Association of heavy metals and radionuclides to wastes from non-operating metallic mining sites in Extremadura (Spain)

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During the 2nd half of the 19th century and the first decades of the 20th century, there was a huge boom of mining sites in Extremadura (located at the western part of Spain) devoted to the extraction of heavy metals, such as Cu, Ni, Zn, Pb, Ag, Fe, Sn, and W, among others. However, due to various reasons theses activities ceased, and there are many abandoned metallic mining sites, many of them in ruins, with waste dumps left on site. Three former mining sites were selected, in which Pb-V-Zn-Ag, Pb-Ag, and Pb-Zn were exploited. The assessment of their environmental radiological impact was carried out in a previous work. In this study, samples from unaltered soil and waste dumps were considered in order to assess whether there is any difference in the association of Ag, Al, Ba, Ca, Cs, Fe, K, Mg, Mn, Na, Pb, Sr, Th, U, V, Zn. This assessment was carried out by the application of a sequential extraction procedure based on Tessier method, which gives information about: water soluble, exchangeable, carbonate, easily reducible, moderately reducible, organic-sulphidric, acid and residual fractions. Due to the low level of activity concentration in bulk samples, these elements were determined by ICP-MS. Comparing the results from unaltered soil and waste dumps, it can be observed that U association to water soluble and exchangeable fractions was about 10 % for both sample types, although differences in less mobile fractions can be observed.

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