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Authors: NOBUHARA, TAKAMI, MAJIMA, RYUICHI, HIKIDA, YOSHINORI, and KITAZAKI, TOMOMI

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Preface: Carbonate rocks of fossil chemosynthetic assemblages in Japan

Since the discovery of hydrothermal vent communities on the Galapagos Rift in the mid-1970s, paleontologists have re-evaluated and newly discovered a great many sites of fossil chemosynthetic assemblages with carbonate rocks all over the world. The carbonate rocks frequently preserve *in situ* chemosynthetic paleocommunities and record geological processes (seepage and its influence on bottom conditions) at the sites.

The Japanese Islands, situated along the subduction zone of the Northwest Pacific rim, form one of the "hot regions" to study both modern and fossil chemosynthetic faunas. Many modern vent and seep communities have been documented by submersible deep-sea surveys, which provide important keys for understanding the biology of chemosynthetic faunas and their surrounding tectono-sedimentary settings. Fossil chemosynthetic assemblages have also been reported from many sites, at more than 70 localities, of Cretaceous to Holocene age in Japan. These advantages make it possible for us to trace the temporal and spatial distribution of chemosynthetic faunas in relation to tectonic history and paleoenvironmental fluctuations through geologic time.

On July 1, 2001, Japanese paleontologists held a symposium entitled "Method and future perspective of the study on fossil chemosynthetic assemblages in Japan" at the annual meeting of the Palaeontological Society of Japan, Tokyo. Topics presented by six contributors covered representative fossil sites of Cretaceous to Holocene age on both forearc and backarc sides of Japan. It is noteworthy that fossil chemosynthetic assemblages occurs not only in the coarse-grained sediments of deep-sea settings (trench-fills and accretionary prisms) but also in shallower (outer shelf to upper slope) muddy sediments, whereas no modern seep community has been confirmed from such shallow-water settings around the Japanese Islands.

One of the symposium conveners, Ryuichi Majima, proposed a working hypothesis that the fossil chemosynthetic assemblages in shallower muddy facies may have depended on a methane-hydrate decomposition triggered by water temperature rises or sea-level falls. This hypothesis makes the point that the occurrence of chemosynthetic communities is controlled not only by tectonics, but also by climatic or eustatic fluctuations, and that the modern high-stand sea-level condition makes seep communities in shallower muddy sediments a rare occurrence. Interpretation of the paleoecology and habitat conditions in shallower muddy sediments is one of the important keys for understanding the evolution of chemosynthetic faunas.

This special issue is partly based on the 2001 symposium, and consists of four case studies on fossil chemosynthetic assemblages in muddy facies. The articles contain a full description of fossil assemblages and carbonate blocks (dimensions, mode of fossil occurrence, lithology, petrography, and stable isotopic ratios).

Kitazaki and Majima report a *Lucinoma-Conchocele* assemblage developing a thickness of about 40 m normal to bedding in outer shelf to slope facies of the Plio-Pleistocene Kazusa Group, Miura Peninsula, in which pockmark-related structures are observed. Majima and others describe large carbonate rock bodies of a *Lucinoma* assemblage in the Pliocene outer shelf facies of Kyushu Island. Nobuhara reports limestone blocks containing *Vesicomya* (*Calyptogena*) shells in the Pliocene slope siltstone of central Honshu. He discusses the geological and biological processes of carbonate block formation, which started from subsurface brecciation induced by methane hydrate decomposition. Hikida and others describe a Cretaceous seep assemblage in a carbonate rock in Hokkaido, consisting of a lower brecciated facies and an upper worm tube boundstone. The lower brecciated facies indicates explosive effusion of methane.

The case studies indicate that the carbonate rock bodies are of cold-seepage origin and grew in a bedding normal direction. It is noteworthy that three of four case studies show several lines of evidence of hydrate decomposition and explosive effusion of methane. Paleontological field observations can shed light on the subsurface structure of chemosynthetic assemblages, something that cannot be observed directly by submersible surveys but is important for understanding origins, pathways, and succession of seepages sustaining chemosynthetic ecosystems.

We are grateful to all the participants in the 2001 symposium who shared a fruitful discussion and also thank the Palaeontological Society of Japan for giving us the opportunity to publish the results.

—Takami Nobuhara, Ryuichi Majima, Yoshinori Hikida and Tomomi Kitazaki

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