

Hawaii Volcanoes

Hawaii Volcanoes National Park
Hawaii

National Park Service
U.S. Department of the Interior

Volcanoes are monuments to earth's origin, evidence that its primordial forces are still at work. During a volcanic eruption, we are reminded that our planet is an ever-changing environment whose basic processes are beyond human control. As much as we have altered the face of the earth to suit our needs, we can only stand in awe before the power of an eruption.

Volcanoes are also prodigious land builders—they have created the Hawaiian Island chain. Kilauea and Mauna Loa, two of the world's most active volcanoes, are still adding land to the island

of Hawai'i. Mauna Loa is the most massive mountain on earth, occupying a volume of at least 18,000 cubic miles. Measured from its base on the seafloor, it rises nearly 32,000 feet, which is greater than Mount Everest's elevation above sea level. In contrast to the explosive continental volcanoes, the more fluid and less gaseous eruptions of Kilauea and Mauna Loa produce fiery fountains and rivers of molten lava. These flows, added layer upon layer, produced a barren volcanic landscape that served as a foundation for life. Hundreds of species of plants and animals found their way across the vast Pacific on wind, water, and the

wings of birds. A few survived, adapted, and prospered during this time of isolation. The arrival of humans—first Polynesians, then Europeans—and the plants and animals they brought with them drastically altered this evolutionary showcase, this grand natural experiment.

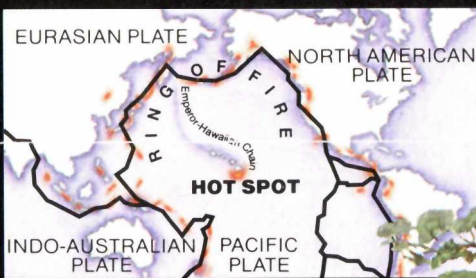
Today Hawaii Volcanoes National Park displays the results of at least 70 million years of volcanism, migration, and evolution—processes that thrust a bare land from the sea and clothed it with

complex and unique ecosystems and a distinct human culture. Created to preserve the natural setting of Kilauea and Mauna Loa, the park is also a refuge for the island's native plants and animals and a link to its human past. Park managers work to protect the resources and promote understanding and appreciation of the park by visitors. Research by scientists at the Hawaiian Volcano Observatory has made Kilauea one of the best understood volcanoes in the world, shedding light on the birth of the Hawaiian Islands and the beginning of planet Earth.

Photo by Ron Dahlquist

Volcanoes attest to the dynamic nature of the earth. Divided into rigid plates, the outermost layer of the earth drifts slowly over the more plastic mantle beneath. Most volcanic activity occurs along the edges of these plates, forming a

"ring of fire." The series of volcanoes that includes Washington's Mount St. Helens, Alaska's Katmai, Japan's Mount Fuji, and the Philippines' Mount Pinatubo define the margins of the Pacific plate.

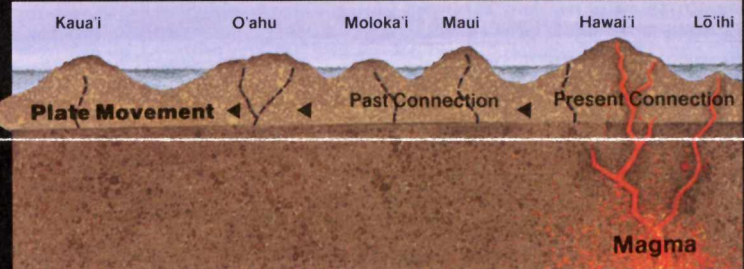


Why are there volcanoes on Hawai'i, which is in the middle of the Pacific plate? Plumes of magma rise from a "hot spot" deep within the mantle. This fluid rock material,

charged with gas, pushes its way to the surface, erupting on the ocean floor to create a seamount. After several hundred thousand years and countless eruptions, the volcano rises above sea level to form a new island. The volcano continues to grow until the movement of the Pacific plate carries the island off

the hot spot. During the last 70 million years or more the Pacific plate has acted as a conveyor belt, moving the islands northwest off the hot spot at a rate of about four inches a year. The park's active volcanoes, Kilauea and Mauna Loa, continue the island-building process that formed the 3,500-mile

Emperor Seamount-Hawaiian Island chain. But they are not the last. To the southeast, Lō'ihi seamount is rising from the ocean floor.



