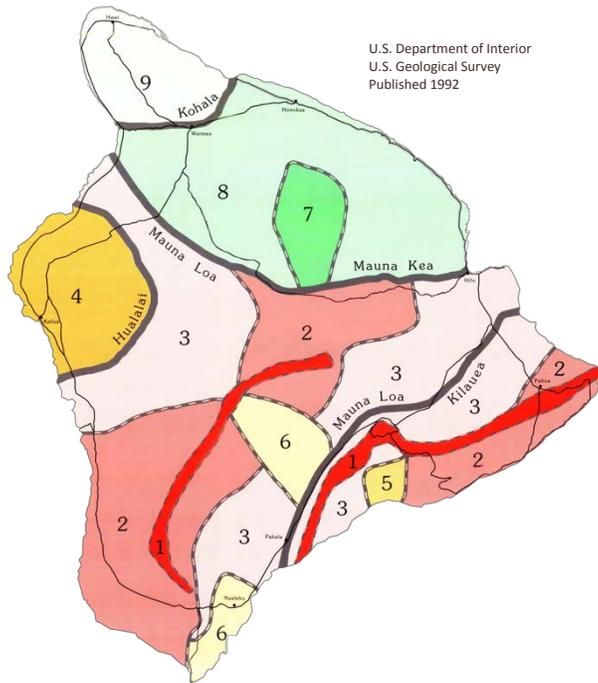




Lava Flow Hazard Zones



| Zone | Explanation |
|------|---|
| 1 | Includes summits and rift zones of Kilauea and Mauna Loa where vents have been repeatedly active in historical time. |
| 2 | Areas adjacent to and downslope of zone 1. 15%-25% of zone 2 has been covered by lava since 1800 and 25%-75% has been covered within the past 750 years. Relative hazard within zone 2 decreases gradually as one moves away from zone 1. |
| 3 | Areas less hazardous than zone 2 because of greater distance from recently active vents and (or) because of topography. 1%-5% of zone 3 has been covered since 1800 and 15%-75% has been covered within the past 750 years |
| 4 | Includes all of Hualalai, where the frequency of eruptions is lower than that for Kilauea or Mauna Loa. Lava coverage is proportionally smaller, about 5% since 1800, and <15% within the past 750 years. |
| 5 | Area on Kilauea currently protected by topography |
| 6 | Two areas on Mauna Loa, both protected by topography |
| 7 | Younger part of dormant volcano Mauna Kea. 20% of this area was covered by lava in the past 10,000 years |
| 8 | Remaining part of Mauna Kea. Only a few percent of the area is covered by lava in the past 10,000 years. |
| 9 | Kohala Volcano, which last erupted over 60,000 years ago. |

Excerpts from USGS publication (1990-259-799)

“Volcanic and Seismic Hazards of the Island of Hawaii”

Maps showing volcanic hazard zones on the island of Hawaii were first prepared in 1974, and revised in 1987. The current map divides the island into zones that are ranked from 1 to 9 based on the probability of coverage by lava flows, with 1 being the highest probability. Other direct hazards from eruptions, such as tephra fallout and ground cracking and settling, are not specifically considered on this map, however, these hazards also tend to be greatest in the areas of highest hazard from lava. Hazard zones from lava flows are based chiefly on the location and frequency of both historic and prehistoric eruptions. Historic eruptions include those for which there are written records, beginning in the early 1800's, and those what are known from the oral traditions of the Hawaiians. Our knowledge of prehistoric eruptions is based on geologic mapping and dating of the old flows of each volcano. The hazard zones also take into account the larger topographic features of the volcanoes that will affect the distribution of lava flows. Finally, any hazard assessment is based on the assumption that future eruptions will be similar to those in the past. Hazard zone boundaries are approximate. The change in the degree of hazard from one zone to the next is generally gradual rather than abrupt, and the change can occur over the distance of a mile or more. Within a single hazard zone, the severity of hazard may vary on a scale too fine to map. These variations may be the result gradual changes that extend

across the entire zone. For example, the hazard posed by lava flows decreases gradually as the distance from the vents increases. There may be abrupt changes, however, in the relative hazard because of the local topography. For example, the hills behind Ninole stand high above the adjacent slopes of Mauna Loa, and consequently are at a much lower risk from lava flows than the surrounding area, even though the entire area is included in a single zone. To determine the hazard difference within a single zone, more detailed studies are required.

KILAUEA is Hawaii's youngest volcano and of the world's most active. Over 90 percent of Kilauea's surface is covered by lava less than 1,100 years old. In historical time, all of Kilauea's eruptions have occurred either in or near its summit caldera, or along the east or southwest rift zones. For the foreseeable future, we can assume that active vents will be limited to these areas. Since 1955, 28 percent of the area encompassing the east rift zone and the slope south of the rift zone has been covered by lava flows. The latest eruption of the east rift zone began in 1983 and continues as of 1989. The Southwest rift one is less active, with 5 eruptions in the past 200 years; the latest was in 1974. The most recent summit eruption occurred in 1982.

