SPECTROSCOPIC CHARACTERIZATION OF CK AND CV CHONDRITES FOR UNDERSTANDING THEIR PARENT BODY HISTORIES.

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Introduction: Carboncaeous chondrites are among the most primitive meteorites and they have been studied through various analytical techniques in order to shed light on parent body histrories and processes they have undergone. It has been suggested that CV and CK chondrites may have originated from the same parent body [1,2]. While oxygen isotopic data and elemental analysis suggests a relationship between the two groups of chondrites [2], magnetite content varies [1]. [3] studied several CV and CK chondrites via instrumental neutron-activation-analysis and suggested a close relationship between the two group of meteorites.

Confocal Raman imaging spectroscopy and FTIR microspectroscopy provide valuable information on the chemistry of meteorites on a ~1 micron scale [e.g, 4,5,6]. In this study, we have studied several CV, CK, and CO chondrites using Raman micro-spectroscopy in order to identify and understand possible chemical links at the molecular level.

Samples and Technical Details: We have received several CK and CV Antarctic chondrites with varying petrological grades from the Meteorite Working Group in the form of thin sections. These samples include Allan Hills 85006 (ALH 85006), Allan Hills 85002 (ALH 85002), David Glacier 92300 (DAV 92300), LaPaz Icefield 02206 (LAP 02206), Allan Hills 82135 (ALH 82135), and Dominion Range 08476 (DOM 08476). Studied samples have very low weathering grade (A), indicating only minimal terrestrial weathering. We conducted our micro-Raman experiments at the Center for Planetary Exploration at Stony Brook University using a WiTec alpha300R confocal Raman imaging system equipped with a Nd:YAG laser (532 nm) and a 50X objective (NA = 0.8). The laser power on the sample surface was around 0.8-1.2 mW. After locating a region of interest under the microscope, two dimensional Raman intensity maps were collected from 100 µm X 100 µm areas with ~1 µm lateral spatial resolution, and a full Raman spectrum was collected at every pixel within the measured area with 0.03-0.05 s integration time.

Results: Our preliminary results, based on the Raman imaging experiments on thin sections at ~2 micron below the surface, indicate that CV chondrites and CK chondrites have similar carbon peak parameters in general, i.e., full-width-half-maximum (FWHM), positions, and intensity ratios. First order D and G carbon peaks appear in most meteorites, and in some cases (e.g., ALH 85006 and LAP 02206) we observed second order carbon peaks as well near 2600-2900 cm^{-1}. In LAP 02206, a sharper D band with missing G band was observed, indicating highly disordered carbon in this CV3 chondrite. This hasn't been observed in the CK chondrites measured so far in our study. Estimated effective parent body peak metamorphism temperatures calculated based on the equations in [7] also show similarities between the CV and CK chondrites. This work is currently preliminary and based on very limited number of meteorites. In our future work, the rest of the meteorites in the CK and CV group will be measured using Raman imaging spectroscopy in order to be able to compare the chemistry of the two groups. We will additionally map spatial distribution of organic matter in these meteorites using micro-FTIR imaging spectroscopy in order to understand and compare distribution and spatial relations of organics with inorganic materials, which will potentially provide clues for the formation and evolution histories of chemical constituents present in these CV and CK chondrites, and thus will enable us to see similarities/differences between these groups of meteorites.

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