

## 5. The ecological-geochemical assessment of urban soils in industrial centres of Mongolia

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### Abstract:

Development of industrial cities and rapid urban population growth in Mongolia which was observed in the last decade causes growing ecological problems in the region. The purpose of the present study is to characterize pollution of soils with heavy metals (HM) in the largest industrial centres of Mongolia – Ulaanbaatar, Darhan, and Erdenet. The investigation included: geochemical characterization of non-polluted (background) soils of the cities; evaluation of geochemical transformation of soils in urban environment; assessment of ecological status of polluted urban soils on the basis of regulatory HM values (MPC) accepted in Mongolia. The soil survey was performed in December, 2007 and included the collection of 195 samples from upper soil horizons (0-10 cm) which were analyzed using spectral method. The analytical data were processed statistically using STATISTICA 7 package.

Background dark chestnut soils of the region are characterized by low or similar concentrations of Ge, Co, Y, Ni, Zn, Mn, V, Ti, Cr, Zr, Hg, Ba compared to their world clarkes. A contrasting geochemical anomaly with high Mo, Cu and Ag and very low Ge content has been found in Erdenet which is located within natural Cu-Mo enrichment zone related to ore deposit. In Ulaanbaatar multi-element (Ag, Pb, Sn, Hg, Ge, Zn, W) geochemical anomaly with relatively low concentration factors Kc (3-1,5) has been detected. Kc is defined as the ratio between HM concentrations in urban and background soils. The highest metal concentrations have been observed along highways and within residential blocks in the central part of the city. In Darhan the prior pollutants are Cr, Hg, and W derived from tanning industry, gold mining, brown coal burning. The extremely high content of W and Cr in soils is found at the industrial sites, W and Hg within residential and roadside areas. In Erdenet the technogenic addition of Mo, and Cu due to mining and enrichment of ores enhances natural ore anomaly of these metals while immission of Sn, Ge increases their low background concentrations. Soils in ger zones are mostly polluted with Sn, Ge, Zn, Cu, Mo, and Pb associated with coal ash released by heating power station and individual stoves.

The ecological-geochemical assessment of soils in different functional zones was based on calculation of bulk pollution coefficients Zc, as well as on evaluation of soil pollution hazard. The former was defined as  $\sum Kc - (n-1)$ , n is a number of metals with Kc > 1, the latter as a proportion of the urban area with excess of HM over MPC. The soil pollution appears to be insignificant in all functional zones of Ulaanbaatar: Zc values range from 2,5 to 8,7, a small excess of MPC is found for four metals. In Darhan and Erdenet the ecological situation is more hazardous: great areas are contaminated with Cr, V, Mo, Cu, and Zn. In Darhan Zc values are equal to 11-14 in residential and traffic zones and 26,7 in industrial zone, the same parameter has low values (1,3-5,1) in Erdenet because of elevated natural geochemical background for some HMs.

Keywords: heavy metals, technogenic anomalies, ecological assessment

Topic: C. Urban soils and ecosystem services

Sub-topic: C5. Pollution status and control of urban soils

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