Photoprotection capacity differs between functional groups of intertidal benthic diatoms: regulation & performance

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Intertidal marine sediments belong to the most productive ecosystems on earth, despite being characterized by rapidly fluctuating and often extreme light conditions. Its main primary producers are benthic diatoms which possess physiological protection mechanisms against oversaturating light conditions (i.e. 'high light'-HL). Among these mechanisms Non Photochemical Quenching (NPQ) is thought to be the most important one. Its main component (Q_E) is dependent on (1) thylakoid lumen acidification (2) the xanthophyll cycle pigment diatoxanthin, synthetized during thylakoid lumen acidification, and (3) LHCX (Light harvesting complex X) proteins which function as NPQ modulators. Intertidal benthic diatoms consist of two main growth forms. The epipelon comprises larger motile diatoms, which can position themselves along the vertical sediment light gradient, whereas epipsammic diatoms are largely immotile and have to undergo changes in light conditions.

We recently showed that epipelic and epipsammic diatoms show fundamentally different photoprotective responses (Barnett et al. 2015): epipsammic diatoms have higher NPQ and associated xanthophyll cycle capacities compared to epipelic diatoms. In the latter group, the behavioural response (motility) is more important. The regulation and performance of NPQ was studied using model representatives of each functional group during and after exposure to HL (2000 Ymol quanta $m^{-2}s^{-1}$ for 1 h). We observed clear differences in xanthophyll cycle pigment (HPLC) and LHCX protein dynamics (Western blotting) between both representatives. *LHCX* regulation at the transcript level was studied in the epipelic representative *S. robusta* only. All but one *LHCX* genes showed distinct upregulation during HL exposure. Our results indicate that benthic diatoms have an elaborate regulatory network to cope with HL stress, likely due to the harsh light environment of intertidal sediments.

References

Barnett, A. et al., 2015. Growth form defines physiological photoprotective capacity in intertidal benthic diatoms. *The ISME journal*, 9(1), pp.32-45. Available at: http://dx.doi.org/10.1038/ismej.2014.105.

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