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Parent material and atmospheric deposition as pollution sources of urban soils and their human exposure risk in Minas de Riotinto (Spain)

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Urban soils of towns nearby mining activities are often exposed to deposition of airborne particulate matter derived from the mine workings. Furthermore, the natural soil forming processes of lithological units may influence the enrichment of metal(loid)s in the soil.

We studied the chemical composition, metal(loid) sources, and associated potential health risks of the urban soils of Minas de Riotinto, including natural soils and aggregate fillings (commonly used in passing areas) in public parks and green areas.

Sulfide-associated elements (As, Cu, Zn, and Pb) were found to be enriched in both urban soils of natural origin and in calcareous aggregate based filling materials, that are naturally poor in these elements. Up to 54% of the natural soils exceed the geochemical background values for Pb, 38% for Cu and As, and 31% for Zn, whereas 73% of aggregate soils exceed the geochemical background (of their original parent material) for As, 27% for Cu, 18% for Pb, and 9% for Zn. The contamination factors (CF) >1 are found for Cu, Zn, As, and Pb, with higher values for natural soils in comparison to aggregate soils. The CF >1 of aggregate soils suggests an external source of Cu, As, and Pb, implying that the atmospheric deposition alters the chemical composition of the soils. The natural soils are primarily enriched in these elements due to characteristics of the parent material. The human health risk modelling for As and Pb revealed that the natural soils present carcinogenic and non-carcinogenic toxicity risk. Even though the aggregate materials did not present health risks, the risk calculations considering all the samples, *i.e.* the whole town as an exposure area, the urban soils of Minas de Riotinto pose carcinogenic risk (Parviainen et al., 2022). We recommend covering the natural soils in public parks with aggregate pavements as a solution to reduce the exposure risk of As and Pb to humans.

References

Parviainen, A., Vázquez-Arias, A., Arrebola-Moreno, J.P., Martín-Peinado, F.J., 2022. Human health risks associated with urban soils in mining areas. Environ. Res. 206, 112514. https://doi.org/10.1016/j.envres.2021.112514