



Number of Heavy Metals and Eco-Toxicological Condition in Bolnisi-Dmanisi Region

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Abstract

From environmental health hazards, chemical hazards are given priority. The mineral deposits in the Bolnisi-Dmanisi region significantly pollute the environment. This fact is confirmed by our work, because cadmium and lead in the control points did not exceed the permissible concentration in any season. Concentrations of pollutants in the river are not always the same because the volume of wastewater from the plant is always different. This process is therefore difficult to control and correlation is difficult to establish. Also, this process is characterized by seasonality (during the period of abundant atmospheric precipitation in autumn and spring, a large volume of water flows) and it is difficult to accurately calculate the water flow, at which time polluted water from the slopes is mixed with the river Mashavera.

Index Terms— Cadmium, Environment, Lea, Water pollution.

1. Introduction

Highlight a section that you want to designate with a certain style, and then select the appropriate name on the style menu. The st from environmental health hazards, chemical hazards are given priority. According to WHO, the production and consumption of chemicals has increased 20 times in 2020-2021. The careless use of chemicals is associated with the deaths of approximately 355,000 people each year, mostly in developing countries. Kvemo Kartli region and in particular, the territory of Bolnisi-Dmanisi municipalities has long been known for minerals - different types of deposits: barite-polymetallic, copper-colchicine, gold-bearing secondary quartzites and others. The mining facilities in the region may have had a significant negative impact on the environment [3,6,8].

There are particularly notable areas in the Bolnisi-Dmanisi area where, according to some studies conducted so far, high levels of pollution have been observed; For example, one of them is the settlement of Kazreti, where a difficult ecological situation is observed [5,9]. The fact is that due to the open-pit mining of ore in the mining and processing plant, the environment is likely to be particularly damaged. It is also worth noting that the population lives close to ore mining processing, receiving food and water from the soil, which is

characterized by high content of heavy metals; The main river Mashavera River, that flow in this area are polluted by water leaked from enterprises, the pH of which is often equal to 2-3 and, consequently, increases the solubility of heavy metals in water [4,7]. These circumstances are due to the fact that environmental and health safety systems in the EU, the United States and other developed countries, instead of the current standard control and protection system, use the principle of qualitatively new risk management, which is based on the scientific-methodological basis of the United Nations. Through the joint efforts of the Environment Program (UNEP), the International Labor Organization (ILO) and the World Health Organization (WHO), the International Chemical Safety Program (IPCS) has been launched [1,2].

The pollution of the environment with heavy metals cadmium and lead is of great concern, their entry into the human body is very dangerous and causes various types of damage. Cadmium in the human body increases ROS production and causes oxidative stress. This mechanism may lead to organ toxicity, carcinogenicity and apoptotic cell death by cadmium. [5,8]. Lead poisoning usually occurs when food or water is contaminated with lead. Lead is rapidly absorbed into the bloodstream and has adverse effects on several organ systems such as the central nervous system, cardiovascular system, kidneys, and immune system.[10,11]. Therefore, we aimed to the monitoring of pollution with chemical agents in the target object (water) in this region of Georgia (Bolnisi), through ecological studies on heavy metals - lead, cadmium

2. Materials and Methods

1. We studied pollution of river Mashavera in October and June.
2. River water samples were taken in pre-selected 9 settlements-villages of Bolnisi-Dmanisi region:
 - a. The point located near the quarry (3 points): Balichi, Kazreti, Kianeti
 - b. The point that is located at a distance away from the quarry (3 points): Kveshi, Geta, Javshniani
 - c. Control point (3 points): Marabda, Koda, Vashlovani, R. Algeti water.
3. The concentration of cadmium (Cd) and lead (Pb) in heavy metals was studied by the Atomic adsorption method.

A sample taken from the river was filtered in situ using a vacuum filtration apparatus using a 0.45 µm membrane filter. The filtrate is acidified with dilute nitric acid (1:1) solution. The acidified solution was placed in a polyethylene container intended for sampling in vials preliminarily washed with nitric acid and distilled water. Sample Vials were sealed and stored in a refrigerator at 4°C. cadmium samples Content was determined by atomic absorption spectrophotometer [6].

3. Results

We conducted monitoring in the summer and autumn of 2020 in the villages of Bolnisi-Dmanisi region. The results of the research revealed that the river water is polluted by the waste water from the quarry. Differences were also observed seasonally, which must be related to rainfall. It was found that the pollution is increased during the summer period, because at this time there is less precipitation and only the polluted water from the factory flows into the river water. (Table I, Table II, Figure I, Figure II).

