



CONCENTRATION OF HEAVY METALS IN THE ENVIRONMENT AROUND ZLETOVO MINES

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ABSTRACT

In the paper will be show the results from the geochemical research on samples taken from the running waters of Kiselica River, Kalnishtanska River, Koritnica River and Zletovska river.

Exploitation and flotation of lead-zinc ore is sent with the creation of large amounts of waste of the rock. Waste water contain metals / contaminants such as Pb, Zn, Cd, Cu, Mn, As and others, depending on the nature of the ore. By examining the diagrams related to the concentration of heavy metals in the water and sediments of rivers Kiselica, Koritnica Zletovska we can conclude that the present mining activities related to mining for lead and zinc Zletovo causes contamination in the environment with heavy and toxic metals.

Contamination does not stop with the stopping of function of the mine, but lag contaminants released into the environment, and change its chemical form so that can change the location of its concentration.

Key words: *pollution, heavy metals, contaminants, Zletovo mines, Pb-Zn ores, environmental, waste water.*

Introduction

The remains of the mining from the past suggest that the lead ores from Zletovo deposit and its immediate surroundings have been used since the Middle Ages and even earlier.

The first significant research was undertaken in 1928 by the English firm Selection mines limited and the ore deposit was investigated continuously until 1939. During this period the deposit was ready for exploitation with a capacity of 120.000 t ore per year. After the Second World war was started with modern mining, when on the Zletovo ore deposit was build a modern mine with an annual capacity of 400.000 t ore. The mine is still active to this moment and produce lead-zinc concentrates.

In the last 30 years, environmental problems increased after accumulated tons of waste in the mining tailing pond. Very big part of this waste now is a source of low-quality drainage waters. The waste dump are located along the river Kiselica which is the reason for the high concentration of heavy metals (Pb, Zn, Cd, Mn, Cu, As, etc.) in the rivers, as Korinica, Zletovska and Kalnishtanska. Therefore, the interest for studying the environment around the mines is increasing steadily.

Results and discuss

By examining the concentration of toxic heavy metals in the environment around the Zletovo mines for lead and zinc, with particular reference to rivers Kiselica, Korinica and Zletovica through years of operation, stopping and restarting the activity of mine can give a comparison of the representation of metals over the years that we have been discuss.



For this purpose, examined the field we would share on a few parts. The division is performed in order to get established compared to higher reliability because it is known that the concentration of heavy metals in the environment depends not only on pH and Eh values, but the geology of the terrain, anthropogenic influences and the presence of various mineralization (in our case lead-zinc mineralization). For all parts we shall get a result for the concentration of metals in running water, and only few of them and data from examined sediments along the river flows.

According to the needs of our comparison field will split into eight parts as follows:

- ❖ River Kiselica in the area under the dump, near the Strmosh
- ❖ River Kiselica between villages Petrshino and Strmosh
- ❖ River Koritnica near capacity for exploitation of ore, near the village Dobrevo
- ❖ River Zletovska near the village Zletovo

The river Kiselica in the area under the dump, near the Strmosh

For the preparation of this comparative diagram will shall use available data on the concentration of heavy metals in tests of water from the river flows from researches performed in 1995, 2003, 2004 and standards values for all metal.

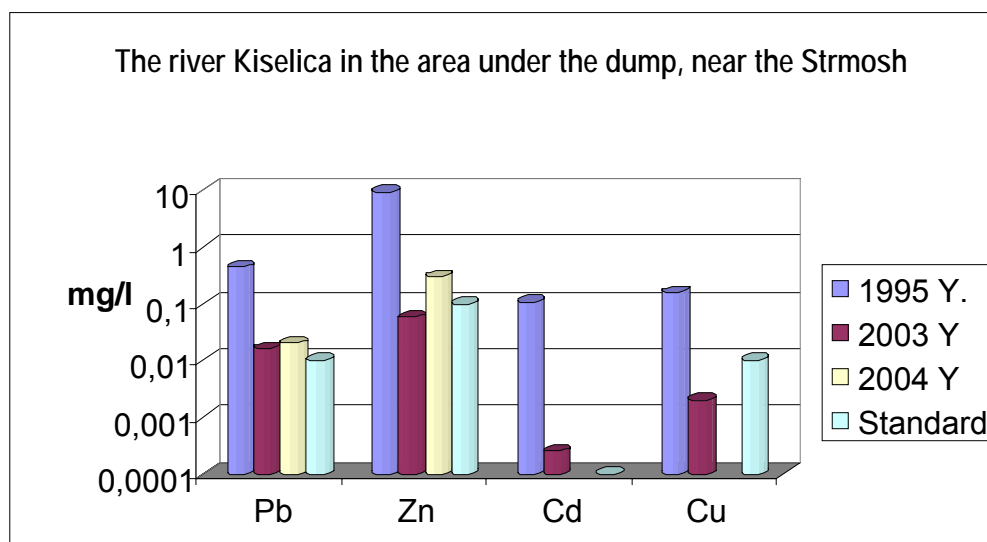


Figure 1. Diagram of the concentrations of metals in the River Kiselica in the area under the dump, near Strmosh

