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Tracing urban metallic pollution in the Seine River (Paris, France) using environmental magnetism

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Recent studies highlight the significant impact of road traffic on the urban environment (air, soil, water), in addition to other sources of pollution (industrial plants, urban dust, waste water, run off, etc.). Highly magnetic iron-rich particles associated to heavy metals are often linked to these urban pollutions. Thus, urban river sediments such as in the Seine River (draining the area of the mega city of Paris) play an important role as sink of these various anthropogenic particles.

In this study, we report on magnetic analyses on fluvial bank and river bed sediments of the Seine River to determine their magnetic properties (susceptibility, hysteresis parameters, isothermal remanent magnetization) and to estimate the presence and spatial concentration of superparamagnetic to multi-domain particles. The results presented here show a general increase of the concentration in magnetic particles from upstream to downstream Paris, likely linked to different types of urban pollutions, as previously observed for suspended particulate matter in the Seine River (Franke et al., 2009; Kayvantash, 2016).

Geochemical analyses were performed on selected samples to compare river bank and bed sediments to the suspended particulate matter along the Seine River profile. The results show a clear linear correlation of typical anthropogenic elements (e.g. Sb or Pb) with the suspended particulate matter samples that strengthen the hypothesis of an anthropogenic input responsible of the increase of the magnetic signal. As for the river bank and bed sediments, the link between the concentration of chemical elements and magnetic signal is less straightforward and needs more detailed insight into the potential influence of the redox- or suspension-redeposition cycles of the respective carrier phases.