Nature and dynamics of organic matter in the Seine Estuary (France) at the bulk and molecular levels

A. THIBAULT[1], A. HUGUET[1*], E. PARLANTI[2], C. MICHEAU[1,2], M. SOURZAC[2], C. LANOS[1], S. DERENNE[1]

[1]METIS, CNRS/Sorbonne Université/EPHE, Paris, France (*correspondence: arnaud.huguet@sorbonne-universite.fr)
[2]Univ. Bordeaux / CNRS / EPOC-LPTC, Talence, France

The quality and amount of organic matter (OM) exert a key role on water quality and biogeochemical processes in estuaries. Nevertheless, to date, the elucidation of the OM dynamics in such settings remains a major challenge due to the heterogeneous and complex nature of this material, and the high variability of environmental and physical parameters. The aim of this study was to constrain the sources and fate of the OM in the Seine Estuary (France), which flows through Paris, one of the largest European megalopolis. 5 sampling campaigns were performed between January 2015 and April 2016, allowing the investigation of OM spatiotemporal variability. Water samples and sediment cores were collected along the estuary. The dynamics of the OM along the Seine Estuary was investigated by comparing the bulk and molecular characteristics of the OM in the different compartments – dissolved (DOM) and particulate (POM) organic matter and sediment. Such characterization was performed by combining (i) elemental and isotopic analyses, (ii) optical characterisation of DOM and (iii) state-of-the-art molecular analyses (^{13}C solid state NMR; pyrolysis -GC-MS; HPLC- and GC-MS lipid analyses). Principal component analysis performed on bulk and molecular data showed that DOM composition significantly differs from that of sediment OM and POM. ^{14}C dating revealed the recent age of DOM and POM, in contrast with sedimentary OM, whose age, in the surface layer of sediment cores, strongly depends on the season and related hydroclimatic conditions. The mixing of riverine and marine water masses seems to be the main factor controlling the OM composition in the estuary, based on the linear increase in δ^{13}C of POM and changes in lipid biomarker distribution (fatty acids, sterols, branched GDGTs) from upstream to downstream. Moreover, the non-linear dilution of the chromophoric DOM along the estuary confirmed the mixing of marine and freshwater end-members, but also highlighted other sources or transformation processes of DOM. Both isotopic and molecular analyses pointed to a predominant autochthonous origin of the OM in the estuary, even though terrestrial-derived compounds (e.g. lignin, long chain *n*-alkanes) were also detected. Seasonal variations in OM composition were, to a lesser extent, also highlighted, with higher molecular weight and aromaticity of DOM in winter than in summer.