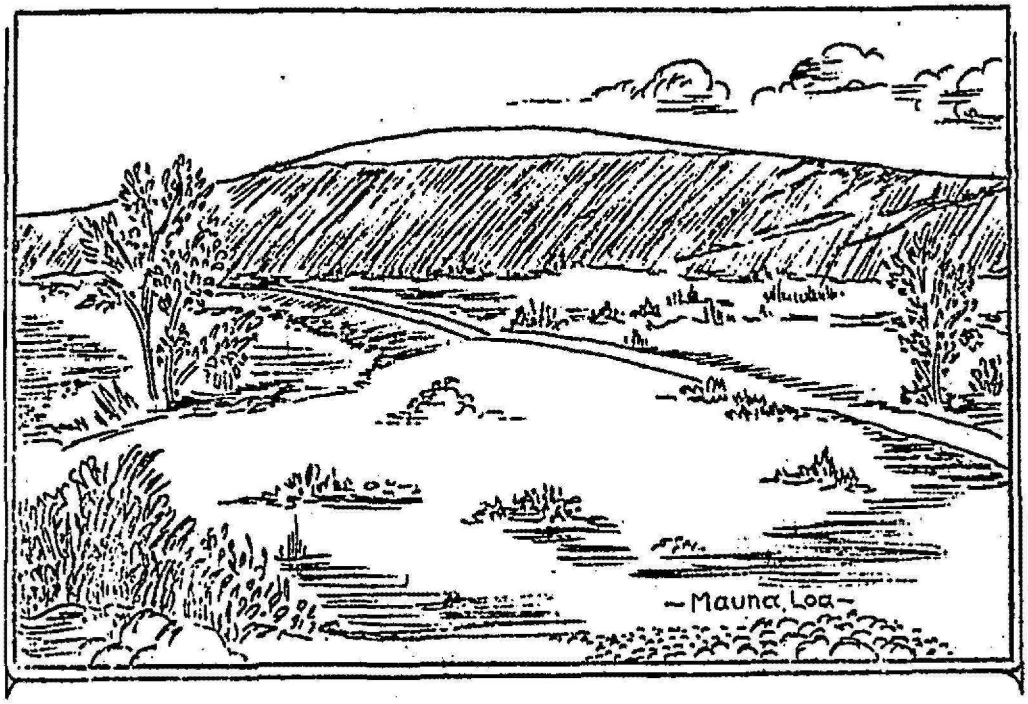
NATURE NOTES



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HAWAII NATIONAL PARK
NATURE NOTES

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E.P.Leavitt, Superintendent John E. Doerr, Jr., Park Naturalist

