



# Keonehelelei - “The Falling Sands”

## Footprints Archeological Site

At Kīlauea Caldera a plume cloud may be rising from Halema`uma`u Crater. There is ash falling from that plume. If you are standing at Kīlauea, and the winds are blowing in your direction, the ash may be falling on you. But it doesn't feel like ash - it feels more like sand. Native Hawaiians of long ago experienced what we are experiencing today at Kīlauea. They too were eyewitnesses to such explosive eruptive events and they named the events that were especially memorable. In 1790 a dramatic eruption occurred at Kīlauea. We know about the name of this event from 19 year-old Frederick S. Lyman, a tax assessor for the Kingdom of Hawaii. In 1857 Lyman traveled around Hawai'i Island talking to the people and gathering information. His job was one of the oldest tasks in the history of civilization - to collect data on its citizens so that the government could collect its taxes.

### Keonehelelei translates to mean “the falling sands” in Hawaiian

Many Native Hawaiians did not know their chronological ages. However, they were able to associate their births with significant “occurrences” that happened in their lifetimes, or in the years immediately preceding their births. Lyman collected statistical data and ethnographic information from those he spoke with, and read the numerous Hawaiian newspapers available to him. From these sources he compiled a “List of Dates” which documented famous events in the Kingdom.



Closeup of typical footprint impression in the Ka`ū Desert. Photo courtesy of Hawai'i Volcanoes National Park.

Five significant events were recorded in 1790. One was called *Keonehelelei*. *Keonehelelei* translates to mean “the falling sands” in Hawaiian. *Keonehelelei* referenced an explosive eruption that happened at Kīlauea. The explosion was so large and dramatic that the ash cloud it produced could be seen on the other side of the island at Kawaihae. That's over 100 miles away. The eruption involved a dramatic explosion of hot gas, ash, and sand that rained down on the Ka`ū Desert, which is currently within Hawai'i Volcanoes National Park. This eruption was unlike most magmatic eruptions to which we have become accustomed. It stands out because of its explosiveness and because of the tragic deaths of a group of Hawaiian warriors who were in the wrong place at the wrong time.

The warriors who died in 1790 were supporters of a famous Hawaiian chief - Keōua. Chief Keōua was a rival and cousin to Kamehameha. The two men had just completed a series of battles at places from Kohala to Waimea, and along the Hāmākua coast. The battles were indecisive, but they were so bloody that both armies retreated, with Keōua heading for his home district of Ka`ū. To get home, Keōua took a traditional trail that led from Hāmākua to Ka`ū through `Ōla`a and up to Lua o Pele (Kīlauea). When they reached Kīlauea, Keōua directed his large group to camp overnight at the edge of the caldera. Although the warriors were settling down to rest, Pele the Hawaiian deity of volcanoes,



## Phreatic and Phreatomagmatic Explosions

The kind of volcanic event that led to the ash deposit in the Ka'ū Desert was the result of phreatic and phreatomagmatic explosions. These explosions produced pyroclastic deposits, chiefly made of volcanic ash. Pyroclasts refer to fragmental materials thrown into the air during a volcanic eruption and deposited. Kīlauea is an explosive volcano and has had numerous explosive eruptions in the past 1200 years. The Keanakāko'i Ash deposit is the most widespread of these deposits and is in an area closely surrounding Kīlauea Caldera. Several eruptions contributed to the Keanakāko'i formation starting about A.D. 1500. The last major eruption related to this deposit was in 1790. Geologists believe that the Keanakāko'i deposits were generated by deep explosions between 500 and 700 meters below the ground surface. The floor of Halema'uma'u Crater at this time was so deep it was below the water table. This allowed ground water to seep in and form a lake. When magma erupted into the lake there was a violent explosion of steam and gases. This resulted in the fragmentation of magma into tiny ash particles and drove fast-moving, very hot ash-laden steam clouds out of the crater. Called a pyroclastic surge, the ash traveled at a speed as great as 100 miles per hour. The explosions also threw out rocks called ejecta from already solidified lava flows inside the volcano. During the eruption, high dust clouds and particles mixing in the upper atmosphere produced rain. As the raindrops fell through the dust, accretionary lapilli were produced. These small, hardened, rounded balls of ash are still evident today. The explosions were violent. The ash that fell in 1790 did not cause the death of the warriors. The group was likely overcome by a sudden, violent and hot pyroclastic surge. The warriors were engulfed in a stream of hurricane force winds, composed of hot steam and sulfuric gases. The heat of the hot gases and entrapped air probably suffocated them causing their death.

