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Original Article

Microelements Accumulation in sediments. Note II: Nikel Accumulation

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Abstract

In Lapus River, the persistence of contaminants depends on the degree of physical, chemical and biological post-storage rehabilitation, and the geomorphology of the water course, being relatively high. The collected sediments have changed their coloration according to the nature of the gray-brown to brownish-brown impact, and in the sections immediately downstream of the surface contamination sources, a finely coat of colloidal suspensions (flocs) formed following the reaction chemical neutralizing pH. Average concentrations were recorded for Ni in section 2 downstream of mine water discharging into the Lapus River, the trend of contamination being transferred to section 4. The assessment of the level of sediment contamination was made in correlation with aspects related to alluvial transport, hydrology and the morphology of evil.

Keywords: *contamination, downstream, mine, upstream.*

1. Introduction

Water courses can be considered temporary deposits of sediment rich in metals, but wetlands or lagoons are the long-term collector of these metals [3]. As the studied Lapus river portion is not meandered and so there is no possibility of forming such wetlands, it can be deduced that the sediment is permanently transported downstream for long distances and the contaminated area is extirpated [5].

In the floodplains of the Lapus River, on the section under study, the persistence of contaminants depends on the degree of physical, chemical and biological post-storage rehabilitation, and the geomorphology of the water course, being relatively high.

Increasing the frequency of flood events or pollution incidents resulted in an increase in the degree of metal contamination of the sediment and implicitly generated an increase in the concentration of contaminants in the environment of the eostem [2, 1]. Larger metal concentrations are often found in sedimentary fine grain deposits (such as sedimentary deposits with flotation tailings) due to the positive relationship between granule surface and metal concentration [2, 4].

The studies focused on the Lapus River, the upper part of the basin, in the area between Baiut and the river side downstream of the Bloaja Avarii TMF, between 2016 and 2017.

The aim of this study was to identify the nickel accumulations in the sediments collected at the experimental site level during 2016-2017 on four sampling sections.

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2. Material and Method

Lapus River supports the historical pollution with metals, accentuated after 2007 when the mining activity ceased.

Under these conditions the mine waters and clear waters from the two tailings ponds (Bloaja Baiut and Bloaja Avarii) have not benefited from treatment in specific installations, the mine waters being collected underground and the clear waters being discharged in the context of ecology the Bloaja Baiut pond.

In recent years, mine water ramping on the surface of the galleries has generated rising flows of mined water discharged into the Lapus River, and implicitly the increase in pollution, as well as the abandonment and continual degradation of the Bloaja Avarii pond caused the tailings to be trained, contributing to contamination.

Moreover, these mine waters contain mixtures of metals, each of which exceeds the maximum allowed, so there is a high potential for additional or inhibitory effects on the ecology of the river.

Sedimentation samples were taken from the Lapus River from the surface of the sedimentary layer into four sampling sections, respectively, in each of these sampling sections, using the screening procedure allowing only the 0.5 microgram fraction to be separated from the coarse.

Samples were stored in hermetically sealed glass containers, transported to the laboratory where, after agitation, they were transferred into crucibles and subjected to drying in the oven at 105 °C for 24 hours.

The collected sediments have changed their coloration according to the nature of the gray-brown to brownish-brown impact, and in the sections immediately downstream of the surface contamination sources, a finely coat of colloidal suspensions (flocs) formed following the reaction chemical neutralizing pH.

Analysis for the collected sediment samples was performed for Ni by inductively coupled plasma optical emission spectrometry using ICP-OES Perkin-Elmer Optima 5300DV equipment.

3. Results and Discussions

Nickel is known to be influenced by pH changes, with greater mobility at a lower pH of water.

By lowering the pH in the sedimentary layers, mobilization of sediment metals should occur. The pH of the aqueous medium of 4.8 to 5.8 is found to have a depth of 4.5 cm in the sedimentary layer and can reach a pH of more than 6 at a depth of only in values of 8.5 cm.

Consequently, the gradient of pH growth between water and the upper sedimentary state may not increase so strongly in acid waters.

In all sections where significant, singular and / or cumulative impacts were identified, the Ni load of the sediment was increasing as the pH dropped. Thus, from the moment of diminishing the pH value, starting with Section 2, and keeping it within the same limits up to Section 4, the Ni concentration was maintained at a relatively constant level.

The Ni loading level of sediment in section 1 confirms the contribution of the natural fund of the Baiut metallographic area, with high concentrations in Ni, according to sampling site (Fig. 1, Table 1).

As in the case of cadmium, in the 3rd campaign there was a higher concentration of Ni in the sediment probably due to the diffuse contribution of the litogenetic area following the erosion, the training with the precipitations.

In the first two campaigns, the sudden drop in pH in section 2, with the intake of mine water in Lapus, determined the significant increase in Ni concentration in sedimentary substrate from about 19 mg/kg dry substance to 60-61 mg/kg dry matter under different hydrological conditions.

In the third campaign, the high level of Ni in the sediment in Section 1 may be the result of a high rainfall period that has resulted in shore and alluvial bed erosion and has altered the chemical characteristics of the aqueous medium with repercussions on Ni mobility in the sediment.

In the case of Ni, its concentrations measured in the aquatic environment did not exceed the EQS environmental quality standards, however sediment concentrations are substantial, confirming that the accumulation of metals at high concentrations is achieved at the level of the sedimentary layer.

