Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.18771

From a fertile mantle source to epithermal deposits: Tracing the flux of precious metals across the lithosphere

DR. SANTIAGO TASSARA[1], ALAN ROONEY[2], JAY AGUE[2], DIEGO GUIDO[3], MARTIN REICH[4], FERNANDO BARRA[4] AND CÉSAR NAVARRETE[5]

[1]Universidad de O'Higgins
[2]Yale University
[3]Universidad Nacional de La Plata
[4]Universidad de Chile
[5]Universidad Nacional de la Patagonia San Juan Bosco

Presenting Author: santiago.tassara@uoh.cl

Understanding the mechanisms and sources responsible for the concentration of ore-metals in the upper crust is crucial for the refinement of metallogenic models that aid mineral exploration. The formation of Au-Ag crustal regions is intricately connected to processes of highly efficient hydrothermal circulation in the shallow crust. Nevertheless, the degree to which metals and volatiles originate from mantle or crustal sources remains unclear. Here, we explore the source and flux of precious metals in the Deseado Massif Auriferous Province (DMAP) located in southern Patagonia, Argentina. The DMAP is home to over 50 occurrences of Jurassic Au-Ag low sulphidation epithermal deposits (~28.2 Moz in Au equivalent). One distinct advantage of this province to exploring the links between metals and their sources is the presence of peridotite xenoliths, brought to the surface by Neogene volcanism, that offer a window into the underlying subcontinental lithospheric mantle (SCLM). Previous research demonstrated that these xenoliths provide direct evidence that Au-rich metasomatic agents may have been responsible for creating Au-enriched SCLM reservoirs beneath the DMAP [1]. To investigate whether these reservoirs could have served as the metal source for the DMAP, we conducted Os isotope analyses on pyrite grains extracted from the Cerro Vanguardia deposit, the largest known ore system within the DMAP. Our results yield an isochron age of 147.4 ± 2.9 Ma (MSWD = 1.04), consistent with previous Ar-Ar dating, and an initial $^{187}Os/^{188}Os$ ratio (Os_i) of 0.26 [2]. The obtained Os_i value can only be attributed to a considerable contribution from the mantle to the overall metal budget of Cerro Vanguardia. Our findings offer a key geochemical connection between previous evidence for Au enrichment in the SCLM and the formation of an epithermal Au province in the overlying upper crust. This supports the hypothesis that Au-enriched crustal domains ultimately form after ore-fluids released from magmas produced by partial melting of fertile SCLM reservoirs.

[1] Tassara, S., et al. Plume-subduction interaction forms large auriferous provinces. Nature Communications 8, 843 (2017).

[2] Tassara, S., et al. Osmium isotopes fingerprint mantle controls on the genesis of an epithermal gold province. Geology 50, 1291–1295 (2022).