



The 2008 eruption of Kīlauea's Pu'u 'Ō'ō rift zone on the Island of Hawai'i created a spectacular display of natural fireworks and an eerie reddish-orange glow in the night sky. One of the most active volcanoes in the world, Kīlauea has been erupting virtually nonstop since 1983.

NATURAL FORCES

Hawai'i's mountains and ocean create a unique paradise

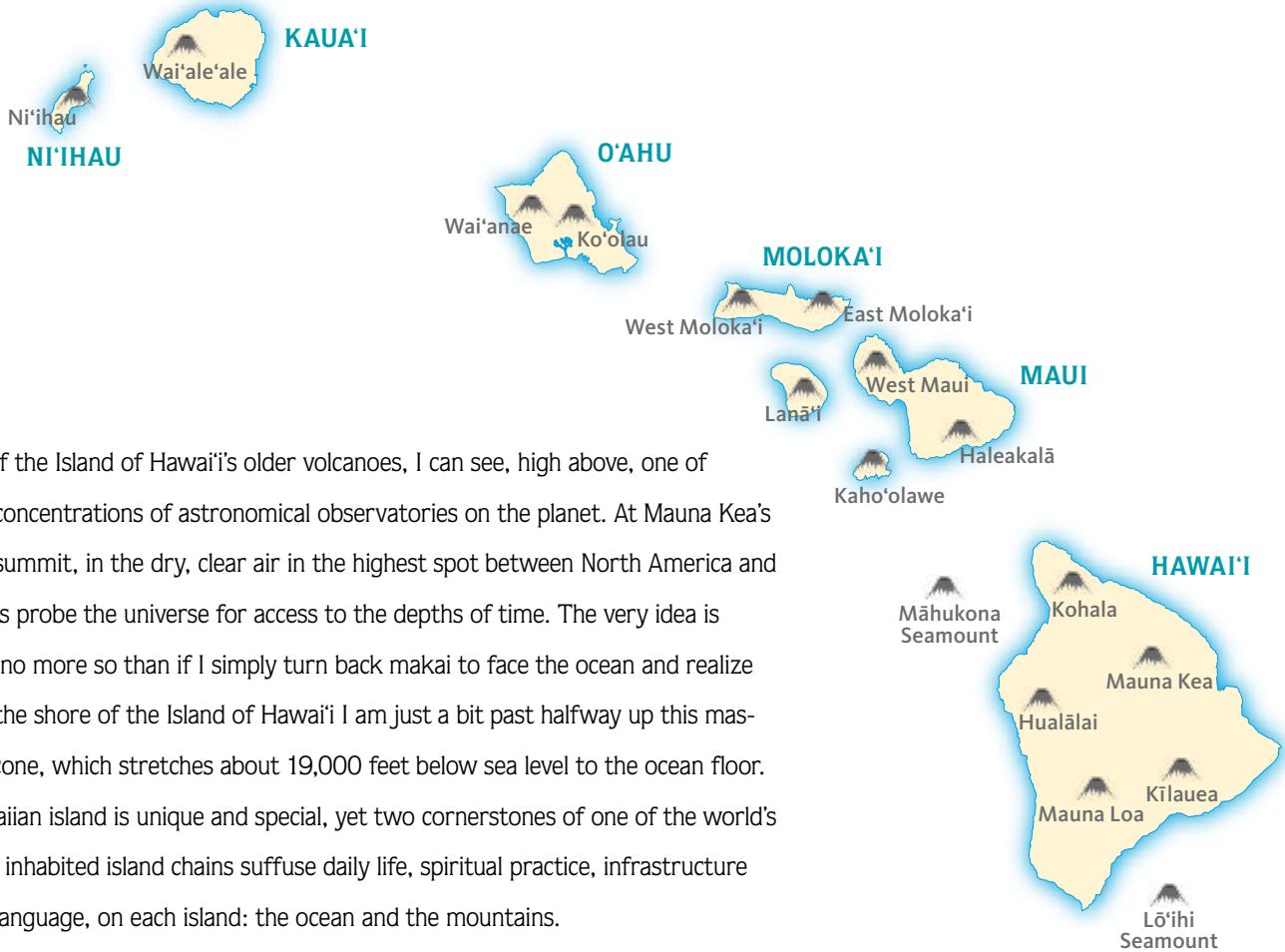
BY ERIC LUCAS

I'm standing at the edge of a new world, on the slope of one of Earth's most active volcanoes, overlooking its largest ocean. Here, just past the end of Chain of Craters Road in Hawai'i Volcanoes National Park, the smooth and undulating *pāhoehoe* lava marks a nine-year-old flow from Kīlauea, one of the dozens of volcanoes that have created the Hawaiian Islands during the past 70 million years.

A warm, moist breeze washes up the cliff from the Pacific. Breakers pound the newly formed rocks, the ocean already attempting to reclaim the hardened, but porous, magma.

