Force of destruction and nature

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Volcanoes are indeed one of the most captivating and powerful natural phenomena on our planet. They serve as channels through which hot lava, volcanic ash and gases from magma chambers underneath the earth's or moon's crust can escape. The composition of a volcano's magma, the intensity and frequency of its eruptions, and its geologic location all influence its size and shape, as well as the kind of eruption it produces. Whether they create positive or negative effects on our environment and human society, is dependent on their impact. In this essay, we will examine what volcanoes are, how they develop, what types of volcanoes exist, and their environmental and social effects.

Etymologically, the word volcano comes from Vulcano, an Italian volcanic island that was considered to be the dwelling place of Vulcan, the Roman god of fire. The scientific investigation of volcanoes is known as volcanology or vulcanology, which uses different methods to study and supervise volcanoes. Techniques such as seismometers, GPS, satellites and sensors are frequently uutilised. Volcanologists use seismometers to detect and measure seismic activity, which can indicate an impending eruption. GPS is used to monitor ground deformation caused by magma movement, while satellites provide images of volcanic activity from space. Sensors are also used to measure gas emissions and temperature changes. With these tools, volcanologists can better understand the behavior of volcanoes and make predictions about future eruptions. Additionally, studying volcanoes can help us understand the Earth's geological history and the processes that shape our planet. It is important to continue researching and monitoring Volcanoes in order to mitigate their potential negative impacts on human society and the environment .

Volcanoes are typically categorized based on their activity level. There are three groups: active, dormant, and extinct. Active volcanoes have recently erupted and are likely to do so again, such as Sabancaya volcano in Peru which erupted in 2017. The Global Volcanism Program of the Smithsonian Institution estimates that there are around 1, 500 active volcanoes on land, and possibly more below sea level. Dormant volcanoes have not erupted in a long time but may potentially erupt in the future, such as the Yellowstone volcano in the US which has been dormant for approximately 70,000 years. Extinct volcanoes, on the other hand, are not expected to erupt again, such as the Kilimanjaro mountain in Tanzania which last erupted more than 360,000 years ago.

The shape and structure of a volcano is another important aspect which is determined by the intensity and frequency of eruptions, as well as the composition of the magma.Shield volcanoes are characterized by their broad, flat shape and gentle slopes, resulting from slow and steady lava flows. The perfect example of a shield volcano is the Mauna Loa volcano in Hawaii. On the other hand, strato volcanoes are tall and cone-shaped with steep slopes, formed by alternating layers of lava and ash. One of the most popular strato volcanoes is Mount Fuji in Japan. Lastly, cinder cones are small, steep, and have a circular base, formed by explosive eruptions of gas-rich magma. A good example of a cinder cone volcano is the Paricutin volcano located in Mexico.

Most of the volcanoes on Earth are located along the boundaries of tectonic plates. These plates are large pieces of Earth's crust that move due to convection currents in the mantle. There are two primary types of plate boundaries where volcanoes can form: divergent convergent.

Divergent plate boundaries occur when two plates move away from each other, creating gaps or rifts in the crust. This allows hot magma to rise up and fill the gaps, forming new crust and volcanic islands. An excellent example of a divergent plate boundary is the Mid-Atlantic Ridge, where new oceanic crust is formed by volcanic activity.Convergent plate boundaries occur when two plates move towards each other, creating zones of subduction or collision. Subduction zones are where one plate slides under another plate, forming deep ocean trenches and volcanic arcs. The Pacific Ring of Fire is an example of a convergent plate boundary, where many active volcanoes are found along the edges of the Pacific Ocean.

Volcanoes don't always form at plate boundaries. Some are formed in hotspot or intraplate volcanism. A hotspot is a place where hot mantle material rises up from deep within the earth and creates volcanoes on the overlying crust. Hotspots can either be stationary or moving relative to the plates. A classic example is Hawaii where a chain of volcanic islands was created by a stationary hotspot as the Pacific plate moved over it. Intraplate volcanism, on the other hand, is when volcanic activity occurs within a plate instead of at its edges. This can be caused by factors such as crustal thinning, rifting, or mantle plumes. A famous example is Yellowstone National Park where a large caldera was formed by a series of massive eruptions from a mantle plume.

Volcanic eruptions can vary in style, magnitude, frequency, and duration depending on the type and amount of magma involved. Magma is molten rock that includes dissolved gases and minerals. The viscosity or thickness of the magma relies on its temperature, composition, and gas content. A higher temperature and higher gas content lower viscosity, while higher silica content increases viscosity. The viscosity of magma plays a role in how easily it flows and violently erupts. Magma with low viscosity tends to create gentle eruptions with lava flows and fountains. High viscosity magma, on the other hand, resists flow and produces explosive eruptions with pyroclastic materials like ash, pumice, bombs, and blocks.

Volcanic eruptions can be classified into four types based on their unique properties: Hawaiian, Strombolian, Vulcanian, and Plinian. The Hawaiian eruptions, which are named after Hawaii's volcanoes, produce low viscosity basaltic lava flows that can travel long distances and form shield volcanoes with gentle slopes. These eruptions also result in lava fountains that can soar to hundreds of meters. Strombolian eruptions, on the other hand, are named after the Stromboli volcano in Italy, producing moderate-viscosity basaltic to andesitic lava that forms cinder cones with steep slopes, accompanied by firework-like explosions that eject lava fragments into the air. The Vulcanian eruptions take their name from Vulcano Island in Italy, producing high-viscosity andesitic to dacitic lava that creates composite volcanoes with alternating layers of lava and pyroclastic materialsPlinian eruptions are named after Pliny the Younger, a Roman writer who witnessed and described the eruption of Vesuvius in 79AD that destroyed Pompeii and Herculaneum. These types of eruptions are characterized by highly viscous rhyolitic to dacitic lava that forms calderas or large depressions in the crust. Additionally, enormous columns of ash and gas can be emitted, reaching heights of tens of kilometers and spreading over large regions.

Volcanoes have both positive and negative impacts on the environment and human society. They can create new landforms, enrich soil with minerals, provide geothermal energy and affect the climate by emitting gases and aerosols into the atmosphere. Volcanic islands like Hawaii and Galapagos also have unique ecosystems with endemic species that evolved from volcanic eruptions. However, volcanic eruptions also cause destruction and death by damaging buildings, roads, crops, water supplies and communication systems. They also harm human health by causing skin burns, respiratory problems and poisoning. Ash clouds produced by volcanic eruptions also pose a risk to air travel. Some of the most devastating volcanic eruptions include Tambora and Krakatoa in 1815 and 1883 respectively.

In conclusion, volcanoes are incredible natural occurrences that display the dynamic essence of our planet. These geological features arise from the movement of tectonic plates, leading to openings in the earth's crust for magma to escape. Scientists categorize volcanoes based on their shape and activity levels. Volcanoes have both advantageous and detrimental consequences on the environment and society. Volcanoes form new landforms, nourish soil, provide geothermal energy, and support countless species. However, volcanoes can also trigger destruction, death, and displacement. They can even affect global climate by affecting the atmospheric composition and temperature.

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