Geochemical anomalies in sulfide-bearing waste disposal areas, Kemerovo and Chelyabinsk regions, Russia

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Sulfide-bearing mill wastes of the mineral processing plants situated in the Kemerovo and Chelyabinsk regions were investigated in the time period 2000-2014. High dissolved metal Cu, Zn, Fe, Pb, Cd and As concentrations are found in acid drainages which form as a result of interaction between sulfide wastes and water. Monitoring research using geochemical and geophysical methods was performed to evaluate the contamination of the surrounding area (water and bottom sediments in the contaminated rivers [1] [2] and snow cover). Zones of geochemical anomalies were identified where the concentrations of Fe, Cu, Zn, Cd, Pb, and As are 2-3 orders of magnitude higher than drinking water standards (for rivers) and background levels (for snow). The use of geophysical methods allowed us to prove penetration of drainage solutions into the groundwaters [3]. A series of laboratory experiments on the interaction of sulfide-bearing mining waste from four different mine tailings (Kemerovo and Chelyabinsk region) with distilled water was conducted in a dynamic mode. Two groups of technogenic systems on the drainage's type produced were identified: acidic drainage with total concentrations of trace elements from 100 mg/L to 30 g/L and neutral alkaline wastewater with total concentrations of trace elements from 1 to 1000 mg/L. Flow experiments proved the danger of drainage waters with neutral pH values due to high concentrations As and Be. The total amount of sulfuric acid, metals, and metalloid waste produced were estimated. Settler ponds with acidic drainage waters and high Cu, Zn, Pb, and Ag concentrations may be considered as a "man-made deposits" which processing can significantly reduce the cost of remediation of disturbed lands. The total environmental damage caused by pollution of water and land resources in the Belovo Zn-processing plant waste disposal area amounted to $156 million at the time of 2011, and could reach $480 million by 2030 if steps are not taken to recycling and remediation of disturbed areas.

[1] Bortnikova *et al*. (2010), *Wat. Sec. in Medit. Reg.,* 191-208. [2] Yurkevich *et al*. (2012), *App. Geochem.* **27,** 2260-2270. [3] Bortnikova *et al*. (2013), *Handbook of Env. Chem*., DOI: 10.1007/698_2013_234.