

Whale falls: an evolutionary stepping stone for the introduction of chemo-symbiotic invertebrates to vent and seep environments

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Deep-sea reducing environments such as hydrothermal vents and seeps harbor chemosynthesis-based biological assemblages. Similar communities have been reported from whale falls and sunken wood in deep sea. Whale falls and sunken wood have recently been proposed to serve as evolutionary stepping stones for the introduction of the shallow-water mussels to deep-sea vent and seep habitats (Distel et al., 2000). However, this hypothesis has been based on the phylogenetic relationships among the mytilid mussels only, and did not mention any evolutionary processes for other vent/seep-endemic invertebrates.

Since the first cruise at whale carcasses off Cape Nomamisaki in 2003, five whale-fall sites have been investigated actively around Japan. Many endemic species have been discovered from each location, which included chemosymbiosis-based invertebrates. Molecular phylogenetic analyses of the host species and their symbionts were conducted for testing their relationships to the vent/seep relatives. Morphological observations of the symbioses were also conducted using electron and light microscopes.

Some whale-fall specialists belonging to Vesicomidae and Siboglinidae as well as Mytilidae represented more ancestral lineages than vent and seep relatives. Several whale-fall mytilids showed extracellular symbioses in their gills, which are thought to be more primitive than intracellular symbioses and have never been reported from vent and seep mussels. These results strongly suggest that whale falls may have acted as stepping stones for the introduction of various chemo-symbiotic invertebrates to vent/seep environments.