AL-MG AGE OF THE ZAKLODZIE ENSTATITE METEORITE. N. Sugiura[1] and W. Fujiya[1], [1]Department of Earth and Planetary Science, University of Tokyo, Tokyo, Japan. E-mail Sugiura@eps.s.u-tokyo.ac.jp.

Introduction: Zaklodzie is an ungrouped meteorite closely related to enstatite chondrites [1]. It is considered to be an achondrite but contains abundant metal and the bulk composition seems to be similar to enstatite chondrites [2]. Its texture suggests relatively rapid cooling and an impact melt origin was suggested [2]. However, mainly based on cumulate-like texture and enrichment of plagioclase, [3] suggested melting due to decay of ^{26}Al. Two generations of feldspar may be present because the feldspar compositions show large variations [3]. The U/Th-He age of 2.1 Ga and the K-Ar age of 4.4Ga were reported [4]. These gas retention ages are often much younger than the formation (initial crystallization) age. Here we report the Al-Mg age of this meteorite.

Experimental: A polished thin section was examined with a scanning electron microscope. Chemical compositions of feldspar grains were measured with energy dispersive spectroscopy. An ion probe (Cameca-6f) at the Univ. of Tokyo was used for the Al-Mg isotope measurements. Mg isotopes were measured with an electron multiplier whereas Al was measured with a Faraday cup in cases of feldspar. In the case of pyroxene measurements which were made for precise determination of y-intercept of the isochron diagram, Al was measured with an electron multiplier. It took about 25 minutes for one SIMS measurement. The measurement was made twice on the same spot.

Results and discussion: As reported in literatures [3], feldspar grains with a wide range of compositions were found. The Al/Mg ratios measured by SIMS are correlated with CaO (Fig.1), although the correlation is not very strong (r~0.92). Since CaO-poor feldspar was probably produced by a secondary event, some Mg seems to be added to CaO-poor feldspar together with Na. $^{Al}/^{24}$Mg ratios in feldspar range from ~1000 (in CaO-poor feldspar) to ~5500 (in CaO-rich feldspar). The high $^{Al}/^{24}$Mg ratios allowed relatively precise age determination. The δ^{26}Mg values range from 0‰ to 13‰ and are correlated with the $^{Al}/^{24}$Mg ratios (Fig.2). This correlation is considered to be an isochron and the inferred initial ^{26}Al/^{27}Al ratio is (3.1 +/- 1.1(2σ)) x10^{-7}. Relative to CAIs with the canonical value of ^{26}Al/^{27}Al = 5x10^{-5}, the age of Zaklodzie is 5.4 +/- 0.4(2σ) Ma.

It was noticed that the δ^{26}Mg values for CaO-poor, second-generation feldspar were nearly normal. Within the 2σ error limit (Errors shown in Fig.2 are 1σ.), they may be considered to belong to the isochron, or they may be considered to have been reset by a late secondary event. At present, the precision of the data is not good enough to distinguish these two alternative interpretations. The initial ^{26}Al/^{27}Al ratio is hardly affected even if the data for the CaO-poor feldspar are omitted from the isochron.

If the absolute age of CAIs is taken as ~4567.1 Ma [5], then the absolute age of Zaklodzie is about 4561.7 Ma. This is similar to Al-Mg ages of many basaltic achondrites. Many eucrites, quenched angrites, NWA 011 etc. have absolute ages of 4562~4563 Ma [5,6]. This old age suggests that the heat source for melting of Zaklodzie was likely to be decay of ^{26}Al rather than impact heating.

The relationship of Zaklodzie with enstatite achondrites has not been studied in detail. The Mn-Cr bulk-isochron age of enstatite achondrites is ~4563 Ma [7] which is not very different from the age of Zaklodzie. But the bulk isochron has a high y-intercept which indicates that the source of enstatite achondrites evolved in an environment with an elevated Mn/Cr ratio for several million years [7]. Since the bulk composition of Zaklodzie seems to be nearly chondritic, it must have evolved in a different parentbody than the enstatite achondrites.

Old ages of ungrouped achondrites (Zaklodzie and NWA 011) suggest that there were many, tiny, molten planetesimals in the early solar nebula.

References:

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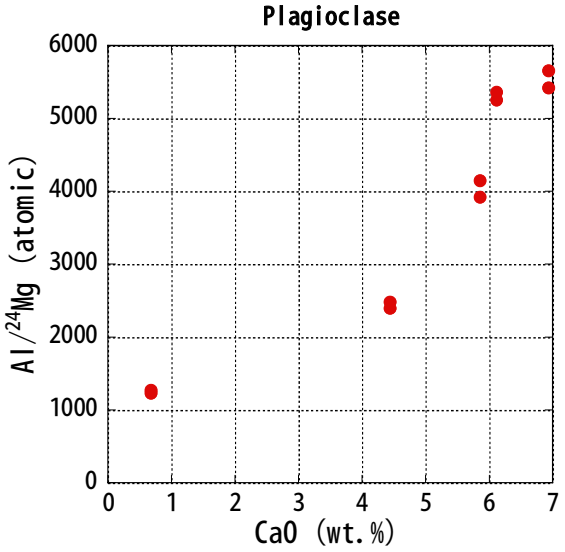

Fig.1 Al/^{24}Mg ratios measured by SIMS are plotted against CaO contents measured by EDS.

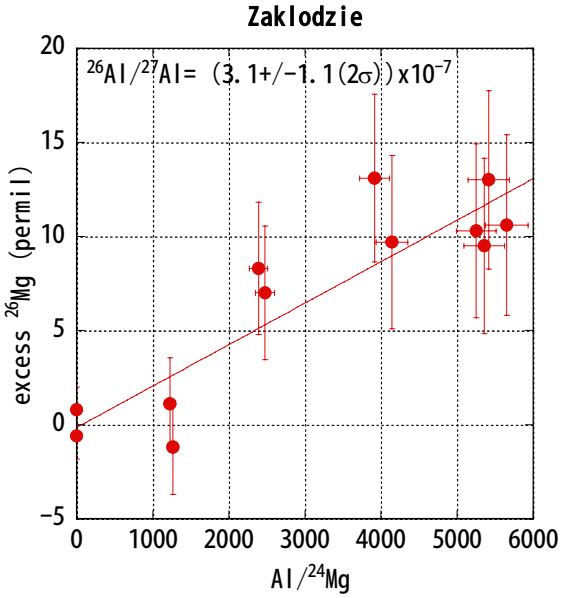

Fig.2 Al-Mg isochron for Zaklodzie.