[JJ] Evening Poster | P (Space and Planetary Sciences) | P-PS Planetary Sciences

[P-PS09]Origin and evolution of materials in space

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Recent progresses of astronomical observations, laboratory experiments, solar-system exploration, and theoretical work have enabled us to attempt to understand the origin and evolution of materials (dust and gas) in space in the context of material science. It is thus important to link further planetary material science and astronomy for comprehensive understanding of dust and gas in space and their role in evolution of galaxies, stars, and planetary systems. In this session, based on latest results on observations, experiments, planetary missions, and theoretical studies on materials in space, we discuss next steps in science for materials in space.

[PPS09-P04]Alminium26-Magnesium26 dating of chondrule in ordinary chondrite NWA7936(L3.15) by NanoSIMS

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[1]Introduction

Meteorites are important samples for understanding the history of early solar system. Their structure and age would give us valuable information about early solar system. The undifferentiated meteorites,whose parent bodies haven't experienced differentiation processes,may have the oldest information before planetesimal formation.

In our study,we studied ordinary chondrites which are undifferentiated meteorites and found on the earth.They,however,generally show some degree of thermal metamorphism.For chondrites with petrologic type(i.e.,the degree of thermal metamorphism,increase from 3 to 6)>4.0,only information after thermal metamorphism would be obtained. We can study the formation ages of chondrules or chondrites with petrologic type 3. Even this group,however,is affected by thermal metamorphism to some extent,and further important to know the relationship between the reliable Al-Mg age and the degree of thermal metamorphism.In this study,we conducted Al-MG dating of chondrules in an ordinary chondrule(L3.15)NWA7936,which haven't been well studied,trying to examine reliability of the chronometer.

[2]Method

We chosed 26Al-26Mg dating method.Half life period of ^{26}Al is 0.7My. We plotted δ26Mg against 27Al/24Mg,where the slope of the correlation line givesthe ^{26}Al/^{27}Al initial ratio.We compare the obtained ^{26}Al/^{27}Alinitial ratios of chondrules with that of CAIs(5.0×10^{-5},whose absolute age is known to be 4567.3 My). Then we compare the present results with those of privious works.

Before the SIMS analysis,we analyzed the chondrules using SEM-EDS at the department of Earth and Planetary Science,the University of Tokyo and selected the areas with high Al/Mg ratios >30,suitable for an isochron plot. The analyzed chondrules consist mostly of olivine phenocrysts with mesostasis

including small anorthite grains,and minor amount of metals. We applied the ^{26}Al-^{26}Mg dating method for threechondrules using NanoSIMS at Atmosphere and Ocean Research Institute,the University of Tokyo. We analyzed four points in each chondrules.Primary ion beam is $^{16}O^-$,2μm in diameter.with an intensity of 200pA.Secondary ions of $^{27}Al^{++}$,$^{26}Mg^+$,$^{25}Mg^+$,and,$^{24}Mg^+$ were measured simultaneously with EMs.We measured 100 cycles for each point.The time of 1 cycle was 25s.

[3]Result
The three chondrules show clear excesses in ^{26}Mg and we can draw 'isochrons' passing through the origin. The obtained $^{26}Al/^{27}Al$ initial ratios are 1.33±0.41,1.67±0.94,and 1.10±0.71(×10^{-5}),respectively. Relative ages are 1.34(+0.38,-0.27),1.11(+0.83,-0.45),and 1.52(+1.04,-0.50)(Ma),respectively. The three ages are identical within erros. If we assume a single formation ages for chondrules in this meteorite,we may obtain weighted average of 1.34 (+0.30,-0.23)Ma after formation.

[4]Discussion
We compared the present results owith those of privious work. The initial $^{26}Al/^{27}Al$ ratios of chondrules are consistently in the range of (0.5 to 2.0)×10^{-5} for chondrites with petrographic types of 3.0 to 3.3, and this range most likely corresponds to the time when chondrules formed. On the other hand, meteorites with petrographic types of >3.4 tend to show much lower values of initial $^{26}Al/^{27}Al$ ratio, suggesting that the values probably show the timing of thermal metamorphism.
The present results show identical formation ages for three chondrules in NWA7936 within uncertainties. The previous data for Semarkona(LL3.0), however, suggests that formation ages of chondrules in the same chondrules in the same chondrite may have true variation (1 to 2 My). Hence, the present results may be fortuitous,and we may find variations in chondrules ages for NWA7936 if we increase the number of analyses If 1-2My difference exists in the chondrule formation ages in a single chondrite, it may require a long-lasting(for a few Mys) mechanism for the formation of chondrules. Further studies about the formation mechanisms of chondrules are required for better understanding of the evolutionary history of the protoplanetary disk.

[5]References
(1)Blair.Schoene(2014),Treatise on Geochemistry 2nd Edition:341-347
(2)AM.Davis,KD.McKeegan(2014),Treatise Geochemistry 2nd Edition:361-375
(3)G.J.MacPherson et.al(2012),Earth and Planetary Science Letters 331-332
(4)Noriko.T.Kita et.al(2013),Meteoritics and Planetaly Science 48,Nr8,1383-1400.