Here, Hawai'i's two main natural forces meet face-to-face. The ocean and the mountains are so intrinsic to the Islands' character that the two terms for direction in the Hawaiian language derive from them. *Makai*, "toward the ocean," means downhill. *Mauka*, "toward the mountains," means inland or uphill.

From this spot, if I turn slightly mauka



toward one of the Island of Hawai'i's older volcanoes, I can see, high above, one of the greatest concentrations of astronomical observatories on the planet. At Mauna Kea's 13,796-foot summit, in the dry, clear air in the highest spot between North America and Asia, scientists probe the universe for access to the depths of time. The very idea is dizzying, but no more so than if I simply turn back makai to face the ocean and realize that here on the shore of the Island of Hawai'i I am just a bit past halfway up this massive volcanic cone, which stretches about 19,000 feet below sea level to the ocean floor.

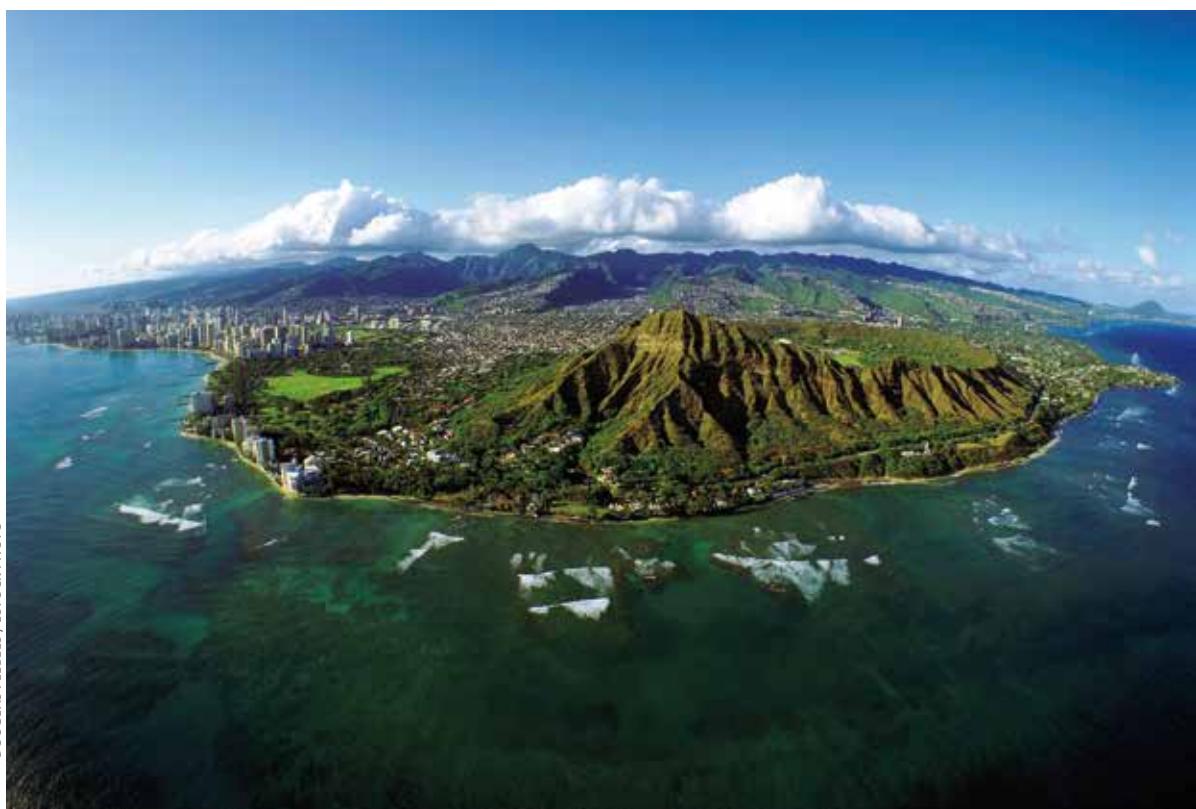
Each Hawaiian island is unique and special, yet two cornerstones of one of the world's most isolated inhabited island chains suffuse daily life, spiritual practice, infrastructure design, even language, on each island: the ocean and the mountains.