# Huli i ka 'oia 'i 'o i ka m

Sea

had other ideas. Kīlauea was preparing to erupt. That night, there were numerous earthquakes. Keōua and his warriors feared they had somehow angered Pele. Perhaps sensing danger, the next morning Keōua split his warriors into three groups, sending them on to Ka'ū separately. His decision proved to be a life-saving one. The first two groups of warriors had not

## The second group of warriors were caught in the hurricane force winds and violent stream of suffocating gases.

gone far when the earth started to convulse violently. Gases and super-heated steam exploded out the volcano followed by a huge, dense cloud of ash, sand and rocks that was ejected out of the crater and rained down for miles around. Not far from the caldera, the second group of warriors were caught in hurricane force winds and a violent cloud of suffocating gases. Unable to escape, all of the warriors in the second group perished. Following soon

behind, but luckily out of the zone of death, the third group of warriors came upon their dead comrades. They left behind the bodies of their fellow warriors, and in their wake the impressions of their footprints in the newly deposited wet ash.

When geologists discovered the footprint impressions in the Ka'ū Desert in 1921, they immediately attributed the prints to Keōua and his warriors. The story of Keōua was well known, having been told to missionaries by local Hawaiians as early as 1823. It was assumed that the footprints must belong to the warriors of Keōua because geologically it fit within the right time-frame. When the site was placed on the National Register of Historic Places in 1974, the nomination referred to Keōua and his warriors as the source of the footprints. No detailed study of the footprints or the area of ash deposit, however, had ever been made. Informal studies of the site began in the early 1990's.



Depiction of the death of the army of Chief Keōua at Kīlauea.

Image courtesy of Hawai'i Volcanoes National Park. HAVO00009691.



# no'omeheu

## Searching for the Truth in the Footprints Left Behind (Mary Kawena Pukui)

At that time researchers noted there were two different ash layers bearing footprint impressions. In addition, the footprint directions suggested people were walking south, away from the crater, north towards the crater, as well as to the east and west. If the prints were from Keōua's warriors, then why were there multiple layers of prints, and why were the prints heading in various directions?

It wasn't until 1998 that the first intensive archeological survey of the footprints area was undertaken by the National Park Service. This survey was expanded in 2001 and the first comprehensive archeological survey report of the area was published in 2003. Results of the survey, coupled with new geologic research, has expanded our understanding of the area. Our interpretation of the site reveals a story that is much more complex than previously believed.

The archeological site known as "Footprints" is located in the district of Ka'ū, within the *ahupua'a* (traditional land unit) of Kapāpala. The Ka'ū Desert



Closeup of toe impressions in the desert. Photo courtesy of Hawai'i Volcanoes National Park.

is part of the mid-elevation woodland zone where the climate is highly seasonal. In the summer, visitors will normally experience dry warm days. Year round the "desert" receives up to 50 inches of rain. Footprints was added to the park in 1938 because the NPS recognized the historic value of the sub-fossil impressions. What the NPS did not know at the time was that the area was also very rich in other cultural and natural

resources. Native Hawaiians used this area of the desert repeatedly, and evidence of their use is spread across the landscape. Archeologists re-discovered the trail that Keōua's army traversed which linked Hilo to Ka'ū. The trail is located along the north rim of Kīlauea and passes through the desert parallel to the Ke'āmoku lava flow and south to Ka'ū. Along the edges of the Ke'āmoku flow are numerous temporary shelters and resource areas where volcanic glass and a unique basalt stone called *hokele* is found. *Hokele* was used to make adze tools - one of only five quarry sites on the island where adze quality rock is found. This trail route was well known and used before and after Keōua's troops passed through. Because the footprints could have taken up to a week to dry, the archeological evidence supports the idea that they are from more than Keōua's warriors. The footprints likely represents the everyday travel of native people through the area.

