

CHARACTERIZATION OF FUMAROLIC PRODUCTS IN NEVADA. E.M. Hausrath, University of Nevada, Las Vegas, 4505 S Maryland Parkway, Las Vegas, NV 89154 Elisabeth.Hausrath@unlv.edu.

Introduction:

Chemical alteration on Mars is of great interest because of its potential to shed light on the climate history and potential for life on that planet. Different scenarios for fluids on Mars include surface water, ground water, and hydrothermal alteration including fumaroles. Evidence for hydrothermal alteration on Mars is present in Mars meteorites [1], from orbital data [2] and rover data [3]. Terrestrial hydrothermal environments have been characterized as Martian analogs [4], and mineral dissolution rates in a hydrothermal environment have also been measured [5].

Samples were collected near fumaroles in Dixie Valley, Nevada, to analyze fumarolic alteration products in an acid vapor environment, characterize the weathering environment, and prepare for measuring *in situ* alteration rates. The fumaroles are located along the Stillwater Range Front Fault in northwest Nevada, and gas compositions have been previously characterized [6, 7].

Methods:

Sample collection:

Samples of the minerals formed near the fumaroles were collected, as well as a sample formed farther away from the fumaroles as a control. Samples were stored at ambient temperature for 2 days, and then refrigerated until analysis. In each case the control sample was treated identically to the fumarole samples.

Sample analyses:

Field wet samples were weighed, dried at 60°C overnight, and then reweighed to determine weight percent water.

Pore water pH was measured by adding 12.5 ml of water to 5 g of material, and then measuring the pH of the slurry. This is the typical method for measuring soil pH, although it can result in increases of pH of 0.2-0.5 pH units for acid soils, and variations of up to 0.5 pH units due to changes in ionic strength [8].

Sample powders were mounted on carbon tape, carbon coated, and then examined using a JSM 5610 SEM and EDS to determine the morphology and chemistry of the materials.

Results and Discussion:

The weight percent water in the sample collected away from the fumaroles was less than 2%, whereas the weight percent water in the samples collected near the fumaroles ranged from 10-20%. These results indicate

that the fumaroles are acting as a source of moisture in the weathering environment.

Pore water pH values were 8.37 for the sample collected away from the fumaroles, and ranged from 2.08 to 6.97 for samples collected near the fumaroles. These results indicate that the fumaroles are providing protons in addition to water in the weathering environment.

Characteristic results from SEM images of samples collected near the fumaroles included the presence of Ca sulfates (Figures 1, 4 and 5), sulfur rich deposits (Figure 2), Al sulfates (Figure 3), and Si-rich globules (Figures 4 and 5). No sulfates were observed in the sample collected away from the fumaroles as a control, indicating that the source of the sulfates is the fumaroles.

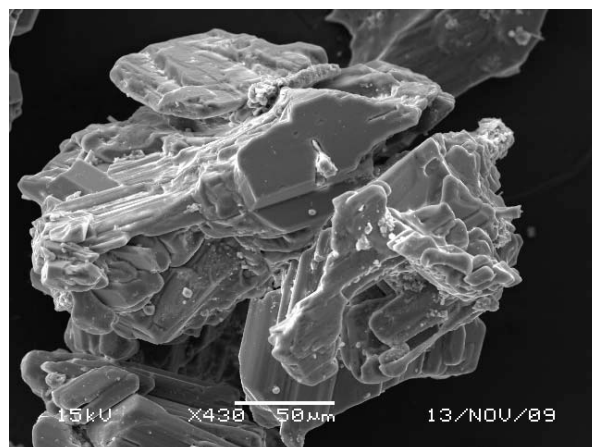


Figure 1. Calcium sulfate minerals formed near the fumaroles.

