PETROLOGIC SUB-TYPES, SUB-GROUPS, AND PAIRING FOR CV CHONDRITES IN THE US ANTARCTIC METEORITE COLLECTION.

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Introduction: Carbonaceous chondrites of the Vigarano group (CV) are primitive meteorites that provide a wealth of information about the early solar system, including constraints on chondrule formation, origin of calcium-aluminum inclusions, stability of organic compounds, and redox conditions (e.g., [1-4]). The US Antarctic meteorite collection contains 119 CV samples from 15 dense collection areas (DCAs) from the Trans-Antarctic Mountains. These samples have been assigned a preliminary classification as CVs, but have not been assigned to the subgroups Oxidized A, Oxidized B, and Reduced [5]. Additionally, variation in petrologic grade can be determined non-destructively using Raman spectroscopy. In order to update classification of both subgroups and petrologic types in the collection, we have acquired magnetic susceptibility, metal and sulfide compositions, and Raman spectra, for as many samples as possible. We use the recent assessment and delineation of CV sub-groups of [6] as a guide.

Samples: Measurements were made on either main mass (magnetic susceptibility, or MS), small chips of meteorites (Raman and some MS), or on thin sections (Raman and microprobe). Meteorites from all 15 dense collection areas were analyzed using at least one technique. Raman spectra were collected on both chips and thin sections of meteorites GRA06101, MIL07671, MIL091010, and RBT04133. In addition, spectra were collected from thin sections of Leoville and Vigarano, and chips of LAP 02228, LAR 06628, LAR 06687, LAR 12049, MET 00429, MIL 07678, MIL 07685, MIL 07696, MIL 15240, MIL 15247, MIL 15254, MIL 15255, MIL 15265, MIL 15306, MIL 15363, MIL 15511, and MIL 15516 where thin sections were not available. Only very small samples (<2 g) were not measured by any of the three approaches, and pairing for those was assessed by find location

Techniques: Magnetic susceptibility (χ) of the CV samples was measured using a SM-30 magnetic susceptibility meter (e.g., [7,8]. These measurements are non-destructive and where possible, multiple measurements were made on the same mass but in different orientations. Raman spectra were collected using a WITec α300R confocal Raman microscope (XMB3000-3003) at the NASA Curation Office, customized for astromaterials studies and named "Ratatoskr." The Raman spectra were collected with 532 nm excitation generated from a WITec diode laser (XSL3100-1154), using analytical conditions described previously [9]. For each sample, 10 Raman spectra were collected each of a different spot on the sample surface. Average G and D band parameters were calculated from the 10 spectra. The samples were plotted with FWHH of the D band as the ordinate and I_D/I_G as the abscissa, which enabled estimate of petrographic type. Mineral composition data was obtained using the NASA-JSC Cameca SX100 electron microprobe using natural minerals (troilite, cuprite, cobaltite) and synthetic materials (Ni, Co, Fe) as standards and PAP reduction scheme for ZAF corrections [10]. The microprobe was operated with a beam current of 20 nA and an accelerating voltage of 15 kV.

Results and summary: Overall, there are 55 Oxidized A samples, 18 Oxidized B samples, and 46 reduced samples. Several of the CV are quite primitive (LEW and MAC) but are also very small. Multiple pairing groups have been identified in the MIL, QUE, and LAR DCAs, including all of the CV subgroups. In a few samples from the MIL and LAR areas, there is evidence for multiple lithologies. We make suggested updates for all the samples, knowing that this information will help to better guide researchers interested in studying the CV chondrites in the US Antarctic meteorite collection.

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