DETERMINATION OF CARBON ORIGIN IN ACAPULCO AND LODRAN BY HRTEM AND C, N ISOTOPES

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Introduction: Acapulcoites and lodranites (A-L) are enigmatic meteorites with characteristics of both chondrites and achondrites. It has been suggested that they register the progressive evolution of a chondritic body by metamorphism and partial melting [1], but also that they experienced important shock processing [2]. Because the organization and isotopic composition of carbons are footprints of their formation conditions and of their thermal history, we decided to study the carbons in a suite of 5 acapulcoites and 1 lodranites in order to understand the differentiation processes underwent by the A-L parent-body [3]. Carbon phases are systematically associated with the metal and their petrography changes with the recrystallization degree. Raman microspectrometry reveals that these carbons are disordered with various graphitisation degrees [3]. Here we report a cross-characterisation of carbon structural improvement (graphitization) by High Resolution Transmission Electron Microscopy (HRTEM) and Raman microspectrometry with their C, N isotopic composition evolution by ion microprobe in Acapulco and Lodran.

Results: Isotopic compositions of C and N are probably decoupled. In Lodran and in particular in Acapulco, we found a large range of $\delta^{13}C$ values between -40 ‰ and +40 ‰. The most frequent $\delta^{13}C$ value is close to -20 ‰, which is comparable to the IOM of chondrites. We found a different N isotopes distribution in Acapulco and Lodran with more negative $\delta^{15}N$ values in Acapulco and less negative $\delta^{15}N$ values in Lodran. In Acapulco, the light N component has the isotopic composition of metal suggesting an equilibration during carbon – metal interaction possibly related to the higher degree of graphitization. In Lodran, carbons can be attributed to a mixture between a nitrogen poor carbon similar to those of Acapulco and a nitrogen rich component similar to the insoluble organic matter (IOM) of CI-CM chondrites. In addition, carbons in Lodran are more disordered than in Acapulco suggesting the partial preservation of a precursor similar to the IOM of CI, CM carbonaceous chondrites. HRTEM of Acapulco carbons reveals the coexistence of graphite and more disordered carbons, detected in Raman microspectrometry. Graphitic layers form shells around metal

Conclusion: These results suggest that a precursor similar to the IOM of CI and CM chondrites has been partially re-equilibrated indicating a strong effect of parent body processes rather than preservation of pre-accretional signatures as suggested by [4]. However the strong isotopic fractionation of C still remains to be understood. In order to understand this isotopic fractionation and the thermal history of the precursor, it is now necessary to study the C and N isotopic systematic of metal coexisting with carbons and to compare natural objects with pyrolysis experiments of saccharose cokes (analogs of chondritic IOM) in the presence of iron powders.

References: [1] McCoy T.J. et al. 2006. *GCA* Vol.70. pp. 516-531. [2] Rubin, A. 2007 *GCA* Vol.71. pp. 2383-2401. [3] Charon et al. 2009. *Meteorit. Planet. Sci.* Vol.44, pp.A48. [4] El Goresy A. et al. 2005. *GCA* Vol.69. No18. pp. 4535-4556.