SCIENCE:

PUBLISHED BY N. D. C. HODGES, 874 BROADWAY, NEW YORK.

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RECENT OBSERVATIONS AT KILAUEA.

BY JOSIAH KEEP, MILLS COLLEGE, ALAMEDA CO., CAL.

THE great volcano of Kilauea, on the island of Hawaii, like all other live things, is constantly changing, and any report of its condition is liable to need important corrections on the advent of the next steamer. The last great explosion, however, took place in 1790, more than a century ago, and since that time the huge pit has been filling up with black lava and the area of activity has been narrowing. During the month of July last I had an opportunity to observe the igneous action under exceptionally favorable circumstances, and a record of its condition at that time can hardly fail to be valuable for comparison with past and future reports.

The crater is a huge depression or pit, about three miles long and two miles broad. The walls are mostly precipitous, though quite irregular, and the floor is some three hundred feet below the surface of the island at that point. Forty years ago it was several hundred feet lower. Standing on the brink of the crater and looking down, one is reminded of a great cellar after a fire. Every thing is black or rusty, and the smoke and steam coming up from dark clefts put you in mind of the charred and smoking timbers to be seen after a conflagration. A zigzag path, a mile long, leads down through ferns and bushes to the black lava, and then you step out on a sea of absolute desolation. The lava is cold now, but there are the most abundant evidences of its recent fusion. The surface is greatly varied; here being nearly smooth, and there swelling up into steep hillocks, perhaps with caves beneath them, into which you can creep or perhaps walk upright. Cracks abound, and out of some of them the hot slag has oozed, and flowed, and cooled, and hardened.

After walking over two miles of this rough floor I came suddenly to the brink of a second pit in the floor of the greater one. This second pit, the "Halem' oum' ou" of the natives, is about half a mile in diameter, and at the time of my visit its floor was some two hundred and fifty feet below the point where I was standing. Some adventurous climbers descended the precipitous sides and actually stood on the freshly-cooled lava, but I did not accompany them. In the centre of this lower floor was the lake of moulten lava, nearly circular in outline, and about one thousand feet across. Its level surface was largely covered by a thin, gray crust, portions of which would often sink and reveal the glowing liquid beneath.

The fiery lake was never free from agitations, particularly around its edges, but the extent and violence of the activity were constantly changing. Occasionally a liquid hillock would rise like an enormous bubble, then sink back again, while a puff of thin, blue smoke would slowly rise and float off from the spot, showing that in a condensed state it had doubtless been the lifting agent. But most of the agitation resembled the lively boiling of a kettle of water over a brisk fire. The glowing fountains would jump and dance in the wildest manner, often throwing up the fiery drops to a height of fifty feet, while waves of lava would surge against the curb of the lake with a sound like that of ocean breakers In the night time, seen through an opera glass, the display was beautiful and grand beyond description.

The continual falling of half-cooled drops of lava around the edge of the lake, combined with the wash of the fire-waves, serves to build up a curb, which grows in proportion to the activity of the lake. On one side of the pool of melted rock its top was some thirty feet higher than the floor which joined the base of the curb to the walls of the pit. One night the lava rose in the lake and poured over the curb on that side in a magnificent cascade of fire. It was not possible to get in front of the overflow, but it was estimated that the stream was fifty feet wide. The motion of the current was like that of a water cascade, but when the flood reached the floor of the pit it quickly began to congeal on the top, while the under part ran on till it reached the confining walls. Another overflow, where the curb was not so high, came directly towards my point of observation, and I could clearly see that the central point of the stream moved swiftest, causing the hardening waves to assume the well-known crescent forms.

By such overflows from the moulten lake the inner pit is being gradually filled up; in fact, its floor has risen several hundred feet the past few years. The lake rises *pari passu*, the curb never rising very high above the floor. What the result will be is uncertain. Should the lava continue to rise, the pit will soon be filled and will overflow into the basin of Kilauea itself. But instead of this the bottom of the pit may drop out, so to speak, as it did very suddenly before this last rise, and instead of gazing into a lake of fire the tourist may be compelled to look into a huge smoking hole, some five or six hundred feet deep. Doubtless the whole floor of Kilauea rests on a very hot foundation, as the steam which ascends from many cracks indicates, but at the time of my visit there was no melted lava visible except in the lake which I have described.

