

2005 Salt Lake City Annual Meeting (October 16–19, 2005)

## Paper No. 126-10

Presentation Time: 1:30 PM-5:30 PM

# CHEMISTRY, CRYSTALLOGRAPHY, AND SPECTROSCOPY OF HYDROUS SULFATES

[O'CONNOR, Vanessa A.](#), Department of Geology, Smith College, Northampton, MA 01063, [vanessa.oconnor@hotmail.com](mailto:vanessa.oconnor@hotmail.com), BRADY, John B., Department of Geology, Smith College, Northampton, MA 01063, DYAR, M. Darby, Dept. of Earth & Environment, Mount Holyoke College, South Hadley, MA 01075, LANE, Melissa D., Planetary Science Institute, 1700 E. Ft. Lowell, Suite 106, Tucson, AZ 85719, and BISHOP, Janice L., SETI Institute/NASA-Ames Research Ctr, Mountain View, CA 94043

Hydrous iron sulfates (HIS) are found only in a few localities on Earth, and few of them have been thoroughly characterized by both chemical and spectroscopic techniques. The fact that HISs are stable at low temperatures and pHs, makes them likely candidates for possible phases on the surface of Mars. This study used X-ray powder diffraction, electron microprobe, and Mössbauer spectroscopy to investigate the crystal chemistry of szomolnokite ( $\text{Fe}^{2+}\text{SO}_4 \cdot \text{H}_2\text{O}$ ), melanterite ( $\text{Fe}^{2+}\text{SO}_4 \cdot 7\text{H}_2\text{O}$ ), coquimbite ( $\text{Fe}_2^{3+}(\text{SO}_4)_3 \cdot 9\text{H}_2\text{O}$ ), römerite ( $\text{Fe}^{2+}\text{Fe}_2^{3+}(\text{SO}_4)_4 \cdot 14\text{H}_2\text{O}$ ), rozenite ( $\text{Fe}^{2+}\text{SO}_4 \cdot 4\text{H}_2\text{O}$ ), and voltaite ( $\text{K}_2\text{Fe}_5^{2+}\text{Fe}_4^{3+}(\text{SO}_4)_{12} \cdot 18\text{H}_2\text{O}$ ). Samples were obtained from the NMNH, Harvard Mineralogical Museums, dealers, from Edward Cloutis, and were handpicked to create homogeneous separates. However, it was often impossible to prepare clean mineral separates because these phases all look similar and are finely intergrown in common terrestrial parageneses. Few of these samples are stable under ambient conditions, and samples sometimes altered (hydrated or dehydrated) based on humidity. The current JCPDS diffraction database has few entries for any of these phases, and many of them are synthetic samples. Our XRD results showed that many of these phases are indistinguishable from one another, although slight variations (i.e., lineshifts) apparently occur with cation substitutions. Microprobe analyses showed that none of the samples studied was of pure end-member composition, and substitutions by Mg, Al, K, and Na for  $\text{Fe}^{2+}$  and  $\text{Fe}^{3+}$  were common. Mössbauer results suggested that tetrahedral  $\text{Fe}^{3+}$  might be present in römerite and voltaite, though it is also possible that the  $^{\text{IV}}\text{Fe}^{3+}$  is present in an impurity such as a clay mineral. Furthermore, the relative amounts of  $\text{Fe}^{2+}$  and  $\text{Fe}^{3+}$  predicted by the formulas were rarely observed due to cation substitutions. We conclude that further detailed studies combining chemical, crystallographic, and spectroscopic analyses are badly needed.

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Session No. 126--Booth# 71  
[Mineralogy/Crystallography \(Posters\)](#)  
Salt Palace Convention Center: Hall C  
1:30 PM-5:30 PM, Monday, 17 October 2005

Geological Society of America *Abstracts with Programs*, Vol. 37, No. 7, p. 287

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