite book](/wiki/Template:Cite_book)
* [Ollier, Cliff](/wiki/Ollier,_Cliff). (1988). Volcanoes. Basil Blackwell, Oxford, UK, ISBN 0-631-15664-X (hardback), ISBN 0-631-15977-0 (paperback).
* [Sigurðsson, Haraldur](/wiki/Haraldur_Sigurðsson), ed. (1999). *Encyclopedia of Volcanoes*. Academic Press. ISBN 0-12-643140-X. This is a reference aimed at geologists, but many articles are accessible to non-professionals.

[Template:Refend](/wiki/Template:Refend)

## External links[[edit](/index.php?title=(none)&action=edit&section=39)]

[Template:Commons](/wiki/Template:Commons) [Template:Wikivoyage](/wiki/Template:Wikivoyage) [Template:Library resources box](/wiki/Template:Library_resources_box)

* [Template:Dmoz](/wiki/Template:Dmoz)
* [Volcano](http://www.fema.gov/hazard/volcano/index.shtm), U.S. [Federal Emergency Management Agency](/wiki/Federal_Emergency_Management_Agency) FEMA
* [Volcano World](http://volcano.oregonstate.edu/)
* [Volcanos](http://www.worsleyschool.net/science/files/volcano/page.html) (Worsley School)

[Template:Natural disasters](/wiki/Template:Natural_disasters) [Template:Volcanoes](/wiki/Template:Volcanoes)

[Template:Authority control](/wiki/Template:Authority_control)

[Category:Volcanoes](/wiki/Category:Volcanoes) [Category:Geological hazards](/wiki/Category:Geological_hazards) [Category:Geological processes](/wiki/Category:Geological_processes) [Category:Plate tectonics](/wiki/Category:Plate_tectonics) [Category:Volcanic landforms](/wiki/Category:Volcanic_landforms) [Category:Volcanic rocks](/wiki/Category:Volcanic_rocks) [Category:Volcanology](/wiki/Category:Volcanology) [Category:Articles containing video clips](/wiki/Category:Articles_containing_video_clips)