Influence of minerals development on environment

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Abstract
Data on a role of minerals in mankind development are resulted. Dynamics of negative consequences of mountain manufacture for environment is characterized and the mechanism of its restraint is formulated. Prospects of a waste use of extracting complexes as stocks for extraction of mineral raw materials are underlined.
Keywords: MINERAL DEPOSITS, DEVELOPMENT CONCEPT, MOUNTAIN MANUFACTURE, ENVIRONMENT, CHEMICALIZATION

The development of the country's economy is largely determined by the state of mineral resources. Complex development of mineral resources, re-development of deposits and, consequently, environment pollution reduction are assuming ever greater importance [1-3]. The consumption of various metals, fertilizers and other minerals 3-5 times increased. The constant rise of obtaining and usage of different metals (from 2 to 5% comparatively to the 2009 level) is run in posterior years (2011-2012). As modern technology of mineral deposits development and processing is not perfect million tons of gas- and vaporous, liquid and solid wastes, which causing total pollution are released into environment. According to data given by many scientists about useful products from some of the extracted raw materials are produced no more than 2%, and more than 98% returns to nature in the form of various waste. In general, in the modern world with an annual extraction of about 25 milliard tons of all raw materials kinds (fuel, ores, building materials, etc.), in the form of finished products are used no more than 1.5 milliard tons. At present time, necessity to assess both natural and anthropogenic impacts on the environment, as well as need to eliminate the consequences is emerged. Taking into account the fact, that the dumping sites and tailings have a negative impact on the environment, emerged an urgent need to carry out environmental-economic assessment. This assessment allows to define the environment protection with combined account of natural and anthropogenic influence mechanisms, as well as the quantitative use of mineral resources deposits, thereby to assess the avoided ecological damage to the environment. In present-day conditions in average on every inhabitant of our planet annually over 20 tons of raw materials are extracted. These 20 tons using 800 tons of fresh water and 2500 W of power are processed into consumer products. Output of final products is 2% of the raw material mass [4-6]. Recycling of wastes, in addition, largely solves ecological problems, because wastes of mining enterprises, occupy the natural lands of hundred thousands hectares. These wastes poison the soils, which are dispersed and pollute the atmosphere. Thus, solid wastes of mining complexes are huge reserves for extraction of mineral raw materials out. Each chemical element at excess content has toxic properties but its toxicity appears only if it is present in biologically active form and in quantities exceeding the threshold values. At the same time, many ore elements - sulfur, zinc, molybdenum, copper, iron, manganese are necessary for normal vital functioning of organisms, but only at concentrations that don't exceed the threshold: the top, above which the element becomes toxic, and the bottom, below which pathological changes occur in the organism due to the lack of this element. A brief description of the toxicity and human impact on the most common ore elements is considered. The class of elements toxicity and danger of which has to be taken into account when assessing the risk of mining waste are presented in Table 1.

Table 1. Toxicity and danger of chemical elements

Classes of danger	Chemical element
I	Selenium, lead, arsenic, zinc, cadmium, mercury
II	Boron, cobalt, nickel, molybdenum, copper, antimony, chromium
III	Barium, vanadium, tungsten, manganese, strontium
Elements, toxicity of which must be revised	Aluminum, sulfur, lithium, bromine, gallium, iron, tin, indium

According to biological importance the major, vitally needed - Mg, Ca, Mn, Fe, Na, K, Co, Cu, Zn, Mo are defined. Ecological impact of many highly toxic elements on the environment is poorly studied. This concerns rare and trace elements such as selenium, thallium, tellurium, strontium, and others, which are scattered in volumes comparable with their industrial extraction when developing deposits. Parameters of element concentration growth in soil in a result of natural leaching of the dust fractions are characterized by Table 2.

Table 2. The content of ingredients in the hydrosphere, mg/dm^3

Ingredients, mg/dm^3	In the area of mining enterprise	Outside the zone of mining enterprise	Δ
pH	7.0	5.5	1.5
Suspended matter	60	12	48
Solid residue	250	170	80
Chemical oxygen demand	50	35	15
Phosphates	0.06	0.04	0.02
Ammonia nitrogen	0.18	0.04	0.14
Nitrites	0.01	0.002	0.008
Nitrates	18	12	6
Chlorides	23.6	10.0	13.6
Total hardness	9.7	6.5	3.2
Iron total	0.17	0.07	0.10
Copper	0.003	0.002	0.001
Lead	0.0015	0.001	0.0005

