

An attempt to estimate the kelyphitization rate of garnet from a zoning of garnet

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Although much work has been published on kelyphite after garnet from high-pressure mafic and ultramafic rocks, very few works have been published on the rate of kelyphitization. This is an attempt to estimate the rate of kelyphitization from the zoning width of garnet adjacent to the kelyphite rim assuming a steady state diffusion. When a garnet is being kelyphitized, its composition is locally re-adjusted by an exchange reaction with product minerals and accompanying diffusion in garnet. The width of zoning is defined by the rate of diffusion and the rate of advancing of the reaction front. The zoning profile and the width of the zoning is formulated assuming a steady state (Lasaga, 1998). However, this estimate bears a large uncertainty arising from experimental errors of the diffusion coefficients and temperature estimations for actual samples. We use, among the samples we have studied, garnet peridotite, garnet pyroxenite from Ronda peridotite, Spain, garnet peridotite from Czech Bohemian massif and a garnet peridotite from western Norway and made an inter-locality comparison. As a preliminary estimate, by the use of 10^{-21} m²/s as a diffusion coefficient at temperature of 1000°C, and 1 μm for a zoning width, we obtain 0.03 μm/year for the kelyphitization rate. This means that it takes about 30,000 years for a 1 mm kelyphite rim to develop.

References:

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