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Urban environmental geochemistry in metal mining districts: street dusts as a screening tool

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Human exposure to toxic metals in urban environments located in mining districts is a source of concern for countries like Chile, where higher backgrounds may be found, and soil quality regulations are absent. This work compares metal concentrations in 185 street dusts samples collected in urban and peri-urban areas in three cities impacted by mining operations in northern Chile, as described in [1] and [2]. The mean concentrations (in mg/kg) of Cu, Pb, and Zn were: Cu:527±600, Pb:47±48 and Zn:220±118 for Chañaral; Cu:690±1,400, Pb:55±58 and Zn:257±329 for Copiapó; and Cu:635±244, Pb<22 and Zn: 146±120 for Andacollo. Arsenic had <15% quantification frequency in each city. While the mean concentrations of Cu, Pb, and Zn had similar values, Copiapó showed higher extreme values, associated to many uncontrolled tailings in the city, which originate from several operations processing minerals from different sources. For Cu, As, Pb and Zn, 100, 7, 5, and 25% of samples, respectively, were above the Canadian guideline of residential/parkland soils, which was used as a reference. Statistical differences in street dusts concentrations ($p<0.01$) were significant for: cooper and zinc between Andacollo/Chañaral and Andacollo/Copiapó (but not Chañaral/Copiapó); and manganese for all city pairs. The concentrations of metals in street dusts are not regulated, but they represent a rapid and simple screening tool for comparison and hotspot detection. Street dusts also offer a cost-effective proxy of the superficial metal pool relevant for human exposure. Improving our knowledge of metal geochemistry and spatial distribution in mining cities is needed for the development of public policies protecting public health in urban environments.

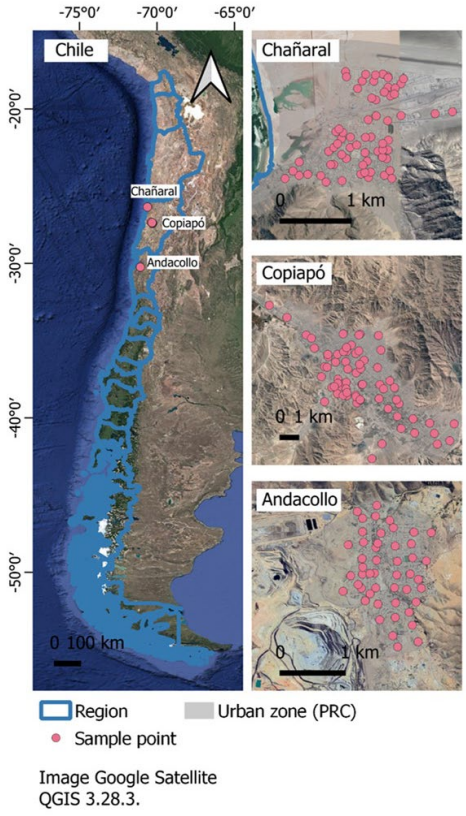

Figure 1: Sampling points in each city.

References

[1] Vega et al. (2022), Applied Geochemistry, 141, 105307.

[2] Carkovic et al. (2016), Environmental Geochemistry and Health, 38(4), 1001-1014.

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