

MINERALOGY OF WELTZ-CLINKER WASTE – WAYS FOR USEFUL COMPONENT EXTRACTION AND ENVIRONMENTAL DECISIONS

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About 250 000 t of waste weltz-clinker have been deposited near the factory for non-ferrous metals in Plovdiv, Bulgaria, for the last 30–35 years. The waste contains 2% Cu, 0.7% Zn, 0.5 g/t Au, 200 g/t Ag and coke. This is a typical technogenic polymetallic deposit of specific mineral composition, as explored by boreholes. Over 30 minerals were identified there: elements (metals and alloys), oxides, silicates, sulfides, carbonates of copper, iron, zinc, lead and noble metals (gold and silver). In the group of sulfide minerals pyrrhotite and non-stoichiometric iron-copper sulfides, chalcopyrite, bornite, chalcocite, covellite, sphalerite, wurtzite and galena are present. Copper (metal), copper oxides and sulfates are considered to be the most essential in this mineral association owing to their solubility in sulfuric acid. A large number of iron oxides formed under changeable redox conditions: magnetite, Zn-ferrite, hematite, wüstite, goethite and lepidocrocite were proved. Iron (α -Fe) is generated by reduction under solid state conditions in close association with iron carbides.

The artificial deposit is determined as very similar to the natural cementation zone, but it is considered that the specific primary composition and physical, mechanical and physico-chemical properties of the clinker have been decisive for the self-organization of the system, which is in a significant contrast with natural processes.

This mineral association underwent natural leaching and the great part of the heavy metals precipitated in the alluvial formation of the Chaja river. However, a part of copper is cemented on α -Fe in the clinker.

The clinker studied is found to be a product containing useful and valuable metals, and, from another point of view, a very hazardous waste for natural equilibrium. On the basis of these results, technological and projective works for processing of this deposit were performed. Economic balance of plant building, production and its effectivities were calculated.

The main practical conclusion is that application of combined schemes, i.e. biogeochemical leaching with cementation or extraction of copper and flotation of coke and sulfides enriched in Au and Ag to extract useful components is possible. In addition to the economic benefit, one more important result of this exploitation could be the environmental effect, as the clinker deposit is situated on the river terrace.

Finally, the methodological steps and results of this investigation together with the technological treatment can be applied successfully to other technogenic objects of similar kind.