

HIGH PRECISION O ISOTOPIC MEASUREMENTS OF Mg-RICH OLIVINES FROM THE ALLENDE METEORITE: CONSTRAINTS ON THEIR ORIGIN

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1. Introduction

Most type I chondrules from primitive chondrites are characterized by ^{16}O enrichments which are intermediate between bulk chondrites and the extreme values ($\Delta^{17}\text{O} < -25\text{‰}$) observed in Ca-Al-rich refractory inclusions [1]. Libourel & Krot [2] have proposed, on the basis of petrographical observations in CV chondrites, that the Mg-rich olivines in type I chondrules were relicts (this is in agreement with the fact that olivines have generally the lowest $\Delta^{17}\text{O}$ value within a given chondrule [3]) and could be fragments of pre-existing planetesimals that underwent global melting and differentiation. One way to test this hypothesis is to look for discrete $\Delta^{17}\text{O}$ values among relict olivines: all olivines originating from a single planetesimal should share the same $\Delta^{17}\text{O}$ value as it is the case for fragments of planetary bodies (Earth, Moon, Mars as sampled by SNCs, Vesta as sampled by HEDs) that underwent an episode of magma ocean ($\Delta^{17}\text{O}$ value homogeneous to $\pm 0.015\text{‰}$, i. e. the precision reached by the best analytical techniques [4, 5]).

2. Analytical procedure

The oxygen isotopic compositions were measured in multi-collection mode with 3 Faraday cups at $M/\Delta M \approx 5000$ for ^{17}O with the CRPG-CNRS ims 1270 and ims 1280 HR2 ion probes. The data on San Carlos and Eagle Station olivine in-house reference materials show that the $\Delta^{17}\text{O}$ can be determined at $\approx \pm 0.1\text{‰}$ (2 sigma) if enough measurements are

made on a homogeneous sample. The ultimate goal is to reach a 2 sigma error of $\pm 0.03 - 0.05\text{‰}$ as for the measurement of the excess of ^{26}Mg [6].

3. Results

Nine Mg-rich olivines from Allende meteorite, either isolated olivines or olivines in type I chondrules, were analysed so far with this high precision technique (more than 10 spots per olivine). The $\Delta^{17}\text{O}$ values of these 9 olivines correspond to only three values which are defined within $\pm 0.15\text{‰}$ (2 sigmas), as it would be if these olivines originated from 3 different planetesimals. Work is in progress to improve the precision and to increase the data set.

References

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