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Report

Early Kasimovian (Late Carboniferous) fusulines from Kamiazahara, Shingu-cho, Tatsuno, Hyogo—Late Paleozoic and Early Mesozoic foraminifers of Hyogo, Prefecture, Japan, Part 13—

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Abstract

Three species of early Kasimovian fusulines were obtained from erratic rock samples of brecciated limestone contained in altered basic pyroclastic rocks along a small valley north of Kamiazahara, Shingu-cho, Tatsuno City. They are thought to be derived from the Kozuki Formation of the Ultra-Tamba Terrane. *Obsoletes obsoletus*, *Protriticites* cf. *subschwagerinoides*, and *Quasifusulinoides* sp. are described as the thirteenth of a series of descriptive works of Hyogo foraminifers.

Key words: Fusulines, Ultra-Tamba Terrane, Late Carboniferous, early Kasimovian, Kamiazahara

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Introduction

Late Paleozoic and Triassic foraminifers, mostly of fusulines and accessarily of non-fusuline foraminifers, were reported from 48 localities in Hyogo Prefecture by early 1990's (Kobayashi and Takemura, 1995). Some of them have been restudied by the present author and his colleagues. In the Ultra-Tamba Terrane (Belt), micropaleontologic information of fusulines has been remained insufficient to collectively reexamine the biostratigraphic distribution and faunal composition of exotic limestone blocks of Hyogo. Although there are some reports of occurrence of fusulines and Carboniferous corals from the terrane in the western part of the Hyogo Prefecture, almost all fusulines are left not described and not illustrated.

Three species of early Kasimovian (Late Carboniferous) fusulines were recognized from one of erratic rock samples of brecciated limestone contained in altered basic pyroclastic rocks of the Ultra-Tamba Terrane. These samples were collected along a small valley north of Kamiazahara, Shingu-cho, Tatsuno City (Fig. 1) about 20 years ago. These erratic rocks are thought to be derived from basic pyroclastic rocks contained in the Kozuki Formation, which is exposed immediately north of the distribution area of the Yakuno ophiolitic rocks mainly of metagabbro and amphibolite in the Kamigori district (Igi and Wadatsumi, 1980). Based on Permian radiolarians from the formation and geotectonic analysis of the district, the Kozuki Formation is thought to be the uppermost tectonic unit (UT-3, Kozuki Unit) of the Ultra-Tamba Terrane (Ishiga, 1990; S. Takemura et al., 1993). Fusuline fossils previously reported from

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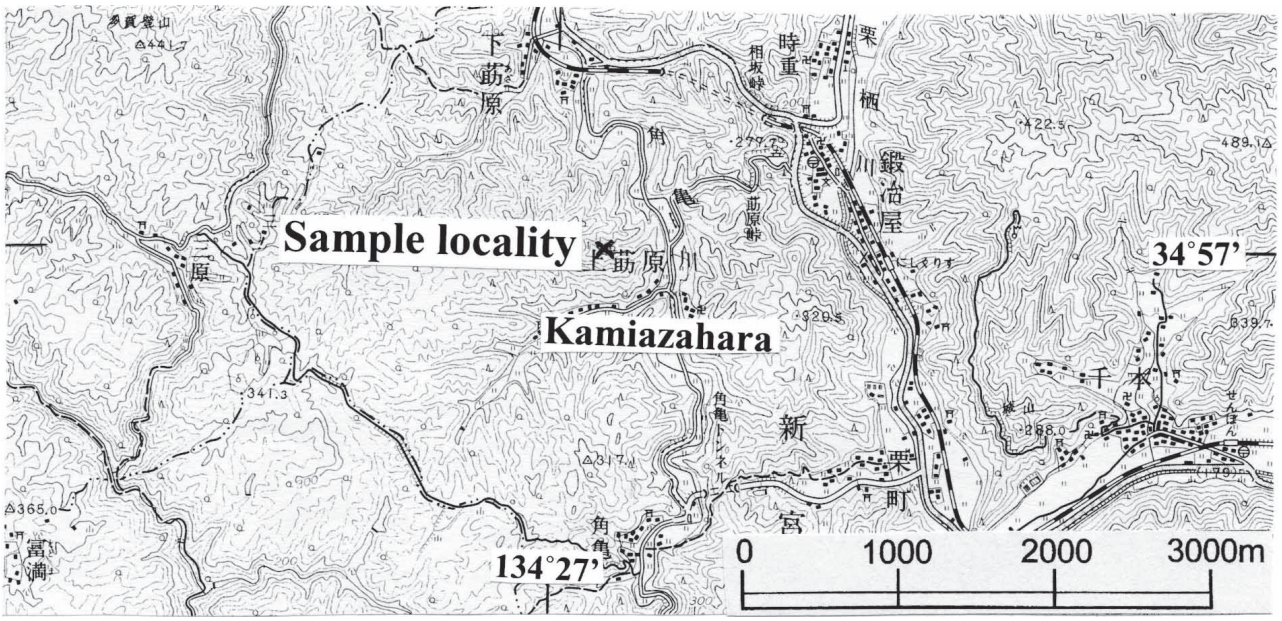

