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# Ion microprobe analyses of Mg isotopes in hibonite inclusions from Murchison meteorite

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Hibonite (CaAl12O19) is one of the most refractory minerals, which condense from the solar nebula at highest temperatures, and hence, hibonite-bearing refractory inclusions may have important information in the earliest history of the solar system. In fact, PLACs (PLAty hibonite Crystals) and BAGs (Blue AGgregates) (Ireland, 1988) show large isotopic anomalies in Ca and Ti, and low inferred initial 26Al/27Al ratios. It is suggested that they might form BEFORE injection of 26Al into the solar system (Liu et al., 2009). In order to better understand earliest evolution of the solar system materials, we recovered about ˜30 of hibonite-bearing inclusions from the Murchison (CM2) meteorite and Mg isotopic compositions were analyzed for 5 SHIBs, 5 PLACs, 1 Blue Spinel (Ireland et al., 1986), and 2 F-inclusions (see below) using two Secondary Ion Mass Spectrometers, NanoSIMS 50 (at AORI, University of Tokyo) and ims-1270 (at AIST, Tsukuba).

Results: Inferred initial 26Al/27Al ratios for SHIBs are (4.7 +/- 1.0)x10E-5, consistent with the canonical ratio for normal CAIs (MacPherson et al., 1995; Jacobsen et al, 2008). On the other hand, PLACs and a Blue Spinel show no resolvable excesses in 26Mg so that their initial 26Al/27Al ratios are zero within errors. Among them, Delta-26Mg for all the data of 5 PLACs are slightly negative (i.e., apparent deficits in 26Mg), suggesting possible isotopic anomalies in Mg isotopes. These results are consistent with previous works (e.g., Liu et al., 2009). In addition to these inclusions, we found two inclusions with heavily fractionated Mg isotopes (up to >50 permil/amu), and here we call them as F-inclusions (F means Fractionation). They also show initial 26Al/27Al ratios of ˜0 within errors, indicating some relations to so called FUN inclusions (Lee, 1988). In order to produce such large isotopic mass fractionation of Mg, evaporation must occur from the molten state, and in the condition without back reactions (e.g., evaporation under vacuum). Large mass fractionation of Mg in spinel suggests that spinel was not present as a solid phase at least during the early stages of evaporation, so that the temperature must be ˜1600C or higher (Stolper, 1982) during the evaporation event, which resulted in extensive loss (>95%) of Mg (Richter et al., 2007).

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Keywords: hibonite, refractory inclusion, ion microprobe, Mg isotopes, isotopic fractionation, Murchison meteorite