

Crystal-size distribution and composition of garnets in eclogites from the Dabie orogen, central China

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ABSTRACT

Crystal-size and spatial distributions of minerals in metamorphic rocks provide insight into their nucleation, growth environment, and the metamorphic evolution of their host rocks. Episodic nucleation and growth histories for garnets in eclogites from the Dabie orogen are revealed by variations in crystal size, geochemical zoning, and mineralogy of inclusions in garnets. The studied garnets show pseudo-lognormal crystal-size distributions (CSDs), prograde chemical zoning patterns indexed by mineral inclusions, and are mainly distributed at random. Constant growth rate for each episode is proposed based on the mineralogy of inclusions in garnets and the chemical zoning patterns. The CSD shapes were evaluated in terms of a size-dependent proportionate growth model and a thermally accelerated, diffusion-controlled model but neither is consistent with the geochemical data and the concordant occurrence of mineral inclusions in garnet. Initial increasing nucleation rate followed by a subsequent, medial stage of nearly constant growth and finally declining nucleation rate is inferred from the CSD data. This study suggests that linking chemical analysis with textural analysis is crucial to avoid misleading interpretation solely through CSD shapes of minerals in metamorphic rocks.

Keywords: Garnet, crystal size, zoning, growth, Dabie