Hawaiian Oral Tradition Clarifies 400 Years of Volcanic Activity at Kīlauea

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The Pele–Hi'iaka chants translated by Nathaniel Emerson describe the eruption of a huge lava flow and the down dropping of the volcano's summit to form the modern caldera. Oral traditions told to Reverend William Ellis in 1823 add more information that rounds out this picture and describes explosive eruptions, one of which Pele used to chase Kamapua'a to the sea. Geologic interpretations until recently overlooked the chants and oral traditions, failed to relate the huge lava flow to the development of the caldera, and assigned the formation of the caldera and all of the explosive eruptions to one year, 1790. During the past decade, geologic evidence has been found to support the chants and information given to Ellis regarding the development of the summit, which involves the eruption of a huge lava flow in the 15th century, the development of the caldera immediately afterward, and 300 years of ensuing explosive eruptions.

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It's a very great honor to be here today. I was surprised and grateful when I was invited to give this presentation. In some ways, I can't imagine a better audience to give it to.* I was thinking this morning that life takes many strange twists. My most inspiring English teacher in high school (Loris Crampton), when I was a senior in a small town in the Pacific Northwest, had just moved there from teaching at Kamehameha Schools in Honolulu. Mr. Crampton imparted to me a real interest in poetry, and that's how I got involved in this study, because I think that the chants that I'm trying to interpret make for marvelous poetry.

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My comments today are based largely on the Pele and Hi'iaka chants translated by Nathaniel Emerson (*Pele and Hi'iaka: A Myth From Hawai'i*, 1993). I started this work some time ago but have recently acquired the 2006 book that Puakea Nogelmeier put together on the subject (a translation of Ho'oulumāhiehie's *The Epic Tale of Hi'iakaikapoliopele*). I've since consulted it, and I believe the interpretations that I offer are consistent with most or all of what's in Nogelmeier's book. I kept my ideas quiet for a long time, but several years ago at a kūpuna (elders) meeting at Hawai'i Volcanoes National Park I discussed my interpretations with Pua Kanahele. She very graciously listened to them and didn't call me crazy, so I developed a little bit of courage and felt that I could go ahead with this work.

Let me just run quickly through the part of the mo'olelo (story/legend) that's relevant to my interpretation. As you know, Pele arrived first at the northwest end of the Hawaiian Island chain. She couldn't find a place to live, but on Kaua'i she found an attractive man whom she wanted for herself. His name was Lohi'au. After a dalliance there, Pele moved down the chain looking for a place to live and finally arrived at Kīlauea, where she found a nice location and developed a home. She then asked her sisters to go fetch Lohi'au for her.

Hi'iakaikapoliopele, whose name is often shortened to Hi'iaka, agreed to get Lohi'au for her sister Pele. All she asked in return is that Pele not destroy her 'ōhi'a lehua forest in Puna during her absence. Pele agreed but set a deadline of around 40 days for the journey. So Hi'iaka and her companion Wahineoma'o left and had many adventures along the way, including the encounter with the mo'o (giant lizard guardian) Pana'ewa, which I think may describe a terrible storm, perhaps a hurricane.

*This article is based on a speech delivered at the 2008 Research Conference on Hawaiian Well-Being in Kāne'ohe, Hawai'i.

Hiʻiaka eventually arrived on Kauaʻi, and the famous story is that when she found Lohiʻau, he was dead. She and her companion worked hard to revive him, and eventually they brought Lohiʻau back to life. On their way back to Hawaiʻi Island, they stopped at Kaʻena Point on Oʻahu, where Hiʻiaka walked to the summit of Pōhākea, looked down the island chain, and saw that her sister had set fire to the forest in Puna.

