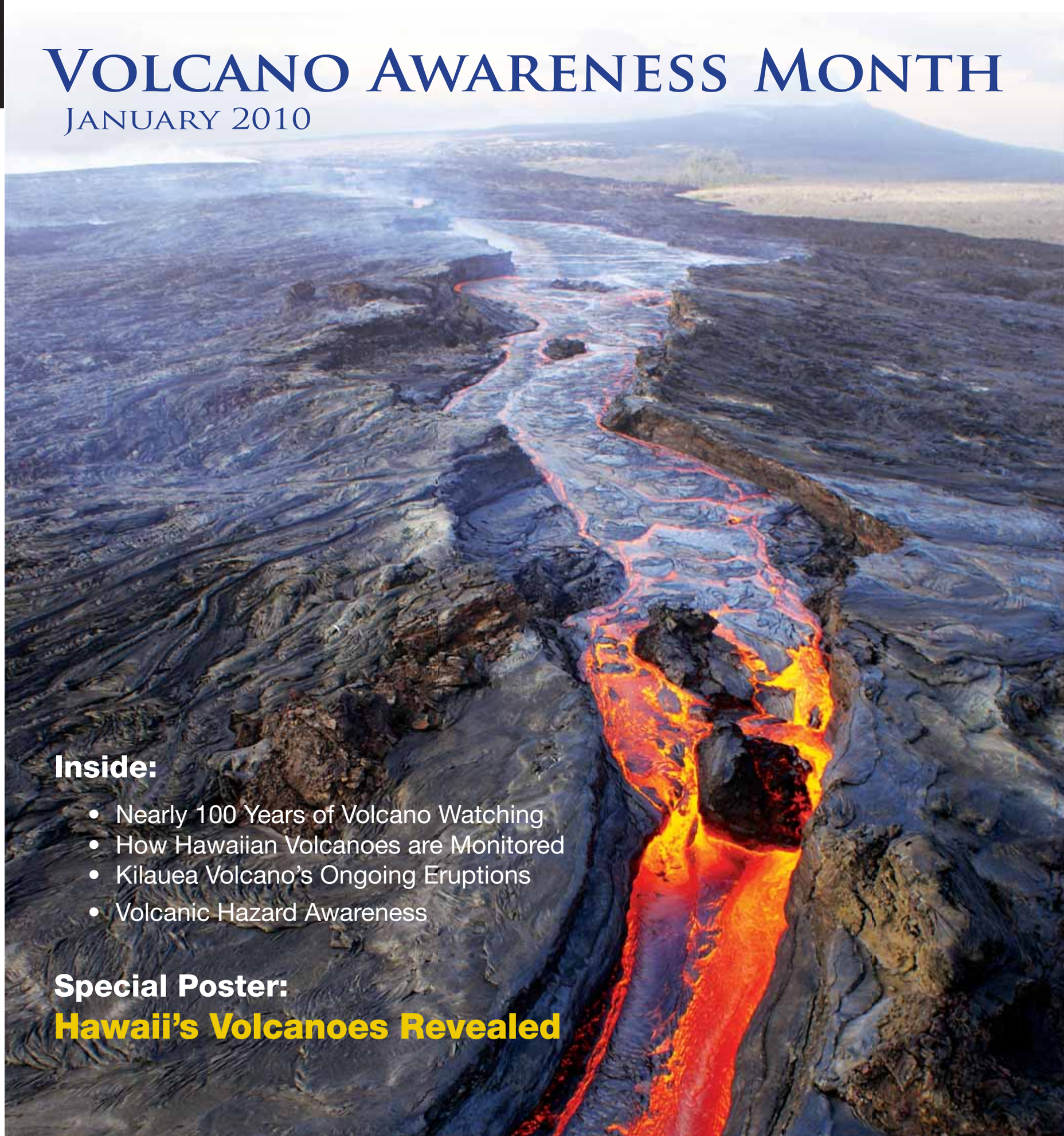
Volcano Awareness Month

January 2010



Inside:

- Nearly 100 Years of Volcano Watching
- How Hawaiian Volcanoes are Monitored
- Kilauea Volcano's Ongoing Eruptions
- Volcanic Hazard Awareness

Special Poster:

Hawaii's Volcanoes Revealed

COUNTY OF HAWAI'I

Proclamation

WHEREAS, Hawai'i Island consists of five volcanoes, four of which are classified as active, and all of which deserve our respect and appreciation; and

WHEREAS, Kilauea has been erupting nearly continuously since 1983, with a summit vent opening in Halema'uma'u Crater in 2008, and Mauna Loa likely to erupt again within our lifetimes; and

WHEREAS, volcano awareness has been an essential component of life on our island since the time of the earliest Hawaiian settlements; and

WHEREAS, current island residents and visitors should become familiar with Hawai'i's volcanoes in order to safely observe and enjoy the drama and beauty of volcanic eruptions while also understanding the hazards they pose; and

WHEREAS, the USGS Hawaiian Volcano Observatory (HVO) is responsible for volcanoes in Hawai'i and providing scientific data and eruption updates to State and County Civil Defense agencies, Hawai'i Volcanoes National Park, and the general public; and

WHEREAS, HVO will promote the importance of understanding and appreciating Hawaiian volcanoes through a series of events conducted in cooperation with Hawai'i Volcanoes National Park, Hawai'i County Civil Defense, and the University of Hawai'i at Hilo,

NOW, THEREFORE, I, Billy Kenoi, Mayor of the County of Hawai'i, do hereby proclaim January 2010, as

VOLCANO AWARENESS MONTH

for Hawai'i Island, and encourage all residents and visitors to increase their knowledge and awareness of Hawaiian volcanoes and the proper safety measures to follow before, during, and after a volcanic eruption.

