

Reaction history recorded by trace element zoning patterns of high-pressure low-temperature garnets

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Garnet is efficient in incorporating significant amounts of trace elements and preserving its zoning pattern due to a combination of slow element diffusion rate and significant stability during subduction.

We compared thermodynamical modeling of garnet composition and measured major and trace element patterns with a changing mineral phase assemblage to determinate a particular breakdown reaction. With emphasis on rare earth elements (REE)-bearing minerals (garnet, titanite, epidote and lawsonite), we show that abrupt changes in garnet patterns develop as a result of a discontinuous reaction and that diffusion is not the controlling factor. Such approach can be used to identify stability field of a particular REE-bearing mineral and to support a geochronological data during burial or exhumation of the garnet.

We conclude that the resulting enrichment in garnet depends on the individual geochemical composition of the actual reactant phases and therefore there is no universal REE pattern for particular breakdown reaction.