First estimates of the impact of mercury on the mediterranean homoscleromorph sponge *Oscarella lobularis*

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Mercury is **bioaccumulated** and **bioamplified** into the marine food web in its toxic organic form : **methylmercury (MeHg)**. Knowing that the impact on vertebrates and human health is well documented, we focused on the active filter feeder sponge ***Oscarella lobularis*** (Porifera, Homoscleromorpha), a species inhabiting a key biocenosis, the coralligenous of the Mediterranean Sea, in the bay of Marseille.

Objectives : What is the impact of mercury on *Oscarella lobularis* ?

Fig. 1 : Oscarella lobularis (Laurent VanBostal)

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Hg body amount was quantified in individuals from 6 sites in the bay of Marseille and 1 site in the Blue Coast using a total mercury analyzer (AMA-254).

Organisms from the **Prado's artificial reefs and Méjean,** the closest sites to the shore, **are the most contaminated** with a median concentration of total Hg of 179 ng/g and 167 ng/g respectively (Fig. 2).

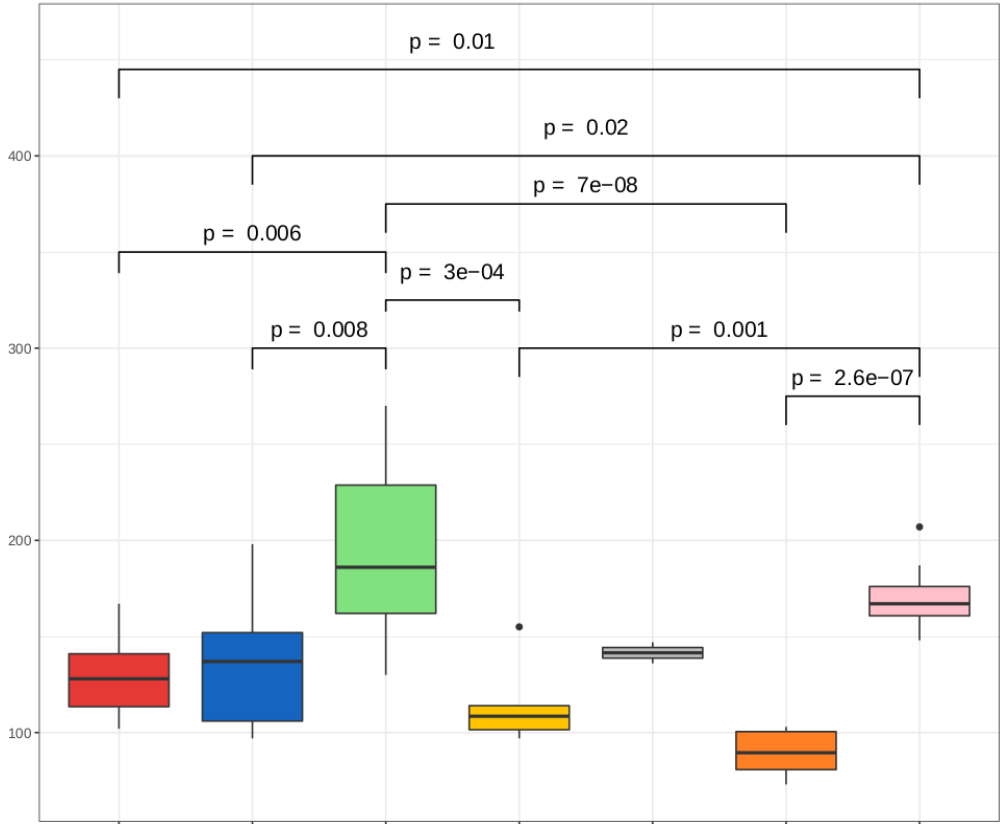

Fig. 2A : Comparison of the average mercury concentrations in sponge tissues from different sites (Kruskal-Wallis and Dunn tests).

