

Occurrence of the Tethyan fauna from the Gokashoura Formation in the Shima Peninsula, SW Japan

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Abstract

The Lower Cretaceous Gokashoura Formation of the Nansei Group is distributed in the Kurosegawa Belt, the western Shima Peninsula. It was hitherto known the occurrence of abundant specimens of *Pterotrigonia* (*Pterotrigonia*) *pocilliformis*. During our study, we newly obtained three bivalve species, *P. (P.) yokoyamai*, *P. (Scabrotrigonia) kawaguchiensis* and *Resatrix bungoensis* from this formation. However, we could not recognize any specimen of *P. (P.) pocilliformis* from this formation. The occurrence of *P. (P.) yokoyamai*, *P. (S.) kawaguchiensis* and *R. bungoensis* excluding that of *P. (P.) pocilliformis* suggests that the Gokashoura Formation can be correlated with the Nankai Group represented by the Tethyan fauna. In addition, two species of *Pterotrigonia* and a species of *Resatrix* from the Gokashoura Formation are described.

Key words: Cretaceous, Bivalves, Nankai Group

Introduction

Lower Cretaceous sedimentary rocks of the Chichibu Belt are roughly classified into the Monobegawa and Nankai Groups, based on the lithology, stratigraphy and bivalve fauna. The Monobegawa Group yields the Northern-tethyan fauna, while the Nankai Group yields the Tethyan fauna (Tashiro, 1994). It is known that the Nankai Group is composed of the southward elements comparing with the Monobegawa Group. Therefore, it is important to examine the distributions, stratigraphy and bivalve faunas of these groups for the reconstruction of the paleogeography in the Early Cretaceous time. Among of them, the Nankai Group is distributed from Kyushu to Shikoku (Tanaka, 1989; Tashiro, 1985). Recently, the Matsuo Group of the Kurosegawa Belt in the eastern Shima Peninsula was correlated with the Nankai Group on the basis of the bivalve fauna and lithology (Tanaka *et al.*, 2000). Thus, the distribution of the Nankai Group

extends to the Kii Peninsula. This implies that the bivalve fauna and stratigraphy of the Nansei Group in the western Shima Peninsula should be examined. In this paper, we describe two species of Pterotrigoniinae and one of Pitarinae which we newly obtained from the Gokashoura Formation of the Nansei Group, and discuss the significance of their occurrence. The materials are deposited in the Faculty of Education, Kumamoto University (KE3583-3587).

Fossil locality

The Lower Cretaceous Nansei Group is divided into two formations (Saka *et al.*, 1979). They are the Izumigawa and Gokashoura Formations in ascending order. The latter Gokashoura Formation is lithologically subdivided into the following four members in ascending order: Sandstone- Conglomerate, Lower Mudstone, Upper Sandstone and Upper Mudstone Members (Saka *et*

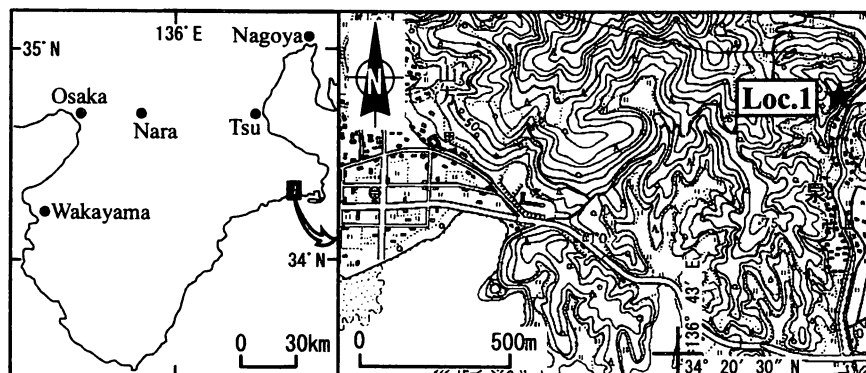


Fig.1. Fossil locality (Topographic map is from 1/25,000 map "Gokashoura" of Geographical Survey Institute of Japan)

