

CONCENTRATION OF Zr, Cr, Cu, Zn AND Fe, Mn IN RIVER SEDIMENTS AND SOILS OF DIFFERENT TYPES OF SOUTHERN BALTIC CATCHMENT

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Introduction

Concentration of metals in soil and river sediment are correlated with their mobility and availability. Human activities affect chemical and physical soil properties what can lead to the change of concentration of trace elements in soils and sediments (Kebata-Pendias and Mukherjee, 2007). The trace elements from anthropogenic sources exist mainly on the surfaces of soils. However, factors such as content of organic matter and fine grains, concentration of SiO₂ or other soil parameters can cause an outflow of metals from soils to the rivers sediments (Pempkowiak, 1997).

Methods

Soil and sediments samples were collected in August 2016. The samples were collected from five rivers which are Gizdepka, Plutnica, Reda, Zagórska Struga and Vistula. These rivers were characterized by different types of catchment. The soil samples were taken from surface layer (0-20cm) and sediment was collected from the river bottom. The samples had been homogenized and freeze dried before analyzing. The concentration of Fe, Mn, Cr, Cu, Zn and Zr was determined XRF method in the laboratory of the Institute of Oceanology of The Polish Academy of Sciences.

Results

The most received concentration of metals were characteristics for unpolluted area. However, some part of them were typical for agricultural soils. The river sediments were characterized by lower concentration of almost every analyzed metal compared to surface soil. Zr was characterized by the widest range of concentration in both soil and sediment samples. Considerable variability was observed for concentration of Zn in soil (fig.1a). The most similar concentration in all of stations was detected for Cu. The highest difference between metal concentration in soil and sediment was in relation to Zr (71%) (fig. 1a,b).

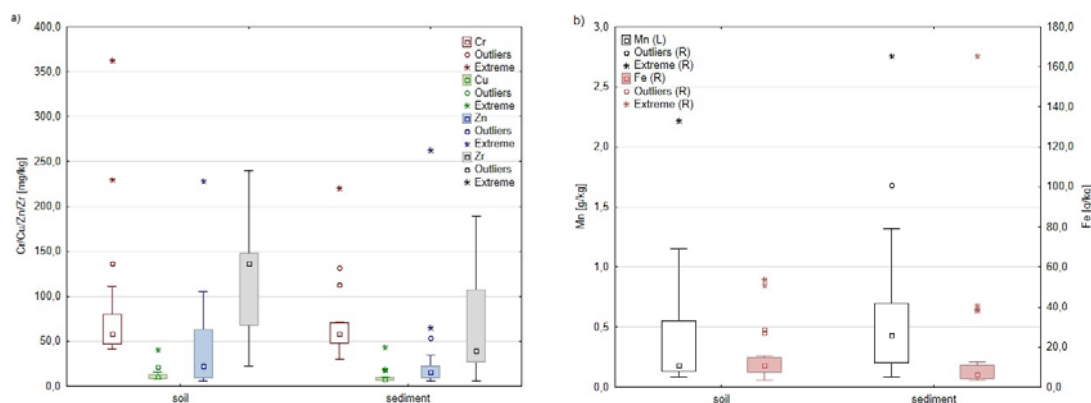


Figure 1. Statistical characteristics of concentration of Cr, Cu, Zn, Zr [mg/kg] (a) and Fe, Mn [g/kg] (b) in soils and river sediments of Gizdepka, Płutnica, Reda, Zagórska Struga and Vistula

Conclusion

Difference between concentration of metals in soils and sediment can depend on different factors such as content of organic matter and fine grains, type of catchment or additional anthropogenic sources. Taking into account analyzed stations, higher concentration of total Cr, Cu, Zn and Zr was detected in the sediments at the source of rivers. Nonetheless, concentration of Zn and Cu normalized to fine grain content showed increased concentration of these metals in all stations localized at mouth of rivers. It can be related to the enrichment of fine grain in Zn and Cu. The extreme concentration of Cr, Cu, Zn and Zr was detected in Zagórska Struga stations. However, the highest concentration of Mn and Fe was found in Płutnica stations. The concentration of total Mn and Fe in sediments at the mouth of all rivers that can be connected with enrichment of organic matter in these metals. It was particularly noticeable at the mouth of the Płutnica station, where content of organic matter was about 70%. Concentration of Zn was typical for agricultural soil. It can be caused by using pesticides and fertilizers with Zn to the production. Due to high directly correlation Cu and Zn to the LOI decrease of concentration of these metals can be connected with the decay of organic matter. Variability in the concentrations of metals in the soil and sediment at the same station can be caused by content of SiO₂ as well. The wide range of concentration of Zr and Zn can be caused by factors like content of fine grains (Kabata-Pendias and Mukherjee, 2007). Taking into account only sediment of stations localized in mouth of rivers, Płutnica and Reda can contribute to increase of concentration of Fe and Mn in the southern Baltic. Moreover, Gizdepka can lead to the increase of concentration of other analyzed metals.

References

- Kabata-Pendias, A.; Mukherjee A.B. (2007). Trace elements from soil to human; Springer, Berlin, Heidelberg, New York, Germany, U.S
- Pempkowiak J. (1997). Zarys geochemii morskiej.; Univ. of Gdańsk, Gdańsk, Poland (in polish)