

Alteration condition of CM chondrites: an experimental approach

L. G. VACHER^{1,2*}, L. TRUCHE³, R. MOSSER-
RUCK³ AND Y. MARROCCHI^{1,2}

¹CNRS, CRPG UMR 7358, Vandoeuvre-lès-Nancy,
F-54501, France (*correspondence:
lvacher@crpg.cnrs-nancy.fr)

²Université de Lorraine, CRPG, UMR 7358,
Vandoeuvre-lès-Nancy, F-54501, France

³GeoRessources UMPR-CRNS 7359, Université de
Lorraine, Faculté des sciences et technologies,
Campus Aiguillettes BP 0239, 54506
Vandoeuvre-lès-Nancy, France

CM carbonaceous chondrites recorded intense episodes of hydrothermal alteration that have strongly modified their primitive petrography [1]. They contained several hydrated minerals, but tochilinite ($6\text{Fe}_{0.9}\text{S}\cdot 5(\text{MgFe}^{2+}(\text{OH})_2)$ - cronstedtite ($\text{Fe}^{2+}_2\text{Fe}^{3+}(\text{Fe}^{3+}\text{Si})\text{O}_5(\text{OH})_4$) intergrowths (also referred as TCI) are the most predominant hydrated phases [2]. These secondary phases are likely to have formed during hydrothermal alteration processes in the parent body conditions, but their stability is poorly constrained.

To fill this gap, we performed anoxic hydrothermal experiments at 80°C contacting glass powder of GEMS-like composition [3], metal iron and forsterite with a salty solution (I = 0.07m NaCl, MgCl_2 and CaCl_2) during 3 months. The water/rock ratio is set to 10, and we played on pH (neutral to alkaline) and sulphide (as Na_2S) concentration.

Micrometric pyramidal crystals of cronstedtite were formed in neutral conditions and high quantity of iron metal (33 wt%). In sulphide-rich environment, TCI precipitated around iron metal particules in small amounts (<1 wt%). TEM analyses indicate that TCIs are very heterogeneous in crystallinity. They are principally composed of nanometer acicular crystals of Fe-rich tochilinite, but they can also occur as intergrowth with another 7Å d-spacing phase.

Our experiments confirmed that TCI in CM chondrites are formed by low-temperature hydrothermal aqueous alteration under reducing conditions. Future works are envisaged to constrain the stability fields of cronstedtite and tochilinite at 50 and 150°C during long term hydrothermal experiments.

[1] Brearley (2006) **MESS II**, 587-624 [2] Rubin *et al.*, (2007) **GCA** 71, 2361-2382 [3] Leroux *et al.*, (2014) **GCA** 170, 247-265.