

# Relationship between recurrent Resuspension of polluted sediment and water quality: a case study of the Deûle River

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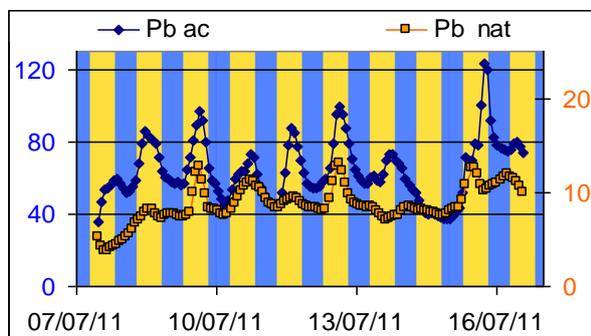
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**Introduction:** The Deûle River is now studied for some years because of its two particular features: 1) a heavy sedimentary pollution of zinc and lead due to metallurgical activities and 2) recurrent resuspension of surface sediment due to boat traffic. The analysis of the data set has permitted to go further on the role played by the boat traffic on the water quality of this river canal.

**Methods:** Both sediment and water column were investigated. Sequential extractions of metals [1] as well as interstitial water analysis were performed in the surface sediments. In the water column, dissolved and particulate metals were analyzed after filtration and digestion. Chelex DGTs for metal quantification were used as well to estimate in the water column the labile fraction of trace metals. A voltammetric system [2] allows to monitor every 90 min the electrolabile fraction (EIF) of Pb and Zn as well as their acid leachable fraction (AcF).

**Results:** In the water column, the average concentrations of total dissolved Zn and Pb were 30.7 and 6.3 µg/L respectively. The average concentrations in the pore waters were found quite similar but with a great variability from one campaign to another. DGT measurements revealed a lability close to 100 % for Zn but only around 5 % for Pb.



**Fig. 1:** Variation of the electrolabile fraction (EIF) and acid leachable fraction (AcF) of Pb in the Deûle River in 2011.

Average concentrations of Zn and Pb in the surface sediment were 5.10 and 1.2 g/kg, respectively and

more than 25% of each metal were relatively easily exchangeable according to the sequential extraction results.

Daily cycles of Pb and Zn EIF are observed in the water column (Fig. 1). Pb and Zn concentrations measured by voltammetry increase during the day and drop down to a background level at night. This behavior is well correlated to the turbidity.

**Discussion:** Benthic fluxes measured previously are not significant enough to explain the quick changes of metal concentrations in the water column within 24 hours. Natural diel cycles (bound to the temperature variations and the biological activities) as evidenced in the literature [3] should be found in phase opposition with those observed Figure 1. The resuspension events of the sediments are then the most probable cause of the diel cycles observed. Influence of the pore water dilution on the trace metal variation in the water column was investigated by calculations and this phenomenon appears insignificant.

Thus, desorption from and/or dissolution of resuspended particles seem to be the main processes, that control the increase of EIF Pb and Zn in the Deûle River during the day. Sequential extractions reveal the substantial presence of metals bound to carbonates, AVS and iron and manganese (oxo)hydroxides. The correlation between turbidity and EIFs being good, with no shift in time, the slow dissolution of PbS and ZnS has been discarded to explain the production of dissolved metals within a few hours. Finally, quick desorption of Pb and Zn due to the dilution of the sediment particles in the water is then considered as the main factor controlling the behavior of these two metals during the day.

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**References:** [1] Rauret (1998) *Talanta* **46**:449-455; [2] Superville et al. (2011) *Talanta* **87**:85-92; [3] Nimick et al. (2011) *Chemical Geology* **283**:3-17.