

GEOTACTIC BEHAVIOUR IN BENTHIC DIATOMS

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Vertical migration by benthic diatoms is a well-known phenomenon, occurring in intertidal and permanently submerged sediment-inhabiting microphytobenthos. It is known to be partially endogenously-driven, as cell movements can be observed in the absence of external stimuli like light, temperature or water cover. This vertical migration of diatoms under constant conditions has often been attributed to geotactic orientation, although this hypothesis was never experimentally demonstrated. This study was set out to test the geotactic nature of the vertical migratory behaviour of benthic diatoms, by using an experimental setup designed to distinguish surface-oriented from geotactic movements.

The variation of surface microalgal biomass during migratory cycles was compared in sediment samples kept with their surface facing upwards (surface-oriented movements coinciding with geotactic movements; controls) and with the surface facing sideways or downwards (surface-oriented movements not coinciding with geotactic movements). Samples were maintained in complete darkness, in custom-made sealed chambers designed to avoid any contact between the sediment and the atmospheric air and the formation of gradients near the surface. Surface biomass was monitored non-intrusively using pulse amplitude modulating (PAM) fluorometry, by measuring dark-level fluorescence.

The results showed a clear effect of sample orientation in relation to the gravitational stimulus. In the controls, a marked biphasic increase-decrease pattern in surface biomass was observed, with the formation of a marked biomass peak (ca. 4-fold variation). Contrastingly, in samples positioned sideways or facing downwards a comparable peaking in surface biomass was never observed, and biomass levels increased only slowly during the all duration of the experiment. These results indicate that the diatom migration towards the sediment surface is mostly determined by geotaxis and not due to the following of other environmental cues, confirming the hypothesis that in diatom-dominated biofilms upward migration is started by an endogenous, negative geotactic behaviour.