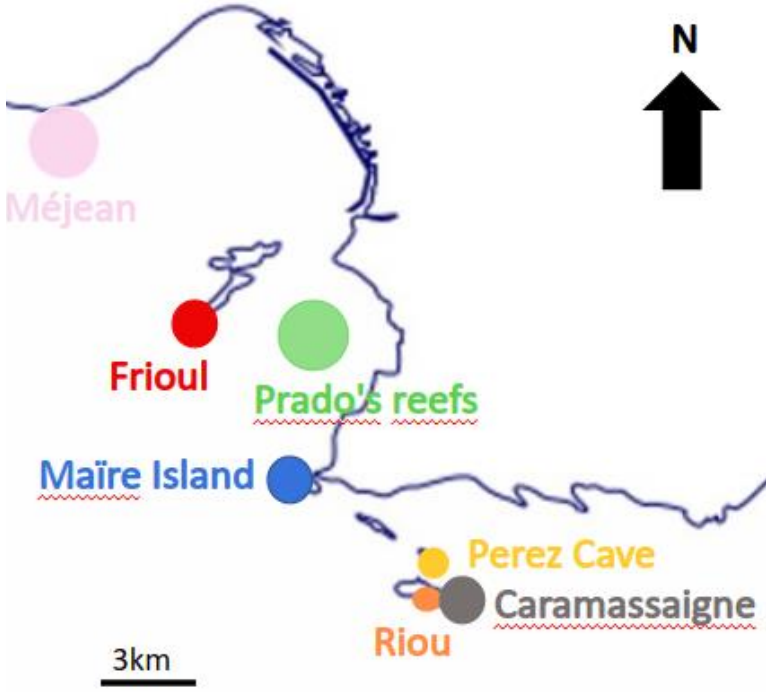

Fig.2B : Geographical locations where sponges were sampled.

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The purpose of the ecotoxicological analysis was to determine the median lethal MeHg concentration "LC50" during 96h in artificial seawater on two stages of the sponge life cycle and sampled on two different seasons.

The results showed that the **buds (juvenile stage) are more sensitive** to methylmercury than adults whatever the season ($LC50_{buds}$ = 2 µg/L) and **adults are more sensitive during summer** ($LC50_{summer}$ = 9 µg/L *vs* $LC50_{winter}$ = 27 µg/L) (Fig. 3).

