STRUCTURE AND IR-SPECTRA OF MHSH(~3/5) (MAGNESIUM HYDROXIDE SULFATE HYDRATE), A POSSIBLE CANDIDATE TO REPRESENT THE PRESUMED SECOND KIESERITE POLYTYPE ON THE SURFACE OF MARS

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The discovery of various sulfate hydrates on the surface of Mars presents one of the exciting findings in the ongoing exploration of our neighbour planet. Based on spectroscopic data obtained by orbital remote sensing, kieserite, $MgSO_4 \cdot H_2O$, represents one of the dominant constituents of the sulfate assemblage at lower and equatorial latitudes (CHRISTENSEN et al., 2004; CLARK et al., 2005). However, the acquired kieserite spectra show some oddities in comparison to patterns observed for terrestric kieserite. Currently, these differences are interpreted in the literature as being due to the existence of a second polytype of the kieserite structure, present on Mars, but having also been observed during laboratory experiments involving controlled dehydration of higher $MgSO_4$ hydrates or re-hydration of $MgSO_4$ at low humidity conditions ('LH-kieserite'; WANG et al., 2009).

This work presents strong evidence that this 'Martian kieserite' is actually a mixture of kieserite with a tetragonal phase of the MHSH-type (magnesium hydroxide sulfate hydrate), structurally related to the mineral caminite ($MgSO_4 \cdot \frac{1}{3}Mg(OH)_2 \cdot \frac{1}{3}H_2O$, space group $I4_1/amd$, a = 5.242, c = 12.995 Å; KEEFER et al., 1981) corresponding to MHSH(2/3) (HOCHELLA et al., 1983), but with different lattice parameters and site occupancies. We managed to hydrothermally synthesize single crystals of such a phase close in composition to MHSH(3/5) and analysed it by means of single crystal (a = 5.219, c = 13.108 Å) as well as powder X-ray diffraction. Additionally, IR and Raman spectra of the phase have been measured and compared to kieserite and the results of WANG et al. (2009).

The comparison of our data to the product obtained in epsomite dehydration experiments at very low humidity by WANG et al. (2009) yields a very good match, corroborating that the obtained phase is indeed analogic to the stable product of sulfate dehydration in a low humidity environment and temperatures relevant to the surface of Mars. We therefore postulate the hypothesis that MHSH is not only the explanation for the observed spectral discrepancies seen in 'Martian kieserite', but that this mineral may as well represent an abundant constituent of sulfate assemblages on the surface of Mars at lower latitudes, with important implications for our understanding of the sulfate-based surface water budget of the Earth's nearest neighbour planet.

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