



Geochemical characteristics and water pollution by Potentially Toxic Elements at the Varatec creek, Baiut mining area, Romania.

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This study provides an identification and evaluation of the Potentially Toxic Element (PTE) (Co, Cu, Cd, Pb, Zn, and Ni) sources, speciation, mobility, distribution patterns, enrichment, and relationships along the Varatic Creek and its tributaries in the Baiut Mining Area, Romania. ICP-OES trace element concentrations were measured in collected samples. The geochemical characterization of the Varatec Creek revealed that the water contains high dissolved metals, high sulfate concentrations, and low pH values, dominated by Ca⁺² and SO₄²⁻ cation and anion in streamwater.

The calculated median concentrations were much higher than the average surface water concentrations in Europe (FOREGS) and decreased in the order of Zn(126.2µg.l⁻¹)>>Cu(3.4µg.l⁻¹)>Ni(1.6µg.l⁻¹)=Cd(1.6µg.l⁻¹)>Co(0.5µg.l⁻¹)>Pb(0.3µg.l⁻¹). The relative variability (MAD/median) follow the order Cd(90%)>Co(80%)=Zn(80%)>Cu(60%)=Ni(60%)>Pb(50%). The regional enrichment factor calculated as the Median/FOREGS_(European level) follow the order Cd(156)>>Zn(47)>>Cu(3.8)>Pb(3)=Co(3)>Ni(0.9).

Element distribution, geochemical behavior and source, aqueous speciation modeling, and correlation analysis were performed to estimate the metal sorption to Fe-oxyhydroxide, Mn-oxyhydroxide, and sulfates. Detailed data analysis, reaction modelling and geochemical interpretation revealed two distinct groups of PTEs in the studied mining-impacted streamwater: Ni and Co seem to be associated with the geochemical background, while Cd, Pb, Zn, and Cu are originating from mining activities.