

Response of benthic organisms to oceanic anoxic event in the Early Jurassic (T-OAE): Insights from quantitative analysis of the trace fossil *Phycosiphon* from the Nishinakayama Formation, Toyora Group

*Kyosuke Kitabatake^{1,2}, Kentaro Izumi³, Kenji Okoshi¹

1. Department of Environmental Science, Faculty of Science, Toho University, 2. Department of Earth Sciences, College of Science, Ibaraki University, 3. Faculty & Graduate School of Education, Chiba University

Paleontological researches on the early Toarcian (Early Jurassic) oceanic anoxic event (T-OAE) have mostly focused on body fossils including marine microfossils. However, marine trace fossils, which are important for understanding the paleoecology of trace-making soft bodied marine benthos, have relatively less been investigated. Therefore, in this study, to evaluate the response of benthos to the T-OAE, we quantitatively measured the occurrence, fractal dimension, and maximum diameter of the trace fossil *Phycosiphon*, which is interpreted to have been produced by small benthos, from the Lower Jurassic shallow-marine Nishinakayama Formation of the Toyora Group (Shimonoseki City, Yamaguchi Prefecture, southwest Japan). Furthermore, to estimate the oceanic redox conditions during the early Toarcian, in addition to the consideration based on available geochemical data, we newly analyzed the size distributions of the pyrite framboids from the mudstones of the Nishinakayama Formation. As a result of our analysis, occurrence percentage and fractal dimension of *Phycosiphon* diminished in the T-OAE interval, and the maximum size also decreased. In addition, the size distribution of the pyrite framboids suggested that the euxinic condition occurred in the ocean at least several times during the T-OAE interval. Available geochemical data suggests that dysoxic benthic condition generally prevailed at the time of deposition of the Nishinakayama Formation. Taken together, it is possible that oceanic redox conditions may have been negatively affected to the ecology and body size of small marine benthos, although small organisms are generally less susceptible to environmental changes than large organisms.

Keywords: Trace fossil, *Phycosiphon*, Toarcian, Oceanic Anoxic Event, Toyora Group, Nishinakayama Formation