By looking at the diagram we can bring some conclusions:

In aspect of lead show that he during all periods exceeding standard value (MPC), however the period of 1995, exceeding is notable. In 2003 and 2004 shows decrease of the concentration of lead in comparison to that of 1995 to a value close to standard. Similarly behavior of lead show and zinc. Quantity of zinc during the 1995 expressed exceed allowable amounts. In 2003 concentrations are smaller than standard, while in 2004 there is again increase due to environmental pH of 7.3 in which zinc is still present in dissolved form. In aspect of cadmium and copper are observed expressed increased concentrations in the period of 1995, as well as reducing the quantities in the period of 2003.

This is due to the fact that in that period of 1995 the mine was in function and in the context of his functions larger amounts of water waste from flotation plant have been omitted in this water flow.

At the same time focused and bigger amount of waste in dump near in this river. These influences enable achievement of suitable acidity (pH <6) in the river for the concentration of heavy metals in it. During 2003 and 2004 the mine was not in function because of that the contribution of waste water decreased and it



notice dilution of water flow to neutral acidity, but exception is zinc to stables in sediments needed more alkalinity surround (pH = 7.7-8.2).

River Kiselica between villages Petrshino and Neokazi

For the preparation of this comparative diagram will shall use available data on the concentration of heavy metals in tests of water from the river flows from researches performed in 2003, 2004, standards values for all metal and scattering data of metals in sediments along the river flow between 2004 and 2005.

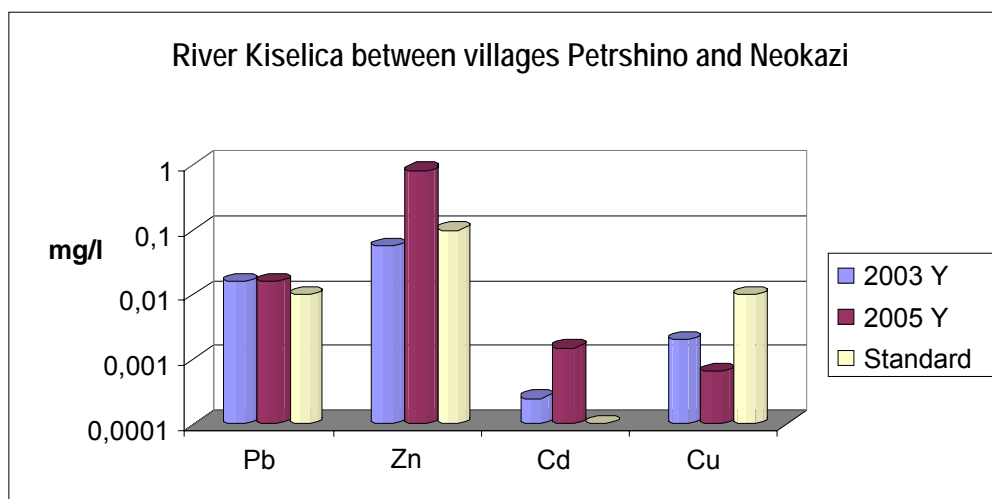


Figure 2. Diagram of the concentrations of metals in the River Kiselica between villages Petrshino and Neokazi

During the consideration of this part of the River Kiselica, Zletovo mine was not in function due to not too large derogation from the standard values in comparison with those when mine worked.

In aspect of lead shows that concentrations are close to the allowable amounts, while the copper under standard values in both considered periods.

The only exception is concentrations of zinc and cadmium. Higher concentrations observed during the period of 2005. Such behaviors of these two metals are due to their similar geochemical characteristics. The reason for this behavior of metals is primarily non-functioning of the mine, which has reduced the direct yield of toxic metals in river flow and distance from themselves processing facilities. That does not mean that with the stopping of the working, mine does not effect on the environment, because metals stumble in the middle, but as a result of dilution of the water is make a change of their chemical forms.

In 2005 the acidity of the environment was pH = 6.94. which is appropriate to occur deposit of lead and copper, and thus reducing their concentration in water flows. The exception is zinc which needs higher pH value to precipitate, so in the water flow is present in increased concentrations.

River Koritnica near capacity for exploitation of ore, near the village Dobrevu

For the preparation of this comparative diagram will shall use available data on the concentration of heavy metals in tests of water from the river flows from researches performed in 1995 and 2003 and standard values for all metal. Increased concentrations of heavy metals in river Koritnica due to the fact that the water flows past a location where is exploitation of lead-zinc ore, near mining gallery.

