KALUAIKI AND THURSTON LAVA TUBE: AN UNRECOGNIZED JAMEO SYSTEM?

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Thurston Lava Tube is a famous but relatively featureless cave near the crater of Kilauea Volcano on the island of Hawaii. Its native name is Keanakakina. The cave extends downslope about 450 meters from the downslope end of a sizeable closed depression called Kaluaiki, located close to the crater of Kilauea Iki.

Traditionally, Kaluaiki has been considered to be a pit crater which was the source of a flow unit containing Thurston Lava Tube. Recent speleological reconnaissance suggests a different interpretation, namely, that Thurston Lava Tube is merely a small overflow or "squeeze-up" structure related to an unknown, larger lava tube extending down-slope from Kilauea Iki, at greater depth. According to this interpretation, Kaluaiki is a jameo-type sink, probably originating entirely through stopping and collapse. These features are compared with similar features in the Cueva de Los Verdes system of Lanzarote, Canary Islands. Methods of further field investigation are suggested.

Traditional interpretations of many geologic concepts of the island of Hawaii are necessarily undergoing extensive reconsideration, and vulcanospeleological observations and concepts increasingly are seen as providing important clues for deciphering the histories and hazards of basaltic volcanoes (Holcomb, 1980, 1981). In this context, a re-evaluation of Thurston Lava Tube and Kaluaiki — an adjoining so-called pit crater — is especially timely.

Thurston Lava Tube is partially developed as a major tourist attraction and interpretive site of Hawaii Volcanoes National Park. Thus, it is one of the world's most widely known lava tube caves. Also, it is one of the world's most featureless lava tube caves. In this, it contrasts strikingly with other shallow lying lava tube caves farther down the Puna lava flows which have a wealth of prominent speleogenetic features. Downslope from the 300-foot tourist section, Thurston Lava Tube is not so sparse of features. The distal part of the cave contains well-developed flow shelves, a drained bubble chamber, lava speleothems, and other speleogenetic features. It ends at a lava seal in a second bubble chamber, clearly undrained. Yet in general, it has the characteristic appearance of a relatively featureless overflow tube rather than a major throughway conduit.

The main entrance of the cave is near the top of the side wall of a closed depression. Its location is close to the margin of the Kilauea Iki section of the present-day Kilauea caldera-crater complex. This closed depression has the Hawaiian name Kaluaiki. It is at or near the apex of a broad lava dome about 40 m high, virtually on the west rim of Kilauea Iki. In this dome are several other smaller closed depressions.

In the past, Kaluaiki and all the other closed depressions (except the obvious small collapse sink forming the tourist exit from Thurston Lava Tube) generally have been considered to be pit craters, presumably independent of the various vents in

Figure 1. *Thurston Lava Tube is a well-known tourist attraction.*

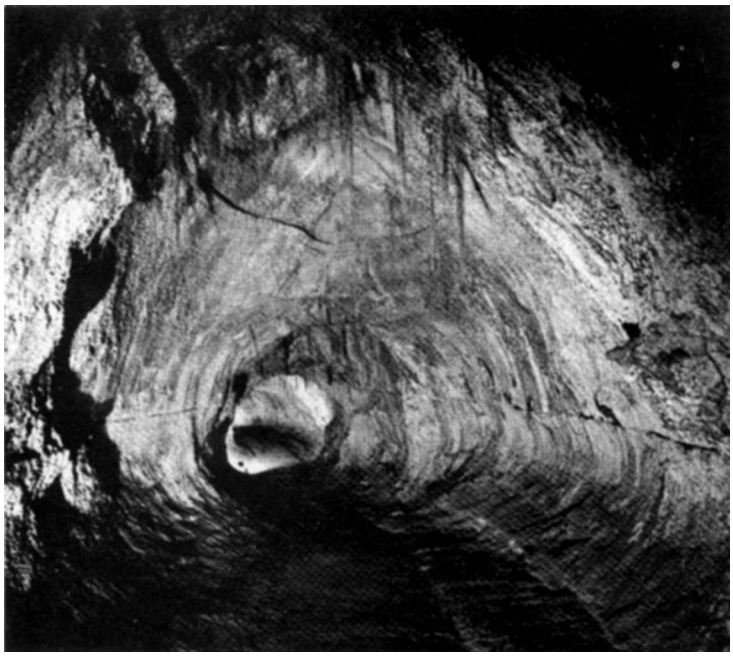


Figure 2. Numerous commercial postcards show the relatively featureless nature of the developed section of Thurston Lava Tube.