The questions presented by these phenomena are intensely interesting; but the more I observed the boiling of the lava, the more I became convinced that aqueous vapor is not the chief agent which does the work, though it may be concerned in starting the tremendous chemical action, perhaps a decomposition of sulphides, which I think is the source both of the heat and of the commotion.

EXTREMES IN THE PLANT WORLD.

BY PROF. J. I. D. HINDS, LEBANON, TENN

OF living organisms, the largest, as well as the smallest, are found in the vegetable kingdom. In point of bulk, even the elephant compares unfavorably with the largest trees, and the smallest living objects, seen by the help of the microscope, are undoubtedly plants.

The largest plants known are what are popularly called "the big trees of California." They are conifers, belonging to the genus Sequoia, which is intermediate between the firs and cypresses. There are two species, *S. sempervirens* and *S. gigantea*. The former is the common redwood and abounds on the Coast Range from the southern part of California northward into Oregon. The latter is not so common, but grows to a larger size. "It is confined to the western portion of the great California range, occurring chiefly in detached groups, locally called 'groves,' at an altitude of from 4,000 to 5,000 feet above the sea." It grows to enormous size, varying in height from 200 to nearly 400 feet and in diameter from 20 to 30 feet. One tree in Calaveras County is 325 feet high and 45 feet in circumference six feet from the ground. Another measured 90 feet in girth and 321 in height. Some of these trees are supposed to be 3,000 years old. They were then in their vigor when the Roman Empire was at the height of its glory and hoary with age when Columbus landed on the American shore.

Let us now turn from these giants of the forest to those plants which can only be seen with the higher powers of the microscope. The smallest of these and at the same time the smallest of living things are the plants known as Bacteria. They have an average diameter of one twenty-five thousandth of an inch and a length

one to ten times as great. Many of them have a diameter of less than one fifty-thousandth of an inch and it is probable that there are multitudes of them so small that the highest powers of the microscope do not render them visible. Two thousand of them could swim side by side through the eye of a needle and one could hold in his single hand fifty millions of millions of them. Of the smaller ones it would take 15,625,000,000,000 to fill one cubic inch.

Now compare these with our mammoth Sequoias. The trunk of one of these trees, to say nothing about its roots and branches, contains at least 200,000,000 cubic inches. It is, therefore, 3,125,000,000,000,000,000,000 times as large as a single bacterium. This number is, of course, inconceivable. It may be read 3 125 millions of millions of millions. The proportion is about the same as that of an ordinary football to the earth itself.

Again, the duration of the life of many of the bacteria is only an hour. There are 8,760 hours in a year, and in 3,000 years there are 26,280,000 hours. Thus the tree has lived on while more than twenty-six millions of generations of its invisible kindred may have lived and died in the stream at its base. From the bacterium to the sequoia, what a span! Yet the rolling globe on which they live is but a speck in the universe, its diameter too small to be used as a measuring unit for interstellar spaces. As many bacteria could be laid side by side on a linear inch as earths upon the diameter of its orbit around the sun. Compared with the tree, the bacterium is almost infinitessimal; by the side of the earth, the tree is insignificant; in the solar system, the earth is but a small factor; and if the solar system were annihilated, it would be millions of years before its loss would be felt on distant stars. Magnitudes are, therefore, relative, and things are great or small according to the standpoint from which we view them.

Cumberland University.

DESTRUCTION OF CROWS DURING THE RECENT COLD SPELL.

BY DR. ROBERT RIDGWAY, SMITHSONIAN INSTITUTION, WASHINGTON, D.C.

