Banyuls sur Mer, France, September 20th 2021

Proposition de stage M2 2021-2022

Linkage between organic matter composition and microbial diversity across temporal scales in the NorthWestern Mediterranean Sea

At present, the amount of atmospheric CO2 approximately equals the carbon content in the form of marine dissolved organic matter (DOM; 660 Gt, Hedges 2002). Microorganisms are key mediators in the formation, transformation, and storage of ocean DOM, while DOM provides the energetic foundation for their growth, their community structure and their metabolic potential. Therefore, knowledge of two-way interactions between DOM and microbes is critical not only to understand the evolution and succession of microbial communities in the ocean, but also to draw the routes of DOM cycling, with an ultimate impact on CO2 sequestration.

In the Mediterranean Sea, there is a temporal mismatch between with the maxima of phytoplankton (early spring), the main DOM source through photosynthesis, and DOM itself, that shows its maxima in late summer (Sánchez-Pérez et. al. 2020). This suggests that DOM accumulation is driven by the activity of heterotrophic bacterioplankton (bacteria and archaea): These organisms would consume labile DOM compounds and release refractory compounds that persist in the water, in a process known as the microbial carbon pump (Jiao, 2010). However, how the different DOM compounds are cycled by the different members of the bacterial community, and how this is modulated by the environment through the year, remains unresolved.

The main scientific questions to tackle during the master internship will be,

1. **How do bacterial communities (diversity and community structure) and DOM composition change along the year in the open Mediterranean Sea?**
2. **Which are the main prokaryotic players driving seasonal changes in DOM composition in the Mediterranean Sea?**

To answer these questions, the student, doing the internship in the first semester of 2022, will work with a 3-year series of both DOM and microbial composition in a Mediterranean open sea station (MOLA), currently being sampled on a monthly basis (https://www.moose-network.fr). The in situ data will be combined with data from biodegradation experiments conducted in 2020 and 2021, where bacterial communities are exposed to different DOM sources to unravel which are the main taxa degrading/producing the different DOM compounds in each season.

The specific tasks of the M2 student will be: (1) To analyze dissolved amino acids and (2) To process 16s rRNA sequences (OTU/ASV Tables, diversity indexes, etc) in both the timeseries and the experiments. The generated datasets of prokaryotic (bacterial and archaeal) composition and amino acids will be combined with other DOM descriptors, microbial activity measures, and environmental variables (datasets available) to infer co-occurrences between the different DOM compounds, the microbes, and the environment.

Experience in 16s sequence analysis and in data analysis using R will be valued, as well as good written English (the master report will be preferentially prepared in English). The master 2 work will involve laboratory analyses and (mostly) data analysis, however the student will have the possibility to punctually join some ongoing projects for 1-day field sampling campaigns. We look for a motivated student willing to learn all aspects of scientific work (including participation in lab

seminars and journal club). The LOMIC hosts a pluridisciplinar and international team of teachers, researchers, technical personnel, master and PhD students. Housing facility in the lab residence will be available.

Any interested candidates should send their motivation letter and cv (in French or English) to Eva Ortega-Retuerta ortegaretuerta@obs-banyuls.fr

References:

ED. Sánchez-Pérez, M Pujo-Pay, E Ortega-Retuerta, P Conan, F Peters, C Marrasé (2020) Mismatched dynamics of dissolved organic carbon and chromophoric dissolved organic matter in the coastal NW Mediterranean Sea Science of The Total Environment,746, ISSN 0048-9697

John Hedges (2002) Why dissolved organics matter. *In Biogeochemistry of marine dissolved organic matter, Oxford Academic Press*

Jiao N, Hansell D, Herndl G, et. al. (2010) Microbial production of recalcitrant dissolved organic matter: long-term carbon storage in the global ocean. Nature Reviews Microbiology 8: 593-599

Dr. Eva Ortega-Retuerta

CNRS UMR7621
Laboratoire d'Océanographie Microbienne de Banyuls
Observatoire Océanologique
F-66650 Banyuls sur Mer France
0033 468887353
ortegaretuerta@obs-banyuls.fr