

Geocological and geochemical assessment of the impact of NMMC mining enterprises on the environment

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Abstract. Study of the dynamics of natural and man-made processes and their impact on the environment in the hills of Uzbekistan; study of ecological and geochemical processes occurring in technogenic and natural landscapes of mining enterprises of the NMMC; Conducting geochemical and analytical studies to identify the contents and distribution of toxic and other associated elements in technogenic waste from NMMC mining enterprises, soils, and plants in connection with their impact on the ecology of the environment. Study of geochemical features of the productive valuable and toxic element's behavior in space and time in industrial waste area Geological and geochemical mapping of soil, plants and water sources. Study of the chemical composition, behavior and forms of occurrence of toxic elements (in soils, water streams, dust, gases, smoke) in the water area and in the vicinity of the Navoi Mining and Metallurgical Combine - geochemical ecology. As a result of investigations of initial samples by using mass spectrometric analysis, the limits of fluctuations and average contents of not only toxic elements, but also other associated elements were revealed.

1 Introduction

Solving environmental problems today is becoming a priority to ensure sustainable development of industrial areas. This applies to both mining regions, where mining enterprises and the industries that serve them take first place, primarily in terms of solid waste, as well as high-mountain and mid-mountain areas, which are increasingly being developed for recreational and hydropower purposes. The current scale of landscape and environmental changes in the natural environment in mining areas is associated with the predominance of open-pit mining. Population growth and the associated intensive development of industry, the development of new agricultural land and a further increase in

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infrastructure lead to irreversible changes in the environment. Assessing the spatiotemporal scale of these changes is today one of the pressing research issues in modern natural science.

Navoi Mining and Metallurgical Combines have been and are developing copper, lead-zinc, gold and gold-silver deposits for many decades. As a result of this activity, billions of tons of technogenic waste (overburden rocks, off-balance and oxidized ores, tailings from processing plants) have been stored in the adjacent territories of Navoi and other regions. These wastes contain not only industrially valuable metals Fe, Cu, Mo, Zn, Pb, Au, Ag, Re, Pt, Pd, rare earth elements, etc., but also toxic elements Hg, Pb, Cd, Se, etc. These wastes are technogenic waste belongs to a heterogeneous water-solid-phase mineralogeochemical system, where synchronous, simultaneous transformation occurs in a genetically related series (dump, tailings, energy (sun, wind), where (water, energy) and structural mineral components (minerals, colloids, amorphous substances and nanoparticles) provide the most important aspects of its functioning.

2 Materials and methods

A methodology has been developed for studying landscape-mineral-geochemical systems (LMGS) of industrial waste and their impact on the state of soil, plants and water in the areas around the enterprises of the Navoi Mining and Metallurgical Combine [1-8].

In detailed studies using ecological-geochemical mapping of soils and plants in the water area of the mining enterprises of the NMMC (Uchkuduk, Kokpatas, Muruntau, Navoi) related to the HMF (Hydro Metallurgical Factory) - 1,2,3. Which, to one degree or another, affect the environmentally friendly environment of these territories. A total of 935 geochemical samples were collected from dumps, soils and plants, which were subsequently studied by mass spectrometry. A methodology was developed to identify indicators of the composition of dumps, soils and plants [4-6].

Studies of the condition of the soil cover at the sites of exploration and operational mining operations of the NMMC have established that the soils are contaminated with heavy metals and toxic elements. Soil contamination ranges from mild to very severe.

3 Results and discussion

As a result of analytical studies using mass spectrometric analysis, samples from the water area of the Uchkuduk field were studied in detail to determine the spatial distribution of toxic elements, calculate their average contents, their concentration clarification (CC), and permissible concentration limits (MPC).

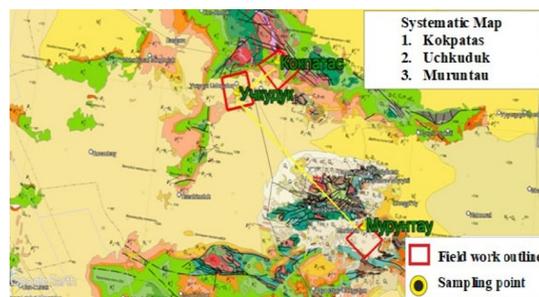


Fig. 1. Ecological-geochemical mapping and sampling of dumps, soil and plants of the Uchkuduk, Kokpatas, Muruntau sites.

Table 1. Average content, limits of fluctuation of toxic elements in soils of the NMMC, clark concentration and maximum permissible concentration (in g/t).

Elements	Average content, fluctuation limits	Clark element	Clark element concentration	Maximum permissible concentration	Increase in maximum permissible concentration (times)
As	70.73	1.7	41.60	2	20.80
Sb	1.63	0.5	3.25	1	0.72
Se	1.15	0.05	23.04	4.5	23.04
Cd	0.06	0.13	0.48	1	0.48
Te	0.16	0.001	160.80	-	-
Bi	0.18	0.009	20.34	3	6.78
Tl	0.27	1	0.27	1	0.27
In	0.02	0.25	0.07	2	0.04
Pb	8.07	16	0.50	30	0.02
Zn	31.66	83	0.38	23	0.02
Mo	2.03	1.1	1.84	10	0.18
U	1.50	2.5	0.02	-	-
Th	4.57	13	0.35	-	-

Calculated data on the maximum permissible concentrations of toxic elements in (dumps, soils and plants) in the water area of NMMC mining and ore enterprises.

