ORIGIN OF SILICA-RICH GLASS INCLUSIONS HOSTED IN PORPHYRITIC MAGNESIAN OLIVINES IN CHONDRULES

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Determining how glass inclusions in the oldest and most primitive magnesian porphyritic olivines of type 1A chondrules formed and were preserved since 4.5 Ga is crucial to understand the first steps of solar system evolution. Some rare silica-rich glass inclusions ($69 < SiO_2 < 82$ %wt.) are described within these magnesian olivines. These glass inclusion compositions are clearly out of equilibrium with their host Mg-olivines and their presence within olivines is generally attributed to an unclear secondary process as a late interaction with nebular gases. Indeed, a magmatic origin for these Si-rich glass inclusions means that classical thermodynamic phase relations do not operate. In particular, peritectic reaction that produces low-calcium pyroxene from forsterite and a silica-rich liquid should be impeded. We performed experiments that demonstrate that Si-rich glass inclusions are actually magmatic inclusions trapped inside olivines that crystallize slowly from a magma which has a CI composition, i.e. the solar composition. The peculiar compositions of these inclusions result from combination of two factors: small volume of melt inclusions and large temperature gap between the crystallization temperature of the first phase, i.e. olivine in our experiments, and the occurrence of the second phase (pyroxene) that inhibits nucleation of this pyroxene and so peritectic reaction. Then, crystallization of olivine continues metastably on the walls of inclusion until the liquid is frozen as a glass. Therefore, we suggest that Si-rich glass inclusions could be the only reliable relicts of what were the first magmas of the solar system, exhibiting a CI, i.e. non-fractionated, composition [1].

Reference: [1] Faure et al. 2017. *Geochimica et Cosmochimica Acta* 204, 19-31