IN WITNESS WHEREOF, I have hereunto set my hand and caused The Seal of the County of Hawai'i to be affixed. Done this 4th day of December, 2009, in Hilo, Hawai'i.

Billy Kenoi
MAYOR

Volcano Awareness: An Essential Component of Living in Hawai'i

January 3, 2010, marks the 27th anniversary of Kilauea's ongoing east rift zone eruption. In a few months, it will have been 20 years since Kalapana was buried beneath lava and 50 years since Kapoho was inundated by fast-moving lava flows. The destruction of these two communities—and others over the years—is a sobering reminder of why it's important to understand how Hawai'i's volcanoes work.

With this in mind, County of Hawai'i Mayor Billy Kenoi has proclaimed January 2010 as "Volcano Awareness Month."

Throughout the month, the USGS Hawaiian Volcano Observatory (HVO), in cooperation with Hawai'i Volcanoes National Park, Hawai'i County Civil Defense, and the University of Hawai'i at Hilo, will sponsor various events to promote increased awareness of and respect for the volcanoes on which we live.

Volcanoes are an integral aspect of life in Hawai'i. If you reside on the island, you live with the consequences—both good and bad—of volcanic activity. We enjoy the spectacular beauty and drama of active lava flows, but bemoan the poor air quality produced by Kilauea's ongoing eruptions. We appreciate the volcanic soils in which we grow flowers and other agricultural products, but lament the loss of beloved landmarks buried by lava.

Hawaiian volcanoes create, but they can also destroy. So, if we choose to live on this island, we must learn to live in harmony with the dynamics of its ever-changing landscape. Awareness, as well as preparedness, is essential to living with our volcanoes.

Volcano Awareness Month offers many opportunities to learn more about your volcanic island home. We encourage you to participate in the hikes, talks, teacher workshops, and other public programs scheduled this month (see page 8).

Jim Kauahikaua
Scientist-in-Charge

USGS
science for a changing world
Hawaiian Volcano Observatory

Message from Hawai'i County Civil Defense

We live in the most beautiful place on Earth. Our volcanoes, broad shields emerging from the Pacific Ocean, are tall enough to create varied climates in a limited geographic area—from lush rain forests to frozen tundra—all of which enhance the attractiveness of Hawai'i Island. Volcanoes, however, are dynamic entities, and their moods and behavior do not always comfortably suit those of us who reside here. Earthquakes, lava flows, and gas emissions are all part of the compromise we make when choosing to live on or near an active volcano.

Hawai'i County Civil Defense, in partnership with the USGS Hawaiian Volcanoes Observatory (HVO), tries to find a middle ground—one that allows us to enjoy living with the beauty of our volcanic island, as well as with its hazards. Please help us by educating yourself about Hawai'i Island's volcanoes through programs offered this month. The HVO Web site (http://hvo.wr.usgs.gov) is also an excellent source of information.

To receive free Civil Defense telephone and text notification when volcanic (or other) hazards threaten to impact your community, sign up for CD Mobile Alerts on the County of Hawai'i Web site at http://www.hawaii-county.com/.

Have a safe day. Quince Mento, Administrator

Above: A high lava fountain erupts from Pu'u 'O'o on June 30, 1984.

Cover photo: Perched lava channel on Kilauea's rift zone, October 7, 2007. USGS photos.

Geology Students Gain Experience on Hawaiian Volcanoes

University of Hawai'i Hilo

Hawaiian volcanoes provide a near perfect "classroom" for studying active volcanism. Through direct exposure to our island's volcanic environment, UH-Hilo students can apply theory learned in class and develop a meaningful understanding of the dynamic nature of volcanic processes. In cooperation with Hawai'i County Civil Defense and Hawai'i Volcanoes National Park, and through intern opportunities with the Hawaiian Volcano Observatory, our geology majors are able to conduct studies of lava properties and learn how to track magma underground. These hands-on experiences are invaluable to students and provide motivation for them to pursue advanced degrees in a variety of Earth Science disciplines.

Ken Hon, Chair and Associate Professor
Department of Geology

Awareness through Experience at Hawai'i Volcanoes National Park

As a park ranger for the past 12 years, I've been to Hawai'i Volcanoes National Park countless times, and it's never the same. On an active volcano, the only constant is change.

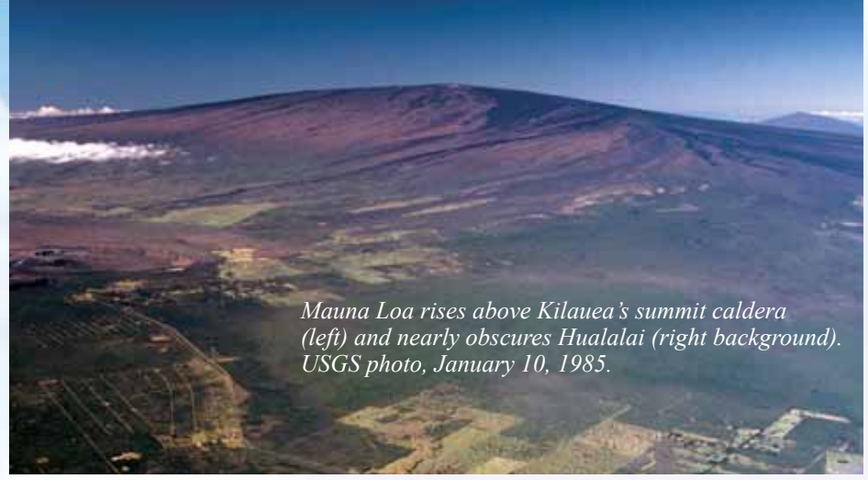
At Hawai'i Volcanoes, we protect, study, and provide access to Kilauea and Mauna Loa, two of the world's most active volcanoes. We also preserve endemic Hawaiian ecosystems and perpetuate the traditional Hawaiian culture connected to these landscapes.

