Spatio-temporal variability of sedimentary organic matter (OM) dynamics on an intertidal mud bank in French Guiana (BIOBANK, VARIFLUX, CYCLEN projects)

S. Gontharet[1], N. Chevalier[2], O. Mathieu[3], L. Denis[4], L.F. Artigas[1], M. Gommeaux[5], W. Simon[1], F. Gevaert[4], F. Goulard[4], V. Klein[2], I. Bouloubassi[2], G. Duong[4], M. Sarrazin[6], L. Courcot[1], J. Caillaud[1], S. Lesourd[7], F. Henry[1], H. Bolhuis[8], S. Philippe[1], J. Lévêque[3], A. Gardel[9]

[1] University of Littoral Cote d'Opale (ULCO), UMR CNRS 8187 LOG, Wimereux, France

[2] University of Pierre et Marie Curie, UMR CNRS IRD 7617 LOCEAN, Paris, France

[3] University of Bourgogne Franche-Comté, UMR CNRS 6282 Biogéosciences, Dijon, France

[4] University of Lille 1, UMR CNRS 8187 LOG, Wimereux, France

[5] University of Reims Champagne-Ardennes, EA 3795 GEGENAA, Reims, France

[6] IRD Center of Cayenne, US 191 LAMA, Cayenne, French Guiana

[7] University of Caen-Basse Normandie, UMR CNRS 6143 M2C, Caen, France

[8] NIOZ, Marine microbiology, Texel, The Netherlands

[9] CNRS Guyane, USR 3456 LEEISA, Cayenne, French Guiana

The 1600 km-long coast of South America between the mouths of the Amazon and the Orinoco rivers is characterized by the occurrence of several unstable shore-attached mud banks (Aller, 1998). These structures, originating mainly from the huge Amazon suspended sediment discharge, migrate northwestwards through successive cycles of deposition and erosion. These cycles are controlled by a complex interaction between hydrological, sedimentological and biological parameters. Depending on their elevation and tidal cycles, mud banks can be temporally emerged, resulting in their rapid colonization and stabilization by microphytobenthos (MPB; Debenay et al., 2007) and opportunistic mangroves (mainly composed of *Avicennia germinans*; Proisy et al., 2009).

Due to intense erosion/deposition cycles and rapid biological colonization of mud banks, they represent preferential sites for accumulation and intense remineralization of organic matter (OM), thus playing a key role in global biogeochemical cycles (Aller, 1998). They receive OM from various sources: marine suspended particulate matter, coastal mangrove plants and *in situ* developed MPB (Gontharet et al., 2014). Three projects (BIOBANK, PIG CNRS, 2014; VARIFLUX, EC2CO 2016-2017; CYCLEN, PIG CNRS 2016) mostly aim to determine, at different air-exposure durations and seasons (wet/dry), the spatio-temporal variability of the sedimentary OM dynamics (abundance, origin and remineralization) in relation with sedimentological and biological parameters.

Two field campaigns were conducted in July 2014 (wet season) and November 2016 (dry season), to collect superficial sediments and samples of potential OM sources (*A. germinans*, MPB, marine suspended particulate matter) on the intertidal mud bank near the East of pointe

Isère (Mana). Three stations, corresponding to three different immersion/emersion conditions, were sampled at each field campaign and characterized by diverse degrees of mud compaction and biological colonization. Samples were studied **(i)** to determine the sedimentary OM characteristics and their origin using various organic geochemical proxies (OM contents, Total Organic Carbon (TOC) and Total Nitrogen (TN) contents, TOC/TN ratios, $\delta^{13}C$ and $\delta^{15}N$ values, lipid biomarkers and their $\delta^{13}C$ values), and **(ii)** to measure the intensity of the OM recycling processes (sediment-water and sediment-atmosphere exchanges). In parallel, the physico-chemical properties of sediments were determined and the characterization of MPB (distribution, composition, biomass and *in situ* production) was made.

During the wet season, sediments, having homogenous textural and mineralogical compositions, showed an increase in their cohesion with the duration of the emersion period. Lower TOC and TN contents were observed, indicating either low terrestrial OM inputs and/or extensive remineralization induced by an important and repeated remobilization of mud deposits. Elemental ratios, $\delta^{13}C$ and $\delta^{15}N$ values as well as lipid biomarker compositions revealed that sedimentary OM originated from marine suspended particulate matter, coastal mangrove plants and MPB. Amounts of OM derived from marine sources seemed to be slightly higher than those originated from terrestrial plants. The relative contribution of MPB OM was higher during the emersion period, which is consistent with the observed increase of the chlorophyll *a* concentration at the sediment surface. Variations in nature and abundance of lipid biomarkers were observed between the three studied stations and might be linked to variations in the community assemblages of MPB identified by microscopic observations. Sediment-water exchanges, as measured by whole core incubation technique, allowed quantifying a slow uptake of oxygen during immersion, indicating rather limited mineralization processes. Low intensity of sediment OM remineralization might be explained by the occurrence of more refractory OM derived from terrestrial plants. These results are compared with those obtained during the dry season in order to determine their seasonal variability. This study will contribute to a better understanding of tropical mud bank's biogeochemical functioning, their seasonal variability, as well as their role for associated pelagic and benthic ecosystems.

References

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