

Fractionation and mobility of thallium in areas impacted by mining-metallurgical activities.

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Residues generated from mining and metallurgical activities may contain thallium (Tl), a highly toxic post-transitional metal, in concentrations that are much lower than those of other trace elements. The geochemical speciation of Tl is currently not possible in these residues through X-ray Absorption Spectroscopy if arsenic concentrations are high, which occurs in most cases. Therefore, fractionation studies are required to analyze the mobility and bioavailability of this metal in soils, and to infer its speciation. In this work a modification of the BCR procedure was applied to residues and contaminated soils from three mining zones of North and Central Mexico and two mining zones of Spain, the results of which were used to infer the Tl speciation. The extracted concentrations were determined by Inductively-Coupled Plasma with Mass Spectrometry (ICP-MS).

The Tl sequential extraction procedure consisted of (1) water-extractable, (2) easily exchangeable and associated to carbonates, associated to (3) microcrystalline ("amorphous"), (4) crystalline Fe and Mn oxyhydroxides, and (5) associated to organic matter and sulfides; and finally a residual fraction as associated to primary and other secondary minerals.

Surprisingly, water-soluble, presumably in Tl(I) oxidation state was detected in most areas. Most of the soils and residues from a metallurgy area showed high levels of Tl in non-residual phases and a strong correlation was obtained between extracted Mn and Tl in the 3rd step, suggesting its association to manganese oxides, and an oxidation state of Tl (III). In most other samples from purely mining environments, most of the Tl was found concentrated in the residual phase, most probably bound to alumino-silicate minerals.