The park helps people understand volcanoes and appreciate their wonders and hazards. Spending time in Hawai'i Volcanoes connects you to its geological, biological, and cultural resources, through which you gain a clearer understanding of our volcanic islands.

During Volcano Awareness Month, park rangers will offer numerous programs and hikes. Come join us. You never truly know a place until you've experienced it yourself.

Kupono McDaniel, Park Ranger (in NPS photo)

National Park Service



Mauna Loa rises above Kilauea's summit caldera (left) and nearly obscures Hualalai (right background). USGS photo, January 10, 1985.

Hawai'i—An Island of Active Volcanoes

The Island of Hawai'i is composed of five volcanoes. Through countless eruptions over hundreds of thousands of years, each one grew from the ocean floor to above sea level, where they merged to form the island we know today.

Kohala, the oldest volcano on the island, last erupted about 60,000 years ago. Mauna Kea has erupted several times in the last 10,000 years, most recently about 4,600 years ago.

Hualalai, the island's third most active volcano, has erupted three times in the past 1,000 years, most recently in 1801. In 1929, an intense and damaging seismic swarm marked a failed eruption. Hualalai is not currently showing signs of unrest, but future eruptions are a certainty. HVO keeps a close eye on the volcano and will notify the public if any change in status is detected.

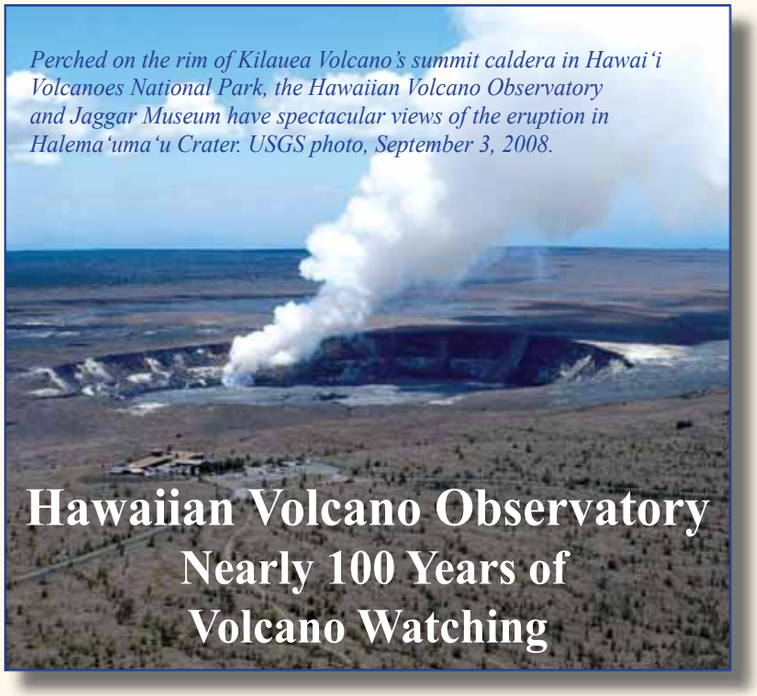
Mauna Loa, the largest volcano on Earth, comprises more than half of Hawai'i Island's surface area. Since 1843, it has erupted 33 times, producing lava flows that have covered extensive areas on its flanks and reached the ocean along the south, west, and northwest coasts of the island.

When this volcano erupts, voluminous and fast-moving flows can travel from the vent to the ocean in only hours. In 1984, during Mauna Loa's most recent eruption, lava flowed to within four miles of Hilo city limits in a matter of days.

Mauna Loa will erupt again, quite likely during your lifetime, and is capable of disrupting lives and commerce island-wide. Therefore, it's essential that Hawai'i Island residents become aware of Mauna Loa's volcano-hazard potential and be prepared for its next eruption.

Kilauea, one of the most active volcanoes in the world, is Hawai'i Island's youngest volcano. Over 90 percent of its surface is covered by lava flows less than 1,100 years old. Kilauea has been erupting essentially non-stop since 1983, and today, eruptions continue from two active vents on the volcano (see page 6).

HVO scientists will give public talks about the eruptive history and current status of Hawai'i's three most active volcanoes—Kilauea, Mauna Loa, and Hualalai—during Volcano Awareness Month (see schedule on page 8).



Perched on the rim of Kilauea Volcano's summit caldera in Hawai'i Volcanoes National Park, the Hawaiian Volcano Observatory and Jaggar Museum have spectacular views of the eruption in Halema'uma'u Crater. USGS photo, September 3, 2008.

Hawaiian Volcano Observatory Nearly 100 Years of Volcano Watching

In two years, the Hawaiian Volcano Observatory (HVO) will celebrate its centennial anniversary. The journey to this milestone began with Thomas A. Jaggar, whose vision and efforts to "protect life and property on the basis of sound scientific achievement" led to the founding of HVO in 1912.

In the beginning, support for HVO came from various organizations, including the Hawaiian Volcano Research Association (1912–1919), the U.S. Weather Bureau (1919–1924), the U.S. Geological Survey (1924–1935), and the National Park Service (1935–1947). In 1947, the U.S. Geological Survey became the permanent administrator of HVO.

Today, as part of the USGS Volcano Hazards Program, HVO's mission is to monitor, conduct research on, and assess hazards from volcanic eruptions and earthquakes on Hawai'i's active volcanoes.

HVO has grown from one geologist (Jaggar) in 1912 to a team of 25 people in 2010. The current staff includes scientists and specialists in geology, geophysics, seismology, gas geochemistry, computer technology, and electronics, as well as Web design, library and photo archives, administration, and public information. Together, they work to fulfill HVO's mission.

