



Geochemical and Historical study of a 700 year old pond, Lansquenet -Lorraine, France- A multidisciplinary approach

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The pond of Lansquenet, in the north eastern part of France, was artificially created in the thirteenth century, for fish farming/fish breeding. The analysis of historical records provided information about the evolution of land use in the vicinity of the pond and in the upstream watershed, about the management of its fishery resources and could evidence striking meteorologic events (floods, draughts) over the last centuries. Additionally, sedimentary deposits could be sampled as core samples on a final depth of 2m35. Such sediment cores were submitted to sedimentological, palynological, mineralogical and geochemical (organic and inorganic) analyses. The organic matter content varies from 1 to 4% of total organic carbon throughout the sedimentary record. The combination of palynological data and organic geochemistry allowed us to reconstruct the evolution of vegetation around the pond. The deepest sediments are characteristic of a swamp. A particular level between 1 and 1.2 m, dated between 1040 and 1378 years AD retained our attention due to accumulations of woody material. This portion of sediments is characterized by an increase of terrigenous inputs as shown by molecular biomarkers (TOC, C/N, TARHC, C29/C27(ST), perylene) and by a relatively (more) oxic environment as suggested by organic markers (Pr/(Pr+Ph), Hopenes/Hopanes) as well as by the apparition of gypsum (X-ray diffraction), strongly suggesting a low water level period. From the 1 m depth layers to the upper layers, the organic inputs evolve toward an increasing contribution of emerging macrophytes indicating an eutrophication of the pond in the last decades evidenced by the occurrence of genus spirogyra and the high concentration of n-C17. Whereas the PAH concentrations remain very low in the deeper layers with a distribution assigned to biomass combustion, the last five decades are marked by an increase of PAH concentrations originating from petroleum combustion. Traces of coprostanol, a marker of human faeces and waste waters, are also observed during the same period. A second oxic event was recorded at a depth of 60 cm, associated with high organic matter degradation evidences. The oxic events could be indicative of draining occurring regularly in the management of such a pond. Draining events could also be evidenced from iron, manganese, and some trace elements concentrations determined by ICP-MS and ICP-AES analyses. Mineralogy and mineral geochemistry provide different and complementary indicators about the history of sedimentation in the Lansquenet pond. Chronological shifts could be evidenced between organic and mineral tracers, suggesting different kinetics of answer to an identical event or different levels of answer for an identical event. While this sampling site was selected as an aquatic medium with low anthropogenic impact, human influence could however be evidenced.