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# Hydrous magmatic underplating in the Ivrea-Verbano Zone (Italian Alps): differentiation processes and primary magma compositions

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The accretion of the lower continental crust by magmatic underplating in extensional continental settings is poorly known. To ascertain the nature of the mantle magmas emplaced at deep crustal levels of the extending lithosphere and the processes driving to their chemical differentiation, we carried out new petrological and Nd-Sr-O isotope analyses of the mafic-ultramafic rocks exposed in the lowermost sector of the Mafic Complex from the Ivrea-Verbano Zone (Italian Alps). The Mafic Complex is an 8 km thick batholith mostly consisting of gabbroic and dioritic rocks, crystallized during the post-Variscan transtensional tectonics.

The lower Mafic Complex is mainly composed of amphibole gabbros, which locally include amphibole-rich ultramafic layers and amphibole-free norite layers. The amphibole-rich rocks display wide Mg# variations that are coupled with nearly homogeneous Nd-Sr-O isotopic signature and incompatible trace element fingerprint, thereby recording a magmatic differentiation process controlled by fractional crystallization. Specifically, the amphibole-rich rocks have enriched Nd-Sr isotopic compositions and the $\delta^{18}O$ of amphibole and pyroxene retain a minor continental crust component. We relate the geochemical characteristics of the amphibole-rich rocks to primary $H_2O$-rich mantle magmas derived from a subcontinental, amphibole-bearing mantle section, presumably metasomatized during the preceding Variscan subduction.

Unlike the amphibole gabbros, the amphibole-free norite layers locally enclose m-scale thick garnet-rich paragneiss lenses. The paragneiss are rutile- and sillimanite-bearing, and locally include accessory corundum and varying amount of hercynitic spinel. Mineral and bulk rock compositions provide evidence for a highly restitic nature of the paragneisses, and the Nd-Sr-O isotopic signature of the norites indicates a cogenetic relation with the amphibole gabbros. We propose that the amphibole gabbro-forming melts locally mixed with anhydrous melts released by basement granulite-facies metasediments. Hence, the assimilation of crustal material inhibited the crystallization of amphibole and triggered the melt saturation in orthopyroxene. It is speculated that crustal contamination represents a minor differentiation process for the mantle magmas emplaced in lowermost continental crust, due to the intrinsic restitic nature of the basement rocks.