How HVO Monitors Volcanoes: Techniques and Technology

HVO, one of five volcano observatories in the United States, uses a variety of methods to monitor volcanic and seismic activity in Hawai'i.

Geologists map and sample lava flows, track eruptive activity, assess hazards, and investigate eruption dynamics. Geochemists analyze gas emissions to determine the depth, volume, and composition of magma. Geophysicists measure ground deformation (changes in a volcano's shape) and locate earthquakes to detect volcanic unrest.

A network of remotely located instruments transmits real-time data via radio signals to HVO around the clock. Webcams provide images of volcanic activity, while electronic tiltmeters and Global Positioning System (GPS) receivers detect ground deformation, and seismometers record earthquakes and tremors.

These ground-based techniques and instruments are supplemented by space-based technology. Satellites orbiting Earth provide data that HVO uses to monitor ash and gas plumes, identify thermal (heat) sources, and discern and measure ground motion and surface changes on Hawai'i's volcanoes.

For more information on how USGS and HVO monitors volcanoes, please visit http://volcanoes.usgs.gov/activity/methods/index.php and http://hvo.wr.usgs.gov.

U.S. Department of Interior
U.S. Geological Survey

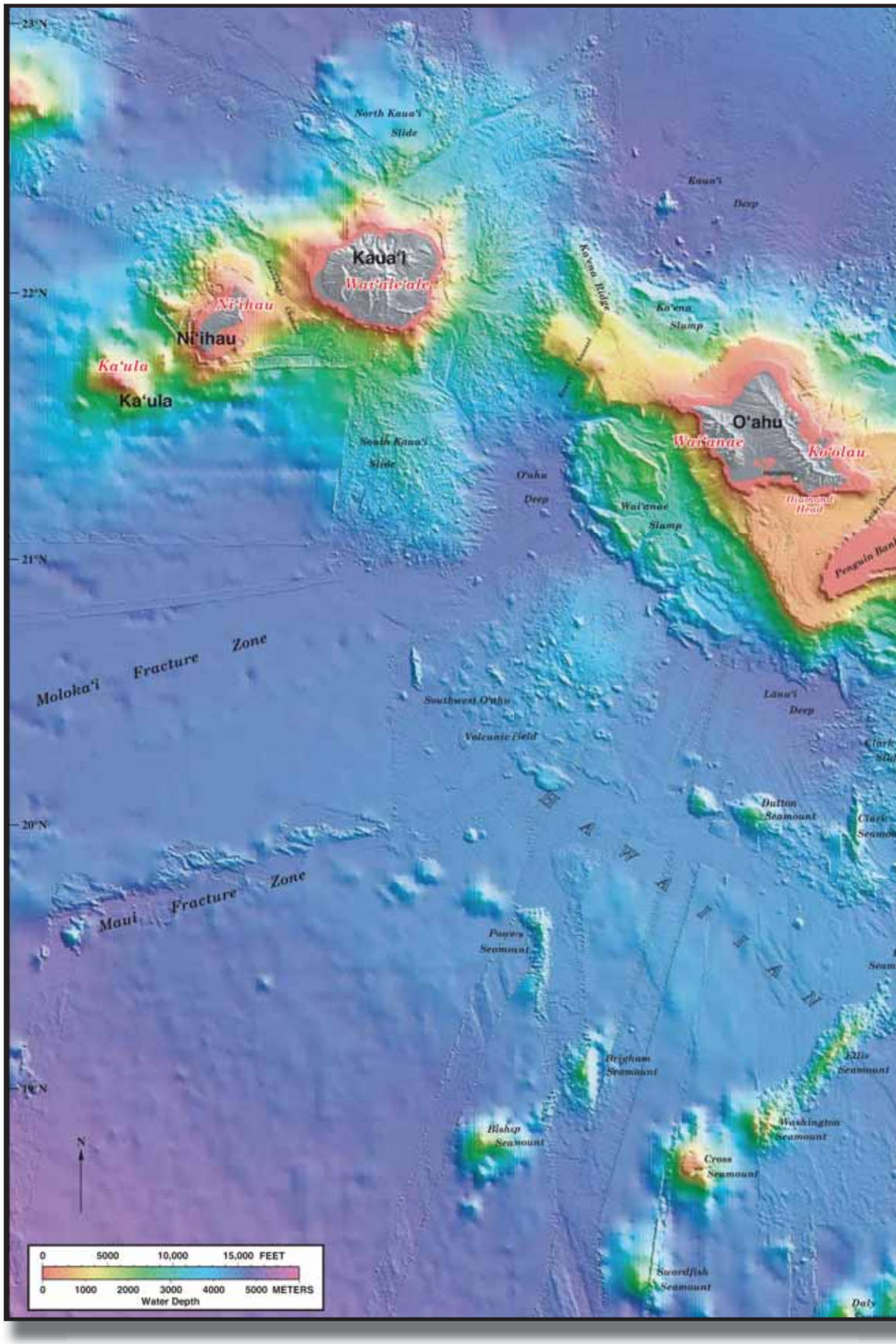
science for a changing world

The Volcanoes of Hawaii

Hawaiian volcanoes typically evolve in four stages as volcanism waxes and wanes: (1) early alkalic, when volcanism originates on the deep sea floor; (2) shield, when roughly 95 percent of a volcano's volume is emplaced; (3) post-shield alkalic, when small-volume eruptions build scattered cones that thinly cap the shield-stage lavas; and (4) rejuvenated, when lavas of distinct chemistry erupt following a lengthy period of erosion and volcanic quiescence. During the early alkalic and shield stages, two or more elongate rift zones may develop as flanks of the volcano separate. Mantle-derived magma rises through a vertical conduit and is temporarily stored in a shallow summit reservoir from which magma may erupt within the summit region or be injected laterally into the rift zones. The ongoing activity at Kilauea's Pu'u 'O'o cone that began in January 1983 is one such rift-zone eruption. The rift zones commonly extend deep underwater, producing submarine eruptions of bulbous pillow lava.