It was found that the dumps of the NMMC mining enterprise are the main sources of environmental pollution. Of the identified galaxy of toxic elements (in dumps, soils and plants), the most toxic were: As, Se, Bi, slightly Cd and Sb. (Table 1).

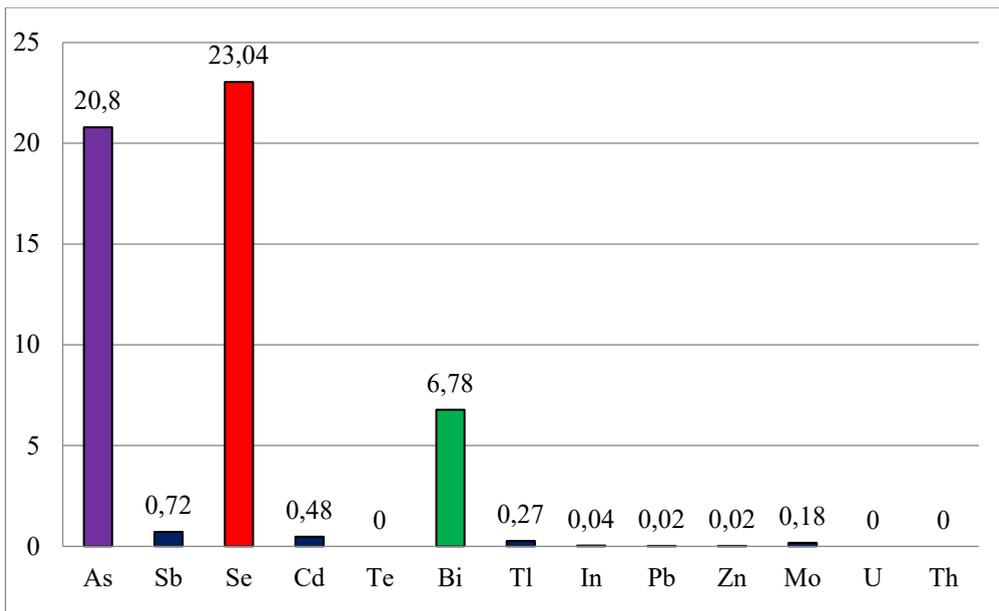


Fig. 2. Increasing the limits of permissible concentration of maximum permissible concentrations in % (times).

4 Conclusion

As a result of calculated data, high concentration limits (MPC) were established in the soils and plants of Uchkuduk. The highest excess (MPC) was found for Se: in soils (41 times), a slight overestimation was found for As and Bi (6.4) times and for Cd (2.6) times. Among the toxic elements in plants, only Se exceeding the maximum permissible concentration (MAC) was found to be (20) times higher (Table 2).

As a result of calculated data, relatively high concentration limits (MPC) were established in soils and plants of Kokpatas: the highest exceeded concentration limits (MPC) were established for Se: in soils (20) times, in plants (18.2) times. A slight excess (MPC) is observed in soils: As (9.5 times) Bi (3.5 times), in plants Bi (8.3 times). (Table 2)

As a result of calculated data, relatively high concentration limits (MPC) were established in the soils and plants of Muruntau: a high excess (MPC) was established for Se: in soils (37 times), As (29 times) and less for Bi (10 times). In plants, Se is found among toxic elements, the excess (MPC) is (14 times) and not significantly Bi (2 times). (Table 2).

As a result of calculated data in soils and plants of the city of Navoi, relatively high concentration limits (MPC) were established for Se: in soils (27 times) and insignificantly for As (8 times) and Bi (7 times). In plants, the only toxic element present is Se excess (MPC), which is (19 times).

Table 2. Calculated data on maximum permissible concentrations (MPC) of toxic elements in dumps, soils and plants.

Areas	Products	Increase (maximum permissible concentration) by several times				
		As	Se	Bi	Cd	Sb
Uchkuduk	Dumps	9.7	95	16	2.6	-
	Soil	6.4	41	6.4	-	-
	Plants	-	20	-	-	-
Kokpatas	Dumps	71	32	21	-	3.5
	Soil	9.5	20	3.5	-	-
	Plants	-	18.2	8.3	-	-
Muruntau	Dumps	2156	423	189	12	-
	Soil	29	37	10	-	-
	Plants	-	14	2	-	-
Navoi	Dumps	192	61	12	17	-
	Soil	8	27	7	-	-
	Plants	-	19	-	-	-

In conclusion, it should be noted that relative to plants, soils are more intensely contaminated with toxic elements than plants (Table 2). Soils are characterized by toxic elements $Se > As > Bi >$, plants are characterized mainly by Se and Bi.

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