

AL-MG DATING OF A CONDRULE IN EFREMOVKA BY USING NANOSIMS. Y. Sano¹, N. Takahata¹, N. Sugiura² and W. Fujiya². ¹Ocean Research Institute, The University of Tokyo, ysano@ori.u-tokyo.ac.jp. ²Department of Earth and Planetary Sciences, The University of Tokyo.

Introduction: It is noted that a CAI of the CV chondrite, Efremovka shows one of the oldest Pb-Pb ages but its chondrule age is not well documented. Here we report ²⁶Al-²⁶Mg dating of a single anorthite grain located in a chondrule of the meteorite by using the NanoSIMS installed at Ocean Research Institute, The University of Tokyo.

Experiment: A thin section of Efremovka was set in a sample holder together with standard anorthite (Miyake-jima) and olivine (San Carlos) and carbon coated to dissipate charge during analysis. The positions of anorthite grains in the chondrule are determined by using a scanning electron microprobe before SIMS analysis. Using a critical illumination mode, a ~500 pA mass filtered O⁻ primary beam was used in the case of anorthite grains to sputter a 3~4 micron meter diameter crater and secondary positive beams were extracted for mass analysis using a Mattauch-Herzog geometry. Before the actual analysis, the sample surface was rastered for 5 min in order to reduce the surface contaminant elements. We detected ²⁷Al⁺⁺ (a secondary electron multiplier detector called EM#1) at mass 13.5, ²⁴Mg⁺ (EM#2) at 24, ²⁵Mg⁺ (EM#3) at 25 and ²⁶Mg⁺ (EM#4) at 26 at the same time under a static magnetic field. A mass resolution of 3500 was attained for separating ²⁴Mg⁺ from ⁴⁸Ca⁺⁺ with adequate flat topped peaks. The Mg sensitivity of 100 cps/1 nA/ppm was obtained by an intensity of ²⁴Mg ion beam and abundance of Mg in the standard anorthite. In order to avoid the QSA effect, we used a primary of 10 nA and detected Mg isotopes of olivine samples by a single Faraday cup with a magnetic scanning mode. Abundance of ²⁷Al was less than the detection limit of the Faraday cup.

Results and Discussion: The $\delta^{25}\text{Mg}$ values of Miyake-jima anorthite (²⁵Mg/²⁴Mg ratios in delta notation) ranged from -24‰ to -30‰, while the $\delta^{26}\text{Mg}$ values ranged from -48‰ to -60‰, suggesting a typical mass dependent fractionation with a slope 2. On the other hand, 5 spots in a single anorthite grain (about 25 x 10 micro-meter) in an Efremovka chondrule showed apparent excess ²⁶Mg. The $\delta^{25}\text{Mg}$ values of San Carlos olivine and Efremovka chondrule olivine ranged from -3‰ to +8‰, though they are located on the mass dependent fractionation line in a three isotope plot. Thus there is no excess ²⁶Mg in both terrestrial and extraterrestrial olivine samples. In the diagram between Al/Mg ratio and excess ²⁶Mg, 5 spots data of Efremovka anorthite are located along a line with a positive inclination. If the excess ²⁶Mg is attributable to the extinct ²⁶Al, an inferred ²⁶Al/²⁷Al ratio becomes $(3.74 \pm 1.53) \times 10^{-6}$ (2 sigma) based on the slope. This ratio suggests that the formation interval between CAIs and this chondrule is about 2.65 Myr.