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Introduction: Hardrock mining activities are long-term industrial activities that take place in the natural environment potentially disturbing large amounts of material and land areas. Closure of a mining operation often implies a continuous leaking of risky trace metals into the surrounding environment [1].

The present research aim is to determine the concentration of pollutants in different media as a way to assess the impact of potential sources of contamination. The chemical analysis of their concentrations in different environmental compartments (i.e., soil, air, vegetation) may be an interesting indirect methodology for human health and environmental risk assessment. Thus, the migration of such pollutants should be monitored in order to avoid a long-term chronic impact of soil, surface and ground water qualities.

Experimental: Ten effluorescence samples were collected along the main gallery of the abandoned mine. Once their physico-chemical characterization was carried out, more exhaustive analytical techniques were used: ICP-MS to know the soil composition and Raman for determining its molecular characteristics.

Mobility tests were also performed in order to have a notion of the movable and, consequently, bioavailable fraction. These solutions were measured by ICP-MS and Ion-Chromatography.

Results and discussion:

The mobility test applied showed how easily some ions were able to dissolve in huge amounts. Not only the most common anions present in soils were obtained (i.e. phosphates, sulphates) but also environmentally risky heavy metals (Zn, Pb, Cu, As, Hg, etc.).

The present study tried to understand the behaviour that the mine-soil polluting components may have under natural weathering conditions. To achieve this, the molecular structures present in the effluorescences were identified by Raman spectroscopy. Besides, the minerals found were classified into primary (geologically natural minerals) and secondary (non-stable phases derived from the weathering of the primary ones)[2].

The primary mineral list observed included galena (PbS), sphalerite (ZnS), calcite (CaCO₃), etc. while the secondary mineral list incorporated calomel (HgCl₂), olivenite (Cu₂AsO₄(OH)), getchellite (SbAsS₃), tincrite (Fe₅(PO₄)₃(OH))₄·7H₂O, otavite (CdCO₃), wolfeite (Fe₂(PO₄)(OH)), claudetite (As₂O₅) etc.

Conclusions:

The concern resulting from the potential exposure to contaminants was the starting point to develop new methodologies in order to evaluate the consequences that those might have over both the environment and human health. Among these methods, risk assessment has been one of the most widely used [1,3]. As it has been shown, environmental monitoring is basic in order to carry out a correct evaluation of the exposure.

The knowledge of the ions’ solubilities mixed with the several mineral phases found per metal (i.e. oxide, sulphide, phosphate, etc.), provide a better understanding of the leaching processes for each metal that may have taken or will take place. Furthermore, considering that the studied area is mainly karstic, such processes become crucial in the groundwater protection. Therefore, such research can be included as a first step within the set of tools for risk assessment that governmental policy makers should consider.

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References:

