# VOLCANOES - Q&A

1, **What is the largest, most explosive, and most active volcano?**

The largest volcano is Mons Olympus on Mars! It is 23,800m high. Its area is the size of the state of Ohio. The largest volcano on Earth—as measured from the ocean floor—is probably Mauna Loa on the island of Hawaii. Perhaps the most explosive volcano in recorded history is the 1815 eruption of Tambora in Indonesia. It had a VEI of 7 and led to the death of 92,000 people. The amount of ejected material was 30,000$km^3$. In 4895 BC Crater Lake, Oregon, was the site of a VEI-7 eruption. Hundreds of thousands of years ago, the Long Valley Caldera in Inyo-Mono County (near the Mammoth Lakes) was formed in perhaps the largest eruption. Currently, the most active volcano might be Stromboli, an island west of Italy which has lava fountains erupting every 15-30 minutes. There are another half-dozen volcanoes which erupt continuously like Stromboli.

2. **Are there any toxic gases emitted from volcanoes?**

The gases are held in molten rock by high pressure like the fizz in a soda bottle. As the magma rises, the pressure lessons resulting in the release of the gases. 70% is usually water vapor, 15% carbon dioxide, 5% sulfur dioxide, 5% nitrogen, and other gases 5%. The sulfur dioxide can combine with water to form sulfuric acid ($H_2SO_4$) which would harm plants, crops, and metal structures. In 1986 Cameroon, West Africa, a crater lake (Lake Nyos) had a small eruption but released a large amount of carbon dioxide which weighs one-and-a-half times as much as air. An estimated $80x10^6$ $m^3$ of this gas was released. It was at night and the gas traveled down river valleys and into a nearby village. 1200 people in the village were found dead the next morning. Another 500 people had died in surrounding areas. The large amount of $CO_2$ reduced the amount of oxygen in the air and the people suffocated. Nearer to home, in 1990 a Mammoth Lake campground was closed when it was found that 90% of the soil gas was $CO_2$. Pine and fir trees were dying and there was concern for campers.

3. **Why were the dead preserved in the Vesuvius eruption of 79 AD while few bodies were found in other eruptions? What is the difference between lahars and nuées ardentes?**

Here, we need to distinguish ashfalls from ashflows. Ashflows such as the one that killed all but 2 people in the port of St. Pierre below Mont Pelée on the island of Martinique, are also called nuées ardentes (glowing clouds). Here the temperatures are quite high and the clouds are often incandescent. There is a swift flowing, turbulent cloud of gases and ash which can incinerate, knock-down, and suffocate. The people died in a matter of minutes. In 79 AD, two cities were destroyed by Vesuvius in two very different ways. When excavations near Herculaneum had uncovered only 30 bodies as of the 1980's, it was believed that the people had successfully evacuated their city. Since then, hundreds of skeletons have been found huddled in small chambers where family groups apparently sought refuge from the hot pyroclastic surges. Now it is believed that a nuée ardente destroyed the town in the order of minutes.

An ashfall is a rain of cooler volcanic ash falling from an eruption cloud. The heavy fall of ash suffocated more than 3,000 inhabitants and eventually buried them and the city under 6m of pyroclastic material, preserving the ruins and the bodies. Pompeii suffered for several days under the rain of ash. So completely buried was the city that its ruins were not uncovered for almost 17 centuries when there was an excavation for a water line. Another century later, systematic excavation in 1738 marked the beginning of the discipline of archaeology.

Lahars are mudflows associated with eruptions. They are massive and move quickly and flood-like down river valleys. The town of Armero in Columbia was buried with over 22,000 people dead. In the Cascade Range, there are many stratovolcanoes covered with snow which can result in lahars upon eruption.

4. **What does lava consist of? How hot is lava? How high do lava fountains rise? Can lava flows be diverted? What is the difference between a "pahoehoe" and an "aa" lava flow?**

Lava is the fluid rock that issues from a volcano or fissure. It is magma which has reached the surface. It may or may not contain suspended solids (such as crystals and rock fragments) and/or gases. Magma which would produce basaltic or gabbro rocks contain about 50% silica and is fluid. Magma which would produce rhyolitic or granite rocks contains about 70% silica and is viscous.

One can make a quick measurement of the temperature of lava by observing the color. This method has long been used by blacksmiths or operators of steel furnaces. Below is a list of colors used as temperature indicators when the object is seen at night or in very dark surroundings.

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| White | 1150°C and up |
| Golden yellow | 1090°C |
| Orange | 900°C |
| Bright cherry red | 700°C |
| Dull red | 550-625°C |
| Lowest visible red | 475°C |

Lava fountains usually range from 10-100m in height. Occasionally they reach a height of 300m.

Lava flows are difficult to divert. Flank eruptions may make it difficult to predict where the flow will originate. Near Mauna Loa, Hawaii, a lava diversion dam has been built.

Pahoehoe flows are ropy and smooth-skinned with wrinkles. These flows are relatively fast, 10 to 300m/hr. Aa flows have a rough surface of jagged blocks and spiny projections. They are relatively cool and thick and advance at 5 to 50m/hr. The outer crust is broken by escaping gases and because of the advancing molten interior, making the flow look like a moving mass of rubble.