Heavy metal pollution in Mine-Soil-Plant System in S.Francisco de Assis - Panasqueira mine (Portugal)

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The active Panasqueira mine is a Sn-W mineralization hosted by metasediments with quartz veins rich in ferberite. The economic exploitation has been focused on wolframite, cassiterite and chalcopyrite. The mineralization also comprises several sulphides, carbonates and silver sulphosalts. The mining and beneficiation processes produces arsenic-rich mine wastes laid up in two huge tailings and open impoundments, one deactivated and the other (Barroca Grande tailing) still active. the rejected materials from the ore processing, containing high concentrations of metals, stored in the open-air impoundments are responsible for the continuous generation of acid drainage. Average contents (mg kg^{-1}) in Barroca Grande impoundment of As=44252, Cd=491, Cu=4029 and Zn=3738 and in Rio impoundment As=73649, Cd=1227, Cu=2497 and Zn=6843 were determinate. DRX analysis reveals the existence of arsenopyrite, ferberite and natrojarosite in the course materials and scorodite, arsenopyrite, sphalerite pyrite, chalcopyrite, ferberite and hematite are still present in the fine grained materials existing in those opens impoundments. The unconfined tailings and open impoundments are the main source of pollution in the surrounding area once the oxidation of sulphides can result in the mobilization and migration of trace metals from the mining wastes into the environment, releasing contaminants into the ecosystem.

In order to investigate the environmental contamination impact on agricultural and residential soils of the nearest village, S. Francisco de Assis, due to the mining activities, a soil geochemical survey was undertaken. Seventeen rhizosphere soil samples were collected and their median reveal higher contents (mg kg^{-1}) of As=224, Cd=1.3, Cu=164, Pb=59, Zn=323 then the national median concentrations proposed by Ferreira (2004) As=11, Cd=0.1, Cu=16, Pb=21, Zn=54.5. All of these contents lying above the reference values proposed by some authors for agricultural soils. Considering that the local population strongly depends on the use of land and water for their subsistence, it is useful to compare these contents with the reference values proposed by the Ontario Guidelines. According these values, these soils

exceed, for example, for As twenty times the reference value for agricultural soils (11 mg kg^{-1}).

Heavy metals soil contamination is an outstanding example of environmental risk. Metals (and metalloids) such as As, Cd or Pb, for example, are the most toxic for humans, as well as for animals and can even lead to death if ingested in large doses, or over large periods of time. Exposure to hazardous elements may have different pathways, being one of them the ingestion of vegetables grown on contaminated soils. Some potatoes and cabbage have also been collected. Preliminary results showed that for potatoes there is a preferential accumulation in the leaves and stems (maximum As content in leaves was 12.5 mg kg^{-1}) while for the cabbage most elements have a preferential accumulation in the roots (maximum As content in roots was 52.3 mg kg^{-1}). This research requires further studies to establish the metals transfer process from soil to the different parts of the plants and to understand their bioavailability.

References

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