REFLECTANCE SPECTRA OF CARBONACEOUS CHONDRITES UNDER CONTROLLED ATMOSPHERE

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Introduction: Carbonaceous chondrites are fine-grained mixtures of silicates, organics and metals. Their connection with asteroid has been studied over the last decades using similarities in the near-infrared reflectance spectra. One of the particularities of carbonaceous chondrites among other chondrites group, is the presence of hydrated silicates, testifying of the action of water at some time of their formation history. Here we report on the NIR spectra of 4 carbonaceous chondrites (Tagish Lake [ungrouped CC], Orgueil [CI1], Murchison [CM2] and Allende [CV3]). The specificity of this study is that we pay particular attention to the 3-µm region and then, spectra were measured under controlled atmosphere in order to avoid contamination by indigenous water

Reflectance spectroscopy: Infrared reflectance spectra were measured using the spectrogonio radiometer available at the Laboratoire de Planétologie de Grenoble [1]. This instrument enables bi-directionnal reflectance spectra measurements with a good photometric accuracy (below 1 %). Spectra were measured in the 0.5-4.6 µm range with a sampling interval of 20 nm. Because ambient atmospheric water might adsorb on the surface of the sample and perturb the 3-µm band, spectra were acquired within the SERAC environmental cell [2]. Samples were heated up to 80°C under vacuum ($P=10^{-3}$ mbar) to remove adsorbed water. Spectra were measured under normal illumination incidence, and with an observation angle of 30°.

The 3-micron band: -OH (and H_20) For all three samples, a spectrum was measured after and prior to submitting the sample to a controlled atmosphere. All spectra reveal the presence of a 3-micron band, but which is much weaker for Allende (Band Depth (BD) of 11%) and stronger for Orgueil, (BD of 60 %) and Murchison (BD=47 %). In the case of Orgueil and Murchison, a significant evolution is observed after heating to 80°C and exposure to vacuum, suggesting that a significant amount of indigenous water was lost. This observation confirms previous work performed using transmission spectroscopy [3]. We show here, the shape, band maximum and band center evolves as adsorbed and mesopore water is removed and dry condition reflectance spectra are needed for a good comparison with asteroid observation.

Organics signature: CH_2 and CH_3. The 3-µm region is also precious since traces or organics can be observed around 3.4 micron [4]. These signatures are clearly detected in the case of Orgueil, Tagish Lake and Murchison, but hardly for Allende. This difference can be explained by the fact that the proportion of organic mater in Allende is smaller than the other two samples, and that the object was slightly metamorphosed.

References: [1] Brissaud et al., *Applied Optics* 2004, 43, 1926-1937. [2] Pommerol et al., 2009, *Icarus* 204, 114-136. [3] Beck at al. 2010, *Geochim. Cosmochim. Acta* 2010, 74, 8881. [4] Moroz et al., 1998, *Icarus* 134, 253-258.