Perspectives on pelagic realm research in the Phanerozoic

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Three topics are given in terms of pelagic realm research in the future. The first is about rhythm in chert sedimentation. The second is on radioilarain biostratigraphy and its dating. The third is about culture work on living planktonic protists such as radiolarians and foraminifers.

Chert is the most common rock type among phanerozoic pelagic deposits. It was wide-spread on sea floor before Cretaceous time when radiolarian tests were the only biogenic rock forming constituents in the pelagic environments. Rhythmical stratification seen in chert has attracted many geologists who expressed a wide range of explanations for the formative mechanism. However, appropriate interpretations for the mechanism have been established just after one could obtain a precise age for pelagic sediments applying radiolarian dating. When we observe carefully chert sequences, we can notice the presence of several orders of rhythm. The rhythm in chert sedimentation is always overprinted. The overprint in rhythm could be observed globally and could give a specific sedimentary structure traceable over a wide distance. Chert with lamina-like structures (striped chert) is found in Triassic pelagic sequences included in Jurassic accretionary complexes in Japan. Chert beds with similar and more distinctive features are recognized in Jurassic accretionary complexes in the North Palawan Block in the Philippines. The striped cherts can be key beds in pelagic successions worldwide.

Radiolarian biostratigraphy gives us a geochronologic framework for pelagic realm research. We have a radiolarian biostratigraphic zonation for the entire Phanerozoic. Our next challenge is to refine it for giving a better age control. Upper Carboniferous to Cretaceous radiolarian zonation has been established in combining data sets obtained from fragmentary pelagic successions embedded in accretionary complexes. According to recent progress in biostratigraphic, taxonomic, and geochronological researches, Jurassic radiolarian zonal scheme is updated as follows: Bipedis horiae Zone (JR 0), Parahsuum simplum Zone (JR 1), Trillus elkhornensis Zone (JR 2), Laxtorum(?) jurassicum Zone (JR 3), Striatojaponocapsa plicarum Zone (JR 4), Striatojaponocapsa conexa Zone (JR 5), Kilinora spiralis Zone (JR 6), Hsuum maxwelli Zone (JR 7), and Loopus primitivus Zone (JR 8) in ascending order. The ages of the zonal boundaries are also revised according to the newly established geochronological time scale - GTS 2004. To assign more precise numerical ages to a radiolarian zonal scheme, U-Pb dating of Zircon in tuff beds typically found in hemipelagic succession is recommended.

Culturing work of living radiolarians and planktonic foraminifers provides us with direct evidence for a role of these planktonic organisms in eco-system. Detailed observations of a variety in feeding behavior of cultured radiolarian specimens make it possible to understand the relationship between skeletal morphology and feeding behavior. The wide variation in feeding behavior means that radiolarians occupy several kinds of ecological niches in marine environments. We can infer feeding behavior of extinct radiolarian group based on their skeletal morphology. Fluctuation in morphological diversity of radiolarian skeletons is well documented in fossil records. This fluctuation can be interpreted as change in the number of ecological niches in the marine eco-system through time. Mass extinctions and the subsequent recoveries seem to be a crash of eco-system and their gradual restoration judging from fossil records. Culturing work can give us a basis for understanding a scenario of mass extinction-recovery processes.