I-Xe SYSTEM OF HAMMADAH AL HAMRA 237 CB CHONDRULE: SUPPORTING EVIDENCE FOR LATE HIGH-ENERGY FORMING EVENT.

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Introduction: The CB carbonaceous chondrites differ from other chondrite groups by high metal content (up to 80 vol%), significant depletion in volatile elements, and nearly a complete lack of interchondrule matrix material. Chondrules in CB chondrites have exclusively magnesium-rich compositions and non-porphyritic textures (skeletal and crypto-crystalline); relict grains or coarse-grained igneous rims, indicative of multiple chondrule melting events, are absent. Based on these observations and young Pb-Pb age of CB chondrules, it was proposed that the CB chondrules formed during a single-stage highly-energetic event in a late-stage protoplanetary disk, most likely in an impact-generated plume [1]. High precision Mg-isotope measurements of skeletal Hammadah al Hamra 237 (HH237) chondrules showed no resolvable ^{26}Mg excess, consistent with their late-stage origin [2]

Results and Discussion: Two HH237 and 4 Gujba chondrules, all magnesium-rich with non-porphyritic skeletal olivine-pyroxene textures, were irradiated at the University of Missouri Research Reactor, receiving 2×10^{19} thermal neutrons/cm^3. Xenon was extracted by step-wise pyrolysis and its isotopic composition was measured by ion-counting mass-spectrometry.

None of the Gujba chondrules studied have detectable ^{129*}Xe, and their concentrations of ^{128*}Xe are at least one order of magnitude lower than those in HH237, similar to what was observed by [3]. The HH237 chondrule #1 yielded a high precision isochron in the temperature interval 1300°C – 1800°C, corresponding to a closure of the I-Xe system at 0.29 ± 0.16 Ma after Shallowater (4562.3 ± 0.4 Ma [3]). The release profile of iodine-derived ^{129*}Xe characterized by two peaks at 1350 °C and 1600 °C. Corresponding activation energies of ~70 kkal/mol and ~126 kkal/mol suggest distinct iodine-carrier phases that experienced simultaneous closure. Absolute I-Xe age of the HH237 chondrule #1 of 4562.0 ± 0.4 Ma is in a good agreement with the U-corrected Pb-Pb age of the Gujba chondrules, 4562.52 ± 0.44 Ma [4] and HH237 silicates, 4561.9 ± 0.9 Ma [1]. All chondrules studied here, with an exeption of Gujba #2, contain comparable concentrations of U-fission xenon. The release profiles of iodine-derived ^{129*}Xe and U-fission ^{132}Xe in the HH237 chondrule #1 seem to correlate, suggesting a common host. Simultaneous reseting of the I-Xe and Pb-Pb systems in CB chondrules, together with simultaneous closure of I-Xe system in different mineral phases within the same CB chondrule at 4562.0 ± 0.4 Ma, supports formation due to highly-energetic event and following rapid cooling in a late-stage protoplanetary disk.

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