THE DISPOSITION OF HYDROGEN IN MARTIAN METEORITE ALTERATION. E. P. Vicenzi Department of Mineral Sciences, Smithsonian Institution, Washington, DC 20560-0119 USA.

Introduction: Understanding the volatile budget of the Martian hydrosphere requires knowledge of the behavior for the most volatile element, hydrogen. In the absence of sending well-equipped probes to the surface of Mars capable of drilling some 10s of meters in fortuitously suitable locations, we are left with examining secondary minerals in the meteorite collection to gain an understanding of fluid/Martian rock interaction. Because the preterrestrial nature of alteration in the nakhlites has been well established[1,2], this study focuses on determining the precise siting of hydrogen within secondary mineral assemblages in the Nakhla and Lafayette SNC meteorites.

Analytical method: The time of flight-secondary ion mass spectrometer (ToF-SIMS) was used to collect high spatial resolution-mass resolved images of alteration veinlets. A pulsed Ga^+ primary ion beam (~0.25-0.27 μm spot size) was used principally at low mass resolution to obtain greater sensitivity for mass one ions. The instrument was operated in dual beam mode, where samples were subjected to cycles of Cs^+ sputtering (to remove surface contaminants) followed by a pulse of Ga ions and negative secondary ion collection.

Results and discussion: Ion images collected to date suggest that hydrogen and hydroxyl are not restricted to clay minerals alone. These species are instead distributed among all alteration phases to varying degrees, including: carbonate, clay, and Si-rich and Fe-rich amorphous silicates. The latter three phases comprise what is commonly termed "iddingsite." Because ion yields differ as a function of matrix composition, it is not possible at this time to determine the relative concentrations of H in each of the secondary minerals. Once suitable standard materials are obtained, spectra can then be used to construct a detailed mass balance for water in low temperature phases in SNC meteorites, a exercise that has not yet been conducted.

The nature of the distribution of hydrogen in multiple phases will impact the way in which high precision-bulk extraction isotopic data are interpreted [3,4] and highlight the need for additional magnetic sector D/H measurements on H-bearing silicate phases to compliment those already performed on carbonate [5].

References:

[1] Gooding et al. (1991) *Meteoritics* 26: 135-143. [2] Treiman et al. (1993) *Meteoritics* 28: 86-9. [3] Karlsson et al. (1992) *Science, 255,* 1409-1411. [4] Eiler et al. (2002) *Meteoritics and Planetary Science 37*, 395-405. [5] Boctor et al. (1999) *Meteoritics and Planetary Science* 34: A14.