COMPARATIVE MICROANALYTICAL STUDY OF SOLID ORGANIC MATERIAL IN THE CR2 GROVE MOUNTAIN 021710 AND THE UNGROUPED CARBONACEOUS CHONDRITE NINGQIANG

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Introduction: In order to unravel the complex evolutionary history of organic matter (OM) from early planetesimals, characterization of the organic chemistry, morphology, isotopic composition and microscopic setting of OM in chondrites is paramount. The focus of this study is the characterization of solid OM *in situ* in an Antarctic CR2 carbonaceous chondrite (CC) find and a CC fall from Ningqiang, China. The CR and Ningqiang CV-like primary and secondary/tertiary chondritic components experienced different formation histories. The properties of solid OM are sensitive to the varying processing histories recorded in different CCs [e.g. 1]. For instance, different CC groups recording varying thermal histories also contain a record of structural variation of OM [1]. We are coordinating Raman-SEM-NanoSIMS-STXM-TEM of GRV 021710 (classified CR2) and Ningqiang (ungrouped CC) on polished thin sections *in situ* in order to shed more light on the evolutionary history of OM across different CCs.

Samples & Methods: Grove Mountain (GRV) 021710 is an Antarctic meteorite from the Chinese Antrarctic Research Exbedition (CHINARE), 2002. Classified as a CR2, it is a unique CC exhibiting amongst the largest number of presolar grains [2]. A traditional polished thin section was prepared embedded in epoxy. Ningqiang is an anomalous CV-like chondrite [3]. It was embedded under vacuum conditions and thus the epoxy was confined to only a few mm along the boundary of the section. Raman Spectroscopy was performed at Guilin University of Technology, China with a Renishaw *Invia* 514 nm laser source. Electron microscopy and isotopic imaging was performed at IGGCAS with a Zeiss *Auriga* Dual Beam FIB-SEM and a Cameca NanoSIMS 50L respectively.

Results & Discussion: Raman mapping shows OM ubiquitously distributed across the matrices of both GRV 012710 and Ningqiang. This is observed by the presence of a G and D band at ~1600 cm-1 and 1350 cm-1 respectively. The larger D band in the Raman spectra from Ningqiang is consistent with elevated thermal history in e.g. CV chondrites than in more primitive CCs such as the CRs [1]. Raman spectra of epoxy on the side of the thin section and within veins in GRV 021710 exhibit a positive shift in the G band position at ~1610 cm-1 and a narrow FWHM, which is distinguishable from chondritic OM (Fig. 1). Ningqiang displays a more homogenous Raman signal interstitial to distinctive chondrules. Coordination of SEM with Raman mapping identified organic particles in GRV 021710. Their morphologies are consistent with CC insoluble organic matter (e.g. Fig. 1b,c) [e.g. 4]. Such organic particles have yet to be identified in Ningqiang. Irregular shaped phases in Ningqiang suggested as relict primary material (Fig. 1a,b) also display this Raman signature unlike in distinctive chondrules where it is lacking. Mild metamorphism of primary material may have distributed IOM within these regions of suggested relict material as well as in the fine scaled matrix of Ningqiang. The use of Raman spectroscopy with SEM demonstrates the effectiveness in rapidly discriminating chondritic OM from epoxy in traditional polished thin sections.

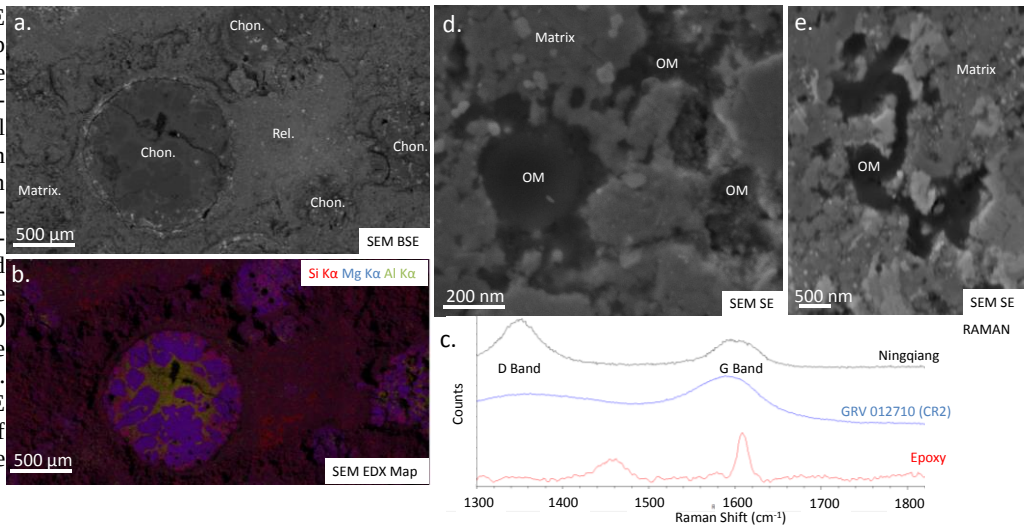

FIG. 1: (a) SEM BSE image and EDX map (b) in Ningqiang. Fine scaled matrix and suggested relict matrial (marked Rel.) contain the Raman spectrum in (c). (c) Off-set representative Raman spectra from Ningqiang and GRV021710. Note the positive shift in the D and G band of the epoxy in GRV021710. (d) & (e) SEM SE images of examples of organic particles in the matrix of GRV012710.

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