ARE CHONDRULES IN THE CB CARBONACEOUS CHONDRITE GUJBA PRIMARY (NEBULAR) OR SECONDARY (ASTEROIDAL)? A. N. Krot[1], Y. Amelin[2], S. S. Russell[3], and E. Twelker[4]. [1]University of Hawai'i at Manoa, USA. sasha@higp.hawaii.edu. [2]Geological Survey of Canada, Canada. [3]The Natural History Museum, UK. [4]Juneau, USA.

The CB (Bencubbin-like) chondrites are subdivided into the CB_a (Bencubbin, Gujba, Weatherford) and CB_b (Hammadah al Hamra 237, QUE94411) subgroups [1]. Both subgroups are characterized by similar O-isotopic compositions, high (60-70 vol%) abundance of Fe,Ni-metal, extreme depletion in moderately volatile elements, and extreme enrichment in ^{15}N. However, they show some differences as well, including sizes of chondritic components, abundances of CAIs and zoned Fe,Ni-metal grains [1]. Based on detailed mineralogical and trace element studies of chondrules and Fe,Ni-metal grains in CB_b, it was concluded that they recorded highly energetic thermal event(s) that resulted in complete vaporization of a dusty region of the solar nebula (dust/gas ratio ~10-50 solar). Chemically-zoned metal grains formed by gas-solid condensation in this region [2,3]; chondrules probably formed by gas-liquid condensation before condensation of Fe,Ni-metal [4]. Although condensation has been also invoked for metal grains in the CB_a chondrites [5], it requires gas with extremely high partial pressures of the siderophile elements (up to $\sim 10^7$ CI). Under these conditions, metallic alloy and sulfides condense as liquids [6]. It has been concluded that metal±sulfide and silicate nodules in CB_a condensed as liquids in a vapor cloud generated in a protoplanetary impact involving a metal-rich body and a reduced-silicate body [5,7]. Here, we report mineralogy and U-Pb isotope studies of chondrules in the CB_a chondrite Gujba.

Chondrules in Gujba are Fe,Ni-metal-free and have exclusively skeletal olivine textures. They consist of forsteritic olivine (Fa_{1-4}), low-Ca pyroxene ($Fs_{2\pm2}Wo_{3\pm2}$; in wt%, 0.5-16.5, Al_2O_3, <0.5, TiO_2) and high-Ca pyroxene ($Fs_{2\pm1}Wo_{44\pm8}$; 2-24, Al_2O_3, 0.3-1.8, TiO_2), and glassy mesostasis, and have a narrow range of bulk abundances of refractory lithophile elements (~1-1.6×CI). In contrast, chondrules in the CB_b subgroup have both skeletal olivine and cryptocrystalline textures and show a large range in bulk abundances of refractory lithophiles (4 <0.01×CI). There is no other chondrite group where chondrules are so drastically different. If the CB_a and CB_b chondrites are genetically related, one possible explanation for the observed differences in mineralogy and chemistry of their components is that the latter formed by reprocessing of the latter, i.e., CB_a chondrules are secondary, not primary nebular products. Our preliminary high precision Pb isotope measurements for multiple fractions from five Gujba chondrules [8] show that three chondrules give a well-constrained U-Pb age of 4562.7±0.5 Ma, MSWD=1.3, whereas two other chondrules yield an errorchron date of 4545.4±3.9 Ma, MSWD=3.6. The latter dates suggest a possible disturbance, post-dating chondrule formation by 15-20 Myr or more, and could be due to shock that resulted in melting of fine-grained interchondrule material and formation of high pressure minerals [9]. A U-Pb isotope study of the CB_b chondrules is in progress.

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