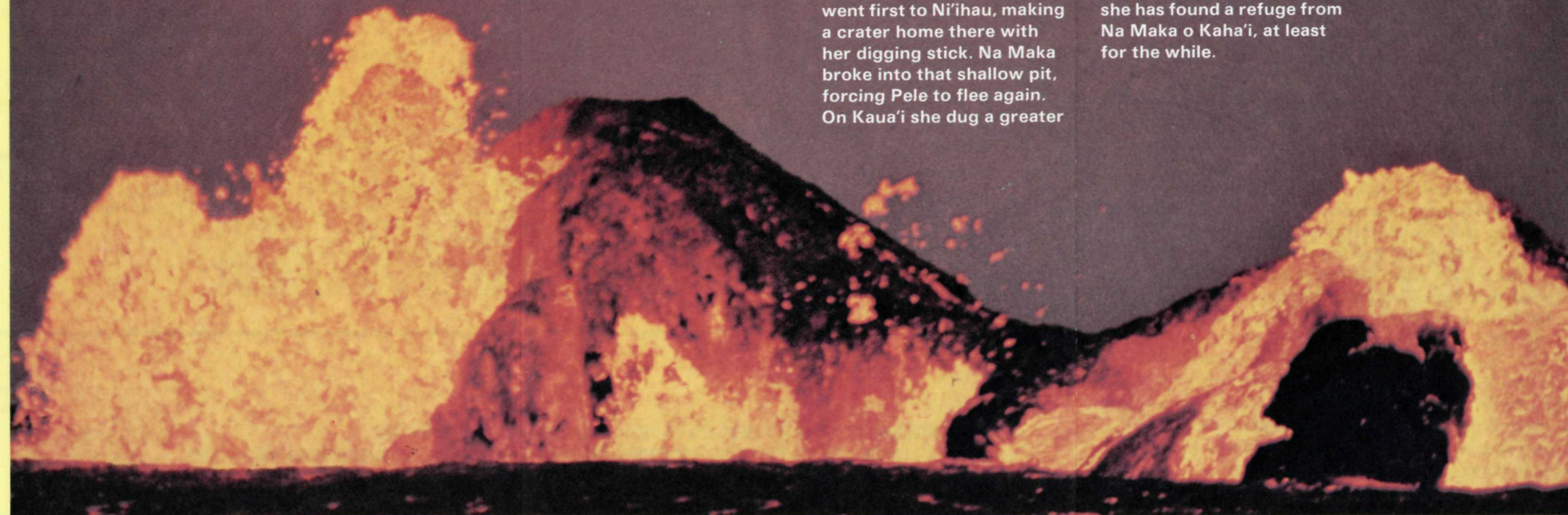


Hawaii Volcanoes National Park



*E Pele e!
O Goddess of the burning stones.
Life for me. Life for you.
The flowers of fire wave gently.
Here is your offering...*



FIERY ISLANDS IN THE SEA

The Hawaiians of old told many myths and stories about their homeland, and the myth recounted above is just one of many about Pele, the volcano goddess. The early storytellers were fine poets, perceptive observers of people, and excellent students of nature. They were aware of many things about their islands that are being explained today by modern research methods. Their account of the succession of Pele's homes, for example, agrees with the relative ages assigned to the islands by geologists—Ni'ihau and Kaua'i are indeed the oldest, the island of Hawai'i is certainly the youngest. But now geologists and volcanologists can tell us facts that the original Hawaiians would have had no way of knowing. By including shoals and atolls between Ni'ihau and Ocean Island, the Hawaiian Chain has been extended far beyond the limits known to its first inhabitants. And volcanologists have increased our understanding of the manner in which these islands were made.

The fires begin—The islands in the Hawaiian archipelago are only the very tops of immense mountains that have been built up from the bottom of the sea during the last 25 million years. They have been created by eruptions of molten rock forced up from earth's mantle through fractures in the planet's thin crust, which here is serving as the floor of the ocean.

Beneath this region, in earth's mantle, a deep-seated source of heat melts the rocks around it. This fluid rock, called magma, then rises through the overlying crust to produce the volcanoes. Magma that flows from volcanoes over the surface of the earth is called lava.

