

**WATER RELATED FEATURES IN THE IR SPECTRA OF CARBONACEOUS CHONDRITES MATRIX.**

P. Beck<sup>1</sup>, E. Quirico<sup>1</sup>, J. Bollard<sup>1</sup>, G. Montes-Hernandez<sup>1</sup>, L. Bonal<sup>2</sup>, F-R. Orthous-Daunay<sup>1</sup> and B. Schmitt<sup>1</sup>. <sup>1</sup>Laboratoire de Planétologie de Grenoble, Université Joseph Fourier, 122 rue de la Piscine, 38045 Grenoble cedex 07. <sup>2</sup>University of Hawai'i at Mānoa, Honolulu, HI 96822, USA

**Introduction:** Carbonaceous chondrites contain a significant amount of water in the form of nominally hydrous minerals [1]. These minerals were likely produced by the alteration of a dry precursor, that led to various mineralogical transformation among which the formation of phyllosilicates from anhydrous mafic minerals. Infrared spectroscopy is one of the few non-destructive techniques that can directly probe water molecules and –OH groups. This technique is also widely used to identify ice and hydrated minerals at the surface of asteroids [2]. Here, we report on micro-infrared measurements of matrix fragment from Orgueil (CI), 10 CM chondrites and 4 CR chondrites. We focus on the H<sub>2</sub>O and –OH related adsorption feature at around 3 μm.

**Analytical method:** Matrix chunks were extracted and crushed within sapphire windows. In the case of the CR chondrites, the samples were subsequently deposited on a KBr window to obtain measurements down to 600 cm<sup>-1</sup> (to assess the Si-O stretching band). IR spectra were acquired with a Hyperion IR microscope at LPG. In order to remove adsorbed and interfoliar molecular water, we used an environmental cell, which allowed measurements under a primary vacuum (10<sup>-3</sup> mbar) and temperatures up to 300°C. This method enables to remove weakly bonded H<sub>2</sub>O molecules whose spectral signature overlaps with the more informative –OH absorption features.

**Results:** At ambient conditions, the 3 μm region is dominated by H<sub>2</sub>O absorption, due to the presence of a combination of adsorbed and interlayer water molecules. Heating of the sample at 100°C enabled to remove adsorbed water, and further heating was able to remove all of the molecular water (disappearance of the ν<sub>2</sub> bending band at 1600 cm<sup>-1</sup>). Molecular water was the dominant signature at 3 μm in previous study [3]. Examination of the CM and CI spectra shows a clear variability among the sample studied. Two end-member types were identified: a sharp asymmetric feature at ~3700 cm<sup>-1</sup> (Orgueil type) or a broad feature centered at 3500-3600 cm<sup>-1</sup> (Murchison type). CR spectra look intermediate between the Orgueil- and Murchison-types.

**Discussion:** In the case of the CM chondrites, there is an apparent relation between the spectral shape at 3 μm and the alteration sequence defined by [4]. The most extensively altered meteorites from [4] correspond to an Orgueil type spectrum while the least altered sample display the Murchison type spectrum. The Orgueil type spectrum resembles measurements we performed on chrysotile. We can propose that the variability encountered is mostly related to a variation in the nature of the cation bonded to the hydroxyl groups, as the chemistry of serpentine evolves from Fe-rich to Mg-rich during the sequence defined by [4]. IR spectroscopy appears promising to provide a qualitative characterization of the extent of aqueous alteration, by depicting the main stages of advancement in the alteration process.

**References:** [1] Brearley A.J. (2006) in *Meteorites and the Early Solar System II* 942pp. [2] Rivkin A.S. et al. (2000) *Icarus* 145, 351-368. [3] Osawa et al. (2005) *Meteoritics and Planet. Sci.*, 40, 71-86. [4] Rubin A.E. et al., 2007, *Geochim. Cosmochim. Acta* 71, 2361-2382.