
Report

Lithology and foraminifers of Triassic limestones in the Maizuru Terrane of the Yakuno area, Kyoto Prefecture, Japan

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Abstract

Triassic limestones of the Yakuno Group in the Maizuru Terrane of the Yakuno area consist mostly of ooid grainstone and ooid packstone with many detrital quartz grains. They are closely similar to those of the Hiraki Formation in the Tatsuno-Aioi area in their lithologies, rare occurrence and small size less than 5 m in thickness. These features are also common to those of the shelf limestone blocks of the Kaizawa and Tanoura Formations in the Kurosegawa Terrane. Presence of *Meandrospira dinarica*, absence of *Pilamina densa* and much lower taxonomic diversity in the foraminiferal faunas of the Yakuno Group suggest early Anisian (Middle Triassic) age older than those of the Kaizawa and Tanoura Formations.

Key words: Foraminifers, early Anisian, Yakuno Group, Yakuno area, Maizuru Terrane

Introduction

Permian and Triassic formations of the Maizuru Terrane consist of the upper Middle to Upper Permian Maizuru Group, the Lower to Middle Triassic Yakuno Group and the Upper Triassic Nabae Group (Nakazawa et al., 1958; Shimizu et al., 1962). Limestones poorly contained in the Maizuru and Yakuno Groups had long been thought to be conformably embedded within siliciclastic rocks or pebbles in the conglomerate. Kobayashi (2003), however, concluded that all the limestone blocks and fragments in the Maizuru Group and the basal part of the Yakuno Group were reworked from the Akiyoshi Terrane and South China.

In addition to these limestone blocks and fragments with Carboniferous and Permian fossils in the Maizuru Terrane, the Middle Triassic limestone blocks

with many detrital quartz grains occur in the Hiraki Formation of the Tatsuno-Aioi area and the Waruishi Formation of the Yakuno area (Kobayashi, 2008). The occurrence of the Middle Triassic shelf limestone is restricted to the Maizuru and Kurosegawa Terranes in Japan. The limestone of these terranes is common in its composition mostly of ooid grainstone with many detrital quartz grains. The foraminifer fauna, however, shows older age in the former than in the latter (Kobayashi, 1996; 2008; Kobayashi et al., 2005).

This paper reports details on the lithology and foraminiferal faunas of the Triassic limestone of the Waruishi Formation, which were briefly mentioned in Kobayashi (2008). Ninety-five limestone thin sections of the formation are stored in the Museum of Nature and Human Activities, Hyogo, Japan (Fumio Kobayashi Collection, MNHAH).



Figure 1. Triassic limestone localities of Takauchi and Kamiouchi in the Yakuno area. Topographic map is from 1:50,000 map “Izushi”, “Oyeyama”, “Tajimatakeda” and “Fukuchiyama” of Geographical Survey Institute of Japan.

Triassic formations in the Yakuno area

The Yakuno area, western part of Fukuchiyama City, Kyoto Prefecture is the type locality of the Yakuno Group in the Maizuru Terrane. The Yakuno Group is divided into the lower Honodani and the upper Waruishi Formations (Nakazawa et al., 1957). The Honodani Formation of more than 500 m thick consists of mudstone, sandstone and conglomerate. Its N-S trending lithological change from the northern coarser-grained facies to the southern finer-grained facies is remarkable not only in the Yakuno area but also throughout the Maizuru Terrane (Nakazawa et al., 1957; 1958). The Waruishi Formation of about 200 m thick consists mainly of mudstone and fine-grained sandstone. Bivalve and ammonoid fossils indicate Early Triassic (Induan and Olenekian) age of the Honodani Formation and early Middle Triassic (Anisian) of the Waruishi Formation (Nakazawa et al., 1957).

The occurrence of the Triassic limestone is reported only from two localities, Takauchi and Kamiouchi in the Yakuno area (Figure 1). Little are mentioned in the limestone except for its composition of oolitic limestone of several meters thick (Nakazawa et al., 1957; Nakazawa and Nogami, 1958) and the occurrence of nautiloids, brachiopods and crinoids from Kamiouchi (Nakazawa and Nogami, 1958). The Triassic limestone of Kamiouchi was assigned to the Ichio Formation which was correlated to the

Honodani Formation by Nakazawa and Nogami (1958). However, it might be assigned to the Waruishi Formation based on its probably Anisian age, as Kobayashi (2008) thought.

