

How to find the sedimentary archive of fluvial pollution in a bedrock-confined river reach

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The Ohre River springs in the Eastern Germany and it is a tributary of the Labe (Elbe) River in Northwest Bohemia. The river received pollution from several sources during the last five centuries. Most of the pollution sources located along the upper and middle reaches, where the depositional and erosional pattern of the river is highly variable. The upper part of the catchment consists of mainly felsic rocks and the river has a broad floodplain. The middle reach and its right-bank tributaries are deeply incised into the Doupovske Hory Mts., which consists of mafic volcanic rocks; whereas the left-bank tributaries are incised into intrusive and metamorphic rocks of the Krusne Hory Mts. (Ore mountains) with several local ore mines (Ag, Pb and U) in particular in around Olovi and Jachymov. Due to the geologic and geomorphologic complexity, deposition of historical sediments in the middle reach has been spatially limited and uneven, and anomalous background concentrations of risk elements are expected. As a consequence, in the middle reach of the Ohre River it is difficult to find a useful sedimentary archive of historical pollution, though it is desired for two main reasons: (1) to decipher the undocumented and poorly described pollution history from the Krusne Hory Mts. and (2) to better understand the retention of pollutants in the transport zones of a confined river system.

Based on historical maps we identified a side-bar (35x320 m) in the middle reach of the river near Straz on Ohre and aimed to describe its formation, its recent erosion/deposition history and to evaluate its sedimentary archive value. In the first half of the 19th century it was an island separated from the valley edge by a side channel. Since then there has been no apparent lateral accretion of the bar (its shape has not been changed), but the upstream part of the side channel aggraded by a sediment plug. We evaluated the current bar topography and geomorphology by a detailed field survey, dated the sediments by dendrology and OSL dating, and performed in situ XRF analysis of sediment cores. The data show that the downstream head of the bar is the oldest and most of fine sediments (mostly sand, minor silt) of the bar material have been historically polluted by Pb mining.

The sedimentary sequences, most valuable for reconstruction of recent pollution, were found in the side channel where the fill the representing the last ca 150 years pollution history (Hg and U). The body of the bar has been formed earlier. According to our hypothesis the bar originated as a direct consequence of historical mining in the nearby Jachymov Ore Region. The use of lateral fluvial deposits as a sedimentary archive definitely requires intensive application of fluvial geomorphology. Vice versa, pollution patterns will allow delineating areas, in particular the bar bank and inlet to the side channel, where intensive reworking (erosion/redeposition) occurred as documented by the microtopography and woody debris.