Kilauea Iki and the main caldera of Kilauea even though virtually on its rim.

To date, no one seems to have given much consideration to this lava dome despite its prominence on the topographic map. I am unaware that it has received any name. Tentatively, I will refer to it as the Kakina Dome, from the original name of Thurston Lava Tube, Keana Kakina (Powers 1920). The presence of this dome may be additional evidence that one or more pit craters actually does exist here, but at least one other alternative explanation exists. In any event, it must be considered in any speleogenetic analysis of Thurston Lava Tube.

Presently, this dome is classified by Holcomb (1980) as "5Dps" — part of a large lava shield 350-500 years old, with a predominance of tube-fed pahoehoe and minor proportions of surface-fed pahoehoe and aa, but morphologically surface-fed pahoehoe. In addition, he inferred a buried crater at the approximate location of Kaluaiki — structures about 750 years old. But these structures were overtopped about 350 years ago by a major flow sequence from Kilauea which formed extensive flows in Puna with a lesser southward extension. This was followed by extensive subsidence in the caldera and a complex subsequent history including the

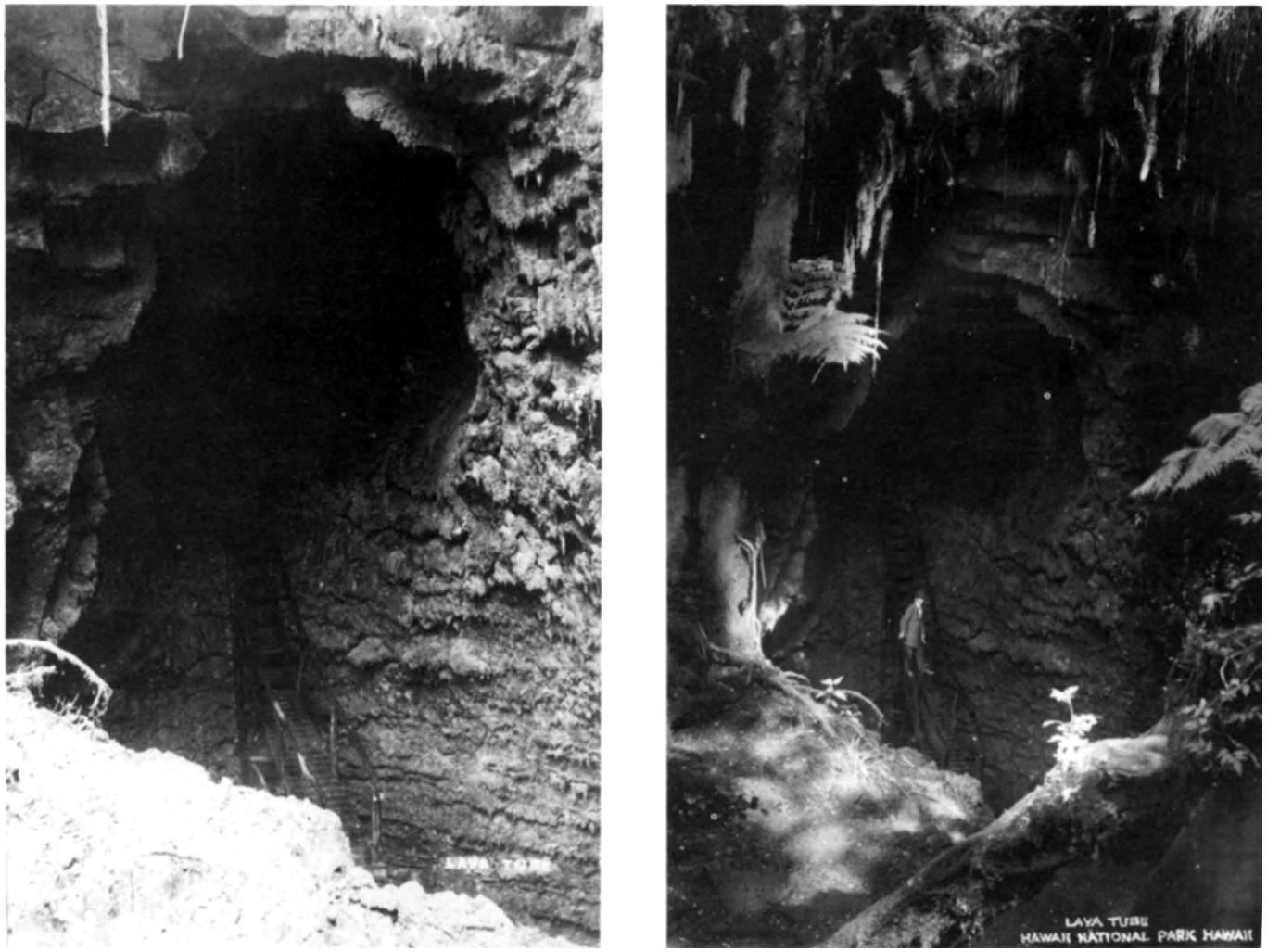


Figure 3. The date of the photographs used on these photo postcards is not known. They were taken before vegetation became lush in the entrance sink and before high-technology trail and footbridge development further obscured the relationship of the cave entrance to the sink.

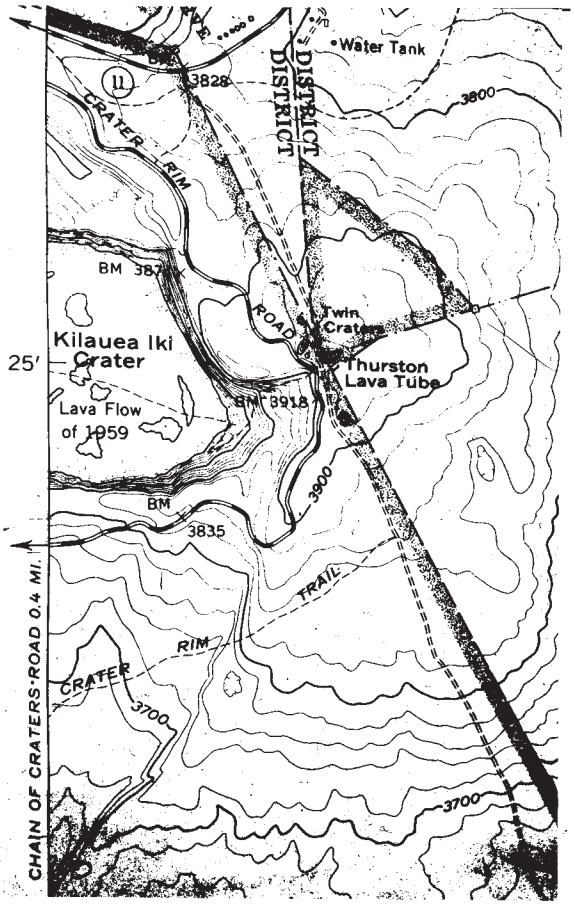


Figure 4. Topography of the vicinity of Thurston Lava Tube. Map by U. S. Geological Survey.

