Identifying FUN inclusions with LA-MC-ICPMS Mg and Si isotopes

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A small group of CAIs exhibit fractionated and unknown nuclear (FUN) isotopic effects, e.g., O, Mg, Si, Ca, and Ti, and are called FUN inclusions. These FUN CAIs are characterized by large mass-dependent fractionation effects in Mg, Si, and O, and a few ‰ of mass-independent isotopic anomalies in elements such as Ca, Ti, Cr, Sr, Ba, Nd, and Sm. Despite their discovery for several decades, the origin and the formation of these FUN CAIs remain poorly constrained, due largely to their identical physical and textual appearance from normal CAI, and are thus difficult to identify potential FUN CAIs. In order to better identify and constrain the nature and origin of FUN CAIs, we have initially set up *in situ* LA-MC-ICPMS for Mg isotopes in CAI from thick slabs, to quickly search for CAIs deficient in ^{26}Mg, a common characteristic of FUN CAIs. Subsequently, CAIs with abnormal Mg isotopes were extracted and prepared for NanoSIMS study, e.g., O and/or Si, and for further solution-based MC-ICPMS study. Approximately ~1mm thick sections of Allende and DAG192 (CO3) were prepared and subjected to *in situ* LA-MC-ICPMS, with a spot size of 50 μm and 50 sec ablation time. San Calos ol, opx, and cpx and two glass standards BCR-2G and BIR-1G were studied and the results were comparable to published data, while San Calos opx was used as the main standard during the experiments. Preliminary results showed that while the Mg isotopes for majority of the CAIs from both Allende and DAG192 exhibited normal to positive ^{26}Mg, two CAIs from Allende showed clear ^{26}Mg deficits of -1 to -1.5‰, and 0 to -0.5‰, respectively. With a typical 2-sigma SD of 0.33‰ for our Mg isotopic analysis, the first CAI showed clearly resolvable ^{26}Mg deficit from both sides of the thick sections, while questionable for the second CAI. Both FUN CAIs have been examined with SEM, and consisted of fine-grained spinel and cpx. Oxygen isotope for spinels from both CAIs and one cpx have been studied using NanoSIMS, and the data are entirely consistent with the published results with the data following a mass-dependent fractionation, indicating an evaporation event occurred shortly after the formation of these CAIs. Besides Mg and O isotopes, FUN CAIs are also characterized with large Si isotopic fractionations. However, NanoSIMS Si isotopic analysis is extremely inefficient and with much poorer precision relative to MC-ICPMS analysis, we are currently in the process of setting up *in situ* LA-MC-ICPMS Si isotopic analysis to look for additional FUN CAI, and the result will be presented during the conference.