FORMATION OF SECONDARY Ca-Fe -RICH ASSEMBLAGES IN CV CHONDRITES

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Introduction: CV chondrites have been affected by secondary processes occurring prior or after their accretion in their asteroidal parent bodies. These (fluid-assisted) secondary thermal processes have all acted to modify the very early record of these chondrites ([1] for a review), by affecting to different degrees several of their primordial components, e.g., CAI's, chondrules, matrix, dark inclusions. Amongst the diversity of phases involved in these secondary processes, Ca-Fe-rich assemblages, i.e., andradite, hedenbergite, kirschsteinite, wollastonite, fayalite, with Fe, Ni sulphides and/or Fe-oxides, are of particular interest since they are almost ubiquitous in different carbonaceous chondrite groups including the CV group ($CVOx_A$, $CVOx_B$, CVR). Despite several mineralogical, chemical, isotopical and geo-chronological studies, their mode of formation still remains controversial, with models invoquing various thermal and redox conditions in nebular or asteroidal environments, alternatively. Owing to i) a ongoing textural, mineralogical and chemical survey of secondary Ca-Fe phases in the matrix of Allende, ii) a thermodynamic modeling with Theriak-Domino software [2] using the updated database from Holland and Powell [3], and iii) a Schreinemakers analyse for the simplified chemical system Ca-Fe-Si-O, we will show that it is possible to provide new insights on (i) the T - log fO_2 - log fS_2 - log $aSiO_2$ conditions of formation of Ca-Fe secondary minerals in carbonaceous chondrites, (ii) the iso- versus allo-chemical nature of the alteration processes responsible of the formation of these phases, as well as on (iii) the scarcity of the hydrous phases (and particularly serpentine) in the invoqued context of aqueous metasomatism during hydrothermal delivery of volatiles [4] in planetesimals.

References:

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