# Mobilization of particulate, colloidal and dissolved Pb and Fe in contaminated soils – effect of metal speciation and soil type

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Lead (Pb) is a common soil contaminant, which may originate from shooting ranges, glass works, metallurgic industries and oil residuals. We aimed to investigate the role of particulate and colloidal mobilization of Pb and iron (Fe) in four contaminated soils with different soil texture and organic carbon (OC) content.

Using an irrigation chamber, unsaturated flow conditions were created in intact soil columns. Metals and OC in leachates were separated in particulate (> 0.45 µm), colloidal (< 0.45 µm to > 10 kDa) and dissolved (< 10 kDa) fractions. The soils were categorized as coarse textured: (1) sandy loam with 5 % OC, (2) sand with 1 % OC; or as fine textured: (3) sandy loam with 11 % clay and 4 % OC and (4) silt loam with 2 % OC. The clay content in soil (1), (2) and (4) was 3 - 5 %.

Extended X-ray Absorption Fine Structure (EXAFS) spectroscopy was used to study the speciation of Fe in the solid soil, particles and colloidal fractions. The speciation of solid soil phase Pb was studied in soil (3) and (4).

Our results showed that a substantial fraction of Pb (60 - 98 %) and Fe (89 - 98 %) was mobilized by particles and colloids in the coarse textured soils. Thus, it is of vital importance to consider the possibility of particulate and colloidal mobilization of Pb when assessing the risk for leaching of Pb to ground and surface waters.

In soil (3) and (4), Pb was bound to organic matter (OM) according to EXAFS. Fe in the soil and in the particles consisted of ferrihydrite in association with OM in all four soils. The colloidal Fe mobilized from the fine textured soils consisted mainly of monomeric Fe complexed by OM, whereas ferrihydrite in association with OM predominated in the colloids leached from the coarse textured soils. This suggests that Fe can act both as sorbent (ferrihydrite) facilitating the transport of Pb and/or as a cation competing with Pb for binding sites on colloidal and particulate OM.