A mountain arises—At first, the lava escaping through volcanic vents in the crust flowed out upon the ocean floor. Gradually, as magma continued to rise from the mantle, successive eruptions of lava built up a submarine mountain around each vent. As layer upon layer of lava was deposited, the volcano grew broader and higher, until eventually it rose far above the surface of the sea. This type of volcano with rather gentle slopes is called a shield volcano.

As long as the conduits that feed magma into a shield volcano can receive fresh supplies of melted rock, the



LAVA—PAHOEHOE
Hawaiian volcanoes release lava in two different physical forms—different in appearance, but identical in chemical composition. Most lava is erupted as pahoehoe. When a pahoehoe flow solidifies, its surface is black and relatively smooth. (No wonder pahoehoe was the name Hawaiians gave to black satin material when they first saw it!) Generally, because of the way this kind of lava flows and cools, the smooth surface is interrupted by wrinkles, billows, rope-like coilings, and other deformations.

mountain will continue to grow. But the Hawaiian Islands rest upon a portion of earth's crust known as the Pacific Plate, and this plate is moving slowly toward the northwest, at the rate of 5 to 8 centimeters (2 to 3 inches) each year.

The fire dies—Because of this movement, contact between the source of magma and the conduits within the volcano cannot be maintained. After a time, that contact is kept only with difficulty, and in a sense, the mountain is starved to death, gradually perhaps, but inexorably. Surface eruptions of lava occur less frequently after contact is broken, and the volcano may remain dormant for long

This is Pele's domain. Pele, a daughter of Haumea the Earth Mother and Wakea the Sky Father, is the goddess of fire, the maker of mountains, melter of rocks, eater of forests, and burner of lands—creator and destroyer both in one. She appears among mortal men sometimes as a beautiful young woman, tempting them, oftener as a wrinkled old hag, testing them. Whatever form she

takes, Pele is unpredictable and tempestuous, as only a proud and jealous female can be. She does not ask for love. She demands respect. Here you must "step lightly, for you are on holy ground," the Hawaiians said in days of old.

The myth makers said that Pele came to the Hawaiian Islands long ago, in flight from a cruel older sister, the goddess of the sea, Na Maka o Kaha'i. Pele went first to Ni'ihau, making a crater home there with her digging stick. Na Maka broke into that shallow pit, forcing Pele to flee again. On Kaua'i she dug a greater

house. Na Maka chased her away from there too. And so the pursued Pele ran, from place to place, from O'ahu to Moloka'i, to Lana'i, to Kaho'olawe, Molokini, and Maui, each in turn; and from each successive home, the unrelenting Na Maka drove her out. At length, weary of being so harried, Pele dug deep and built high on the island of Hawai'i. Here, at last, in these huge fortress-mountains, she has found a refuge from Na Maka o Kaha'i, at least for the while.

intervals. Ultimately, the volcano ceases to grow: it becomes extinct.

At present, the volcanic mountains Kilauea and Mauna Loa here on the island of Hawai'i are linked most directly to the source of magma beneath the Pacific Plate. The other mountains in the Hawaiian chain have been carried beyond their sources of supply. As a result, some are extinct, such as those farthest to the northwest: like a slow-moving assembly line, the Pacific Plate has carried them away from the foundry that made them. Those at the southeastern end—especially Haleakala, Mauna Kea, and Hualalai—are dormant, awaiting the time when magma might rise within them and lava will flow again from their vents.

The mountain retreats into the sea—The oldest, northwesternmost islands have died long since, worn away by the action of the ocean through which they rose. The sea has claimed their bodies, and soon it will roll over their heads. Their successors, too, are doomed to this same fate.

Many forces have destroyed those older islands. Even while they were growing, their own immense weight caused the ocean floor to sag under them, and they began to sink. While that slow subsidence was happening, the agencies of erosion attacked the parts standing above the surface of the sea: scouring wind, rains, streams, and ocean waves cut down the mountains, leveled the cliffs, stole the soil, ate away the islands' very bones. Because volcanic activity had ended, no new deposits of lava replaced the parts that had been worn away. Today, for such an island nothing is left above the sea except perhaps an atoll; the volcanic island has drowned, leaving only a lei of reef and sand as its memorial, seeming to float upon the waves of the conquering sea.

The younger islands in the Hawaiian chain still hold heads and shoulders high above the water. Yet for them, too, the processes of dying have begun. In the course of implacable time, all these islands will disappear into the sea. Na Maka o Kaha'i will triumph in the end. Surely this must be one of the greatest causes of Pele's rage.

