Kīlauea Iki Trail Guide

Hawai‘i Volcanoes
National Park

Walk across a once-molten lake of lava in Kīlauea Iki Crater.

Stops along this trail reveal the story of a dramatic eruption in 1959. A well-marked path leads you through lush rain forest along the rim of Kīlauea Iki (little Kīlauea) and down to its still-steaming crater floor.

Start/End:
Kīlauea Iki Overlook on Crater Rim Drive (recommended route is counterclockwise—to your right—from the overlook)

Walking distance: 4 miles (6.4 km)

Estimated walking time: 2–3 hours

Elevation: 3,874 feet (1,180 m) above sea level

Descent/Ascent:
400 feet (122 m) with steps and switchbacks, equivalent to climbing down and up a 40-story building

Trail rating: Moderate

For your safety and health:

- stay on the trail
- avoid unstable cliff edges
- keep away from ground cracks
- wear sturdy walking shoes
- carry drinking water

Weather conditions can change quickly. Take protective gear for sun and rain.

Trailhead

Welcome to Kīlauea Iki, one of the most popular trails in the park.

As you hike the trail today, listen to the soothing forest sounds—birds singing, insects buzzing and trees blowing in the wind. In 1959, this tranquility was shattered by the deafening roar of lava blasting skyward in Kīlauea Iki Crater. People could hear the rumble—a sound like thunder and pounding surf combined—long before they could see erupting lava. Pele, the spiritual force of the volcano, had once again made her presence known.

Hawaiians observe Pele's activity and create names that reflect her various moods. When she erupts within a crater, we know her as Kawahineokalua, the woman of the pit. Flowing through the forests, she is Kawahine'aihonua, eater of the land. Yet we live upon the island that she provides, so she is also Pelehonuamea, creator of new land.

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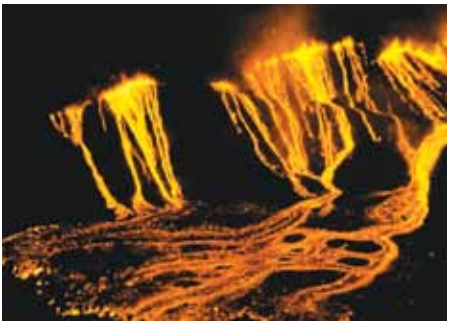
Can you see people on the crater floor?

On your way to the first stop, peer into Kīlauea Iki to look for hikers on the trail below. Remember to keep a safe distance from the crater rim.

Kīlauea means "spewing," and that's exactly what happened here on the night of November 14, 1959.

The eruption began when a curtain of lava burst from a half-mile (0.8 km) long fissure, or crack, in the crater wall directly across from you. Within a day, multiple vents along the fissure consolidated into one main vent (an opening through which lava erupts).



USGS

USGS

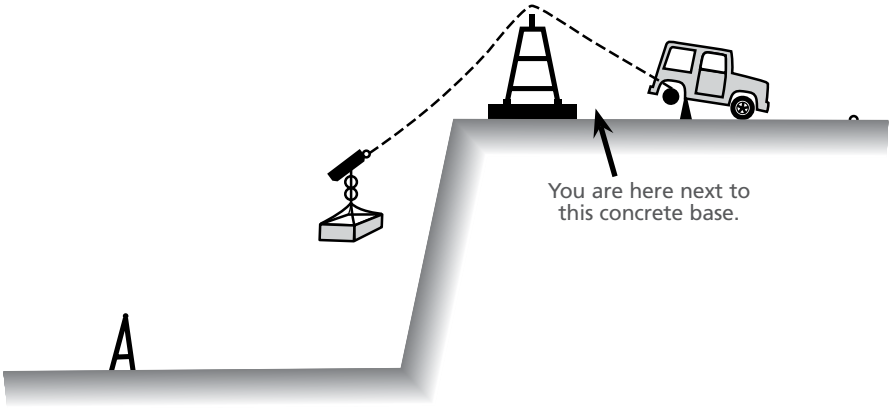
Over the next five weeks, fountains of lava gushed from the vent in 17 separate episodes. Molten rock flooded the crater, creating a lake of lava that rose halfway up the crater walls, burying the initial fissure.

Look at the hill on the opposite crater wall.
This cinder-and-spatter cone, Pu'u Pua'i (gushing hill), did not exist prior to 1959. The reddish-brown cavity at the base of this cone was the main vent from which lava erupted.

