Geophysical Research Abstracts
Vol. 19, EGU2017-7956, 2017
EGU General Assembly 2017

Distribution of metals in various particle-size fractions in topsoils of a small dry valley system (European Russia, forest zone)

Olga Samonova and Elena Aseyeva
Lomonosov Moscow State University, Faculty of Geography, Moscow, Russian Federation (aseyeva@mail.ru)

A detailed study of heavy metals distribution in various soil grain-size fractions helps to increase the knowledge about the complex nature of metals' occurrence and their distribution pathways in the environment. On the basis of particle size fractionation of topsoil horizons we examined the specific behavior of heavy metals in a small erosional landform located in the humid temperate zone of the Russian Plain.
The object of the study is a 400 m small U-shaped dry valley (balka in Russian) with a catchment area of 32.8 ha located in the central part of the Protva river basin, 100 km southwest of Moscow. The uppermost parts of the landform are incised in Late Pleistocene loessial loams, which cover significant portions of interfluve area in the region, while the middle and the lower parts cut through Middle Pleistocene glacial sediments. A total of 50 samples were collected from topsoil horizons of different landform geomorphic units along three cross-sections as well as along the bottom of the landform and its detrital fan. Samples were analyzed for Mn, Cu, Ni, Co, Cr, Zn, Pb, Ti, Zr, and Fe content. Eleven samples were chosen for physical fractionation into 5 grain-size fractions (1-0.25 mm, 0.25-0.05 mm, 0.05-0.01 mm, 0.01-0.001 mm and <0.001 mm) and further analysis for fractionized metal contents.
Across the grain-size fractions the maximum Zr content was observed in the coarse silt fraction and Ti – in the medium and fine silt fraction, while other metals, such as Fe, Mn, Co, Ni, Cr, Pb, and Zn revealed their highest concentrations in the clay fraction. For Fe, Mn, Co and Ni a second concentration peak was observed in the coarse and medium sand fraction. Due to probably eolian genesis and (or) transformation during weathering, the coarse silt fraction in comparison to other fractions showed a depletion of the majority of metals while the minimum concentrations of Ti, Zr and Cr were limited to the coarse and medium sand.
Statistical analysis showed that the variation of metal contents depends on particle sizes: the Cv coefficients calculated for Cu, Ni, Co, Fe, Mn, Ti and Zr reach their maximum in the 1-0.25 mm fraction (for Cu and Ni exceeding 75%, for Ti, Zr being around 40%). For Zn, Cr and Pb the maximum variation (50-60%) was found in the 0.25-0.05 mm fraction. In contrast, the two studied silt fractions and also the clay showed very low variations of all metal contents (except for Mn) characteristically in the range between 6% (Cr) and 23.5% (Zn). Unlike the finer fractions, which displayed very poor geochemical differentiation across the landform's geomorphic units, the coarser (sand) fractions showed distinct spatial patterns in the elements' distribution, possibly related to migration processes, the depletion of metals in the landforms' slopes and their prevalent enrichment in the bottom unit is observed.