Once a volcano has grown above sea level, subaerial eruptions produce lava flows of jagged, clinkery 'a'a or smooth, ropy pahoehoe. If the flows reach the ocean they are rapidly quenched by seawater and shatter, producing a steep blanket of unstable volcanic sediment that mantles the upper submarine slopes. Above sea level then, the volcanoes develop the classic shield profile of gentle lava-flow slopes, whereas below sea level slopes are substantially steeper. While the volcanoes grow rapidly during the shield stage, they may also collapse catastrophically, generating giant landslides and tsunami, or fail more gradually, forming slumps. Deformation and seismicity along Kilauea's south flank indicate that slumping is occurring there today.

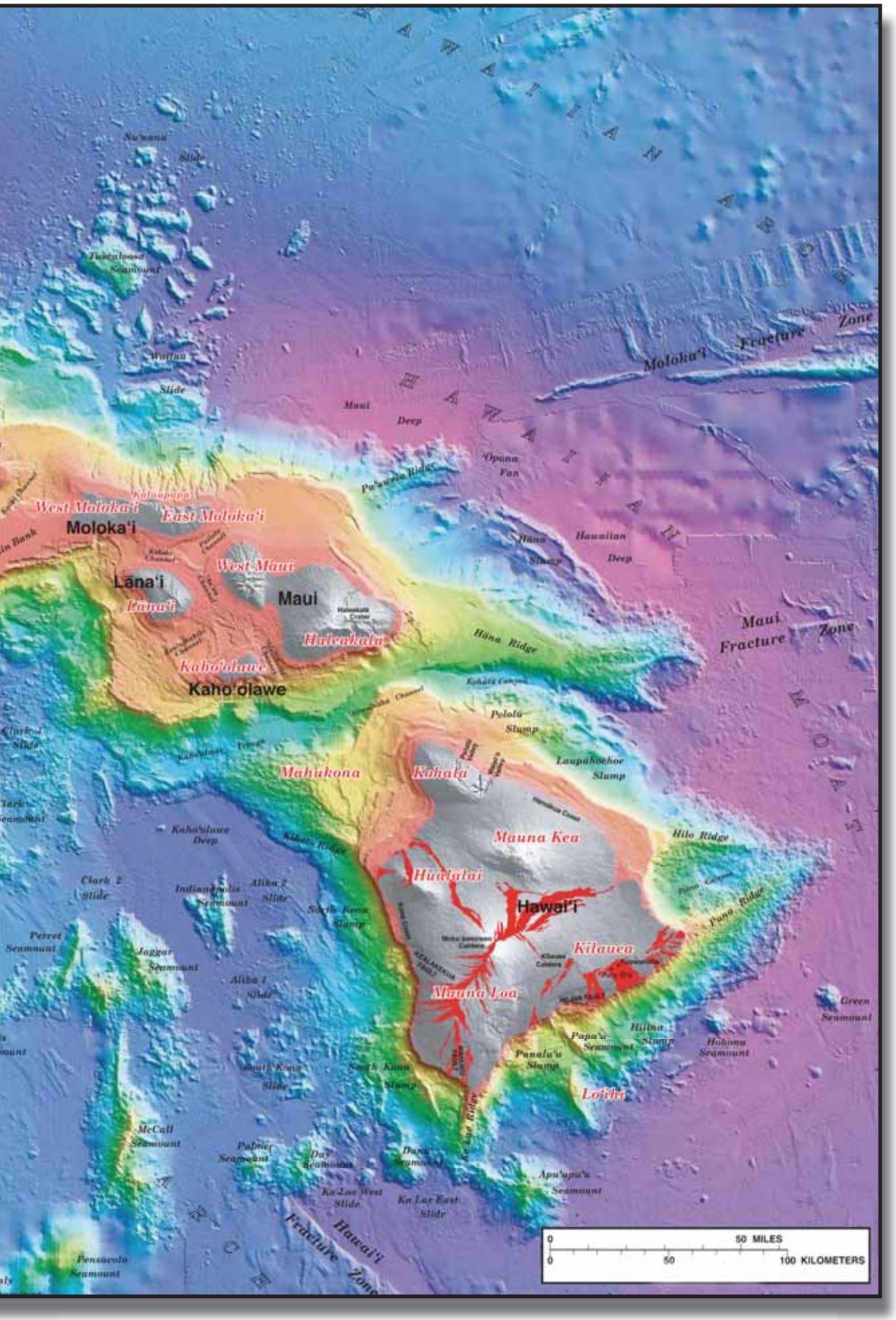
Loading of the underlying Pacific Plate by the growing volcanic edifices causes subsidence, forming deep basins at the base of the volcanoes. Once volcanism wanes and lava flows no longer reach the ocean, the volcano continues to submerge, while erosion incises deep river valleys, such as those on the Island of Kaua'i. The edges of the submarine terraces that ring the islands, thus, mark paleocoastlines that are now as much as 2,000 m (6,560 feet) underwater, many of which are capped by drowned coral reefs.



The Hawaiian Islands, shown in shades of gray with highest areas appearing white, are the tops of massive volcanoes, the bulks of which lie below sea level. Ocean depths, indicated by colors ranging from orange (shallowest) to green to violet (deepest), are greatest northeast of Maui, where the ocean is 5,750 m (18,865 feet) deep. Historical lava flows that have erupted from Mauna Loa, Kilauea, and Hualalai volcanoes on the Island of Hawai'i are shown in red.

