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# Deciphering particulate Zn and Pb origin during flood event using a geochemical fingerprints.

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The pollution linked to anthropogenic pressure since the industrial revolution can be retained in environment for a more or less long period. Among these pollutants, heavy metals are of particular interest due to their danger for the environment. The Orne watershed, a Moselle tributary (NE France) was strongly impacted by iron and steel activities during the last century leading to massive deposition of steel-making wastes (SMW) into the river. Those SMW are highly enriched in metals particularly, Zn and Pb. In order to trace potential contribution of those SMW into the River system, suspended particle matter (SPM) were studied for their content and Pb and Zn isotopic composition.

The aim of this work is to study the origin of SPM during a flood event and determine the contribution of each source of particulates Pb and Zn. For this purpose, spatio-temporal evolution of suspended particulate matter (SPM) as a function of water discharges was conducted in 2021 in the Orne River.

During the flood event, SPM contents closely followed river discharge with a maximum value (75 mg/L) coinciding with the discharge peak (23 $m^3/s$). Our results showed range from 300 to 900 mg/kg and from 60 to 180 mg/kg for Zn and Pb respectively. The highest content for both Zn and Pb are measured during low water discharges while the lowest content are measured during high water flow. The SPM collected during this flood monitoring tend to be more enriched in heavy Zn isotopes rather than light isotopes ($\delta^{66}Zn$ range from 0.14 to 0.41 ‰) and revealed a restricted variation in $^{206}Pb/^{204}Pb$ ratio ($^{206}Pb/^{204}Pb$ isotope ratios range from 18.418 to 18.492). Element contents and isotopic fingerprints evolution in SPM during distinct stages of the flood were attributed to successive dominance of different water masses transporting material from different sources, that include natural material (due to the erosion of the watershed) and anthropogenic contribution (current pollution and inherited SMW contribution). This work demonstrates that chemical and isotopic tools can be used as fingerprints to trace the sources of particles in such a watershed during flood events.