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On the nature of the transition between the mantle and crustal units in the Finero Complex (Ivrea-Verbano Zone, Southern Alps

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A well-exposed contact between mantle and crustal rocks is present in the Finero Complex (northern Ivrea-Verbano Zone; Southern Alps). The core of the Complex is composed by the Finero Phlogopite Peridotite mantle unit (FPP), which is wrapped out by an intercalation of mafic-ultramafic rocks interpreted as intrusive crustal bodies. The first crustal unit, placed in contact with the FPP, is the Layered Internal Zone (LIZ), which is overlaid by the Amphibole Peridotite and the External Gabbro units. With the aim of characterising the nature of such transition, a detailed investigation has been done on the outcrop at the confluence between Rio Cannobino and Rio Creves. In the transition area, no apparent melt injection (i.e. veins or dykes) from the LIZ is observed into the FPP. A few meters far from the contact, the mantle rocks are similar to those forming the typical FPP sequence. They are coarse-granular phlogopite-amphibole-bearing harzburgite showing a foliation parallel to the contact. The amphibole chemistry is characterised by large Mg# and Cr, Th and U contents, large and linearly-fractionated LREE/PM values, and low Nb, Ta and HREE. Towards the LIZ, the olivine grain-size decreases and the peridotite becomes richer in orthopyroxene, phlogopite and amphibole. At the contact with the LIZ, the harzburgite is replaced by a layer, up to 1-m-thick, of weakly-deformed coarse-granular amphibole-biotite-bearing orthopyroxenite. Besides, approaching the contact, the minerals have larger Fe and Al, and lower Cr. Amphiboles are still enriched in Th, U, and LREE, and depleted in HREE, but with greater absolute values than in the harzburgite farther from the contact. The LIZ starts with dm-thick hornblendites, followed by amphibole gabbro layers containing garnet and clinopyroxene. Both hornblendites and gabbros preserve magmatic textures, with modest deformation and subsolidus recrystallisation. Hornblendites are made by titanian pargasites, definitely richer in Fe, Al and Ti than the FPP amphiboles. Besides, they show L-MREE-enriched convex-upward normalised patterns and local enrichment in Nb and Ta, suggesting segregation from alkaline melts. More complex processes are recorded by the amphibole gabbros, in which amphibole and clinopyroxene show lower LREE, associated to a huge positive Eu anomaly in the normalised pattern: the latter is commonly considered evidence of assimilated plagioclase component into a melt.
Thus, the combination of the structural and petrochemical features suggests that contact between FPP and LIZ is primary and made by reactive/magmatic rocks. The observation that the mantle ultramafics at the contact show mineralogy and trace element composition consistent with those of the rest of FPP suggests that they were segregated during the same pervasive metasomatic event that produced phlogopite-bearing mineral assemblages. The hornblendites and amphibole gabbros of LIZ record the migration of different melts, locally involving the assimilation of early gabbroic cumulates. This suggests that the FPP-LIZ transition has likely worked for a very long time as a primary discontinuity, representing a preferential level of channelling for the uprising melts.