Because of all the adventure along the way and the difficulty in reviving Lohiʻau, it had taken longer than 40 days for Hiʻiaka to return, and Pele was upset, perhaps suspecting that Hiʻiaka was messing around with Lohiʻau. As punishment, Pele laid waste to her sister's beloved ʻōhiʻa forest. However, Hiʻiaka hadn't done anything with Lohiʻau, and they continued traveling to Waiākea, and from there, to the summit of Kīlauea. There in the presence of her older sister, Hiʻiaka made love to Lohiʻau. As you might imagine, Pele was incensed. In a rage she killed Lohiʻau and she threw his body, according to the Emerson translation, into Kalua o Pele, which I think was a small, pitlike crater that indented the summit of Kīlauea in earlier times. Hiʻiaka dug furiously to recover the body; rocks were sent flying as she was digging. She dug so deeply that she was warned not to go much farther because water would be struck, which could put out the fires of Pele. To make a long story short, Hiʻiaka eventually found Lohiʻau, and they're together in spirit today, according to Emerson's version at least.

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Now, what does this tell us about 400 years of Kīlauea's volcanic history? I think the chants describe the two largest volcanic events that have taken place in Hawaiʻi since people arrived (now thought by archaeologists to have been around 800 CE or somewhat later). The first is the eruption of what geologists call the ʻAilāʻau lava flow. Although it's a misnomer (ʻAilāʻau oversaw Kīlauea *before* Pele arrived and displaced him), it's the largest lava flow to have occurred on the island in the last 1,200 years. The other big event is the down dropping of the summit of Kīlauea that formed the large crater that you see today, what we geologists call a caldera.

I think that the ʻAilāʻau lava flow is what Pele used to destroy Hiʻiaka's forest, as mentioned in the chant. It was a massive lava flow; its volume is many times that of any other lava flow that has occurred since people have been living in Hawaiʻi, and it lasted for about 60 years.

The ʻAilāʻau flow covered virtually all of Kīlauea, north of the east rift zone. Most of the subdivisions on Kīlauea fall into this area. To put it in perspective, when you drive from Keaʻau to Pāhoa, you're traveling over that ancient lava flow most of the way. The Thurston lava tube is one of the geologic features that are in that flow, and some of the lava even made its way down to the south coast. Surely, this flow had a tremendous impact on society at the time, to destroy that much of a very important forest.

And then it's the formation of the caldera, the down dropping of the Kīlauea summit, that I think is metaphorically described by Hiʻiaka's digging to recover the body of Lohiʻau.

I will return in more detail to these topics after I address others that are based on an oral history that was told to Reverend William Ellis on August 1–2, 1823. I mention Ellis because I think the information he was given relates to the overall history of the summit and its caldera that I'm trying to develop for you.

Reverend Ellis was quite a remarkable person. There may be folks who argue otherwise, but he was exceptionally talented. He learned Hawaiian and was the first missionary to preach to Hawaiians in their native language. He made Hawaiian into a written language using the Roman alphabet, and he was only 27 or 28 at the time. For those of us who are long past that age, it's a pretty remarkable achievement! He came to Hawaiʻi Island looking for places to establish church missions. When he arrived at the summit of Kīlauea on August 1, 1823, his guides told him many things about the area. Among them, he was told that Kīlauea had been "burning from time immemorial" and that "it used to boil up, overflow its banks, and inundate the adjacent country." But very importantly, "for many kings' reigns past it had kept below the level of the surrounding plain…occasionally throwing up, with violent explosion, huge rocks or red-hot stones" (Ellis, 1825/1917, p. 184). In addition, Ellis was told there had been no big explosion at Kīlauea between 1790, when part of a group led by Keōua (a cousin and rival of Kamehameha for control of the island) was killed by a powerful explosive eruption, and the time of Ellis's visit in 1823. What does this oral history reported by Ellis tell us about what was happening at Kīlauea?

Kīlauea has been active for a long time, and of course geologists have known this fact. But the oral history tells us that the caldera had existed for "many kings' reigns" before 1823 and that is likely why the eruptions were kept from spreading out across the landscape—because they were confined within a crater, "below the

level of the surrounding plain." Now, until a few years ago, geologists thought otherwise. We believed that the crater, the caldera, had formed in 1790 during the explosions that killed a large number (estimates range from about 80 to 5,405) of Keōua's warriors. So right away you see that if we had been paying attention to the oral traditions and to what Ellis had written, we wouldn't have made this blunder. The oral history goes on to say that occasionally there were red-hot stones flung out in the air. What Ellis's guide is telling us is that multiple explosive eruptions have occurred at Kīlauea for centuries earlier than we had known. For a long time, geologists thought that all the explosive eruptions happened in 1790. In other words, before that time we thought the slate was clean—there had been no explosive activity at Kīlauea since people have lived here. As it turns out, Ellis's visit in 1823 provides very important information.