Text and map (reduced for this publication) are from:
USGS Geological Investigations Series I-2809
Full version available at http://geopubs.wr.usgs.gov/i-map/i2809/

Hawaii's Volcan



anoes Revealed

Mapping the sea floor around Hawaii

The Japan Marine Science and Technology Center (JAMSTEC) funded and led a four-year collaborative survey of the underwater flanks of Hawaii's shield volcanoes. This exploration, involving scientists from the U.S. Geological Survey (USGS) and other Japanese and U.S. academic and research institutions, utilized manned and unmanned submersibles, rock dredges, and sediment piston cores to directly sample and visually observe the sea floor at specific sites. Ship-based sonar systems were used to more widely map the bathymetry from the sea surface.

State-of-the-art multibeam sonar systems, mounted on the hull of GPS-navigated research vessels, convert the two-way travel times of individual sonar pings and their echoes into a line of bathymetry values across the ship track. The resulting swaths across the ocean bottom, obtained along numerous overlapping ship tracks, reveal the sea floor in stunning detail. Survey data collected by JAMSTEC form the basis for the bathymetry shown on the map, augmented with bathymetric data from other sources. Bathymetry that is predicted from variations in sea-surface height, observable from satellites, provides the low-resolution (fuzzy) bathymetry in between ship tracks. Subaerial topography is from a USGS 30-m digital elevation model of Hawaii.

Prominent terraces (shown in orange and yellow) illustrate the larger size of the islands in the past; O'ahu and the Maui-Nui complex (Maui, Moloka'i, Lana'i, and Kaho'olawe islands, and Penguin Bank), in particular, are mere vestiges of their former extent. Lo'ihi, the youngest volcano in the chain, has not yet reached the sea surface. Fields of blocky debris, such as Ko'olau's Nu'uanu Slide, were created by catastrophic landslides, which carried large parts of some volcanoes as much as 200 km (124 miles) across the sea floor. Slower-moving, sediment-blanketed slumps, in contrast, typically develop ridges that parallel the paleocoastlines, such as Haleakala's Hana Slump. Eruptions along the submarine part of a volcano's rift zone produce a rugged morphology, as at Kilauea's Puna Ridge. Numerous seamounts of Late Cretaceous age (approximately 80 million years ago) are scattered across the deep sea floor and are unrelated to the hot spot that supplies Hawaii's volcanoes.

By Barry W. Eakins, Joel E. Robinson, Toshiya Kanamatsu, Jiro Naka, John R. Smith, Eiichi Takahashi, and David A. Clague.

Prepared in cooperation with the Japan Marine Science and Technology Center, the University of Hawai'i, School of Ocean and Earth Science and Technology, and the Monterey Bay Aquarium Research Institute (2003).

Mercator map projection; image illuminated from the northeast to emphasize sea-floor relief. NOT TO BE USED FOR NAVIGATION

More Gas Than Ash, Halema‘uma‘u Crater Continues to Erupt

USGS photos

On March 12, 2008, vigorous fuming began at the base of Halema‘uma‘u Crater’s east wall. A week later, an explosive eruption—the first at Kilauea’s summit since 1924—blasted hot, rocky debris to the crater’s rim and formed a vent on the floor of Halema‘uma‘u. Thus began Kilauea’s current summit eruption.

Changes leading to it can be traced back to 2003, when Kilauea’s summit began inflating after two decades of deflation. Seismic tremor and sulfur dioxide (SO_2) gas emissions started increasing in late 2007. By February 2008, SO_2 concentrations were so high in the southern part of the summit caldera that Hawai‘i Volcanoes National Park closed a section of Crater Rim Drive, including the Halema‘uma‘u Overlook and parking area.

Since the March 19, 2008, explosive eruption, tephra (small fragments of rock and lava) has been erupted nearly continuously—and, at times, rather energetically, in explosive pulses—from the new vent in Halema‘uma‘u. To date, the eruption has produced 2,200 tonnes of tephra. The eruptive vent, initially 35 m (115 ft) wide, has grown to form an opening that is about 135 m (440 ft) in diameter—larger than a football field.

By day, a persistent gas plume—usually light gray or white, but briefly tinted dusty brown by rock falls within the vent—rises from the vent in Halema‘uma‘u. At night, an orange glow, which waxes and wanes depending on the level and activity of molten lava within the vent, is often visible from the Jaggar Museum overlook in Hawai‘i Volcanoes National Park.

SO_2 levels remain elevated, with an average emission rate of 800–1,200 tonnes per day. The impact of these emissions has caused repeated exceedances of Federal and State air quality standards in downwind communities, and has resulted in agricultural losses and long-term health concerns for island residents.

Today, HVO scientists closely monitor Kilauea’s summit vent, which continues to erupt more gas than ash.

Kilauea East Rift Zone Eruption: 27 Years and Still Flowing

January 3, 2010, marks the 27th anniversary of the Pu‘u ‘O‘o–Kupaianaha eruption, Kilauea Volcano’s longest east rift zone eruption in more than 600 years.

It began just after midnight on January 3, 1983. Following a swarm of small earthquakes, the ground cracked opened on Kilauea’s east rift zone. Within moments, lava erupted to the surface—the first of several fissure eruptions over the next six months.

By June 1983, the eruption was focused at a single vent. Over the next three years, lava fountains up to 457 m (1,500 ft) high roared from the vent 44 times, building a 254-m- (835-ft-) high cinder and spatter cone, now called Pu‘u ‘O‘o.

In July 1986, the eruption shifted to Kupaianaha, a new vent farther down the east rift zone. Lava poured from this vent nearly continuously for almost six years, burying Kilauea’s south flank, including the communities of Kapa‘ahu in 1986 and Kalapana in 1990.

