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Evidences of increase of heavy metals concentration due to atmospheric deposition in natural soils (Cantabrian Mountain Range, N Spain)

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The heavy metal backgrounds in natural soils (i.e. natural geochemical concentrations) came mainly from the geological substrata. One effect of chemical weathering processes in the rock is the release of trace elements from the crystallographic networks of minerals to soil parent material. Nevertheless, many times the natural soils show rates of trace elements concentration differing from those expected when only the bedrock mineralogical composition is considered.

In order to assess the existence of heavy metals diffuse pollution caused by atmospheric deposition in non disturbed areas the concentration of 16 trace elements (Mn, Zn, Cr, Pb, Tl, V, Co, Ni, Cu, Ba, As, Mo, Ag, Cd, Sb, Hg) were measured in 117 soil samples spread over a mountainous area of 10000 km2 located in the N of Spain (Cantabrian Range, Asturias)

With the aim to obtain non polluted soil samples pristine (i.e with no or minimum human disturbance) hillslopes with homogeneous lithology were selected at the longer distance possible from the main pollution focuses (cities, industrial areas, mines, etc) and identified geochemical anomalies.

For each place selected, the sampling was designed taking pairs of hillsides, one exposed to dominant rain and wind fronts which cross over the pollution focuses, and the other one opposite to the former and protected of them. In addition for each hillside two soil samples were taken at the upper part and another at the lower part with the aim of identify, if any, the pattern of trace elements distribution in slopes caused by

runoff and creep mobilization.

When considering the whole data pool coming from the samples, higher values for many elements were found at the exposed slopes revealing some kind of diffuse deposition of such elements. Even these differences become statistically significant for Mn, Co, Ni, Cu, Ba, Mo if only samples closer than 40 km to the main pollution focus were considered for the analysis. In addition correlations with the distance to the pollution focus were calculated and the results further support the idea of atmospheric deposition of such elements at exposed slopes of non disturbed areas.

In the other hand also mobilization along the slopes was noticed for some elements being higher the concentrations at the lower parts. These differences were statistically significant for Co and Ni in the areas closer than 40 km to the main pollution focus and for Tl, Ba and As in areas at longer distance, although this results could be related to differences in pH lithology (e.g acid substrates are common at the furthest areas while basic ones predominate near the main industrial area)

The main conclusions of this study are that in despite of many areas are considered as pristine and being protected by different laws, atmospheric deposition of trace elements could be of importance where singular climatic and topographic circumstances can occur. In the other hand the determination of natural geochemical backgrounds for some trace elements should be able to identify such process in order to no overestimate those levels, which are commonly used in developing environmental management strategies and legislation related to these concentrations thresholds.