ROUNDING OF CHONDRULES BY ABRASION: A CAUTIONARY NOTE REGARDING TEXTURAL EVIDENCE. **William R. Skinner, Department of Geology, Oberlin College, Oberlin, OH 44074, and Harold C. Connolly Jr., Department of Geological Sciences, Rutgers University, New Brunswick, NJ 08903.**

It has been proposed by several investigators that significant numbers of chondrules in primitive meteorites have been rounded and/or reduced in size by the abrasion of their surfaces. We challenge some of the textural arguments used to support the concept that chondrules have been abraded. Specifically, we do not believe that the truncation of crystal outlines or compositional zoning of crystals by the surface margin of a chondrule is sufficient to prove that the surface was created by abrasion, because these truncation textures can be produced purely by crystallization of chondrule compositions in the laboratory.

The concept of chondrule abrasion was elaborated and proposed as a major process affecting a large proportion of chondrules by King and King [1]. Their Figure 2 illustrates the truncation of otherwise euhedral crystal shapes by the surface margins of chondrules as seen in thin section. They interpret this truncation as evidence that the chondrules, and the crystals within them, have been abraded. Kitamura and Watanabe [2], apparently unaware of this earlier study, used the same textural argument to demonstrate that chondrules, both lithic and droplet types, had been rounded by abrasion. They assigned chondrules to three major groups defined by surface characteristics and internal geometry. Their "Group C" includes chondrules with crystal outlines, and in some cases compositional zoning within crystals, that are truncated by the chondrule margin. Their Figure 3 includes several excellent photomicrographs illustrating this truncation. They report that the Group C chondrules make up a large proportion, in some cases more than half, of the chondrules in their unequilibrated chondrites, but that Group C chondrules do not occur in the equilibrated chondrites which they studied. Bunch, et al., [3] also illustrate the concept of abrasion of chondrules by drawing the hypothetical extensions of crystals truncated at the chondrule margin (see their Figure 3).

Abrasion of chondrules, if it occurs in the nebula, has important implications for chondrule number density (concentration) as well as for energy considerations. If abrasion occurs during accretion or within the regolith of a parent body, there are implications for process and energy as well. Thus if abrasion occurs at all, the process must be accommodated within models of chondrule formation and evolution, and the concept will influence the formulation of such models [4, 5].

The point we wish to emphasize is that chondrule textures that exhibit crystal outlines and zonation patterns truncated by a chondrule surface do not, of themselves, demonstrate that abrasion has occurred. Figures 1 and 2 shown here are synthetic chondrules that were produced by the junior author in the laboratory. In each of these figures it is clear that the olivine crystal outlines as well as the compositional zonation within them are truncated at the surface of the synthetic chondrule, *even though no abrasion has occurred.* The chondrule surfaces and the crystal morphologies shown here were solely determined by the bulk compositions and the heating and cooling histories of the two synthetic chondrules. This is not to say that such textures could not be produced by abrasion of larger objects, but it does clearly demonstrate that such textural relationships are not sufficient to prove abrasion. Where abrasion is proposed, additional arguments must be presented to support it, as was done, for example, by Bunch, et al. [3].

References: [1] King T. V. V. and King E. A. (1978) *Meteoritics 13*, 47-71. [2] Kitamura K. and Watanabe S. (1986) *Mem. NIPR, Spec. Issue 41*, 222-234. [3] Bunch T. E. et al. (1991) *Icarus 91*, 76-92. [4] Hewins R. H. (1989) *Proc. NIPR Symp. Antarctic Meteorites 2*, 200-220. [5] Hewins, R. H., personal communication, Aug. 1993.

ABRASION OF CHONDRULES: W. R. Skinner and H. C. Connolly, Jr.

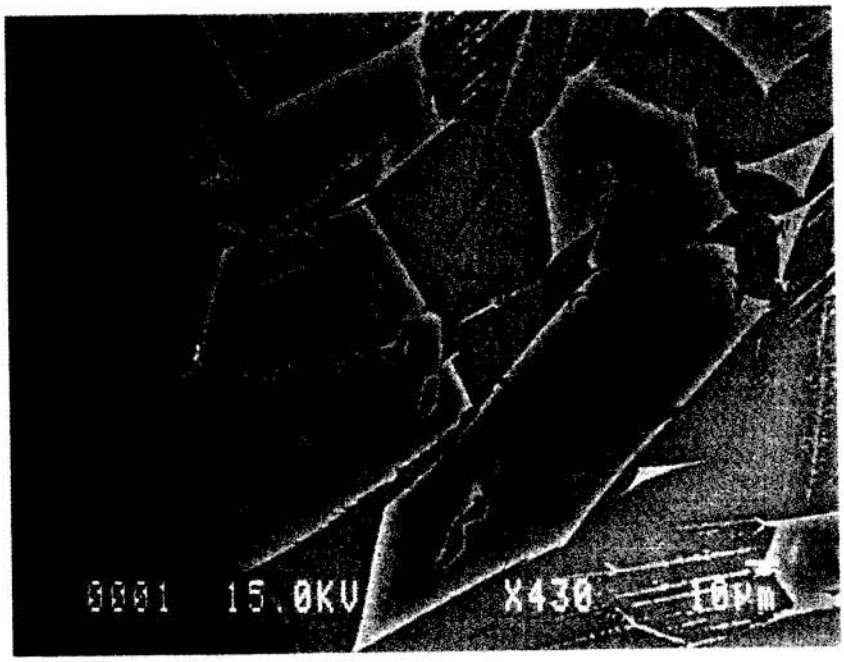

Figure 1. Compositionally zoned olivine crystals in a glassy mesostasis as grown in a synthetic charge. The large, almost euhedral crystal at the edge of the chondrule is truncated by the surface margin of the chondrule, as is the compositional zoning within the crystal. (Backscattered electron image.)

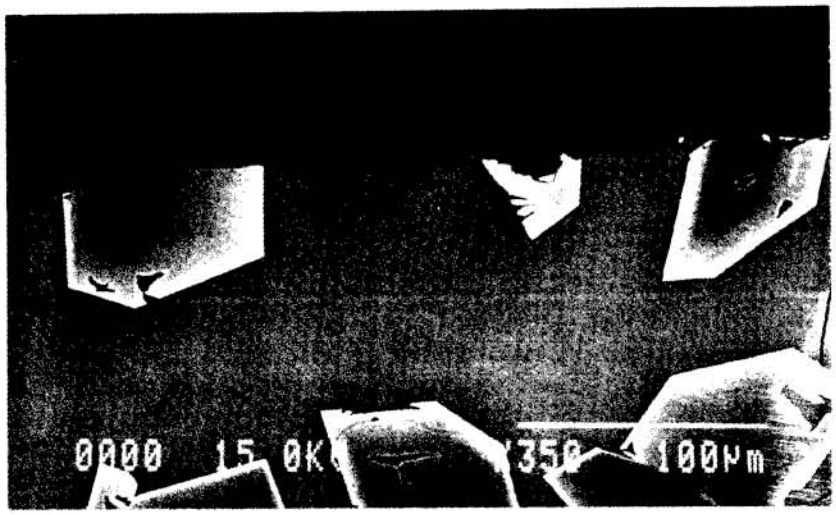

Figure 2. Compositionally zoned olivine crystals in a glassy mesostasis as grown in a synthetic charge. Note that the otherwise euhedral crystals are truncated by the margin of the chondrule. The compositional zoning in these crystals is truncated as well. (Backscattered electron image.)