Geophysical Research Abstracts
Vol. 20, EGU2018-4180, 2018
EGU General Assembly 2018

Migration of pollutants in the floodplain fill and how to recognise it (the Litavka River, the Czech Republic)

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The Litavka River downstream of the city of Příbram (Czech Republic) drains a polymetallic ore district with mining activities since early historical times. Ore mining and metallurgy during several hundred years with a peak between 1850 and 1950 have strongly impacted the fluvial system of the Litavka River. The river floodplain is therefore heavily polluted by risk elements, in particular Pb, Zn and Cd. The Litavka River was also influenced by uranium ore mining between 1948 and 1989.

Severe contamination of the Litavka River system is well known, but the spatial distribution of pollutants in the floodplain fill has yet been poorly documented. Moreover, the alluvial architecture and specific distribution of contamination have not been fully understood yet. In the building of the Litavka floodplain fill, the lateral deposition of the sediments has apparently dominated. Furthermore, the sediment reworking in the channel belt has also been important. Floodplain architecture visualised by geophysical imaging shows signs of the past channel avulsions.

We can distinguish three pathways of floodplain sediment pollution: a fluvial deposition mainly from ore processing, an atmospheric deposition by metal smelting, and post-depositional migration. The latest has produced high-concentrations of pollutants in isolated peaks more than 1 m deep below weakly polluted or unpolluted deposits, which can be found relatively far from the current channel belt. These stratigraphically anomalous enrichments occur when pollutants migrated from previously deposited sediments or perhaps from side channel/ditches in the distal floodplain.

Our aim was to distinguish fluvial and migration pollution pathways using stratigraphic correlation method and use of non-migrating sediment components related to pollution history. The vertical and horizontal mobility of the ions (contaminants), as well as their potential return to the channel, was investigated for both uncontaminated and polluted parts of the floodplain. Such information is necessary for the prediction of the mobility of contaminants in the river system and thus the spread of pollution.