al., 1979). Through our study, we obtained shallow marine bivalve species, *Pterotrigonia* (*Pterotrigonia*) *yokoyamai* (Yehara), *P.* (*Scabrotrigonia*) *kawaguchiensis* Tamura and Nishida and *Resatrix bungoensis* Tashiro and Tanaka from the medium-grained sandstone at Loc.1 (Fig.1). According to Saka *et al.* (1979), this fossil locality belongs to the Sandstone-Conglomerate Member. Moreover, Loc.1 situates in the north of Akugatani, and it is considered to be the same location which was reported by Saka *et al.* (1979).

Description of species

Class Bivalvia
Subclass Palaeoheterodonta
Order Trigonioida
Superfamily Trigoniacea
Family Trigoniidae
Subfamily Pterotrigoniinae
Genus *Pterotrigonia* van Hoepen, 1929
Subgenus *Pterotrigonia* van Hoepen, 1929
Pterotrigonia (*Pterotrigonia*) *yokoyamai* (Yehara)
(1915) Figs. 1-1, 2a,b

1915. *Trigonia yokoyamai* Yehara; p.41, pl.2, figs.15-17

1934. *Trigonia yokoyamai* Yehara; Nagao, p.205

1954. *Pterotrigonia yokoyamai* (Yehara); Kobayashi, p.77

1975. *Pterotrigonia* (*Pterotrigonia*) *yokoyamai* (Yehara); Hayami, p.118

1985. *Pterotrigonia* (*Pterotrigonia*) sp. cf. *P.* (*P.*) *yokoyamai* (Yehara); Tashiro, Matsuda and Tanaka, p.9,

pl.2, figs.11-12

1996. *Pterotrigonia* (*Pterotrigonia*) *yokoyamai* (Yehara); Tanaka, Miyamoto, Tashiro and Takahashi, p.26, pl.3, fig.10

Material:- KE3583, one incomplete right external mould; KE3584, incomplete right internal mould; KE3585, incomplete right internal mould, all specimens from Loc.1.

Remarks:- The present material (KE3583) is measured 23.5 mm in length, 16.0 mm in height. Shell comparatively small-sized, moderately inflated, crescent in outline; umbo sharply prominent; disk ornamented with 10 or more strong and smooth costae; area smooth and very narrow with a rounded siphonal margin. The present specimens are referable to *P.* (*P.*) *yokoyamai* (Yehara, 1915) from the Miyako Group in the northeastern part of Japan, in view of similar mode of the area ornamentation. This species is similar to *P.* (*P.*) *pocilliformis* (Yokoyama, 1891) from the Monobegawa Group in Shikoku, in its subradial costae on the disk. The former, however, discriminated from the latter in more rounded siphonal margin and smooth costae. *P.* (*P.*) *datemasamunei* (Yehara, 1915) from the Miyako Group is also distinguishable from this species in more tuberculated costae on the disk. The present species is referable to *P.* (*P.*) *hokkaidoana* (Yehara, 1915) from the Miyako Group in some respects, but differs from it in its less costae, narrow area and rounded siphonal margin.

Occurrence:- These specimens were collected from medium-grained sandstone of the Nansei Group at the Akugatani, Gokashoura area, Mie Prefecture.

Genus *Scabrotrigonia* Dietrich, 1933
Pterotrigonia (Scabrotrigonia)
kawaguchiensis

Tamura and Nishida (1989)

Figs. 1-3

1989. *Pterotrigonia (Scabrotrigonia) kawaguchiensis*
 Tamura and Nishida; p.22-23, pl.1, figs.12-23

1994. *Pterotrigonia (Scabrotrigonia) kawaguchiensis*
 Tamura and Nishida; Tashiro and Hashimoto, p.2-4,
 figs.2-1-3.

Material:- One incomplete, right internal mould
 (KE3586) from Loc.1.

