

PIT LAKES IN KUZBASS, RUSSIA: THE ECOLOGICAL RISK ASSESMENT AND THE WAYS OF TREATMENT

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ABSTRACT

The open pit mining and processing of polymetallic ores resulted in rise of pits. The pit lakes arise after pits flooding with atmospheric and underground water and are characterized by low pH, high metal and SO_4^{2-} concentrations due to interactions between waters and sulfide minerals in host rocks. Investigations on pit lakes composition, development and transformation are necessary for adequate risk assessment and development of methods remediation.

The seven pit lakes situated in the Salair ore field (Kemerovo region, Kuzbass, Russia) are examined in this paper.

Results of the field researches in 2005-2008 and following analytical works allowed to ascertain the composition of water and bottom sediments in pit lakes situated in three ore deposits: Aleksandrovskoe, II Mine, III Mine. Slow interaction between water and oxidized sulfide ore bodies with high amounts of FeS_2 , CuFeS_2 , FeAsS in the pit walls resulted in formation of acid solutions (pH 3–5) with high mineralization (5-8 g/l), metals, and metalloids (concentration of As is up to 0.3 mg/l). The concentrations of concerned elements considerably exceed the background and maximum allowable values with the greatest portion of Cu, Zn, Cd species is most toxic aqua ion.

The geochemical anomalies of various elements (Ti, Mn, V, Cu, Zn, Cd, Pb, As, Sb, Ag, Te) appear in the pit lake bottom sediments which are mainly in very soluble forms and of high mobility.

The data obtained point out not only an ecological risk but also indicate it is possible to extract the ore elements from these objects for the second time.

The number of experiments on the acidic pit lake waters treatment was conducted. Natural limestone was used for initial neutralization of solutions, and then clays, peats, bottom sediments precipitate and sorb metals (Cu, Zn, Cd, Pb) and some metalloids (As, Sb). The scheme described simulate the processes occurred in nature when contaminated waters interact with host rocks, soils, and bottom sediments and allow to treat pit waters effectively and inexpensively. Moreover the electrochemical method with alkali was used for excretion of metallic copper. The cost of produced metal can reduce the costs of pit lakes reclamation.

Keywords: Pit, lake, metals, treatment