



Geoenvironmental characterisation of mine tailings: pond and watercourse sediments from the Cartagena-La Unión district (Spain)

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This study presents the results of the geoenvironmental characterization of Descargador watercourse, affected by mine tailings in the Cartagena-La Unión district, Murcia (SE Spain). The main objective of the study was to characterize the present conditions of abandoned mine tailings and watercourse in order to identify environmental hazards. The goal is particularly relevant because the abandoned mine wastes remain a continual source of AMD and metal contamination. Soils and watercourse in this area are still highly polluted.

Electrical resistivity tomography (ERT) has provided information about both the thickness and geometry of the mine tailings. Using a Wenner-Schlumberger array to combine a good resolution and investigation depth, 2 ERT profiles have been carried out (1 longitudinal to the mine pond and 1 transverse to the watercourse). The Paleozoic metasediments that constitute the base of the deposits, present high (>200 ohm•m) resistivity values whereas the infilling of both the mine pond and the watercourse are characterized by low (<20 ohm•m) values. Regarding the thickness of the deposits, in both cases it ranges from 5-7 m. To obtain more detailed information about the internal structure of the deposits, 4 GPR profiles (3 in the mine pond and 1 transverse to the watercourse) using both 100 Mhz and 200 Mhz frequency antennae were carried out. The GPR provide similar values for the thickness of the deposits than the ERT. Moreover, at least two different units can be imaged for both the deposits of the mine pond and the watercourse, suggesting the occurrence of differences in the textural properties inside the deposits that produce a different response to the electromagnetic waves. The watercourse structure obtained by the borehole has confirmed the accuracy of the results obtained from ERT and GPR profiles. The borehole sampling showed thicknesses of 2 m of mine tailings, 1.5 m of tailings mixed with watercourse sediments, and 4 m of watercourse sediments. Fe-carbonates, and secondary Fe-sulphates and Fe-oxi-hidroxides have been determined at the mine tailings upper level. Significant amounts (5-10%) of pyrite, sphalerite, and galena, and anglesite (5%) were determined in both mine tailings and watercourse sediments. Remarkable amounts (5%) of pyrite, sphalerite, galena, and anglesite have also been determined in the underlying watercourse sediments. Consequently, significant toxic metal and metalloid contents (As, Cd, Cu, Pb, Sb and Zn) have been determined, and could potentially release substantial amounts of trace elements to the surrounding environment. And finally, to the Las Manga coastal area, a major tourism location in SE Spain. The manifest environmental hazards related to the mine tailings make necessary works on remediation and monitoring to minimize environmental impact on the areas affected, in one of the most touristic areas in SE Spain.

Joint application of geophysical and geochemical techniques has revealed itself as very useful for obtaining a complete characterization of abandoned mine deposits, previously to a future reclamation of these dangerous tailings.