Remarks:- Umbonal and anterior parts are missing. A
 preserved part of the specimen (KE3586) is 31.2 mm long
 and 17.2 mm high. The ornamentation is well preserved
 on the internal surface. Area elongated with weak and
 smooth reverse V-shaped costae and weak growth line.
 This specimen is undoubtedly identical with *P. (S.)*
kawaguchiensis Tamura and Nishida (1989) in view of
 the same sculptures of disk and area. The present species
 is similar to *P. (P.) obsolete* Nakano (1958), *P. (P.)*
imanishii Nakano (1958) and *P. (P.) kobayashii*
 Nakano (1958) from the Cenomanian species of Japan, in
 their outlines and ornamentations of the area. *P. (P.)*

obsolete is clearly discriminated from this species in its
 incomplete reverse V-shaped costae on the area. *P. (P.)*
imanishii differs from it in its more smooth costae and
 complete reverse V-shaped area. *P. (P.) kobayashii*
 appears to be finer and waved reverse V-shaped costae on
 the area.

Occurrence:- The present material was collected from
 sandstone of the Nansei Group at the Akugatani,
 Gokashoura area, Mie Prefecture.

Subclass Heterodonta

Order Veneroida

Superfamily Veneracea

Family Veneridae

Subfamily Pitarinae

Genus *Resatrix* Casey, 1952

Resatrix bungoensis Tashiro and Tanaka, 1996

Fig. 4

1996. *Resatrix bungoensis* Tashiro and Tanaka; p.35-
 36, text-fig.7, pl.5, figs.1-4; pl.6, fig.7

Material:- One right internal mould (KE3587) from
 Loc.1.

Remarks:- This specimen is obtained as internal
 mould. Shell roundly ovate, slightly inflated; umbo

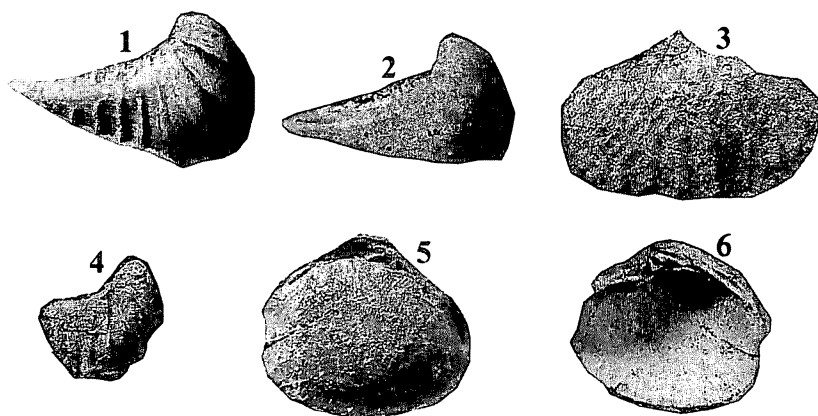


Fig. 2. Bivalves from Loc.1

1-2, 4 : *Pterotrigonia (Pterotrigonia) yokoyamai* (Yehara), 1 : external rubber cast of a right valve,
 KE3583, $\times 1$., 2 : internal mould of a right valve, KE3584, $\times 1$., 4 : internal mould of a right valve, KE3585,
 $\times 1$., 3 : *Pterotrigonia (Scablotrigonia) kawaguchiensis* Tamura and Nishida, internal mould of a
 right valve, KE3586, $\times 1$., 5-6. *Resatrix bungoensis* Tashiro and Tanaka, 5 : internal mould of a right
 valve, KE3587, $\times 1$., 6 : Rubber internal cast of right valve, KE3588, $\times 1$.

