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Towards an operational use of benthic foraminifera for organic pollution monitoring in open and enclosed marine environments: case histories from the outer shelf off Congo and the Firth of Clyde in Scotland.

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Résumé en anglais

Foraminifera are among the most abundant protists in marine benthic environments. Because of their short life cycles, high biodiversity and specific ecological requirements of individual species, foraminifera react quickly to environmental disturbance, and can be successfully employed as bio-indicators of environmental change, such as those brought about by anthropogenic pollution. In the last decennia, foraminifera have been increasingly used to monitor pollution in a wide range of marine environments, such as intertidal mudflats impacted by oil spillages, harbours affected by heavy metal pollution, or eutrophicated continental shelves. Our best examples of anthropogenic eutrophication are 1) a drill cutting disposal sites at the outer continental shelf off Congo, where we observed a zonation of foraminiferal faunas in the 750 m around the discharge point. In the immediate vicinity of the discharge points (within 70 m), faunas are characterised by low foraminiferal densities. Faunas between 70 m and 250 m of the disposal sites have very high foraminiferal densities, with high percentages of opportunistic taxa such as B. aculeata and B. marginata. Between 250 and 750 m, foraminiferal densities decrease, and the percentages of opportunistic species are lower; 2) a sewage sludge disposal on the sea floor in the Firth of Clyde (Scotland) where we used benthic foraminifera and macrofaunal/meiofaunal assemblages to evaluate the impact. These two communities present a very similar distributional pattern around the disposal site. In its immediate vicinity, both groups show impoverished faunas composed exclusively of species tolerant to strong oxygen depletion. This area is surrounded by an aureole of high density faunas dominated by opportunistic species. Still farther away, faunal density decreases, and equilibrium taxa gradually replace opportunistic species. At about 3 Km of the disposal site, both foraminiferal and macro-/meiofaunal taxa become comparable to those found at the reference station. We used these data to develop a quantitative pollution index, values of which are strongly correlated with the distance to the disposal site. This foraminiferal index offers the possibility to quantify the impact of anthropogenic eutrophication in marine environments, but its validity must be tested in wider range of naturally and anthropogenetically impacted marine environments.Foraminifera are among the most abundant protists in marine benthic environments. Because of their short life cycles, high biodiversity and specific ecological requirements of individual species, foraminifera react quickly to environmental disturbance, and can be successfully employed as bio-indicators of environmental change, such as those brought about by anthropogenic pollution. In the last decennia, foraminifera have been increasingly used to monitor pollution in a wide range of marine environments, such as intertidal mudflats impacted by oil spillages, harbours affected by heavy metal pollution, or eutrophicated continental shelves. Our best examples of anthropogenic eutrophication are 1) a drill cutting disposal sites at the outer continental shelf off Congo, where we observed a zonation of foraminiferal faunas in the 750 m around the discharge point. In the immediate vicinity of the discharge points (within 70 m), faunas are characterised by low foraminiferal densities. Faunas between 70 m and 250 m of the disposal sites have very high foraminiferal densities, with high percentages of opportunistic taxa such as B. aculeata and B. marginata. Between 250 and 750 m, foraminiferal densities decrease, and the percentages of opportunistic species are lower; 2) a sewage sludge disposal on the sea floor in the Firth of Clyde (Scotland) where we used benthic foraminifera and macrofaunal/meiofaunal assemblages to evaluate the impact. These two communities present a very similar distributional pattern around the disposal site. In its immediate vicinity, both groups show impoverished faunas composed exclusively of species tolerant to strong oxygen depletion. This area is surrounded by an aureole of high density faunas dominated by opportunistic species. Still farther away, faunal density decreases, and equilibrium taxa gradually replace opportunistic species. At about 3 Km of the disposal site, both foraminiferal and macro-/meiofaunal taxa become comparable to those found at the reference station. We used these data to develop a quantitative pollution index, values of which are strongly correlated with the distance to the disposal site. This foraminiferal index offers the possibility to quantify the impact of anthropogenic eutrophication in marine environments, but its validity must be tested in wider range of naturally and anthropogenetically impacted marine environments.

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