Spectral properties of akaganéite and schwertmannite and geochemical implications of their presence on Mars

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Akaganéite and schwertmannite are crystallographically related ferric minerals that include 0.5 nm^2 tunnels in their structure occupied by anions. Akaganéite has Cl^- or F^- in the tunnels [1,2], whereas schwertmannite has SO_4^{2-} [3]. The visible/near-infrared (VNIR) spectral properties indicate akaganéite and schwertmannite have similar Fe environments and abundant H_2O [4]. Mid-IR spectral analyses of akaganéite showed that akaganéite readily adsorbs extra H_2O from its environment and that it can incorporate additional ions quickly into the tunnels [5].

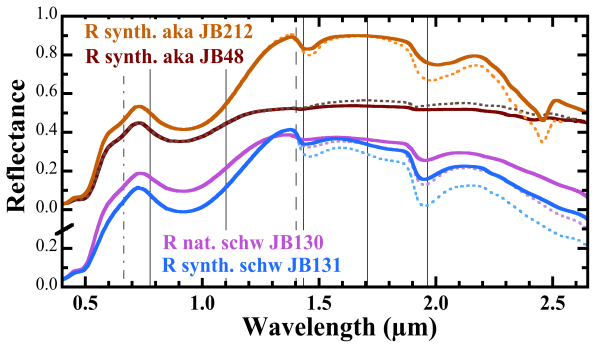

Figure 1: VNIR spectra of akaganéite and schwertmannite under ambient (dashed) and dehydrated (solid) conditions.

Akaganéite has recently been identified on Mars through VNIR spectra acquired by CRISM using the band at 2.45 μm [6]. Schwertmannite is consistent with some CRISM spectra of Mars, although it has not yet been positively identified. Both minerals could be part of the "amorphous" phase identified at Gale crater by the MSL (Mars Science Lab) rover; however, only akaganéite has been unequivocally identified to date [7].

[1] Cornell & Schwertmann (2003) The Iron Oxides, Wiley-VCH. [2] Post & Buchwald (1991) *Am. Min.* **76,** 272-277 [3] Bigham *et al* (1994) *Min. Mag.* **58,** 641-648 [4] Bishop & Murad (1996) *Mineral Spectroscopy*, Geochem. Soc. 337-358 [5] Murad & Bishop (2000) *Am. Min.* **85,** 716-721 [6] Carter *et al* (2014) *LPSC* **45**, #2364 [7] Ming *et al* (2014) *Science* **343**, #6169