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Synchrotron x-ray and electron micro-probe study of contaminated dredged sediments.

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Sediments originating from periodic dredging of waterways were traditionally disposed of in storage sites without any precautions or treatments. There may be some environmental concerns especially when the dredged material comes from historically contaminated areas such as the North French coal basin.

This study aims to characterize the metal mobility (mainly Zn and Pb) in deposited dredged sediments by combining chemical and spectroscopic techniques. The sediments consist of a silty fraction ($\sim$ 40 %: dominant quartz, minor feldspar), carbonates and a clay fraction (illite dominant, illite-smectite mixed layer, kaolinite). This mineralogical heterogeneity and the observed grain-size distribution (70 to 80 % wt of the total sediment is $<50\mu$m) lead to a need to use microbeam techniques to identify Zn and Pb carriers. Electron probe micro-analyse (EPMA) combined with microbeam x-ray fluorescence (μXRF) at Synchrotron sources were used to identify Zn and Pb carriers. In particular Zn and Pb distributions in thin-section samples were determined by μ-XRF elemental mappings. EPMA was used to determine the distribution of light elements for which the energy of the emission lines is below 4 keV (Si, S, P…). The presence of reduced (sulphides) and oxidized (sulphates, oxihydroxides) phases strongly suggests that the redox state is one of the major parameters controlling the metal mobility. Therefore x-ray absorption spectroscopy experiments were also performed to study the oxidation state in both bulk samples and on selected regions of interest in thin section samples. Preliminary chemical analyses

In this work, the potential effects of the sample preparation on phase's structure and redox state were also studied and will be presented. In particular measurements using x-ray absorption spectroscopy were carried out on air dried or lyophilised powders and on samples stored in a cryogenic environment after sampling. For the latter, we studied the evolution of the iron oxidation state during the sample warm up (from -190°C to 20°C).

To conclude, the need of further investigations will be discussed.