

CHONDRULE RECYCLING EXPERIMENTS. G. E. Fox and R. H. Hewins, Dept. of Geological Sciences, Rutgers University, 610 Taylor Road, Piscataway NJ 08855, USA.

Introduction: The exact conditions under which chondrules formed are of great interest to those who seek to determine what major heating mechanism operated in the early solar system. We have shown that with a single rapid heating, very fine grained starting material analogous to nebular condensates do not normally generate the porphyritic textures characteristic of chondrules [1]. We explore here the consequences of reheating such synthetic chondrules.

Experimental Techniques: We prepared 8 charges by heating a $<20\mu\text{m}$ mix for 1 minute at 1537°C in 1 atm CO/CO_2 and cooling on a curve starting at $2400^\circ\text{C}/\text{hr}$ and ending at $360^\circ\text{C}/\text{hr}$, as in [1]. The products (MPO, NGS $32\mu\text{m}$) were reheated for one minute at temperatures between 1540 and 1640°C , and then cooled as before. We made additional runs with a first peak temperature of 1600°C which were reheated at various temperatures down to 1466°C .

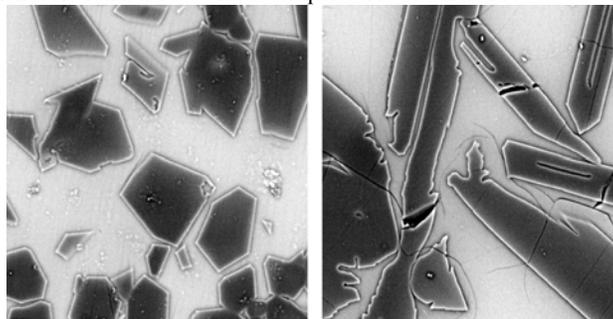


FIG. 1 (a) Left, heated once (b) Right, heated twice.

Results: The grain size of charges first heated to 1537°C increases directly with reheating temperature, until total melting. A charge heated twice (Fig 1b) is much coarser than one heated once to the same temperature (1a). There is no textural evidence of reheating in 1b. Some relict grains survived in runs reheated at the lower temperatures, but fewer than in charges heated only once to those temperatures. Heating once to 1600°C produced BO, and reheating to very low temperatures preserved the BO texture. Similarly, reheating at low temperature does not appreciably coarsen fine-grained charges [2].

Discussion and Conclusions: Reheating a charge to the same temperature makes little difference, because the same grains grow back. With higher temperatures, the smallest grains are dissolved and the survivors can grow bigger. Fine-grained condensate precursors could be converted to PO chondrules by repeated heating, but only to the extent that reheating is to successively higher temperatures. Normally it should be impossible to tell from textures whether a chondrule has been heated once or more than once. Relicts are destroyed by recycling, and indicate polymict precursors (nebular or asteroidal debris) rather than reheating of chondrules.

References: [1] Fox G.E. and Hewins R.H. (2002) *LPS XXXIII* 1612.pdf. [2] Yu, Y., and Hewins, R.H. (1998) *Geochim. Cosmochim. Acta* 62, 159-172.