Table 1. 2020. Summer. Cadmium (Cd) content in rivers (Mashavera, Algeti) water, mg / l. (The maximum allowable dose of cadmium is 0.001 mg / l)

control point 0.001 mg / l	Marabda 0.001	Koda 0.001	Vashlovani 0.001
The point that is located at a distance from the quarry	Balichi 0,0029±0.001	Kianeti 0,0021±0.001	kazreti 0,0027±0.001
The point that is near located at a distance from the quarry	Geta 0,005±0.001	Kveshi 0,003±0.001	javshaniani 0,004±0.001

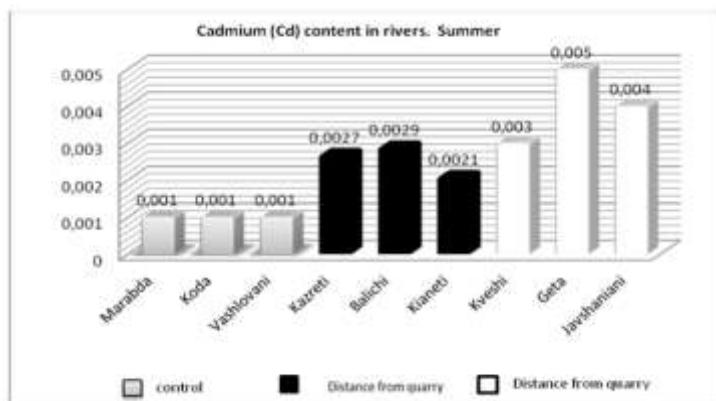


Fig. 1. 2020. Summer. Cadmium (Cd) content in rivers (Mashavera, Algeti) water, mg / l. (The maximum allowable dose of cadmium is 0.001 mg / l)

Table 2. 2020 Summer. Lead (Pb) content in rivers (Mashavera, Algeti) water, mg / l. (The maximum allowable dose of cadmium is 0.003 mg / l).

control point 0.003 mg / l	Marabda 0.003	Koda 0.003	Vashlovani 0.003
The point that is near located at a distance from the quarry	Balichi 0,005±0.003	Kianeti 0,004±0.003	kazreti 0,006±0.003
The point that is located at a distance from the quarry	Geta ≤0.003	Kveshi ≤0.003	javshaniani ≤0.003

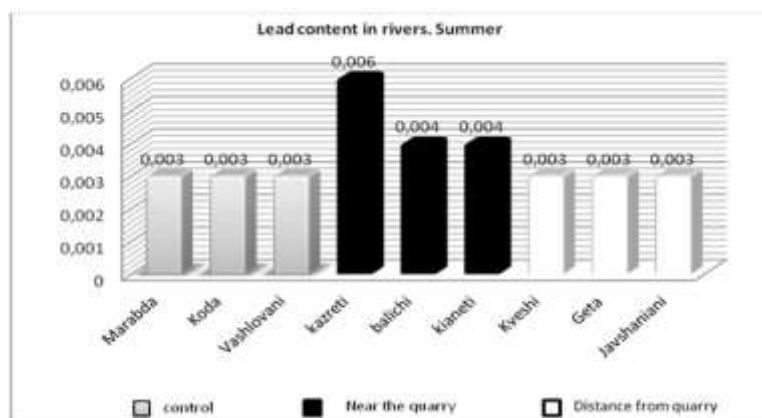


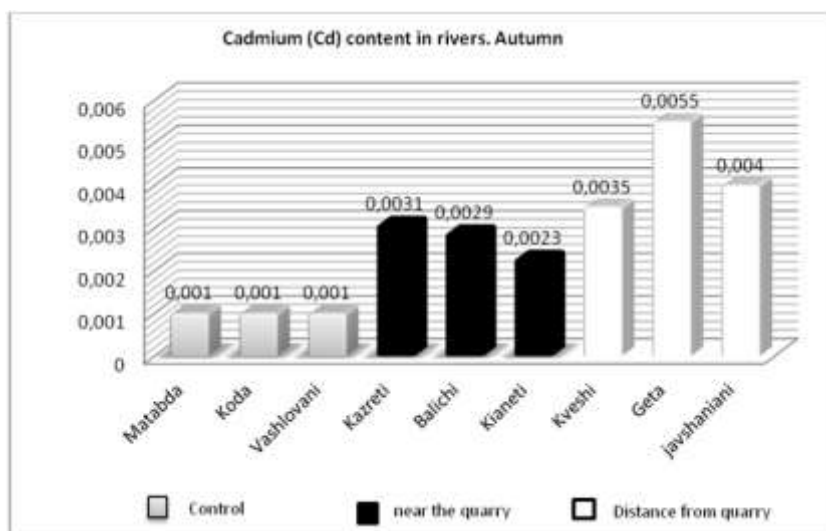
Fig. 2. 2020 Summer. Lead (Pb) content in rivers (Mashavera, Algeti) water, mg / l. (The maximum allowable dose of cadmium is 0.003 mg / l)

The table above shows that the lead content in the villages away from the quarry is equal to or less than the permissible concentration, while the content of heavy metals in the control points is normal.

