



Heavy metal contamination in the rivers Tisza and Szamos from 2000 to 2005

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In early 2000, two major mining-related accidents occurred in the Maramures County in Romania which caused the release of large amounts of cyanide and heavy metals into the rivers Szamos and Tisza (a major tributary of the Danube). The high concentrations of cyanides killed almost immediately more than 1000 t of fish on the Hungarian side. Cyanides pose a short-term threat to the environment due to their degradability. In contrast, heavy metals deposit in the river catchment area and can accumulate in the food web due to their lack of degradability, which results in a long-term threat to the ecosystem and to humans. To assess the contamination, sediments were sampled along Szamos and Tisza in Hungary from 2000 to 2005. The aqua-regia soluble element contents and the bonding forms of selected elements were analyzed in the grain size fraction $< 20 \mu\text{m}$. Heavy metal concentrations in sediments were initially high at the Szamos ($< 3000 \text{ mg/kg Zn}$) and decreased with increasing distance from the mining accident (ca. 500 mg/kg Zn in the middle section of the Tisza). In 2005, the trace element concentrations in the Szamos have decreased to a level slightly higher than in the Tisza. The concentration decline is probably caused by dilution with "uncontaminated" sediment, transport of contaminated substrate further downriver as well as transport out off the river onto the floodplains. Most of the sediment profiles do not reflect the mining accidents of the year 2000, which indicates a long history of heavy metal contamination in the Tisza catchment. Cluster analysis discriminates three sections of the research area: (1) Szamos, (2) middle Tisza and

(3) lower Tisza. This pattern is based on the contamination level ranking from high to low. Over the observed years the element pattern changed only marginally: (1) Cd-Pb-Zn, (2) As-Cu, (3) Cr and (4) Co-Ni. Although the decrease of the sedimentary heavy metal concentration gives a positive impression regarding the sediment quality, potential sinks of the contaminants should be determined. Therefore further research is needed to assess the effect on floodplains, because they are due to their agricultural use integrated in the human food web.