Soils geochemical surveys as an indicator of the quality of urban environment

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Being natural basis of urban ecosystem soils mirror historical development of a city area. Accumulating in soil, potentially toxic elements (PTE) worsened its qualitative characteristics and may become a risk factor. The situation is more severe in post-Soviet Union (SU) countries such as Armenia. Here after SU collapse significant socio-economic transformations (SET) and chaotic urban development took place. Thus, the goal of this study is to investigate how SET and poor urban management reflected on soils PTE spatial distribution and the pollution levels using the data of Yerevan soils geochemical surveys of 1989, 2002 and 2012. Surveys were done by the same method of sampling and pretreatment. In order to carry out scientifically and methodologically grounded collation of data, 174 soil samples representing the same sampling grid of three surveys were selected from 1989 and 2002 samples archives. The contents of Ti, Ba, Mn, Co, V, Pb, Zn, Cu, Ni, Cr and Mo determined by XRF (Innov-X-5000 (USA)) according to US EPA Method 6200 as in 2012.

The results showed that higher Coefficient of variation observed for Cu, Mo, Pb and Zn and these PTE grouped together in cluster analysis of 1989, 2002 and 2012 surveys. Comparison of Cu, Mo, Pb and Zn results of 1989 with 2002; 2002 with 2012 using Wilcoxon Signed Ranks Test showed significant changes of Mo and Zn contents between 1989 and 2002. Mo increased due to the production of metal Mo and ferromolybdenum since 1995. Zn contents decreased as after SU collapse known sources of Zn (the Aluminum plant, Electric bulb plant etc.) were closed. Although contents of Cu and Pb decreased in transit medium, being a rather immobile in soils their contents did not changed due to the absence of decisions and measures to remediate known polluted sites. The Enrichment factor of Cu and Pb showed that during 30 years the redistribution of the contents resulted mainly in change of enrichment levels spatial locations and shapes. Multi-elemental pollution assessment showed that in all cases medium and high levels of pollution predominated: 72.4, 86.2 and 83.7 % of studied area for 1989, 2002 and 2012 respectively. The latter indicated that due to the poor urban management and environmental quality control during last 30 years Yerevan soils PTE have been posing an adverse health effects to urban inhabitants.