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ABSTRACT BOOK

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Il tempo del pianeta Terra e il tempo dell'uomo: Le geoscienze fra passato e futuro

Unravelling colling rates of the Calabria continental lower crust from combined microstructural, thermodynamic and diffusion modeling: An example from the Sila Piccola Massif, (Northern Calabria)

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Understanding the temporal evolution of metamorphic processes and how fast these can occur is one of the most fascinating goals of the earth scientists. Evidence of a rapidly exhumed basement is given by metamorphic rocks where mineral assemblages and compositionally-zoned crystals preserve the prograde growth history (e.g. Zhang et al., 2010). Conversely, a slow exhumation can involve long-lasting high-T processes which can destroy evidences of the early PT path, by erasing the growth mineral zoning (e.g. Spear, 2014). In this context, the study of compositional changes due to diffusion provides a valuable tool for outlining how long zoned minerals in chemical disequilibrium with the surrounding matrix can retain their pre-existing zonings before being homogenized by diffusion mechanisms (Chakraborty, 2008).

In this work, a detailed structural and petrological study was focused on a mylonitic horizon affecting granulite facies rocks cropping out in the Sila Piccola Massif, to obtain new constraints about the exhumation rate-meter of the lower portion of a Variscan basement fragment of the northern Calabria Peloritani Orogen. In particular, an Alpine metamorphic shearing overprint on earlier high temperature Variscan relics was recognized. These pre-mylonitic relics are given by a first generation of garnet, plagioclase, biotite, sillimanite and quartz in which garnet shows a flat compositional profile. The subsequent mylonitic cycle can be subdivided into two metamorphic stages. The first one, ascribable to a late-Variscan extensional shearing, generates a syn-kinematic growth of the second generation of garnet, plagioclase, biotite and quartz. The second one is characterized by a syn-shearing growth of chlorite, white mica, plagioclase and quartz, here interpreted as an early Alpine mylonitic re-activation in compressional regime. In this context, quantitative image analysis was adopted to extract the effective bulk rock chemistries to be used in PT pseudosections computation. This step was useful for constraining the PT range (P=5-6 Kbar; T=610-650 °C) of the early mylonitic stage. In this case, diffusion modeling of garnet compositional relaxation along the equilibrated rims allowed to derive a maximum timescale of ~ 5 Ma for a cooling rate of ~ 25 °C/Ma. Furthermore, a detailed microstructural study for paleopiezometer purpose, consisting in the quartz c-axis pattern analysis accompanied by grain-scale distribution analysis of the syn-mylonitic recrystallized quartz, permitted to obtain shearing temperature of 400-450 °C for a strain-rate of $7{,}58\times10^{-11}$ (1/s). Finally, the mylonitic cycle evolved to an asymmetrical folding stage at shallower conditions as proved by structural evidences, probably ascribable to the staking stages of the Alpine-Appennine tectonic activity in the central Mediterranean area.

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