Imagine lava shooting five times higher than Pu'u Pua'i is tall. Three days before the eruption ended, lava surged 1,900 feet (580 m) above the vent—a record for the highest fountain ever measured in Hawai'i.

This concrete platform was the foundation of a trolley system used in research projects after the eruption.

The lava lake at Kīlauea Iki provided a rare opportunity to study how molten rock cools and solidifies. By drilling into the lake's solidified crust, scientists acquired data to help them understand processes within deep, inaccessible magma reservoirs—like the one beneath Kīlauea's summit.



An old Jeep powered the trolley system. Workers suspended a steel cable from a tripod on the crater rim to an A-frame on the crater floor. Rope wrapped around a spool on the rear axle of the Jeep moved the trolley along the cable, transporting heavy equipment into and out of the crater. This ingenious system succeeded but almost certainly would not be approved under today's stricter safety standards.

Watch for ground cracks hidden by lush vegetation.
As you walk to the next stop, you'll cross a deep crack, one of many that opened up during the collapse of Kīlauea Iki Crater about 500 years ago. For your safety, please stay on the trail.

"The high crater rim . . . was drenched in glowing spatter during the night when an avalanche of cone debris deflected the jetting fountain across the lake."

D.H. Richter, USGS*

When you put your thumb across the end of a gushing hose, water doesn't stop flowing—it spurts out in different directions. Similarly, when slabs of rock blocked Kīlauea Iki's gushing vent, lava fountains were deflected.

USGS

During one eruptive episode, spatter (blobs of molten rock) up to three feet (one meter) in diameter shot across the crater and landed where you are standing. Fortunately, no spectators were at this often-crowded vantage point that night.

The bombardment lasted only 20 minutes, but in that short time, Pele lived up to another of her names: Kawahine'aila'au, woman who eats trees. Spatter completely denuded the forest here. Most of the plants you see today sprouted from seeds that colonized the molten rock after it cooled.

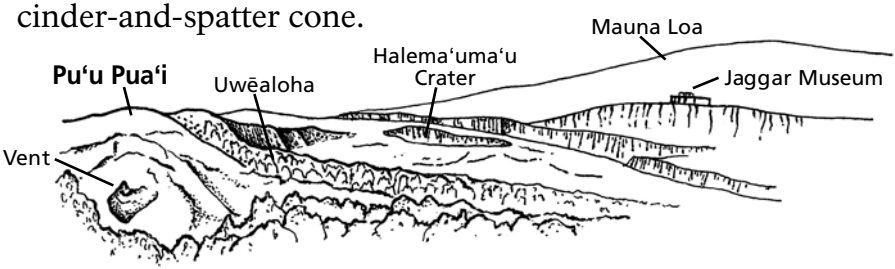
USGS

Did you feel a difference in the trail surface as you approached this stop?

Spatter forms the lumpy black rock beneath your feet. Notice how the path changes when you walk out of the spatter fallout area.

"Pumice from the fountain continued to fall like black rain . . . accumulating rapidly on the rim of the crater . . . where a new cinder cone was beginning to grow."
D.H. Richter, USGS*

Pause here to enjoy a magnificent view of Puʻu Puaʻi. With each high fountain, fragments of frothy lava (cinder) and blobs of molten rock (spatter) piled up on the crater rim, forming this cinder-and-spatter cone.



Uwēaloha (Byron Ledge), a tree-covered ridge, separates Kīlauea Iki Crater from Kīlauea summit caldera. On the floor of this large depression, you can see Halemaʻumaʻu Crater, home of the volcano goddess Pele. Jaggar Museum and the Hawaiian Volcano Observatory are perched on the caldera rim. Mauna Loa, the islands most massive volcano, is visible from here on clear days.

Look and listen for ʻapapane in the ʻōhiʻa trees below.
These crimson honeycreepers sip nectar from red lehua blossoms and fill the forest with melodious songs and whistles. Stand quietly to hear the distinct whir of their wings as these native birds fly past.


©JACK JEFFREY

CAUTION: Rocky slope ahead.
The trail cuts through a section of large boulders shaken loose from cliffs during powerful earthquakes in 1975 and 1983 (magnitude 7.2 and 6.8, respectively).

Spared by the 1959 eruption, this forest has been subjected to other destructive forces—non-native plants and animals.

