Chondrule rims in Murchison, cathodoluminescence evidence for *in situ* formation by aqueous alteration. Derek W. G. Sears, Lu Jie and Paul H. Benoit. Cosmochemistry Group, Department of Chemistry and Biochemistry, University of Arkansas, Fayetteville, Arkansas 72701, USA.

The fine-grained rims on ordinary and carbonaceous chondrite chondrules are often regarded as accretionary, mainly because they are often volatile-rich (King and King, 1981). However, Sears *et al.* (1991) recently argued that some chondrule rims in CM chondrites may be the result of aqueous alteration. The rims, like many features in primitive chondrites, stand out especially clear in cathodoluminescence (CL) imagery due to the distinctive bright red CL of their abundant fine-grained forsterite. Chondrules similarly stand out well in CL images. Group A chondrules show the strong red CL of Fe-free olivine, sometimes associated with the bright yellow CL of anorthite-normative mesostases, while group B chondrules containing Fe-rich olivines and quartz-normative mesostases do not produce CL (Sears *et al.*, 1992).

Using a CL mosaic, we measured chondrule and rim diameters for every chondrule in a 17 × 10 mm section of Murchison. Thirty-eight percent of the chondrules were group A, compared with 46% in the Semarkona (LL3.0) and 61% in the Dhajala (H3.8) ordinary chondrites. While both group A and group B chondrules have rims, those on group A chondrules are significantly thicker than those on group B chondrules, the rim to diameter ratios being 0.2–0.5 for group A chondrules and 0.1–0.2 for group B chondrules (Fig. 1).

There are two reasonable explanations for the relationship between rim thickness and chondrule group. Either (1) the composition of chondrule mainly determines the thickness of the rim, *e.g.*, the rims were produced by the aqueous alteration of the host chondrule, or (2) the two chondrule groups were formed in different environments, say a very dusty locale favoring thick rims versus a less favorable relatively dust-free location. We note that (a) both types of chondrule coexist in the same rock, (b) CL textures at the rim/matrix are sharp while at the rim/chondrule interface they are irregular (see Figs. 7d,e in Sears *et al.*, 1991), (c) all faces on the objects in Murchison have rims of some sort, including the fracture faces of chondrule fragments, (d) the redistribution of volatiles will have accompanied aqueous alteration, and (e) mesostases of calcic plagioclase composition are more susceptible to hydrolysis than the more SiO_2-rich glasses. **We therefore suggest that the evidence favors the idea that these rims formed by *in situ* aqueous alteration.** We suspect that most of this alteration predated the complex multi-stage, multi-environment, brecciation process (Metzler *et al.*, 1992). We speculate that some of the coarse-grained rims observed in higher petrologic type meteorites (*e.g.*, Rubin, 1984) were produced by metamorphism of these fine-grained rims.

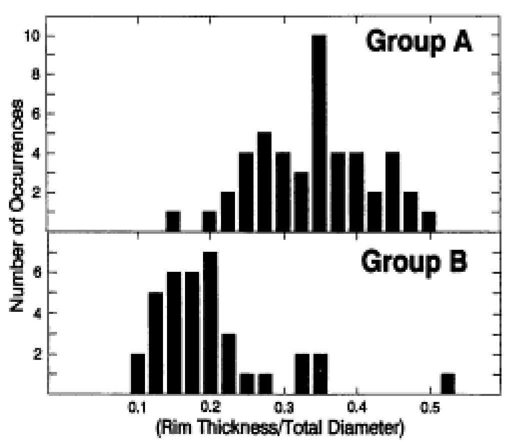

FIG. 1. Chondrule rim thickness to diameter ratio for 70 chondrules in Murchison. "Group A" and "Group B" refers to the compositional chondrule groups (Sears *et al.*, 1992).

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