Variability of organic matter (OM) distribution and sources in surficial sediments from an intertidal mudflat of a coastal plain temperate estuary (Authie, France)

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Even though estuaries represent only a limited surface on Earth, estuarine ecosystems are among the most dynamic and productive in the world. These areas act as an ocean-continent interface, regulating biogeochemical fluxes of numerous chemical elements (C, N, S, nutrients, contaminants, …).

Estuarine sediments receive organic matter (OM) derived from both terrestrial and marine sources but also OM produced by autochthonous primary production. Intense OM mineralization in estuarine sediments results in high nutrient release that supports the growth of dense biofilms of microphytobenthos (MPB), which are important food sources constituting the basis of major estuarine trophic networks. These biofilms are a generic grouping of algae (diatoms, euglenids, chrysophyceans, dinoflagellates), cyanobacteria and other prokaryotes that colonize benthic substrata. The objectives of this study are to determine the spatio-temporal (emersion duration, season) variations of the sedimentary OM abundance and geochemical characteristics in relation to physico-chemical sediment parameters as well as the MPB biomass and productivity.

The study was conducted on an intertidal station located in the temperate coastal plain macrotidal Authie estuary (Nord-Pas-de-Calais, France) within a recently-established marine protected area, where massive spring blooms of the Haptophyte *Phaeocystis globosa* is recurrently observed, with episodes of important amounts of organic foam accumulated in vast intertidal areas. Surficial sediments (0 to 5 cm depth) and potential OM sources (terrestrial plants, marine, fluviatile and estuarine suspended particulate matter, MPB) were sampled in June and November 2015 at different emersion duration. For their study we applied a multidisciplinary approach including **(1)** characterization of physico-chemical sediment

parameters (grain-size, water content, porosity, mineralogy), **(2)** assessment of the sedimentary OM abundance, sources and early diagenetic processes using various organic geochemical proxies (TOC/TN ratios, $\delta^{13}C$ and $\delta^{15}N$ values, lipid biomarkers and their $\delta^{13}C$ values), and **(3)** determination of the distribution, composition (microscopic observations, pigment analyses, diversity profiles of microorganism communities by metabarcoding techniques, …), biomass and degraded pigments (chlorophyll *a* and phaeopigment contents) and *in situ* productivity of the MPB.

Preliminary results showed that sediments were mostly composed by silt and sand fractions, associated with minor amounts of clay. The XRD patterns indicated the predominance of quartz and calcium carbonate associated with minor amounts of clays minerals and feldspars. The water content and consequently sediment porosity seemed to decrease with the increasing duration of emersion. Variations in OM abundance and sources were observed with depth, emersion duration and season. Elemental ratios, stable carbon and nitrogen isotopic compositions as well as lipid biomarker compositions provided evidence that sedimentary OM is mostly derived from fluvial inputs. However, the relative contribution of OM originating from marine sources (including MPB) showed significant spatio-temporal variations with the emersion duration. These variations are most likely controlled by the MPB distribution, composition, biomass and *in situ* productivity. The multidisciplinary results of this study contribute in better understanding the estuarine ecosystem functioning as well as their role for associated marine and coastal ecosystems.