

Characterization and Resource Potential of Anthropogenic Deposits for CRM Recovery in Poland

Anna Januszewska-Kacprzak¹, Andrzej Chmielewski¹

¹Polish Geological Institute - National Research Institute, Warsaw, Poland

Anthropogenic deposits from historical mining and mineral processing are increasingly recognized as potential secondary sources of critical raw materials (CRM). The European Union's Critical Raw Materials Act and growing demand for resource security prompted a nationwide project by the Polish Geological Institute - National Research Institute (PGI-NRI). The initial phase involved reviewing the national HAŁDY geodatabase which contains approximately 1,380 anthropogenic sites. Based on geological, technological, and spatial criteria, around 380 sites were identified as potentially prospective for CRM, with at least 50 deposits selected for detailed investigation. These include heaps from hard coal, Fe-ore, Zn-Pb and polymetallic ores as well as chemical raw materials like phosphorites and phosphogypsum, along with selected barite-fluorite and magnesite sites. The research process comprises drilling, sampling, laboratory work, mineral processing, and geophysical surveys, with resistivity imaging (ERI) and induced polarization (IP) applied initially to characterize deposit structures and optimize sampling. Investigation progresses with boreholes arranged in grids based on the morphology and size of each feature, typically 3-5 boreholes per site. Approximately 150-200 boreholes are expected in total. Due to the heterogeneity of anthropogenic deposits, drilling requires a customized approach using techniques such as percussion, air, rotary drilling with fluids, and augers. Collected samples undergo granulometric, mineralogical, and geochemical analyses. The study particularly targets elements such as Ga and Ge in coal and Zn-Pb-related wastes, as well as REE in phosphorite and phosphogypsum deposits, where total REE concentrations can exceed 3,000–4,000 ppm. The final stage will include analyzing selected materials in mineral processing laboratories to produce experimental concentrates and assess CRM recovery efficiency. Since the project is still underway, detailed results are not yet available. Once completed, the findings will be added to the HAŁDY database maintained by PGI-NRI, providing information on prospective sites and average CRM contents for scientific and applied purposes.