

Increase in Dissolved Iron Concentration from Fayalite by UltravioletA · C Irradiation

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To investigate the mystery of "Why the Mars' surface with poor oxygen has so much iron oxide" I have led student experiments at junior high schools. I will show my recent experiments and their results. A.S.Yen (1999) showed that reactive oxygen species can also be formed on mineral grains under Martian conditions by irradiating ultraviolet C to quartz samples. Furthermore he irradiated ultraviolet C to thin iron films in the air and showed that exposure to ultraviolet radiation increases the rate of oxide formation. My experiments were irradiating ultraviolet A and C to fayalites and iron in acid water. This results indicated the possibility that iron oxides might be formed because of ultraviolet rays other than the cause of reactive oxygen species in the past.

Experiment no.1:

I had students irradiate ultraviolet rays A and C to Fayalite in hydrochloric acid. I had students irradiate ultraviolet rays A and C to Fayalite in hydrochloric acid. In this experiment, I used Fayalite from Kawamata-machi, Fukushima.

Fayalite, which is about 1g and not formatted was put in the test tube in the test tube filled with hydrochloric acid pH2. After the experiment, I had students check the concentration of iron ions in the water solution by using a digital pack test. This experiment with ultraviolet rays A was carried out 7 times and the experiment with ultraviolet rays C was carried out 3 times. According to the results of the experiment with ultraviolet rays A, the quantity of iron elution increased more in the case of ultraviolet rays irradiating 6 times out of 7 than with the result of no irradiation. The results of the experiment with ultraviolet rays C were identical (3 times out of 3). The peak of wavelength ultraviolet rays A is generated by black light is 365 nm. The peak of wavelength ultraviolet rays C is generated by germicidal lamp is 254 nm.

Experiments no.2:

I had the students irradiate ultraviolet rays A to a battery that has the iron cathode copper anode in hydrochloric acid. The students then measured the occurred voltage of the battery. I compared the voltage between ultraviolet rays irradiation and non irradiation. The irradiated battery's voltage stayed over 0.2V and the voltage did not decrease after 150 hours. Another non-irradiated battery's voltage decreased a little by little and the voltage was close to 0V after 150 hours. This experiment was carried out 4 times. In all cases the voltage of the battery that was irradiated by ultraviolet rays was higher than the non-irradiated battery.

It seems that electrons dissociate from iron atoms by ultraviolet energy and form iron ions.

Consideration

From my experiments results, I would infer that ultraviolet rays advance the dissolution of iron ion from fayalite and iron. I think ultraviolet rays are one of the causes of iron oxide and hydroxide existing on Mars' surface besides reactive oxygen species. It seems that there was water on Mars' surface. There was a possibility that advancing of iron dissolution from rocks on Mars by ultraviolet rays irradiation.

Keywords: ultraviolet rays, fayalite, hydrochloric acid, iron, elution increase