Limestone lithology

The Triassic limestone formerly exposed at north of Takauchi was completely mined. Its fragments, however, are scattered around its original site of the limestone exposure (Figure 1). Eight erratic limestone fragments examined herein consist of ooid grainstone and ooid packstone (Figure 2-1, 2-2). They are almost barren in megafossils except for crinoids and of unknown affinities. The Triassic limestone of Takauchi is lithologically largely different from the Upper Permian (Changhsingian) one with *Colaniella* and *Nanlingella* that is exposed at the point 250 m south of the Triassic limestone. The Upper Permian one consists of floatstone to bioclastic packstone with abundant brachiopods, bryozoans and crinoids (Figure 3).

Two limestone blocks of less than 4 m thick exposed 1.1 km NW of Kamiouchi (Figure 1) are contained in weathered, foliated muddy rocks. One block is weakly recrystallized and has abundant crinoids, minor amounts of detrital quartz grains and narrow matrices (Figure 4-1). The adjacent other block is made up of ooid grainstone having many detrital quartz grains and common fossils such as

brachiopods, crinoids and algae (Figure 4-2). Fossils such as *Pleronautilus*, *Spiriferina*, *Terebratula* and *Rhynchonella* listed by Nakawaza and Nogami (1958) might be derived from this limestone block. Exact age assignment by these fossils, however, is almost impossible. Largely different lithologies of these two limestone blocks at Kamiouchi are not conflict with and suggest the exotic origin of the Triassic limestones (Kobayashi, 2008) as well as the Upper Paleozoic limestones (Kobayashi, 2003) in the

Maizuru Terrane.

Foraminiferal fauna

Triassic foraminifers are very rare in the Yakuno area. They commonly occur as the nucleus of ooids. Identified foraminifers at Takauchi are *Meandrospira dinarica* Kochansky-Devidé and Pantic, 1966, *Hoyenella sinensis* (Ho, 1959), *Gandinella* sp., *Endoteba* sp., *Endotriada* sp., and *Protonodosaria*?