Trouble in Paradise

The Hawaiian Archipelago was once celebrated as islands of evolution; now they are islands of extinction. The arrival of people changed forever the conditions that fostered the original diversity of life. Forests disappeared as people cleared the land to plant crops and establish communities. Polynesian and other settlers introduced numerous alien plants and animals, some of which thrived in their new home and multiplied. Their impact has been catastrophic: Pigs destroy the understorey of tree fern and 'ōhi'a forests. Their muddy wallows provide breeding grounds for mosquitoes that transmit avian malaria and pox to native birds. Mongooses, cats, and rats eat native birds and their eggs. Alien plants such as firetree and banana poka displace vast areas of Hawaiian forests. The onslaught of introduced plants and animals caused the extinction of countless native species and continues to threaten Hawai'i's unique life forms.



Endemic Unique to Hawai'i, found no place else on earth. Introduced Naturally occurring in Hawai'i but also found elsewhere. Alien Introduced by humans. Endangered

- 1 Common mynah
- 2 Firetree
- 3 Japanese white-eye
- 4 Ōhelo

- 5 Nēnē (Hawaiian goose)
- 6 Tree snail
- 7 Happyface spider
- 8 'A'alii
- 9 Kūkaenē

- 10 Kōa'e kea (White-tailed tropicbird)
- 11 Pueo (Hawaiian owl)
- 12 Predatory caterpillar
- 13 Dragonfly
- 14 Naupaka
- 15 Small Indian mongoose

- 16 'Io (Hawaiian hawk)
- 17 Kōa
- 18 Black rat
- 19 'Amakihi (Hawaiian honeycreeper)
- 20 Damsel

- 21 Pa'niu
- 22 'Elepaio (Hawaiian flycatcher)
- 23 'I'iwi (Hawaiian honeycreeper)

- 24 Hāhā
- 25 Blackburn butterfly
- 30 'Ōhi'a lehua
- 31 'Apapane (Hawaiian honeycreeper)
- 32 Kamehameha butterfly

- 29 Feral pig
- 30 'Ōhi'a lehua
- 31 'Apapane (Hawaiian honeycreeper)
- 32 Kamehameha butterfly

- 33 Māma
- 34 'Ōma'o (Hawaiian hoary bat)
- 39 Pūkaew
- 40 Lava cricket
- 41 Kōlea (lesser golden plover)

- 38 'Ōpe'a (Hawaiian hoary bat)
- 39 Pūkaew
- 40 Lava cricket
- 41 Kōlea (lesser golden plover)

- 42 Coconut palm
- 43 'Amia'u
- 44 'Ae
- 45 Feral cat
- 46 Humpback whale

- 47 Noio (Hawaiian noddy)
- 48 'Ea (Hawksbill turtle)

Life Comes to the New Land

A few million years ago: A spore from a fern somewhere in southeast Asia is released into the wind and carried by a rising current eight miles high into the jet stream, where it is borne eastward. Eventually it drifts down and settles on a barren lava field in the middle of the Pacific Ocean. This is one of the ways life came to the Hawaiian Islands.

Insects, seeds, and spiders also reached the islands by riding the air currents, but there were other ways. Migrating or storm-driven birds carried seeds either in their digestive tracts or stuck to their feathers. Pacific Ocean currents transported salt-resistant seeds and rafted insects, plants, and snails on floating debris. Amphibians, reptiles, freshwater fish, and most mammals were

unable to cross the vast expanse of ocean—only the monk seal and hoary bat succeeded. Of the millions of organisms that embarked on this chance voyage, very few made it here, and of those that did, few survived.

Over a span of about 70 million years, plants and animals colonized the Hawaiian Island chain at

the rate of roughly one every 70,000 years. These species changed gradually with time—they evolved into new forms that were better adapted to island life. In the absence of predators and competitors found in their former homelands, their survival no longer depended on elaborate defense mechanisms. Those qualities that once protected them proved unnecessary and were

eventually lost. Contradictory terms describe these new life forms: nettleless nettles, mintless mints, stinkless stink bugs, and flightless birds.

