Metamorphic timescale events constrained by diffusion in garnet overgrowth stages: the Late-Variscan static metamorphism of the Serre Massif (southern Calabria, Italy)

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The tectono-metamorphic evolution of metamorphic basements reflects the dynamic journey of rocks, faced during their burial evolution into the deep crust up to exhumation upon surface, passing, potentially, through one or more static metamorphic stages due to local thermal rising. This implies a continuous changing in the intensive variables (*e.g.*, *T*, *P*, fO_2) through several types of d*P*/d*T* gradient for different precursor rocks, as highlighted by the peculiar continuous adjustment of the mineral assemblages as well as of the solid solution compositions. In the metapelite system, for instance, garnet is the solid solution mineral that best records these changes, since its forming porphyroblast textural characteristic and its slow cationic diffusion rates, making it one of the mineral most commonly used as a tracer of the *P-T-t* trajectories of metamorphic basements. In recent years, modeling concentration gradients modified by cationic diffusion processes has become an increasingly used geo-chronometry tool to constrain durations of thermal events, if temperature, pressure and element diffusion coefficients are known and if kinetic window condition is verified (Chakraborty, 2008).

In this work, we have investigated millimeter almandine-rich garnet crystals from garnet-micaschists of the Mammola Paragneiss Complex (Serre Massif-southern Calabria; Angì et al., 2010), highlighting a multistage metamorphic evolution consisting of an orogenic cycle partly overprinted by a thermal one, both of them ascribable to the Variscan orogenesis (Angì et al., 2010). In particular, we focused on the thermal cycle with the intent to estimate the timescale of the static event linked to the emplacement of Late-Variscan huge masses of granitoid bodies, by modeling compositional changes within garnet due to the high-temperature multi-component diffusive effects.

Obtained results highlighting a timescale for the Late-Variscan thermal event of about 1-3 Ma, suggesting a relatively rapid exhumation in this portion of the dismembered southern Hercynian European Belt, presently involved within the internal Alpine sector of the western Mediterranean geodynamics.

Angì, G., Cirrincione, R., Fazio, E., Fiannacca, P., Ortolano, G., Pezzino A. (2010): Metamorphic evolution of preserved Hercynian crustal section in the Serre Massif (Calabria- Peloritani Orogen, southern Italy). Lithos, 115, 237-262.

Chakraborty, S. (2008): Diffusion in solid silicates: a tool to track timescales of processes comes of age. Ann. Rev. Earth Planet. Sci., 36, 153-190.