For a long time, geologists thought that all the explosive eruptions happened in 1790.

A very famous passage in Ellis's writing describes the story of a misadventure between Pele and Kamapua'a. At the time the two of them were on the outs of an off-again/on-again affair. Having his advances rejected, Kamapua'a threw a lot of water onto Pele to try to put out her fires. As a result Pele was almost done for, according to what Ellis was told. But she was able to muster her strength and rose out of the crater, throwing rocks at Kamapua'a and chasing him into the sea.

I think this describes, in beautiful metaphor, an explosive eruption. Do we have geologic evidence for such an eruption? We didn't until about 5 years ago. Geologists are now aware of an explosive eruption that threw rocks from the summit of Kīlauea all the way out to the coastline and that took place after the caldera formed, in perfect harmony with what Ellis was told. I believe it is surely a very good candidate for the explosive eruption that chased Kamapua'a to the sea. When these oral accounts are considered together—Pele's destruction of the forest, Hi'iaka's digging after the body of Lohi'au, the fact that the caldera had existed for a long time before 1823, and the fact that Pele threw rocks to chase Kamapua'a away—we see a picture of the past that we hadn't realized before. It's taken science a long time to catch up, but now we can see not only the real poetry but also some of the meaning of these chants.

So oral traditions tell us very important things, but when exactly did these geologic events take place? Here is where the science can help in the interpretation of the chants. Because scientifically, we're able to date some of these events, and doing so allows us to put together a time frame for what the oral history describes.

The ʻAilāʻau lava flow, which I mentioned earlier, erupted just before the caldera formed in about 1470–1500. How do we know these dates with any precision? Well, we have carbon-14 or radiocarbon dating evidence. We know from the work of my predecessor, Dave Clague, that the large ʻAilāʻau lava flow erupted throughout a 60-year period between about 1410 and 1470 CE. If we take this to be the lava flow that Pele sent to destroy Hiʻiaka's ʻōhiʻa lehua forest, that tells us that Pele was at Kīlauea by the early 1400s or perhaps somewhat earlier. The down dropping of the caldera occurred after the end of the eruption—in fact, for all we know it might have caused the eruption to end—because the outermost part of the caldera slices like a cookie cutter right across a shield edifice that was built at the vent for the ʻAilāʻau lava flow near Thurston lava tube. Today, you can see a profile of this shield on the horizon from Jaggar Museum. This shield was active as late as 1470 and the caldera cuts across it, so the down dropping of the summit happened sometime after 1470. But how do we know how long after? We're very lucky because we find volcanic ash and pumice plastered on the side of the caldera, so this material is younger than the caldera, which, in turn, is younger than the shield that was split. There's a lot of charcoal associated with this ash, and the charcoal dates between about 1470 and 1500 CE.

Here is where the science can help in the interpretation of the chants.

Piecing all this together, we now see that the end of the ʻAilāʻau eruption, the end of the eruption that destroyed Hiʻiaka's forest, and the formation of the caldera occurred within a very short period of time. This is consistent with what the Pele–Hiʻiaka chants say, whereby one event immediately follows the other. If you put all this information into a table with geologic activity in the left column, carbon-14 ages in the center column, and the oral traditions on the right column, the matchup is quite nice (see Table 1).

The geology says that the ʻAilāʻau flow covers much of Puna, north of the east rift zone, and occurred between 1410 and about 1470. My interpretation is that this flow is represented by the burning of the forest in Puna that so angered Hiʻiaka and estranged her from Pele. Then, the collapse of the caldera occurred between 1470 and 1500. This development represents Hiʻiaka's digging after the body of Lohiʻau. And then many explosive eruptions occurred—perhaps when there were lakes in the caldera—and those took place, according to radiocarbon age, between about 1500 and 1790. The large eruption that threw rocks and chased Kamapuaʻa

into the sea took place in the late 1500s or early 1600s based on radiocarbon ages of its deposits. These eruptions culminated in 1790 when so many of Keōua's party were destroyed. My interpretation is that these explosive eruptions are manifestations of Pele's temper and in fact may be the reason that she has acquired such a reputation.

