Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37364

Magnetic fraction of urban deposit in Krakow - insights from quantitative and qualitative analysis

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The study investigates the magnetic fraction of urban deposit profiles collected at four sites across Kraków, Poland. The city provides a compelling case study for historical pollution research, with a contamination record extending from medieval metalworking, through 19th- and 20-th century industrialization, to intensive 20th-century coal combustion. The four sites were selected to represent a range of land-use histories and anthropogenic pressures, from a historic city centre to a modern suburban area.

The magnetic fraction was extracted from bulk samples at successive depth intervals using magnets. Quantitative depth profiles based on the mass of separated material reveal differences between the sites that reflect their individual pollution histories. Sites with longer and more intensive anthropogenic activity yield higher amounts of magnetic material, while the deepest intervals across all sections contain minimal magnetic content, marking the transition to largely uncontaminated substrate. The characterisation of magnetic particles using SEM-EDS, supported by XRD and Mössbauer spectrometry, provides information on particle morphology, mineralogy, and chemical composition, allowing discrimination between anthropogenic and natural sources. In parallel, ICP-MS analysis of bulk samples yields multi-element geochemical profiles along the sections, documenting the vertical distribution of potentially toxic metals and metalloids and complementing the magnetic fraction data.

By integrating magnetic separation with detailed particle analysis and bulk geochemical data, authors attempted to reconstruct the spatial and temporal variability of metal pollution across different urban settings and to evaluate the combined approach as a tool for long-term contamination assessment with implications for environmental quality and public health.

Acknowledgments

Research funded by the National Science Centre of Poland (Project No. 2023/51/I/ST10/01543)