Zinc	0.002	0.001	0.001
Sulfates	82.33	42.3	40.03

The concentration of metals in the enterprise influence zone is 1.5-2 times higher than outside it. Metals that get into the soil with fine-dispersed dust fractions are concentrated in the upper accumulative horizon. Minerals of iron, which play the role of cathode, are initiators of natural leaching of metals and salts. Effect of electrode processes occurs at the boundaries of minerals with different potentials. The intensity of natural leaching is defined by the nature and time of contact of solid and liquid media. Increase of water inflow intensifies leaching and the metal content in solutions increases. Leaching occurs throughout complex chemical reactions with the formation of various compounds of the same metal. Under the air and water influences in the mineral mass the catamorphism progresses - destruction of the mineral fractions with heat emission due to decomposition of sulfides. Water take products of natural leaching in the form of compounds Zn SO_4, Cu SO_4, Ca SO_4, and Fe $SO_4 7H_2O$ into the environment. In the secondary tailings of natural leaching remain Zn CO_3, Pb CO_3, Cu CO_3, Pb SO_4 and Fe SO_4. Consequen- ces of natural leaching of the tailings on the environment depends on the ratio of these groups. Biological activity of soils that sustained a technogenic impact is evaluated by their compliance with the criterion of vital activity (Table 3).

Table 3. Criterion of biological activity of soils

Depth, cm	Humus content, %	Density, g/cm^3	Acidity, pH	Nitrogen content, %	CO_2 content, %	Ca content,mg	Mg content, mg
< 10	9.2	-	6.3	0.48	-	43.9	9.6
10-20	7.8	1.1	6.3	-	-	42.8	10.7
20-30	6.0	-	6.3	0.27	-	34.2	9.6
30-40	5.6	1.2	6.4	-	-	33.2	8.6
40-50	4.8	-	6.5	0.23	-	34.2	6.4
50-60	4.5	-	6.7	-	-	27.8	7.5
60-70	3.9	1.3	6.9	-	-	23.5	9.6
70-80	3.2	-	7.0	0.16	-	27.8	9.6
80-90	3.0	1.4	7.4	-	-	30.0	7.5
90-100	1.7	-	7.8	-	0.3	-	-
100-110	1.5	-	8.5	-	3.9	-	-
120-130	0.7	1.5	-	-	5.1	-	-
140-150	0.6	-	8.6	-	5.8	-	-

To determine the ability of soil to self-recovery, qualitative and quantitative analysis of the presence and distribution of heavy metals was conducted: Fe, Pb, Zn, Co, Cr, Cu, Ni and Cd – were founded in the soils of agricultural grounds in the zone of influence of mining enterprises [6-8]. Besides heavy metals a number of chemical and biochemical parameters was also determined in soils: the content of nitrogen and phosphorus, the concentration of organic carbon, hydrochemical acidity and activity of oxidative enzymes. Zone of extremely dangerous pollution is located within a radius of 10 km from the quarry.

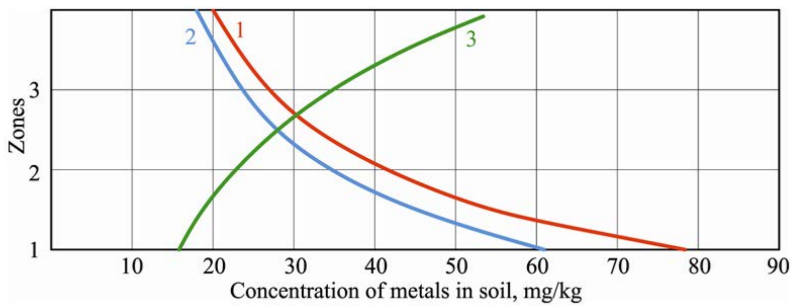

Figure 1. Biota degradation at metal pollution of soil: 1 – iron concentration, mg/m^3; 2 – copper concentration, mg/m^3; 3 – ferments existence (catalase), c.u.

In soils of this zone the part of the first class danger elements is about 70%. The second zone - of dangerous pollution extends to a distance of 10 to 20 km from the quarry. Soils of this zone contain up to 20% of the first class danger elements. The third zone – is a zone of moderately-dangerous pollution, which is located on a distance of more than 20 kilometers. It is determined that biota mass in soil is in inverse proportion with metals content (Fig. 1).

Soils pollution assessment must be performed not only in technogenic field but mainly by its response to impact using value of its ecological potential.

Conclusions

The influence reduction of processes of ores extraction and processing on the ecosystem of the natural environment is possible after: conversion from ecologically and socially dangerous methods of open pit and underground mining to the physical, technical and physical-chemical geotechnologies (borehole hydraulic mining, uderground leaching, underground coal gasification, underground melting of sulfur, the use of coal-bed methane, coal-water fuels, etc.); development of high-performance complex processing technologies and opening of the mineral grains of middle quality and hardly separated ores, as well as technogenic materials

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