Environmental controls on the reactivity of sedimentary organic matter in the St. Lawrence Estuary

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Abstract

We report multiple parameters used to describe the reactivity and diagenetic state of sediment organic matter (OM), including total hydrolysable amino acid (THAA), amino acid enantiomer, chlorin (CI) and amino acid degradation (DI) indices, along a transect between the Upper St. Lawrence Estuary and the Gulf of St. Lawrence, Canada. The study area is characterized by gradients in water oxygen concentration, water depth, OM source, primary productivity, and sedimentation rate. Both CI and DI indicate a decline in OM reactivity with the transition of a more terrestrial to a more marine-dominated sedimentation regime from the shallow Upper Estuary (23-95m) to the hypoxic, mid-depth Lower Estuary and to the deep (>400m), well-oxygenated Gulf. Systematic variations in the amino acid composition along the Laurentian Channel confirmed the increased diagenesis of OM with distance from the Upper St. Lawrence Estuary. The ratio of D/L stereoisomers of alanine increased along the transect, and the co-variation between DI and the D/L-Ala suggests a close coupling between the extent of diagenesis and the accumulation and selective preservation of bacterially-derived cell wall material in the sediments. The patterns observed along the estuarine transect were also present down-core in two sediment cores, confirming the robustness of our reactivity indices. Oxygen exposure time of the sediments appears to strongly determine sediment OM reactivity in the St. Lawrence Estuary. The sediment oxygen regime itself is related to the interplay between water column depth, vertical OM flux, and reactivity of settling OM.

Rare Earth Elements in the Misten peat bog (Belgium) as tracers of dust depositions and past environmental changes

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The Misten peat bog representing 7.5 m of peat accumulation in the Hautes-Fagnes Plateau, Belgium, provides a record of Rare Earth Elements (REE) deposition since more than 7000 years. The analyses of REE and lithogenic element concentrations, as well as the Nd isotopes, were performed by HR-ICP-MS and MC-ICP-MS, respectively in peat layers previously dated by ^{210}Pb and ^{14}C. REE concentration variations in peat samples are correlated with Ti, Zr and Sc that are lithogenic conservative elements, suggesting that REE are immobile in the studied peat bogs [1] and can be used as tracers of dust deposition. Peat humification, C/N ratio, ash content and bulk density were used to evaluate hydroclimatic conditions. The εNd values show large variability, between +1 to –22, identifying three major sources of dusts falling into the peat: local soils, distal volcanic and desert particles. More recently, industrial emissions provide a fourth source of dusts [2], which is also clearly recorded in the last 200 years of the Misten peat profile.

[1] Aubert D., Le Roux G. *et al.* (2006) *Geochimica Cosmochimica Acta* 70, 2815-2826.

[2] Le Roux G., Fagel N. *et al.* (in press) *Geology* Volcano- and climate-driven changes in atmospheric dust sources and fluxes since the Late Glacial in Central Europe.