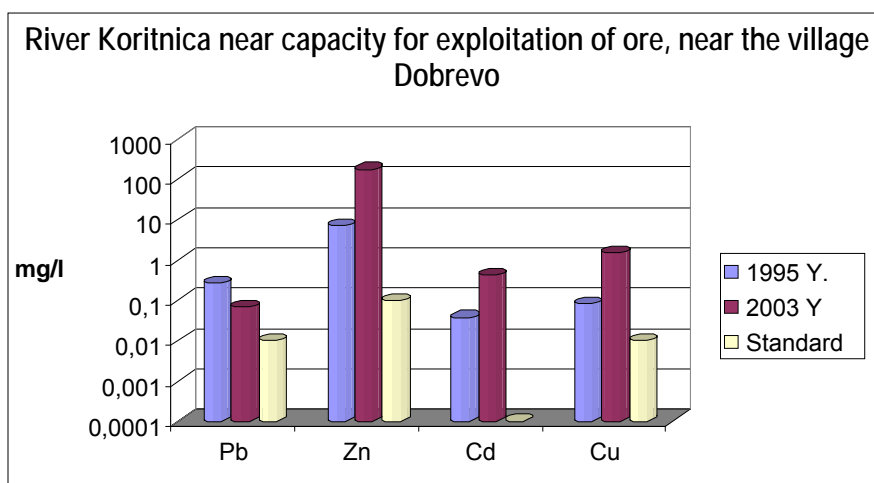


Figure 3. Diagram of the concentrations of metals in the River Koritnica near capacity for exploitation of ore, near the village Dobrevo

It is notice that all the metals considered in these periods are present in concentrations higher than allowable (MAC). However they are higher in the period of 2003 when the mine was not in function.

This could be due to the neglect of the mine after its closure. While the mine was in function it was taken care of cleaning facilities for the physical processing of ore (crushing machine, mills). After termination of the activities are not paying attention to maintenance and cleaning of these facilities as a result of which trough the winds and the mining water occurred concentrate of released metals into the water flow.

River Zletovska near the village Zletovo

For the preparation of this comparative diagram will shall use available data on the concentration of heavy metals in tests of water from the river flows from researches performed in 1995, 2003, 2005 and standard values for all metal.

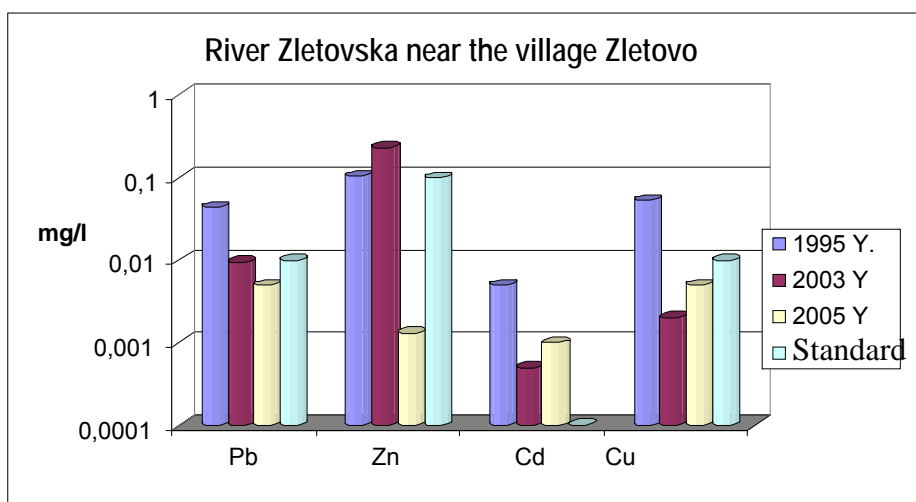


Figure 4. Diagram of the concentrations of metals in the River Zletovska near village Zletovo

By looking at the comparative diagram we show that the highest concentrations are related to the period when the mine was in function. That is the case with lead and cadmium and copper. Throughout 2003 and 2005, their concentration decreases in the lead and copper that is lower than maximum allowable concentrations.



The only exception is the zinc with highest concentration found in the period of 2003 which could be due to increased acidity of the environment. In the researches from 2005 was measured pH value of 7.71 is suitable for deposition of Zn. This fact is based on the concentration decline in this period.

Conclusion

With analyzing of the comparative diagrams related to the concentration of heavy metals in the waters and sediments of rivers Kiselica, Koritnica and Zletovska we can conclude that the present activities of mining related to mining for lead and zinc Zletovo causes contamination of the environment with heavy and toxic metals.

The increased acidity of the environment due to presence and oxidation of pyrite and the lithology of the field that is represented by silicate minerals that have very little ability to mitigate (reduce acidity) in the environment. Contamination does not stop with the cessation of function of the mine but free contaminants released into the environment, and they change its chemical form so that can change the location of its concentration. In acidic conditions they are in a dissolved condition, but with increased the alkalinity of the environment they cross in less soluble forms and deposited in river sediments and surrounding soils. It shows that it takes serious consideration of appropriate methods for removing toxic metals from various parts of the environment in order to establish a proper balance in the ecosystem.

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