SELECTIVE RESETTING OF AL-MG SYSTEMATICS IN A TYPE C CAI FROM ALLENDE CV3.

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Introduction: CAIs show an evidence of live-^{26}Al ($t_{1/2}$= 0.73 Myr) at their formation [1]. A relative chronometer of ^{26}Al-Mg systematics has been applied for determining time interval of heating events in the early Solar System. Disturbances of ^{26}Al-Mg systematics were found among or within CAI minerals by heating events in the solar nebula and/or on the parent body. Deciphering disturbed ^{26}Al-Mg systematics is one of the most important matters for understanding of a complex history of CAI formation. Therefore, we carried out a coordinated study of detailed petrographic observations and O and Mg isotope measurements by SIMS for a Type C CAI, EK1-04-2 from Allende CV3 chondrite. We found that selective resetting of ^{26}Al-Mg systematics and the O isotopic compositions occurred in the CAI anorthite with no disturbance of the other minerals.

Results and Discussion: EK1-04-2 mainly consists of spinel, anorthite, olivine and diopside, and has a core and mantle structure. O isotopic compositions of the minerals are distributed along a CCAM line. Spinel is ^{16}O-rich (δ^{18}O ~ −43‰), while anorthite is ^{16}O-poor (δ^{18}O ~ +8‰). Other minerals show intermediate O isotopic compositions between spinel and anorthite. On the ^{26}Al-Mg isochron, spinel is plotted on a line of $(^{26}\mathrm{Al}/^{27}\mathrm{Al})_0$ = (3.4 ± 0.2) $\times 10^{-5}$, anorthite is (−1 ± 5) $\times 10^{-7}$ and $\delta^{26}\mathrm{Mg}_0$ = 1.7 ± 0.7‰, and olivine and diopside in the core are (−1 ± 7) $\times 10^{-6}$ and $\delta^{26}\mathrm{Mg}_0$ = 0.39 ± 0.06‰. EK1-04-2 has experienced multiple melting with O isotopic exchange and disturbance of ^{26}Al-Mg systematics, explaining disequilibrium distribution of O and Mg isotopes of spinel, diopside and olivine [2].

The ^{16}O-poor and distinct ^{26}Al-Mg isochron of anorthite cannot be explained by the multiple melting. Diffusivities of O in anorthite, spinel, olivine and diopside [3,4] and maximum thickness of observed platy anorthite (~100 μm) in the CAI indicate that the anorthite was re-equilibrated in O with matrix materials having ^{16}O-poor characteristics [5] during the metamorphism on the parent body, with no disturbance of the other minerals. Diffusivity of Mg in anorthite [6] also implies that anorthite of EK1-04-2 was re-equilibrated in Mg with the matrix materials or adjacent minerals during the metamorphism. However, the anorthite isochron showed the initial $\delta^{26}\mathrm{Mg}_0$ value of 1.7 ± 0.7‰, which is significantly higher than spinel, olivine and diopside (δ^{26}Mg* ~0.4-0.6‰), or minerals in Allende matrix. This indicates that Mg isotopic exchange between anorthite and the matrix materials or adjacent minerals was incomplete and suppressed by a limited amount of Mg supply from them. In contrast, δ^{26}Mg* values of minerals of EK1-04-2 except for anorthite have been preserved original values because the disturbances were estimated to less than 0.003‰. The $(^{26}\mathrm{Al}/^{27}\mathrm{Al})_0$ value of anorthite suggests that the metamorphism occurred at least after 4.8 My of the CAI formation.

References: [1] MacPherson G. J. et al. 1995. *Meteoritics* 30:365–386. [2] Kawasaki et al. 2014. Goldschmidt2014 Abst. #1211. [3] Ryerson and McKeegan 1994. *GCA* 58:3717–3734. [4] Oishi and Ando 1984. In *Materials science of the Earth's interior* 271-280. [5] Clayton and Mayeda 1999. *GCA* 63:2089–2104. [6] LaTourette and Wasserburg 1998. *EPSL* 158:91-108.