Influence of the mode of macrofauna-mediated bioturbation on the vertical distribution of living benthic foraminifera: First insight from axial tomodensitometry

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Résumé en anglais	We investigated the influence of bioturbation by macrofauna on the vertical distribution of living (stained) benthic foraminifera in marine intertidal sediments. We investigated the links between macrofaunal bioturbation and foraminiferal distribution, by sampling from stations situated on a gradient of perturbation by oyster-farming, which has a major effect on benthic faunal assemblages. Sediment cores were collected on the French Atlantic coast, from three intertidal stations: an oyster farm, an area without oysters but affected by oyster biodeposits, and a control station. Axial tomodensitometry (CT-scan) was used for three-dimensional visualization and two-dimensional analysis of the cores. Biogenic structure volumes were quantified and compared between cores. We collected the macrofauna, living foraminifera, shells and gravel from the cores after scanning, to validate image analysis. We did not investigate differences in the biogenic structure volume between cores. However, biogenic structure volume is not necessarily proportional to the extent of bioturbation in a core, given that many biodiffusive activities cannot be detected on CT-scans. Biodiffusors and larger gallery-diffusors were abundant in macrofaunal assemblage at the control station. By contrast, macrofaunal assemblages consisted principally of downward-conveyors at the two stations affected by oyster farming. At the control station, the vertical distribution of biogenic structures mainly built by the biodiffusor Scorbicularia plana and the large gallery-diffusor Hediste diversicolor was significantly correlated with the vertical profiles of living foraminifera in the sediment, whereas vertical distributions of foraminifera and downward-conveyors were not correlated at the station affected by oyster farming. This relationship was probably responsible for the collection of foraminifera in deep sediment layers (> 6 cm below the sediment surface) at the control station. As previously suggested for other species, oxygen diffusion may occur via the burrows built by S. plana and H. diversicolor, potentially increasing oxygen penetration and providing a favorable microhabitat for foraminifera in terms of oxygen levels. By contrast, the absence of living foraminifera below 6 cm at the stations affected by oyster farming was probably associated with a lack of biodiffusor and large gallery-diffusor bioturbation. Our findings suggest that the effect of macrofaunal bioturbation on the vertical distribution of foraminiferal assemblages in sediments depends on the effects of the macrofauna on bioirrigation and sediment oxidation, as deduced by Eh values, rather than on the biogenic structure volume produced by macrofauna. The loss of bioturbator functional diversity due to oyster farming may thus indirectly affect infaunal communities by suppressing favorable microhabitats produced by bioturbation.
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