Downwind from high lava fountains, forests suffered tremendous damage. Trees were stripped of leaves and branches—or completely buried—by falling cinder. Prevailing trade winds blew most of the cinder away from here, sparing this forest from the eruption. Protecting it from invasive flora and fauna has required human intervention.

A conspicuous non-native plant along the trail is kāhili ginger. This weed is even more noticeable when its fragrant yellow flowers bloom in late summer. Efforts to eradicate ginger are in progress, but dangerous ground cracks in this area make the work difficult.

Feral pigs (domestic pigs gone wild) stomped and chomped their way through this forest until 1980, when park resources management crews built fences to keep them out. Pig fences are expensive to build—up to $35,000 per mile—but they work.

Protected from feral pigs, this forest is showing signs of recovery. Delicate native plants that survive only in pig-free areas are now growing here.

Look for paʻiniu along the trail.

Paʻiniu, one of the few native lilies in Hawaiʻi, can grow on the ground now that pigs and kāhili ginger have been removed.

Prior to 1959, you would be looking into a forest-covered crater 800 feet (244 m) deep, twice the present depth.

The black rock that forms the crater floor is actually the surface of the lava lake that flooded Kīlauea Iki. Don't worry about walking across the crater—the lake is now solid.

Stop to look for slump scars on Pu'u Pua'i. As you make your way into the crater, look for grooves cut into the side of the cinder-and-spatter cone. How did they get there? Read on.

Cinder and spatter rapidly accumulated to form Pu'u Pua'i (gushing hill). Perched precariously on the crater rim, oversteepened slabs of congealed spatter occasionally broke loose and slid down the cone, exposing its yellow-hot interior. Pulled by gravity, the slabs scraped and scratched groove marks in semi-molten rock beneath the cone's cooling surface.

USGS

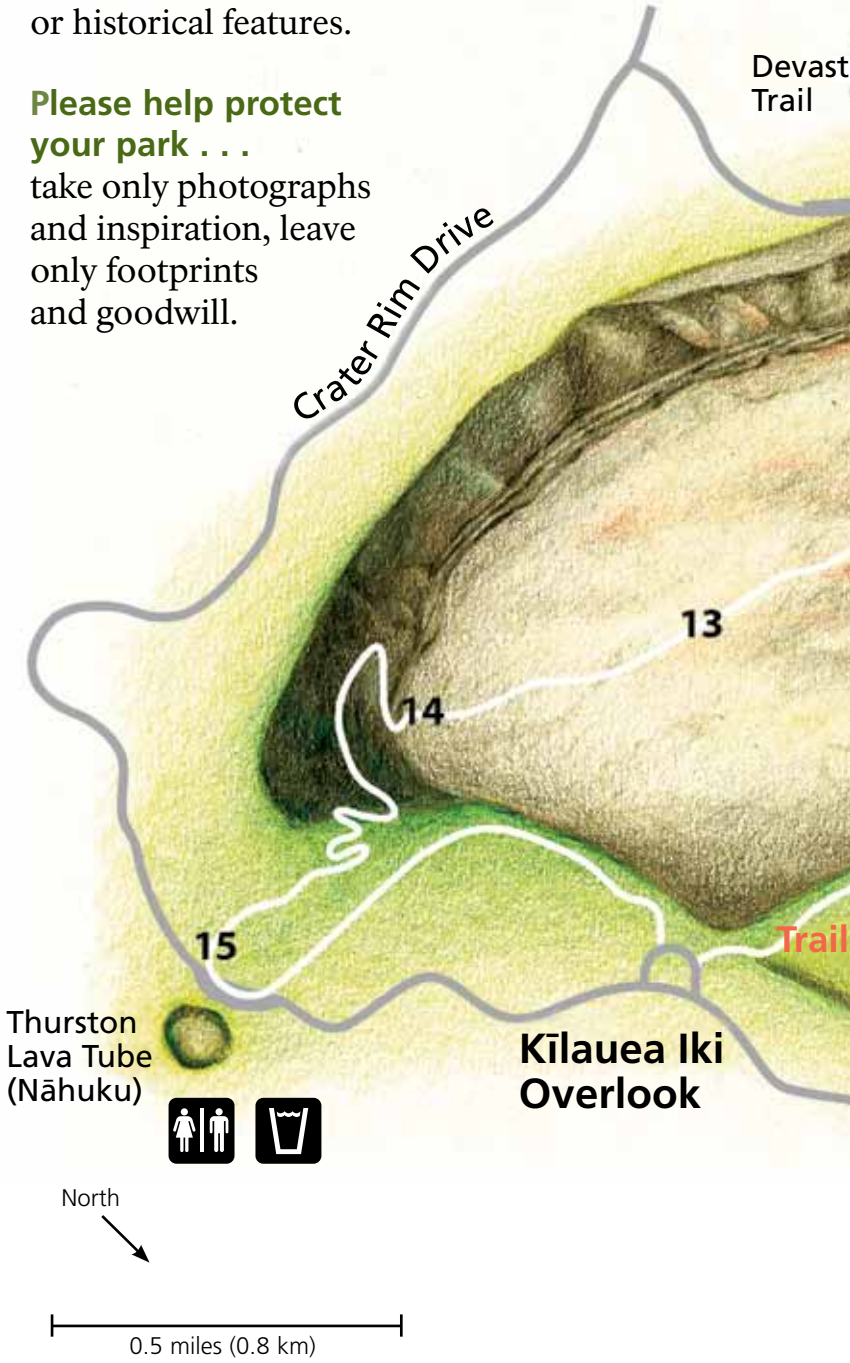
CAUTION: Uneven steps ahead.

