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Information aggregation to support policy and investment on critical raw materials: automating the upscaling of geochemical signals in mineral deposit valuation

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The supply of critical raw materials (CRM) underpins the global economic transition to renewable energy and digitalisation, contributing to human development. It is essential to identify, classify, and determine the economic value of mineral resources ensuring a sustainable future [1]. With the advent of AI and the development of advanced cloud computing infrastructure such as Amazon Web Services (AWS), challenges connected with the evolution of information and its understanding can be overcome. As part of the Nordic Sustainable Mineral Program for the Nordic Countries [2], this research aims at providing a decision-making platform that supports public policy on natural resources. A methodological approach is proposed that upscales geochemical information from sample to country level and interconnect it with mineral resource data, facilitating economic valuations. The experimental framework considers a PostgreSQL database hosted on AWS infrastructure. The data organisational structure includes inventory tables as well as classification tables that allow ranking and evaluation of mineral resources' potential for some of the Nordic Countries (Finland, Norway, Sweden). Classification results based on *in situ* valuations were constrained to specific groups of elements (CRMs or selected by-products), providing a different angle to conventional estimates of economic potential based on metal equivalents. Automation of upscaling and metal equivalent calculations allowed cross-comparison of CRM budgets in mineral deposits with different styles and commodities. Furthermore, this approach highlights the impact of CRM price fluctuations on the valuation of deposits, affecting metal tonnes or grade equivalent estimates. If the information is complete and of sufficient quality, the methodology could serve as an additional tool to mitigate the risks associated with CRM price volatility.

[1] Valenta, R. K., Kemp, D., Owen, J. R., Corder, G. D., & Lèbre, É (2019), *Journal of Cleaner Production*, 816–826.

[2] Eilu, P., Bjerkgård, T., Franzson, H., Gautneb, H., Häkkinen, T., Jonsson, E., et al. (2021), *Nordic Innovation Report,* 93 pp.