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Study of heavy metals transport by runoff and sediments from an abandoned mine: Alagoa, Portugal

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Over time, several studies have been designed to understand heavy metals fate and its impact on the environment and on human health. However, only a few studies have focused on the transport of heavy metals in mining areas through the various hydrological processes such as runoff, infiltration, and subsurface flow. In particular, heavy rainfall events have a great impact on the dispersion of metals existing in the soil. This problem is often more serious in abandoned and inactive mining sites causing environmental problems.

In Portugal, there are 175 identified abandoned mines that continuously threaten the environment through acid drainage waters that pollute the soil as well as surface and groundwater. An example is the abandoned mine of Alagoa, located near the village of Penacova (Centre of Portugal); in this site mining activities ceased about 30 years ago. The area is characterized by very steep slopes that are confining with a small stream; the mining excavation by-products were deposited on these slopes. We have selected this mine as a case study, aiming at understanding the transport mechanisms and dispersion of heavy metals and at contributing to the definition of the most appropriate mitigation measures for this area that is contaminated by heavy metals from the mine tailings. So far a total of 30 soil samples from 3 contaminated zones were collected and analysed for pH, texture and heavy metal content, using atomic absorption spectroscopy. Results indicate that the contents of Zn and Pb in the soil samples are in the range from 95-460 mg/kg and 67-239 mg/kg, respectively, which exceed the critical limit-values defined by the Portuguese legislation. These metals are dispersed downslope and downstream from the mine tailings by storm water. The next step of this work is to investigate the transport of heavy metals by runoff, by mobilization of sediments and by subsurface flow. Three spatial scales tests will be conducted: on the mine tailings, on the slope areas, and in the laboratory, using soil flumes, which include the use of rainfall simulators. This study will allow the evaluation of several variables and processes, described above, under controlled conditions.