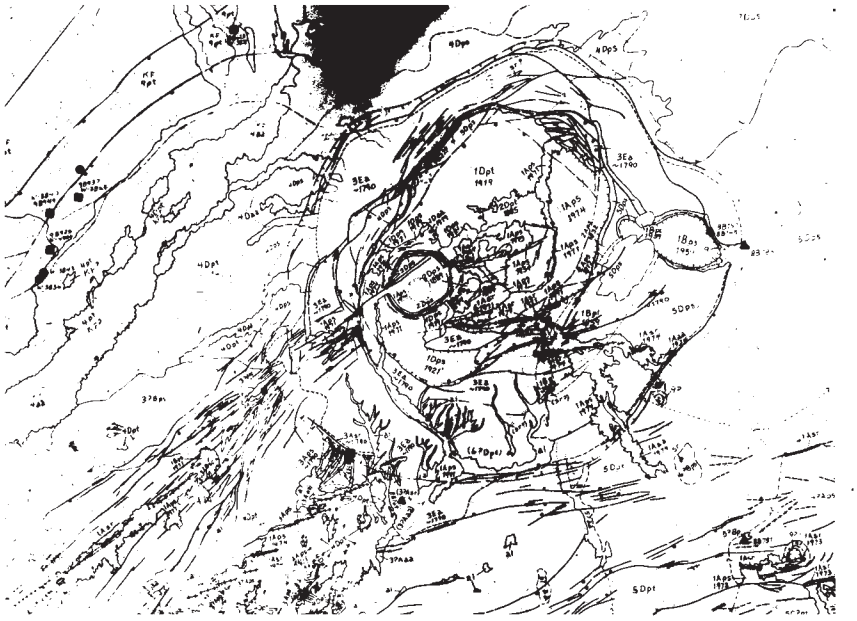


Figure 5. Holcomb's map of Kilauea volcano and vicinity. The location of Thurston Lava Tube is easily determined by its position just east of Kilauea Iki near right

development of Kilauea Iki about 100 years later.

The original map of Thurston Lava Tube (Powers 1920) depicts Kaluaiki as almost perfectly circular, as in the case of such nearby pit craters as Devil's Throat. Actually, Kaluaiki is elongate and slightly sinuous. Its walls are nearly vertical. The floor consists of irregular piles of rubble, covered with dense vegetation which obscures many details.

At both ends of this short, trench-like depression, the rubbly floor slopes downward, not upward as is characteristic of pit craters. At the end of the trench beneath the entrance of Thurston Lava Tube, the rubble slopes down to the rock wall of the depression. At the other end, observation is hindered by vegetation, but I found that it slopes into a cavity of some sort, or at least into an overhanging space. The slope is unstable and at the time of my only opportunity for observation, I had no gear nor any backup crew. However, it appears that this alcove or cave leads back toward Kilauea, and that it is below a partial breach in the rim of the depression — a low point used by the tourist trail.

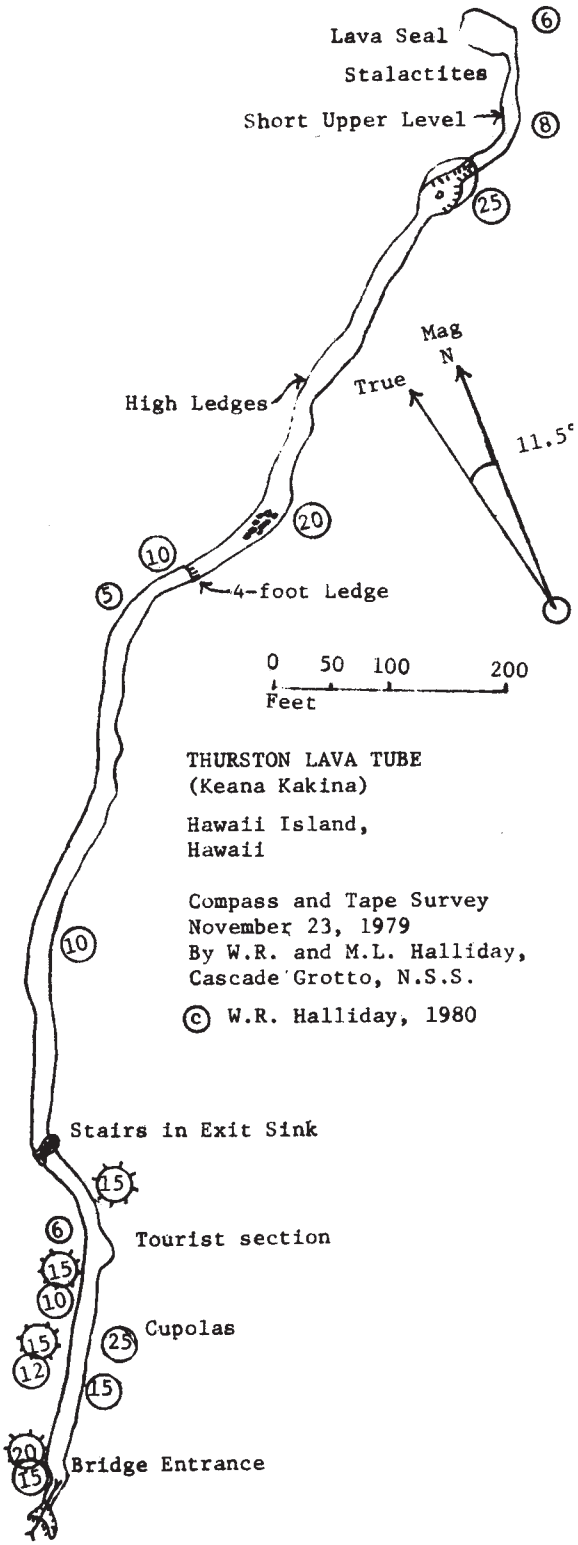
This low point in the rim of the trench continues westward a few dozen meters before becoming lost in the slopes of Kilauea Iki. It appeared to me to be approximately at the level one would expect if Thurston Lava Tube were to be collapsed. The lower grotto or cave is several meters lower. I did not get close enough to determine whether it has any features of an intact or a stopped lava tube. It appears, however, that studies could easily determine whether Kaluaiki is a trench segment of a lava tube system with at least two levels of unroofing. The uppermost level would be a shallow, almost imperceptible trench just mentioned. The lower level (or possibly an intermediate level, with one or more additional levels still lower) would be represented at the west end of the trench by the grotto or cave several meters lower than the present low point in the rim. At the other end of the trench, it would be represented by an undiscovered cavernous passage, probably stacked beneath Thurston Lava Tube.

