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## Fluorescent intensity of organic matter during a resuspension experiment

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Sediments form a huge natural reservoir of organic matter (OM), mineralized by bacteria through the early diagenesis process<sup>1-3</sup>. OM is known to strongly bound metals in the dissolved phase<sup>2</sup>. Therefore, below the sediment/water interface, the increase of dissolved metals' concentration is attributed to OM mineralization<sup>4-6</sup>. When sediment is resuspended (tides, waves, wind, dredging activities...), it releases OM which eventually can be degraded by marine bacteria and finally increase metals' concentration in the column water.

In this work, sediment core was sampled at La Spezia harbour (Italy), a semi-closed bay undergoing strong anthropic pressures. The sediment was characterized for Dissolved Organic and Inorganic Carbon (DOC/DIC) concentration, as well as fluorescence. Then, to understand the kinetics of dissolved OM release and/or removal, and its extent, a laboratory resuspension experiment was performed by mixing the sampled sediment to seawater collected at the same sampling site<sup>7,8</sup>.

DOC/DIC concentrations were analysed with a TOC-VCSH (Shimadzu) equipped with an autosampler (ASI-V). Fluorescence intensity was measured with a F7000 (Hitachi) instrument and the decomposition of the signal was performed using PARAllel FACtor analysis (PARAFAC)<sup>9</sup>.

The obtained results showed a DOC increase at the sediment/water interface followed by a globally constant concentration along the profile whereas DIC profile showed an increase along the profile demonstrating OM mineralization by bacteria. Fluorescence analysis revealed two major fluorescent compounds: a marine-like C1 (Ex: 325, Em: 425) and a terrestrial C2 (Ex: 400, Em: 500) whose intensities increased along the profile. At the sediment surface, C2 intensity was higher than that of C1, whereas at the bottom C1 and C2 intensities were quite the same. C1/C2 ratio increased with depth suggesting a higher mineralization of terrestrial OM, probably less refractory than the marine one in that case. Those OM changes along the profile were probably driven by pH and Eh decreased. Nevertheless, no correlation with metals could be established for now.

The resuspension experiment showed a quick release of particulate DOC then consumed or re-adsorbed to finally reached a concentration close to the initial DOC concentration in the sampled seawater. The kinetics of DIC exhibited no or small variations during the experiment, suggesting a low microbial activity.

The fluorescence intensity followed a three-steps pattern: for the first contact times, the two compounds intensity rapidly increased, then decreased down to the sampled seawater initial intensity, followed by a simultaneous increase.

C1/C2 ratio kinetics also followed a three-steps pattern revealing a modification of OM during the resuspension experiment.

An experiment with different Solid/Liquid (S/L) ratios was also performed and underlined an increase in DOC release, along with S/L increase, whereas DIC was constant. These results suggested that DOC release is mostly abiotic. Indeed, in the presence of 50mM NaN<sub>3</sub>, DOC increased up to a 6-folds, which suggests that (1) microbial activity was not the main process in DOC release and (2) that NaN<sub>3</sub> probably influenced the physicochemical parameters allowing a higher DOC release.

## References

1. Burdige, D. J. Preservation of Organic Matter in Marine Sediments: Controls, Mechanisms, and an Imbalance in Sediment Organic Carbon Budgets? *Chemical Reviews* **107**, 467–485 (2007).
2. Dang, D. H. *et al.* Seasonal variations of coastal sedimentary trace metals cycling: Insight on the effect of manganese and iron (oxy)hydroxides, sulphide and organic matter. *Marine Pollution Bulletin* **92**, 113–124 (2015).
3. Robador, A., Brüchert, V., Steen, A. D. & Arnosti, C. Temperature induced decoupling of enzymatic hydrolysis and carbon remineralization in long-term incubations of Arctic and temperate sediments. *Geochimica et Cosmochimica Acta* **74**, 2316–2326 (2010).
4. Naylor, C., Davison, W., Motelicaheino, M., Vandenberg, G. & Vanderheijdt, L. Simultaneous release of sulfide with Fe, Mn, Ni and Zn in marine harbour sediment measured using a combined metal/sulfide DGT probe. *Science of The Total Environment* **328**, 275–286 (2004).
5. Scholz, F. & Neumann, T. Trace element diagenesis in pyrite-rich sediments of the Achterwasser lagoon, SW Baltic Sea. *Marine Chemistry* **107**, 516–532 (2007).
6. Tankere-Muller, S. *et al.* Fine scale remobilisation of Fe, Mn, Co, Ni, Cu and Cd in contaminated marine sediment. *Marine Chemistry* **106**, 192–207 (2007).
7. Dang, D. H. *et al.* Evidencing the Impact of Coastal Contaminated Sediments on Mussels Through Pb Stable Isotopes Composition. *Environmental Science & Technology* **49**, 11438–11448 (2015).
8. Oursel, B. *et al.* Flood inputs in a Mediterranean coastal zone impacted by a large urban area: Dynamic and fate of trace metals. *Marine Chemistry* **167**, 44–56 (2014).
9. Luciani, X. *et al.* Tracing of dissolved organic matter from the SEPETIBA Bay (Brazil) by PARAFAC analysis of total luminescence matrices. *Marine Environmental Research* **65**, 148–157 (2008).