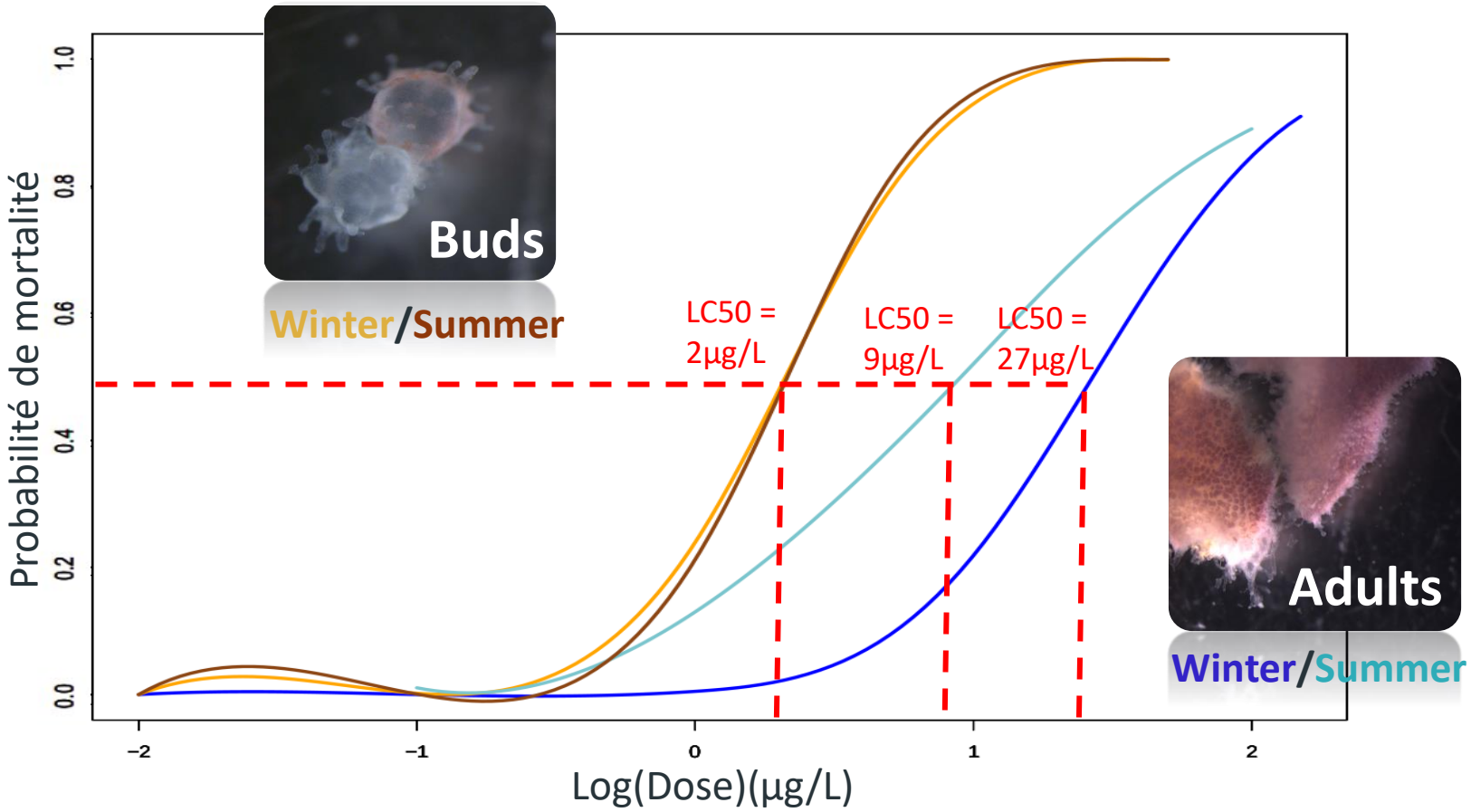

Fig. 3 : Probit regression fitting mortality in Buds and Adults as a function of Hg concentration after a 96h exposure. LC50 = Lethal concentration for 50% of the tested population.

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For the first time in a sponge, our genomic survey enabled to characterize in a same species the genes encoding for phytochelatin synthase, as well as two genes encoding for metallothionein and for each of the three antioxidant enzymes : catalase (CAT), glutathione peroxidase (GPx) and superoxide dismutase (SOD). We measured their relative expression by qPCR on buds treated (or not : control) with methylmercury (0.1 µg/L and 1 µg/L for 96h).

Genes encoding for the metal scavenging protein **MT1** and for the antioxidant enzyme **GPx** were **significantly overexpressed** after mercury exposure. However, genes encoding for PCS and for SOD were under expressed (Fig. 4).

