Evolution in the chemosynthesis-based communities -From central ridges to back-arc basins and subduction zones-

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Around deep-sea reducing environments such as hydrothermal vent fields and seep areas, large biological communities supported by chemosynthetic energy have been discovered. Most endemic groups of these communities are highly adapted to and restricted within such environments. As reducing environments are scattered at various distances from one another, these animals appear to be very suitable subjects for studying evolutionary processes in the deep-sea, such as dispersion, geological isolation, genetic diversification, speciation and formation of new groups. I and coworkers analyzed evolutionary processes of some dominant groups endemic to deep-sea chemosynthesis-based communities in the western Pacific, namely, vestimentiferan tube worms, provannid gastropods and Calyptogena bivalves.

By molecular phylogenetic analysis, vestimentiferan tube worms with the exception of families Lamellibrachiidae and Escarpiidae, which are relatively old lineages within vestimentiferans, were shown to originated in the spreading ridges in the eastern Pacific. After the isolation from the Juan de Fuca Ridge System by the North American Plate in the Oligocene, vestmentiferans inhabiting vent fields on the East Pacific Rise are thought to have immigrated into the south Pacific via the acific-Antarctic Ridge. In the backarc basins in the south Pacific, they diverged into two families Arcovestiidae and Alaysiidae. While arcovestiids have been staying their birthplace and have not speciated, alaysiids have dispersed into not only seep sites but also into the north Pacific, and diverged into some species.

Two sibling gastropod genera of the family Provannidae, namely, Ifremeria and Alviniconcha, form a dominant group in the hydrothermal vent fields in the backarc basins in the south Pacific. In addition to habitats of the former, namely, the Manus Basin, the North Fiji Basin and the Lau Basin, the latter also inhabits the Mariana Trough and the central ridge in the Indian Ocean. Higher dispersal ability of Alviniconcha gastropods might have enabled them to disperse over wider geographical range and to speciate into A. hessleri and three tentative species.

Only species of Calyptogena bivalves in the backarc basins in the south Pacific was discovered in the DESMOS Caldera, the Manus Basin. Our molecular analysis showed that this undescribed species is closely related to C. similaris, which inhabits seep areas in the Nankai Trough and off the Kikaijima Island.

The Lau-Harve-Taupo arc-backarc complex is very important for studying processes of immigration and genetic diversification between the central ridge in the eastern Pacific and the backarc basins in the south Pacific. From the Lau Basin, gastropods of genera Alviniconcha and Ifremeria were reported. By electrophoretic examination of allozymes, genetic difference of populations of Alviniconcha was showed between the Lau Basin and the North Fiji Basin. The Lau Basin is also the type locality of sole described species of the family Alaysiidae, Alaysia spiralis. Unfortunately, no information on nucleotide sequences of DNA as well as specimens for molecular analyses is available for the Lau Basin. In addition, no biological information have been obtained from hydrothermal vent fields of the Kermadec-Tonga Arc. In order to clearly formation process of chemosynythesis-based communities in the Pacific Ocean, biological survey and sampling at this area is necessary.