

Chemosynthetic bivalve community discovered from the Cretaceous deposits in Horokanai-cho, northwestern Hokkaido

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北海道北西部, 幌加内町の白亜系から発見された化学合成二枚貝群集

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北海道北西部の幌加内町, 三十線沢の中部蝦夷層群My4部層 (白亜系の下部セノマニアン, 約95 Ma) に含まれる巨大円形の石灰質ノジュールから3種の二枚貝化石が合弁状態で密集して発見された。それは, 1)大形で, 丸みのある亜三角形, 左右等殻で強く膨らみ, 後方は裁断状となる *Vesicomya inflata*, 2)中形で, 細長で薄く, 表面に幅の広い放射肋があり, 靱帯は外在する *Acharax cretacea*, 3)中形で, 楕円形の *Miltha* sp.である。これら3属共産の組み合わせは, 三笠市奔別の中部蝦夷層群 (下部アルビアン, 約106 Ma) から報告された *Nipponothracia* (スエモノガイ科), *Solemya* (キヌタレガイ科), *Calyptogena* (オトヒメハマグリ科) で構成される軟体動物群集や, 小平町の中部蝦夷層群 (下部セノマニアン) から報告された *Thracia* (スエモノガイ科) と *Miltha* からなる軟体動物群集に似ている。これらの化石群集は, 現生の冷湧水性化学合成軟体動物群集の構成種と類似することから, 北海道のアルビアン~セノマニアンの時代にメタンを含む冷湧水に依存する生息環境が存在した。

Introduction

NISHIDA *et al.* (1998) reported that three species of articulated bivalves from huge-sized calcareous concretions embedded in the Lower Cenomanian (Upper Cretaceous, ca. 95 Ma) mudstones of the My4 Member of the Middle Yezo Group in the upper course of the Sanjussen-zawa, Horokanai-cho, northwestern Hokkaido (Fig. 1).

KANIE *et al.* (1999) examined the bivalves closely, and concluded they were genera *Vesicomya* (Vesicomylidae), *Acharax*

(Solemyidae) and *Miltha* (Lucinidae), and regarded as the constituents of chemosynthetic mollusks (KANIE *et al.*, 1999). In this paper, we identified two genera and describe them as new species.

NISHIDA and KAWASHITA surveyed and collected the specimens, thereafter KANIE, NISHIDA and KURAMOCHI played taxonomic and chemosynthetic studies in the laboratory.

The specimens described here are kept in the Yokosuka City Museum (YCM).

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Manuscript received Dec. 7, 1999. Contribution from the Yokosuka City Museum, No. 536.

Key words: Chemosynthesis, bivalve, Cretaceous, Hokkaido キーワード: 化学合成, 二枚貝, 白亜紀, 北海道

