8.WPGI 2024

The influence of the applied fraction on the results of heavy metal distribution analysis in the Vistula Valley near Kępa Gostecka

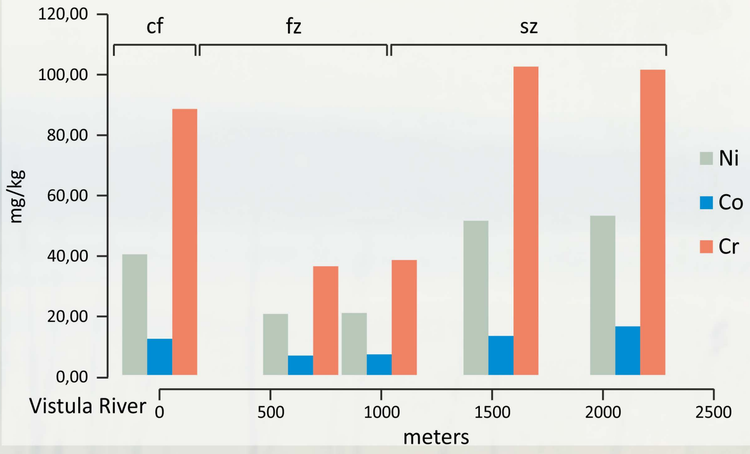
AGNIESZKA KAŁMYKOW-PIWIŃSKA, EWA FALKOWSKA
Faculty od Geology, University of Warsaw, Warsaw, Poland
a.kalmykow-piwinska@uw.edu.pl

The problem of pollution in river valleys with trace elements has appeared in many researches, but studies on the relationship between heavy metal concentration and the pattern of floodplain features are relatively few. They most often concern heavy metal concentration in the floodplain deposits depending on the distance measured from the river channel. However, they do not provide clear results. In most cases, in cross-sections through the river valley, the highest concentrations of heavy metals occur in the immediate vicinity of the channel but some studies show an increase in trace element concentrations with increasing distance from the channel. When comparing these results, it is notable that these studies were conducted on different particle fractions (0.063 mm or 1.0 mm), which undoubtedly influenced the results.

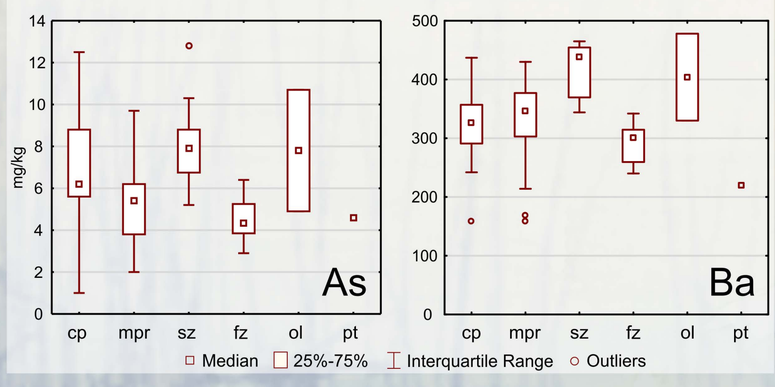
To investigate the impact of the chosen particle fraction on the results of heavy metal distribution on the floodplain, we compared trace element concentrations (Cu, Pb, Zn, Ni, Co, As, Sr, Cd, Cr, Ba) obtained for the 0.063 mm and 1.0 mm fractions.

