RARE EARTH ELEMENT CONCENTRATIONS IN ALLENDE FUN CAI CMS-1.

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Introduction: Condensation and evaporation processes played an important role in the early Solar System in the formation of meteoritic components such as calcium-aluminum-rich inclusions (CAIs) [1], and significantly influenced chemical differentiation between the inner rocky and outer gaseous planets [2,3]. The relative abundances of rare earth elements (REE) in CAIs can elucidate these condensation-evaporation processes as well as the particular conditions (e.g., fO_2) under which they may have occured. Here, we report the REE concentrations in the primary phases (i.e., melilite and Ti-Al-rich pyroxene) of the Allende FUN CAI CMS-1 [4,5].

Analytical Methods: REE were measured *in situ* with the Cameca IMS-6f ion microprobe at Arizona State University, using an O^- primary beam with currents in the range of 2 to 9 nA and an accelerating voltage of -12.5 keV. Secondary ions were accelerated using a +10 keV accelerating voltage with a -75 eV offset to avoid interferences from molecular ions. Interferences by monoxides, particularly the interferences of the light REE oxides on the heavy REE masses, were corrected for using procedures similar to those previously described by [6].

Results and Discussion: The Ti-Al-rich pyroxene has a light REE depletion (La~12-17xCI; $[La/Sm]_{CI}$~0.4-0.6), with a slight negative Ce anomaly (Ce/Ce*~0.6-0.8). Additionally, this mineral has a large negative Eu anomaly (Eu/Eu*~0.1) and a heavy REE pattern that is relatively unfractionated (40-70xCI). Melilite shows a relatively flat light REE pattern (~6-19xCI) and a slightly negative Ce anomaly (Ce/Ce*~0.7). This mineral has a positive Eu anomaly (Eu/Eu*~3) and a depletion in the heavy REE ($[Gd/Lu]_{CI}$~5-7). The REE distributions in these two phases are consistent with fractional crystallization from a melt. The bulk REE pattern calculated for CMS-1 (based on estimated modal abundances of phases) is relatively flat (Group V; [7]) but with a small negative Ce anomaly, and enriched ~ 20xCI. This suggests that the CMS-1 precursor material condensed from the Solar nebula with chondritic relative REE abundances and that the REE were not fractionated during the thermal event(s) that produced the large mass-dependent fractionations of Mg, Si, and O in CMS-1 [4,5]. However, the small negative Ce anomaly may be indicative of slightly oxidizing conditions during the melting of CMS-1 precursor material [8 and references therein] or an original product of the condensation of the precursor material.

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