Chapter 7

CONCLUSION AND RECOMMENDATION

Conclusion

There is a high Pb and Zn content found in the surrounding area. For each element, two significantly distinct populations can be statistically separated. The population with low content of Pb and Zn is corresponding to the regional geochemical background. The high population is centered around the abandoned mine and has a maximum extension down the valley and up to the ridge, mainly along to west, northeast, and southeast direction. For Zn the main dispersion direction extends to the southeast direction. The anomalous values are especially marked for Pb from 31 to 5,270 ppm and from 52 to 5,440 ppm for Zn. The high results are related with geological setting with a natural heavy metal source known in the region in the form of the Pb-Zn bearing ore deposit.

In this study the regional background of Pb and Zn level was set up as a range of minimum values found for each element in the range below 100 ppm. In the study, anomalous Pb and Zn values are 1000 times more than the assigned regional background value. The soils around the abandoned mine are strongly enriched in Pb and Zn and the situation is quite complex. First of all, the region has a high potential in heavy metal mineralization and the regional geochemical background values are high. Numerous surface anomalies indicate mineral occurrences and for this site, except the area disturbed

by mining activities, high Pb and Zn content in other parts of the study area can be considered as "natural contamination" of the soil by Pb-Zn mineralization. In close proximity of mine, where ore sorting floor and transportation ways of past mining activities are observed, very high contents of Pb and Zn were detected in the soils, which can be considered as pollution.

The soil profile of samples with background samples have highest content of Pb and Zn in the bottom layer (50 to 60 cm). The soil profile of Pb and Zn is disturbed in the high level samples.

It can be assumed that a part of these metals budget is related to the natural ore body, from which metals were leached and deposited downstream. It also clear that a part of the budget is the consequence of human activity from previous mining time.

The metal contents in soils, exceptionally high relative to the regional natural background, are unusual and there is a need to have a regional background level to compare and assess with. When the national regulation is not yet available, reference to the regional background level will prove to be a very useful tool for determining the anomaly and threshold level.

Concentrations of Pb and Zn in five ground flora species *Apluda, Anisocampium, Selagela, Microstegium, Ligodium* vary among species. The root part accumulates more Pb and Zn than the above ground parts. Uptake rate of Pb by plants in this study decreased in the order of *Microstegium, Selagela, Ligodium, Apluda, Anisocampium*. For

the plant uptake of Zn the decreasing order is *Microstegium, Ligodium, Apluda, Selagela, Anisocampium.*

Apluda tends to be sensitive to Pb and Zn concentrations less than 500 ppm in soil, in contrast to *Microstegium*, which tends to be sensitive to Pb and Zn levels of more than 10,000 ppm in soil. Both plant species show a high tolerance for extra high concentration of Pb and Zn in soil. They can be chosen for re-vegetation of the site as well as for use as bioindicators for heavy metal pollution in soil. Soil-plant transfer coefficient is a good parameter for assessment of heavy metal uptake by plants.

Environmental monitoring as well as soil media and plant survey are useful to identify the degree of heavy metal loading in the environment, to establish ecosystem guidelines, to identify the pathway and subsequent fate of heavy metals and for risk assessment. The GIS map of thesis work can be base data for environmental risk assessment and for environmental management planning.

Recommendation

1. To better assess the fate of heavy metals, biomonitoring using a wider diversity of biota should be encouraged in areas at risk of toxic metal contamination.

2. The regular monitoring of food and feed products and water pollution by heavy metals in the study area are highly recommended to assess the risk of Pb and Zn coming into the food chain, and to enable a proper planning for crop plantation, settlement and health protection for local people.

3. The regional geochemical background level should be determined on a national scale in order to make a start towards to setting up of national guidelines for environmental quality.