American Mineralogist, Volume 92, pages 1936–1945, 2007

A modeling approach to understanding the role of microstructure development on crystal-size distributions and on recovering crystal-size distributions from thin slices

RODDY AMENTA,* ANNE EWING, AMY JENSEN, SARAH ROBERTS, KRISTA STEVENS, MICHELLE SUMMA, STEPHANIE WEAVER, AND PAXTON WERTZ

Department of Geology and Environmental Science, James Madison University, Harrisonburg, Virginia 22807, U.S.A.

ABSTRACT

Computer modeling of microstructure development was used to determine whether competition for space among growing crystals modifies the crystal-size distribution (CSD) predicted by the crystallization kinetics. Microstructures were modeled with prisms, plates, and cuboids, respectively. In all cases, the true CSDs calculated from crystal volumes in the microstructure corresponded closely with the linear ideal CSDs predicted by crystallization equations indicating that grain impingements did not significantly modify the predicted CSD information. Crystal intersection widths and lengths were measured in 2-dimensional slices through the microstructures to test if the CSD information could be recovered. For prisms and plates, the recovered CSDs compared favorably with the true CSDs, but cuboids yielded mixed results depending on their shapes and need further study. For prisms, the recovered CSDs were linear and for plates slightly curvilinear. These results indicate that rocks with recovered, curvilinear CSDs should be interpreted cautiously as indicators of complex crystallization histories, and that petrographic examination should have precedence in such interpretations.

Keyword: Crystal-size distribution, CSD, microstructure, computer modeling