REDOX CONDITIONS DURING CV CHONDRULE FORMATION. Yves Marrocchi[1], [1]CRPG-CNRS, 15 rue Notre Dame des Pauvres, 54500 Vandoeuvre-lès-Nancy, yvesm@crpg.cnrs-nancy.fr.

Introduction: Chondrules are submillimeter silicate spherules that constitute up to 80% by volume of primitive meteorites. Although the mineralogy, petrography, bulk chemical and isotopic compositions of chondrules are well-documented, the nature of the chondrule-forming events remain enigmatic. One of the main open questions is the redox conditions at which chondrules formed, because the reduced conditions (i.e., oxygen-poor) estimated for the accretion disk are difficult to reconcile with the chemical observations in chondrules. Especially, CV chondrules are characterized by the presence of spindle-shaped fayalitic halos occuring in forsterites. Such halos likely result of the oxidation of olivine-enclosed Fe-Ni metal beads prior to their incorporation in their parent body(ies) [1]. I will present new results suggesting that fayalitic halos and Fe^{3+}-bearing minerals (e.g.., magnetite) are contemporaneous of the chondrule-forming event.

Results: I report a petrographic and isotopic survey of FeS- and magnetite-bearing chondrules in the CV3 chondrites Kaba and Vigarano. FeS are mainly located within the low-Ca pyroxene outer zone and their amount increases with the abundance of low-Ca pyroxene within chondrules [2]. The magmatic FeS commonly occurs in close association with Cr-poor magnetite within Fe-Ni metal-free structures that present liquid-shaped textures. These characteristics suggest that magnetite are high-temperature products resulting from the crystallization of FeSO melts [3].

Discussion: FeS associated to magnetite present homogeneous S- isotopic compositions ($\delta^{34}S = \delta^{33}S \approx 0‰$). Magnetites show O-isotopic compositions that define a linear array with a slope of 0.94 with no hint for mass fractionation, contrary to what could be expected in case of aqueous alteration processes. Hence, isotopic compositions of FeS-Fe_3O_4 assemblages are in line with magnetite being high temperature magmatic minerals. According to phase diagrams, forming FeSO melts in chondrules can only be achieved under oxidizing conditions (IW+1/IW+2), suggesting that chondrules interacted with an oxidizing gas likely generated by impact between planetesimals. Such oxidizing conditions would also produce the fayalitic halos commonly observed in CV chondrules.

References: [1] Hua X and Buseck P. R. (1998) *GCA, 62,* 1443–1458. [2] Marrocchi Y. & Libourel G. (2013). *Geochim. Cosmochim. Acta.*, 119, 117-136 [3] Marrocchi et al. (2016) *Science advances* **2**, e1601001.