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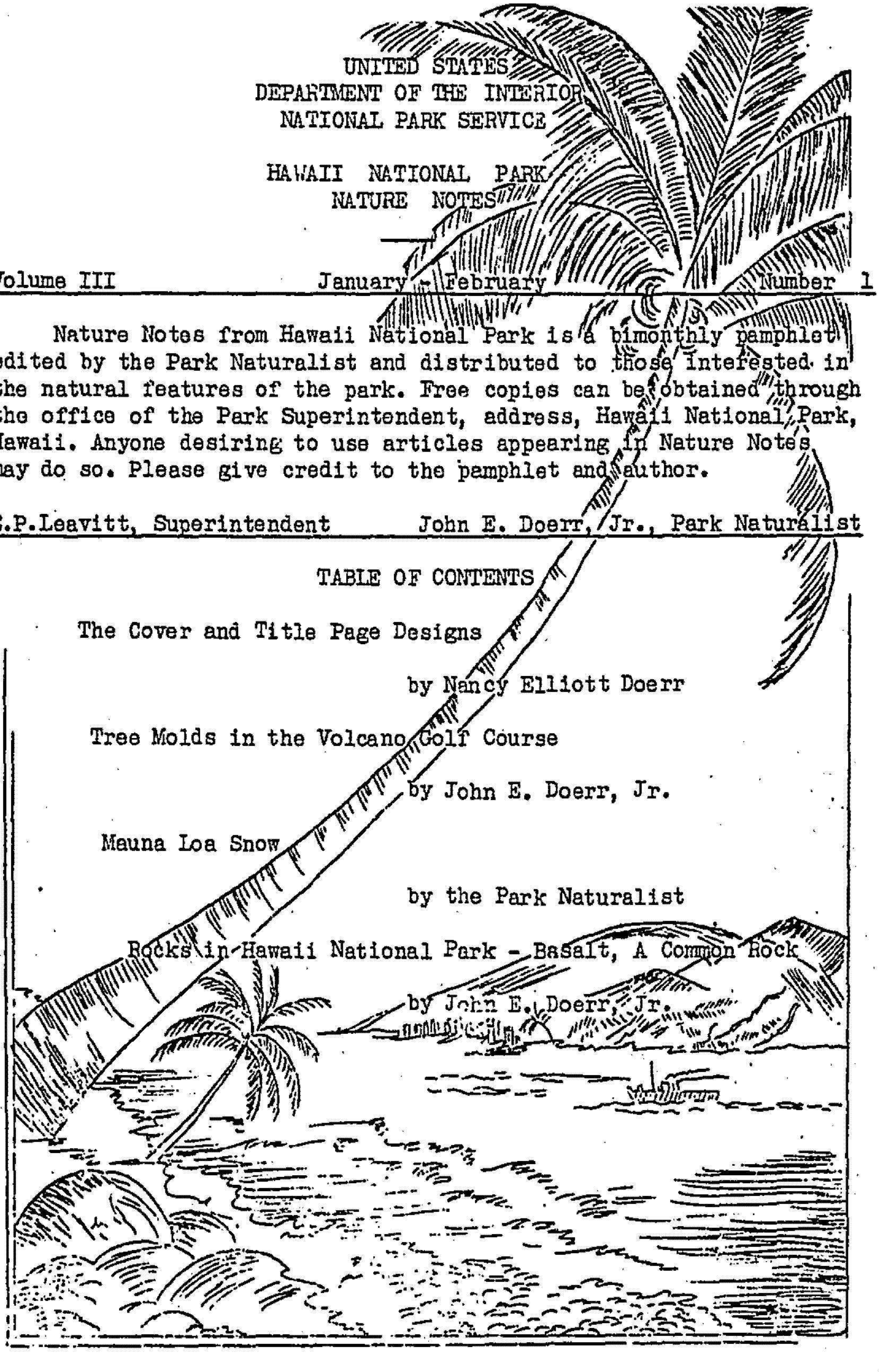


TREE MOLDS IN THE VOLCANO GOLF COURSE

A very ancient lava flow from Kilauea volcano had an important part in providing a natural hazard for those golfers who over-drive the fourth green of the Volcano Golf Course in Hawaii National Park. For many years, in fact for many centuries nature has maintained a natural hazard in the vicinity of the fourth green. It would seem that nature has long maintained hazards in that locality in anticipation of the approach of the golfing era.

Golfers change their stance and nature changes her hazards. What would have been - hundreds, perhaps thousands of years ago - a hazard of trees is to-day a hazard of holes, holes in a grass-covered lava flow, holes where giant Hawaiian trees once grew. Nowhere in the vicinity of Kilauea is the periodic dominance of volcanic formations over plant growth, and vice versa, so strikingly illustrated as in the area of tree molds in the Volcano Golf Course.

