Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37926

Topographic connectivity controls on sediment geochemistry of the mining-impacted Elqui River Basin, Chile

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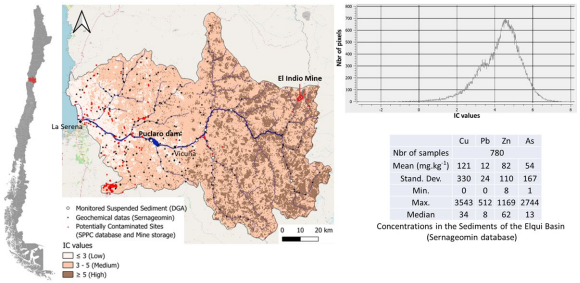

	Cu	Pb	Zn	As
Nbr of samples	780			
Mean (mg.kg^{-1})	121	12	82	54
Stand. Dev.	330	24	110	167
Min.	0	0	8	1
Max.	3543	512	1169	2744
Median	34	8	62	13

Concentrations in the Sediments of the Elqui Basin (Sernageomin database)

In the Anthropocene, the geochemical signatures of fluvial sediments are increasingly reshaped by human-induced shifts in both sediment deposition dynamics and composition. In this study, we investigate how both the topography and human infrastructures (mining, dams and artificial lakes) dictate the geochemical distribution of trace metals in surface sediments of the semi-arid Elqui catchment.

We examined the extent to which catchment-scale Connectivity Index (IC) relates to the spatial variability of sediment geochemistry. While IC represents the potential for sediment transfer based on topography and land cover, the measured geochemical signal, from the Sernageomin public database, reflects physical and chemical processes related to the sediments history i.e., sources, transport, stockage, alteration. We hypothesize a significant spatial coupling between high-connectivity areas and trace metal enrichment, particularly close to upstream mining sites. We further suggest that anthropogenic structures, such as reservoirs, disrupts sediment cascades and decouple the geochemical signal from topographic control.

Studying the relationship between sediment connectivity and geochemical distribution shows that sediment transit and composition in the Elqui Basin are not merely gravity-driven process, but are impacted by human activities. This research highlights the vulnerability of semi-arid watersheds to environmental perturbations and provides a methodological framework that could help environmental managers to characterize environmental sensitivity, particularly in developing mining regions where data are scarce and in geographically isolated areas.