Fig. 1. Sample locality at a small valley north of Kamiazahara. Topographical map is from 1:50,000 map "Kamigori" published by the Geospatial Information Authority of Japan.

the lenticular limestones near Kamiazahara are five species of *Fusulinella* (*F. simplicata*, *F.* cf. *hanzawai*, *F.* cf. *biconica*, *F.* aff. *bocki*, and *F.* sp.) and four species of Early Permian ones (*Pseudofusulina* aff. *kraffti*, *Pseudofusulina* sp., *Schwagerina hawkinsi*, and *Schwagerina* sp.) (Igi and Wadatsumi, 1980; Igi and Goto, 1981). Detailed examination and comparison of them are not possible due to no description and no illustration of these fusulines.

Three species of early Kasimovian fusulines (*Obsoletes obsoletus*, *Protriticites* cf. *subschwagerinoides*, and *Quasifusulinoides* sp.) from Kamiazahara are described in this report as the thirteenth of a series of descriptive works of Hyogo foraminifers. Description of fusulines herein is the second example in the Ultra-Tamba Terrane, succeeded by Kobayashi et al. (2007) fom Hijima, west of Yamasaki.

Forty limestone thin sections prepared in the Kamiazahara are stored in the Museum of Nature and Human Activities, Hyogo, Japan (Fumio Kobayashi Collection, MNHAH).

Description of species

In these twenty years, higher taxonomy of fusulines has been largely renewed (e.g., Rauser-Chernousova et al, 1996; Leven, 2009) in comparison with the previous ones (e.g., Thompson, 1964; Loeblich and Tappan, 1988). Since the present author has no clear idea to argue reasonably these changes, three species distinguished from Kamiazahara are described and discussed without their assignment into higher taxa. For the purpose of morphologic comparison of the Kamiazahara specimens, illustrated are three species from the Kasimovian of the Akiyoshi Limestone, *Obsoletes obsoletus*, *Protriticites subschwagerinoides*, and *Quasifusulinoides ohtanii* (Fig. 2).

Genus *Obsoletes* Kireeva, 1950

Type species: *Fusulina obsoleta* Schellwien, 1908, p. 186.

Discussion.—Fusulines having intermediate test characters between *Obsoletes* and *Protriticites* are not easily discriminated. Both genera were established on the basis of the difference of wall structure of Fusulinella, and by the same reasons the former was separated from the latter. They were assigned to the Family Fusulinidae in Loeblich and Tappan (1988). Whereas, *Obsoletes* is belonged to Schwagerinidae and *Protriticites* to Fusulinidae in Rauser-Chernousova et al. (1996). More exactly, the former is belonged to Family Fusulinellidae under the Order Fusulinida and the latter to Family Triticitidae under Order Schwagerinida. *Obsoletes obsoletus*, designated as the type species of the genus (Kireeva, 1950), is assigned to *Protriticites* by Rozovskaya

(1950) and Sheng (1958), as well as by Putrya (1948) who proposed the genus *Protriticites*.

Protheca with finely alveolar structure is common in wall of outer whorls of both genera. However, transparent layer undoubtedly comparable to diaphanotheca or porous structure referable to keriotheca is not clearly developed in both genera. Thus, *Obsoletes* and *Protriticites* are not separated by the slight difference of wall composition. Although both genera might be congeneric, they are thought to be independent each other by most workers. In this paper, *Obsoletes* is provisionally separated from *Protriticites* by its more elongate test with thinner wall.

