DOM dynamics in open sea waters of the Mediterranean Sea: New insights from optical properties

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One of the most intriguing aspect of DOM dynamics in the Mediterranean Sea (Med Sea) is that it shows concentrations and distribution very similar to that observed in the global oceans, even if the Med Sea is a marginal basin (Santinelli et al., 2015). Isotope data unveil that DOM in the deep waters of the Med Sea is more depleted in both $\Delta^{14}C$ and $\delta^{13}C$ than in the deep Atlantic Ocean (Santinelli et al., 2015). Another peculiarity of the Med Sea is that its surface waters are "greener" than it would be expected from their low phytoplankton content (Claustre et al., 2002). These observations suggest that in the Med Sea the DOM pool is richer in material with an older radiocarbon age (~1000 years older), lighter and with an higher fraction of humic-like substances than in the oceans. Optical properties (absorption and fluorescence) of chromophoric DOM (CDOM) are a powerful tool to get insights into DOM pool even in open sea waters, where DOM concentration is very low. Our data show that absorption of CDOM is higher in the Med Sea than in the oceans (Nelson and Siegel, 2013), despite its concentration is comparable. Fluorescence Excitation-Emission Matrixes (EEMs), combined with parallel factor analysis (PARAFAC), unveiled the presence of 4 humic-like components, 2 with a clear terrestrial signature (C2 and C3), 1 attributed to in-situ microbial activity (C4) and 1 (C1) that we hypothesize can be a mixture between humic-acids and polycyclic aromatic hydrocarbon (Fig. 1). Only 1 protein-like component (C5) was found. It is noteworthy that C3 has an emission maximum at 516 nm and that its emission spectrum overlaps that of the Pahokee peat humic acids (Fig. 1). The wavelength of this emission maximum is typical of terrestrial humic acids characterized by either highly substituted aromatic nuclei or conjugated unsaturated systems capable of high degree of resonance, suggesting the occurrence of terrestrial molecules with a small degree of degradation. None similar component was found in the open ocean.

These data support that Mediterranean DOM is dominated by humic-like (yellow) substances with a terrestrial origin and open intriguing questions about the impact of external sources to DOM dynamics in the basin.

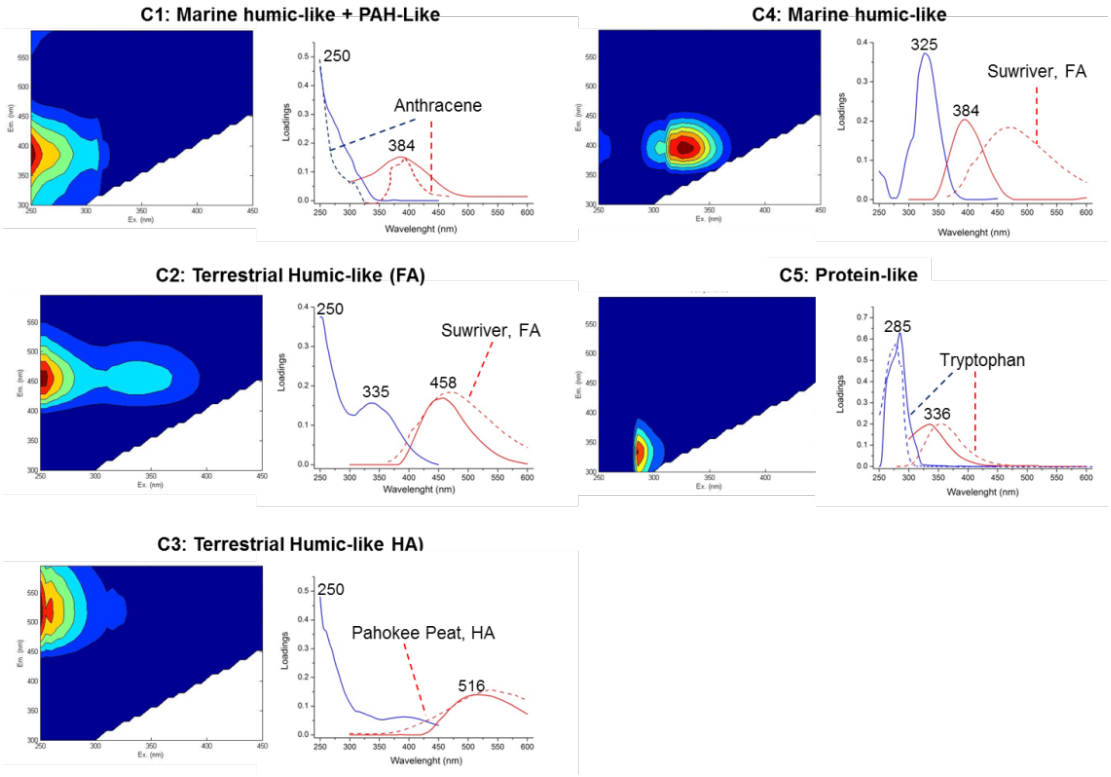

Figure 5. Excitation (blue) and Emission (red) spectra of the five components validated by PARAFAC.. The spectra are overlapped to those of commercial substances (dotted lines). FA: Fulvic Acid; HA: Humic Acid.

References

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