Studying the physical processes promoting aqueous alteration of Carbonaceous Chondrites

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We are currently studying the most primitive groups of carbonaceous chondrites (hereafter CCs) to gain insight into the physico-chemical processes that were promoting aqueous alteration of their parent bodies [1]. We use different analytical techniques (SEM+EDX, micro-Raman, ICP-MS and GC-MS) to study the formation conditions of aqueously altered CCs. From this multiple approach we plan to study the minerals formed by aqueous alteration and the circumstances in which organic matter might have experienced significant processing concomitant to the formation of clays and other minerals. Several lines of evidence exist in this regard, e.g., clays have been found to be associated with complex organics [2,3]. Furthermore, analytical studies appear to correlate the abiotic chemistry of carbonaceous chondrites with extant biomolecules including e.g. an L-enantiomeric excess for some meteoritic amino acids [4,5,6]. Several meteoritic α-methyl-α-amino acids rare in the terrestrial biosphere have L-enantiomeric excesses in Murchison, Murray and Orgueil [4,5]. It has been also suggested that amplification of a small initial L-enantiomer excess during aqueous alteration on the meteorite parent body could have led to the large L-enrichments observed for aspartic acid and other amino acids in Tagish Lake [6]. We wish to obtain additional clues on the physical processes promoting aqueous alteration [7]: gravitational sintering, impact shock, etc. and the importance in matrix amorphitization. There is therefore growing evidence pointing towards a prebiotic synthesis of complex organic species in water-rich undifferentiated bodies. Interdisciplinary research is needed to significantly enrich our knowledge on this quickly progressing discipline.

[1] Trigo-Rodríguez *et al* (2014) *MNRAS* **437**, 227-240 [2] Pearson *et al* (2002) *MAPS* **37**, 1829-1833 [3] Garvie & Buseck (2007) *MAPS* **42**, 2111-2117 [4] Pizzarello and Cronin (2000) *GCA* **64**, 329-338 [4] Glavin & Dworkin (2009) *PNAS* **106**, 5487-5492 [5] Glavin *et al* (2012) *MAPS* **47**, 1347-1364 [6] Trigo-Rodríguez *et al* (2006) *GCA* **70**, 1271-1290