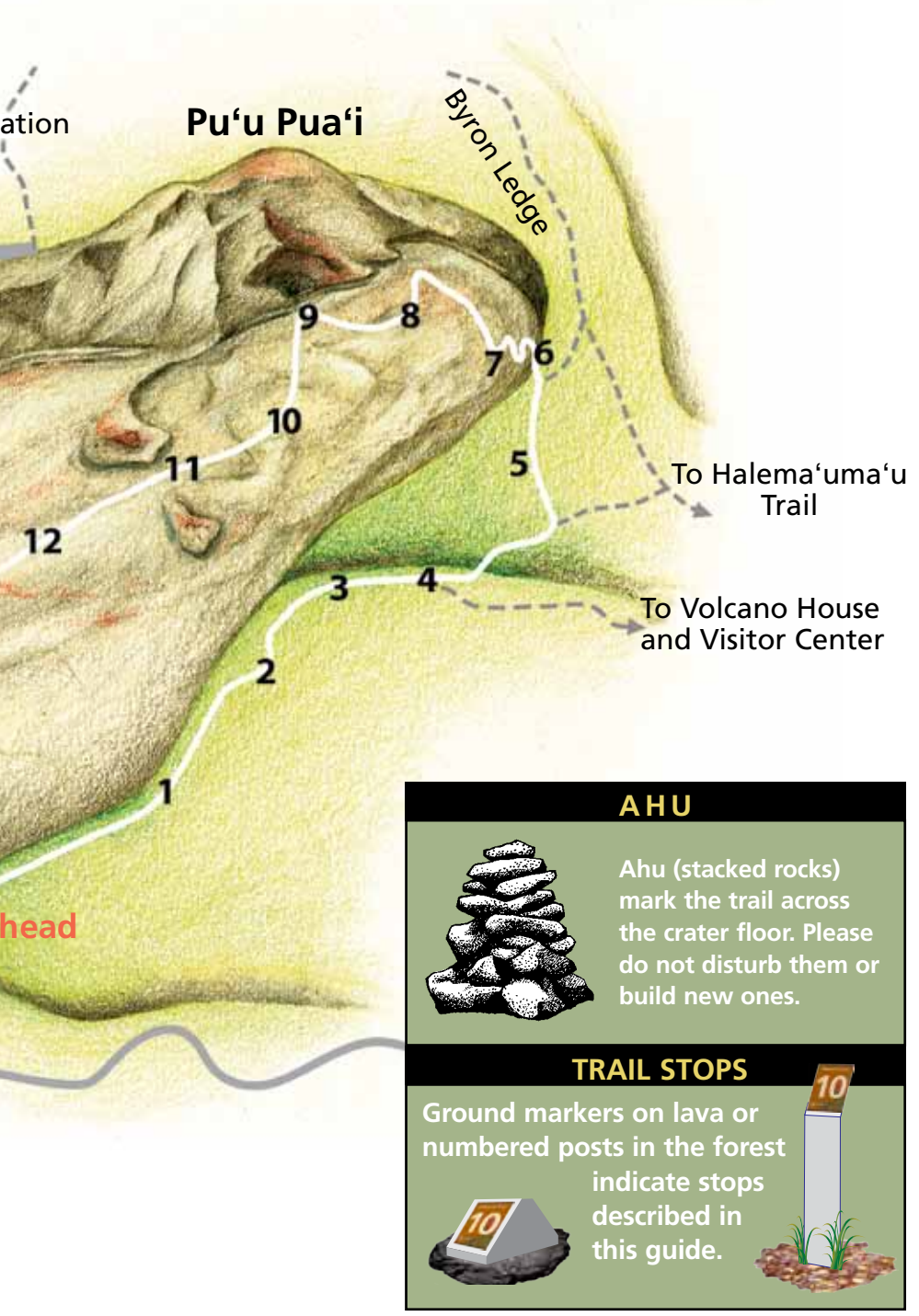
Walk carefully as you make your way down to the crater floor.