WHETHER it be the result of disease or exposure, the suffering inflicted on the crows in the vicinity of Washington during the recent severe weather is of great extent, and of such a character as to excite the sympathy of any one familiar with the facts. On the 20th of January my son went rabbit hunting, and on his return told me he had found many dead crows in the pine woods, and others that were totally blind. The following day I accompanied him to the place where he had found them, and was really astonished at the sight presented. Very few crows were seen flying about, but upon entering the thick woods of scrub-pines, which was evidently the roosting-place of large numbers of these birds, they were met with on every hand. Some were lying on the snow, dead and frozen stiff; many more were perched in the trees, at various heights, in all stages of helplessness. The majority of them could fly, and on our near approach would do so; but in a moment it became apparent that they could not see, for the first thing in their line of flight, as, for example, a branch, would stop them, when they would either flutter to the ground or, changing their course, would continue their flight, to be again checked by a branch, or if they happened to miss any obstruction until clear of the woods (which rarely occurred) they continued, slowly feeling their way, over the open fields, often dropping to the snow-covered ground after flying a few hundred yards. Those which did not fly at our approach were too much weakened from starvation to do so. They were easily caught, and in every instance were found to be absolutely blind, except one individual, which had one eye but little affected. In many the eyes were closed and much swollen; in some one or both eyes had burst and frozen, this having possibly been caused by violent contact with the sharp ends of broken twigs. In all cases in which the eyes were not closed or inflamed the pupil was milky white and the iris bluish. Inability to find food on account of their blindness was evidently the immediate cause of starvation; for it was found that the dead birds were, as a rule, very much emaciated, while many of the living ones, particularly those which were most active, and consequently difficult to capture, were in fairly good condition. It was pitiful to behold their suffering, both from the pangs of hunger as well as from the pain of their wounded eyes. Sometimes the snow beneath the trees was nearly covered by pine needles and small twigs which they had plucked off and tried to eat (they were seen doing this), while several of those which had fallen to the ground were eating snow.

The extent to which this epidemic, or whatever it may be, has affected the crow population of this locality is not easy to estimate. My first impression was that the species was nearly exterminated there, since certainly 95 out of every 100 crows seen during the day were perfectly "stone-blind," and 10 per cent of them dead. That this impression was incorrect was, however, proven by the next day's observation, the locality being visited much later in the day, when large numbers were seen coming in from the surrounding country to roost, — all these "able-bodied" crows having been abroad after food at the time of our previous visit. There seemed to be about as many of these as there were of the disabled ones, so the reduction in their numbers will probably not exceed one-half, and may not be so great.

A third visit, several days later, showed no increase among the afflicted birds. There were, however, as might have been expected, a much larger number of dead ones, while those still living were found more scattered, being encountered nearly everywhere in the open fields, where they had fallen, exhausted, during their flight from the woods.

So far as I was able to discover, after very careful examination of all specimens within reach, during both visits, only the common species, *Corvus americanus*, was affected by the malady. At any rate, neither my companions nor myself could discover a single fish crow (*C. ossifragus*), though the latter was well represented among those which were flying about.

I am at a loss to account for this scourge. Several causes have been suggested, the most plausible of which, it seems to me, is that in returning to their roosting-place one excessively cold evening they were compelled to face a freezing wind, perhaps bearing minute ice-particles, which actually froze their eyes. It may be, however, that a better explanation can be given.

REMARKS ON AMERICAN LICHENOLOGY. — III.

BY W. W. CALKINS. CHICAGO, ILL.

THE explorers for lichens in a locality so favorable as Florida will not fail to notice the abundance of brilliantly colored fungi, and, if interested, will be tempted to collect them. On some of these will perhaps occur parasitic lichens of rarity, as *Colnogonium* and *Opegrapha*. But beneath a bed of *Agaraci*, on the sandy soil of an old plantation, a close search will show another interesting lichen, known as *Heppia despreauxii* Tuck. Its character was long disputed, owing to a close resemblance to an allied genus of lichens, *Solorina*. The small cup shaped apothecia, growing single or in clusters, immersed in a green thallus, have deceived good lichenists. We owe to Dr. Tuckerman the elucidation of this elegent species. Only two were described by him in the "Synopsis." Last winter I had the good fortune to find anotner in the mountains of Tennessee, which, having been sent in vain around our own country, a puzzle to all, was promptly determined by Dr. Nylander of Paris to be the *Heppia virescens*, *Ach. variety rugosa* Nyl. I may remark that it is astonishing how soon afterwards we all saw the point.

In the old field as well, with a mixed second growth of *Pinus taeda*, *Ilex opaca*, *Ilex Cassine*, *Myrica cerifera*, *Olea americana*, etc., will be found on their foliage numerous small fungi, such as *Sphaeria* and *Cercospora*, many of which have been illustrated by Professor Ellis in his "Exsiccati" from my collections of fungi.

In close contact, lichens and fresh-water algæ and *Hepaticæ* also hold equal sway. But, towering over all, the stately *Magnolia* and the *Gordonia* (red or bull bay), with their glossy evergreen foliage, afford us the tropical lichen, *Strigula complanata* Fee., and, rarer still, *Heterothecium augustini* Tuck., though, indeed, the *Sabal serrulata*, common everywhere, abounds in elegant specimens in