

ART. LX.—*A recent analysis of Pele's Hair and a Stalagmite from the lava Caves of Kilauea*; by A. H. PHILLIPS.

THE Pele's Hair was collected the past summer by Prof. Libbey during his recent trip to Hawaii. In both cases the finely powdered substance was dried at 100° C. On subsequently igniting the stalagmite became reddish and increased in weight due in all probability to the oxidation of the ferrous iron present.

|              | SiO <sub>2</sub> | Al <sub>2</sub> O <sub>3</sub> | Fe <sub>2</sub> O <sub>3</sub> | FeO  | MnO | P <sub>2</sub> O <sub>5</sub> | CaO   | MgO  | Na <sub>2</sub> O | K <sub>2</sub> O | Total. |
|--------------|------------------|--------------------------------|--------------------------------|------|-----|-------------------------------|-------|------|-------------------|------------------|--------|
| Peles' Hair, | 50·76            | 14·75                          | 2·89                           | 9·85 | ·41 | ·26                           | 11·05 | 6·54 | 2·70              | ·88              | 100·09 |
| Stalagmite,  | 51·77            | 15·66                          | 8·46                           | 6·54 | ·82 | --                            | 9·56  | 4·95 | 2·17              | ·96              | 100·89 |

The above analysis of Pele's Hair does not differ in any essential respect from that of Prof. O. D. Allen's,† but there is quite a large difference, both in the amount of alumina and potassa when compared to that of D. E. Cohens.‡ In the latter the alumina is only 9·14 per cent while the potassa is 3·06 per cent. These variations may be explained by the fact that, the fused lava charge of Kilauea is drawn off every few years by some subterranean channel and is again slowly refilled by a new supply.

The stalagmite is of the kind, so characteristic of the lava caverns of Kilauea and Mount Loa; while it has not been pos-

\* Quicksilver Deposits, p. 383.

† This Journal, 1879, III, xviii, p. 134.

‡ Quoted in Characteristics of Volcanoes, Dana, p. 348.

sible to find an analysis of a stalagmite with which to compare it, but in comparison with that of Pele's Hair, their similarity is very striking, differing from it not as much as do the several analyses of Pele's Hair do from each other. With the one exception, the iron in the stalagmite has been further oxidized, but even here the  $\text{FeO}$  exists in larger proportions as compared to the  $\text{Fe}_2\text{O}_3$  than it does in magnetite and could still undergo oxidation to a considerable extent before it would exist or could be represented by the formula  $\text{Fe}_3\text{O}_4$ . Both from the physical character and chemical composition of these stalagmites, it seems impossible to think of them as being formed from solution alone. Some other cause must be sought for as the chief factor in their formation. They are almost without exception, both stalactites and stalagmites, porous and vesicular though being quite solid on the surface, while the stalactites are of nearly the same diameter throughout their entire length, which in some cases may reach thirty inches. Two characters very hard to find if at all in a stalactite known to be formed from solution without doubt.

The stalagmites in particular are suggestive of fused drops, which falling one on the other are at the time sufficiently plastic to be quite firmly welded together and congealed in a slightly drooping position, while gases liberated internally and being held there by the more viscous external portions of the drop, would form vesicles. Then too the condition of iron oxides point to some other mode of formation than that of pure solution, for certainly a solution of ferrous iron flowing in a thin film down the sides of a stalactite, then dropping from its point to the stalagmite would be oxidized to a far greater extent than this analysis shows. Unless surrounded by an atmosphere strongly reducing in character it would pass to ferric iron. True the analysis by J. C. Jackson given by Brigham contains no ferrous iron, but then this was of a solid stalactite, which may have been one of solution.

Again any solvent must show some selective character in the substances it dissolves, but here all constituents are carried down to the stalagmite in the same proportion as they exist at least in Pele's Hair. I hope soon to be able to draw a closer comparison by making, as soon as the material can be obtained, an analysis of a stalactite and the lava above it from which it is supposed to have originated by solution. In all probability they will show no marked differences but everything will be found in the same proportions in the stalactite as in the lava. What the principal factor in the production of their peculiar formation is; if they are not formed while still in a fused or plastic condition. It certainly is other than by solution alone.

John C. Green School of Science, Princeton, N. J., Mar. 19th, 1894.