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# Pervasive migration of K-Mg-rich melts through off-craton subcontinental lithospheric mantle: Sources, migration mechanisms and geodynamic environment

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The mantle unit of the Finero Complex is a unique example of huge orogenic massif consisting of off-craton subcontinental lithospheric mantle pervasively metasomatised by K-Mg-rich melts: thus, it represents a very precious opportunity to characterize sources, composition, migration mechanisms and geodynamic environment of this peculiar type of melt.
The Finero Complex is located in the northern sector of the Ivrea-Verbano Zone (IVZ, Southern Alps), being placed in contact by means of the Insubric line with the Austro-Alpine terrains of the Sesia-Lanzo Zone. It has an antiform structure, consisting of a phlogopite-bearing spinel-facies dunitic-harzburgitic mantle unit at the core, which is surrounded by a layered mafic-ultramafic intrusion, i.e. the Finero Mafic Complex.
Unlike the central and southern sectors of the IVZ (in which the petrogenetic processes are mainly Permian or older), geochronological data suggest that metasomatic events experienced by the Finero mantle unit, as well as the emplacement of the Finero Mafic Complex, occurred over a time span from Middle Triassic to Lower Jurassic. In particular, U-Pb zircon data point to a Middle Triassic intrusion age for the Finero Mafic Complex. Consistent ages have been documented for zircons from tuffitic layers of the Triassic sedimentary sequence, suggesting that the plutonic activity was associated to volcanism on surface. The hydrous tholeiitic to transitional geochemical affinity argued for the parent melts, the ubiquitous occurrence of large amphibole modal content throughout the intrusion and the early precipitation of garnet amphibolites have been interpreted as the evidence that the intrusion of the Finero Mafic Complex took place in a supra-subduction setting (Zanetti et al., submitted).
In the frame of this contribution, new data about field relationships, petrographic features, major and trace elements mineral chemistry of the main lithologies of the mantle unit (e.g. phlogopite-amphibole-bearing harzburgites, dunites with massive chromitite and pyroxenite bands, phlogopite-bearing websterite, orthopyroxenites, clinopyroxenites and sapphirine-bearing amphibole gabbros), as well as U-Pb zircon data for massive chromitite layers located in huge dunites, will be provided.
Our investigation points out that the mantle unit experienced a virtually complete metasomatic recrystallization triggered by several episodes of pervasive-to-channelled porous flow migration of hydrous melts, alternated with episodes of melt migration in open fractures. The latter mechanism formed pyroxenites usually containing Opx, Cpx, Amph and Phl, with the relevant exception of the latest magmatic event, which was characterised by segregation of banded veins formed by sapphirine-bearing hornblendite and leucogabbro. Both peridotites and pyroxenites related to the pervasive recrystallisation event display a similar geochemical signature, characterized by low content in Al, Ti, Nb, Ta, HREE and Y, associated to very large Mg# value and K, Th, U, Sr, Pb, Ba, LREE concentrations. The U-Pb zircon data for the chromitite layers point to Lower Jurassic ages. These data indicate that the Finero Mafic Complex and the mantle unit experienced different thermal and structural evolutions until Lower Jurassic, being tectonically juxtaposed during the opening of the Jurassic Neo-Tethys or later.
The sources of the migrating melts, the age and geodynamic environment of the mantle metasomatism and the age of the crustal accretion of the mantle unit will be debated. In particular, it will be stressed out the possibility that the K-Mg-rich melt migration suffered by the Finero mantle unit took place in a post-collisional environment, similarly to the high-MgO ultrapotassic, lamproitic magmatism widespread in different Mediterranean areas from Oligocene to Pleistocene in association with shoshonitic and calk-alkaline rocks.

Reference: Zanetti A., Mazzucchelli M., Sinigoi S., Giovanardi T., Peressini G., Fanning M. (2012). Insights into the Melt-Lower Crust Interplay and the Triassic Geodynamic Evolution of the Southern Alps: Evidence from the Finero Mafic Complex. J. Pet., submitted.