Change of Basalt by Solar Light and Sulfuric Acid

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Ⅰ Background and Purpose

The author considers that one of the causes of the large amount of iron oxide on the surface of Mars is ultraviolet rays, and has investigated the effects of ultraviolet rays on rocks under the guidance of the science department of a junior high school.The purpose of this experiment was to irradiate the basalt in sulfuric acid with solar rays to investigate the changes in the aqueous solution and the surface of the basalt.

Ⅱ Methods

1 Prepare two test tubes containing a sulfuric acid aqueous solution of pH2. Then, place a piece of shaped basalt of the same size in each test tube. The basalt used was from Genbudo park in Hyogo Prefecture Japan.

2 Place these test tubes on a balcony and expose them to the sun's rays. One of the test tubes is wrapped in aluminum foil, and the sun's rays do not reach the basalt at all. The temperatures of the two aqueous sulfuric acid solutions were adjusted so that they were almost the same in both test tubes (within ±2 ˚C).

3 After installation, the total iron concentration and trivalent iron ion concentration in the sulfuric acid aqueous solution was measured every 1 to 2 weeks. We also observed and photographed basalt samples.

4 After the experiment, the analysis of bright yellow powder generated on the sample of surface of the basalt was analyzed by XRD. In addition, SEM observation and EDS analysis of the sample were performed.

Ⅲ Results and Considerations

When the solar rays were irradiated, the trivalent iron ions in the sulfuric acid aqueous solution increased when compared with in which solar rays were not irradiated. The reason for this is presumed to be photooxidation by the solar rays. In addition larege amount of powdery bright yellow substance was generated on the surface of the basalt. XRD revealed that the powder produced on this surface was mainly metahomanite or amorphous ferric sulfate. Without irradiation, small amount of powder was formed on the whole surface, but XRD analysis could not be performed due to the insignificant amount.From these results it is presumed that trivalent iron sulfate was produced by solar rays in the past on the surface of Mars. Additionally trivalent iron sulfates were produced after the acid solution evaporated.

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