**THERMAL METAMORPHISM EFFECTS IN CR CHONDRITES**

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CR chondrites are considered among the most primordial meteorites [1]. Almost all CR chondrites are classified as petrologic type 2 meteorites. Exceptions are GRO 95577, classified as CR1, and Sahara 00182, MET 00426 and QUE 99177, recently suggested to be of petrologic type 3 [2-4]. To establish a more precise metamorphic classification of CR chondrites we started a study based on Raman spectroscopy of macromolecular organic matter (OM) and characterization of texture and chemical composition of metal grains. Raman spectroscopy is sensitive to the metamorphic degree of type 3 chondrites [5-7] and is also a useful tool to characterize OM in unmetamorphosed type 1 and 2 samples [8]. Fe-Ni metal grains were shown to be metamorphic indicators in ordinary and CO chondrites [9].

Polished blocks from eleven CR chondrites (EET 87711, GRA 06100, GRA 95229, GRO 03116, GRO 95577, LAP 02342, LAP 04516, MAC 87320, PCA 91082, QUE 99177, Renazzo) have been analyzed. Raman spectra of OM have been acquired on randomly selected matrix areas. Metal grains inside chondrules, on chondrule surfaces and isolated in matrix have been analyzed by SEM, EDX spectroscopy and EMPA.

All the Raman spectra show a high level of fluorescence, with the exception of those from OM in GRA06100 and GRO03116. This suggests a higher structural order of the OM in these two meteorites than in the other ones. The spectral parameters of the D- and G-bands tend to confirm that observation: the structural order of the OM in all the CR chondrites we studied, with the exception of GRA 06100 and GRO 03116, is comparable to that of OM in CM2 chondrites. GRA 06100 and, to a lesser extent, GRO 03116 have a more organized OM. Furthermore, metal grains in GRA 06100, independently of petrographic context, display abundant Ni-rich inclusions (up to ~21 wt% Ni) with size up to ~15 µm. In the other CR chondrites, metal grains with Ni-rich inclusions appear to be less abundant, and the Ni-rich phases appear to be smoothly distributed rather than being coarse-grained, isolated inclusions.

Our results indicate that GRA 06100 is the most metamorphosed CR chondrite among our studied meteorite suite. A slightly lower and possibly short heating event is suggested for GRO 03116, as observed in metamorphosed CMs like WIS 91600 and PCA 91008 [10, 11].

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