A COMPARATIVE STUDY OF FINE-GRAINED MATERIALS IN O AND C CHONDRITES.

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Introduction: Unequilibrated ordinary chondrites (UOCs) and carbonaceous chondrites (CCs) contain fine-grained material (rims and matrix) that was later altered via thermal and aqueous processing. We aim to distinguish between the characteristics of fine-grained materials in primitive meteorites by surveying (using SEM, Field Emission-SEM and electron probe) rims (FGRs) in 4 UOCs (LL3.0 Semarkona, LL3.1 Watonga, LL3.15 Bishunpur, ungrouped 3.05 Northwest Africa (NWA) 5717), in 3 CCs (relatively unaltered CM2 Yamato (Y) 791198 [1] and CR3s QUE 99177 and MET 00426 [2]) and comparing them to matrix.

Results: *FGRs in UOCs.* The majority of chondrules in UOCs have FGRs that are discernable in BSE images due to high average Z-contrast and well-defined contacts with chondrules and adjacent matrix. Type I chondrules have continuous FeO-rich FGRs that appear sintered and composed predominently of a submicron groundmass containing tabular fayalitic olivine, ferromagnesian amorphous material and phyllosilicates; groundmass supports micron-sized anhydrous mineral fragments and is the dominant setting for microchondrules (dia. ≤ 40μm) [3-5]. This is in contrast with matrix, which has more amorphous material, phyllosilicates and mineral fragments, and less commonly microchondrules. FGRs around type II chondrules are discontinous, not sintered, and more closely resemble clastic matrix. FGRs in NWA 5717 and Watonga have apparent thickness ranging from 17 – 38 μm (n=41) and 15 – 54 μm (n=15), respectively. Semarkona and Bishunpur have less well-defined surfaces and contain coarser-grained phyllosilicates.

FGRs in CCs. Not surprisingly, fine-grained material in Y 791198 shows more extensive hydration than in UOCs [1]. However, unlike UOCs, its FGRs lack a distinction between type I and type II chondrules, are generally thicker (50 – 130 μm) and surround all components including broken chondrules, mineral fragments and CAIs. Though they resemble matrix, the FGRs are relatively finer-grained, chemically distinct and do not contain Ca-carbonate, which is ubiquitus in matrix. FGRs and matrix in QUE 99177 and MET 00426 (CR3) contain abundant Fe-rich amorphous material, phyllosilicates and Fe-sulfides, but are less hydrated than in Y 791198.

Discussion: FGRs in UOCs, CM2 and CR3s show sharp differences that reflect their pre- and post-accretionary environments. FGRs in Y 791198 uniformly surround essentially all components and are compositionally uniform. This suggests that rimming was a late stage sedimentation event that directly preceded accretion. The rims in UOCs show more variation, differ among type I and II chondrules, do not surround all components and contain evidence (e.g., microchondrules and sintered textures) of repeated cycles of heating. Higher degrees of alteration in Y 791198 FGRs may indicate greater abundances of ices accreted with the fine-grained materials in CM chondrites.

References: [1] Chizmadia L. J. and Brearley A. J. 2008. *GCA* 72:602-625. [2] Abreu N. M. and Brearley A. J. 2010. *GCA* 74:1146-1171. [3] Bigolski J. N. et al. 2015. Abstract #2126. 46th LPSC. [4] Bigolski J. N. et al. 2014. Abstract #1879. 45th LPSC. [5] Bigolski J. N. et al. 2013. Abstract #5227. 76th MetSoc.