TABLE 1 Correlations of present-day science with ancient oral tradition

Geology	Carbon-14 ages	Oral traditions
ʻAilāʻau lava flow covers much of Puna north of east rift zone	~1410 – 1470 CE	Burning of Puna that angered Hiʻiaka and estranged her from Pele
Collapse of caldera	~1470 – 1500 CE	Hiʻiaka digging for body of Lohiʻau
Many explosive eruptions (when lakes were in caldera?)	~1500 – 1790 CE (big ones in about 1600 and in 1790)	Pele's quarrels with Kamapuaʻa Deaths of about 80 to 5,405 in Keōua's group

In summary, the oral tradition describes volcanic events—the huge lava flow, formation of the caldera, explosive eruptions—that took place over a long period of time, about 400 years on the basis of radiocarbon dates from about 1400 when the ʻAilāʻau eruption began until around 1800. We volcanologists used to think that these same events, except for the ʻAilāʻau flow, had all occurred in 1790, in fact within a few days or weeks in that year, so we had incorrectly telescoped 400 years of time into 1 year. But we were clearly wrong and we only realized this very recently. It's pretty embarrassing that the Pele–Hiʻiaka chants have been translated for all to read for so many years and yet geologists failed to take them into account because we hadn't believed that the chants had any real meaning.

My interpretation is that these explosive eruptions are manifestations of Pele's temper.

To help convince my fellow geologists of the value of the chants, I submitted this essay as a formal paper in a leading volcanologic journal for anyone interested in pursuing this topic further (Swanson, 2008). And to illustrate that the story never ends, I recently recognized supporting evidence for the warning that Hiʻiaka received not to dig so deeply

that water would come in and drown Pele. The water table is about 2,000 feet below the high point on Kīlauea; if Hi'iaka dug deeper, water would appear in the caldera. Deposits of the explosive eruptions that took place within a few years after the caldera formed have features suggesting the caldera was already very deep, possibly 2,000 feet or more; among these features is evidence that water was involved in the eruptions. This finding is completely consistent with Hi'iaka's warning.

It is my hope that there can be some people who go into volcanology...who know Hawaiian and can properly interpret these events.

As I said, I've been working on these interpretations for some time, though I've examined only the Emerson translations. But here I want to make a plea, particularly to students, because I think there are a lot more treasures that are hidden away in the chants, mele (songs), and mo'olelo that have not been interpreted yet in terms of volcanic history, earthquakes, a lot of physical events that have transpired in Hawai'i. And because the oral tradition is so couched in metaphor, beautiful poetic metaphor, it can be very difficult to read beneath this metaphor to understand the real events. So that's why it takes someone who is trained in a particular science and who also knows Hawaiian language and culture to really interpret these many oral traditions properly. It is my hope that there can be some people who go into volcanology, who go into seismology, who know Hawaiian and can properly interpret these events. I had to rely on translations, imperfect as we know translations are. The best approach is to study the oral traditions in their native language. I've given you my ideas based on these translations, but I hope this is only the start and that the final work is going to come about from people who are really well-versed in both the science and the Hawaiian language. Thank you very much.

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About the Author

Don Swanson has studied active volcanoes and old volcanic rocks since 1961. After receiving his doctorate from Johns Hopkins University and spending a year's postdoc in Europe, he joined the U.S. Geological Survey's volcanic studies group. He was at the Hawaiian Volcano Observatory (HVO) in 1968–1971, at Mount St. Helens for 10 years starting before its big eruption in 1980, and, after 6 years at the University of Washington, returned to Hawaiʻi in late 1996 to become director of HVO. He resumed research in late 2004 and is currently studying the past and present explosive eruptions of Kīlauea.