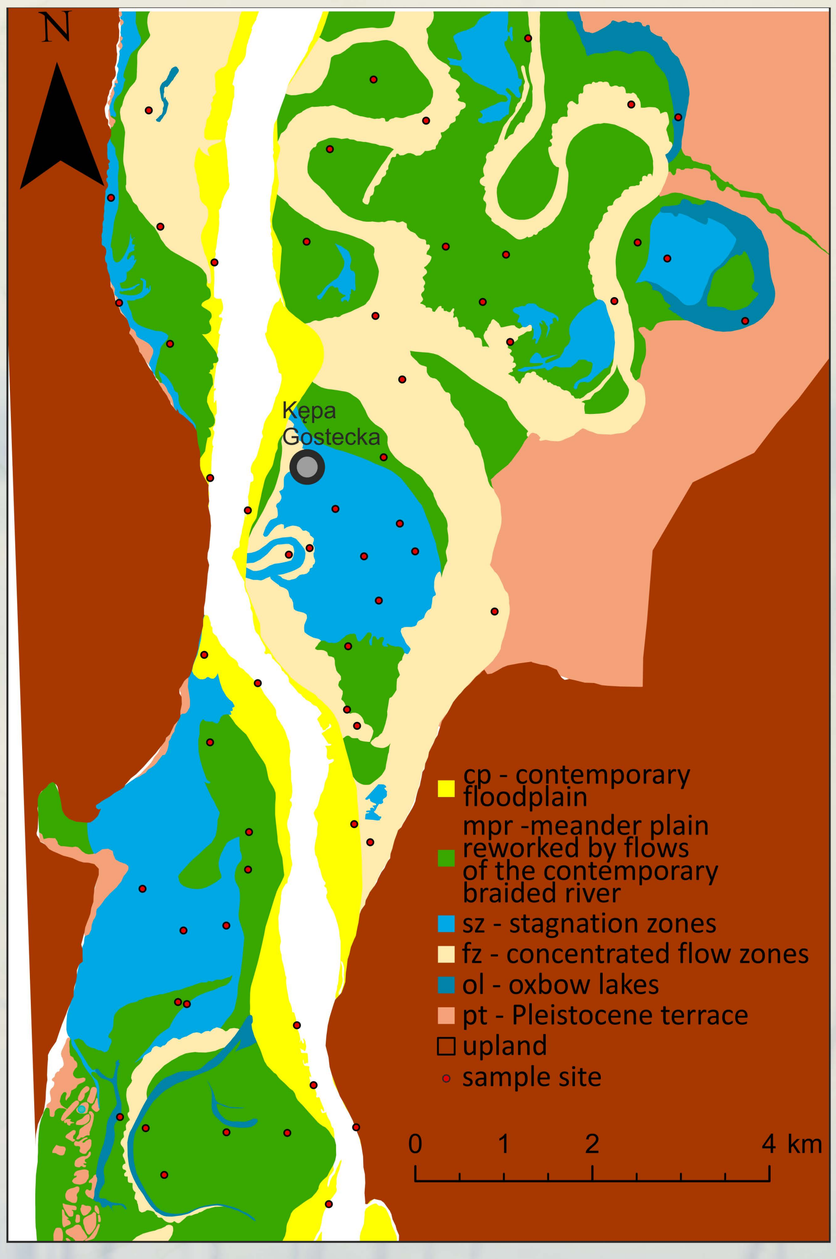
1,0 mm fraction

For the 1,0 mm fraction, there is not a noticeable increase in concentrations of the majority of analyzed heavy metals near the river channel.



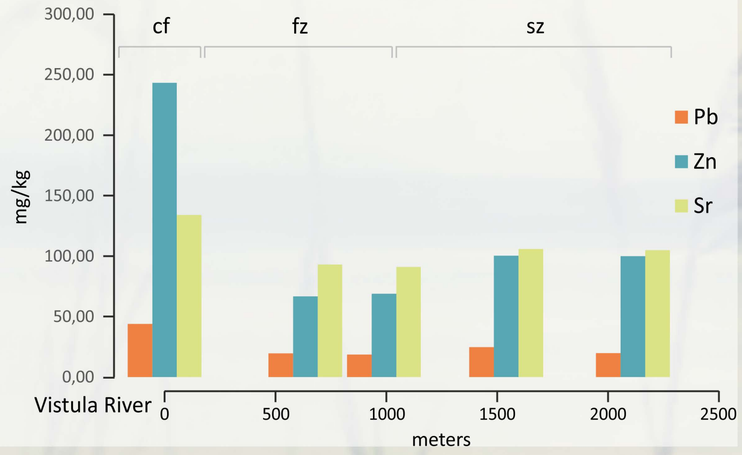
Analysis of the mean concentration of those metals in the deposits of the geomorphological landforms shows differences in the concentrations between the distinguished forms.



