THE PARIS CM CHONDRITE YIELDS NEW INSIGHTS ON THE ONSET OF PARENT BODY ALTERATION

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Introduction: The recently found Paris meteorite is a CM chondrite, which is less aqueously altered than other CMs and has experienced mild thermal metamorphism (~ 3.0 ± 0.1) [1]. We present here new observations on this exceptional sample.

Methods and results:

Bulk chemistry: A 13 g sample was crushed into a homogenous fine-grained powder to be later allocated for bulk isotopic measurements. A 500 mg aliquot was analyzed for major elements, while trace element measurements are still in progress. With 22.5wt% Fe, 13.5 wt% Si & 12wt% Mg, Paris falls well within the range of CM chondrites.

Bulk physical properties: Paris has a grain density of 2.92, typical of CM chondrites [2], while its magnetic susceptibility of $\log\chi = 4.36$ (χ in 10-9 $m^3.kg^{-1}$) places it in the upper range for CM chondrites [3]. Preliminary magnetic analyses show that, unlike other CM chondrites whose magnetic mineralogy is dominated by magnetite, Paris contains more metallic iron than magnetite (wt%).

Petrographic observations: CM chondrites were shown to exhibit significant variations in alteration state within the same sample [4,5]. All alteration stages defined for opaque minerals by [5] are present in Paris. While adjoining opaque grains may vary in alteration state, large (≤cm-sized) regions have dominantly unaltered metal (stage 0-1 of [5]), while others are significantly altered, much more similar to other CM chondrites. The boundaries between these zones are sometimes sharply defined but more frequently diffuse.

Discussion: The low magnetite abundance and the preservation of large unaltered zones in Paris are consistent with it being less altered than other CM chondrites. Whether CM chondrite alteration took place in the nebula or on the parent body is still a matter of debate. The existence of alteration zones and their size supports the latter hypothesis. The sharp boundaries between some of these zones indicate that Paris was brecciated (like most other CMs) and that this brecciation happened after alteration had taken place. The more diffuse boundaries, on the other hand, suggest that alteration post-dates some of the brecciation episodes. We surmise that brecciation and alteration were concomitant on the CM parent-body and lasted a few million years [6].

References: [1] Bourot-Denise M. et al. 2010. 31st Lunar and Planetary Science Conference #1683. [2] Consolmagno G. et al. 2008 Chemie der Erde 68:1-29. [3] Rochette et al. 2008 MAPS 43:959-980 [4] Palmer E. E. et al. 2007. 28th Lunar and Planetary Science Conference.#1416. [5] Palmer E. E. and Lauretta. 2010. 31st Lunar and Planetary Science Conference.#2211. [6] Petitat M. and Gounelle M. 2010. 31st Lunar and Planetary Science Conference.#1673.