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Baseline levels of potentially toxic elements in soils: a case study in Puren, La Araucania, Chile

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The distribution patterns of element concentration are primarily influenced by the lithology of parent material, and secondly by the soil forming processes that modify the basic geochemical composition and redistribute the content of metals within the soil profile. To evaluate the heavy metal contamination in soils it is necessary to survey heavy metal background levels in order to understand their migration and distribution during pedogenesis. Four soil profiles of the forest area of Puren (IX region, Chile) have been investigated and the variability in the natural background of four metals (i.e. As, Cu, Mn and Zn) has been examined. Sampling sites with minimal anthropogenic influence were selected. Soil samples were collected from every horizon in each profile and samples were digested in Teflon vessels with concentrated HF and HNO_3 acid solutions for the determination of total heavy metal concentrations. The Zn content was determined by flame atomic absorption spectrometry (FAAS). The Cu and Mn contents were determined by electrothermal atomization atomic absorption spectrometry (ETAAS). The As content was measured by atomic fluorescence spectrometry using an automated continuous flow hydride generation spectrometer (PSA for As). The range of total soil values in $mgkg^{-1}$ is as follows: As 0.51 and 2.66; Cu: 4.00 and 32.10; Mn 373 and 1563; Zn 73.2 and 193.2 mg•kg-1, respectively. Soils had acid pH (5.2$\pm$0.5), organic matter contents ranging from 3.1 to 7.2 at surface, and decreases with depth (range 0.1-0.3). Cation exchange capacity (CEC) is generally high (average 38.4 cmol(+)•kg-1) at surface and decreases with depth (range 24.3-6.7). In this study, no association between heavy metals and organic carbon content was found. However, Cu and Mn was strongly positive correlated with CEC. Transformation and translocation of soil constituents as the clay illuviaton represent the soil forming processes that have greater relevance in the distribution of heavy metals in the soil profile.