
An Overview of the Volcanoes in Hawaii and Their Histories

The volcanoes in Hawaii are formed on a chain of hotspots in the ocean known as the Hawaiian Emperor Seamount chain. The hotspot location climaxes, resulting in a shield volcano, and then dies out, reappearing on the trail of the chain, creating a new volcano. This is known as the plate tectonics and hotspot theory, developed by Tuzo Wilson in 1963. The trail of hotspots dates back to the oldest volcano at 5.1 billion years in the location of Kauai Island. The “Big Island” is a focal point in volcanic science and its origin is much younger at 400,000 years. Its younger life reinforces the hotspot theory, as it is the most active island on the chain due to its younger stage in the volcano stage cycle.

The shield volcano stage cycle begins with the submarine pre-shield, which is a low-volume underwater eruption occurrence. This is due to submarine vents in the earth’s crust. The low-volume eventually accumulates into rising earth creating a submarine shield, which is known as the submarine shield stage. The magma cools during this time and deteriorates calderas, allowing new calderas to form. This pattern repeats and recycles which is why the shield continues to create height above the original ocean floor. The explosive shield stage describes when the volcano breaches sea level and oxygen exposure allows more frequent eruptions. The sub aerial shield stage is a time when the violent eruptions lessen becoming less frequent and less aggressive. This allows landmass to expand from cooling magma, resulting in the resemblance of a shield above the sea level. The post-shield stage is a reverse from the sub aerial time and the eruptions create large volumes of sticky lava. Lastly is the rejuvenated stage, where small eruptions take place and lava plumes are visible infrequently. The final stage is the coral atoll, marking the end of the volcano life. This is when erosion and activity break down the volcano to sea level and it becomes a lagoon which is evident by geological occurrence on Kauai.

The Big Island is the main island of Hawaii chain, and the landmass is comprised of five volcanoes. Kohala, the oldest, is the northwestern-most located volcano on the island and is estimated to be 1 million years old. The oldest recorded rock emitted from the volcano however is only 460,000 years old. The last eruption that has occurred from Kohala was 120,000 years ago, lending itself to be a less risky zone of the island. A major event that Kohala has experienced was a sign of the post-shield, when a massive landslide carried debris 81 miles out into the ocean. The volcano in particular traps low viscosity lava. Its main geographic features are the large faults, caused by the landslide. It has completed its shield stage and is now post-shield for the last 245,000 years. Having completed its shield stage, life forms have been able to thrive on the dormant land. Heavy moss covers the lava covered floor, which effectively traps frequent rain water. This has attracted 155 native species, making it the most thriving

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ecosystem on the big island.

Mauna Kea is another volcano on the big island and has similar fissure features to that of Kohala. Its main distinctive features are the cinder cones and the presence of glacial activity. The cinder cones are 4500 to 9000 years old, and are the most recent signs of explosive eruptions. The glacial influences are caused by the small temperature drop during the last ice age, which allowed snow caps to form on the peak of the volcano. The snow has created moraines, which are soil and sediment deposits found in the caldera. The environment is the most windy and alpine found on the big island, and is significant for observatory research.

Hualalai is most famous for its large eruption in 1801. The northwestern rift zone collapsed and caused lava to flow freely to the northwest and west. The first flow traveled 16 km to modern Kona International Airport, and the second flow traveled 6km which ended in the sea. Secondly was the earthquake swarm of 1929, a geological anomaly when thousands of small earthquakes were triggered by slight magma movements under the volcano. This event caused \$100,000 worth of damage and marked the last sign of threatening volcanic activity in Hualalai. The region experiences at least one magnitude 4 earthquake per year.

Mauna Loa is the world largest volcano and occupies over ½ of the big island's landmass. The peak reaches a height of 13,679 feet caused by large volumes of lava accumulating and building a large caldera. Its lava has reached the ocean eight times since 1868 and can reach speeds to bring the lava within a matter of hours. There have been 33 eruptions since 1843 and its last eruption was in 1984. These eruptions are distinct for having massive vog, when volcanic smog accumulates into a thick presence in the atmosphere. The large size of the shield causes air activity as well as seismic activity because the magma pressure may become unstable and disrupt a flank. In 1868 Mauna Loa created a magnitude 8 and in 1975 a magnitude 7.2 was recorded. The seismic activity is also researched to be the source of generated tsunamis in the area.

The fifth volcano of the big island is Kilauea, the world's most active volcano. Despite the brief pause of activity from 1934-1952, the volcano experiences eruptions from caldera, southwestern, and east, making it an extremely unpredictable location on the island. The rock has been researched to be 300,000-600,000 years old, making it the youngest region of the big island. The landmass appears as a bulge on the flank of Mauna Loa, thus sharing some volcanic and seismic activity from the neighboring region. Its newest caldera is 500 years old, and is heavily in the shield stage of the volcanic life cycle. The frequent eruptions not only has recycled the caldera, but also has altered the ecosystem of the volcano. Precipitation mixes with volcanic ash comprised of sulfur dioxide and this in chemical analysis creates acid rain with a PH of 3.4. Furthermore, the Tephra and ash causes soil infection, preventing plant growth. However, the coast is the home of three out of nine existing nesting sites of the Hawksbill Sea

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Turtle. This is a growing biological and environmental concern due to growing and more frequent eruptions possibly affecting the sites.

The Hawaiian lava is most commonly Trachyte which is feldspar-rich and contains 65% silica. This is an interest of scientists because it is common on the entire chain not only the big island therefore hinting at a connection between the islands. The United States Geological Survey classifies the risk of the volcanoes of the big island and states that Mauna Loa and Kilauea are 2-3, Hualalai is 4, Mauna Kea is 8 and Kohala is a 9, the higher the number the less risk in general. The big island is a fascinating collection of geological and volcanic information, and hints that a new shield may be forming further down the Emperor Seamount Chain which they have named Lo'ihi, a young submarine pre-shield zone. All five volcanoes have interaction and form the landmass of the most populated island on the chain and signify how geological activity create islands found throughout the Pacific Ocean and the entire world.

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