

## Tracking deep crustal processes by U-Pb zircon geochronology and isotopic compositions of metagneous and metasedimentary granulites, Serre Massif, Calabria, southern Italy

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Mafic and felsic granulites from the lower crust exposed in the Serre Massif (Calabria-Peloritani Orogen) have long been considered to originate from *MP/HT* Variscan metamorphism of pre-Variscan gabbros and siliciclastic rocks, respectively. Reliable U-Pb zircon ages of ~ 300 Ma have been obtained for the late Variscan metamorphism, while more doubtful ages of ~ 593-564 Ma have been proposed for the protoliths of the metagabbros (*e.g.*, Fornelli et al., 2011). Similarities with Permian-Triassic gabbroic intrusions in the lower crust of northern Calabria, as well as with the Permian Ivrea crustal section of the southern Alps, suggest that the Serre metagabbros might also represent late-to-post Variscan magmatic underplating. To investigate this possibility a metagabbro sample has been dated by SHRIMP zircon U-Pb. Dates obtained range from ~ 3.2 Ga to ~ 270 Ma. Most of the older cores yield ~ 720 – 450 Ma, the youngest of which possibly places an upper limit on the age of magmatism. The maximum age for the metamorphism is ~ 313 Ma. All of the metamorphic zircon has high  $\delta^{18}\text{O}$  (9.3 – 10.6 ‰), indicating crystallization in the presence of sediment-derived fluids. Older zircon cores have lower  $\delta^{18}\text{O}$  (6.1 – 9.2 ‰), only three of which are < 7.5 ‰. The oxygen isotopes have a strong sediment signature, consistent with the large amount of detrital zircon in the sample. The  $\epsilon_{\text{Nd}}$  value of the metagabbro sample at 290 Ma is -2.1, within the reported range of -0.9 to -3.4 for similar samples (-0.8 to -2.4, at 550 Ma). The data indicate a high degree of older crust in the mantle derived magma. Both the O and Nd isotopic signatures of the metagabbro therefore suggest that prolonged residence of a sediment-contaminated mafic magma in the deep crust has largely modified the zircon  $\delta^{18}\text{O}$  and some U-Pb dates, making it hard to determine the original gabbro  $\delta^{18}\text{O}$  and emplacement age. If the ~ 450 Ma zircon age is that of a detrital zircon, however, the gabbro magmatism must be younger. This hypothesis has been tested by studying two samples of felsic granulites hosting the metagabbro. Prolonged residence in the deep crust also caused zircon Pb mobilization in those granulites, but reliable ages were nevertheless obtained for the growth of new metamorphic zircon, indicating granulite facies metamorphism at ~ 300 Ma. Furthermore, in one of the felsic granulite samples, it was possible to obtain a well constrained age of ~ 400 Ma for the youngest zircon core population, providing a best estimate for the maximum depositional age of the arenite protoliths, and supporting the conclusion that the gabbro is not latest Precambrian, but rather ~ 400 Ma or younger.

Fornelli, A, Langone, A, Micheletti, F, Piccarreta, G. (2011): Time and duration of Variscan high temperature metamorphic processes in the south European Variscides: constraints from U-Pb chronology and trace element chemistry of zircon. *Mineral. Petrol.*, 103, 101-122.