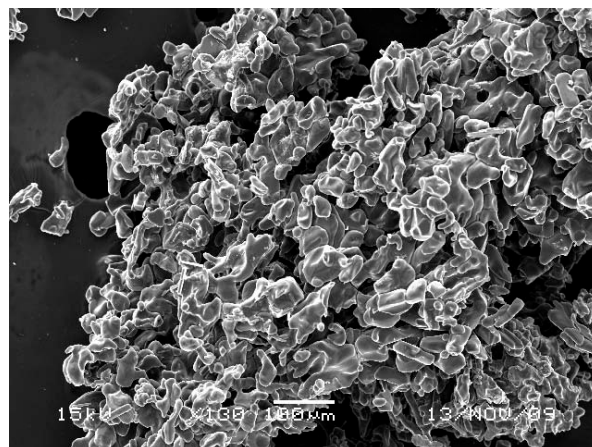


Figure 2. Sulfur-rich globules formed near the fumaroles

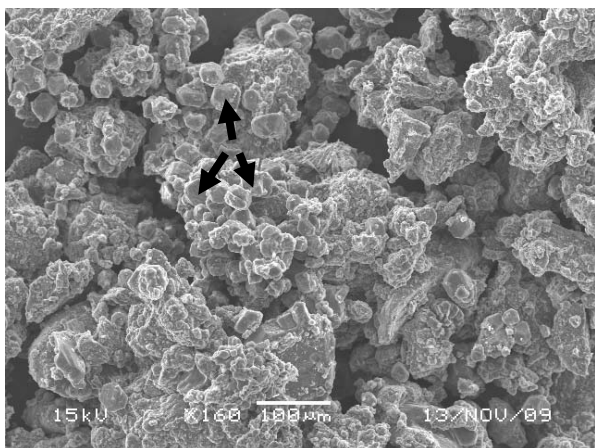


Figure 3. Al-rich sulfates containing some Fe (black arrows) formed near the fumaroles

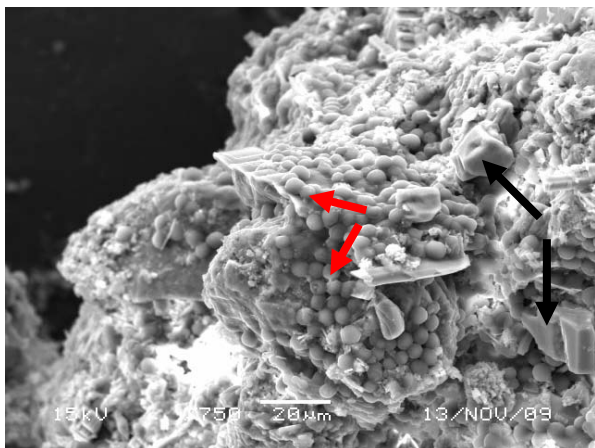


Figure 4. Calcium sulfates (black arrow) and Si-rich globules (red arrows) formed near the fumaroles.

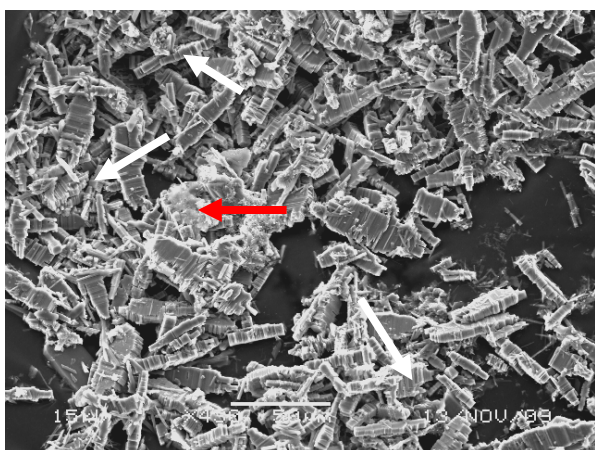


Figure 5. Ca-sulfates (white arrows), and silica rich deposits (red arrow) formed near the fumaroles.

Conclusions: The weathering environment near the fumaroles is significantly different in both concentrations of water and acidity than the environment farther from the fumaroles, and different minerals, including abundant sulfates, were formed near the fumaroles. These differences in weathering environments will likely be reflected in different alteration rates and secondary products in *in situ* weathering experiments. Future work will include further characterization of naturally weathered samples, as well as measurement of *in situ* weathering rates and secondary products.

References:

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