DETERMINATION OF PETROLOGIC SUBTYPES OF CV3 CHONDRITES BY RAMAN SPECTROSCOPY

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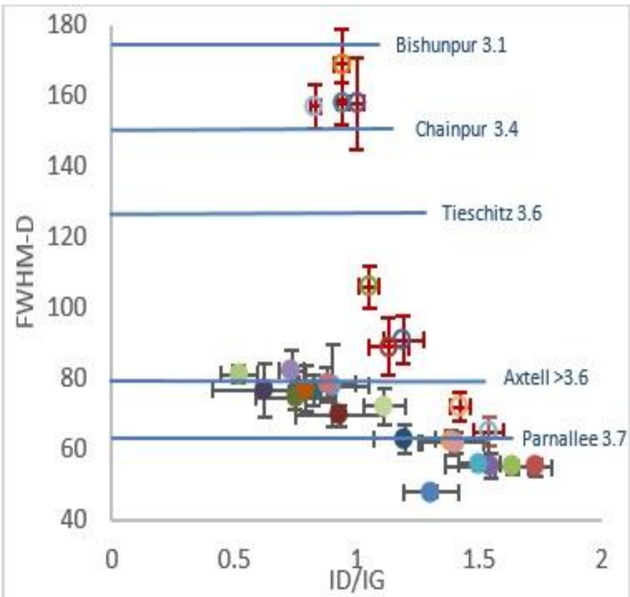

Figure shows the relationship between the FWHM-D and I_D/I_G of the CV chondrites. The filled in plots with black error bars represent samples from our study while plots with red error bars represent CV chondrites from [3].

Introduction: Meteorites come from a wide variety of rocky bodies throughout the solar system. To characterize these meteorites and to understand the parent body processes that produced them, we use classification schemes that include petrologic type and shock classification [1, 2]. Petrologic type for chondritic meteorites range from type 1 to 6; 1 being the most aqueously altered and 6 being the most thermally metamorphosed [1]. Meteorites of petrologic type 3 are the most pristine [1]. Type 3 chondrites can then be further divided into subtypes (e.g. 3.x) [3]. The current classification scheme for chondrites assigns a petrologic type of 3.0 to meteorites that do not possess any signs of thermal metamorphism and 3.1 or higher for those that show increasing, but limited, metamorphic features [4]. A Raman spectroscopy study of unequilibrated ordinary and carbonaceous chondrites by [3] observed that the Full Width Half Maxima of the D band (FWHM-D) of carbon found in the matrix decreases with increasing petrologic subtype as well as the increasing height ratio between the D band and the G band (I_D/I_G). The most common petrologically pristine group of chondrites is the CV group carbonaceous chondrites. Here we introduce new type 3 CV chondrites and determine their petrologic subtypes with the classification scheme of [3] using Raman spectroscopy.

Experimental: A suite of 17 CV group carbonaceous chondrites was analyzed for the FWHM-D and I_D/I_G of carbon in the matrix using a Horiba LabRAM Aramis micro-Raman spectrometer at the Royal Ontario Museum (ROM). A 532 nm, 50 mW laser was used, filtered down to a power of 171.9 µW to prevent carbon alteration in the sample. An 1800 gr/mm grating and 100 µm slit were used during collection. A Kr reference lamp was used for calibration. The spectra were collected for 90 s, measured 10 times and then averaged. Ten spots were analyzed for each sample. A 50x long-working-distance objective was used with a spot size of 0.865 µm. Five of the samples belong to the ROM (Toronto, Canada): NWA 10395, NWA 4838, NWA 11554, NWA 12565, Allende and Dhofar 2037. Eleven others were loaned by the National Institute of Polar Research (NIPR) in Tokyo, Japan: Asuka 87344, Asuka 880835, Asuka 881317, Asuka 12373, Yamato 86009, Yamato 86751, Yamato 86752, Yamato 980010, Yamato 980145, Yamato 980146, Yamato 981208.

Results: The Raman spectra of the Allende CV group carbonaceous chondrite shows petrologic subtype of >3.7 that closely resembles the subtype of previous studies [3]. The subtype of the remaining samples were also determined based on the same study [3]. The samples all plot on a trend similar to that of [3].

Discussion: We support the usage of Raman spectroscopy as a non-destructive tool for determining the petrologic subtype of CV chondrites. We have incorporated these analyses into our typing procedures and four untyped meteorites from the ROM collection have now been analyzed. Future work will consist of plotting the ratio between FWHM-D/(I_D/I_G) to the elemental abundance acquired by the LA-ICP-MS.

References: [1] Brearley & Jones (1998) Chapter 3 in *Planetary Materials* (Papike, Ed.); [2] Stöffler & Keil (1991) *GCA 55*, 3845-3867; [3] Bonal et al. (2016) *GCA 189*, 312-337; [4] Sears et al. (1980) *Nature 287*, 791;