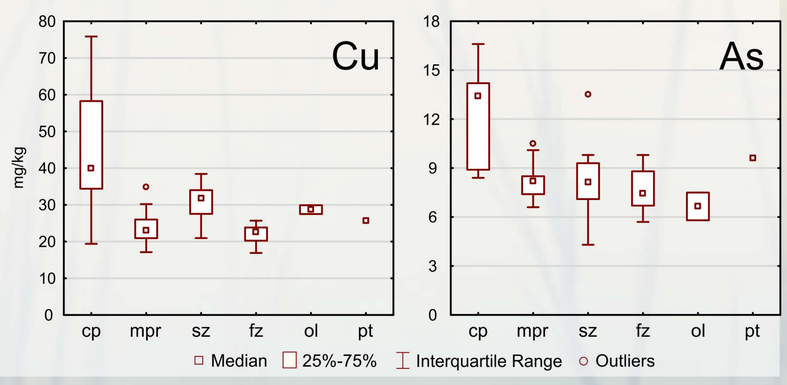


0,063 mm fraction

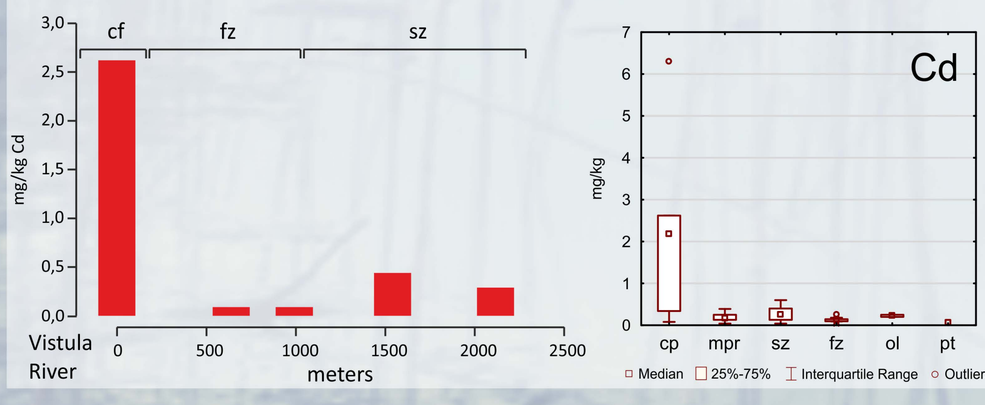
For the 0,063 mm fraction, there is a noticeable increase in concentrations of the majority of analyzed heavy metals near the river channel.



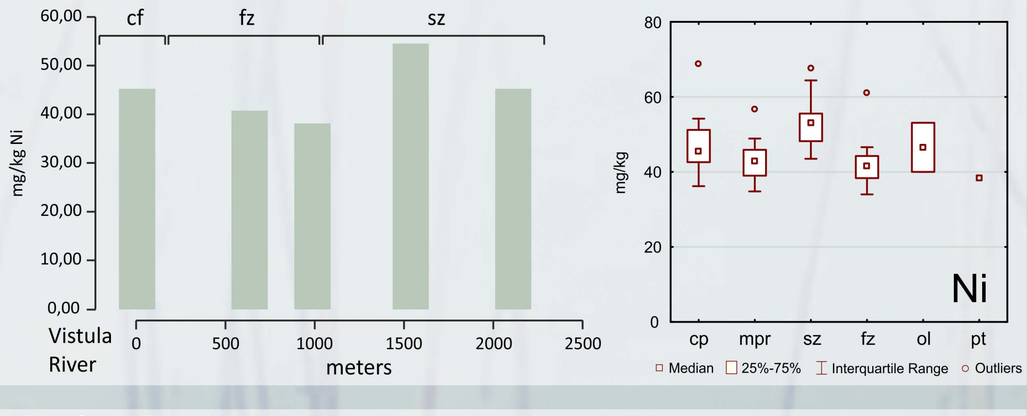
Analysis of the mean concentration of those metals in the deposits of the geomorphological landforms shows that the concentrations in the contemporary floodplain sediments are the highest.