It is not difficult to visualize the building of a symmetrical volcanic dome such as Kilauea. Tongues of lava pouring over the rim of the summit crater have formed as layers of rock on the slopes of the dome. In terms of the entire life of the volcano the symmetry of the dome has been maintained by a uniform distribution of flows on the slopes. During any particular portion of the life of the volcano all the flows of lava have no doubt occurred on one side; thus, for a period of time a particular sector of the dome received all the flows. During periods when one sector was receiving all the flows the other sectors were subject to weathering and perhaps the deposition of layers of volcanic ash. Climatic conditions being favorable, vegetation migrated into and covered the inactive sectors of the dome. At present the north and east sloping sectors of the Kilauea dome are covered with a dense vegetation. In the past these sectors now covered with luxuriant fern forests received the lava flows and were as devoid of vegetation as the Kau sector to the south and southwest of the crater is to-day.

Prior to the most recent yet very ancient flow on the northwest slope of Kilauea, that slope or sector supported - in spots at least - a very heavy growth of trees. The area of tree molds in the golf course is evidence of the ancient trees of Hawaii. The molds are evidence that vegetation dominated the northern slopes of Kilauea in the distant past just as it does to-day. The two periods of dominance of vegetation are separated by a great lava flow. No name has been applied to the flow. Its date is beyond any record of man. The extent of the flow can not be determined; other flows and the migration of vegetation have overlapped and obliterated its margins.

Realizing how historic flows from Kilauea and Mauna Loa have made winding swaths of volcanic desolation through existing forests, it is not difficult to visualize the last flow on the northwest slope of Kilauea creeping through, surrounding and burning out the trees of an ancient forest, leaving molds where once trees grew.

To those who have never examined a tree mold in a lava flow, it may seem incredible that the heat of volcanic activity does not totally destroy all evidence of the vegetation in the pathway of a flow. Hot, viscous lava creeping through a forest surrounds the indivdual trees. Moisture in the bark and the sap chills the lava in contact with the trees. Immediately a crust of solidified lava several inches thick forms around the portion of the tree submerged by the flow. If the flow is thick, submerging the trees to a depth of several feet, even the largest trees are burned out before the entire mass of the flow has completely solidified, in which case the trees leave a mold of their submerged trunks as evidence of their former existence. Where a thin flow, one to two feet in thickness, has moved through a forest, trees a few inches in diameter are of course killed and charred but not completely burned out. The charred remains of small trees can be seen in the tree molds formed in the 1923 flow near Makaopuhi Crater.

The tree molds in the Volcano Golf Course show no evidence of pushing over by the advance of the flow. Trees rooted in very shallow soil, trees partially decayed at their bases, and trees growing on slopes steep enough to permit an unusually rapid advance of a flow have no doubt been pushed over, resulting in the molds being inclined in the direction of the movement of the flow. The tree molds near the shelter at Hilina Pali show evidence of trees which were pushed over by a flow moving rapidly down a steep slope.

The sketch map on page 7 shows the location of the tree molds in the Volcano Golf Course. The chart on page 6 gives a brief description of each mold in the area. Each mold contributes something to the picture of the ancient forest and the story of its destruction. The most interesting mold in the area is described in some detail below.

