CHONDRULES IN LL3 CLUSTER CHONDRITES: EVIDENCE FOR INTERACTION OF CHONDRULE MELTS WITH NEBULAR GAS.

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Introduction: Cluster chondrites are a specific type of chondritic rock, characterized by close-fit textures of deformed and indented chondrules. Their textures have been taken as evidence for ultra-rapid chondrite formation by hot chondrule accretion [1]. They occur as lithic clasts in unequilibrated ordinary chondrite (UOC) breccias. We investigated 7 clasts from 6 LL3 chondrites and measured their bulk oxygen isotopic and chemical composition, including concentrations of REE, Zr, and Hf. The same parameters were measured *in-situ* on 93 chondrules and 4 interchondrule matrix areas. The purpose of this study was to clarify whether cluster chondrites represent a peculiar type of otherwise normal UOC material or represent foreign inclusions of chemically different matter. First results were shown in [2-4].

Results and discussion: Based on the close similarities in chemistry [2] and oxygen isotopic composition [3,4] we conclude that cluster chondrites represent normal UOC material with a different accretion history. We found evidence for oxygen isotope exchange between chondrule melts and ^{17,18}O-rich ambient gas, since chondrules scatter along a correlation (mixing) line with a slope of 0.63 in the oxygen 3-isotope diagram [4]. Similar mixing lines have also been described for other UOC´s [e.g. 5,6]. Type I chondrules show a much larger variation along the mixing line, whereas the small range of type II chondrules is centered within the type I range. Similar results were found by [7] by ion probe measurements in UOC chondrules. The lower diversity of type II chondrules may indicate a larger homogeneity of their precursors, possibly due to a higher degree of recycling, mixing and reprocessing of type I chondrule material [7,8]. In one clast a distinct anticorrelation between chondrule size and δ^{18}O value is found. This possibly results from a more intense oxygen isotope exchange between the gas and smaller chondrules due to their higher surface/volume ratio. In some clasts the δ^{18}O values of type I chondrules are correlated with concentrations of MnO and anti-correlated with MgO, possibly due to the admixture of an external component to chondrule melts during oxygen isotope exchange. Two chondrules with an ultrarefractory REE pattern and three chondrules with strong LREE>HREE and Zr/Hf fractionations are found, interpreted as admixture of ultrarefractory condensates [9] and planetary crustal material, respectively, to chondrule precursors.

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