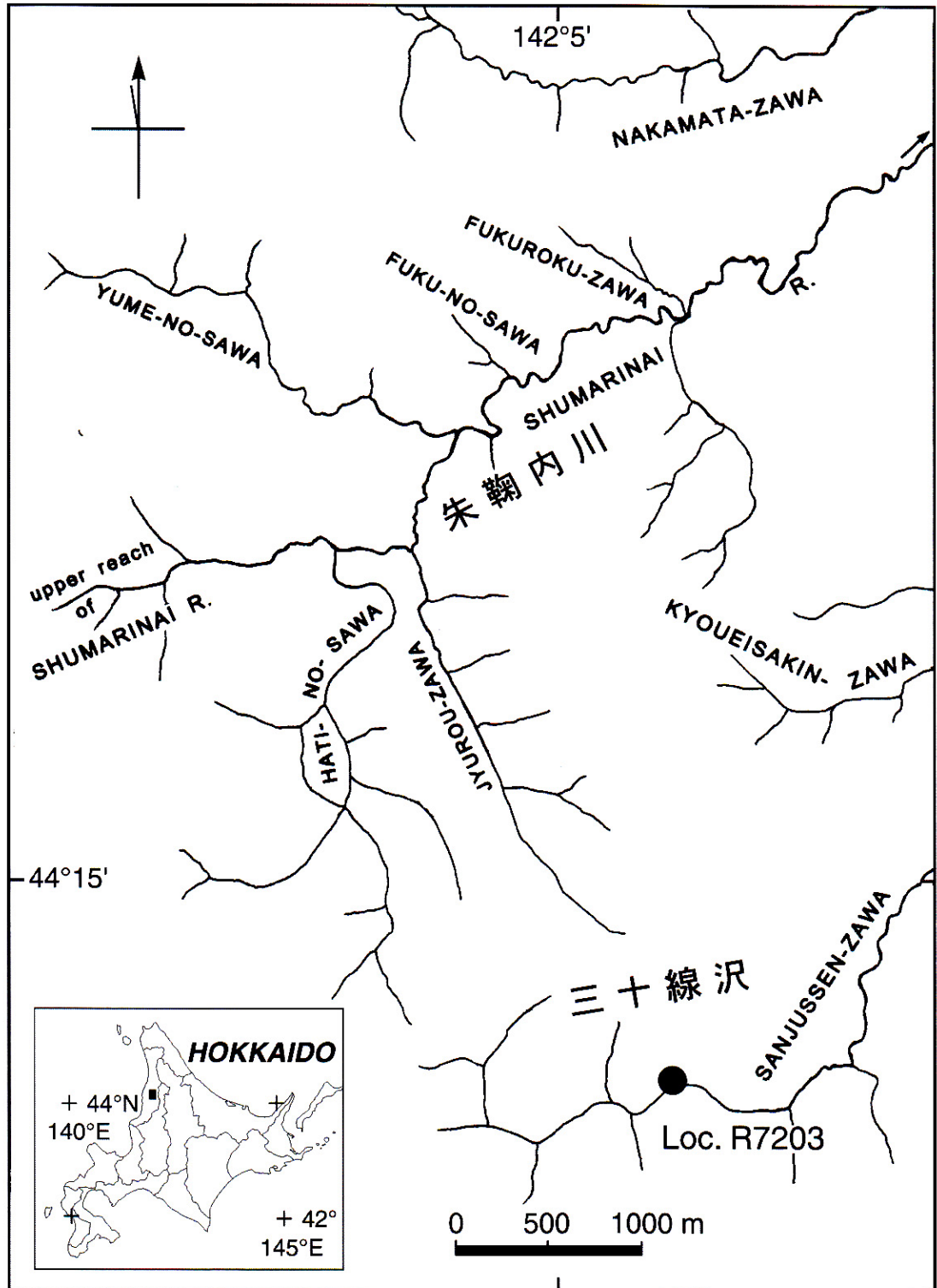


Fig. 1 Locality map of chemosynthetic molluscan fossils in the upper course of the Sanjussen-zawa, Horokanai-cho, central-northwestern Hokkaido.



Fig. 2 Mode of occurrences of huge concretions at the Loc. R7203, in the upper course of the Sanjussen-zawa, Horokanai-cho, Hokkaido. 1. Calcareous concretion of 1.5 m in diameter; 2. numerous fossils were excavated in this concretion; 3. another concretion located about 10 m below of the present concretion (length of the hammer is 40 cm).

Geological setting and mode of fossil occurrence

Three species of articulated bivalves were discovered in a huge-sized calcareous concretion embedded in unit My4 (Lower Cenomanian, ca 95 Ma) of the Middle Yezo Group. The outcrop exposed at Locality R7203, in the upper course of the Sanjussen-zawa, Horokanai-cho, northwestern Hokkaido.

In the specimens, *Vesicomya* occurred as a dominance of present concretion.

NISHIDA *et al.* (1998) described the mode of occurrence of these fossils as "diagnostic large-sized bivalves with trace fossils were included in the concretion". In the chemical composition of this concretion, most of calcium is composed of calcite with minor amounts of quartz (NISHIDA *et al.*, 1998, Fig. 12).

Outline of shell morphology

Systematic description of *Vesicomya infrata* and *Acharax cretacea* are shown in KANIE and NISHIDA (2000).

Vesicomya inflata (Vesicomyiidae). Strongly inflated large-sized shell of rounded-subangular form. Equivalves of truncated postero-ventral end. Test thick.

Acharax cretacea (Solemyidae). Middle-sized shell of long and narrow form.

***Miltha* sp.** (Lucinidae). Long-ellipsoid form of middle-sized shell (Fig. 3). Rare in occurrence.

Chemosynthetic aspect between the Cretaceous and modern species

Living

Formerly, *Vesicomya katsuae* was only one species around the Japanese waters (KURODA, 1953).