Over 90 percent of Hawai'i's native flora and fauna is endemic—found nowhere else on earth. The island's 100 endemic land birds evolved from as few as 20 original ancestors; a thousand kinds

of flowering plants evolved from 272 colonizers; over 1,000 mollusks evolved from at least 22 immigrants; and about 10,000 insect and spider species evolved from 350 to 400 precursors. The astounding diversity of life that flourished on these isolated, once barren islands bears witness to the force of evolution and the tenacity of life.

Illustration by John Dawson

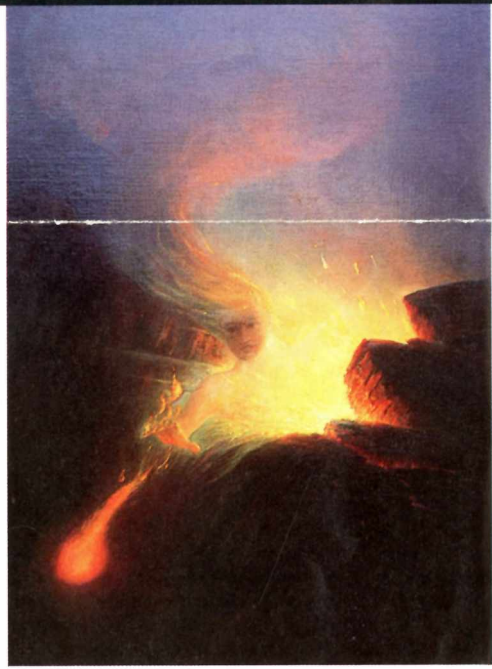


Wearing boar-tusk bracelets and dog-teeth anklets, men hula (dance) to the accompaniment of

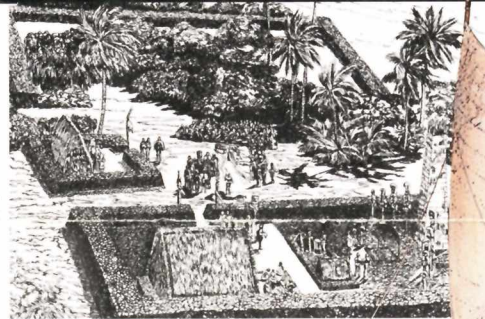
mele (song) and musicians beating rhythmically on gourd drums and coconut shells.



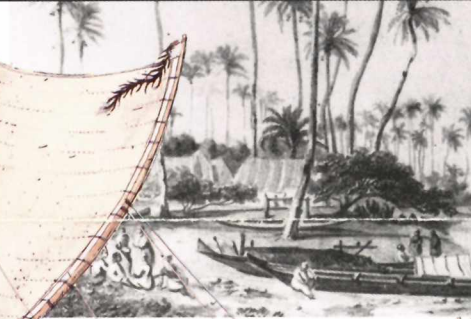
Ki'i pōhaku (petroglyphs) range from symbols to human and animal figures.



Pele-'ai-honua (Pele, who eats the land) is both creator and destroyer. She throws molten fountains into the air, governs the great flows of lava, and sometimes reveals herself, for a few moments, in the fires of Kilauea.



Wahā'ula Heiau (temple of the red-mouth), was a luakini (sacred) heiau where Hawaiians sought the favor of their god, Kū.



Coconut groves mark the location of a coastal village where the canoes of fishermen and travellers are drawn up on the beach.



Woman beats wauke (paper mulberry) bark to make kapa for clothes and bedding.

People of the Islands

Superb voyagers, Polynesians from the Marquesas Islands migrated to Hawai'i over 1,600 years ago. Navigating by the sun and stars, reading the winds, currents, and the flight of seabirds, they sailed across 2,400 miles of open ocean in great double-hulled canoes. They brought along items essential to their survival: pua'a (pigs), 'ilio (dogs), and moa (chickens); the roots of kalo (taro) and 'uala (sweet potato); and the seeds and saplings of niu (coconut), mai'a (banana), kō (sugar cane), and other edible and medicinal plants. They were well-established on

the islands when, about 800 years ago, Polynesians from the Society Islands arrived in Hawai'i. Claiming descent from the greatest gods, they became the new rulers of Hawai'i. After a time of voyaging back and forth, contact with southern Polynesia ceased. During the 400 years of isolation that followed, a unique Hawaiian culture developed.

