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Timing of metasomatism in a subcontinental mantle: evidence from zircon at Finero (Italy)

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The Finero phlogopite-peridotite represents a metasomatized residual mantle harzburgite, exposed at the base of the lower-crust section in the Ivrea Zone, Western Alps (*Hartmann* and *Wedepohl* 1993). It forms the core of a concentrically zoned sequence of internal layered gabbro, amphibole-rich peridotite and external gabbro. The phlogopite peridotite contains small-size chromitite bodies, with a suite of accessory minerals such as phlogopite, apatite, Ca-Mg carbonates, zirconolite, zircon, thorianite and uraninite, proposed to form during alkaline-carbonatitic metasomatism process within the mantle (*Zaccarini* et al. 2004). In this study, the combined application of a non-destructive technique to separate zircon from their host rocks (see details at http://www.natires.com) and *in-situ* analytical technique for compositional and isotopic analysis (SHRIMP-II at Russian Geological Research Institute, St. Petersburg) has provided new more detailed age constraints on the formation of chromitite and related metasomatic events within a mantle tectonite at Finero.

Chromitite samples derived from the dump in the prospecting trenches of Rio Creves. In thin sections, zircon occurs as relatively large (up to 200 μm) grains characterized by subhedral to euhedral shapes. Separated grains of zircon form two distinct populations. Dominant zircon population is pale pink and characterized by different shapes (subhedral, subrounded or elongated). In cathodoluminescense, the main set of population is represented by complex grains, which show development of core-rim relationship (most likely recrystallized rim on a preserved core). Subordinate zircon grains are colourless. They are characterized by a smoky cathodoluminescense, with almost no internal pattern.

Three main U-Pb age clusters have been recognized. The youngest age cluster, typical for subordinate colourless zircon population and rims in complex grains of dominant pale pink population, show two concordant $^{206}Pb/^{238}U$ ages (e.g., 208.6 $\pm$ 4.0 Ma, MSWD=2.0; P=0.16, n=8 and 194.9 $\pm$ 3.4 Ma, MSWD=0.45; P=0.50, n=3, respectively). Other age clusters are characterized by the cores and rims observed in composite grains. They yielded concordant $^{206}Pb/^{238}U$ ages of 288.3 $\pm$ 7.3 Ma (MSWD=3.3, n=6) and 248.6 $\pm$ 3.3 Ma (MSWD=0.13, P=0.72, n=8), respectively.

Since the pioneering work of *Exley* et al. (1982), the complex metasomatic history at Finero has received much attention. New U-Pb results are consistent with the age range obtained for mantle rocks, the phlogopite peridotite (293 $\pm$ 13 Ma, *Voshage* et al. 1987) and chromitite (208 $\pm$ 2 Ma, *Grieco* et al. 2001). The former age estimate, based on a Rb-Sr whole-rock isochron for six phlogopite-bearing peridotites and one phlogopite pyroxenite, has been interpreted as time of K metasomatic enrichment of the harzburgite. This event has been coeval with the intrusion of alkaline ultramafic magmas into the deep crust of the Ivrea Zone during the late Carboniferous (287 $\pm$ 3 Ma, *Garuti* et al. 2001). The U-Pb age of 208$\pm$2 Ma for zircon at Alpe Polunia, attributed by Grieco et al. (2001) to one of the major metasomatic episodes, is corroborated by a subordinate subset of zircon grains at Rio Creves. The U-Pb zircon ages identified in this study thus show notable differences. Our U-Pb data do not concur with the assumption of a single metasomatic event during chromitite formation. In contrast, we suggest a prolonged formation and multistage evolution of zircon growth, as mirrored by multiple U-Pb ages. U-Pb results for zircons from two chromitite localities (Alpe Polunia and Rio Creves) place tight constraints on their different temporal evolution. We presume that Hf-isotope data of zircon and Os-isotope data of laurite, to be investigated in the future, will shed new light on the sources of materials involved in a subcontinental mantle at Finero.

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