FORMATION PERIOD FOR A FLUFFY TYPE A CAI FROM VIGARANO.

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Introduction: Fluffy Type A CAIs containing reversely zoned melilite crystals are suggested to be direct condensates from a solar nebular gas [1]. The O isotope measurements with a line-profile technique using SIMS for single reversely zoned melilite crystals in a fluffy Type A CAI, V2-01 from Vigarano CV3 have revealed the O isotopic compositions change from ^{16}O-poor to ^{16}O-rich along with their crystal growths, indicating that the O isotopic compositions of surrounding nebular gas were changed from ^{16}O-poor to ^{16}O-rich during their condensations [2]. Such trends have also been found in other Type A CAIs from Allende and Efremovka [3, 4]. In this study, we have measured O isotopic compositions of spinel enclosed by melilite crystals, and spinel and diopside from the Wark-Lovering rim (W-L rim) in the V2-01 CAI, to understand the O isotope change during the total formation of V2-01. We have also investigated ^{26}Al-Mg systematics of individual reversely zoned melilite crystals, spinel, and diopside in V2-01. The O and Al-Mg isotope measurements were conducted using SIMS of Hokkaido University (Cameca ims-1280HR). Time duration for a formation of V2-01 and O isotope change during the formation have been determined.

Results and discussion: The spinel enclosed by melilite crystals showed ^{16}O-rich compositions ($\Delta^{17}O \sim -24‰$). The spinel and diopside from W-L rim also had homogeneously ^{16}O-rich compositions ($\Delta^{17}O \sim -23‰$). On the other hands, the O isotopic compositions of surrounding nebular gas during the formation of reversely zoned melilite crystals have been suggested to be changed from ^{16}O-poor ($\Delta^{17}O \sim -5‰$) to ^{16}O-rich ($\Delta^{17}O \sim -25‰$) [2]. The petrography suggests that formation sequences of these minerals were spinel enclosed by melilite, reversely zoned melilite crystals, and spinel and diopside in the W-L rim. It indicated that V2-01 was formed in a variable O isotope reservoir changing from ^{16}O-rich to ^{16}O-poor and back to ^{16}O-rich.

The ^{26}Al-Mg systematics is consistent to the formation sequences. The spinel enclosed by melilite showed an initial value of $(^{26}Al/^{27}Al)_0 = (5.7 \pm 0.2) \times 10^{-5}$. The six reversely zoned melilite crystals measured showed indistinguishable initial values of $(^{26}Al/^{27}Al)_0 \sim 4.7 \times 10^{-5}$. The spinel and diopside from W-L rim showed an initial value of $(^{26}Al/^{27}Al)_0 = (4.6 \pm 0.4) \times 10^{-5}$, which is comparable to the initial values of melilite crystals. This is a first determination of a formation age of the W-L rim. The time duration for the V2-01 CAI formation could be estimated as 0.22 ± 0.11 Myr from the difference of initial values. Therefore, our study revealed that the V2-01 was formed within the time duration of 0.22 ± 0.11 Myr in the variable O isotope reservoir changing from ^{16}O-rich to ^{16}O-poor and back to ^{16}O-rich.

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