Hawai'i was a highly stratified society with strictly maintained castes. The ali'i (chiefs) headed the social pyramid and ruled over the

land. Highly regarded and sometimes feared, the kāhuna (professionals) were experts on religious ritual or specialists in canoe-building, herbal medicine, or healing. The maka'āinana (commoners) farmed and fished; built walls, houses, and fishponds; and paid taxes to the king and his chiefs. Kauwā, the lowest class, were outcasts or slaves.

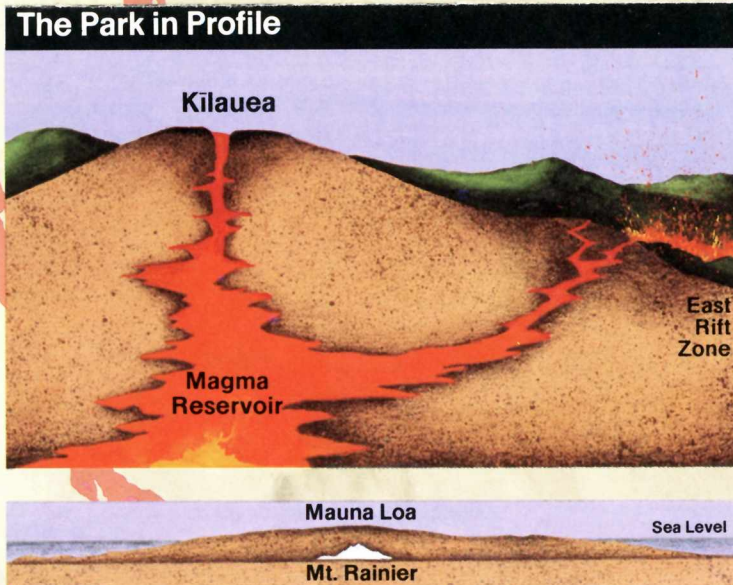
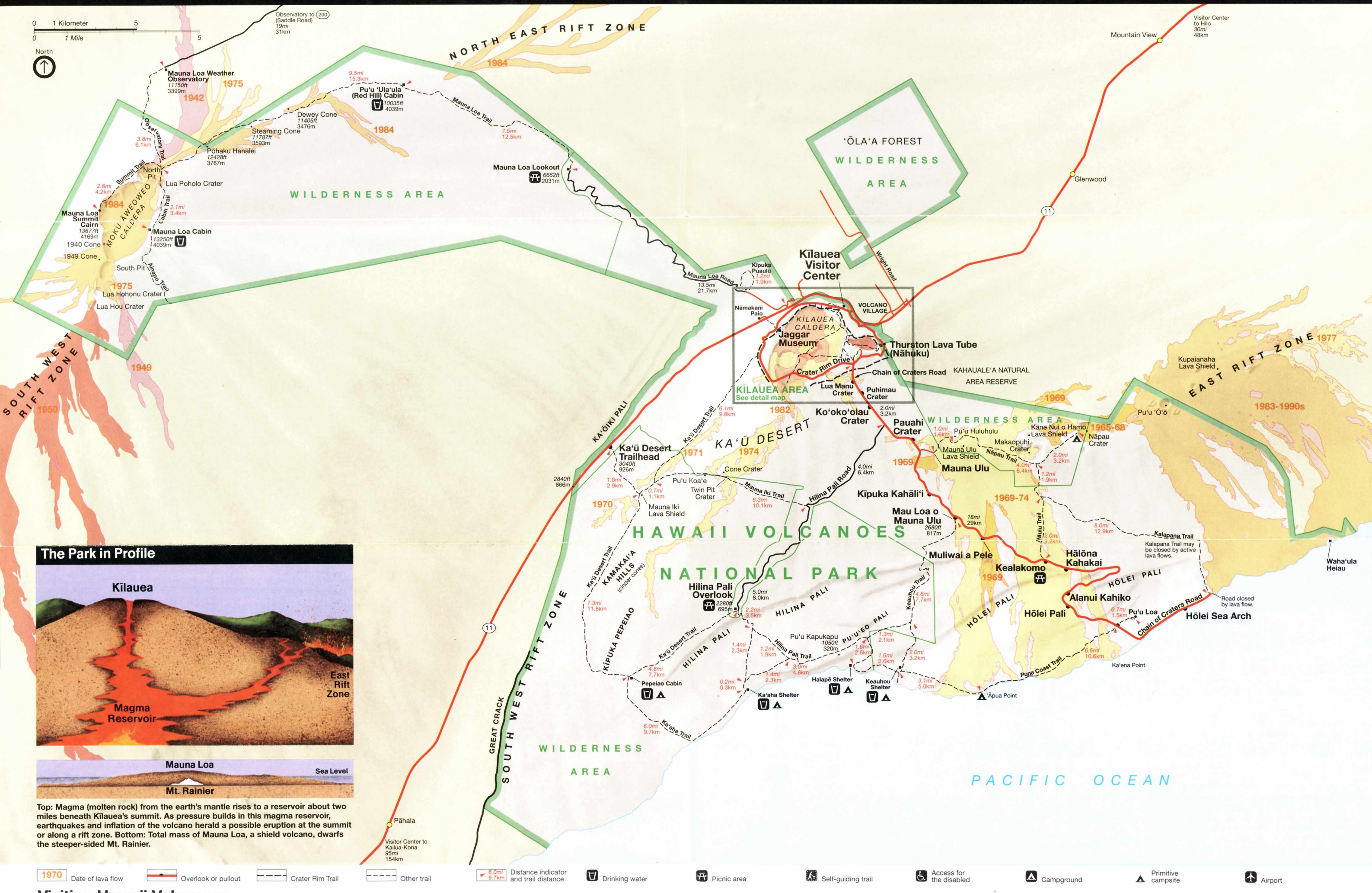
A system of laws known as kānāwai enforced the social order. Certain people, places, things, and times were sacred—they were kapu, or forbidden. Women ate apart from men and were not

