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ACID MINE DRAINAGE PRODUCTS RELATED TO ABANDONED SURFACE MINING ACTIVITIES IN THE BĂLAN AREA (EASTERN CARPATHIANS)

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Abstract

In the perimeter of abandoned quarry works of the Bălan area, the acid mine drainage (AMD) develops in relation to the scattered fragments and blocks of sulfide-bearing schists, through alternating processes of oxidation, hydration and neutralization. Solid AMD products have an efflorescence-like appearance, SEM images revealing intergrowths of prismatic (acicular) and tabular mineral grains; mineralogically, they consist mostly of Fe²⁺, Fe³⁺, Mg, Mn, and SO₃-rich hydrous sulfates (e.g. alunogen, pickeringite, apjohnite, halotrichite, chalcantite, brochantite) and are highly soluble in water, leading to acidic solutions (pH lower than 4.0). Moreover, XRD analyses indicate the presence of some hydrated oxides (goethite, lepidocrocite) and carbonates (malachite, azurite), as well as a clay fraction, consisting of illite. This complex mineralogy leads to the conclusion of a three-steps genetic process developing in the perimeter and generating specific minerals, as follows: (a) primary minerals (endogenous silicates and sulfides from the schists); (b) secondary minerals (hydrated oxides and carbonates, developed through the *in situ* oxidation of the upper part of the ore deposit); (c) tertiary minerals (hydrous sulfates developed as a result of weathering affecting sulfide-bearing fragments of rocks brought to the surface by quarrying activities). The chemistry of waters from the Minei creek, which flows at the bottom of the quarry, indicates that the open pit produces acidic and heavy metal-rich (Pb, Cd, Fe, Cu, Zn, and Mn) leachates; the acidity of leachates plays an important role in increasing the solubility of solid materials, as well as in the mobility of heavy metals.

Key words: acidic leachate, AMD product, heavy metal, hydrous sulfate, SEM-EDS, X-ray

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