Early in 1992, Kupaianaha activity ceased, but the eruption resumed almost immediately from new vents on the flanks of Pu‘u ‘O‘o. For the next 15 years, lava flowed down the slopes of Kilauea and into the sea, mostly within Hawai‘i Volcanoes National Park.

On July 21, 2007, the eruption changed course again. A fissure opened on the east flank of Pu‘u ‘O‘o and propagated toward Kupaianaha, sending the first of several channelized lava flows to the northeast.

In November 2007, on Thanksgiving eve, lava burst out of the channel, diverting flows to the southeast. Within a month, rootless lava shields had grown on the flank of this new vent.

By early 2008, ‘a‘a lava from these shields had headed south, flowed through the Royal Gardens subdivision and on to the coastal plain.

Lava reached the ocean for the first time in eight months on March 5, 2008. It continued to flow from the vent to the sea through a lava tube, entering the ocean at Waikupanaha, through 2008 and 2009. At times, molten lava broke out of the tube, creating active surface flows that sometimes produced short-lived ocean entries west of Waikupanaha.

Since the ongoing east rift eruption began in 1983, lava flows have buried 120 sq km (46 sq mi) of public and private land, destroying vast tracts of native forest, 16 km (10 mi) of highway, and 210 structures, including homes, a church, and a national park visitor center.

The eruption has been Kilauea’s most destructive event of the 20th century, but it has also been constructive, adding about 198 hectares (490 acres) of new land to the island.

As we usher in the New Year, there are no signs that Kilauea’s east rift zone eruption will stop soon.

Viewing Lava Safely

Witnessing the formation of new land as lava enters the sea can be a life-changing experience—as long as you stay safe. Without knowing all the hazards associated with ocean entries, it’s easy to underestimate their danger.

The billowy white steam plumes created when lava enters the sea can be harmful to your health. They contain fine lava fragments and assorted acid droplets that should not be inhaled.

When molten lava enters water, it shatters into glassy fragments that accumulate along the coast. This rubble, buried beneath a veneer of lava flows, forms a “delta” that gives a false impression of solid ground. But this new land is highly unstable and often collapses with no warning. When a delta collapses, steam explosions can blast blocks of hot rock hundreds of feet, both inland and out to sea, and generate large local waves. Being on, or too near, a lava delta puts you directly in harm’s way.

Because conditions near ocean entries change rapidly, warning signs cannot always be posted. Residents and visitors should be aware of the hazards and be responsible for their own safety when viewing active lava flows. To learn more, visit these Web sites:

- **Viewing Lava Safely** http://pubs.usgs.gov/fs/2000/fs152-00/
- **Lava Viewing Update** www.lavainfo.us

Today, Kilauea’s ocean entry attracts hundreds of spectators nightly. If you’re one of them, please stay within the public viewing area a safe distance from the ocean entry. From there, your experience can be life-changing, not life-threatening.

Incandescent lava fragments, blasted up to 70 m (230 ft) high, created a beautiful, but potentially dangerous, ocean entry display on July 16, 2008. USGS photo.

For more information, visit HVO’s Web site at http://hvo.wr.usgs.gov.

Awareness and Planning: Key Elements to Reduce Risk from Volcanic Hazards

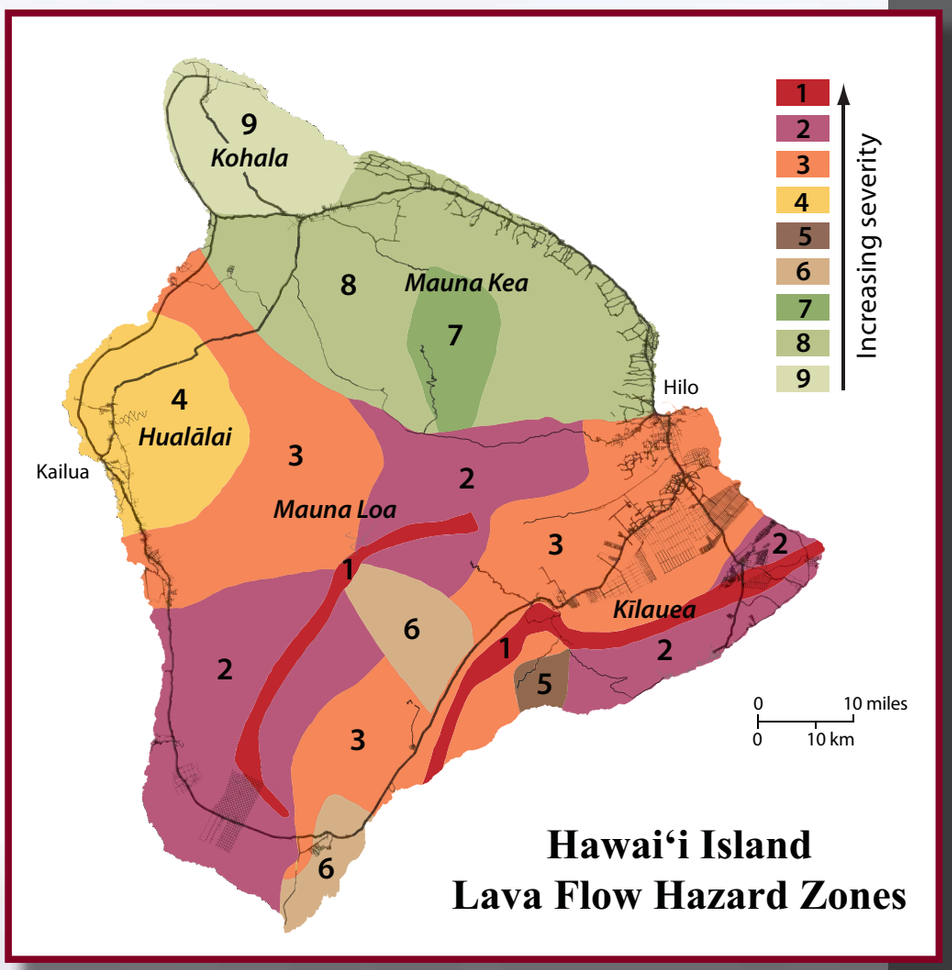
Volcanoes directly and indirectly affect people's lives, activities, and property. In Hawai'i, hazards posed by volcanic eruptions include lava flows, tephra (airborne lava fragments), volcanic gases, explosive events, and earthquakes.

