UV RAMAN SPECTROSCOPY AS A POWERFUL TOOL FOR INVESTIGATING INSOLUBLE ORGANIC MATTER OF CHONDRITES AND COMETARY DUST

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Introduction: The characterization of carbonaceous matter in micrometric grains (IDPs, AMMs, STARDUST grains) is a big issue as most analytical techniques are insensitive to such low amounts of material. Raman spectroscopy has been proposed as a useful tool for characterizing natural carbonaceous matter, in particular for metamorphism issues. However, this technique apparently presents limitations for the characterization of Insoluble Organic Matter (IOM) extracted from unmetamorphosed chondrites, and more generally immature kerogens. First, many of these compounds induce a fluorescence background, which makes difficult or even impossible the interpretation of the Raman spectrum. Secondly, for such disordered compounds, spectra acquired with a single visible wavelength provide little information, and it would be more useful to take advantage of the dispersive character of the first-order carbon bands [1]. We present the first study of natural kerogen-like compounds by UV Raman spectroscopy. We show this technique is suitable 1) to distinguish structural differences among various samples as chondritic IOMs, coals and stratospheric IDPs, and 2) to identify specific functional groups like cyanides. The implementation of this technique to study AMMs is presented in this volume [2].

Methods and Results: We studied series of IOMs extracted from chondrites (CI, CM, CR, ungrouped C2), two IDPs and coals. Measurements were carried out using a JOBIN-YVON LabRaman micro-Raman spectrometer, equipped with a X40 objective and using a 244 nm wavelength. Particular care was devoted to minimize beam damage (thermal/photolysis alteration). The spot size on the sample was around 4-5 µm. The 244 nm Raman spectra of all samples do exhibit a very intense and narrow G band, and a weak D band. These spectra present some similarities with those of hydrogenated amorphous carbon, and point to highly disordered compounds with a significant sp^3/sp^2 ratio. Interestingly, coal and IOMs spectra have slight but significant spectral differences, which are quantified either by bands fitting or principal components analysis (PCA). They definitely evidence the polyaromatic structure are dissimilar, consistently with independent analytical measurements [3,4]. In one chondrite, Alais (CI1), we report the first identification of the cyanide (-CN) functional group. In the case of two stratospheric IDPs, significant spectral differences were observed in the intensity of the D band, when compared with chondritic IOMs. These results confirmed the systematic trend derived from 514 nm measurements by [5], and point to differences in IOMs in dust and chondrites. Recent analyses of two ultra-carbonaceous AMMs seem to confirm this observation [2]. We will present in details the implementation of this technique, and provide extensive details on these new results.

References: [1] Ferrari A. C. et al. 2001 *Physical Review B* 63, 121405 [2] Dobrika et al. 2008. This volume [3] Gardinier A. et al. 2000. *Earth and Planetary Sciences* 184, 9-21 [4] Cody G. and Alexander *Geochimica Cosmochimica Acta* 69, 1085-1097 [5] Quirico et al. 2005. *Planetary and Space Science* 53, 1443-1448