In all sampling campaigns, the nickel concentration in Section 2 was within the same limits, even though it was fluctuating in the reference section 1, suggesting that the sediment in section 1 may remain stationary in the area of this section and not contribute in addition to the deposition of the sediment in Ni in the next section next to that generated by the mine waters.

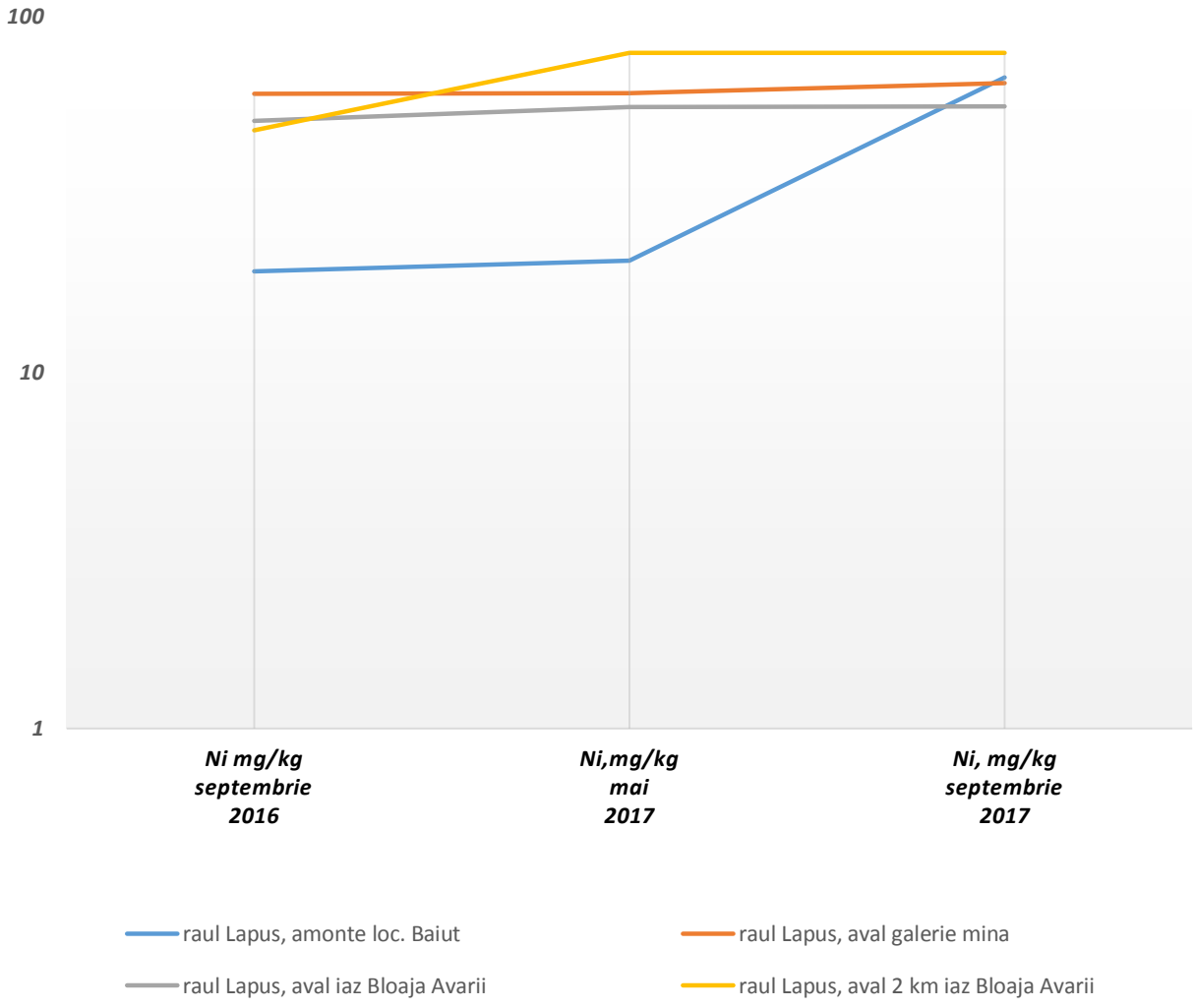

Figure 1. The evolution of the Ni (mg/kg) concentrations in sediment samples harvested from the experimental site, during 2016 – 2017

Table 1. Ni (mg/kg) concentration according to sediment harvesting parameter

Issue	Ni mg/kg September 2016	Ni.mg/kg May 2017	Ni. mg/kg September 2017
Lapus River. upstream Baiut	19.23	20.592	67.3
Lapus River. upstream mine gallery	60.58	61.001	64.89
Lapus River. downstream Bloaja Avarii pool	50.81	55.651	55.9
Lapus River. 2 km doenstream Bloaja Avarii pool	47.9	79.161	79.05

Calculation of the Igeo geo-accumulation index for Ni indicated that the intensity of sediment pollution was considered moderate, but the Ni concentration measured in the sediment was found to be much higher compared to cadmium.

4. Conclusions

Average concentrations were recorded for Ni in section 2 downstream of mine water discharging into the Lapus river, the trend of contamination being

transferred to section 4. The assessment of the level of sediment contamination was made in correlation with aspects related to alluvial transport, hydrology and the morphology of evil.

The two water monitoring sections, upstream and downstream of the studied area, highlighted the Cd concentrations on the basis of which the level of contamination was established, which was subsequently confirmed and justified by the loading of these parameters in the sediment.

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