Samples were also taken in autumn, it was found that there is a more or less increase of heavy metals in this season, especially the concentration is increased near the villages near the quarry, although the water flow, which is increased in autumn, carries heavy metals to the surrounding villages where it flows. (Table III, Figure III).

Table 3. 2020. Autumn. Cadmium (Cd) content in rivers (Mashavera, Algeti) water, mg / l. (The maximum allowable dose of cadmium is 0.001 mg / l)

control point 0.001 mg / l	Marabda 0.001	Koda 0.001	Vashlovani 0.001
The point that is located at near a distance from the quarry	Balichi 0.0029±0.001	Kianeti 0.0023±0.001	kazreti 0.0031±0.001
The point that is located at a distance from the quarry	Geta 0.0055±0.001	Kveshi 0.0035±0.001	Javshniani 0.004±0.001



It was also found that the content of lead in the villages near the quarry is elevated and in the villages located away from the quarry it is close to the permissible concentration. (Table IV, Figure IV).

Table 4. 2020 autumn. Lead content in rivers (Mashavera, Algeti) water, mg / l. (The maximum allowable dose of cadmium is 0.003 mg / l)

control point 0.003 mg / l	Marabda 0.003	Koda 0.003	Vashlovani 0.003
The point near the quarry	Balichi 0.004±0.003	Kianeti 0.004±0.003	kazreti 0.005±0.003
The point that is located at a distance from the quarry	Geta ≤0.003	Kvesahi ≤0.003	Javshniani ≤0.003

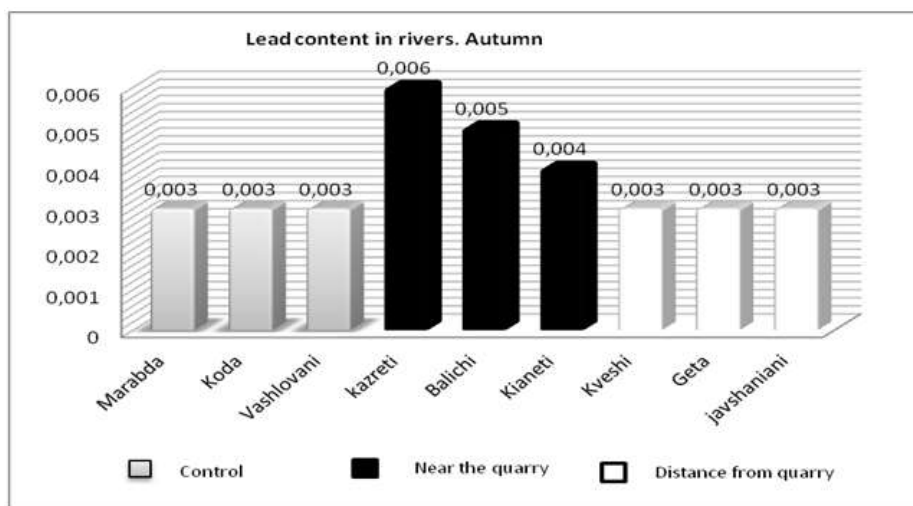


Figure 4. 2020 autumn. Lead content in rivers (Mashavera, Algeti) water, mg / l.
(The maximum allowable dose of cadmium is 0.003 mg / l)

4. Discussion

The results of the study showed that the concentration of heavy metals in the samples exceeded the maximum allowable norm. However, it should be noted that in this case the samples were taken only once. Based on all this, we can say that the mineral deposits in the Bolnisi-Dmanisi region significantly pollute the environment. This fact is confirmed by our work, because the control cadmium and lead in the points did not exceed the permissible concentration in any season.

Also, we can say that the mineral deposits in the Bolnisi-Dmanisi region significantly pollute the environment. This fact is confirmed by our work, because cadmium and lead in the control points did not exceed the permissible concentration in any season. Concentrations of pollutants in the river are not always the same because the volume of wastewater from the plant is always different. This process is therefore difficult to control and correlation is difficult to establish. Also, this process is characterized by seasonality (during the period of abundant atmospheric precipitation in autumn and spring, a large volume of water flows) and it is difficult to accurately calculate the water flow, at which time polluted water from the slopes is mixed with the river Mashavera.

5. Conclusion

Thus, according to our data, the concentration of cadmium in the Bolnisi-Dmanisi region is higher than the permissible concentration in water in almost all samples, and the concentration of lead is higher in the villages near the quarry. Our experimental studies clearly show an increasing trend of toxic metals, certainly these data are noteworthy and require further studies every year.

6. Acknowledgment

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