

III.—*Report to Prof. W. D. Alexander, of Mr. FRANK S. DODGE, Assistant Surveyor and Draughtsman, made Nov. 15, on the Survey of Kilauea in the last week of September and the first of October, 1886. With Plate II.*

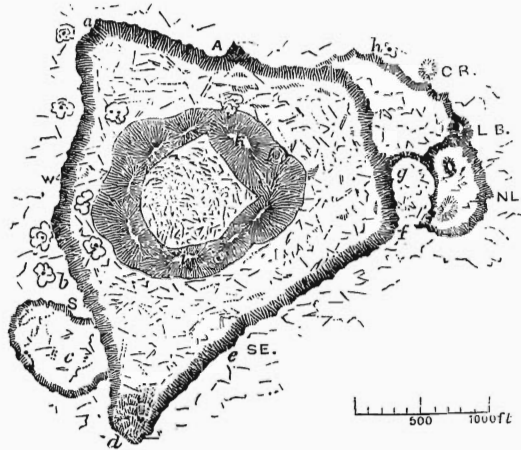
I herewith submit the following report of my visit to Kilauea, Hawaii, for the purpose of surveying the crater and vicinity, under the direction of the Bureau of Surveying. . . .

Leaving Hilo by the steamer Kinau, on the evening of Sept. 23d, '86, I landed at Keauhou early the following morning, and reached the Volcano House shortly before noon. The weather being favorable for surveying, a part of the afternoon was devoted to triangulation for the purpose of determining what changes had taken place since the last survey was made by Mr. J. S. Emerson, in March and April. From the triangulation I concluded that no material change had occurred in the general outline of the sunken district, covering the sites of Halema'uma'u and the so-called "New Lake."

At the very first opportunity I took careful observations to ascertain the height of two hills which had formed in the

Halema'uma'u pit, and later observations taken from the same station and under similar circumstances, showed that the hills were rising at the rate of nearly one foot per day. . . .

Having exhausted my supply of flags, I continued my walk along the eastern side, examining the ground carefully for proper locations for new stations, and visiting the very interesting small craters of Kilauea Iki and Keanakakoi. The former is about 3300 feet in length from east to west, and 2800 feet from north to south, with regularly sloping walls, completely covered with a dense growth of small Ohia trees, ferns, etc. In March last, at the time of the disturbance in Kilauea, a landslide occurred on the northeast side of Kilauea Iki, leaving the face of the cliff bare from top to bottom, and showing all the strata distinctly. The depth of this crater was found to be 749 feet from the point at the end of the path from the Volcano House, or 867 feet below the Volcano House veranda—which has been taken as a datum for all elevations connected with Kilauea.



Map of Halema'uma'u; from the map of Kilauea by Mr. Dodge, of which Plate II is a reduced copy. N. L., New Lake; L. B., Little Beggar; C. R., Central Rock. A, W, S, SE positions Halema'uma'u A, W, S, SE of text. Level below that of the datum mark at the Volcano House at *a*, 335.2; *b*, 350.4; *c*, 365; *d*, 344.5; *e*, 331.8; *f*, 337.4; *g*, 334; *h*, 321.3; *i*, 360; *k*, 329.5 (*i* and *k* on the cone).

Keanakakoi is 1600 feet in length and 1100 in width and approximately 400 feet in depth, with almost vertical walls, bare of vegetation, and a very smooth floor of pahoehoe.

From careful study of Mr. Emerson's map, and from observations made during five visits to the locality, I conclude that there has been no change in the "New Lake" depression, or in the "Bridge" between that and Halema'uma'u, and very little

change in the main walls of the larger pit. I think a small portion of the wall near the northeast corner has fallen in quite recently, covering a part of the new floor of pahoe-hoe with great masses of irregularly broken rock. As far as I was able to examine it, I could discover no other change in the outline. But since the survey of March-April, there have been great and important changes going on in the pit of Halema'uma'u, the present scene of activity in Kilauea. The approximate center of the sunken tract is now occupied by an irregular pit or "lake"—surrounded by a range of hills, which were carefully located, but which prevented me from obtaining the exact size of the "lake." This range of hills, or ridge, is nearly circular in form (see preceding figure), and the distance from summit to summit across the pit from northeast to southwest is 1080 feet, from east to west 1100 feet and 930 feet from northwest to southeast. I was unable to learn the condition of the central pit from close personal observation, but from the flashes of light seen over it at night, I judged that there was some action, and the native guide, who had lately visited it, informed me that there was "plenty fire."

