DETERMINING THE TIMING OF PHYLLOSILICATE FORMATION IN FINE-GRAINED CHONDRULE RIMS USING FOCUSED ION BEAM (FIB) TECHNIQUES. J. McKay[1] and M. R. Lee[1], [1]Division of Earth Sciences, University of Glasgow, Glasgow G12 8QQ, U.K. m.lee@geology.gla.ac.uk.

Introduction: Most chondrules in the Murchison (CM2) meteorite are enclosed by <~100 μm thick fine-grained phyllosilicate-rich rims. The timing of formation of the phyllosilicates relative to accretion of the rim has been especially difficult to determine using standard SEM techniques. Some authors have suggested that the phyllosilicates formed prior to accretion of the rim on its host chondrule [1], whereas others have concluded that an originally anhydrous and mineralogically diverse rim was aqueously altered after accretion and incorporation in to a parent body (e.g. [2]). We suggest that one simple way to distinguish between the two models is to image the chondrule-rim interface using high-resolution TEM. Interpenetration of rim phyllosilicates with chondrule minerals will be unequivocal evidence for aqueous alteration of an originally anhydrous rim following accretion.

Methods: Preparing interfaces between different materials for examination by TEM using conventional Ar ion milling is challenging owing to differential thinning rates. To circumvent these problems, we used a Focused Ion Beam (FIB) instrument to mill cross-sectional slices of the chondrule-rim interface. These slices were typically ~10 microns in length by ~ 5 microns in depth and ~125 nanometres in thickness. Following extraction from the thin section these slices were placed on a holey carbon film for examination by TEM. Initial work concentrated on preparing cross-sections of the interface between chondrule olivines and the rim (Fig. 1), but differential thinning between the olivine and phyllosilicates did produce some problems in lifting out the finished slices. Subsequent work has centered on the interface between phyllosilicates in the interiors of broken chondrules and the rim.

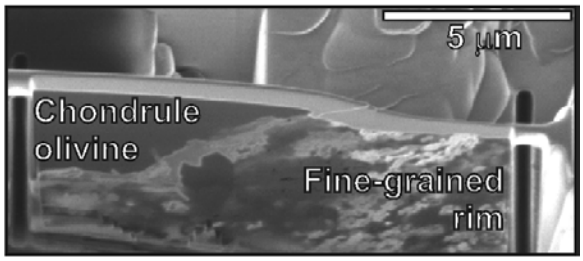

FIG. 1. FIB image of the chondrule-rim interface.

Results: TEM images of the interface between chondrule and rim phyllosilicates show that the two differ considerably in both morphology and crystal size. The rim phyllosilicates are very finely crystalline whereas the chondrule phyllosilicates are much coarser and lath-shaped. The two groups of phyllosilicates interpenetrate on the micron-scale, indicating that they formed at a similar time (i.e. after accretion into the Murchison parent body). The fluids that mediated alteration cannot have moved over distances of more than a few microns during alteration such that the chondrule and rim phyllosilicates have retained some of the chemical character of their different precursors (nebular dust *vs* chondrule glass).

References: [1] Metzler K. et al. (1992) *Geochim. Cosmochim. Acta, 56,* 2873-2897. [2] Zega T. J. and Buseck P. R. (2003) *Geochim. Cosmochim. Acta 67,* 1711-1721.

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