Kīlauea Iki Trail Map

To preserve Hawai'i Volcanoes National Park for the enjoyment of present and future generations, do not collect or disturb natural, cultural, or historical features.

Please help protect your park . . .
take only photographs and inspiration, leave only footprints and goodwill.





AHU

Ahu (stacked rocks) mark the trail across the crater floor. Please do not disturb them or build new ones.

TRAIL STOPS

Ground markers on lava or numbered posts in the forest indicate stops described in this guide.

You are standing on a rocky ledge known as a "bathtub ring." In geologic terms, it's called a lava subsidence terrace.

When the lava lake grew higher than the vent, fountains stopped erupting. Molten lava drained back into the vent, dragging pieces of the lake's crust with it. Lava often poured back into the vent four times faster than it was erupted, generating a noisy whirlpool of red-hot, liquid lava and black slabs of solid rock.

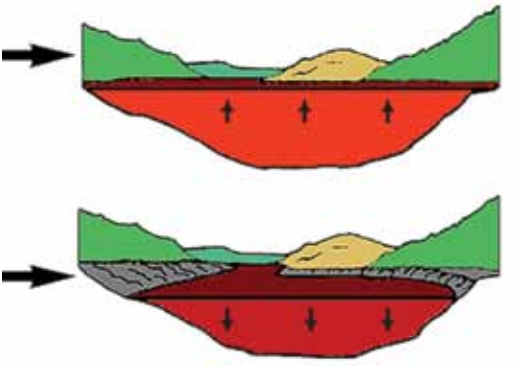

USGS

". . . a constant clatter and rumble was audible as the thickening crust was crumpled and dragged toward the vent by the retreating lava."

D.H. Richter, USGS*

Lush forests survived above the lake's high lava mark.

As the lake partially drained, its surface dropped nearly 50 feet (15 m), leaving behind a crusty lava "bathtub ring" to indicate its highest level.



Can you see glassy green crystals of olivine in the rocks here?

Hawaiian lava contains the mineral olivine, which forms deep green crystals. Enjoy looking at the olivine crystals, but remember to leave them in place.

With temperatures up to 2,200˚ F (1,217˚ C), Kīlauea Iki erupted the hottest lava ever measured on the volcano.

Throughout the eruption, Hawaiian Volcano Observatory scientists entered the crater daily, but never without a clear line of retreat to escape from deadly fumes and blistering cinders. They risked scorched gloves and charred boots to measure temperatures and collect samples of gas and lava to help them better understand the inner workings of Kīlauea Volcano.

USGS

"We were continually broiled by radiant heat from the fountain and flows and were bathed in strong, at times choking, sulfur dioxide fumes . . ."

D.H. Richter, USGS*

You are walking through rough, unstable rock that looks like the jumbled ʻaʻā lava you see elsewhere in the park. But this rock is not ʻaʻā. It formed when welded spatter (blobs of molten lava fused together) broke apart as it slid down the cone, rolling and tumbling into coarse, jagged pieces of rock. Watch your step on the uneven trail.

Gaze skyward to look for koaʻe kea (white-tailed tropicbird) gliding above the crater.

These graceful birds nest in rocky cliffs around Kīlauea Iki but fly to the ocean to feed.

©JACK JEFFREY

You are standing at the lip of the main vent. Fallen rocks cover the actual opening through which lava erupted 17 times.

Each episode of the eruption played out differently. Some went on for days while others lasted only hours. Molten rock sometimes poured from the vent in a rolling boil. At other times lava burst skyward to form towering fountains in a matter of seconds.

USGS

". . . incandescent clots of gas-inflated lava glow bright orange as they spurt skyward . . . then darken rapidly through tones of red to steely gray as they plummet back to the earth."

