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MACROINVERTEBRATE COMMUNITIES IN MINE-WATER AFFECTED STREAMS OF TISZA VALLEY

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ABSTRACT. We selected two mine affected stream, one is the Toka stream near Gyöngyösoroszi, and the other is Baláta stream near Recsk for our study. We selected four sampling sites in Toka stream and two sampling sites in recultivated area of Baláta stream. On site we measured the depth and the transparency, the temperature, the pH, the dissolved oxygen and the saturated oxygen of water, as well as we collected macroinvertebrates. In laboratory further measures (nitrite, nitrate, ammonia, COD_{aMn}, ortho-phosphate, sulphate, sulphide, chloride, suspended solids and concentration of elements) were carried out. The aim of our study was to determine that the phisico-chemical parameters of streams how effect the composition and occurrence of macroinvertebrates and the impacts of the deposited mine tailing pile and to prove the effects of recultivation organisms of Baláta stream. Last years the recovery of the landscape and the habitat has been started in these mine affected areas of Gyöngyösoroszi. Our researches can found the future studies and the long term monitoring, which intend to estimate the success of recultivation.

Keywords: stream, mine, macroinvertebrates

INTRODUCTION

The environmental problems caused by the increasing of pollutant loads discharged into natural water bodies, require a complex amount of information for setting out frameworks of regulation and control (Velísková, 2006). Mining has a significant effect on the environment as it produces the most amount of waste in the industrial section. However after finishing the activity on the area, these discarded mines can also caused adverse effects on the environment, which might be increased highly (e.g. heavy metals pollution). The discharge of heavy metal wastes into the receiving waters may result in several physical, chemical, and biological responses (Moore et al., 1984). The exact nature of the environmental problems caused by mining, which depending largely on the mined material, processing techniques, local geography and geology were studied in some papers. However it is generally accepted that mining negatively affects the local biota, changing the natural community structure and reducing biodiversity (Batty, 2005).

Two mine affected streams, one is the Toka stream near Gyöngyösoroszi, and the other is Baláta stream near Recsk for our study were selected. Four sampling sites in Toka stream and two sampling sites in recultivated area of Baláta stream were chosen. The aim of our study was to determine that the physico-chemical parameters of streams how effect the composition and occurrence of macro-invertebrates unities.

MATERIALS AND METHODS

Baláta stream, which is a mountain stream, is situated in Baláta Valley, on the North-eastern part of Mátra. In the region of Parádfürdő ore explorations have started about 200 years. Mining activity in the first pit (of mine) was started in 1970 then that the activity was continued in the second pit in 1974 so one of the biggest activities has started in the history of the Hungarian mining. Regarding the use of ore many experiments and studies were carried out in case of ore enrichment, environmental protection and water management. Despite of the ideas further development did not happen. In 1998 the deep working was finished in the mine and filled with water (Fig. 1).

In the neighbourhood of Gyöngyösoroszi mining activities were being carried out for centuries. Due to the extensive ore enrichment and mining activities, which were started in 1950, the heavy metal pollution highly increased in the region. Contaminations derived from un-purified mine-water, waste pile, floating pile of ore separator and the bursting of a dam of the slurry reservoir. Currently the re-cultivation process of the area is prepared by Mecsek-Öko Zrt (Fig. 2).

Four sampling sites in Toka stream and two sampling sites in recultivated area of Baláta stream were selected. On site we measured the depth and the transparency, the temperature, the pH, the dissolved oxygen and the saturated oxygen of water, as well as we collected macroinvertebrates. In the laboratory further investigations (nitrite, nitrate, ammonia, COD_{aMn}, ortho-phosphate, sulphate, sulphide, chloride, suspended solids and concentration of elements) were carried out.

RESULTS AND DISCUSSIONS

Based on the water chemical analysing the pH is neutral in both streams. However the pH is increasing mildly in case of the second sampling site of stream Baláta. The conductivity is too high in both streams, however samples received from stream Toka are higher and become higher and higher towards to mouth. The low concentration of suspended solids and the high conductivity refer to high concentration of dissolved

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material (Table 1). This is supported by the concentration of inorganic ions.