## Routes, Ruins and Resources

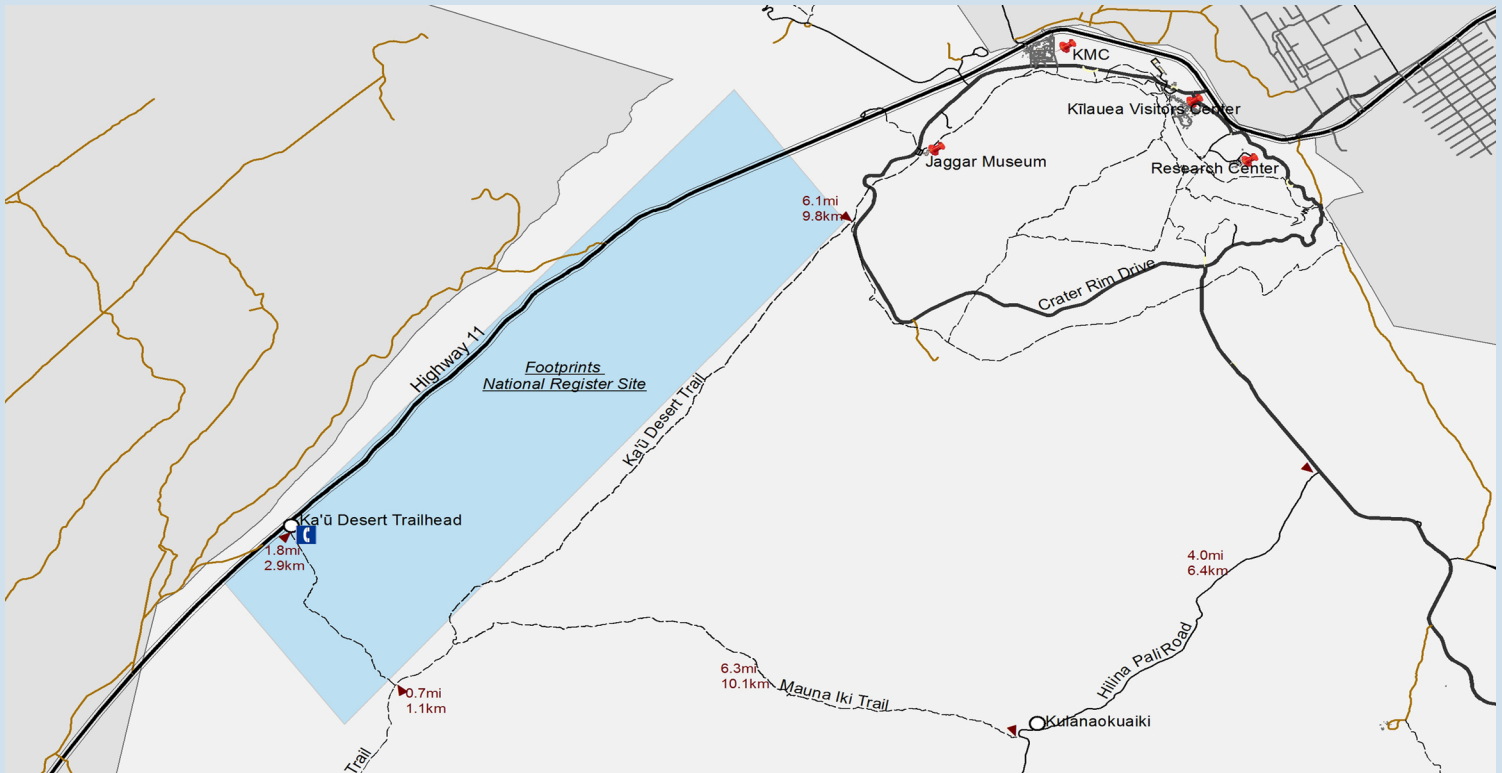
Archeologists have identified over 246 cultural features in the Footprints area that does not include the footprint impressions. They include habitation sites - structures used for shelter or processing food; resource procurement sites - those related to the collection of materials for making tools such as volcanic glass or basalt; markers - which were used to identify areas of importance such as trails; and trails which were used to transit across the landscape. Clearly, the trails were the primary features that bound this part of the desert with the caldera at Kīlauea and village sites in Ka'ū and Hilo. The main route and trail system through the desert is a worn path across the flat, smooth, pahoehoe flow. Other trails were cleared alignments that crossed over sections of the rough 'a'a lava flow of Ke'āmoku. The Ke'āmoku flow is an obvious natural feature on the landscape and Hawaiians found it to be very useful. The flow may have been difficult to traverse, but the inlet areas along the base of the flow provided natural shelter from the desert wind, rain and sun. Within most of these inlets are almost one hundred ruins - temporary "c-shaped" shelters built by Native Hawaiians. The shelters were built from dry-laid stacked 'a'a rocks from the Ke'āmoku flow. The shelters are simply constructed, and most lack hearths or other evidence of occupation. They may have been used on overnight stops or for day rest. Also along the trail route are numerous areas where natural resources were being sought and removed. These included volcanic glass and basalt quarry sites, both of which were used to make highly sought after tools.