D.H. Richter, USGS*

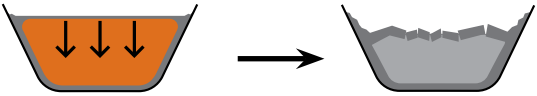
Every episode ended with lava draining back into the vent. The rock beneath your feet—slabs of the lake's crust—stacked up as lava drained from the crater. These brittle layers broke and pulled apart as they slumped into the vent, creating the dangerous cracks and unstable rock layers in front of you.

The rocks here weigh less than you might expect because they contain numerous holes left by gas bubbles in the frothy lava. If you pick up a rock, watch out for its razor-sharp edges, and be sure to leave it where you found it.

Note the variety of colors in rocks around the vent.
In a process similar to the way water rusts a nail, volcanic gases oxidize iron-rich minerals in lava, creating shades of red, purple and brown in the rocks.

Fractures in the crater floor widen (or close) as the lava lake continues to slowly cool and subside.

When molten lava drained back into the vent, the lake's crust collapsed 50 feet (15 m) or more. As it dropped into deeper parts of the crater, the rigid crust buckled and cracked, creating the uneven rocky ridges you see here.



Today, the crater floor continues to subside about 3/4 inch (2 cm) per year as the hot interior of the lava lake slowly cools and contracts.

"Under the continued rain of pumice and cinder, the cone was growing rapidly . . . and becoming very unstable."

D.H. Richter, USGS*

Raised terraces flanking the trail probably formed when huge blocks of Puʻu Puaʻi slid into the lava lake. Slowly rafted away from the base of the cone by gushing lava, these "floating islands" came to rest here. Each time the lake level rose, they were covered by molten lava. When lava drained back into the vent, the blocks were again exposed as terraces standing above the surrounding lake surface.

You often see steam rising from the terraces and cracks in the crater floor. Steam forms when rainwater percolates down to hot rock below the surface and vaporizes. Steaming cracks attract visitors on cold, windy days, but beware! The steam is scalding hot.

Did you notice chalky white streaks on the black rock?

These white deposits form when dissolved minerals, primarily calcium sulfates and silica, are carried to the surface by steam.

The lava fountains at Kīlauea Iki were impressive, but the real story of this eruption was the rapidly rising lava lake.

With no outlet from the crater, lava flooded Kīlauea Iki. During the first episode alone, 68 million tons of lava poured into the crater, creating a lake several hundred feet deep. By the time the eruption ended on December 20, another 18 million tons of lava were added to the crater, increasing the lake depth to over 400 feet (120 m). The enormous weight of this lava lake is 235 times heavier than the Empire State Building.


USGS

". . . a dark crust formed rapidly on the glowing lava, and incandescence was restricted to the ever-changing pattern of cracks that crisscrossed the [lake's] surface."

D.H. Richter, USGS*

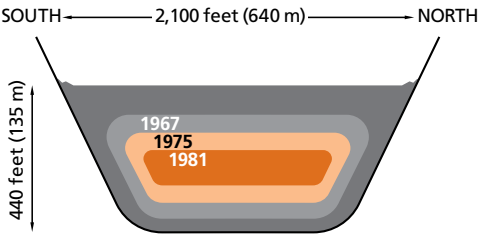
The lake's surface quickly cooled to form a thin black crust that readily broke into plates 10–20 feet (3–6 m) across. Cracks between the plates were quickly filled by less dense molten lava rising from beneath the crust. As frothy orange-hot lava oozed over the rigid plates, they were "swallowed" into the lake.

This process of "crustal overturning" moved across the entire lake in a matter of minutes. It occurred many times during the eruption and for almost a week after it ceased. You are walking on a surface created by the final overturn of the lake.

Based on cooling rates measured through repeated drilling projects, scientists believe the lava lake was solid by the mid-1990s.

Scientists first drilled into the lava lake at Kīlauea Iki four months after the eruption ended. Drilling stopped abruptly at a depth of only nine feet (2.7 m), when red-hot lava oozed up the borehole. With each passing year, the crust grew thicker.

As the lava cooled from outside to inside, zones of molten rock within the lake decreased in size. By 1988, the last time scientists drilled into the lake, only traces of melt remained at depths of 240–330 feet (73–100 m). Although the lake is now entirely solid, it's still hot inside.



