ASSESSMENT OF VERTICAL CONTAMINATION OF CD, PB AND ZN IN SOILS AROUND A FORMER ORE SMELTER IN WALLONIA, BELGIUM

Amandine Liénard, G. Colinet

University of Liège, Gembloux Agro-Bio Tech, Department of BIOSystem Engineering, Soil-Water-Plant Exchanges, Gembloux, Belgium

Amandine.Lienard@ulg.ac.be

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Introduction

Examples of sites contaminated by atmospheric fallouts are numerous across former industrial areas, among which the valleys of Sambre and Meuse in Wallonia hosted metal ore treatment factories. We have studied the fate of Cd, Pb and Zn in soils affected by atmospheric deposition in the vicinity of old smelters. The importance of vertical redistribution of contaminants in soils is questioned and the aims of this paper are to i) characterize the vertical distribution of TEs and soil properties along diverse soil profiles, ii) evaluate enrichment or impoverishment of TEs along the profiles to discriminate anthropogenic or geogenic origin of contaminations and iii) evaluate whether soil type or land use influenced the mobility of contaminants in the selected profiles.

Methods

Concentrations of trace elements (Cd, Co, Cr, Cu, Ni, Pb, and Zn) and major elements (Ca, Mg, K, Fe, Al, and Mn) as well as pH_{KCl} and TOC were measured on 22 profiles located in a 3 km radius of a former ore treatment plant in Wallonia (Belgium). Enrichment factor (EF), vertical impoverishment factor (VIF), and availability ratio (AR) were used as diagnostic tools of contamination and migration of Cd, Pb, and Zn in profiles.

Results

Data revealed that soil profiles are significantly contaminated. The ranges of enrichment factors for Cd (17-3570), Pb (1-2883), and Zn (2-309) are very broad with the higher EF in the topsoil of profile. VIFs of subhorizons are rarely above 1. In a few remaining cases with VIF > 1, the main factor explaining is soil type (especially, Colluvic Regosols, Luvisols, and, Cambisols with shale load). Cd, Pb and Zn ARs are strongly correlated with TOC and to a lesser extent with pH_{KCl}. Pb and Zn ARs are influenced by soil type and land use only plays on Zn AR. The Cd availability is independent by these two factors.

Conclusion

The contents of trace elements measured in soil profiles are very high especially in topsoil. Until now, the Cd, Pb, and Zn vertical distribution shows a low migration from topsoil up to depth. However, we must not minimize the hazard of a future potential transfer.