



Sedimentation and contamination patterns of dike systems along the Rhône River (France)

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Humans have historically modified the Rhône River, especially in the last centuries. In the 19th century, the river was systematically embanked for flood protection purposes, and works continued along the 20th century with dike system engineering work for navigation. The Rhône was canalised and its historical course by-passed by a series of hydroelectric dams. Besides, industrial activity polluted the river. For example, high levels of PCB's were attributed to the inputs of the heavily industrialized zone downstream from Lyon. During floods, these contaminants, associated with the suspended sediment, were trapped by the engineering works and the floodplain. Currently, a master plan to reactivate the river dynamics in the alluvial margins by removing the groyne-fields and dikes in the by-passed sections is being implemented. Within this context, this work aims to assess historical dynamics of sediment and associated contaminants in the floodplain (e.g. trace metal elements), notably in the dike system, in order to evaluate the contamination risk related to bank protection removal. With this objective, a transversal methodology has been applied coupling GIS diachronic analysis (old maps, bathymetric data, Orthophotos, LIDAR, etc.) to understand the historical floodplain evolution, sediment survey to obtain sediment thickness (metal rod and Ground Penetrating Radar), and sediment sampling (manual auger and core sampling) to obtain the metal element concentrations (X-Ray Fluorescence and Inductively Coupled Plasma Mass Spectrometry). By this way, metal element patterns were defined and used as contamination tracing indicators to apprehend the contamination history but also as geochemical background indicators to define the sediment source influence. We found that sediment temporal patterns are directly related with the by-pass construction year. Spatially, fine sediment deposition predominates in the dike systems, being lower in the floodplain already disconnected in the 20th century. Sediment thickness tends to increase in the dike systems following downstream direction. Coupling trace elements (Cu, Zn, Pb) and sediment patterns, metal pollution is mainly observed in the 1970's deposits, similarly to previous studies focused on PCB. These results constitute basic information to inform managers and improve restoration actions that are currently implemented in the Rhône River.