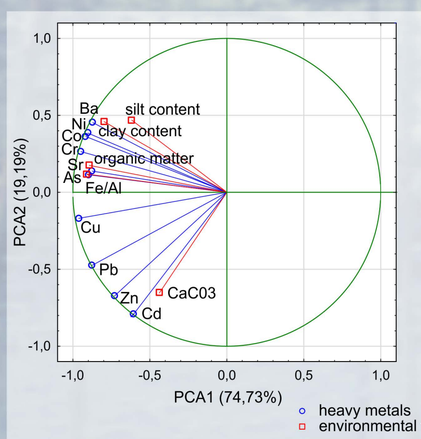


However, there are exceptions – Pb, Zn, Cd. For those metals, there is a noticeable increase in concentrations near the river channel, in the contemporary floodplain sediments.

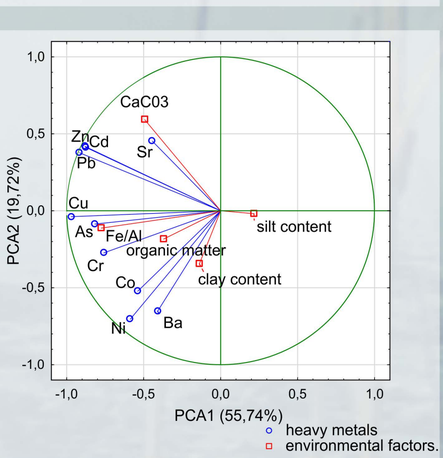


However, there are exceptions – Ni, Co, Ba. For those metals, there is no noticeable connection with the distance from the channel, but there are differences between different landforms.





The PCA analysis for the fraction 1,0 mm shows that the concentration of Pb, Zn, Cd depends on the CaCO3 content - which was found (most often and in the highest concentrations) in the contemporary floodplain deposits.
The concentration of the other elements depends more on environmental factors such as clay and organic matter contents and Fe/Al relationship.



The PCA analysis for the fraction 0,063 mm shows that the concentration of Ni, Co, Ba depends on the clay content and (same as in the 1,0 fraction) concentration of those metals reflects the clay content in distinguished forms.
The concentration of Cu, As, Sr, Cr (elements whose concentration shows in the 0,063 mm fraction increase near the river channel which isn't visible in the 1,0 mm fraction) depends mostly on the Fe/Al relationship (which in the fraction 0,063 mm in the contemporary floodplain is higher than it was in 1,0 mm fraction) and CaCO3 content.

Conclusions:
The analysis of heavy metals concentration across the river valley shows the differences between those conducted on the fractions 1,0 and 0,063 mm.
The concentration of heavy metals depends on the geomorphology of the river valley.

UNIWERSYTET WARSZAWSKI

Selected references:
Falkowska E, Falkowski T, Tatur A, Kałmykow-Piwińska A. Floodplain morphodynamics and dis-tribution of trace elements in overbank deposits, Vistula River Valley Gorge near Solec nad Wisłą, Poland. Acta Geol Pol. 2016;66:541–59.
Kałmykow-Piwińska A, Falkowska E. Morphodynamic conditions of heavy metal concentration in deposits of the Vistula River valley near Kępa Gostecka (central Poland). Open Geosciences. 2020;12(1): 1036-1051.