



Heavy metal content in forest soils of the nature conservation area of the Bükk Mountains (NE Hungary)

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The cycle of elements in soils is closely related to geological processes as metals and other elements get into the soil as a result of the weathering of the basic rock. In this regard the various minerals found in the basic rock are geochemical sources of metals and other elements to the soil. However, the accumulation of heavy metal in soils can also originate from anthropogenic sources.

The aim of our research was the investigation of soils under a natural forests in the Bükk Mountains in North-East Hungary in order to determine the effects of base rock weathering and to track possible heavy metal pollution effects by the detailed analysis of 10 representative soil profiles from the territory.

Elemental analysis of the soil samples was carried out by ICP-OES method including 13 elements (Al, Ca, Fe, K, Mg, Mn, Na, Co, Cr, Cu, Ni, Pb, Zn). Soil minerals were investigated by the application of X-ray powder diffraction. As the majority of the samples was rich in humic substances, sample preparation prior to the analysis of „total” heavy metal content involved the digestion of the samples with $\text{HNO}_3 + \text{H}_2\text{O}_2$. Evaluation of the results was done using the applying Hungarian regulations on the total dissoluble heavy metal contents of soils obtained after aqua regia digestion of the samples (which involves soluble-, surface-bound- and weathered metal contents). According to the mineralogical investigations, major soil minerals in the samples were quartz, clay minerals, feldspars, goethite, chlorite, calcite and dolomite. Pollution limit was only exceeded in 3 profiles for Ni (48.2 - 110.8 mg/kg) and in 2 profiles for Zn (237.3 - 383.2 mg/kg). In the case of Co, Cr, Cu and Pb pollution limits were not reached, but certain samples contained some of these metals in somewhat higher concentrations (e.g. Co: 22.30 mg/kg; 24.72 mg/kg; Cu: 60.52 mg/kg; 69.55 mg/kg). According to the results of the elemental analyses Al, Ca and Fe accumulated mostly in investigated soil profiles, whereas Mn, Mg, K and Na accumulated to a lesser extent: these metals could possibly be found bound to the soil minerals (clay minerals, feldspars, chlorites, goethite, calcite, dolomite) and are released during the weathering processes. Strong significant positive correlations were indicated between the concentrations of Co, Fe, Mn, Cu, Ni and Zn which proved the co-occurrence and possible common source of these metals.

Because of the location and the land use of the investigated territory no significant contribution of the traffic or agriculture to heavy metal pollution was supposed. These assumptions were verified by measured data. According to the results it was concluded that the origin of the heavy metals found in the investigated samples is predominantly natural (from soil forming materials) even in the case of the samples with lightly higher Ni and Zn contents.

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