

New insights into crustal differentiation using whole-rock and in-situ Sm-Nd isotopes along the Serre crustal section (Calabria, Southern Italy)

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New Phanerozoic continental crust is mainly formed in magmatic arc contexts and can then be reworked by tectonic, magmatic and metamorphic processes during late orogenic stages. These geological processes shape the continental crust and are responsible for its stratified structure, leading to intra-crustal differentiation [1]. In most collisional/post-collisional environments, a wide variety of granitoids can be generated including granitoids with hybrid signature (mantle-crust sources) and pure crustal S-type granites. The exact contribution of mantle and crust components is however difficult to quantify and several recent studies suggested that some of the geochemical proxies, extensively used to quantify them (e.g. Hf isotopes in zircon), can largely underestimate the mantle component in post-collisional magmas [2]. Another limitation on our abilities to untangle the sources that participate in the construction of the crust is related to the inaccessibility of the continental crust roots where important melting and hybridization processes occur.

Here, we present an extensive dataset of Sm-Nd isotopic measurements along a 26 km-thick crustal section in Calabria. The main aim is to characterize the Sm-Nd isotopic variability at various scales (outcrop, thin-section, mineral) and to investigate hybridization and lower crustal processes. The Serre crustal section exposes partially melted lower crustal rocks (mafic and felsic granulites, migmatitic paragneisses) and middle crustal granitoids (tonalites, 2-mica granites and granodiorites) forming a 13-km thick batholith and constituting the final products of crustal differentiation. They mainly formed and emplaced during the final stages of the Variscan orogeny following decompression and extensive partial melting of the lower crust [3], [4]. Results show that the lower crust is strongly heterogeneous (with whole-rock $\varepsilon_{\text{Nd}_{290 \text{ Ma}}} = -10.5$ to $+1.7$) at various scales (from whole-rock to mineral), whereas the mid-crustal granitoids reveal a striking homogeneity (with whole-rock $\varepsilon_{\text{Nd}_{290 \text{ Ma}}}$ close to -7). Hybridization processes are clearly identified using *in-situ* Sm-Nd isotopes coupled with trace element analyses on accessory minerals. They are particularly vigorous in a narrow zone (1-2 km) located at the transition from the lower to the middle crust.

References:

- [1] Brown & Rushmer (2006)
- [2] Couzinié et al. (2016)
- [3] Schenk (1990)
- [4] Fiannacca et al. (2015)