COLLISIONAL AND ALTERATION HISTORY OF THE CM2 BORISKINO

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Introduction: Brecciation is a common feature in CM chondrites and attests to the collisional activity that took place on their parent body. CM clasts exhibiting different degrees of aqueous alteration, from less altered (CM2) to heavily altered (CM1) and thus represent valuable information about the genetic relationship between aqueous alteration and the deformation history of the CM parent body(ies) [1, 2]. We focused on Boriskino meteorite, a little studied CM chondrite fell in 1930 in ex-U.S.S.R that describes the presence of millimeter clasts with both CM2 and CM1 lithologies suggesting that this chondrite may present a good opportunity to better understand the link between aqueous alteration and the deformation history of the CM chondrites [3].

Methodology: C and O-isotopic compositions were measured using a CAMECA ims 1280 HR2 ion microprobe at CRPG laboratory (Nancy, France). A Cs^+ primary Gaussian beams of 20 nA (spot of ≈ 20 µm) and 5nA (spot of ≈ 15 µm) were measured in multi-collection mode (two Faraday and three Faraday cups) for C and O-isotopes, respectively.

Results and Discussion: Our data demonstrate that Boriskino is composed of millimeter clasts, in direct contact with each other, that display various lithologies characterized by different degrees of alteration and deformation histories [3].

The least altered lithology contains Type 1a Ca-carbonates (calcites and aragonites) that are ^{16}O-poor and precipitated early in Boriskino's alteration history (**Fig. 1a**). The more altered lithologies (lithology B, **Fig. 1b**) are composed of ^{16}O-rich Type 2a Ca-carbonates (calcites) and veins of calcite lying subparallel to the petrofabric. These calcites precipitated after the establishment of the deformation, from transported ^{16}O-rich fluid in preexisting fractures and cracks **(Fig 1a & 1b)**.

Based on strong evidence of shock features in Boriskino, we propose that some of the clasts that make up the Boriskino meteorite were subjected to high pressure impact(s) (i.e., 10-30 GPa) that generated strong petrofabrics, chondrule flattening and fractures (**Fig. 1b**) [4].

Taking all our results together, we propose that the difference between the degree of alteration in the lithologies could be explained by their different location close to the impact zone, promoting a late circulation of fluid flow into fractures (**Fig. 1b**). Based on the C-isotopic composition of Boriskino Ca-carbonates, we assume that the formation of T2a calcite probably can took place in an open system environment with a loss of ^{13}C-depleted CH_4 produced by Serpentinization [5]. Considering a mean precipitation temperature of Ca-carbonates of 110°C [6], an escape of ≈ 15-50% of dissolved carbon into CH_4 by Rayleigh distillation is able to reproduce the range of C-isotopic compositions observed in T2a calcites [7].

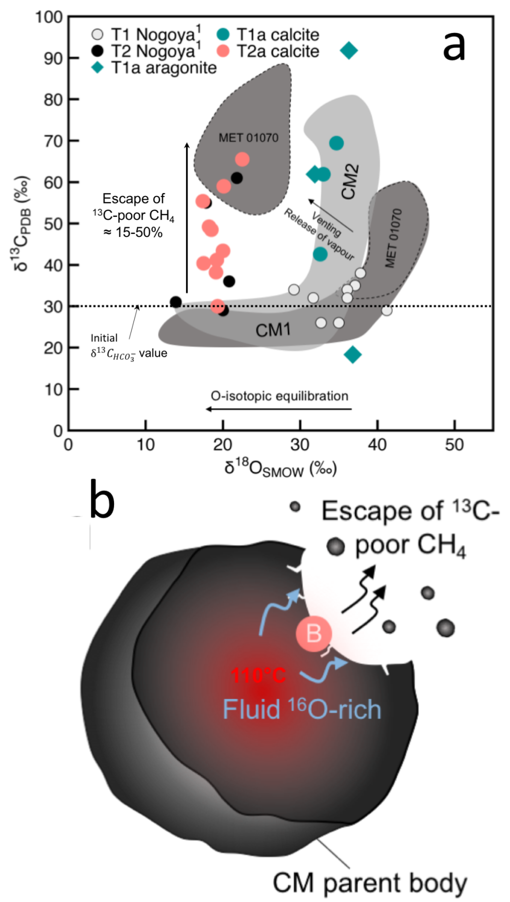

Figure 1 – a) $\delta^{13}C$ *vs.* $\delta^{18}O$ values (2σ) of the Ca-carbonates from this study (green and red points), the CM Nogoya [7] and the literature (light and dark grey). b) Schematic representation of the thermal and deformation history of the Boriskino parent body.

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