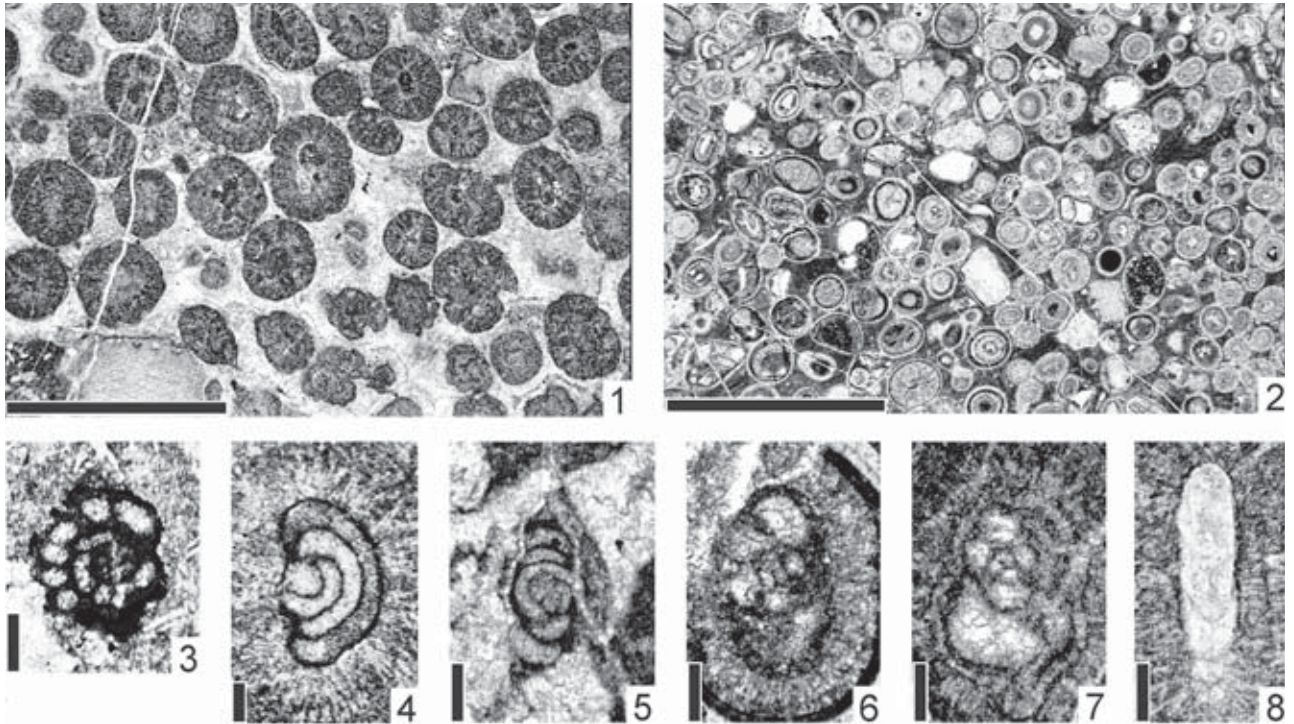


Figure 2. Lithology and foraminifers of the Triassic limestone at Takauchi, 1: ooid grainstone, D2-037689; 2: ooid packstone, D2-037664; 3: *Meandrospira dinarica* Kochansky-Devidé and Pantic, D2-037706; 4: *Hoyenella sinensis* (Ho), D2-037686; 5: *Gandinella* sp., D2-038687; 6: *Endoteba* sp., D2-037709; 7: *Endotriada* sp., D2-037696; 8: *Protonodosaria*? sp., D2-037687. Scale bar shows 2.5 mm in 1 and 2, and 0.1 mm in 3-8.

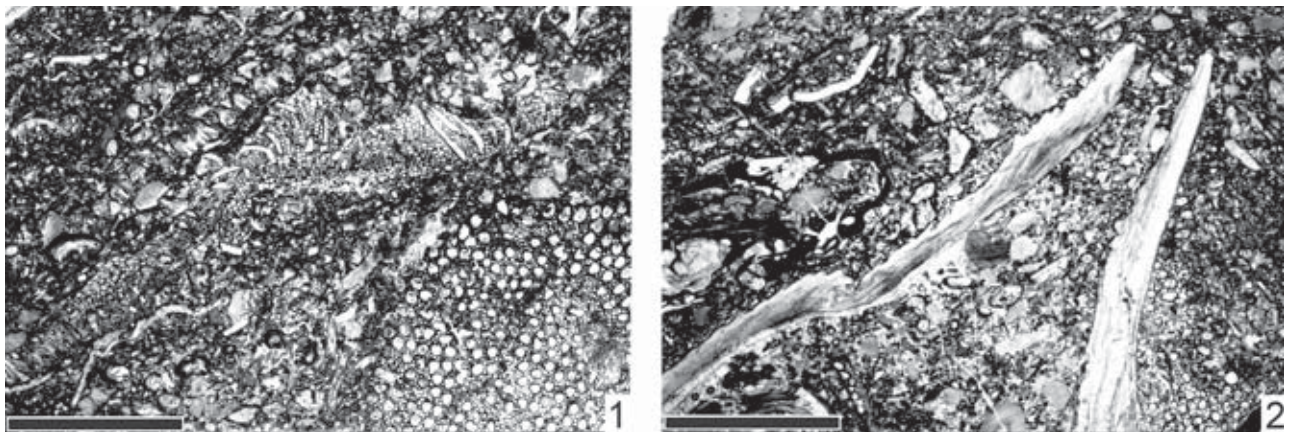


Figure 3. Lithology of the Changhsingian (Upper Permian) limestone at Takauchi, 1: bryozoan floatstone, D2-023497; 2: bioclastic packstone, D2-023500. Scale bar shows 5 mm.

