

The Timing of Ni-Cu-PGE Mineralizing Metasomatic Events in Lower Crustal Rocks of the Ivrea-Verbanio Zone, Italy

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The Ivrea–Verbanio Zone (IVZ) in northwest Italy represents a sub-vertical cross-section of the lower continental crust and subcontinental lithospheric mantle that was uplifted during the Alpine Orogeny. The evolution of the IVZ has been strongly influenced by the underplating of mantle-derived mafic magmas (the Mafic Complex) beneath the metamorphic basement of the Southern Alps (the Kinzigite Formation). In addition, mantle peridotites were uplifted along the Insubric Line during the Alpine Orogeny.

The IVZ hosts a series of Ni-Cu-platinum-group element (PGE) deposits that display varying degrees of metasomatism. The highest ore grades (>20% Ni+Cu; 5 ppm PGE) occur in a series of strongly metasomatized ultramafic pipes, approximately 300 meters wide, that intruded the Mafic Complex and Kinzigite Formation. In contrast, strongly metasomatized portions of the mantle peridotites only contain minor sulfide mineralization. Ni-Cu-PGE mineralized magmatic sills within the Mafic Complex that were not metasomatized display significantly lower ore grades (i.e., 3-5% Ni+Cu; 1 ppm PGE).

To better understand the role of metasomatism in the formation of high-grade sulfide mineralization in the IVZ, this study investigates the timing of magmatic and metasomatic events in the ultramafic pipes, the Mafic Complex, and the mantle peridotites. Our data show that metasomatism responsible for Ni-Cu-PGE mineralization in the ultramafic pipes occurred around 200 Ma, i.e., more than 50 Ma after the initial emplacement of the pipes. This presentation will discuss new phlogopite and apatite geochronological data to better constrain the timing of the mineralizing event(s) in the ultramafic pipes within the broader context of the geodynamic evolution of the IVZ. Constraining the timing of metasomatism in the IVZ, and its relationship to ore grade variability, will provide new insights into the processes responsible for metal enrichment in the lower continental crust and may help guide mineral exploration in exhumed deep lithospheric terranes.