Multi-level lava tube trenches and caves are fairly common in the United States. Perhaps the most dramatic example of multi-level trench segments is the Big Trench Cave System in Washington State (Halliday 1963). Here, abrupt change in the level of the floor of the trench clearly demonstrate collapse of various segments of a stacked multi-level lava tube cave system, of which only small portions now can be entered. In the same area of Washington State, a shallow inconspicuous trench much like that at the west end of Kaluaiki extends upslope from the entrance of Dynamited Cave, representing an unroofed segment of another stacked multi-level lava tube cave system.

Outside the United States, an especially notable stacked lava tube cave system is located on the island of Lanzarote in the Canary Islands — the Cueva de Los Verdes System. Deep, steep-walled collapse sinks along the course of this system are known as jameos. As in the case of the Big Trench Cave System, some of these jameos vary abruptly in depth. Much more of this system's caves can be entered and studied, however. Its levels occur at depths of approximately 5 to 30 meters. The lower levels are throughway passages; the upper levels are smaller and probably never were fully integrated longitudinally (Halliday 1972).

Those jameos which extend all the way down to the levels of the large, deep-lying throughway passages characteristically have steep walls and a central rubble accumulation which slopes downward at each end, as in Kaluaiki. In some cases, the cavernous passage can be entered by descending this rubble slope. In other places, the rubble blocks the cave and it must be entered at another jameo.

Although on a much smaller scale than in some of the jameos of the Cueva de Los Verdes System, the Kaluaiki-Thurston Lava Tube complex has many of the characteristics of a jameo system. If a Jameo-type system in fact does exist here, Thurston Lava Tube is a minor disconnected upper level of a larger throughway lava tube passage or passages, quite possibly stacked precisely beneath Thurston Lava Tube.



Such stacking does occur in Hawaiian lavas. Several km downslope from Thurston Lava Tube, Dock Ballou's Cave is a disconnected upper level, stacked above Kazumura Cave.

Other so-called pit craters nearby also may be jameos or other types of collapse sinks, and the topography suggests the possibility of access to undiscovered feeder tubes fanning out approximately 180° from the Kakina Dome.

Figure 7. View of Jameo de la Gente, Cueva de Los Verdes System, Lanzarote, Canary Islands. This jameo is a compound collapse sink in a unitary system with stacked levels as described in Halliday (1976).

If such a system or systems exist here, undiscovered, the entire Kakina Dome may have developed through hydrostatic overflow when one or more of the distal throughway conduits became obstructed during the major Puna flows about 350 years ago. In that case, unfortunately, a principal conduit would not necessarily be stacked beneath Thurston Lava Tube and discovery and access would be considerably more difficult.

In any event, however, detailed study of Kaluaiki plus well-planned excavation and/or drilling around the so-called pit craters of the Kakina Dome seem likely to yield important clues in the deciphering of the history of Kilauea and the dynamics of its basaltic lava flows.

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