PETROLOGY OF MATRIX IN THE SEMARKONA ORDINARY CHONDRITE.

M. K. Weisberg[1,2], D. S. Ebel[2] and H. C. Connolly Jr.[1] [1]Dept. Physical Sciences, Kingsborough College, City University of New York, Brooklyn, NY 11235. (mweisberg@kbcc.cuny.edu). [2]Dept. Earth and Planetary Sciences, American Museum of Natural History, NY, NY 10024.

Introduction: The origin of chondrite matrix, its constituents and its relationship to chondrules and refractory-rich inclusions are poorly understood. Early work showed ordinary chondrite matrix to be a complex mixture of olivine, pyroxene and feldspathic components [e.g., 1]. Mn-rich forsterite (LIME olivine) has been identified in the matrix of Semarkona [2]. We are particularly interested in Mn-rich forsterite because it is a ubiquitous component of many primitive materials including matrix, amoeboid olivine aggregates (AOA's), interplanetary dust particles (IDP's) and comet samples [2-4]. However, its morphology, textural setting and associated phases are not well documented. These issues led us to initiate a study of the matrix in primitive meteorites. Here we present the preliminary results of our petrologic survey of matrix in Semarkona, the least equilibrated ordinary chondrite. Our goals are to survey and characterize the material interstitial to the chondrules and fragments in a thin section of Semarkona, and decipher the origins of matrix constituents.

Results: We focused on regions between two or more sharply bound, adjacent chondrules. The matrix is a mixture of components that include (1) isolated mineral grains, (2) fluffy (porous) fine-grained (<1μm) aggregates, (3) fragments with igneous textures and (4) rare microchondrules. Some of the fragments have textures that suggest that they are chondrule fragments. The isolated grains are dominantly olivine but include low-Ca pyroxene. Olivine morphologies include irregular-shaped, euhedral, tabular and lath-shaped crystals. The 13 olivine grains that were analyzed show a wide compositional range from $Fa_{1\text{-}39}$, with (wt.%) 0.1-1.2 MnO and 0.1-0.5 Cr_2O_3. Included are two low-iron, Mn-enriched (LIME) olivine grains, having (wt.%) MnO and FeO, respectively, of 1.0 and 3.0 in one grain and 0.6 and 1.0 in the other. Na occurs in small (50μm) fragments that are intergrowths of olivine, high-Ca pyroxene and a material with 76.1 SiO_2, 7.6 Al_2O_3 and 6.1 Na_2O. The microchondrules are 50μm in size and contain olivine phenocrysts in a glassy mesostasis.

Discussion and Conclusions: The matrix of Semarkona is a highly unequilibrated mixture of Solar System materials, both primitive and processed. Presolar grains are also present [e.g., 5]. Some of the matrix has suffered hydrothermal alteration [6], but much if it appears to be pristine. We are currently working to characterize and decipher the origins of matrix materials. Some of the matrix material, such as Mn-rich (LIME) olivine, has been interpreted to be a nebular condensate [e.g., 2]. The occurrence of this primitive material in chondrites, IDPs and comet samples suggests a close relationship between the silicates that accreted to form asteroids and comets.

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