Cross section of lava lake
(vertical exaggeration 2:1)

The 1988 drilling project revealed a surprising discovery: The lava lake at Kīlauea Iki is deeper than originally projected. The old crater floor apparently subsided into the underlying magma reservoir. No collapse was observed during the eruption, so the crater floor must have gradually "floated down" as molten rock erupted from the reservoir. The lava lake is now estimated to be 440 feet (135 m) deep.

Drill holes are still visible 175 feet (50 m) to the left of this stop. You can step off the trail for a closer look, but approach boreholes with care. Many of them emit scalding steam.

Look for evidence of rockslides ahead.

Kīlauea Iki, changed forever by the 1959 eruption, continues to be shaped by catastrophic events. Huge boulders from its unstable walls tumbled down to the crater floor during the 1975 and 1983 earthquakes.

"The fountain blasting through fluid lava . . . generated large waves . . . which traveled the short distance across the lake to the opposite shore where they broke like waves on a beach."

D.H. Richter, USGS*

As you climb back up the "bathtub ring," turn around and gaze across Kīlauea Iki. Picture this crater as it was in November 1959—a rolling lake of molten rock, with waves of incandescent lava washing up this ledge.

Envision high lava fountains illuminating the night sky and Pu'u Pua'i growing larger as cinder and spatter rain down on the crater rim. Imagine the searing heat and thundering roar of lava bursting from the vent. Think about future eruptions and how Kīlauea Iki may look a century from now.

NPS/CHARLENE MEYERS

As Pele creates new land, her sister Hi'iakaikapoliopele brings life to the barren lava. Note how 'ōhi'a and other plants are revegetating the lava. Windblown seeds take root in cracks where moisture and nutrients collect. Given enough time, trees and shrubs will again create a forest like the one buried beneath this lake of lava.

Watch for 'io (Hawaiian hawks).

If you're lucky, you may see an endangered 'io soaring on air currents above Kīlauea Iki's forested crater walls.

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Explore a lava tube where molten rock flowed around 500 years ago. It's just across the road.

If you have time, walk through Thurston Lava Tube (Nāhuku) before returning to your car. As you walk along the path to this cave-like feature, listen and look for native birds in the rain forest.

Restrooms and a water fountain are available across the road.

To go directly back to Kīlauea Iki Overlook, where you started your hike, follow the sidewalk until you reach the Crater Rim Trailhead—to your left near the end of the line of parked cars.

Peer into Kīlauea Iki from crater rim overlooks.

As you walk the last half-mile (0.8 km) of the trail, linger a moment at each overlook to savor your experience of walking through a dynamic, ever-changing volcanic crater.

CREDITS

* Quotes are from Hawaiian Volcano Observatory scientists who monitored the 1959 eruption from beginning to end. Their observations are recorded in the U.S. Geological Survey Professional Paper 537-E, Chronological Narrative of the 1959–60 Eruption of Kilauea Volcano, Hawaii by D.H. Richter and others, 1970 (available online through the USGS Publications Warehouse at pubs.er.usgs.gov).

Eruption photos courtesy of the Hawaiian Volcano Observatory. Lava lake cross section diagram provided by Rosalind Helz, USGS National Center, Reston, Virginia.

For more information

- *Chronological narrative of the 1959-60 eruption of Kilauea Volcano, Hawaii: U.S. Geological Survey Professional Paper 537-E* by Richter, D.H., Eaton, J.P., Murata, K.J., Ault, W.U., and Krivoy, H.L.
- *Invasion and Recovery of Vegetation after a Volcanic Eruption in Hawaii, NPS Scientific Monograph No. 5* by Garrett A. Smathers
- *Kilauea Iki Eruption, 1959 by Fred Rackel* at <*http://vimeo.com/16034869*>, video posted by Darcy Bevins with the Center for the Study of Active Volcanoes, viewed November 14, 2011
- *Geological Field Guide, Kīlauea Volcano* by Richard W. Hazlett
- *Volcanoes In The Sea: The Geology of Hawaii* by Gordon Andrew MacDonald

To learn more about Hawai'i Volcanoes National Park visit: **www.nps.gov/havo**.

To read more about the eription of Kīlauea Iki and historic eruptions, visit the Hawaiian Volcano Observatory at: **hvo.wr.usgs.gov.**

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Printed on recycled paper with soy-based ink

Written by Janet Babb, edited by Jane Takahashi, USGS
Produced by the Interpretive Planning and Media Development Branch
Hawai'i Volcanoes National Park

03/13