Laura Kergoat (2019 – 2022)

Title : Functional and structural responses of microbial communities to combined stressors in hyporheic zone

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Doctoral school : E2M2, Lyon

- **Context and problematic** :

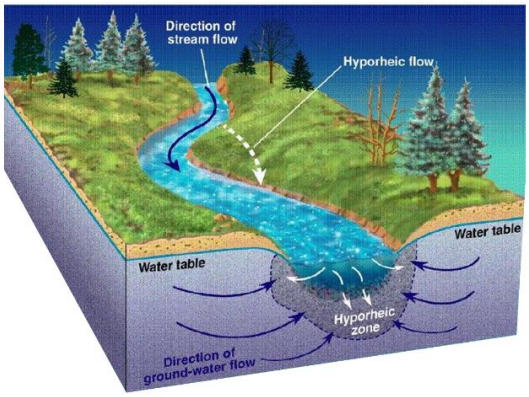

Figure 1 : Schematic representation of the hyporheic zone (modified from Alley et *al.,* 2002)

Hyporheic zone plays an important ecological role in river ecosystem. This is an interface between surface water and groundwater where oxygen and nutrients exchanges take place (White 1993 ; Wood, Armitage 1997). Hyporheic zone is also a habitat for microbial communities and invertebrates that contribute to organic matter mineralisation and pollutant filtration (Datry et *al*., 2008). Human activities resulting in physical alteration of the river (e.g. hydroelectric dam) or chemical pollution (e.g. pesticides, heavy metals) disturb this ecosystem functioning. In this context, my thesis project focuses on clogging caused by fine sediment input and copper contamination in the river. The impacts of these two stressors have been independently demonstrated (Mahamoud Ahmed et *al.*, 2018 ; Nogaro et *al.*, 2010 ; Navel et *al.*, 2010 ; Feris et *al.*, 2004) but the combined effects on microbial communities have not been studied even though they are both frequent in agricultural watershed. In the first part of my thesis, I will investigate (1) the influence of clogging on copper distribution in the hyporheic zone and (2) the combined effects of clogging and copper on the structure and activities of hyporheic microbial communities. I hypothesised that copper will accumulate preferentially in the clogged area leading to a strong ecotoxicological impact in this section. By altering copper repartition in the hyporheic zone, clogging is expected to act as a protective layer against contamination and prevent polluting in deep layer. In the second part of my thesis, I will evaluate the influence of invertebrate presence in a clogged ecosystem contaminated with copper. On the one hand, bioturbation is expected to reduce effects of clogging while, on the other hand, bioturbation is also expected to increase copper diffusion through the hyporheic zone. .

- **Method** :

To understand the impacts of combined stressors on microbial structure and activities in hyporheic zone, an experimental approach in microcosms will be used. Columns filled with sediment will be clogged with an additive layer of fine sediment and exposed to water contaminated with copper.

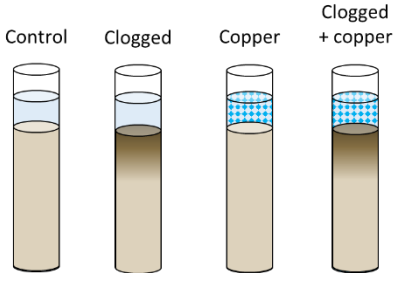

Figure 2 : Schematic representation of the experiment in microcosm for the first thesis axis

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