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Ca in olivine geospeedometer indicates multistage cooling history of parent bodies of IAB meteorites

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The record of cooling histories of planetesimals during the early evolution of the solar system is preserved in the compositional record in meteorites such as the Ca zonation in olivines. During cooling of the parent body of the meteorite, Ca diffuses out of olivine into clinopyroxene [1]. The stranded concentration profiles can be measured and modeled using Ca diffusion coefficients measured in the laboratory [2]. We have studied the Ca zoning profiles in olivines from silicate inclusions in IAB iron meteorites (that had been studied by [1] as well) using a computer code to numerically simulate the evolution of Ca zoning profiles that develop along arbitrarily complex T-t paths. Preliminary results indicate that at least a three stage cooling history is required to describe the compositional zoning: a period of early cooling from high temperatures, followed by an anneal at a nearly constant temperature (~ 600 °C), and then subsequent cooling to low temperatures.

[1] Köhler et al. (1991), N. Jb. Miner. Mh., H. 9, 423-431

[2] Coogan et al. (2005), Geochim. et Cosmochim. Acta,

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