

Environmental Geochemistry and Bioavailability of Heavy Metal(oid)s in Vicinity of Karabash Cu Smelter, Russia

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Local technogenic geochemical anomalies are formed in the area of mining and smelters. Such sites can be seen as natural-technogenic testing areas for studying processes of involvement of chemicals in natural migratory flows. The Karabash technogenic anomaly which was being formed around the large copper smelter plant is precisely such testing area. It gives a unique opportunity to study the degradation and restoration of the environment under changing technogenic load.

During its existence the Karabash Cu smelter plant emitted into the atmosphere more than 10 million tones of toxic substances – SO₂, dust, heavy metals. In 1989 the smelter plant was stopped, but in 1998 it was started up again and currently it intensively upgraded. The modernization of smelter led to considerable reduction of emissions, but they remain sufficiently high. The most dangerous emissions are sulphur dioxide (SO₂) (76% of total), and dust (19,2%). The area continues to suffer also from wastewater and acidic drains from abandoned mines.

The main goal of this work is to assess and characterize distribution (the fallout spots) of heavy metal(oid)s around the Karabash Cu smelter plant after its reconstruction. The main object is Serebry Lake in 4 km from the source of emission. Polluters come with atmospheric precipitations and washout from watershed area.

According to the results of field studies by 2010-2013 were determined the enrichment of rain water as a result of smelter emissions, concentrations of heavy metal(oid)s in soils, distribution and accumulation of elements in lake water and bottom sediments. The assessment of contamination of soil and upper layer of bottom sediments showed extremely high concentrations of heavy metals, especially Hg, Pb, Zn, Cd, Cu and As ($Z_c > 200$). Bioavailability was evaluated on the basis of distribution of elements in tissues, kidney and liver of lake fish.