Your abstract submission has been received

Click HERE to print this page now.

You have submitted the following abstract to 2016 AGU Fall Meeting. Receipt of this notice does not guarantee that your submission was complete or free of errors.

Is Tridymite at Gale Crater Evidence for Silicic Volcanism on Mars?

Richard V Morris[1], David T Vaniman[2], Douglas W Ming[3], Trevor G. Graff[4], Robert T Downs[5], Kim Fendrich[5] and Stanley A Mertzman[6], (1)NASA Johnson Space Center, Code XI3, Houston, TX, United States, (2)Planetary Science Institute Tucson, Tucson, AZ, United States, (3)NASA Johnson Space Center, Houston, TX, United States, (4)Jacobs Technology, NASA Johnson Space Center, Houston, TX, United States, (5)University of Arizona, Department of Geosciences, Tucson, AZ, United States, (6)Franklin and Marshall College, Department of Earth and Environment, Lancaster, PA, United States

Abstract Text:

The X-ray diffraction (XRD) instrument (CheMin) onboard the MSL rover Curiosity detected 17 wt% of the SiO_2 polymorph tridymite (relative to bulk sample) for the Buckskin drill sample (73 wt% SiO_2) obtained from sedimentary rock in the Murray formation at Gale Crater, Mars. Other detected crystalline materials are plagioclase, sanidine, cristobalite, cation-deficient magnetite, and anhydrite. XRD amorphous material constitutes approx. 60 wt% of bulk sample, and the position of its broad diffraction peak near approx. 26 deg. 2-theta is consistent with opal-A. Tridymite is a low-pressure, high-temperature mineral (approx. 870 to 1670 deg. C) whose XRD-identified occurrence on the Earth is usually associated with silicic (e.g., rhyolitic) volcanism. High SiO_2 deposits have been detected at Gale crater by remote sensing from martian orbit and interpreted as opal-A on the basis H_2O and Si-OH spectral features. Proposed opal-A formation pathways include precipitation of silica from lake waters and high-SiO_2 residues of acid-sulfate leaching. Tridymite is nominally anhydrous and would not exhibit these spectral features. We have chemically and spectrally analyzed rhyolitic samples from New Mexico and Iwodake volcano (Japan). The glassy (by XRD) NM samples have H_2O spectral features similar to opal-A. The Iwodake sample, which has been subjected to high-temperature acid sulfate leaching, also has H_2O spectral features similar to opal-A. The Iwodake sample has approx. 98 wt% SiO_2 and 1% wt% TiO_2 (by XRF), tridymite (>80 wt.% of crystalline material without detectable quartz by XRD), and H_2O and Si-OH spectral features. These results open the working hypothesis that the opal-A-like high-SiO_2 deposits at Gale crater detected from martian orbit are products of alteration associated with silicic volcanism. The presence or absence of tridymite will depend on lava crystallization temperatures (NM) and post crystallization alteration temperatures (Iwodake).