SECONDARY PROCESSES WITHIN THE PARIS CM CHONDRITE.

Ingrid Blanchard[1,2], Matthieu Gounelle[1], Michèle Bourot-Denise[1] & Anton Kearsley[3]. [1]LMCM, UMR 7202, CNRS & MNHN, CP 52, 57 rue Cuvier, 75005 Paris, France. gounelle@mnhn.fr [2] IPGP, PRES SPC, Université Paris-Diderot, 4 Place Jussieu, 75005 Paris. [3]IARC, Department of Mineralogy, Natural History Museum, London SW7 5BD, UK.

Introduction: The Paris meteorite is a pristine rock whose petrography, oxygen isotopic and bulk chemical compositions are compatible with a classification as a CM chondrite [1, 2]. Based on petrography and mineral compositions it was initially classified as a 3.0 chondrite [2, 3]. This classification is however ambiguous as it has been known for a while that hydrothermalism and thermal metamorphism might be unrelated within CM chondrites [4]. The goal of the present work is to place Paris on two *distinct* alteration scales (hydrothermalism and thermal metamorphism) proposed for CM chondrites by [5-7]

Methods: We investigated the Paris polished blocks 2010-05 and 2010-07 prepared at MNHN. X-ray mapping was done at NHM London [8]. Standard SEM and EMPA techniques were performed in Paris itself.

Results: As previously noted, Paris is a breccia whose alteration properties vary at the cm-scale [1, 2]. Matrix is made of a mixture of abundant phyllosilicates, tochilinite and other minerals that cannot be resolved individually by the techniques we have used so far. Chondrule mesostasis is usually turned into phyllosilicates. Paris has a Fe-Ni metal abundance of ≈ 1 %. Metal is predominantly kamacite with Ni < 10 wt % and Co < 0.5 wt %. Metal grains often have an oxidized rim. Iron sulfides are pyrrhotite and pentlandite. The latter appears as rims around or lamellae within the former. PCPs are abundant as clumps, and have elevated S/SiO_2 (0.7) and FeO/SiO_2 (4.1) ratios. Olivine mean Cr_2O_3 content is 0.37 wt % (σ = 0.08). Lacking matrix analyses with S < 2 wt %, we were not able to calculate Paris Mineralogical Alteration Index [9].

Discussion: All these properties place Paris among one of the least altered CM chondrite on the *hydrothermal* scale designed by [7]. On that scale, it is at least a 2.6 rock, possibly a 2.7 or 2.8 given the chemical composition of PCPs. Paris cannot be considered as a (hydrothermal) type 3.0 given the large abundance of secondary minerals such as phyllosilicates or tochilinite. Metal and sulfide compositions, as well as their petrographic relationships, place Paris in between the groups A and B defined by [6] on the basis of the thermal metamorphism experienced. It shows features indicative of both an absence of heating and a moderate amount of heating. Thermal metamorphism temperatures of group B are below 700°C [5]. We strongly recommend that two different scales are used for hydrothermal alteration and thermal metamorphism experienced by CM parent-bodies, be they cometary or asteroidal [10]. We propose that Paris is a CM 2.7/2.8 A/B chondrite, the number referring to hydrothermal alteration and the letter to thermal metamorphism.

References: [1] B. Zanda, et al., *LPSC* 42 (2011) #2040.[2] M. Bourot-Denise, et al., *LPSC* 41 (2010) #1683. [3] B. Zanda, et al., *MAPS* 45 (Supp) (2010) #5312. [4] J. Akai, *Proc. NIPR Symp. Antarc. Meteor.* 3rd (1990) 55-68. [5] T. Nakamura, *Journal. Min. Pet. Sciences* 100 (2005) 260-272. [6] M. Kimura, et al., *MAPS* 46 (2011) 431-442. [7] A.E. Rubin, et al., *GCA* 71 (2007) 2367-2382. [8] A.T. Kearsley, et al., *MAPS* This conference (2011). [9] L.B. Browning, et al., *GCA* 60 (1996) 2621-2633. [10] M. Gounelle, *Elements* 7 (2011) 29-34.