Sm-Nd study of garnets in metapelites from Naxos (Cyclades, Greece): Closure temperature – Isotopic disequilibrium

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Naxos island (Cyclades, Greece) comprises a migmatitic dome rimed by a metasedimentary sequence. Two metamorphic events are recognized: a high pressure / low temperature (M1) event dated at 50My, and a medium pressure / medium temperature (M2) event at 18-20My during which temperatures ranged from 450 to 700°C. The aim of this study is to estimate the closure temperature of the Sm-Nd decay system. Four samples were chosen from four metamorphic zones over which peak temperature ranges from 450 to 700°C. Rare earth element compositions in metamorphic garnet that grew during M2 preserves growth zoning, even at 700°C. However, an increase in temperature induces chemical diffusion of elements at a scale of 10-100µm, smoothing out the initial steep concentration gradients that developed during crystallization and equilibrating garnet rim with matrix. Sm-Nd isotopic measurements show that in the migmatite sample, Sm-Nd decay system remained open to diffusion at 700°C. Therefore the calculated apparent age of 13.0 ± 3.6Ma is interpreted as a cooling age and the closure temperature of the Sm-Nd system in garnet has been estimated higher than 700°C. Below 700°C, the Sm-Nd system in M2 minerals was re-equilibrated but not in minerals from older paragenesis.

References