HAWAII—THE BIG ISLAND

By far the largest island in the archipelago, Hawai'i is also one of earth's most prodigious volcanic constructions. The ocean floor lies more than 5,500 meters (18,000 feet) below its beaches; the highest point on Mauna Kea is 4,205 meters (13,796 feet) above sea level; and Mauna Loa is 4,159 meters (13,667 feet) high. Measured from the ocean floor, these shield volcanoes are considered to be the greatest mountain masses on earth. Geologists also tell us that it took Mauna Loa about 3 million years to attain its size: 2 million to reach the surface of the ocean and perhaps another million to make that vast mound of stone now visible above sea level.

Although Mauna Loa appears to be so much bigger, Kilauea is an impressive shield volcano in its own right. It rises about 6,700 meters (22,000 feet) above the ocean floor; its height above sea level is slightly more than 1,200 meters (4,000 feet). Both are counted among earth's most active volcanoes.

Kilauea's activity is evident almost everywhere within the bounds of this park. Recently, its most frequent and spectacular displays have been presented along the east rift zone. Sometimes magma pushes its way through lateral conduits and flows from vents in a volcano's sides instead of in its summit crater—usually along the structural weaknesses in a shield volcano known as rift zones. Kilauea has two such rift zones. One extends from the caldera toward the southwest, through Ka'u. The other, which includes the Chain of Craters, extends east-northeast through Puna,

past Cape Kumakahi and into the sea beyond. Several eruptions have occurred in the summit crater of Halemau-mau also, and a few have broken out along the southwest rift zone extending into Ka'u.

Since 1969 repeated eruptions have created a new parasitic lava shield in Mauna Ulu, "Growing Mountain," on the east rift zone. In the first 5 years of its existence, Mauna Ulu's vents poured out enough lava to fill up two pit craters; to build a new lava shield 122 meters (400 feet) above the level of the surrounding area; to bury or block off 19 kilometers (12 miles) of park road—burying some sections of it under more than 90 meters (300 feet) of rock; to cover 4,050 hectares (10,000 acres) of park land; and, where the flows entered the ocean, to add about 80 hectares (200 acres) to the island's area.

Active though they are, Hawai'i's volcanoes are relatively gentle. Violent outbursts—characterized by tremendous explosions, destructive earthquakes, clouds of poisonous gases, showers of hot mud, and rains of erupted rocks—have occurred only twice in recorded history. Both happened at Kilauea, one about 1790, the other in 1924.

The eruption of 1924 seems to have been caused by the build-up of great steam pressure, generated when ground water came in contact with hot rocks below the caldera. The steam pressure blew out a great part of the volcanic conduit's plug of solidified rock, scattering stones and other debris for several kilometers. The explosion enlarged the diameter of Halemau-mau from about 360 meters (1,200 feet) to about 900 meters (3,000 feet), and left a hole some 400 meters (1,300 feet) deep.

In general, however, Kilauea's eruptions are mild, and by far the greatest part of the material it releases appears in the form of slowly moving lava flows. The lava, gases, and cinders issuing from the vents can be dangerous, of course. Lava flows have destroyed forests, crops, houses, and other property, even villages, on occasion.

And beyond any doubt, Pele can be capricious. In the past, before scientists learned enough about her behavior, she would pop up in unpredictable places at most unexpected times. Now, however, they know enough about her humors to be able to anticipate most, if not all, of those fiery tantrums.

