Trees as sensors of metallic pollution dissemination during past flood events

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Anthropogenic activities such as mining are responsible for acid drainage and metal-enriched waters that in turn contaminate river ecosystems downstream due to the weathering of exposed minerals or tailing dam failures. The release of heavy metals is especially disturbing because of their high toxicity and long permanence. Detecting highly polluted areas and their links with high (low) water flow stages can contribute to a better land management of affected areas. Here, we test if trees growing in different geomorphic positions along a river record heavy metal uptake during past floods. To this end, we applied dendrochemical analysis to twenty-five Pinus pinaster Ait. growing on the banks of Odiel River flowing into the Atlantic Ocean located in south-western Spain. In addition, five trees disconnected from the river channel were sampled as references values. For each tree, we extracted 1 cm-sized increment cores. After dating dendrochronologically, we isolated tree-ring sequences into 5-year blocks matching with the dates of major floods in the catchments. Samples were then analyzed using an Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Our results suggest coherence between tree locations and the amount of heavy metal accumulated in the tree over the last decades. Thus, we clearly show a control of river morphological units on the heavy metal concentrations in trees, being higher in those trees located on meander cut banks than in trees on point-bar sedimentary structures. We conclude that trees could be a natural proxy to trace chemical dispersion and pollution related to flood events in highly anthropogenic catchments.