

MG, SI AND FE FRACTIONATION OBSERVED IN ANTARCTIC SILICATE SPHERULES. T. Yada¹, T. Nakamura², T. Noguchi³, T. Ushikubo¹, H. Hiyagon¹ and N. Sugiura¹, ¹ Dept. Earth & Plant. Sci., Grad. Sch. Sci., Univ. Tokyo, Tokyo 113-0033, Japan (yada@space.eps.s.u-tokyo.ac.jp), ² Dept. Earth & Plant. Sci., Grad. Sch. Sci., Kyushu Univ., Fukuoka 812-8581, Japan, ³ Dept. Mater. & Biol. Sci., Ibaraki Univ., Mito 310-8512, Japan.

Introduction: Previously, we analyzed oxygen isotopic compositions of Antarctic silicate spherules with an ion probe [1]. Together with major element chemistry and the isotopic fractionation, we attempted to recover the chemical compositions and O-isotopic compositions of the precursors.

We performed Mg, Si and Fe isotope analyses of four silicate spherules, whose oxygen isotopic compositions had been analyzed, with the ion probe CAMECA IMS 6F at Univ. Tokyo. The analytical condition was basically the same as [2, 3]. The San Carlos olivine was set in the same holder with samples and analyzed to compensate instrumental mass fractionations.

Results and Discussion: Mg, Si and Fe isotopic fractionations of the silicate spherules relative to the San Carlos olivine are shown in Table 1. Errors are expressed in 2σ . The degree of isotopic fractionation observed in M23, G13 and possibly MY240184 shows a trend Fe > Mg > Si, whereas that in M10 shows a trend Fe > Si > Mg, that is the same tendency observed in [4]. This indicates heating conditions of M10 was different from those of the others.

We assumed Rayleigh fractionations for the evaporation of the spherules during their atmospheric entry and calculated how much Mg, Si and Fe were retained in the spherule from their original abundances. These elements should have evaporated with oxygen. Thus oxygen should have been lost at a ratio of 1:1 with Mg and Fe and 2:1 with Si. From the calculation, original oxygen isotopic compositions of the spherules were estimated.

Estimated original chemical compositions of M10 and G13 are close to the CI abundance and not depleted in Ca, which is depleted in matrices of carbonaceous chondrites. This implies that they are different from majority of unmelted micrometeorites, which are similar to the matrices of carbonaceous chondrites [5, 6]. Since the oxygen in M23 is enriched in ¹⁶O [1], the precursor, which is almost identical to forsterite, would be something similar to amoeboid olivine aggregates [7].

Estimated original oxygen isotopic compositions of M10, M23 and G13 are isotopically heavy. For example, the analytical data of G13 are +23‰ in $\delta^{17}\text{O}$, +49‰ in $\delta^{18}\text{O}$, whereas the estimated isotopic compositions of precursors are +17‰ and +38‰, respectively. The estimated value is isotopically heavier than any chondrite groups. This can be explained that oxygen coupled with cations other than Mg, Si and Fe may have evaporated to contribute to the isotopic fractionation of oxygen.

References: [1] Yada T. et al. (2003) *LPS XXXIV*, #1587. [2] Ushikubo T. (2002) *LPS XXXIII*, #1587. [3] Sugiura N. et al. (2003) *LPS XXXIV*, #1307. [4] Alexander C. M. O'D. et al. (2002) *GCA.*, 66, 173-183. [5] Noguchi T. et al. (2002) *EPSL*, 202, 229-246. [6] Genge M. J. et al. (1997) *GCA*, 61, 5149-5162. [7] Krot A. N. et al. (2002) *Science*, 295, 1051-1054.

Table 1. Isotopic fractionation of four silicate spherules.

Sample No.	Φ_{Mg} (‰/AMU)	Φ_{Si} (‰/AMU)	Φ_{Fe} (‰/AMU)
M10	0.9±0.4	2.8±0.7	8.3±1.5
MY240184	21.0±0.5	12.9±0.9	-
M23	0.7±0.4	-2.2±0.7	10.4±11.8
G13	4.6±0.4	3.5±0.7	12.4±1.8