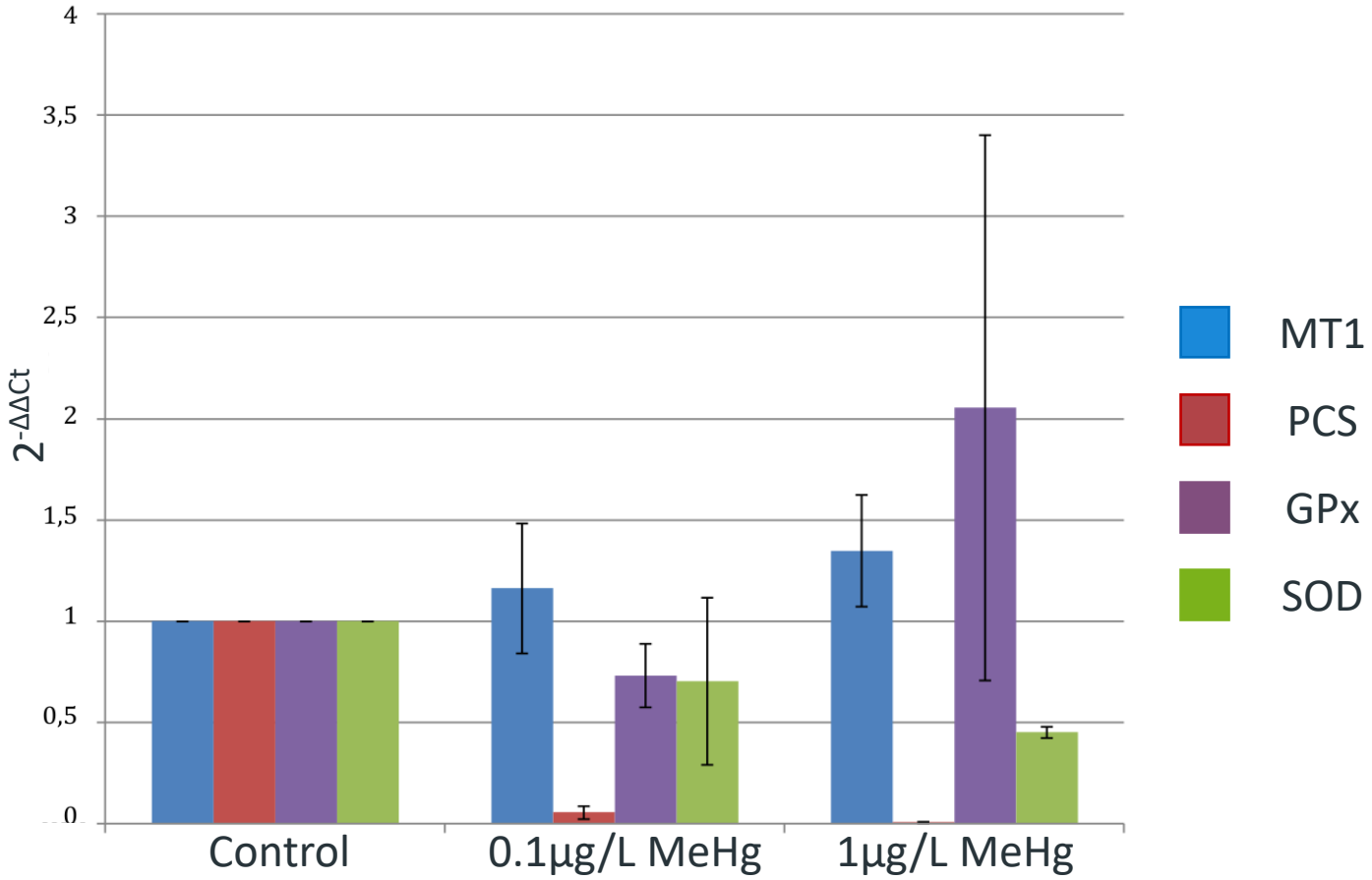

Fig. 4 : Relative expression of metal detoxification genes (MT et PCS) and antioxydant enzymes (SOD et GPx) on buds exposed to MeHg.

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We showed that epithelial integrity (characterized by a cell polarity, adherens-like cell junctions and a basement membrane) is **affected in buds exposed to mercury** compared to controls (Fig. 5).

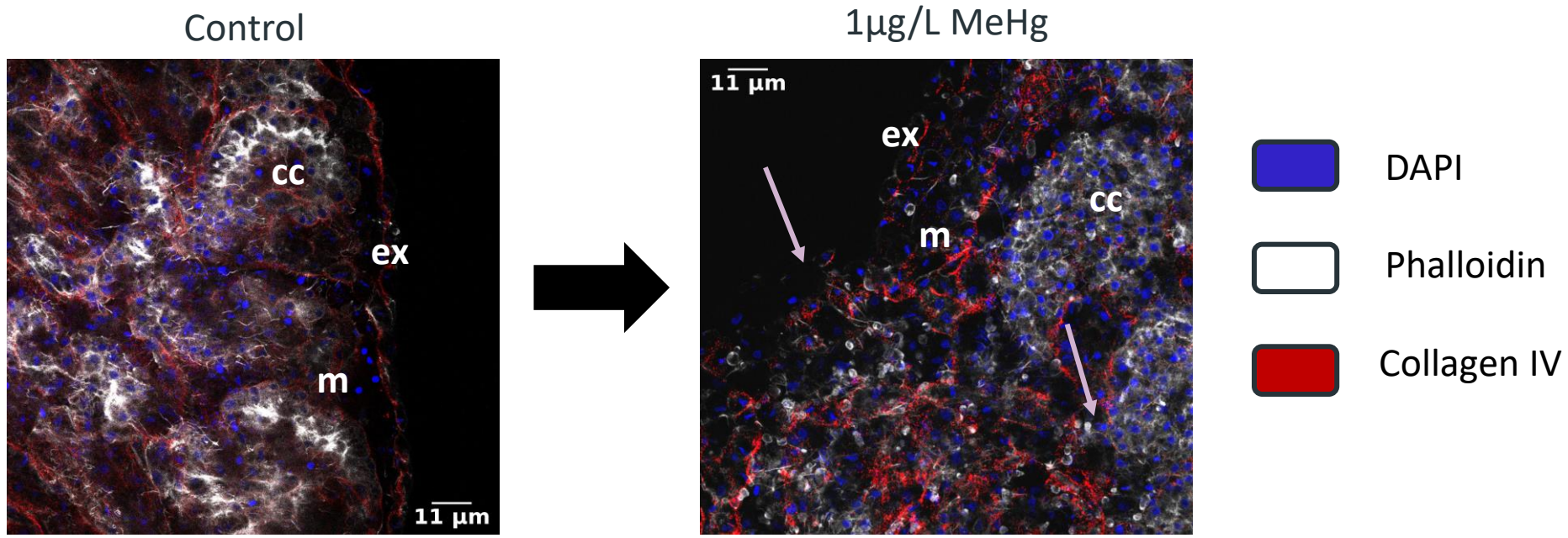

Fig. 5 : Tissues are disorganized in buds after a 96 hours exposure to 1 µg/L (right) compared to the control (artificial sea weater on the left) (confocal imaging). cc= choanocyte chambers; ex= exopinacoderm; m = mesohyl.

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Sessile organisms of the coralligenous biocenosis are exposed to different amounts of mercury depending on their localization in the Bay of Marseille. This finding is in agreement with the past and present anthropogenic activities. We show that mercury induces an increase of antioxidant defense expression in sponges as in most animals where it was studied, and that metallothionein is the main chelating agent used by sponges for the detoxification of this metal. The studied sponge displays one of the lowest LC50 reported for invertebrates. The very low LC50 value and the loss of epithelial integrity observed at sublethal concentrations at the bud stage is worrying since asexual reproduction is the main reproductive process in this species.