Mineralogy and Cu distribution in historical slags issued from processing of the Zechstein Kupferschifer formation

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Copper ores of the largest economic importance in Poland, belong to the strata-bound type and are related to the Zechstein Kupferschifer formation. In this type of deposit Cu is associated with silicates, carbonates, and sulfides within sedimentary rocks (e.g., shales, sandstones). Currently, the exploitation of Polish Cu ores takes place in underground mines (at the deph of more than 1000 meters below the surface). However, mining and processing of the same strata-bound type deposits, but located tens of kilometers south of today's mines at a depth of several meters below the surface, began in the Middle Ages. As a result of historical mining and smelting of Cu ores important quantities of pyrometallurgical slags, were produced and disposed in the vicinity of the old smelters without any concern for the environment. In this study we present some preliminary results concerning chemical and phase composition of slags issued from historical Cu smelting. We pay special attention to the distribution of Cu and presence of secondary phases formed as a result of weathering of studied slags. Chemical composition of historical smelting wastes is dominated by silica, lime, alumina and iron with minor contribution of potassium and magnesia. Average Cu concentration in slags exceeds 1 wt % and reaches up to 4.5 wt %. Major phases are represented by silicates (e.g., leucite, pyroxene) and silicate glass. Copper is mostly held by droplets of metallic Cu, chalcocite and bornite. Weathering of studied wastes is manifested by presence of secondary brochantite on the slag surface. Additionally, replacements of primary sulfides and metallic Cu by secondary cuprite and Fe oxyhydroxides is common. Our preliminary study indicates that historical slags still contain considerable concentrations of Cu. Furthermore, presence of Cu-rich secondary phases demonstrates that studied wastes are susceptible to weathering and constitute a source of Cu for the environment.