Lava flows are the most common hazard of Hawaiian volcanoes. On Mauna Loa, high-volume eruptions can produce lava flows that travel down the volcano's steep slopes and reach the sea in as little as two hours. Kilauea's ongoing east rift zone eruption reveals the impact of a prolonged low-volume eruption.

Volcanic gases pose the greatest hazard immediately downwind of active vents. Although not the most abundant gas, sulfur dioxide—and the vog (or volcanic smog) it creates—has the greatest impact on people and agriculture statewide.

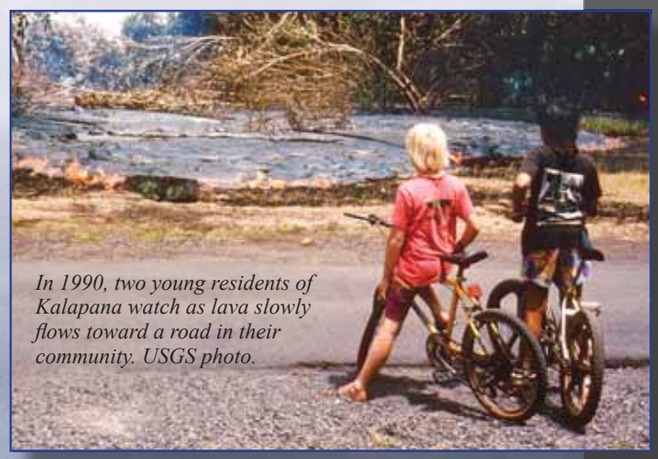
In Hawai'i, tephra includes ash, scoria, spatter, cinder, Pele's hair, and Pele's tears ejected in lava fountains, or, more uncommonly, during explosive eruptions. Larger airborne fragments pose a serious hazard near an erupting vent, but small particles, like ash and Pele's hair, can be blown downwind great distances. Very fine ash erupted from small explosive eruptions in Halema'uma'u Crater in 2008–2009 was carried beyond the Miloli'i shoreline 75 km (45 mi) away. More powerful explosive events, like Kilauea's 1790 eruption, can result in extensive and widespread ash deposits.

Thousands of earthquakes are recorded beneath Hawai'i Island each year. Most are so small that they are detected only by instruments, but some are strong enough to be felt, and a small number cause minor-to-moderate damage.



Nothing we do will reduce volcanic hazards. We can, however, reduce risk—the possibility of loss (of life, property, or productive capacity) in an area subject to volcanic hazards—through careful land-use planning.

Researchers with the U.S. Geological Survey, University of Hawai'i, and other academic institutions work to better understand the mechanisms that produce volcanic hazards, ways to mitigate negative effects of hazards, and means of successfully communicating scientific findings to the public. Well-informed citizens can then create resilient communities in volcanic-hazard-prone areas.



In 1990, two young residents of Kalapana watch as lava slowly flows toward a road in their community. USGS photo.

Lava Flow Hazard Map

▲ Nine hazard zones on the Island of Hawai'i—based on the location of past vents, frequency and rate of coverage by past lava flows, and area topography—estimate relative long-term future lava flow hazards across the island.

▲ Zone 1, the most hazardous, includes volcanic vents in the summits and rift zones of Kilauea and Mauna Loa, Hawai'i's two most active volcanoes. Zone 9, the least hazardous, consists of Kohala, a volcano that has not erupted for 60,000 years.

▲ Hazard-zone boundaries are approximate, with the transition from one zone to the next gradually changing over the distance of a mile or more. The map was designed for general planning purposes only, in hope that critical community facilities would be sited in less hazardous zones.

▲ Additional information about Lava Flow Hazard Zones, including how to use Google Earth to determine the zone in which a parcel lies, is available on the HVO Web site: http://hvo.wr.usgs.gov/hazards/lavazones/main.html

More Hazard Info

Volcanic Hazards in Hawai'i
http://hvo.wr.usgs.gov/hazards/

Volcanic and Seismic Hazards on the Island of Hawai'i
http://pubs.usgs.gov/gip/hazards/

Frequently Asked Questions about Sulfur Dioxide and Vog
http://hvo.wr.usgs.gov/hazards/FAQ_SO2-Vog-Ash/main.html

Recent Earthquakes in Hawai'i
http://tux.wr.usgs.gov/

USGS Volcano Hazards Program
http://volcanoes.usgs.gov/

USGS Earthquake Hazards Program
http://earthquake.usgs.gov/

USGS Earthquake Information Products and Tools from ANSS
http://pubs.usgs.gov/fs/2006/3050/

COUNTY OF HAWAI'I

Proclamation

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VOLCANO AWARENESS MONTH

for Hawai'i Island, and encourage all residents and visitors to increase their knowledge and awareness of Hawaiian volcanoes and the proper safety measures to follow before, during, and after a volcanic eruption.

IN WITNESS WHEREOF, I have hereunto set my hand and caused The Seal of the County of Hawai'i to be affixed. Done this 4th day of December, 2009, in Hilo, Hawai'i.

Billy Kenoi
MAYOR