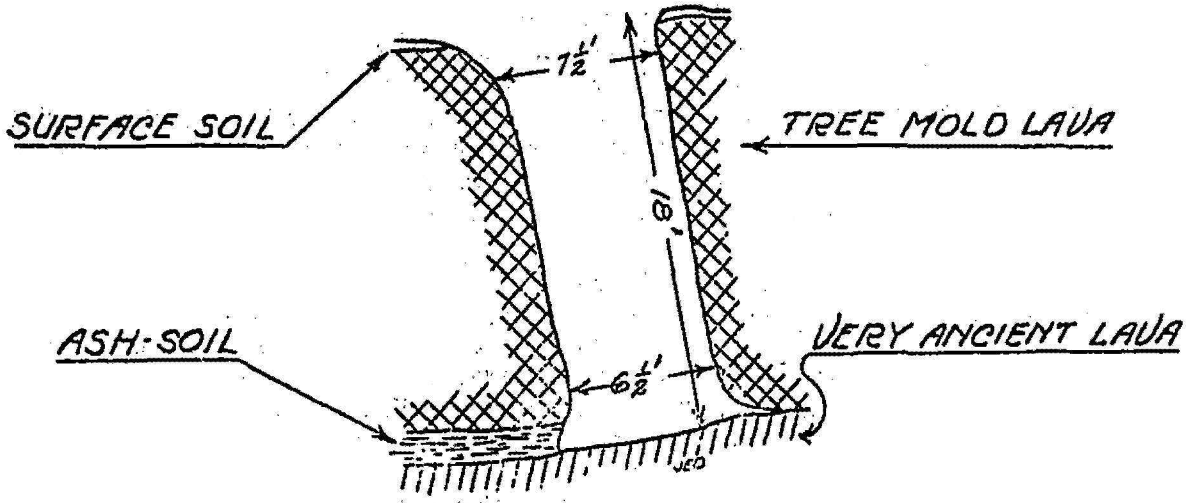


FIGURE 1
CROSS SECTION ENE TO WSW OF TREE MOLD No. 19

Large size is not necessarily the most interesting feature of the scores of tree molds in Hawaii National Park. In several places the smaller molds tell the more interesting story; however, in the Volcano Golf Course the largest of the twenty-one tree molds (No. 19 on the sketch map page 7) is by far the most interesting. It has a maximum depth of 18 feet. Three feet above the bottom the mold is circular and has a diameter of $6\frac{1}{2}$ feet. The opening at the top is oval-shaped, the maximum diameter being $7\frac{1}{2}$ feet, the minimum 4 feet. The shape of the mold, particularly the variation in diameter, indicates that the lava submerged the entire trunk and part of the lowest branch of the tree. The mold is inclined 10 degrees from the vertical as indicated in Figure 1, page 4. There is no indication that the inclination is due to any shove by advancing lava.

This large mold is interesting not only bevause of its great depth and large diameter but also because a cross section of the soil in which the ancient tree grew, and the surface on which the soil rests can be seen at the bottom of the mold. This mold was made around a tree - probably an Acacia koa - which grew on the gentle slope of a pahoehoe (smooth) lava knoll. The knoll was covered by a few inches to $2\frac{1}{2}$ feet of stratified volcanic ash. The brownish red, stratified ash-soil exposed at the bottom of the mold rests on a slightly weathered pahoehoe surface. Above the ash-soil is the flow which made the tree molds. Water seeping through from the present surface has removed part of the buried ash-soil layer, resulting in a low cavity 30 to 35 feet long and 8 to 10 feet wide which extends horizontally from the bottom of the mold. The roof of the cavity - a ropy pahoehoe surface - is the underneath side of the mold flow. The floor of the cavity is the upper surface of a very ancient flow. The stratified ash-soil is exposed in the walls of the cavity. In places this stratification has been disturbed.

