Dispersal and evolutionary processes of endemic faunal groups of deep-sea chemoautosythesis-based communities

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Deep-sea reducing environments such as the hydrothermal vent fields and cold water seep areas are scattered at various distances from one another. Since most of the endemic groups are highly adapted to and restricted in such environments, they appear to be very suitable subjects for evolutionary studies in the deep-sea. In the western Pacific, many vent and seep sites have been discovered. On the basis of analyses of molecular phylogeny and phylogenography, we have studied processes of historical dispersal and evolution for many endemic animals to deep-sea reducing environments.

Vestimentoferans of the genera Arcovestia and Alaysia were shown to have derived from vestimentiferans endemic to vent areas along the East Pacific Rise. While arcovestiids stayed at their birthplace, namely, the back-arc basins in the south western Pacific and did not speciate, Alaysia vestimentiferans dispersed not only into seep sites but also into the north Pacific, where they diverged into four species.

Similar processes of dispersion and divergence were suggested for the sibling genera of hydrothermal vent-endemic gastropods of the family Provannidae, namely, Alviniconcha and Ifremeria. A sole species of the latter I nautilei is distributed only in the south western Pacific, while Alviniconcha snails were suggested to have expanded their distribution into not only the Mariana Trough but also the Indian Ocean and diverged into five species.

Vent-endemic barnacles of the family Neoverrucidae were showed to have dispersed from the Mariana Trough to the Okinawa Trough, and then to submarine volcanoes of the Izu-Ogasawara Arc. Populations of these three areas have been isolated and genetically diverged into two species, namely, Neoverruca brachylepadoformis in the Marianna Trough and an undescribed species in the Japanese waters. Our molecular analyses also suggested the historical dispersal of neoverrucids is attributable to the Kuroshio Current and the present isolation among sea regions have been kept by the sills of the back-arc basins.

Compared with vent-endemic or vent-derived, relatively young groups mentioned above, bivalves of the family Vesicomyidae, which can inhabit both vent and seep areas, showed a historical dispersion in reverse direction. Vesicomyid calms dispersed from the north to south western Pacific at least twice and speciated into two species, one of which dispersed into the Indian Ocean.

Difference in the pattern of historical dispersion among faunal groups might be attributable to differences in the larval ecological characteristics, the degree of endemicity to vent environments and/or the antiquity of lineages. Information on larval ecology will offer excellent insights into the evolution of vent-endemic animals as shown by our recent studies on neoverrucid barnacles.