STUDY OF CHONDRULES IN CH CHONDRITES - I: OXYGEN ISOTOPE RATIOS OF CHONDRULES

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Introduction: Asuka-881020 is classified as a CH chondrite [1-2]. Chondrules in the meteorite are tiny (50-100µm) and mostly cryptocrystalline (CC) type [2-3]. It was suggested that magnesian CC chondrules in CHs and CBs are genetically related from the chemical and oxygen-isotopic affinities [4-5]. However, relationship between ferroan CC chondrules in CHs and CBs as well as that between porphyritic chondrules in these two chondrite types still remain unknown. In order to discuss these two genetic relationships, we measured oxygen isotope ratios of the chondrules in Asuka-881020 with the IMS-1280 at UW-Madison (using 10×15µm Cs^+ primary beam).

Results: On a three-isotope oxygen diagram ($\delta^{17}O$ vs. $\delta^{18}O$), ratios of chondrules are plotted along the slope-1 line. Most of the magnesian CC chondrules have nearly identical $\Delta^{17}O$ values with the average -2.2±0.5‰ (n=22; 2SD), while eight magnesian CC chondrules have distinct $\Delta^{17}O$ values (-6.1 to +1.7‰). Eight ferroan CC chondrules cluster with $\Delta^{17}O$ values with the average +1.5±0.5‰ (2SD). $\Delta^{17}O$ values of olivine and pyroxene in 20 type I porphyritic chondrules range from -6 to +5‰. Type II porphyritic chondrule analysis with 3µm spot is in progress.

Discussion: $\Delta^{17}O$ values of most magnesian and ferroan CC chondrules are identical to those of magnesian and ferroan CC chondrules from other CHs, CH/CB, and CBs [4-5], respectively. This suggests a close relation of origins of CC chondrules in CHs and CBs. However, significant variation in $\Delta^{17}O$ values from -6.1 to +1.7‰ imply that not all the CC chondrules formed from the common isotope reservoir, as suggested in [5].

In porphyritic chondrules, olivine tends to be positive (18 out of 30 have positive $\Delta^{17}O$ values), while pyroxene seems to relatively scatter evenly. Given that pyroxene formed from melt equilibrated with ambient gas and olivine may be residual phases inherited from precursor materials [6], the precursor materials of the type I chondrules might have been ^{16}O-depleted and interacted with relatively ^{16}O-rich nebular gas.

Most of the porphyritic chondrules in carbonaceous chondrites have negative $\Delta^{17}O$ values [7]. In contrast, our study and [4] showed that the porphyritic chondrules frequently show positive $\Delta^{17}O$ values (type II chondrules in CR2s are also exceptional in this respect; [8]). This suggests that porphyritic chondrules in metal-rich carbonaceous chondrites formed in a separate nebular region or at a different time from chondrules in other carbonaceous chondrites, which is not inconsistent with the distinct chemistry of CH porphyritic chondrules from those of porphyritic chondrules of other carbonaceous chondrites [3].

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