Recently, *Vesicomya* sp. was discovered on the Kuroshima Knoll, south of Yaeyama Islands, Ryukyu Trench. MATSUMOTO *et al.* (1998) regarded as the chemosynthetic

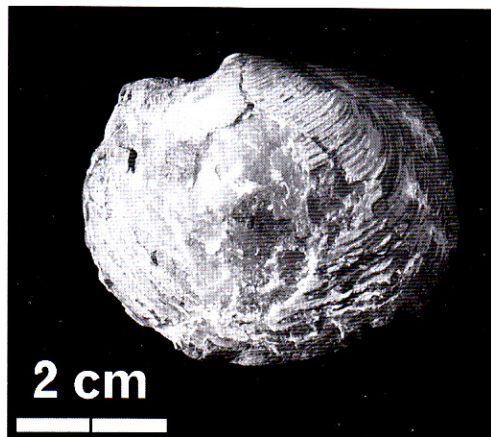


Fig 3. *Miltha* sp from the Sanjussen-zawa, Hokkaido. Specimen YCM-GP1176.

communities at the bottom ruptures of the sea.

Living *Acharax johnsonii* inhabits in reduced muddy sediments (HATTORI *et al.*, 1996) but, modern *Lucinoma spectabilis* (Lucinidae) lives in reduced sandy sediments (HASHIMOTO *et al.*, 1995).

HATTORI *et al.* (1996) clarified that some calcareous concretions had been generated along methane-rich cold seepage zones where chemosynthetic animal communities and carbonate stones were widely distributed.

Extinct

Several papers were presented on chemosynthesis of molluscan fossils.

Widely distributed Miocene to Pleistocene species, *A. tokunagai* (Solemyidae) of both valves, occurred in the mudstones or embedded in calcareous concretion (MAJIMA *et al.*, 1996; SHIBAZAKI *et al.*, 1997)

Nipponothracia (Thracidae); *Solemya* (Solemyidae); *Calyptogena* (Vesicomyiidae) were described as chemosynthetic communities, in the Middle Yezo Group (Lower Albian, ca. 106 Ma) at Ponbetsu, Mikasa, central Hokkaido (KANIE *et al.*, 1993; KANIE and SAKAI, 1997). The community of *Thracia* under the Thracidae and *Miltha* under the Lucinidae had been reported from the Middle Yezo Group (Lower Cenomanian,



Fig. 4 Habitat of *Vesicomya* sp. on the muddy bottom, depth 813 m off Kuroshima, Ryukyu Trench (N24° 07' 35.7", E124° 12' 13.4"). Diving #D3K 347 using the unmanned submersible "Dorphan 3K" of the JAMSTEC. Photo by MATSUMOTO. White spots in front-right and center-left are colonies of *Vesicomya* sp.1

ca. 95 Ma) in Obira, northwestern Hokkaido (KANIE and KURAMOCHI, 1996; KANIE *et al.*, 1996).

Concluding remarks

The fossil bivalves were included in huge calcareous concretions embedded in the Lower Cenomanian (Upper Cretaceous, ca. 95 Ma) mudstones of the Middle Yezo Group in the upper course of the Sanjussen-zawa, northwestern Hokkaido.

The bivalve fauna is composed of 1) *Vesicomya inflata* KANIE et NISHIDA, 2000, 2) *Acharax cretacea* KANIE et NISHIDA, 2000, and 3) *Miltha* sp.

The combination of three genera, *Vesicomya*, *Acharax*, and *Miltha* is common to chemosynthetic communities of the Cretaceous faunae previously described as chemosynthetic mollusca from Hokkaido. Their modes of occurrences of the communities are similar to those of living chemosynthetic molluscan communities associated with cold

water seepage including methane.

It is confirmed that the localized environmental conditions depend on cold seepage during the Albian to Cenomanian of the Cretaceous time in Hokkaido.

Acknowledgements:

We appreciate to Ms. SAKAI Tamie (c/o Yokosuka City Museum) for discussing, Mr. MATSUMOTO Takashi, FUJIKURA Katsunori and FUJIWARA Yoshihiro (JAMSTEC: Japan Marine Science and Technology Center) for the observation on undescribed specimens, Emeritus Professor MATSUMOTO Tatsuro (c/o Faculty of Sciences, Kyushu University) for the collaboration of the field work, and Mr. KAIJO Fumio for rephrasing the English manuscript.

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