prosogyrous, slightly incurved, placed at about one-third of shell-length from the anterior end; hinge plate comparatively narrow with distinct three cardinal teeth and elongated lateral teeth, anterior lateral tooth continued with cardinal tooth; inner surface and inner ventral margin smooth; pallial sinus triangular, rather deep. The present specimen is referable to *R. bungoensis* Tashiro and Tanaka (1996) from the Osaka Formation of Oita Prefecture, in view of the similar outline, dentition and pallial sinus. This species is clearly distinguishable from *Resatrix (Vectorbis) japonica* Tashiro and Kozai (1989) in view of its smooth inner ventral margin and acute pallial sinus. *Resatrix suzuki* Hayami and Oji (1980) differs from this species in its smaller and more rounded valve, and more anterior location of umbo, though *Resatrix suzuki* resembles this species with its rounded outline of the valve. *Resatrix (Vectorbis) miyazakinesis* Tashiro and Tanaka (1992) easily discriminated from this species in its subcircular outline and narrow hinge plate.

Occurrence:- The present material was collected from sandstone of the Nansei Group at the Akugatani, Gokashoura area, Mie Prefecture.

Significance of the occurrence

Previously, the bivalve fossils, *Protocyprina naumanni*, *Costocyrena otsukai* and *Pterotrigonia (Pterotrigonia) pocilliformis*, had been reported from the Gokashoura Formation (Saka *et al.*, 1979). These species has been known from the Ryoseki, Monobe and Lower Hibihara Formations of the Monobegawa Group and their equivalents (Tanaka *et al.*, 1984 etc.). Bivalve fauna of this Group is recognized as the Northern-tethyan fauna, and the above species are the characteristic species of the Northern-tethyan fauna (Tashiro, 1993). As concerns trigonian species, *P. (P.) pocilliformis* had been reported from the Sandstone- Conglomerate and Upper Sandstone Members of the Gokashoura Formation (Saka *et al.*, 1979). However, we could not obtain this species from the sandstone of the Sandstone-Conglomerate Member at Loc.1, though it is the same locality reported by Saka *et al.* (1979). Instead of this species, we could obtain *P. (P.) yokoyamai* (Yehara), *P. (Scabrotrigonia) kawaguchiensis* and *Resatrix bungoensis* at Loc.1 of the Sandstone- Conglomerate Member. The occurrence of these species had been

known from the Nankai, “pre-Sotoizumi” and Miyako Groups. The bivalve faunas of these groups are recognized as the Tethyan fauna, and these species are its important component species (Tashiro, 1994). Thus, the bivalve fossils, which are obtained at Loc.1, can be regarded not as the Northern-tethyan fauna, but as the Tethyan fauna. In addition, we identified with the Tethyan bivalve fauna from the Izumigawa Formation underlying the Gokashoura Formation. It is characterized by the occurrence of brackish-water bivalve species, *Aguilerella nagatoensis* and *Eomiodon matsumotoi*. Then, it is known that the sandstone of the Gokashoura Formation is composed of quartzose arenite (Saka *et al.*, 1979), as like as the Nankai Group which is also characterized by arenite or arkosic sandstone (Tashiro, 1985; Tanaka, 1989 etc.). This lithologic feature supports our conclusion, and this occurrence implies the widespread distribution of the Nankai Group and its equivalents in the Kii Peninsula.

The geologic age of the Sandstone- Conglomerate Member had been generally inferred to be the Hauterivian based on the echinoid study from the Lower Mudstone Member (Obata *et al.*, 1979). On the other hand, *P. (P.) yokoyamai* has been reported from the Aptian beds of the Miyako Group (Hayami, 1966) and the Albian Sukubo Formation of the “pre-Sotoizumi” (Tashiro, 1993) Group. *P. (S.) kawaguchiensis* was also described from the Valanginian to Hauterivian Kawaguchi Formation (Tamura and Nishida, 1989) of the “pre-Sotoizumi” Group and the Barremian to Aptian Mamidani Formation of the Nankai Group (Tashiro and Hashimoto, 1994), respectively. In addition, *R. bungoensis* was described from the Aptian Osaka Formation of the “pre-Sotoizumi” Group (Tanaka *et al.*, 1996). These lines of fossil evidence suggest that the sandstone yielding these species at Loc.1 is probably inferred as the Aptian or so.

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* in Japanese with English abstract

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