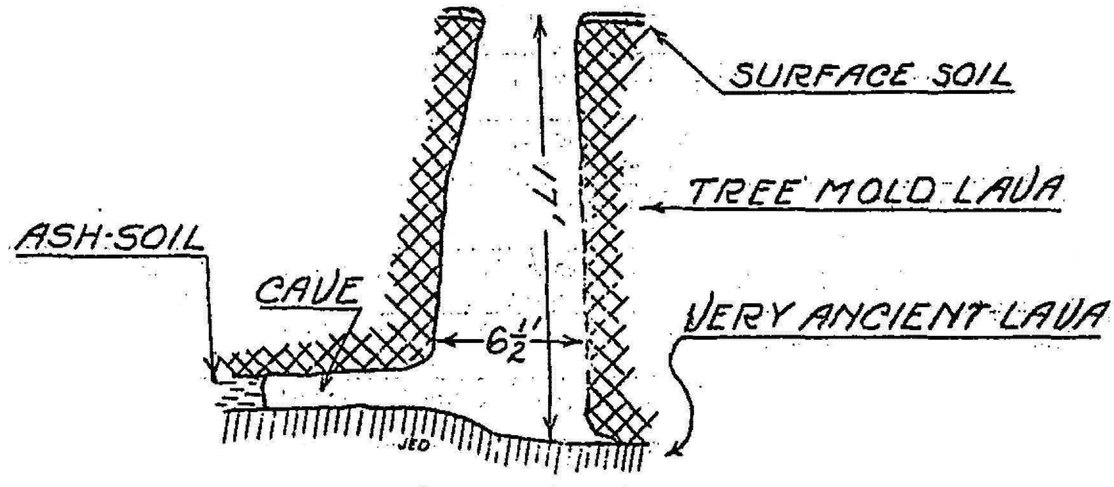
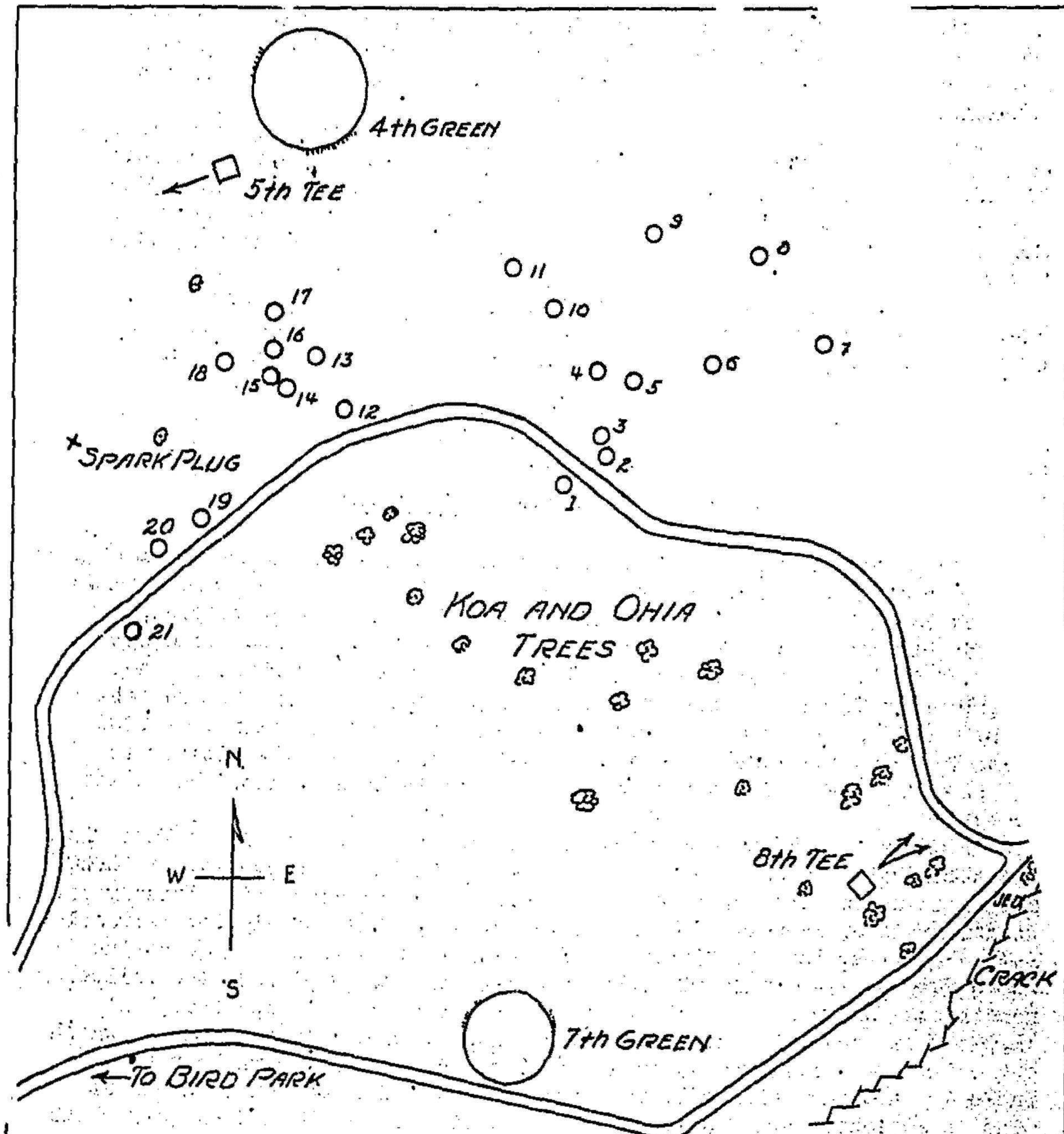


