Effect of euxinic conditions on planktic foraminifers: results from laboratory culture experiments and implications for oceanic anoxic events

*Azumi Kuroyanagi[1], Takashi Toyofuku[2], Yukiko Nagai[2], Katsunori Kimoto[2], Hiroshi Nishi[1], Reishi Takashima[1], Hodaka Kawahata[3]

1. The Center for Academic Resources and Archives, Tohoku University, 2. JAMSTEC, 3. Atmosphere and Ocean Research Institute, The university of Tokyo

The oceanic redox state is a critical determinant for life on Earth, and “anoxic events” may have substantially impacted the oceanic biosphere. However, we do not know much about the sensitivity of living planktic foraminifers to conditions of anoxia or euxinia (anoxia in the presence of free H_2S).We examined the biological response of planktic foraminifers to euxinic conditions (free H_2S) by culturing six species of planktic foraminifers (n = 31) in three treatments: ~2 mg hydrogen sulfide (H_2S) L^{-1}, ~9 mg H_2S L^{-1}, and a control, without H_2S. No planktic foraminifers survived more than 48 hr in the presence of H_2S, the gametogenesis percentage was extremely low, and the time to gametogenes was very short. These results show that the biological impact of euxinia is fundamentally different from that of dysoxic conditions. Two foraminiferal species survived euxinia for 24 hr, suggesting a species-specific, varying tolerance to H_2S. If the exposure to H_2S was restricted to a relatively short time (i.e., <24 hr; e.g., linked to a tidal cycle), some species of foraminifers (i.e., *Neogloboquadrina dutertrei*) might be able to survive. We argue that disappearance of planktic foraminifers from sediments deposited during anoxic events could be the result of the absence of planktic foraminifers in the photic zone to euxinia (free H_2S), rather than due to carbonate dissolution in the water column and sediment. If this is confirmed, the presence/absence and abundance record of planktic foraminifers might record the oceanic redox state in the euphotic zone and contribute to the evaluation of results of modeling studies. The variability in species-specific response suggests that future changes in foraminiferal assemblages are possible, linked to ocean deoxygenation.

Keywords: planktic foraminifers, culture experiments, hydrogen sulfide, oceanic anoxic event (OAE)

