Fe-Ni AND Al-Mg ISOTOPE SYSTEMATICS IN CHONDRULES FROM SEMARKONA (LL3.0) AND LEW 86314 (L3.0).

R. K. Mishra and J. N. Goswami, Physical Research Laboratory, Ahmedabad–380009, India (ritesh@prl. res.in).

Introduction: The short-lived nuclide ^{60}Fe is an unique product of stellar nucleosynthesis. A robust value for the initial abundance of ^{60}Fe in the solar system allows us to infer its possible stellar source and contribution from this source to the inventory of the other co-injected short-lived nuclides. The lack of Fe-rich phases in CAIs led to studies of sulfide in UOC matrix and both sulfide and silicates in UOC chondrule to infer initial ^{60}Fe/^{56}Fe at the time of their formation [1-3]. Based on an independent estimate of the time of formation of the chondrules, relative to CAIs, from a study of ^{26}Al records, one can infer the solar system initial ^{60}Fe/^{56}Fe. However, such an approach will not work if the recent suggestion [4] that injection of ^{26}Al preceded that of ^{60}Fe (from the same stellar source) by more than a million year is valid. We have initiated a combined study of Al-Mg and Fe-Ni isotope systematics in a set of UOC chondrules to address these issues.

Samples: The analyzed chondrules are from two UOCs, Semarkona (LL3.0) and LEW 86314 (L3.0), belonging to the lowest petrologic grade. We have selected five chondrules, three from Semarkona and two from LEW86314, for this study; data for ^{26}Al in three of these chondrules have been reported earlier [5-6]. The Al-Mg and Fe-Ni isotope systematics in these chondrules were studied using a Cameca ims-4f ion microprobe following procedures described earlier [5,7]. Data from multiple analyses on a given spot were combined, as long as the Al/Mg and Fe/Ni ratios are nearly the same, to improve precision of the measured isotope ratios.

Results & Discussion: The data for four chondrules yielded initial ^{60}Fe/^{56}Fe ratios ranging from ~5×10^{-7} to 3.8×10^{-7}; the corresponding range of initial ^{26}Al/^{27}Al is ~1.6×10^{-5} to 1.1×10^{-5}. The Al-Mg isotope data were obtained primarily in glassy mesostasis, while the Fe-Ni isotope data are based on analysis of silicate phases. In one of these chondrules, a radial chondrule with low Al/Mg ratio in mesostasis, we could not obtain meaningful initial ^{26}Al/^{27}Al. The fifth chondrule, hosting the lowest initial ^{26}Al/^{27}Al [$(5.5\pm0.32)\times10^{-6}$; ($2\sigma$)], yielded an upper limit of 3×10^{-7} for initial ^{60}Fe/^{56}Fe. Our data suggest a very good correlation between the initial ^{60}Fe/^{56}Fe and initial ^{26}Al/^{27}Al in the analyzed chondrules if we infer their time of formation based on the canonical solar system initial ^{26}Al/^{27}Al value of 5×10^{-5}. This correlation argues for simultaneous injection of these nuclides from a common stellar source and yields a solar system initial ^{60}Fe/^{56}Fe value of ~9×10^{-7}. Our results raise questions on the validity of the proposed late injection of ^{60}Fe relative to ^{26}Al into the early solar system [4].

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