HIGH PRECISION Mg ISOTOPES MEASUREMENTS OF ISOLATED OLIVINES IN ALLENDE (CV3) MATRIX USING HIGH RESOLUTION MC-ICPMS

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Introduction: Variations of the Mg isotopic composition of meteoritic olivines can be understood, to first order, as the sum of (i) mass dependent isotopic fractionations due to processes such as evaporation or condensation (either in the nebular gas or in the parent liquids) and (ii) decay of short-lived ^{26}Al ($T_{1/2}$=0.73My). Because olivines are virtually devoid of Al, their ^{26}Mg excesses or deficits might be used to calculate ^{26}Al model ages corresponding to the Mg isotopic composition of their source. In order to better constrain their origin, a set of Mg-rich isolated olivines was extracted from the Allende CV3 chondrite. One fragment of each olivine grain was kept for microbeam techniques (SEM, electron probe, ion microprobe for O and Mg isotopic compositions) and the rest was analysed for its Mg isotopic composition by MC-ICPMS. The goal is to reach the highest possible precision for the different isotopic ratios at the grain scale by combining bulk and in situ techniques. We report here the first Mg isotopic analyses by MC-ICPMS.

Analytical procedure: Olivines were dissolved by a 1:1 concentrated HF:HNO_3 mixture. Mg was then chemically separated using an anion-exchange chromatographic procedure in 9N HCl on a BioRad AG®1-X8 resin to remove the main part of Mn, followed by a cation-exchange procedure in 1N HCl on a BioRad AG®50W-X12 resin to remove the remaining elements. Recovery from the column averages 98%. High-precision Mg isotopes analyses are obtained using the IPGP ThermoFinnigan Neptune MC-ICPMS, via an Apex desolvatation system, following a standard-sample-standard bracketing procedure, and measuring in static mode ^{24}Mg, ^{25}Mg, and ^{26}Mg. Each sample is bracketed by two DSM-3 pure Mg metal international standards. This procedure was repeated twice, enabling five sample values to be determined [1]. The average of these five values constitutes then, what is referred to as a single analysis. The internal precision obtained for the $^{26}Mg/^{24}Mg$ and $^{25}Mg/^{24}Mg$ ratios is better than 0.025‰ and 0.015‰, respectively (2s.d.), and the external reproducibility of the $\delta^{26}Mg$ and $\delta^{25}Mg$, estimated from repeated analyses (n=24) of the DSM-3 standard over 7 months is better than 0.34‰ and 0.16‰, respectively. Terrestrial mantle olivines from San Carlos were also analysed as an internal standard.

Results: The $\delta^{25}Mg$ and $\delta^{26}Mg$ for the Allende isolated olivines (17 different grains analysed) show a significant range from -0.68‰ to -0.11‰ and from -1.07‰ to -0.22‰, respectively. The average $\delta^{25}Mg$ and $\delta^{26}Mg$ values for these 17 grains are of -0.31±0.06‰ and -0.54±0.10‰ (2s.e.), in good agreement with recent data by [2]. Variable ^{26}Mg deficits and excesses (from -0.032±0.018‰ to 0.062±0.036‰) are present in the different olivines. The variable $^{26}Mg^*$ excesses indicate either (i) variable Al/Mg ratios in the olivine parent melts or (ii) the presence in variable amounts of melt inclusions with high Al/Mg ratios in olivines.

References: [1] Galy A. et al. 2003. *Journal of Analytical Atomic Spectrometry* 18: 1352-1356. [2] Chakrabarti R. and Jacobsen S. B. 2010. *Earth and Planetary Science Letters* 293: 349-358.