Deep-sea bivalve robust to long-term experimental ocean acidification combined to particle availability

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Background: The ocean is acidifying and coastal systems such as the Norwegian fjords are under strong local human pressure. For instance, the discharge of mine tailings and aquaculture in fjords could result in particle overload, which may affect the life of filter-feeders. Deep-sea coral reefs are present in some fjords at depths ranging from 40 to 6000m. These ecosystems are emblematic of the richness of cold and North Atlantic waters but are facing possible under-saturation with respect to aragonite by the end of the century. *Acesta excavata* is a bivalve inhabiting the reefs and one of the three species building the reef. Like for most deep-sea organisms, the literature on its physiology is scarce, and the abilities of such animals - living in environments harboring little variation – to cope with future environmental changes is supposedly low. Ocean acidification on bivalve has mostly been shown to induce metabolic suppression, with a potential to recover control metabolic performances when the food sources are increased (e.g. *Thomsen et al. 2013 in Global Change Biology 19(4)*).

Methods: In this crossed design, we looked at the effect of 1) seawater acidification (-0.4 pH units) combined to 2) decreased (-P) and increased (+P) particle load (>40um). The animals were exposed to the six crossed treatments (Control and Low pH x Control particles, +P and -P) for five months. The seawater used was from natural habitats. It was filtered out of >40um particles in the decreased treatment, and filters were re-suspended in the increased particle load treatment.

We expected the seawater acidification to impact the animal physiology negatively and hence, a decreased particle load to be limiting to the animal abilities to cope with seawater acidification, contrary to an increase in particle load.

Results: We however could not validate our hypothesis, since we observed no significant effect of pH on the ecophysiology of the mussel (mortality, calcified growth, respiration, acid-base balance). The diet had a slight effect with decreasing the lysosome integrity from 80% of the cells in the control to 50% in the +P treatment. The +P treatment also yielded a difference in the buffering capacity of the coelomic fluid. From these results, we can conclude *Acesta excavata* is apparently quite robust to the changes of pH it experienced on the time-scale of this experiment, even with limited potential food particles. However, an increase in particle load seemed to be a potential stressor to this animal and solicits further investigation. The diet of these mussels is only partially described (filtration rates on artificial feeds) and more information on its natural diet is needed in order to understand how this bivalve is able to not display the expected signs of metabolic suppression/compensation in facing ocean acidification.

Analyses of tissue for gonad index, fatty acid composition, total lipids as well as stress markers are ongoing.

Keywords: Coral ecosystems; Ecophysiology; Global change; bivalves; ocean acidification