FIGURE 2
CROSS SECTION NNW TO SSE OF TREE MOLD № 19

DESCRIPTION OF THE VOLCANO GOLF COURSE
TREE MOLDS

No.	Depth	Diameter	Remarks
1	8½'	2½ - 3½'	Entire trunk and part of lower branch submerged, inside of mold very smooth.
2	11'	4 - 4½'	Second largest mold in the group, inclined 18 degrees to NE.
3	8½'	7"	In low mound with No.2, inclined to NW. 7" curb around top of mold.
4	13'	2½ - 3'	Vertical, smooth sides, 6 to 10" curb around top of mold, curb 7" above ground, evidence of branch
5	8'	7"	In low mound
6	11'	3½ - 4'	Distinctly circular and vertical, smooth ropy lava on inside of mold, 8" curb around top
7	9'	1'	In low mound, inclined to the NE, diameter uniform for the entire depth
8	?	7"	Curb 4 to 6" thick marks the location of this mold which is completely filled with debris
9	4'	14"	In low mound, inclined to the SW
10	13'	3 - 4½'	Vertical, smooth ropy sides, oval shape at top indicates branching trunk, distinct curb 10"thic
11	2'	½ - 1'	Oval shape, in low mound, curb around top
12	21'*	1'	Deepest mold, uniform diameter, enlargement at the bottom indicates ash-soil layer
13	4'	1'	In low mound, slightly inclined to the NE
14	?	1'	Completely filled with debris, partial curb remains, in low mound with No. 15
15	2'	5"	Near No. 14, it is possible that this mold is a branch of No. 14
16	6'	7"	In low mound, inclined to the SW
17	7'	8"	In low mound, this mold shows evidence of a branching trunk
18	9'	7"	In low mound
19	18'*	4 - 7'	Largest mold in group, inclined to NE, ash-soil layer at bottom, see detailed description
20	8'	2 - 3'	Oval shape, wall broken down
21	7'	2½'	Inclined to SW, wall partially broken down

In the above description the number refers to the location of the molds on the sketch map on the opposite page.
*With the exception of No. 12 and No. 19 all molds are completely or partially filled with debris hence actual depth could not be determined.



Sketch Map of

TREE MOLDS IN VOLCANO GOLF COURSE

Scale
1 in. = 100 ft.

The small areas in which the stratification has been disturbed indicate the location of roots burned out by the flow of lava. Figure 2 page 5 shows another cross section of tree mold No. 19 and the cavity in the ash-soil.

As one crawls into the low cavity covered by 18 feet of solid rock, many questions come to mind. What are the dates of the flows which form the floor and roof of the cavity? Is the bed of ash-soil from an explosion of Kilauea, Mauna Loa or Mauna Kea? Did human beings ever seek shade and shelter beneath the giant tree? How high was the tree and what view could be obtained from its topmost branches? How old was the tree?

Only Pele can answer those questions. Not the least important question that comes to ones mind while reclining in the cool darkness of the cavity is, will the roof cave in? Pele can answer that also.

