Assessment of Panasqueira mine surrounding soils through a contamination factor

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Mining despite being vital for national economy has associated problems not only by short term damage but also by long term impacts that might affect soils, sediments and waters.

Panasqueira mine, labouring since 1888, has a Sn-W deposit reported as the largest quartz vein in Europe. The economic exploitation has been focused on wolframite, cassiterite and chalcopyrite. Between 1947 and 2004, over 96,000t of WO3 was produced from more than 27Mt of rock. The milling processes results on a huge volume of wastes deposited in tailings – Rio (~1,200,000m^3), Barroca Grande (~7,000,000m^3), Vale da Ermida (100,000m^3) and Panasqueira (1,000,000m^3) – and three mud dams – Rio (~731,034m^3) and Barroca Grande (two dams ~1,193,885m^3). The exposure of those materials to atmospheric conditions for long periods of time resulted in their weathering. As disclosed in previous studies the percolation of rain waters through the tailings materials forms acid mine drainage which contaminates local streams sediments and waters, in the vicinity of Zêzere River, and soils.

For this study soils samples were collected, according to a previous defined mesh spaced ~500m, in two depths. One hundred and twenty two samples of superficial soil (A) were collected and from a depth of 15-20cm (B) 116 samples were also collected. Type A samples aiming the characterization of superficial contamination coming from the tailings and type B samples making possible the geogenic cartography.

Statistical data analysis showed that As have 2x higher median concentrations in both depths samples than proposed values by several authors, including the one that established values for Portuguese soils.

PCA was applied in order to identified the cluster of elements with antropogenic origin, permiting to evaluate the enrichment of the study area on those specific permicious elements.

Enrichment Index (EI) calculated with As, Cd, Cr, Cu, Pb, Ni, V, Sb and Zn concentrations, reveal in both depths a high degree of trace metal contamination around Rio and Barroca Grande tailings. Values in superficial soils are in general higher, beeing the values

over 3.0 on the vicinity of Rio tailings. EI over 1.0 indicates, on average, metal concentrations above the permissible level.

Contamination factor (Cf) was also calculated for these soils. Arsenic values are very high in both depths, while superficial soils present very high values of W and considerable contamination in Cu and P. Regarding type B soils a considerable contamination was in P, Pb and W was reveald.

The Modified Degree of Contamination (mCd) was calculated based on enriched values for Portuguese soils. According the (mCd), type A soils were classified with an high degree of contamination while type B soils were classified as moderate contaminated.

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