CULTURAL CORNERSTONES

One could say that either is the key factor that defines Hawai'i, but it's better to frame the two as an inextricably connected pair.

The ocean brings Hawai'i its weather, much of its food, and its setting, and until

the advent of airplanes, brought its people, starting with the Polynesian adventurers who sailed massive hand-carved canoes here centuries ago. Hawai'i's most famous sport, surfing, has spread from these ocean shorelines around the world. Tourists and



Left: Diamond Head, on the island of O'ahu, is one of the iconic peaks that have helped define the image of Hawai'i. Above: A map of the volcanoes on each of the main Hawaiian Islands.



JAMES RANDKLEV

residents alike congregate on island beaches to enjoy the balmy water and the fresh breezes. At first glance, the ocean may seem like it is everything to Hawai‘i.

But without the mountains—actually,

without the volcanoes that formed them—there would be no islands to begin with. And while the ocean brings Hawai‘i’s weather, it is the mountains that shape the climate, leading to islands with rainforests

The silversword plant, with its large and colorful bloom, is known for having leaves that glisten like prisms in the sunlight. It is one of the unique forms of vegetation found in Maui’s Haleakalā National Park.

on one side of a range and semi-arid lands on the other. The mountains are, like the ocean, a visual constant.

They are the source of the streams that spill water down to cities and towns, forests and farms—streams considered hallowed by ancient Hawaiians. They gather clouds that define the light and shade; coffee growers in upland Kona produce shade-grown beans because of nearly constant clouds. The mountains are also the last refuge for many of Hawai‘i’s more than 20,000 endemic species.

And they are, to Native Hawaiians, the source of many sacred things.

One day about a decade ago, Maui’s Hawaiian Canoe Club decided to undertake something that had not been done for

decades: carve a racing canoe from a native koa tree right there on the Valley Isle. Attempting to renew such a tradition proved daunting.

“There just aren’t that many big, old koa trees left,” explains ‘Iokepa Nae‘ole, one of the canoe club’s leaders. “Certainly not in the lowlands. And it takes a big koa if you want to carve a racing canoe.”

To find such a tree, the club members would need to turn to the central facet of life on Maui, a geographical landmark that’s also one of the planet’s most significant geological features, known worldwide for its impressive size and its power as a cultural touchstone for the Hawaiian people: Haleakalā, the 10,023-foot volcano, with about 93 percent of its mass underwater. The Hawaiian Canoe Club members gained permission from a private land-owner in the area and mounted scouting expeditions for a sufficiently large koa among the old-growth native forests on the volcano’s upper slopes.

GRAND PEAKS

The mountains are, in traditional Hawaiian belief, the realm of the gods: *Wao akua* is the Hawaiian term.

“The lowlands were the realm of man, the uplands were only for chiefs and *kahunas*, such as canoe carvers,” explains the Canoe Club’s Nae‘ole.

