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Foraminiferal response to long-term anoxia: In situ experiment in the Gulf of Trieste (Northern Adriatic Sea)

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An increasing number of coastal seas is exposed to severe eutrophication, often resulting in seasonal hypoxia. In the Northern Adriatic Sea, marine snow events also develop every year in late summer to early autumn, further promoting severe hypoxia or anoxia at the sea floor. Consequently, benthic communities of the most exposed areas experience recurrent low oxygen events. These conditions make the Northern Adriatic Sea particularly suitable model to study the effect of anoxia on benthic ecosystems.
To better understand the influence of anoxia on benthic communities, several in situ experiments were performed. Four 0.5 m3 Plexiglas chambers were deployed on the sea floor by scuba divers, at 24m depth in the Gulf of Trieste. The four chambers are used to experimentally generate anoxia in the bottom waters and in the sediment; they were left on the sea floor for different periods of time, ranging from one week to one year. The sediment geochemistry was examined for all sampling periods using different techniques (oxygen and sulphur microsensors for the one-week experiment, DET probes for the one-week and one-month experiments, and interstitial water analysis for all time periods). Meiofaunal density and diversity were analysed after each experiment. The response of the foraminifera, facultative anaerobic unicellular organisms, is presented here.
A one-week period of anoxia had no significant effect on foraminiferal communities. After one month of anoxia, foraminiferal density decreased, some taxa disappeared, but diversity did not change significantly. In the two-month anoxia chamber, density decreased considerably, especially close to the sediment surface. The fauna was strongly dominated by a single species, Eggerella scabra, although many other species were still present in low numbers. The last chamber, deployed for one year, will be sampled in summer 2011.
Thus, short-term anoxia may have only a minor impact on benthic foraminiferal faunas. After two months, however, many species have been reduced to very low numbers, and the fauna is strongly dominated by a single species. This contrasts strongly with the macrofauna, most of which already dies at severe hypoxia or after several hours of anoxia.