FINE-GRAINED CHONDRULE RIMS IN THE TAGISH LAKE CHONDRITE: EVIDENCE FOR PARENT-BODY PROCESSES

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Introduction: Most chondrules and coarse-grained aggregates in the Tagish Lake carbonaceous chondrite are surrounded by fine-grained rims [1, 2]. Previous workers [2] suggested that the rims in Tagish Lake were formed by accretion of dust in the solar nebula, and subsequently after accretion, they experienced aqueous alteration on the meteorite parent body. Here we present the results of our mineralogical and petrological study of fine-grained rims surrounding chondrules and coarse-grained aggregates in Tagish Lake.

Results and Discussion: We found 87 chondrules, 12 olivine-rich aggregates, and two CAIs in ~114 μm^2 area of two thin sections. These coarse-grained components are embedded in the matrix consisting mainly of phyllosilicates. 95 % of the coarse-grained components are surrounded by fine-grained rims ranging in thickness from 2−220 μm. The rims consist mainly of phyllosilicates similar to those in the surrounding matrix but have a distinctly smoother appearance and slightly more Mg-poor compositions. ~50 % of the rims exhibit a double-layer feature, consisting of Mg-rich/Fe-poor inner layer and Mg-poor/Fe-rich outer layer. Single-layered rims and the inner layers of the double-layered rims are similar in texture and mineralogy. ~80 % of all the rims contain characteristic round-shaped phyllosilicate-rich objects, typically along the core-rim boundary, which are identical to the pseudomorphs in their interior chondrules. The rims commonly have radial cracks running from the core-rim boundary toward the rim-matrix boundary.

We found evidence suggesting that the chondrules with the rims have gone through a fragmentation process. The chondrules commonly partly lack rims. There are abundant clasts (90−480 μm in size) that resemble the chondrule rims in texture and mineralogy. 9 of the 55 clasts studied contain two to three chondrules, and their matrices have cracks emanating from the chondrule surfaces; the cracks resemble impact fractures observed in the matrix of the experimentally shocked Murchison CM chondrite [3]. These observations suggest that the individual chondrules with the rims are actually clasts that were produced during brecciation; the process is similar to that proposed for the chondrule rims in Vigarano [4].

We conclude that the single-layered rims and the inner layers of the double-layered rims were formed, at least partially, by replacing their interior chondrules during aqueous alteration on the parent body. Following fragmentation caused by shock impacts on the parent body, the chondrules with the rims were probably transported and then re-incorporated into the present host matrix. The outer layers of the double-layered rims, especially those with cracks, appear to be remnants of the interchondrule matrix of the material from the former location.

References: [1] Zolensky M. E. et al. 2002. *Meteoritics & Planetary Science* 37:737-761. [2] Greshake A. et al. 2005. *Meteoritics & Planetary Science* 40:1413-1431. [3] Tomeoka K. et al. 1999. *Geochimica et Cosmochimica Acta* 63:3683-3703. [4] Tomeoka K. and Tanimura I. 2000. *Geochimica et Cosmochimica Acta* 64:1971-1988.