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SOIL GEOCHEMICAL SURVEY IN PANASQUEIRA MINE SURROUNDINGS (CENTRAL PORTUGAL): MINING, METAL(LOID)S AND RELATED ENVIRONMENTAL IMPACT

CANDEIAS, C.¹, **SALGUEIRO, A.R.**¹, FERREIRA DA SILVA, E.¹, ÁVILA, P.F.², and MELO, R.¹, (1) Aveiro University, GeoBioTec, Departamento de Geociências, Campus de Santiago, Aveiro, 3810-193, Portugal, rita.salgueiro@ua.pt, (2) LNEG – National Laboratory of Energy and Geology, S. Mamede de Infesta Lab, Rua da Amieira, Apartado 1089, S. Mamede de Infesta, 4466-901, Portugal

Mining activity is one of the industrial activities that produce more residues, most of them left in piles and/or tailing dams. Mine wastes containing high sulphide concentrations produce acid mine drainage, that will leach contaminants, resulting in pollution of soils. Soils can be easily contaminated by meta(loid)s due to their direct contact with the chemical processes of metal liberation and mobilization that result from mining operations. These consequences are very problematic when the mining and ore treatment operations are performed in the vicinity of villages.

The economic exploitation of Panasqueira Sn–W mine has been focused on wolframite, cassiterite, chalcopyrite, several sulphides, carbonates and silver sulphosalts. The beneficiation processes have given rise, during a long production period, to a large amount of sulphide-rich waste, contained in tailing ponds.

A soil sampling campaign was conducted in the surrounding area of the mine aiming to assess the contamination extent. A study area of ~32km² was defined and a total of 238 samples (400x400m grid) were collected at two depths: superficial samples (A type) and 15 cm depth samples (B type).

ICP-MS analysis reveal that As presents very high concentrations in both depths, being more expressive superficially. Type A soils show also very high W concentrations and considerable contamination in Cu. According to the portuguese soil quality guidelines (PSGQ) the results indicate that a high percentage of samples (94 % for A type and 93% for B type soils), exceed the PSGQ proposed value for As (22.0 mg kg⁻¹).

A Principal Component Analysis was performed to identify the local geology elements and those associated with anthropogenic activities (W, Cd, Ag, As, Bi, Cu). This last association reveal elements strongly correlated between them, with strong positive skewness (Sk>3.0). Correlation coefficient showed $r \geq 0.7$ ($p < 0.01$) among several of the anthropogenic elements.

The Contamination factor and the modified Contamination factor (mCf) were also computed. According to mCf, A type soils were classified with an high degree of contamination while B type soils were classified with a moderate degree of contamination. Spatially the samples which exceed PSQG, as well as mCf are related to the most affected areas, specifically the Panasqueira main tailings.

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