From the time of the first written accounts in the early 1800's and through the first decades of this century, Kilauea erupted almost continuously at its summit caldera. In 1924, the summit caldera's active lava lake in Halemaumau crater abruptly drained away, and ground water beneath the caldera apparently came into contact with the hot rocks surrounding the magma conduit, causing a series of steam explosions that threw out large blocks of dense lava along with ash. Sporadic eruptions continued at Halemaumau until 1934, when all activity ceased for 18 years. In 1952, Kilauea re-awoke with a 4-month eruption in Halemaumau. Since then, eruptive activity has occurred mainly on the volcano's two rift zones, particularly in the East rift zone. From 1969 to 1974, Kilauea erupted at the Mauna Ulu vent on the upper East rift zone. The Mauna Ulu eruption was the most voluminous rift eruption in over a century, but has been surpassed by the recent eruption at the Pu`u O`o and Kupaianaha vents.

The hazard map for Kilauea shows the relative degree of hazard from lava flows for different areas of the volcano. Zone 1 is the most hazardous; it consists of the summit area and rift zones because Kilauea's frequent eruptions originate in these areas. Zone 2 includes the areas that are adjacent to, and downslope from, the East rift zone. The entire area south of the East rift zone lies in this zone. Lava flows are most likely to travel in this direction because the ground slopes downhill from the rift zone to the ocean. The area north of the lower East rift zone, which includes Pahoa, is also in Zone 2. Here the land slides away to the North as well as the South, and flows can advance in either direction. Zone 3 includes the areas north of the upper East rift zone and both North and south of the Southwest rift zone. Less than 5% of the area in Zone 3 has been covered with lava in historical time, but more than 75% has been covered in the last 750 years.

MAUNA LOA erupts less frequently than does Kilauea, but it tends to produce a much greater volume of lava over a shorter period of time. 40% of Mauna Loa's surface is covered by lava flows less than 1,000 years old. Nearly all of the Mauna Loa eruptions observed since the early 1800's began at its summit caldera; during half of these, the activity subsequently shifted to either the Northeast or the Southwest rift zones. In addition to the summit and rift zones, the upper Northwest flank of Mauna Loa has been the source of three eruptions in the last 200 years. The largest of these, in 1859, produced a lava flow that reached the ocean North of Kiholo Bay on Hawaii's West coast. Mauna Loa has also erupted from a submarine vent on its West flank in historic time. In 1877, a 1 day eruption took place beneath Kealakekua Bay within 1 mile of the shore. This eruption produced turbulent water and floating blocks of lava, but it caused no injuries to onlookers who approached the area in canoes and other small boats. Between 1868 and 1950, lava flows from the Southwest rift zone reached the ocean during 5 eruptions. Flows from 4 of these eruptions traveled to the sea in 3 to 48 hours. Since 1900,

Mauna Loa has erupted 15 times, with eruptions lasting from a few hours to 145 days. After the 1950 eruption, Mauna Loa was quiet for 25 years. It reawakened with a 1 day summit eruption in 1975. The recent eruption of Mauna Loa occurred in 1984. This eruption originated at the summit and, within a few hours, migrated to the Northeast rift zone. The resulting lava flows advanced to within 4 miles of Hilo before the 3 week long eruption ended. Similar short duration eruptions of Mauna Loa's Northeast rift zone in 1852 and 1942 produced flows that came within about the same distance of Hilo. In 1855, a much longer lived eruption fed a flow that stopped half a mile east of the upper Kaumana area on the Western outskirts of modern Hilo. Lava invaded the present boundaries of Hilo in 1881, although the flow did not reach the shoreline, where the village of Hilo was located at that time. The 1881 flow underlies much of Kaumana and extends a half mile downslope of Komohana Rd. Zone 1 on the lava flow hazard map for Mauna Loa included the summit region and the recently active parts of the rift zones. Zone 2 consists of areas on both sides of the Northeast and Southwest rift zones. Since both of Mauna Loa's rift zones form prominent ridges, all the areas in Zone 2 are downslope of potential eruption sites. About 20% of this area has been covered by lava in historical time, 5% since 1950. Zone 3 includes other areas on Mauna Loa in which the hazard is gradationally lower than in Zone 2. During the past 750 years, lava flows have covered about 15 to 20% of Zone 3 on Mauna Loa. These areas are less affected by rift activity than Zone 2, although the area of Zone 3 that lies on the Northwest flank of the volcano is vulnerable to eruptions originating at vents on that flank. The 1859 lava flow covers 10% of this area.

* The information contained in this document does not reflect the eruptive events in Pahoa in 2014 and Leilani Estates in 2018

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