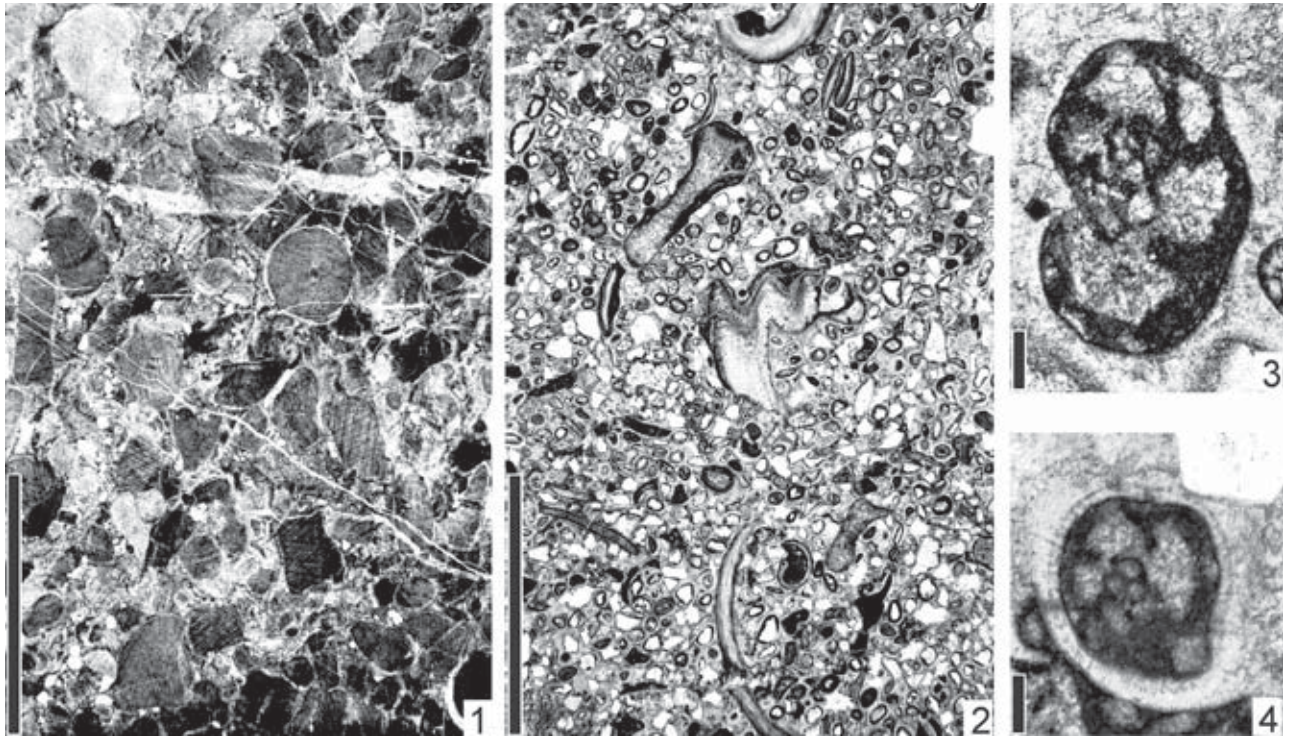


Figure 4. Lithology and foraminifers of the Triassic limestone at Kamiouchi, 1: weakly recrystallized limestone with many bioclasts of crinoids, D2-027408; 2: ooid grainstone with many detrital quartz grains and bioclasts of brachiopods, crinoids and algae, D2-027402; 3, 4: *Endoteba* sp., 2: D2-027397; 3: D2-027391. Scale bar shows 5 mm in 1 and 2, and 0.1 mm in 3 and 4.

sp. (Figure 2-3-2-8). They are further rare at Kamiouchi and confined to *Endoteba* sp. (Figure 4-3, 4-4) and a fragmental specimen probably referable to *Meandrospira*.

The Takauchi fauna and Hiraki fauna (Kobayashi, 2008) are common in the presence of age-diagnostic species of *Meandrospira dinarica* and low taxonomic diversity. They suggest probably early Anisian age of the Takauchi fauna. Foraminifers of these two faunas in the Maizuru Terrane are thought to be younger than those of the Kaizawa (Kobayashi, 1996) and Tanoura (Kobayashi et al., 2005) faunas in the Kurosegawa Terrane judging from the absence of index species of the Middle to Late Anisian such as *Pilammina densa* Pantic, 1964 and much lower taxonomic diversity in the Hiraki and Takauchi faunas.

