In situ hydrogen isotopic composition of H-bearing phases in the matrix of CM carbonaceous chondrites.

L. PIANI[1], H. YURIMOTO[1], L. REMUSAT[2], A. GONZALES[2]

[1]Dept. Natural History Sciences, Hokkaido University, Japan (laurette@ep.sci.hokudai.ac.jp)
[2]IMPMC-UMR CNRS 7590, Sorbonne Universités, UPMC, IRD, MNHN Paris, France

Organic matter (OM) and hydrated minerals are the two main H-bearing components in the aqueously altered chondrites. They are important witnesses of the volatile-rich reservoirs present in the inner protoplanetary disk as well as of chemical reactions that occurred on the asteroidal parent bodies [1-2]. The CM-type carbonaceous chondrites constitute a well-identified chemical group that presents a wide range of hydrothermal alteration degrees on their parent body [3]. They contain significant amount of OM, both soluble and insoluble in organic solvents, intimately mixed with hydrated silicates in their fine-grained matrix [4]. However, the nature, amount, distribution and relationship of these H-bearing phases remain poorly constrained.

The secondary ion mass spetrometry (SIMS) IMS1280HR at Hokkaido University was used in a first step to look at the relationship between organic matter and hydrated minerals in CM having different degrees of aqueous alteration [2] [5]. We found that, at a scale of tens of micrometers, most of the CM chondrite matrices correspond to a mixture of a D-rich OM with a D-poor water (δD ~350 ‰). The least altered lithology of the Paris chondrites show nontheless the presence of a third C-poor/H-rich component that might be a D-richer ice or some pre-accretionally hydrated inorganic phases [6] [2]. Surprisingly, the insoluble OM isolated after acid dissolution of the minerals do not correspond to any of the hydrogen-rich end-members identified in situ [5].

In a second step, the distribution of the D/H and C/H ratios has been imaged at a sub-micrometer scale by using the NanoSIMS at MNHN (Paris) on the matrix of two CM chondrites: the extensively altered Sayama chondrite (CM2) and the least altered lithology of the slightly altered Paris chondrite (CM2.7/2.9). The comparison of the isotope images with conventional SIMS data and scanning electron microscope images gives clues on the nature of the H-bearing phase of the CM matrices.

References: [1] Alexander et al. 2012 *Science* 337, 721–3. [2] Piani et al. 2017 LPSC abstract #1203 [3] Le Guillou et al. 2014 GCA 131, 368-392 [4] Rubin et al. 2007 GCA 71, 2361-2382 [5] Piani et al. 2016 Goldschmidt abstract [6] Howard et al. 2014 GCA 149, 206-222.