In various places on the sides of the encircling hills, or ridge, which are formed of fine, loose material and angular blocks of stone, there were many openings which emitted dense, bluish white smoke, and steam under considerable pressure. The mouths of the openings were coated with deposits of sulphur and many of them glowed with red heat at night. The space between the base of these hills and the foot of the pali or wall, on all sides, was being filled gradually by small flows of pahoe-hoe from vents all over the floor of the pit. Around the base of the hills and at various points near the pali, were many small cones and "blow-holes" which sent up quantities of smoke and steam. In the extreme eastern portion of the pit were immense blocks of lava piled up in confusion; and parts of the eastern wall that had fallen in at the time of the great collapse, but the remainder of the floor was nearly level and slowly rising.

Outside the walls of the pit, in the Kilauea crater, I found only three or four localities where there were signs of any great heat below the surface. The first of these was in a small crack a few hundred feet west of Central Rock, and not far from the edge of the cliff—where the rock was red hot within two feet of the surface, and I was told that it had been so for many months. At the eastern edge of the sunken area and directly north of New Lake were large openings to a tunnel that began near the "Little Beggar," and extended several hundred feet in a general northeast direction, and considerable heat was given out from cracks in its roof; and the same was the case in a small area directly south of the peninsula, between New Lake and Halema'uma'u.

At various points on the southeast half of Kilauea, and on the face of the cliffs in that section, small jets of steam were seen at times. The steam cracks near the Volcano House, and on the sandy plain north of the crater, seemed to be in their normal condition.

Almost the entire floor of Kilauea is formed of pahoehoe, that had flowed out from the region of the lakes late in 1885, or early in the present year, covering all traces of the old Black Ledge and other features shown on earlier maps. The slope of the pahoehoe floor is quite regular in every direction, the descent from Central Rock to the foot of Lookout Hill, where the trail strikes the pahoehoe, being 163 feet—135 feet to the base of Kaniakoha, 125 feet to the foot of Kamohoalii, 105 feet to the foot of Uwekahuna pali, 75 feet to the base of Pali Iki, and approximately 80 feet to the foot of the pali* on the southeast side. Near Uwekahuna is a large patch of *Aa* (surface made of large slabs or masses of rough lavas), a few acres in extent, which I think is the only lava of that nature in the crater.

In the southern end of the crater is a long point or spit of gravel and bowlders, extending from the southeast wall about four-fifths of a mile due west, bounded on the south side by an abrupt cliff, and sloping gradually to the north and west, until it is covered up by the pahoehoe flow of this year. This same flow has also encroached upon the south bluffs and covered the older formation at the head of the bay near Holoholokolea, so that at the extreme south angle in the bluffs, a further rise of forty feet, more or less, would cause Kilauea to outflow toward the sea. At the extreme southwest corner the pali has been entirely covered by the hills of pumice which form the southern boundary.

The summits of these low, rounded hills are about 1,000 feet back from the edge of the crater, and thence they slope gently to the south and southwest, and are traversed by numerous large cracks, extending in the latter direction. At the eastern end of the aforesaid gravel point are many deep cracks parallel to the general direction of the main wall of the crater on that side, and outside the walls are many more of the same nature.

I have attempted to describe the condition of the crater of Kilauea as I found it early in October; and from observations then made, I think that in the course of time, perhaps in a few months, the great central pit will fill up and overflow, as it did prior to the 6th of March, '86, and that the center of activity will continue to be in the present locality of Halema'u-ma'u.

* The word *pali* means a precipice.

