Resilience of meiofaunal communities in response to an induced perturbation on the Lucky Strike vent field: RECOVER

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Our knowledge of the natural dynamics of hydrothermal ecosystems is still incomplete and greatly limits our ability to predict the resilience of these ecosystems to natural (e.g. geological) or anthropogenic (e.g. mining) disturbances. However, in a context where deep-sea mineral resources, and particularly those related to massive deposits of polymetallic sulphides, are increasingly coveted, it is imperative to increase our efforts to understand the dynamics of communities associated with hydrothermal vents, and in particular the colonization of new habitats.

This thesis subject is based on an *in situ* experiment initiated in 2017. The latter consisted in removing fauna within a series of 17 quadrats deployed on three types of habitats: an active hydrothermal site, a peripheral sedimentary zone and an inactive chimney in order to follow the recovery of *Bathymodiolus azoricus* mussel communities over time (2017-2019) as well as to assess the role of biological interactions in this recolonization dynamic. An environmental monitoring was carried out in parallel. Focusing on macrofauna, Julien Marticorena's thesis (2016-2019) has shown that despite a good recovery of the initial taxonomic richness on the active site, only a partial recovery of faunal densities was observed after 2 years (Marticorena et al. 2021). In addition, major changes in community composition were observed, with a strong increase in the abundance of gastropods, which may be the pioneer species of these habitats. A post-disruption succession model was proposed, from the opening of a new colonization space to the development of a climax community. The role of the meiofauna in the functioning of these ecosystems has only recently been included in hydrothermal ecological studies (Zeppilli et al. 2015, Alfaro-Lucas et al. 2020). This faunal compartment could represent a key link in recolonization processes.

The objectives of this thesis, focused on meiofauna, will therefore be:

1. to assess the ability and rate of recovery of hydrothermal meiofaunal communities following an induced disturbance within three habitat types,
2. to estimate the role of large predators on the recolonization of fauna (active site) through the deployment of exclusion cages,
3. to compare the results obtained with those of macrofaunal communities (thesis J Marticorena) and complete the succession model,
4. to describe the biodiversity of the meiofauna associated with the periphery and inactive zones and to understand its potential role in the recolonization of the active zones,
5. to develop indicators of disturbance and evaluation of the ecological state of the ecosystem by focusing on certain functional traits (reproductive stages, complexity of the food web) during the stages of succession.

The main objective is therefore to follow the recolonization dynamics of the impacted areas and to characterize the biotic and abiotic factors influencing this recolonization process. For this, several approaches are envisaged. The description of the structure of meiofaunal communities through the analysis of biological samples will provide information on the temporal evolution of abundance and diversity within the assemblages studied. The functional approach aims to monitor the reproductive status and condition indices of the dominant species and to characterize the food web structure at different stages of recolonization. A biogeochemical approach based on *in situ* measurements and fluid sampling will characterize the evolution of the physico-chemical environment.

This thesis project completes a study started in the framework of the European project H2020 MERCES (No. 689518) and is integrated in the European project DEEP-REST (PI J Sarrazin) which focuses on the conservation and restoration of deep-sea ecosystems in a mining context, as well as in the PPR LIFE DEEPER project (PI MA Cambon), which is focused on similar themes. Results will help to characterize the natural recolonization of fauna after a disturbance and assess the resilience of hydrothermal communities in deep-sea environments. This fundamental knowledge can be used to develop management and monitoring protocols to mitigate the potential impacts of exploitation on hydrothermal fauna and eventually, to suggest active restoration methods for these ecosystems.