John E. Doerr, Jr.
Park Naturalist

MAUNA LOA SNOW

The first snow visible from Kilauea in 1932 feel on Mauna Loa during the night of January 17. From that date until June 2 blankets and patches of snow could be seen on Mauna Loa, Hawaii's highest active volcano, the top of which is 13,680 feet above sea level.* Patches of snow no doubt remained in the summit crater, and in areas near the top which are not visible from Kilauea, until after June 2. On January 18 and 29 and February 8 and 9, 1932 snow-line was at an elevation of approximately 9000 feet. That was the lowest recorded snow-line of the year. A visitor to the summit on March 4 reported 3 feet of snow in Mokuaweoweo, the summit crater.

From June 2, 1932 to January 2, 1933 no snow was visible on Mauna Loa. On the morning of January 2, 1933 snow-line was at an elevation of 10,500 feet. Patches of that snow remained visible from Kilauea until January 11. On the night of January 30 Park Naturalist G.C. Ruhle, of Glacier National Park, Ranger V. Lowery, "Levi" and I encountered an inch of snow at the Puu Ulaula shelter at 10,000 feet on Mauna Loa. By 10 o'clock the following morning the snow in the vicinity of the shelter had melted, although at 11,000 feet Ranger Lowery found enough show to make a large snow-man which for a time was given the honor of wearing a Ranger hat. Park Naturalist Ruhle did not say definitely that the snow on Mauna Loa reminded him of Glacier National Park; however, he was convinced that Hawaii can offer the visitor a wide variety of climate.

On the morning of February 2 of this year a heavy blanket of snow covered Mauna Loa, snow-line being at 9000 feet. At the end of the month patches of this snow are still visible from Kilauea. As this issue of Nature Notes goes to "press" thunder can be heard in the direction of Mauna Loa. According to "Old-Timers" in Hawaii, thunder in the mountains is a sign of snow.

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* From Uwekahuna Bluff, on the west rim of Kilauea, the top of the Mauna Loa dome above 12,000 feet is not visible.

ROCKS IN HAWAII NATIONAL PARK

BASALT - A COMMON ROCK

Nature's products are recognized and identified by their names. A name may bring to mind some association with a natutal feature. A name - a single word - may identify an object in terms of the effect the object has had on one or more of the five senses. Ice, for example, is one of nature's products which appeals to the sense of touch. Ice needs no explanation as to its characteristics, its uses, its composition or method of formation; the word conveys a common meaning and tells a story of the natural processes by which it is formed.

Too frequently the scientific names of nature's products discourage one beginning the study of a natural science. The names may not be as common as ice, yet with surprisingly little effort they become familiar and one soon finds ones vocabulary of scientific names increasing. Each new name acquired is a pass-key to nature's secrets. Names that at first appear difficult to master soon become symbols of a history of natural events. Basalt - derived from the Latin word "Basaltes" - is such a word.

Basalt is the universally recognized name of a type of volcanic rock. The name conveys a definite meaning. It tells the story of a series of events which took place while the material making up the rock was changing from a hot liquid to a cold solid. The series of events or history is essentially the same for basalt formed in Hawaii or Iceland, India or Idaho. The name implies that a basalt rock, regardless of where it occurs on the surface of the earth, is strikingly similar to, and has gone through the same processes of formation as each and every basalt. The name indicates that all basalts are very similar in chemical composition. The similarity suggests that the material of which basaltic rocks are composed has had its origin at essentially the same depth within the earth. The universal aphanitic texture (individual grains of a rock so small that they can not be distinguished with the naked eye) is evidence that all basalt crystallizes at essentially the same speed. Such a texture indicates rapid crystallization at or near the surface of the earth, hence they are called extrusive rocks as compared with intrusive rocks which have a coarse texture(large grains) and crystallize slowly at great depths below the surface of the earth.

