Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.34220

Metal transfer and potential metal reservoirs in the subcontinental lithospheric mantle: Balmuccia Massif, Ivrea–Verbano Zone

MR. BARTOSZ PIETEREK[1], MAGDALENA MATUSIAK-MAŁEK[2] AND RICCARDO TRIBUZIO[3]

[1]Adam Mickiewicz University in Poznań
[2]University of Wrocław
[3]University of Pavia

Melt migration in the upper mantle induces melt–rock reactions that drive refertilization and sulfide-controlled metal transfer, thereby contributing to mantle heterogeneity. However, the role of sulfides during refertilization remains poorly constrained, limiting our understanding of subcontinental lithospheric mantle metallogeny. The contrast between Cu-rich mantle melts (80–120 ppm) and the relatively Cu-poor upper mantle (~30 ppm) and lower continental crust (~26 ppm) suggests that chalcophile metals are retained in deep-seated magmatic cumulates.

To elucidate the role of sulfide-saturated mantle magmas in metal transfer through the deep continental lithosphere, we investigated exceptionally fresh pyroxenite veins hosted by the Balmuccia peridotite massif [1], an exhumed mantle body exposed at the Earth's surface. Additionally, we analyzed the pyroxenite-gabbro association of the Contact Series [2], which envelops the external sector of the Balmuccia massif and is interpreted as a fossil mantle–crust transition zone. Both the mantle pyroxenite veins and the Contact Series cumulates are markedly enriched in magmatic sulfides and Cu (~230 ppm and ~180 ppm, respectively) compared to the Balmuccia mantle peridotites (Cu ~26 ppm). This trend is mirrored by Ag and S, which are relatively high in mantle pyroxenites and Contact Series rocks but depleted in the mantle peridotites.

Accordingly, the sulfide-enriched mantle pyroxenites and the cumulates of the mantle-crust transition zone are inferred to play an important role in global Cu and Ag budgets. Accurate spatial characterization of chalcophile metal distribution within the lithospheric profile, therefore, has key implications for upper-crustal metallogeny and ore exploration.

[1] Pieterek, B., et al., 2025, Geochimica et Cosmochimica Acta, 395, 248–266.

[2] Pieterek, B., et al., 2024, Communications Earth & Environment, 5, 45.