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Magnesium isotopic composition of W-L rim of CAIs

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It is known that common type CAIs such as Types A, B and C, which are frequently found in CV chondrites, have layered rim structures which are called as Wark-Lovering rims (W-L rims). W-L rims consist of three layers: spinel layer, melilite (or its alteration products) layer and diopsidic pyroxene layer, from interior to exterior. It is also known that CAIs are sometimes surrounded by fine grained mineral layers which are called as accretionary rims. Although 16O-rich signatures observed in diopsidic pyroxene and spinel of W-L rims and olivine of accretionary rims suggests that the origin of these layers relates to the CAI formation event, it is not known how these rim structure formed. Here we present preliminary results of Mg isotopic measurements of CAI core, W-L rims and olivine in accretionary rims. Mg isotopic compositions were measured with an ion microprobe, CAMECA ims-6f in the University of Tokyo.

Mg isotopic compositions of CAI core, W-L rims of four CAIs (two type A CAIs, one type B1 CAI and hibonite-spinel-rich CAI) were measured. Mg isotopic compositions of some CAIs are fractionated positively or negatively and Mg isotopic compositions of the W-L rims tend to correlate with that of the core. Mg isotopic compositions of olivine in the accretionary rims, in contrast, are not fractionated and show no correlation with the former.

The fact that various phases in the core of CAIs, their W-L rims and accretionary rims show similar 16O-rich compositions (although some of the minerals like melilite and anorthite often lost their 16O-rich signatures) suggests that all these three formed in a 16O-rich environment. However, the present results suggest that olivine in accretionary rims is Mg-isotopically different from the core and W-L rims of CAIs. It seems difficult to explain the present Mg isotope results by the evaporation model or the condensation model, though the present results are still rather preliminary. Evaporation of Mg usually causes isotopic fractionation preferring heavier isotopes and condensation of Mg would further change the Mg isotopic composition of the rims.

Further studies on Mg isotopes would give important constraints on the formation process of the W-L rims and accretionary rims.