

III.—Remarks on the “Principle of least paste, as regulating the Crystallization of Fused Rocks.”

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I HAVE been lately examining in conjunction with Prof. Hull a large series of lavas from Vesuvius, which were collected by Prof. Guiscardi, of the University of Naples, with a view of determining whether, in the space of 300 years, any difference had occurred in the composition of the lava flow. In the course of this investigation a much more important question arose, viz. :—What is the proportion of each mineral present in the lava, and why does that proportion exist?

The rock is composed of *unknown* quantities of nine minerals, of *known* composition viz.: Leucite, Plagioclase, Magnetite, Olivine, Augite, Hornblende, Mica, Nepheline, and Sodalite, together with an *unknown* quantity of a paste of *unknown* composition; from which it is easy to shew that the unknown quantities exceed the number of equations; and consequently, the discussion of the composition of the rock belongs to a branch of the Indeterminate Analysis.

If we attempt to make up as large a percentage of the rock as possible by means of the nine observed minerals, we soon find that the silica, lime, and protoxides, are in excess, and that probably the paste is simply a silicate of lime and iron.

Notwithstanding the apparent difficulty in finding which of the many possible solutions of our system of indeterminate equations is the nearest to the truth, we can, as I think, approach very near the actual solution in nature by the aid of the following principle: “Of the numerous solutions possible that one will occur in nature which involves the largest amount of Definite Minerals and the least amount of Indefinite Paste.”

There are a certain number of forces tending to unite the elements into definite combinations as distinct minerals, and the tendency to form such minerals must be greater than that which forms the indefinite paste, so that the affinities of the elements composing the paste are less than those of any definite mineral in the rocks; and thus it will happen (by the principle of "least action") that that particular combination will occur which makes the definite minerals a maximum, and the paste a minimum.*

*The subject is fully treated in the 'Transactions of the Royal Irish Academy,' Vol. XXVI. March, 1876.