Fig. 1 Stream Baláta

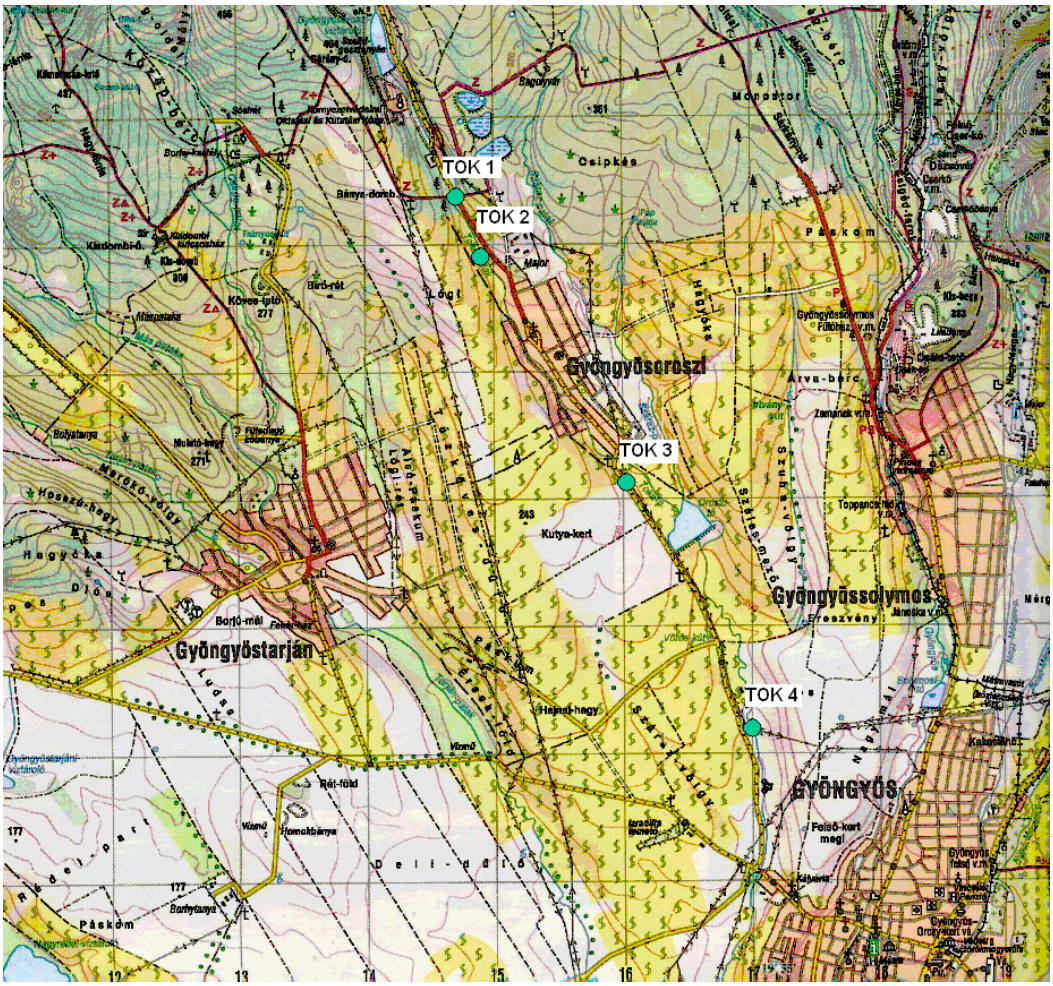

Fig. 2 Stream Toka

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Table 1

Water chemical parameters I.

Sampling sites	Water temperature (^{O}C)	pH	Conductivity (µS cm^{-1})	O_2 (mg l^{-1})	O_2 saturation%	Suspended solids (mg l^{-1})
TOK 1	14,3	6,58	1427	9,63	91,0	1,0
TOK 2	15,3	6,59	1422	9,69	97,4	3,5
TOK 3	16,0	6,51	1440	9,53	99,2	2,5
TOK 4	16,0	6,76	1411	9,73	101,5	5,0
BAL 1	14,5	6,88	876	9,50	95,1	5,5
BAL 2	16,8	7,35	904	9,96	103,2	35,5

Table 2

Water chemical parameters II.

