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Grain-size dependence of mercury speciation in river suspended matter, sediments and soils in a mercury mining area at varying hydrological conditions

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1 **Grain-size dependence of mercury speciation in river suspended matter, sediments and**  
2 **soils in a mercury mining area at varying hydrological conditions**

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10

11 **Abstract**

12 Suspended matter (SM) plays an important role in the transport of mercury (Hg) in aquatic systems.  
13 Information about Hg-species in this material is crucial to understand risk potential, especially for Hg  
14 methylation and bioavailability. In the Idrija Hg mine (Slovenia) cinnabar ( $\alpha$ -HgS) was mined and  
15 processed for centuries. These activities caused contamination of the Idrijca river system by dumping  
16 of ore roasting residues, as well as atmospheric Hg deposition in soils attributed to excessive Hg  
17 emissions from the roasting plant. Cinnabar is the dominant Hg-species in the coarse-grained  
18 sediments of the Idrijca river where Hg methylation is generally low, whereas natural-organic-matter-  
19 bound Hg (NOM-bound) has caused intense Hg methylation in the Gulf of Trieste (GT), the final sink  
20 for Hg released from the Idrijca catchment. Hydrology of the Idrijca river is characterized by high  
21 discharge events during heavy rains and snowmelt, which transports large amounts of SM towards the  
22 GT. However, the dominant Hg-species transported in SM and their specific source under varying  
23 hydrological conditions is largely unknown, yet crucial to predict future transport of bioavailable Hg  
24 forms from the mining area to the GT.

25 We analyzed Hg concentrations and Hg-species (Hg-thermo-desorption) in SM and different grain size  
26 fractions of soils from the Idrijca catchment to evaluate changes in solid phase Hg-species under low  
27 and high flow conditions. Concentrations of dissolved Hg did not change significantly during low and  
28 high flow (median: 21.3 to 28.1 ng L<sup>-1</sup>, respectively). Hg concentrations in SM in tributaries decreased  
29 with distance (~ 30 km) from the mine from 32.7 to 0.47 mg kg<sup>-1</sup> related to Hg concentrations in fine

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