Feeding behavior and shell morphology of Radiolaria - A key to reconstructing past marine ecology

Atsushi Matsuoka[1]

[1] Dept.Geology, Niigata Univ

Radiolarians, marine protist, appeared in the Cambrian time of ca. 540 Ma and are still occupy marine eco-system worldwide. It is essential to assess the role of radiolarians in marine eco-system for well understanding ocean environments in the past. Since radiolarians are still alive, we can obtain them from the sea and try to culture them in laboratory. We are successful in keeping radiolarians in environmentally controlled conditions and in making a long term observation.

Detailed microscopic observations of living radiolarians reveal that shell morphology is strongly connected to feeding behavior. Four types (A to D) of feeding strategy are recognized in subtropical radiolarians obtained from the South China Sea near Okinawa. Type A, typical in multisegmented nassellarians such as Eucyrtidium and Prerocorys, collects prey by a central shaft extending from the basal opening of shell. Larger prey including ciliates and flagellates can be taken by this strategy. Type B, typical in one or two segmented nassellarians represented by Pseudocubus, gathers prey by using a basal cone as fishing apparatus like a casting net. This strategy is advantageous in collecting tiny prey including micro flagellates and bacteria. Type C, typical in most solitary spumellaria, collects prey by using numerous axopodia radiating outward in all directions. This strategy is also favorable for getting tiny prey mainly composed of bacteria and micro algae. Type D, typical in colonial spumellaria, depends largely on symbiotic algae and do not collect any prey. These four types of strategy well correspond to skeletal morphology. This means that we can infer feeding behavior of extinct radiolarian taxa based on their skeletal morphology.

The wide variation of feeding behavior implies that Radiolaria occupies several kinds of niche in ocean environments. High diversity of radiolarian skeletal morphology is partly related to having a variation in feeding strategies. Once we recognize the role of radiolarians in food web in the recent ocean environments, we can apply it to those in the past. Fluctuation in morphological diversity of radiolarian skeletons is well documented in fossil records. This fluctuation can be interpreted as change in the number of niches in ocean environments through time. Mass extinctions and their recoveries can be understood in the context of drastic eco-system fluctuation which is well documented by the change in radiolarian faunal associations.