All extruded rocks with aphanitic texture are not basalt but practically all basalt forms as extrusions and has aphanitic texture. Basalts, in addition to having a common mode of occurrence (extrusive) and texture, are strikingly similar in chemical composition. The name implies a chemical composition which may vary only within certain narrow limits. Chemically basalt is classified as basic, that is, it has comparatively small amounts of the acid element silicon or silica, and large amounts of the iron-magnesian elements. The following table shows the chemical composition of a number of basalts from different parts of the world.*

TABLE

Oxide	Chemical Symbol	K	D	O	T
Silica	SiO_2	49.9	50.6	50.0	47.5
Alumina	Al_2O_3	12.7	13.6	13.7	13.9
Ferric Oxide (Iron)	Fe_2O_3	1.45	3.2	2.4	3.6
Ferrous Oxide (Iron)	FeO	10.0	9.9	11.6	9.4
Magnesia	MgO	9.0	5.5	4.7	6.8
Lime	CaO	10.5	9.5	8.2	9.8
Soda	Na_2O	2.0	2.6	2.9	2.9
Potash	K_2O	.45	.7	1.3	1.0
Titanium Oxide	TiO_2	2.7	1.9	2.8	2.7
Phosphorus Oxide	P_2O_5	.25	.4	.8	.4
Manganese Oxide	MnO	.12	.16	.24	.22

K. Average of 19 analyses of Kilauea Lavas. 13 from H.S.Washington, Petrology of Hawaiian Lavas.(Amer. Jour.Sci.)
D. Average of 11 analyses of Deccan(Western India) lava. H.S.Washington, Deccan Traps and Other Plateau Basalts. (Geol. Soc. Amer.)
O. Average of 6 analyses of Oregon basalts, H.S.Washington, Deccan Traps, etc. (Geol. Soc. Amer.)
T. Average of 33 Thulean (Iceland-Britain-Greenland) basalts, H.S. Washington, Deccan Traps, etc. (Geol. Soc. Amer.)

It is not necessary for one to be a student of chemistry or have a chemical analysis made in order to determine a basalt as such. The color of basaltic rocks gives some indication as to their chemical composition. Basalts are generally dark, dark gray, dark green, brown or black, hence their dull dark colors and aphanitic texture appeals to the sense of sight.

Basalt is the name of an extrusive, chemically basic, dark colored rock composed of an aggregate of minerals each grain of which is too small to be distinguished by the naked eye. Basalt tells a story of the deep

* Powers, H. A., The chemical analyses of Kilauea lavas, The Volcano Letter, No. 362, Hawaiian Volcano Observatory, Dec. 3, 1931.

seated origin of molten material (magma) composed of relatively low amounts of acid elements and high amounts of ferro-magnesian or basic elements. The word implies the rise of the molten mass through the crust of the earth, its extrusion as a liquid on the surface of the earth, and its rapid crystallization to a solid rock.

Basalt is a common rock not only in Hawaii but in many other parts of the world. The famous Columbia River Lava Plateau, covering parts of Washington, Oregon, Idaho, Nevada and Utah, is composed of basaltic rocks. From the active volcanoes of Iceland basaltic lavas are being extruded. An ex ensive area in western India is covered by basalt. This rock is common in the Lake Superior Region of the United Sates and Canada. Whitman Cross in his paper, "Lavas of Hawaii and Their Relations", states: "The analogues of Hawaiian magmas (rocks) are widely distributed over the world, 36 occurring in various countries of Europe, 32 in North America, 10 in Africa or the adjacent island of Reunion, 11 in other islands of the Pacific, and a few others in scattered localities."*

With very few exceptions the rocks in Hawaii National Park (Hawaii section) have formed as the result of the extrusion of basaltic lavas from the active volcanoes Kilauea and Mauna Loa. The surface features of the rocks or lava flows vary in some respects. Even though special names have been applied to the various types of lava, they all belong to the group of rocks called basalt.

John E. Doerr, Jr.
Park Naturalist

Editor's Note - The above article on basalt is the first of a series of articles describing the rocks in Hawaii National Park. Other articles will appear in forthcoming issues of Nature Notes.

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* Cross, Whitman, Lavas of Hawaii and their relations, U.S.G.S. Prof. Paper. 88, p. 78, 1915.