

EGU2020-18549

<https://doi.org/10.5194/egusphere-egu2020-18549>

EGU General Assembly 2020

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Recycling of mercury pollution in the fluvial system - revitalize or not?

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The catchments of the Kössein and the Röslau rivers (north-eastern Bavaria, Germany) was impacted by pollution from Chemical Factory Marktrechwitz (CFM). The CFM produced Hg compounds for almost 200 years until the severe pollution of the factory surroundings and the Kössein River was revealed in the 1980s. The channel belt of the Kössein-Röslau rivers downstream the CFM is now one of the most severe Hg pollution hotspots in Central Europe. At the present days, more than 30 years after the factory abandonment, the Hg concentrations in fish muscles reach up to 6 mg/kg in the Skalka Reservoir, which acts as a sedimentary trap for that pollution.

The main vector for the actual fluvial recycling of Hg is suspended particulate matter (SPM) formed by the fluvial erosion of the channel belt. In previous work we found out that the Hg inventory in the Kössein-Röslau river system is approximately 20 t Hg deposited in a 22 km long channel belt, mainly as easily thermodesorbed form, perhaps natural organic matter bound Hg (NOM-Hg). Because the Kössein and the Röslau rivers still export SPM with mean concentrations of approximately 20 mg Hg/kg, revitalization options to stop Hg pollution recycling should be considered. We studied the Röslau River floodplain upstream the confluence with the Eger River, situated just upstream the inlet to the Skalka Reservoir. This locality is used for cattle grazing although Hg concentration up to 122 mg/kg can be found in some sediment strata and approximately 45 mg/kg is in topsoils. The locality has been investigated by geophysical methods ERT (electrical resistivity tomography) and DEMP (dipole electromagnetic profiling) to reveal the floodplain subsurface sedimentary architecture, because it is a key to find recent geomorphic traps for the polluted sediment. The floodplain was then sampled after drill coring, Hg analysis was performed by AMA-254 and element analysis by XRF. We found a close correlation between Zn and Hg concentrations, which facilitated the study of the pollution hotspot. We found three facies types of polluted sediments: channel belt (up to 122 mg Hg/kg), fills of shallow flood channels in floodplain (up to 73 mg Hg/kg), and top strata of overbank fines (up to 56 mg Hg/kg). The knowledge on the pollution distribution is essential for the future revitalization and protection measures.