A NEW LAMELLAR SULFIDE MORPHOLOGY ASSOCIATED WITH GLASSY SILICATE MATERIALS IN UNEQUILIBRATED ORDINARY CHONDRIES. E. Dobrică and A. J. Brearley, Department of Earth and Planetary Sciences, MSC03-2040, 1University of New Mexico, Albuquerque, NM 87131-0001, USA, edobrica@unm.edu.

Introduction: We identified a new intergrowth composed of lamellar low-Ni sulfide and FeO-rich silica glass in the matrices and rims of type I chondrules of several unequilibrated ordinary chondrites (UOCs, Semarkona, MET 00526 and QUE 97008) [1]. In this study, we describe the texture and mineralogy of this intergrowth using transmission electron microscopy (TEM). The goal is to investigate the formation of these materials and to determine the processes that form them. We focus on the effects of the earliest stages of metamorphism and aqueous alteration on these materials.

Results and discussion: Scanning electron microscope studies show that the new lamellar morphology of sulfides occurs either in the matrices of UOCs or in the rims of type I chondrules. Typically these type I chondrules contain microchondrules in their rims [2]. The lamellar morphology occurs in discrete objects that range in size from ~4 µm to 100 µm. The sulfide lamellae, ranging from a few nanometers up to 1 µm in size, occur intergrown with a lower Z phase. One intergrowth from Semarkona was analyzed by TEM and was found to consist of pyrrhotite intergrown with a porous FeO-rich silica glass (49.7 wt% SiO_2; 36.1 wt% FeO). The glass contains elevated concentrations of volatile elements (up to 6.9 wt% SO_3 and 6.1 wt% Na_2O), as well as significant concentrations of MgO (4.5 wt%) Al_2O_3 (1.8 wt%), K_2O (0.4 wt%) and CaO (0.5 wt%); avg. of N=15).

The glassy material in the lamellar intergrowth has the same porous texture and chemical composition as the glass in porous microchondrules [2], suggesting that there may be a genetic link between them. We suggest that this lamellar texture could be secondary and formed during short episodes of acid weathering on the parent body [3], due to release of HCl derived from $HCl{\cdot}3H_2O$ during the melting of accreted water ice. The lamellar texture could be formed by alteration of a sulfide (or metal) where the alteration is controlled crystallographically. We know that the matrix of Semarkona have been extensively altered [4-5], so this texture could be secondary in origin. The lamellar sulfides are embedded in a material, which may not be glass, but a low temperature, hydrated gel-like phase. This Si-rich hydrous gel probably formed as a result of enhanced mobility of silica in low pH solutions.

If this texture is made by alteration processes and the glassy material is a hydrated gel-like phase, this indicates that the chemical composition of porous microchondrules was modified by secondary processes. Furthermore, Dobrica and Brearley (2014) showed that some of the porous microchondrules have compositions similar to that of fine-grained matrix in Semarkona and MET 00526 [2] suggesting extensive aqueous alteration processes in the parent-body/-ies of UOCs.

References: [1] Dobrica E., Brearley A.J., 2015. *LPSC*, #2445. [2] Dobrica E., Brearley A.J., 2014. *LPSC*, #2084. [3] Zolotov M. Y. and Mironenko M. V. (2007). (abstract #3365), Seventh International Conference on Mars. [4] Krot et al., 1997. *Geochimica et Cosmochimica Acta*, 61:219-237. [5] Alexander et al., 1989. *Geochimica et Cosmochimica Acta*, 53:3045-3057.