allowed to eat pork, coconuts, bananas, or a variety of other foods. Kapu regulated fishing, planting, and the harvesting of other resources, thus ensuring their conservation. Any breaking of kapu disturbed the stability of society; the punishment often was death.

Village life was rich and varied: Hawaiians fished in coastal waters and collected shellfish, seaweed, and salt along the shore. They raised pigs, dogs, and chickens, and harvested sweet potatoes, taro, and other crops. Men pounded taro

into poi, while women beat the inner bark of wauke (paper mulberry) into kapa. They worshipped akua (gods) and 'aumākua (guardian spirits) and chronicled their history through oli (chant), mele (song), and hula (dance). Over several hundred years the people of Hawai'i cultivated traditions that they passed on through generations. But the sounds of taro pounding and kapa beating, rhythmical signatures of Hawaiian village life, would fade away after Capt. James Cook arrived in 1778 and introduced the rest of the world to Hawai'i.

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Top: Magma (molten rock) from the earth's mantle rises to a reservoir about two miles beneath Kilauea's summit. As pressure builds in this magma reservoir, earthquakes and inflation of the volcano herald a possible eruption at the summit or along a rift zone. Bottom: Total mass of Mauna Loa, a shield volcano, dwarfs the steeper-sided Mt. Rainier.

Visiting Hawaii Volcanoes

Awaiting your discovery is a fascinating world of active volcanism and biological diversity and a legacy of prehistoric culture. Before you begin your park adventure, stop at the Kilauea Visitor Center for an orientation to the park's roads, trails, activities, and safety precautions. For information contact: Superintendent, Hawaii Volcanoes National Park, P.O. Box 52, Hawaii National Park, HI 96718-0052 or visit www.nps.gov/havo on the Internet.

Climate
Visitors to the park should expect changeable weather. Kilauea's summit, at 4,000 feet above sea level, can be rainy and chilly any time of the year. The coastal area is usually warm and dry. Come prepared. Bring a windbreaker or rain jacket, long pants, and closed-toe shoes.

Eruption Information
For an update on current volcanic activity, call 808-985-6000 day or night.

Access for People with Disabilities
The Kilauea Visitor Center, Jaggar Museum, Volcano House Hotel, and Volcano Art Center are accessible. Pullouts along Crater Rim Drive and Chain of Craters Road afford panoramic views of the park. Accessible pathways include Steam Vents, Keanakāko'i, Devastation Trail, Pauahi Crater, Muliwai a Pele, and Thurston Lava Tube.