Sampling sites	ortho-PO_4 (mg l^{-1})	NH_4^+ (N mg l^{-1})	Nitrite (N mg l^{-1})	Nitrate (N mg/l)	Chloride (mg l^{-1})	Sulphate (mg l^{-1})	COD_{aMn} (O_2 mg l^{-1})
TOK 1	0,016	0,341	0,035	0,007	15,52	294,91	1,57
TOK 2	0,006	0,341	0,005	0,003	15,91	426,28	2,2
TOK 3	0,016	0,313	0,015	0,024	19,25	434,86	2,2
TOK 4	0,007	0,287	0,003	0,002	20,63	441,38	3,61
BAL 1	0,008	0,287	0,017	0,048	48,33	57,69	4,47
BAL 2	0,001	0,427	0,015	0,018	52,06	68,07	4,24

The nitrogen and phosphorus forms are in low concentration, which refer to the low contamination of organic materials. In both streams the concentrations of chloride and sulphate are high. In case of stream Baláta chloride is higher, while in stream Toka the sulphate is higher which are increasing towards the mouth. These results caused by external loading and the dissolved material from base stone (Table 2).

List of taxa was prepared after the microscopic examination. Totally 24 taxa could be collected, out of this only 7 taxa were found in stream Baláta. In stream Baláta only the Amphipoda, Heteroptera and Plecoptera taxa can be collected. Furthermore it can be interesting that during the sampling only the *Radix peregra* (only one individual) was identified from Mollusca (Table 3). According to the results of the previous studies high concentration of heavy metals (copper and lead) were detected from the collected samples of macrophytes and periphyton. In addition, uptake of copper by benthonic species is directly related to levels in sediments (Moore et al., 1984). Unfortunately, we couldn't measure the sediment in the studies, but in similar mine affected river the high concentrations of cadmium (up to 8.7 mg kg^{-1}) and copper (up to 49.2 mg kg^{-1}) were found in the sediment (Ardelean, 2006).

CONCLUSIONS

We studied stream Baláta which is situated in a re-cultivated area, and another stream called Toka that is under re-cultivation processes.

The aim of our study, were to establish the data of the water chemical parameters in the streams as well as to identify the macroinvertebrates taxa in the selected sampling sites. The results will be a basis for further investigations and detailed analysis of more elements and provide us more information. We are planning to select control streams which are not affected by similar pollutants.

Our further targets to monitoring stream Baláta, to detect the changes in macroinvertebrates communities as a function of time and water qualities. Finishing the re-cultivation in case of stream Toka, we intend to examine the inhabited macroinvertebrates and to compare with the previous ecological status.

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Table 3

List of Taxa

Taxa	TOK 1	TOK 2	TOK 3	TOK 4	BAL 1	BAL 2
Amphipoda						
Gammarus pulex gr.					+	+
Mollusca						
Radix peregra Müll.		+				
Diptera						
Chironomidae		+	+	+		
Limoniidae			+			+
Simuliidae		+	+	+		
Simulium sp.	+					
Prosimulium sp.	+					
Atrichops crassipes Meigen			+			
Odonata						
Calopteryx splendens Harris.			+	+		
Onychogomphus forcipatus L.		+	+			
Trichoptera						
Hydropsyche sp.		+	+	+		
Hydropsyche angustipennis Curt.			+			
Hydropsyche bulbifera McL.		+	+			
Halesus sp.		+		+		
Halesus tesselatus Halb.			+			
Chaetopteryx sp.					+	+
Potamophylax rotundipennis Brau.		+				
Hydroptila sp.				+		
Ephemeroptera						
Baetis sp.			+		+	
Baetis rhodani Pict.	+		+			
Plecoptera						
Nemura sp.					+	+
Heteroptera						
Nepa cinerea L.						+
Gerris lacustris L.					+	
Coleoptera						
Dytiscidae lárva				+		
Total:	**3**	**8**	**12**	**7**	**5**	**5**

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