For eight months in 2001, dozens of members of the canoe club searched Haleakalā, looking for old, large-bole koa trees. After a sufficiently large tree was found, club members performed a traditional ceremony to mark the taking of the tree, and then they hauled the log down by hand from the Kīpahulu Forest Reserve to the shore, an all-day trek. Afterward, a Tahitian master canoe carver helped them create a prize canoe named Pāhili Kiu. The name refers to the sacred winds of the Kīpahulu forest—which flow around the mighty mountain.

Haleakalā is so revered—by Maui residents and all Hawaiians—that a national park encompasses much of the mountain. The preserve is designed to “protect the bond between the land and its people,” according to the National Park Service.

"It is important to realize that for the Polynesian-Hawaiian, everything is interconnected," says Clifford Nae'ole, 'Iokepa's brother, who, as cultural adviser at Maui's Ritz-Carlton Kapalua, is one of the leaders of the Hawaiian cultural renaissance. "The mountains were sacred, revered and spewed forth life. The summits brought us closer to the gods and allowed us to view their grandeur from whatever outlook we chose."

Grandeur is a fitting term to describe Hawai'i's mountains. The highest summit on the islands, the 13,796-foot Mauna Kea on the Island of Hawai'i, is actually the world's tallest mountain, when measured from its base on the ocean floor to its snow-covered pinnacle. The total is at least 32,000 feet, far more than Mount Everest's 29,029-foot elevation.

Mauna Kea is so high that there may be a very small area of permafrost atop the mountain's summit that is a remnant from the global Ice Age, about 20,000 years ago.

The top of Mauna Kea is the site of 13 different observatories, including the world's largest optical, infrared and sub-millimeter telescopes. This is because very little pollution or humidity interferes with visibility in the summit's dry, cool air. A similar but smaller colony of observatories sits atop Haleakalā, for similar reasons.

On Kaua'i, Mount Wai'ale'ale stands 5,246 feet above sea level and is among the wettest locations on Earth. Strong trade winds bring this area more than 450 inches of rain a year, with a record 683 inches recorded in 1982.

David Beilman, a professor of geography at the University of Hawai'i at Mānoa, says such places are unique.

"There are lots and lots of atolls in the Pacific," Beilman says. "But high-elevation tropical islands are uncommon."

VOLCANIC HOT SPOT

The whole aggregation of land that is Hawai'i—all seven inhabited islands, plus more than 100 outlying islets—represents what may be the world's most active volcanic hot spot, one of about 25 such hot spots around the world, including Iceland, the Azores, the Galapagos and Yellowstone.

"Hawai'i is certainly the most-studied

SCIENCEFACTION / SUPERSTOCK



BRYAN LOWR / ALAMY

and best-understood hot spot. Is it the most active? Quite likely," says Scott Rowland, a vulcanologist and professor at the University of Hawai'i, at Mānoa, on O'ahu.

Rowland often must explain to people that Hawai'i does not lie along a tectonic activity zone, such as the Pacific Ring of Fire that marks much of the American West Coast. There, where the Pacific Plate

and North American and other plates meet, volcanic activity develops from tectonic plates going through subduction—the process in which one tectonic plate moves under another plate and is forced down into the earth's mantle. Hawai'i, rather, lies above a hot spot that is deep within the earth's crust, below the Pacific Plate. This allows

Above left: Visitors stand at the entrance to the Thurston Lava Tube in Hawai'i Volcanoes National Park on the Island of Hawai'i. Also on the island are the silver-topped Gemini Northern Observatory and the Canada-France-Hawai'i Telescope (shown above) located on the summit of Mauna Kea.



On Kaua'i, Mount Wai'ale'ale (left), which stands 5,246 feet above sea level, is among the wettest locations on Earth. Strong trade winds bring this area more than 450 inches of rain a year, with a record 683 inches recorded in 1982.

magma to rise from the mantle and break through. During millions of years, these magma plumes have built cones that, when they surpass sea level, form islands. The weight of these islands depresses the sea floor.

