

EQUILIBRIUM TEMPERATURE ESTIMATIONS ON COEXISTING PHASES IN MESOSIDERITES

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Introduction: The thermal history of mesosiderites is not totally understood yet. Materials with different physical and chemical properties (e.g., silicates, oxides, sulfides and metal) make up the whole rock showing a heterogeneous mineral distribution with variable degrees of recrystallization. Here we report on new equilibrium temperature calculations made on the silicate pairs high-Ca/low-Ca pyroxene and low-Ca pyroxene/olivine. We took into account only clinopyroxene and orthopyroxene exsolutions present as lamellae and/or blebs.

Methods: To assess equilibria among pyroxene-pyroxene and low-Ca pyroxene-olivine pairs, we have used the oxythermobarometry program QUILF [1]. The program was run using 1 bar as pressure condition since mesosiderites silicates have been considered to be part of shallow crustal levels [e.g., 2,3].

Samples: The studied PTS are Vaca Muerta K, Vaca Muerta O, Crab Orchard L3771, Mincy L, Estherville M2072 (from NHMV) and ALHA77219,74-10, Asuka 87106.51.3 and Asuka 882023.51-3 (from NIPR).

Results and Discussion: For thermometric purposes, the molar compositions of all involved phases were recalculated into the scheme Mg-Fe-Ca according to QUILF projection. Almost all compositions corresponding to both, high- and low-Ca pyroxenes nearly fit the equilibrium model in Fe-Mg exchange. The equilibrium temperatures fall in the range from $872\text{ °C} \pm 49\text{ °C}$ to $1057\text{ °C} \pm 28\text{ °C}$. This temperature range is in agreement with that previously estimated for Budulan and Mincy [4]. For Crab Orchard, QUILF gives temperatures with relatively large uncertainty values ($1018\text{ °C} \pm 75\text{ °C}$ – $1025\text{ °C} \pm 121\text{ °C}$) suggesting that equilibrium conditions were not established.

If olivines and orthopyroxene rims are taking into account the estimated temperatures give similar results. Concerning Fe-Mg exchange, the highest temperature corresponds to Vaca Muerta K $1038\text{ °C} \pm 0\text{ °C}$ and the lowest to Mincy L ($848\text{ °C} \pm 0\text{ °C}$) with a mean value placed at 950.5 °C . In all olivine-orthopyroxene pairs an exact solution ($\pm 0\text{ °C}$ uncertainty) was verified indicating that Fe-Mg partitioning has achieved a near equilibrium state. However, if Fe-Mg-Ca is taken into account, the measured amount of calcio-olivine component is too low to reach equilibrium conditions. Did olivine lose Ca during cooling?

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References: [1] Andersen D. J. et al. 1993. *Computer & Geosciences* 19:1333–1390. [2] Powell B. N. 1971. *Geochimica et Cosmochimica Acta* 35:5-34. [3] Ganguly J. et al. 1994. *Geochimica et Cosmochimica Acta* 58: 2711-2723. [4] Hewins R. H. and Harriot T. A. 1986. Proceedings of the 16th Lunar and Planetary Science Conference 91:D365-D372.