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Discovery of chemosymbiotic ciliate from a shallow-water whale fall in Japan

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Chemosynthesis-based ecosystems occur in the deep-sea reducing environments such as hydrothermal vents and seeps. Similar biological assemblages have been reported from sunken whale carcasses in deep sea, which is called as whale-fall ecosystems. As in deep-sea vents and seeps, invertebrates showing symbiotic association with chemosynthetic bacteria have been discovered in whale-fall environments. A hypothesis concerning a role of sunken whale carcasses have been proposed, in which whale falls have been thought to be stepping stones not only for dispersal of deep-sea animals but also for the introduction of chemosymbiotic invertebrates to vent and seep environments.
Most of the whale-fall communities reported to date was found in deep sea, and shallow-water whale falls have been less understood. It is not clear whether sunken whale carcasses are capable of maintaining chemosynthesis-based ecosystems even in euphotic zones. To clarify whether a whale-fall ecosystem occurs in a subtidal zone, one vertebra of a sperm whale was implanted on the seafloor at a depth of 5 m in Tokyo Bay.
After one-year deployment, neither the whale-fall specialist nor the chemosymbiotic invertebrates living in deep-sea reducing environments appeared around bone. Unexpectedly, the giant colonial ciliate was discovered from the surface of the bone. Morphological observations and molecular phylogenetic analyses confirmed that the ciliate was identical to Zoothamnium niveum, a symbiont -harboring protozoan reported from plant materials in subtropical, tropical and temperate subtidal areas. Z. niveum from a whale fall harbored same ectosymbiotic bacteria as the thioautotrophic ectosymbionts of previously reported Z. niveum. These findings indicated that sunken whale carcasses provide a suitable reducing environment for chemosymbiotic species not only in deep sea but also in shallow-water environments.