As the Pacific Plate moves toward the northwest, the hot spot stays relatively stationary, with each new cone forming in a different spot. The plate movement results in the Hawaiian chain being formed in a southeasterly direction. As a result, Kaua'i, the oldest of the main islands and the farthest to the northwest, is about 6 million years old, while the Island of Hawai'i, the youngest and the farthest southeast, is less than 1 million years old. In fact, the Island

of Hawai'i continues to grow, thanks to ongoing eruptions from Kīlauea.

Nor do the islands represent a single volcano. Even individual islands may be composed of multiple volcanoes. The Island of Hawai'i was formed by at least five different volcanoes: Kohala, Hualālai, Mauna Loa, Mauna Kea and Kīlauea. These are "shield" volcanoes—named such because their large, wide-angle profiles resemble warriors' shields—that are formed by successive layers of lava spreading out and building up over time. Though Kīlauea appears to be on Mauna Loa, it is actually a separate volcano. Its recent lava flows are covering up material from Mauna Loa. The same process took place when Hualālai formed beside Mauna Kea.

O'ahu was formed by two volcanoes; thus the resulting mountain ridges that lie on each side of the most populous island, with the valley between representing the connecting of the two and erosion from above. Maui is similar, with Haleakalā being the bigger volcano and the West Maui Mountains representing the remnants of an older volcano. The valley between the two is the source of Maui's nickname, the Valley Isle. Kaua'i, on the other hand, appears to have been formed by a single volcano.

Soon, geologically speaking, there will be even more islands. Lō'ihi, a new volcano, lies about 22 miles southeast of the Island of Hawai'i and could be the next island to form. Its shield rises about 10,000 feet above the ocean floor and is within 3,000 feet of the ocean's surface. Don't book tickets to watch it reach open air, though. The process is expected to take tens of thousands of years.

MOUNTAIN WONDERS

You can, however, book tickets today to experience the many wonders of these islands. Visiting the mountains of Hawai'i can be challenging, considering the ruggedness of the topography. For instance, a road climbs to the top of Haleakalā, and the mountain holds numerous visitor attractions. However, a helicopter is needed to view the top of Kaua'i's Mount Wai'ale'ale.

Kōke'e State Park, straddling a shoulder of Wai'ale'ale, is an accessible rainforest where a hike brings you into an otherworldly environment. You will find the Alaka'i Swamp, where drizzle is a constant amid stunted trees, gray-leaved shrubs, and mosses and fungi on every surface. Surprisingly, there are few puddles or pockets of water, as the old lava is quite porous.

The national park on Maui's Haleakalā is famed for, among other things, its vantage point for sunrises. Vans and buses climb the 36-mile road to the top in the predawn hours so that visitors can watch the eastern horizon brighten along a memorable spectrum from indigo blue to brilliant vermilion red. Island residents maintain that sunsets on the mountain are just as impressive—and less crowded.

The volcano is also the home of a famous endemic plant, the silversword, ‘*ahina hina* in Hawaiian, a perennial that’s like few others on Earth and exemplifies the importance of Hawai‘i’s mountains as refuges for the state’s many endangered birds and plants. The tiny hairs on a silversword’s lancelike leaves create its most appealing aesthetic, catching the light and dispersing it in a shimmering hue that is more accurately called platinum than silver. Driven to near extinction before the creation of Haleakalā National Park in 1961, the silversword is now a common sight atop the summit, its leaves glistening like prisms in the sunlight. Little other vegetation is evident in the seemingly barren landscape.

While the view from Haleakalā is expansive—allowing you to see Mauna Kea and Mauna Loa almost 100 miles in the distance—the island of Maui is frequently blanketed in a wreath of clouds at about 6,000 feet. This “halo” is a function of the humid trade winds that surround the mountain below 5,000 feet. The air hits Haleakalā’s slopes and rises until meeting colder, drier air and condensing into clouds. On the windward slopes, such as in the Kīpahulu forest where the Hawaiian Canoe Club found its koa tree, the cloud buildup yields considerable rainfall.

“The northeasterly trade winds dominate the weather 80 percent of the time or more,” explains meteorologist Kevin Hamilton of the International Pacific Research Center on O‘ahu. “The exceptions are usually in the winter.”

