



Mineral transformations and Zn, Pb, As, Cd mobility in soils developed on Zn non-sulfide mining wastes near Olkusz, S Poland

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To estimate the degree of threat posed by heavy metals and other environmentally harmful elements it is necessary to determine forms in which these elements occur and their stability in the weathering environment. The aim of this work was to (1) describe mineral transformations occurring in soils developed on Zn non-sulfide mining wastes near Olkusz (S Poland), (2) identify forms of occurrence of Zn, Pb, As, Cd; and (3) predict potential mobility of these elements. Studied samples come from soil profiles developed on four dumps after mining of non-sulfide Zn ores from the end of the XIX century until 1985. Two types of approaches were used: mineralogical methods (optical and electron microscopy with in situ elemental analysis, X-ray diffraction) and geochemical methods (selective sequential extraction and bulk elemental analysis).

Zn in studied samples is present in smithsonite or hemimorphite, Zn aluminosilicates (smectite and kaolinite groups) and absorbed on Fe-oxide. The largest amounts of Pb is encountered in Mn-oxides and less in cerussite, Fe-oxides and dolomite. As dominates as the ions absorbed on goethite and Cd as an impurity in carbonates, silicates and Zn-aluminosilicates, and in the form of exchangeable ions. Most important mineral transformations due to weathering observed in the samples are dissolution of dolomite, goethite, smithsonite, hemimorphite and precipitation of Zn-aluminosilicates, Mn-oxides and secondary Fe-oxides. The study has shown that Cd occurring in the form of exchangeable ions, potentially available to living organisms, pose the greatest threat to the environment. Cd is the most mobile in surface horizons of the soils developed on the oxidized ores dumps. Zn and Pb can be released from their forms in the event of a change of pH of the environment to a more acidic and As in case of changing conditions to more reductive.