

SORPTION OF ORGANIC MATTER ON CLAY MINERALS IN AQUATIC SYSTEM: INFLUENCE ON SEDIMENTARY ORGANIC PRESERVATION. AN EXAMPLE OF A LACUSTRINE ENVIRONMENT (LAC PAVIN, FRANCE)

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Sorption of organic molecules on clay surfaces in aquatic environment influence organic sedimentation fluxes to bottom water and to sediment. It is well known that physical and chemical interactions produce the flocculation of organo-mineral complexes. Flocculation decrease the transfer time across the water column and thus the risks of oxidation and/or bacterial recycling in this environment. Other studies, based on analyses of organic matter in sediments, revealed also that direct contacts between clay surfaces and organic molecules influence molecule availability to benthic fauna and bacteria. Many studies conclude that mineral sorption can be considered as one of the preservation mechanisms, leading to incorporation of metabolisable organic matter in sediments. The most part of these studies based their conclusions on analyses of sediments but never fully considered sorption processes resulting to organic matter preservation.

Many questions in this topic remain unresolved. Does sorption of organic molecules on clay minerals can occur in the water column, i.e. before sedimentation? Which organic molecules can be fixed on clays? What is the reactivity of these organo-mineral complexes in deep water? Does interaction can be considered as an efficient process for organic molecules protection, leading an efficient transport of organic matter from the dynamic water column to sediments?

The aims of this work are first to test the possible *in situ* sorption of organic molecules on clay minerals, in a lacustrine environment, and secondly to test the stability of the organo-clay complexes formed under these conditions. In this respect, the behaviour of natural organic matter in presence of synthetic saponites (high- and low-charge Na-smectites) has been studied in oxic and anoxic levels of an oligotrophic meromictic crater lake (Lac Pavin, Massif Central, France). Clay samples were positioned in traps, closed by two membranes, allowing only circulation of dissolved organic matter. Interactions were interrupted on the spot, after 3, 10 and 21 days of immersion.

Bulk chemical analyses showed the presence of organic carbon, associated with clays after interaction with the water lake. Low-charge saponites present higher organic carbon concentrations than high-charges, suggesting the non-prominence of cation bridge linkages between organic molecules and clay surfaces. Molecular pyro-GC/MS investigations, performed on clays, revealed the sorption of n- and iso- fatty acids, alkanes and alkenes, in significant amounts (Figure 1). The molecular pyro-GC/MS analyses of organic extracts carried out on waters emphasized the existence of selectivity during fixation, since the same molecular fractions are present in waters and associated to clays, but in contrasted relative proportions.

X-ray diffraction analyses, performed on the two saponites, proved the lack of molecular intercalation in clay mineral structure. ESCA analyses showed a loss of sodium in the interlayer space of the two saponites, and its probable substitution by divalent iron in anoxic deep water. Failure of extractions by saponification and organic solvents, tested on sorbed molecules, indicates the strong stability of the assemblages between clays and organic molecules. This strong relationship could explain the organic matter preservation under lacustrine water conditions.

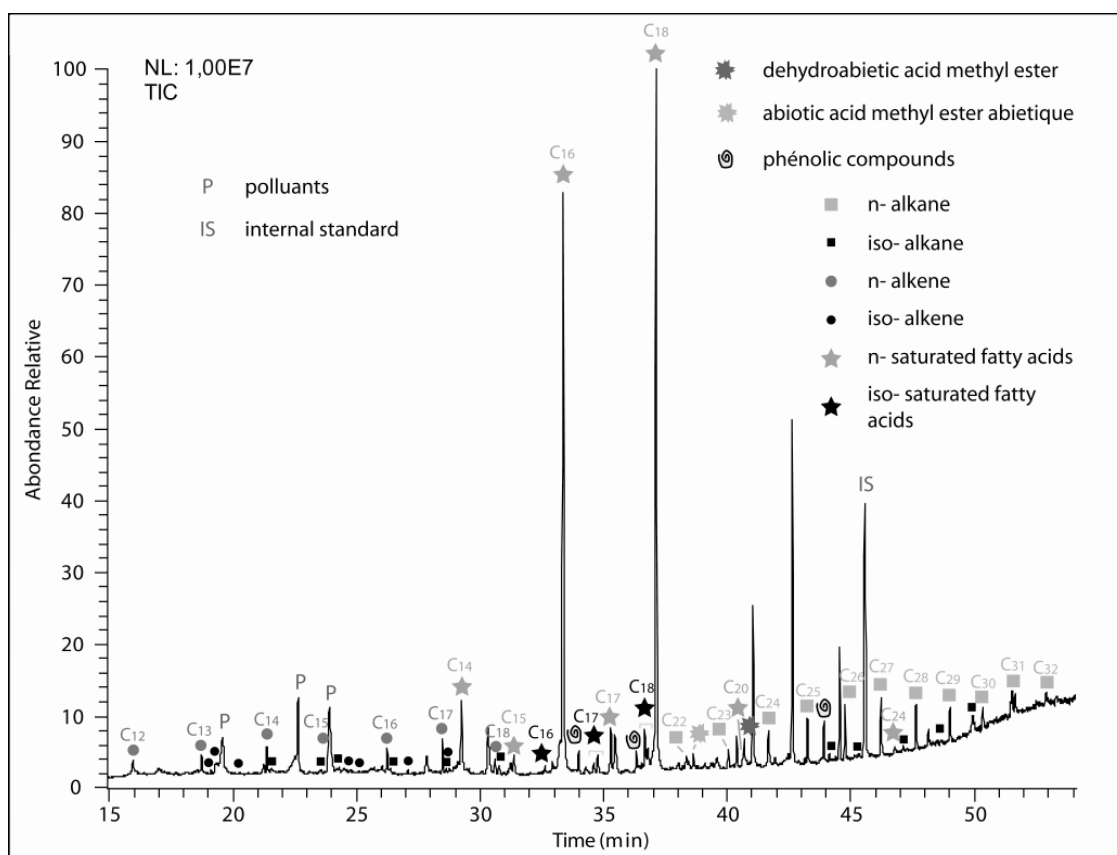


Figure 1. TIC chromatogram of py-GC/MS analyses with TMAH performed on low charge saponite before 10 days of interactions in the anoxic level of the Pavin lake.