Hamilton and other researchers are studying the potential effect of climate change on this pattern. While they are not sure what it will be yet, if anything, they suspect global warming may intensify the predominance of the trade winds.

The rugged country along the northern coast of Maui is a prime example of the island’s raw beauty. Haleakalā’s volcanic neighbors, the West Maui Mountains, for instance, have created one of the most rugged landscapes I have ever seen. Here, the lava has been transformed into clay by thousands of years of rain and the deep canyons look as though

they were cut into by large chainsaws.

Winding along the north side of Haleakalā, the famous road to Hāna traverses towering escarpments, winds through rainforests, and ducks into deep canyons where waterfalls plunge from great heights. Every mile is alive with the dynamic presence of the mountain far above, and each bend brings a reminder of Haleakalā's size and power.

The popular drive has many twists and turns, but is considered safe. However, most rental-car companies restrict customers from driving on the unpaved road beyond the town of Hāna. On the Island of Hawai'i, the road leading up Mauna Kea allows visitors to drive to the 9,200-foot level and tour the Mauna Kea Visitor Information Station. But to reach the summit requires a four-wheel-drive vehicle, and most car-rental firms restrict customers from driving the partially unpaved road. Instead, several tour operators take small groups to the top, including Hawai'i Forest & Trail, whose president, Rob Pacheco, helped pioneer this enterprise.

"The trip to the summit has been rated a top-10 world 'must-do' travel experience," says Pacheco, "and we go up for the sunset. It's otherworldly."

"But we try to steer our customers away from the concept of 'bagging a trophy' and instead provide information to help connect them to the island," Pacheco adds. "Mauna Kea is one of the world's masterpieces of natural history, a laboratory for earth processes and life processes."

Like Haleakalā, Mauna Kea shelters many endemic species, including its own version of the silversword, a close cousin to the one found on Maui.

CHANGING PERCEPTIONS

In my travels to Hawai'i, I've gaped at the Mars-like summit of Haleakalā and marveled at the thick, twisting, ever-damp rainforest of Wai'ale'ale. I've sat atop a crater rim at Kīlauea and watched a sulfuric plume of smoke and gas issue from a vent, lit orange by the glowing lava below.

However, the drive down Kīlauea through Hawai'i Volcanoes National Park to the newly formed section of the island's

Pacific shoreline is one of my most memorable. I descend the Chain of Craters Road through a landscape made within human memory (there were lava flows in this area of Kīlauea as recently as 1974) to the newly formed land whose creation was in the headlines just months ago. This drive changes one's perception of mountains, from static bulwarks into dynamic forces ever in motion. At the end of the road is a thought-provoking spot where an eruption overran a highway in 2003. The sign says "Road Closed" atop a post set in 3 feet of solidified, smooth pāhoehoe lava.

But Hawai'i's peaks represent more than dynamic forces. I have experienced them in more contemplative ways, too, including simply admiring them from a distance. The most memorable such moment came at a beach near Hāna, Maui, where golden sand runs up to a lush hillside of palm trees and tropical vegetation. Gentle swells roll into the little bay, cresting over coral reefs just offshore. Pausing to tread water while traversing the bay, I glanced up and noticed, far above the 'Alenuihāhā Channel, the snowcapped summit of Mauna Kea. So at that moment I was experiencing, simultaneously, both ocean and mountain. My vantage was both mauka and makai.

It is hard to imagine many other places on Earth where such an experience could be had—swimming in balmy waters off a golden tropical beach with snowcapped peaks in sight.

"There's only one Hawai'i," says geographer David Beilman. One Hawai'i, but many mountains within. ▲

Eric Lucas lives in Seattle.

For more information on visiting the Hawaiian Islands, go to www.gohawaii.com.

GETTING THERE



Alaska Airlines offers daily service to O'ahu, Maui, Kaua'i and the Island of Hawai'i. To book an Alaska Airlines Vacations package to Hawai'i, go to alaskaair.com or call 800-468-2248.