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References

- Ho, Y.** (1959) Triassic foraminifera from the Chialingkiang Limestone of South Szechuan. *Acta Palaeont. Sinica*, **7**: 387–418. (in Chinese with English abstract).
- Kobayashi, F.** (1996) Middle Triassic (Anisian) foraminifers from the Kaizawa Formation, southern Kanto Mountains, Japan. *Trans. Proc. Palaeont. Soc. Japan*, no. 183: 528–539.
- Kobayashi, F.** (2003) Palaeogeographic constraints on the tectonic evolution of the Maizuru Terrane of Southwest Japan to the eastern continental margin of South China during the Permian and Triassic. *Palaeogeogr. Palaeoclim. Palaeoecol.*, **195**: 299–317.
- Kobayashi, F.** (2008) Early Anisian (Triassic) foraminifers from the Hiraki Formation of the Maizuru Terrane in the Tatsuno-Aioi area, Hyogo Prefecture, Japan. *Jour. Geol. Soc. Japan*, **114**: 80–87.
- Kobayashi, F., Martini, R. and Zaninetti, L.** (2005) Anisian foraminifers from allochthonous limestones of the Tanoura Formation (Kurosegawa Terrane, Japan). *Geobios*, **38**: 751–763.
- Kochansky-Devidé, V. and Pantic, S.** (1966) *Meandrospira* in der Unteren und Mittleren Trias sowie einige begleitende Fossilien in der Dinariden. *Geol. Vjesnik.*, **19**:

15–28.

Nakazawa, K. and Nogami, Y. (1958) Paleozoic and Mesozoic formations in the vicinity of Kawanishi, Oe-cho, Kyoto Prefecture, Japan—A study on the stratigraphy and geological structure of the “Maizuru Zone” (Part 6)—. *Jour. Geol. Soc. Japan*, **64**: 68–77. (in Japanese with English abstract)

Nakazawa, K., Shiki, T. and Shimizu, D. (1957) Paleozoic and Mesozoic formations of the Yakuno district, Kyoto Prefecture, Japan—A study on the stratigraphy and geological structure of the “Maizuru Zone” (Part 4)—. *Jour. Geol. Soc. Japan*, **63**: 455–465. (in Japanese with English abstract)

Nakazawa, K., Shiki, T., Shimizu, D. and Nogami, Y.

(1958) Summary of the Lower and Middle Triassic System in the Maizuru Zone—A study on the stratigraphy and geological structure of the “Maizuru Zone” (Part 8) —. *Jour. Geol. Soc. Japan*, **64**: 125–137. (in Japanese with English abstract)

Pantic, S. (1964) Die Fauna der Werfener Schichten in der Umgebung des Piva Klosters. *Bull. Géol., Soc. Géol. Cranska Gora (Montenegro)*, **1**: 124–128.

Shimizu, D., Nakazawa, K., Shiki, T. and Nogami, Y. (1962) Stratigraphy of the Permian Maizuru Group, Southwest Japan—A study on the stratigraphy and geological structure of the “Maizuru Zone” (Part 10) —. *Jour. Geol. Soc. Japan*, **68**: 237–247. (in Japanese with English abstract)

小林文夫：夜久野地域舞鶴テレーンの三疊紀石灰岩の岩相と有孔虫化石

夜久野地域の舞鶴テレーン夜久野層群の三疊紀石灰岩は碎屑性石英粒子を多く含む ooid grainstone と ooid packstone から成る。石灰岩相・稀な産出・5 m以下の層厚は龍野 - 相生地域の舞鶴テレーン平木層の石灰岩，さらには西南日本外帯黒瀬川テレーンの貝沢層や田浦層の石灰岩のそれらと酷似する。 *Meandrospira dinarica* を産し *Pilamina densa* を欠くこと，はるかに低い種多様性から，夜久野層群の有孔虫群集はアニシアン前期（三疊紀中期）で，貝沢層や田浦層の群集よりも古いと考えられる。

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