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Volcanoes of the Hawaiian Islands and the Pacific Northwest

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Destructive, deadly, and able to uproot and ruin lives, yet awe inspiring and a supportive platform for the growth of a wide range of organic entities. Volcanoes are a powerful force of nature that intrigue many but at the same time are widely misunderstood. These impressive structures can be formed in a variety of different ways and there are even factors that affect the explosive properties of magma. Why do the Hawaiian Islands seem to be ever-expanding? Is the volcanic arc of the Pacific Northwest region still active? What makes the lava of some volcanoes flow out like a burning red hissing and incredibly fluid river while others ooze down their path, and still others exist in an explosive fashion, a deadly firework show leaving behind rock and ash? In comparing the Hawaiian volcanoes and the cascade volcanoes of the Pacific Northwest region of the United States, much can be uncovered and answered about the magnificent volcanoes.

Because volcanoes are known more for the lives they take, it may come as a surprise how many lives they sustain. There are people, animals, and entire populated pieces of land that would not even be here if not for the volcano. For example, how did the Hawaiian Islands form? To answer this, take a step back and know that the formation of volcanoes has everything to do with geographical locations. A volcano does not only form over tectonic plates as one might assume. There are other ways that volcanoes are formed such as with hotspots. The Hawaiian Islands is your typical hotspot chain or track. A hotspot is a volcanic region. Therefore, the

Hawaiian Islands are volcanoes. This place that hosts billions of life-forms ranging from human beings to coral reefs would be non-existent were it not for volcanoes.

Presently, there are two hypotheses that try to figure out the origin of the volcanoes in a hotspot chain. Very basically put, one hypothesis suggests that volcanism is not caused by a high temperature of the core directly but by the movement of the lithosphere, or skin, of the earth permitting magma from the region of the tectonic plate borders to gather and form volcanoes that are far from the border itself. The second more accepted hypothesis is that there is in fact the involvement of heat directly from the core, with hot mantle plumes being the answer. This hypothesis is used to attempt and explain the reason behind the formation of the Hawaiian volcanoes. It suggests that a plume of magma rises through the asthenosphere of the earth until it hits the lithosphere. Pressure in this plume is released and melts its surroundings to produce a large quantity of basalt magma. These fluid basalt magma flows then gather to eventually produce what is called a shield volcano. The reason that many of these islands have been formed is because the motion of the pacific plate, or the lithosphere in this region, drags each volcano away from the source of their magma and existence which creates another spot for volcano formation. Thus the conception of a new volcano starts all over again. Active hotspots include Hawaii, Iceland, and Yellowstone, among others.

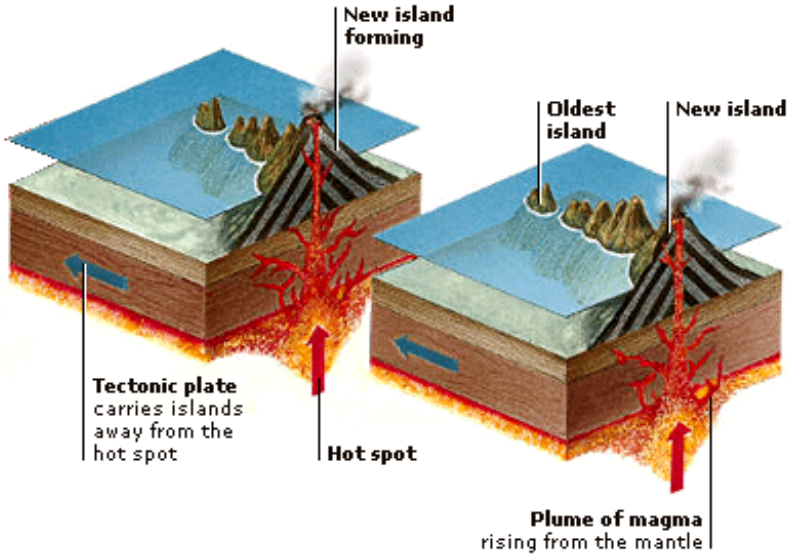
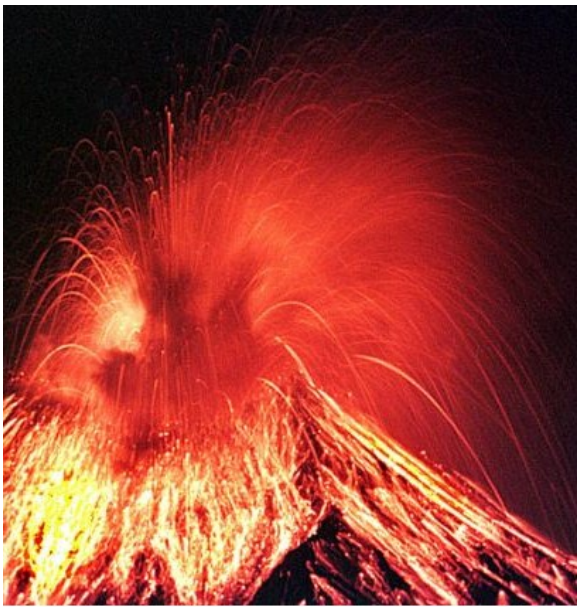


Figure 1-Island Formation
http://www.factmonster.com/dk/science/encyclopedia/islands.html

