



Investigating organic matter preservation through complexation with iron oxides in Lake Tantaré

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The biogeochemical cycles of iron (Fe) and organic carbon (OC) are closely interconnected. The concentration of reactive Fe is tightly controlled by soluble organic ligands in oceanic waters. In soil, solid phase Fe stabilizes OC by forming mixed aggregates that shield OC and decrease its degradation rate. In sediments however, the role of Fe in the preservation of organic compounds is only starting to be explored. We recently developed an approach based on the reductive dissolution of reactive solid phase Fe to quantify the amount of OC retained in the solid phase through its interaction with Fe. This method was applied to a series of aquatic sediments of contrasting OC contents and mineralogies collected from a broad range of deposition environments. On average, $21.5 \pm 8.6\%$ of the total OC in sediments was released to the liquid phase upon dissolution of iron and was thus directly attached to reactive solid iron phases. Interestingly, the only lake sediment in our sample set, collected in the boreal forest, had the highest percentage of OC bound to Fe. In this work, we investigated Fe-OC interactions in lake sediments to verify whether this very high percentage of OC bound to Fe is a characteristic of lake sediments in general, as well as to assess the importance of redox conditions and oxic/anoxic interfaces in the formation of stable Fe-OC aggregates. We used sediments collected from Lake Tantaré, an aquatic system with two basins characterized by contrasting bottom water redox conditions in the summer. We found a high percentage of OC directly associated with Fe minerals ($30.1 \pm 6.4\%$), with no significant difference between the two basins, which confirmed our previous results obtained from boreal lake sediments. Total nitrogen (TN) followed the same trend, although with lower percentages of TN associated with Fe minerals ($20.7 \pm 6.7\%$). We characterized the Fe-associated and the non-Fe-associated OC pools at the elemental (OC, TN), isotopic ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$) and functional group (FTIR) levels. Differences in reducible Fe content and in OC:Fe and TN:Fe ratios were found between the two basins; they will be presented and discussed in relation with our working hypothesis.