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Resource Potential of Rare Metals in Technogenic Wastes of Almalyk MMC (Uzbekistan)

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The process of copper extraction creating large volumes of technogenic waste. Significant amounts of technogenic wastes have accumulated in the Almalyk mining and industrial area (1.3 billion t). In order to evaluate the possibilities of using them as secondary raw materials, geochemical and mineralogical studies were carried out on slags and ore processing wastes of the Almalyk Copper Concentration Plant of Almalyk MMC. To determine the occurrence forms of gold and other associated elements, X-ray spectral local analyses were performed using a Zeiss evo Ma10 SEM equipped with an Oxford Instruments NanoAnalysis X-ray detector, as well as a JEOL Superprobe JXA-8800R microprobe. The mineral composition of samples was studied based on mineralogical and high-precision analytical methods. High concentrations of non-ferrous and precious metals were identified in copper smelting slags (g/t): Au – 0.17–0.26; Ag – 8.42–10.64; Zn – 4288–10216; Pb – 2014–3360. Heavy metals contents in technogenic wastes was analyzed using XRF Siemens SRS-303 (Germany) and Shimadzu ICP-MS (Japan). According to the analytical results, the average contents of heavy metals (g/t) are as follows: As – 185.79; Sb – 61.37; Se – 1.82; Cd – 0.26; Tl – 2.25; Bi – 3.65; Te – 2.73; Pb – 252.84; Zn – 81.58; Mo – 5.43; U – 4.45; Th – 10.07. Calculated Clark concentration coefficients of heavy metals are high. The significant presence of rare metals such as selenium (Se), cadmium (Cd), thallium (Tl), tellurium (Te) indicates the scientific and industrial importance of the obtained results. The results of various analytical research methods confirm that valuable components occur in mineral form. The high content of metals in technogenic wastes and their occurrence in mineral form increase their value as technogenic deposits. Technogenic wastes can be proposed as a source of copper, gold, silver, molybdenum, iron, lead, zinc, and other metals. The use of mineralogical research results makes it possible to develop technological schemes for the maximum processing and extraction of valuable components from technogenic wastes. Processing technogenic waste expands the mineral resource base of the Republic of Uzbekistan, and waste utilization helps solve environmental problems associated with waste accumulation.