The chain of volcanoes that make up the Hawaiian Islands are especially extraordinary for their length. The large island of Hawaii currently has the most activity, and the southeastern direction. This type of volcano is called a shield volcano. A young volcano in its beginning stage begins its growth in something called the submarine preshield stage. This stage is when a relatively small amount of lava is pushed out into the ocean in sparing amounts and in an irregular frequency. This is generally seen as "pillow lava" in the beginning stages of volcano formation as shown in Figure 1. This stage takes a very long time but gradually, as it gets stronger and happens more often, forms what is called a caldera. After this stage, the volcano goes through the explosive phase. The change from immediate lava to water contact, with the new addition of air contact, removes the immediate cool and the pressure of the oceanic water that initially stopped the lava from forming in the first place. Pillow lava formations are no longer the typical formation that magma takes at this stage. The explosive phase is characterized with generally fragmented lava that turns into volcanic ash and the continuously making and filling of calderas. The next stage is the sub-aerial shield phase which marks the end of the insistent contact with the cooling sea. Less intent and less frequent explosions are typical in this phase. The eruptions again become more explosive in the post shield stage where the volcano is essentially being capped until it becomes dormant. The erosional stage follows the post shield and, as is discernible by its name, is characterized by the erosion of the volcano as it subsides into the ocean's crust. Coral reefs grow along the shoreline. After this, some volcanoes go through what is called the rejuvenated stage before being broken

Figure 2-Pillow Lava
bhttps://upload.wikimedia.org/wikipedia/commons/thumb/7/7c/Nur05018.jpg/180px-Nur05018.jpg

down to sea level. This is where the volcano becomes slightly active again and erupts a small amount of lava every thousand or even tens of thousands of years. Next comes the coral atoll stage. This stage is characterized by a ring of coral around the volcano. The last stage is the guyot stage in which the water becomes too cold to sustain life in the coral reef and it subsequently withers away. The volcano is now termed a seamount or guyot. This is not a strict lifetime of volcanoes and there are many exceptions to the sequence.



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In comparison with subduction zones, like where cascade volcanoes are, hotspots are fundamentally different in their origin. The hotspot chain of volcanoes that make up Hawaii and its associated islands have low-viscosity basaltic magma with a low level of silica content. This characteristic of the magma makes it much more fluid and less explosive than the mature continental volcanic arc in the Pacific Northwest. The subduction zone that harbors the cascade volcanoes typically has a much more viscous magma. A'a is a Hawaiian word pronounced "ah-ah" for a type of flow of lava. It is characterized by a slightly viscous consistency with sharp and spiny rocks sandwiching a layer of lava, another type of lava flow called Pahoehoe is basaltic lava which has a characteristically low viscosity. The lava from the volcanoes of this chain have the consistency of either one of the aforementioned viscosities.

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The cascade volcanoes are completely different. They were formed through subduction rather than a hotspot and the characteristic of the magma produced from the lava domes of the cascade arc has a much thicker viscosity largely due to the high silica content rather than the fluid lava of the Hawaiian hotspot with a flowing lava less viscous than water in some places. It runs along some major cities like Seattle, Washington, where the population is large and growing. This makes the volcanoes in this arc extremely dangerous because they are known to have been active and have a very strong possibility that another eruption is to occur. There is also the possibility of landslides to think about. The famous major eruption of the volcano Mt. St. Helens in 1980 is a part of this region. These volcanoes were formed by subduction of tectonic plates. The Cascadia subduction zone runs along a very large fault but there is no oceanic trench. Instead of the trench, mountains were formed. There are 13 volcanoes total in this region and seven of these volcanoes have erupted in only the last two hundred years. In total, more than one hundred eruptions have occurred, many of them being explosive. These volcanoes are very

unlike the volcanoes of the Hawaiian hotspot with their unpredictability being their dominant feature. These volcanoes do not erupt in a predictable manner and just the variety of over 4,000 separate volcanic vents of different types show that it is disorganized, making the hotspot of Hawaii with its volcanic line and specific developmental stages seem highly organized.

A cycle of life and death and of destruction and beauty, the formation and degradation of volcanoes is an incredibly beautiful and complex topic. Comparing the Hawaiian hotspot and the cascade volcanoes gives a glimpse of the complex nature into just what are some characteristics of volcanoes. The seemingly ever-expanding islands and disasters waiting to happen show just how unpredictable and formidable volcanoes are.

Works Cited

Grove, T. L., N. Chatterjee, S. W. Parman, and E. Médard (2006), The Influence of H_2O on Mantle Wedge Melting, *Earth and Planetary Science Letters*, *249*, 74-89.

"How Volcanoes Work - Intraplate (hotspot) Volcanism." *How Volcanoes Work - Intraplate (hotspot) Volcanism*. N.p., n.d. Web. 16 Nov. 2015.

"Lava Flows and Their Effects." *Lava Flows and Their Effects*. N.p., n.d. Web. 16 Dec. 2015.

"Magma | Rock." *Encyclopedia Britannica Online*. Encyclopedia Britannica, n.d. Web. 23 Nov. 2015.

"Volcanoes, Magma, and Volcanic Eruptions." *Volcanoes, Magma, and Volcanic Eruptions*. N.p., 14 Sep. 2015. Web. 1 Dec. 2015.