Oxygen isotope distribution in igneous rim of magnesian chondrule from CR chondrite

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Introduction

Magnesian (type I) chondrules are the dominant chondrule type in the CR chondrite. The type I chondrule of porphyritic texture are commonly layered (Weisberg et al., 1992). Several researchers argue the origin and formation process of the chondrules, Fe-Ni metal, and rim (e.g., Weisberg et al., 1992). In this study, we report oxygen isotope distributions of chondrule rim from CR2 chondrite.

Experimental

The sample used in this study is a polished thin section from NWA-530 CR2 chondrite. Petrologic and mineralogical studies by SEM-EDX were made before and after the isotope analysis.

Oxygen isotopic analyses were performed by TiTech isotope microscope system (CAMECA ims-1270 + SCAPS). In addition to ion microprobe analyses, isotope mapping technique (Yurimoto et al., 2003) for $\delta^{18}O$ was also applied. The size of a $\delta^{18}O$ map corresponds to 70 x 70μm on the sample.

Results and Discussion

A chondrule NWA530-1 has MgO-rich porphyritic texture and a Fe-Ni metal layer and igneous rim. The igneous rim is 100 μm in thickness. The rim crystals are mostly Mg-rich pyroxene (Fs_{3-11}, Wo_{0-7}). MgO-rich olivine (Fa_{4-5}), CaO- and FeO-rich pyroxene, and plagioclase also exist as minor phases. The crystals are 10-20 μm in size and enclosed by mesostasis with feldspathic composition.

5 maps of $\delta^{18}O$ in the igneous rim were obtained for investigation of oxygen isotopic distribution in the rim. The maps show that about 50% of olivine crystals in mapping areas have ^{18}O-poor compositions, and another 50% of olivine and the other components are ^{18}O-rich. The ^{18}O-poor olivine crystal found in $\delta^{18}O$ map was evaluated by three O isotopic measurement using ion microprobe method, and show ^{16}O-rich compositions ($\delta^{17,18}O_{SMOW}$ ~ -35 ‰). Oxygen isotopic composition of ^{18}O-rich grains in the rim, and of phenocrysts and mesostasis in the core show ^{16}O-poor. ^{16}O-rich and –poor olivine crystals in the igneous rim indicate that materials produced at different places and/or different times were mixed in the nebula and accreted onto pre-existing core of the chondrule.

References

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Long-range transport: To and from East Asia

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Introduction

It is now known that regional-scale ozone change in one continent is controlled by the meteorology and photochemistry within the continent and also by intercontinental long-range transport in the hemispheric scale. Therefore it becomes necessary to formulate a suitable and versatile technique, which could estimate the changes in background ozone at one continent and also distinguish the contribution from other continents.

Methodology and Data

Long-term (about 30 years) ozonesonde data from East Asia, Europe and N. America have been analyzed using the isentropic backward trajectories. Ozone data were analysised by residence time of air masses as well as by sectoral approach and two types of ozone were defined, which are 1) Photochemically aged ozone and 2) Background ozone.

Results

Seasonal variations in photochemical ozone over northern Japan (Sapporo), particularly in lower troposphere, are nearly similar to the variations over European sites with spring-summer maximum. Whereas, Central and southern Japan (Kagoshima and Naha) show maximum in spring and minimum in summer. Background ozone over East Asia is much lower (as high as 30 ppbv) than over Europe. This leads to very large build-up over East Asia. East Asia shows rapid increase in ozone during 1980s and early 1990s, while Europe shows increase in 1970s and early 1980s. Interestingly, anthropogenic NO_x emissions (see figure) over East Asia show large increase in late 1980 and early 1990s. More results, including those from N. America will be discussed in detail during presentation.