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Reclamation of soils influenced by coal mining in Southern European Russia

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In the recent decades, the concentrations of metals have increased in such media of biosphere as atmosphere, hydrosphere, pedosphere. The greatest geochemical changes have occurred in soils, which are the deposing medium where the high concentrations of metals are saved for years after their direct human use. Mining sites and beneficiation zones are the areas of the highest concentrations of metals in soils. Coal mining areas in the European part of Russia (Rostov region) were selected for a detailed consideration. Soil samples were taken from the uppermost soil horizons: layer of 0–30 cm. The soil samples were analysed for gross concentrations of Cu, Zn, Pb, Ag, Sn, Mo, Ba, Co, Ni, Mn, Ti, V, Cr, Ga, P, Li, Sr, Y, Yb, Nb, Sc, and Zr, using emission spectral analysis. All ordinary analyses were carried out in the certified and accredited laboratory. The external control was conducted by the X-ray fluorescence, gravimetric, and neutron activation analyses. Calculation of random and systematic errors showed high analyses repeatability and correctness. Several cases of self-purification of soils and restoration of landscapes were discussed. The way of remediation through the flooding of mining sites with water was investigated as well as filling of natural relief depressions with soils and dumps. The process of Technosols remediation at the sites occupied by tailings of waste heaps was considered separately.
In conclusion:
1. The dominant contemporary way of remediation in Southern European Russia does not prevent the spread of metals through the decades. The modern underground coal mining leads to the destruction of soils in the area directly occupied by wastes and by rock dumps located nearby.
2. Soils have not formed yet as a result of self-restoration at the waste heaps at the age of 50 years, spontaneously combusted decades ago. The vegetation formed during this time virtually eliminates the occurrence of any significant soil-forming process. The ponds formed by the flooding of burning waste heaps, do not give possibility for the formation of soils and hardly contribute to plant growth.
3. The Technosols of waste heaps' surface layers are different from the surrounding steppe soils in geochemical features and mineralogical composition at every stage of their development.
4. The atmospheric and water inflow of material from the waste heaps changes (in the cases studied – worsens) the state of steppe soils within a radius of 1 km, and leads to the increase of heavy metals content in these soils.

Keywords: Technosols, Technogenic Superficial Formations, self-purification, flooding