Typical structure found in the Ka'ū Desert. Photo courtesy of Hawai'i Volcanoes National Park.



## How To Get There.....



## Further Reading

Doerr, John E.  
1931 "The Footprints of Kau." In Nature Notes, Vol. 1, No. 7, December.

Finch, R.H.  
1947 "Kilauea in 1790 and 1823." In The Volcano Letter, No. 496. April - June.

Jaggar, T.J.  
1921 "When Kilauea was Dangerous." In Paradise of the Pacific vol. 34, no. 12. December.

1930 "The Human Footprints in Kilauea's Ash Bed." In The Volcano Letter no. 273, March 20.

1932 "Fossil Footprints in the Kau Desert." In Paradise of the Pacific, Vol. 46, No. 5.

Nakamura, J. Moniz  
2003 "Keonehelele. Archeological Inventory Survey of the Footprints National Register Site. Ahupua'a of Kapapala. Hawaii Volcanoes National Park." Pacific Island Cluster. Publications in Anthropology #2.

2009 "Hominid Footprints in Recent Volcanic Ash: New Interpretations from Hawaii Volcanoes National Park," Ichnos, 16:1, 118-123.

Mastin, L., R. Christiansen, D. Swanson, P. Stauffer, and J. Hendley  
1999 "Explosive Eruptions at Kilauea Volcano, Hawaii?" USGS Fact Sheet 132-98.

Swanson, D.A. and R.L. Christiansen  
1978 "Tragic Base Surge In 1790 at Kilauea Volcano." Geology, vol., no. 2, pp.83-86.

Swanson, D.A., R.S. Fiske, T.R. Rose, and C.L. Kenedi  
1998 "Prolonged deposition of the Keanakako'i Ash Member, Kilauea." EOS, American Geophysical Union, Transactions, vol. 79, no. 45, p.937.



National Park Service  
U.S. Department of the Interior

This fact sheet and a copy of the entire Footprints report entitled "Keonehelele. Archeological Inventory Survey of the Footprints National Register Site" can be found at the Hawai'i Volcanoes National Park web site: [www.nps.gov/havo](http://www.nps.gov/havo)

For further information on this archeological site and others contact:

*Hawai'i Volcanoes National Park  
Cultural Resources Management  
1 Crater Rim Drive  
Hawai'i National Park, HI 96718*

Phone:  
808-985-6136

E-mail:  
[jadelyn\\_moniz-nakamura@nps.gov](mailto:jadelyn_moniz-nakamura@nps.gov)

The National Park Service cares for the special places saved by the American people so that all may experience our heritage.