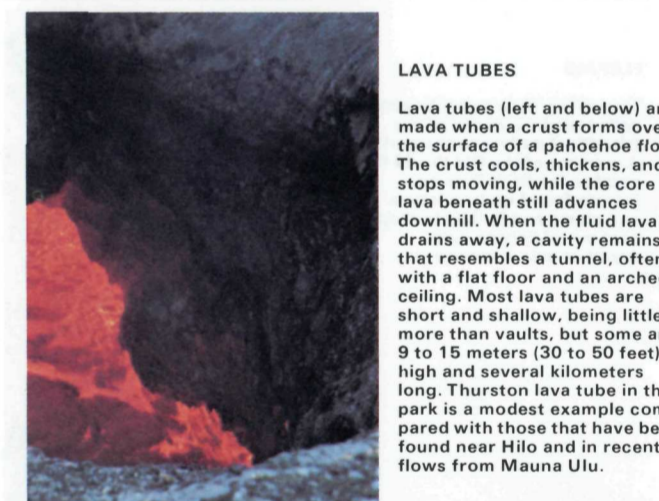
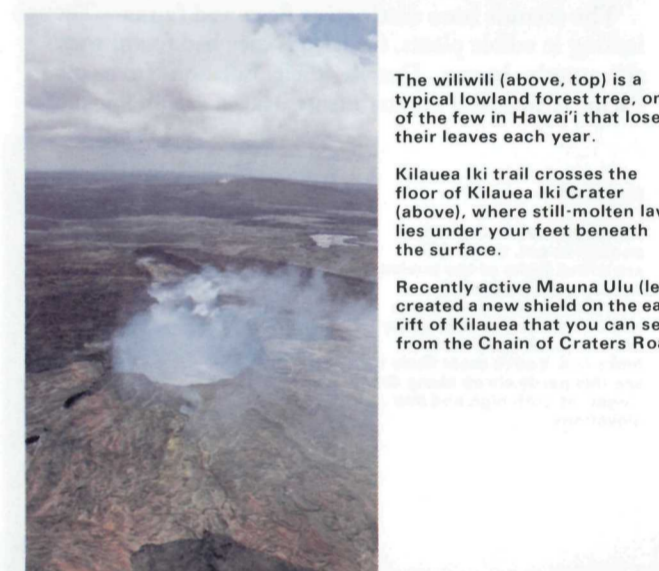
Even so, geologists, who regard earth processes in terms of eons, are understandably reluctant to predict the near



LAVA—'A'A
'A'a is the form of lava that solidifies in a jumble of relatively small clinker-like rocks having extremely rough surfaces. Pahoehoe lava emerging from a vent may change to 'a'a even while the flow is still moving; as the temperature and gas content of the pahoehoe are reduced, the lava becomes more viscous and congeals as 'a'a.

future. Some have ventured to say, however, that before volcanic activity on Hawai'i Island ends, the entire surface of Mauna Loa and Kilauea will be covered again, at least once, with fresh lava.

And oceanographers have found evidence suggesting that someday Pele may abandon her present homes completely. She has built many mountains upon the ocean's floor to the southeast. One such seamount is already about 4,600 meters (15,000 feet) high. If ever she lifts any of these above the surface of the waves, beyond the reach of vindictive Na Maka o Kaha'i, who can tell what new monument to herself Pele may not build?



The wiliwili (above, top) is a typical lowland forest tree, one of the few in Hawai'i that lose their leaves each year.

Kilauea Iki trail crosses the floor of Kilauea Iki Crater (above), where still-molten lava lies under your feet beneath the surface.

Recently active Mauna Ulu (left) created a new shield on the east rift of Kilauea that you can see from the Chain of Craters Road.

LAVA TUBES

Lava tubes (left and below) are made when a crust forms over the surface of a pahoehoe flow. The crust cools, thickens, and stops moving, while the core of lava beneath still advances downhill. When the fluid lava drains away, a cavity remains that resembles a tunnel, often with a flat floor and an arched ceiling. Most lava tubes are short and shallow, being little more than vaults, but some are 9 to 15 meters (30 to 50 feet) high and several kilometers long. Thurston lava tube in the park is a modest example compared with those that have been found near Hilo and in recent flows from Mauna Ulu.

ERUPTION BULLETINS

You can get up-to-date information about on-going eruptions or potential activity by calling (808) 967-7977 day or night. The automatic answering service is updated whenever Kilauea or Mauna Loa show signs of change.

Because eruptions are the most exciting events at Hawaii Volcanoes, temporary road signs will direct you to access or vantage points where you can confront the power of these events when conditions are safe.

FOR YOUR SAFETY

Be aware of these special hazards at Hawaii Volcanoes.

Please stay on trails. The surface of Kilauea is laced with deep cracks, and many of these are hidden by vegetation. Recent lava flows are shelly and collapse easily.

Fumes from volcanoes can compound respiratory problems. If in doubt, heed the warning signs.

A number of trails lie along the edges of cliff tops, so keep children under control.

ADMINISTRATION

Hawaii Volcanoes National Park is administered by the National Park Service, U.S. Department of the Interior. A superintendent, whose address is Hawaii Volcanoes National Park, HI 96718, is in immediate charge. His offices are at park headquarters, Hilo entrance.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and

water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