Regulations
To protect the park and yourself, please obey these rules:

- Fires** are prohibited except in the pavilion fireplaces located at Nāmākani Paio and Kipuka Puauulu.
- Motorized vehicles** are restricted to paved roadways.
- Bicycles** are permitted on roadways, the Escape Road, and paved sections of the Crater Rim Trail. Check with rangers for exceptions.
- Nēnē** (the Hawaiian goose) is an endangered species that needs your protection. Watch for nēnē on roads. Slow down and pay particular attention to nēnē habitat areas marked by signs. **Do not feed nēnē.** Feeding causes them to beg for food by roadsides and approach moving vehicles.
- Pets** must be under control at all times. Dogs are not allowed on trails or in the backcountry. Nēnē and other ground nesting birds are vulnerable to harassment and predation.
- Collecting rocks** (including lava, sand, and minerals), cultural artifacts, or plants and animals is prohibited.
- Fishing** along the coast from Halape to the park's eastern boundary is reserved for Native Hawaiians of the Kalapana area and their guests.
- Backcountry camping** is by permit only. You must register at the Kilauea Visitor Center prior to departure. No group may exceed 12 people. Hikers are required to pack out everything they pack in. Heed special regulations relating to fire prevention and protection of archaeological sites and endangered sea turtles.

Campgrounds
The park has one drive-in campground: Nāmākani Paio (located off Highway 11). It has restrooms, water, a pavilion, and fireplaces (no wood available). Camping is on a first-come basis; no fees are charged. Stays are limited to seven days per year.

Volcano Village, located one mile from the park, has general stores, food, gas, and lodging.



A geologist shields himself from the intense heat of molten lava (exceeding 2,000°F) to collect spatter samples.

What to See and Do

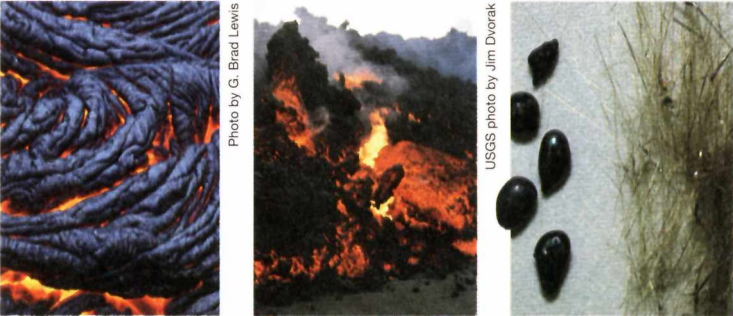
In the Kilauea area:
If you have only a few hours, take one of the short drives or hikes around Kilauea Crater.

Crater Rim Drive
This 11-mile drive circles Kilauea's summit caldera and craters, passes through rainforest and desert, and provides access to well-marked scenic stops and short walks. Highlights include Sulphur Banks, Steam Vents, Jaggar Museum, Halema'uma'u Crater, Devastation Trail, Kilauea Iki Crater, and Thurston Lava Tube.

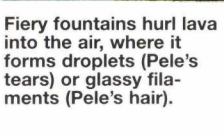
Chain of Craters Road
This 40-mile roundtrip drive intersects with Crater Rim Drive, descends 3,700 feet to the coast and dead ends at a lava flow across the road. Points of interest include Lua Manu and Pauahi craters, Mauna Ulu Lava Shield, Kealakomo Overlook and Hōlei Sea Arch.

Trails
The character of the park is best discovered on foot. There are over 150 miles of trails in the park. If you have only a single day, explore Kilauea's summit trails. Highly recommended is the Kilauea Iki trail, a four-mile (two-hour) hike, descending 400 feet through native rainforest into a crater, and across lava flows still steaming from the 1959 eruption. Additional trail options are marked on the map.

On Mauna Loa
For an unforgettable backcountry trip, hike the 19.6-mile trail (three or four days) to the summit of Mauna Loa (nearly 14,000 feet). But be forewarned: hikers must be in good physical condition and properly equipped for winter mountaineering.



The two types of Hawaiian lava, pāhoehoe and 'a'ā, differ in appearance but are chemically alike. Pāhoehoe (left) has a smooth and rosy surface; it is hotter and contains more gas than the jagged and clinkery 'a'ā.



Fiery fountains hurl lava into the air, where it forms droplets (Pele's tears) or glassy filaments (Pele's hair).