Obsoletes obsoletus (Schellwien, 1908)
Figure 2-1–2-10, 2-12–2-14

1908. *Fsuslina obsoleta* Schellwien, p. 186–188, pl. 19, figs. 5–7.
1940. *Fsuslina obsoleta* Schellwien.— Putrya, p. 54–56, pl. 2, figs. 5–7.
1948. *Protriticites obsoletus* (Schellwien).— Putrya, p. 94, pl. 1, fig. 7.
1950. *Protriticites obsoletus* (Schellwien).— Rozovskaya, p. 10–11, pl. 1, figs. 4, 6–9.
1958. *Protriticites* aff. *obsoletus* (Schellwien).— Sheng, p. 95, 96, pl. 10, fig. 12.
1991. *Obsoletes obsoletus* (Schellwien).— Watanabe, fig. 20-1–23.
1994. *Obsoletes obsoletus* (Schellwien).— Kobayashi, p. 630–632, fig. 7-8–14.

Description.— Test elongate fusiform to subcylindrical with broadly arched periphery, almost straight lateral sides, and broadly rounded poles. Mature test with five to six whorls, about 3.2 to 5.2 mm in axial length and 1.2 to 1.5 mm in median width, and form ratio about 2.6 to 4.1.

Proloculus spherical, less than 0.12 mm in diameter. Inner two to three whorls short fusiform to fusiform and tightly coiled. Subsequent ones become elongate fusiform gradually increasing their length and width. Wall thin less than 0.015 mm in outer whorls, and consist of a single layer or relatively dense layer partly with discontinuous thin layer corresponding to tectorium in inner whorls, and tectum and protheca partly showing very finely alveolar structure.

Septa plane in the median part of the test and weakly folded in polar regions. Chomata massive, asymmetrical, one-third to two-fifth as high as chambers, and poorly developed in the outermost whorl. Tunnel not straight and its path irregular.

Discussion.—The present specimens are more or less deformed and weakly recrystallized. Although their detailed comparison is difficult, relatively short fusiform specimens are thought to be incomplete ones without outer or outermost whorls, or due to different appearances by the deformation of the test. Wall of outer whorls might be originally composed of tectum and protheca as well as that *Obsoletes obsoletus* yielded from the Akiyoshi Limestone (Fig. 2-A, 2-B). Based on size and shape of the test, mode of septal folding, development of chomata, and thickness and composition of wall, they are almost identical with *Obsoletes obsoletus* originally described from the Upper Carboniferous of Donetz Basin by Schellwien (1908), and later ones very common in the lower Kasimovian of European Russia and Tethyan regions.

The Kamiazamui specimens are as large as the Akiyoshi ones. But, chomata is more distinct in the latter. Putrya's (1940) ones from Donetz Basin, Putrya's (1948) one from Donbas, and Rozovskaya's (1950) ones from the Moscow Basin are closely similar to the present ones. The present and these European ones are larger than the types and those from the Omi Limestone illustrated by Watanabe (1991). Specimens described by Kobayashi (1994) from the Kanto Mountains are alike to the present ones but have more elongate test with more broadly arched periphery.

Genus *Protriticites* Putrya, 1948
Type species: *Protriticites globulus* Putrya, 1948, p. 91.

Protriticites cf. *subschwagerinoides* Rozovskaya, 1950
Figure 2-15–2-19

Compare—
1950. *Protriticites subschwagerinoides* Rozovskaya, p. 9–10, pl. 1, figs. 5–7.
par 1990. *Protriticites subschwagerinoides* Rozovskaya.— Ozawa and Kobayashi, pl. 3, figs. 19, 21. (non pl. 3, fig. 20 = *Protriticites variabilis* Bensh, 1972)

Discussion.—Acccording to the original description of *Protriticites subschwagerinoides* from the lower Kasimovian of Moscow Basin (Rozovskaya, 1950), wall of the species is finely to coarsely alveolar and consists of tectum and protheca in the last whorl. In addition to the same wall structure, size and shape of

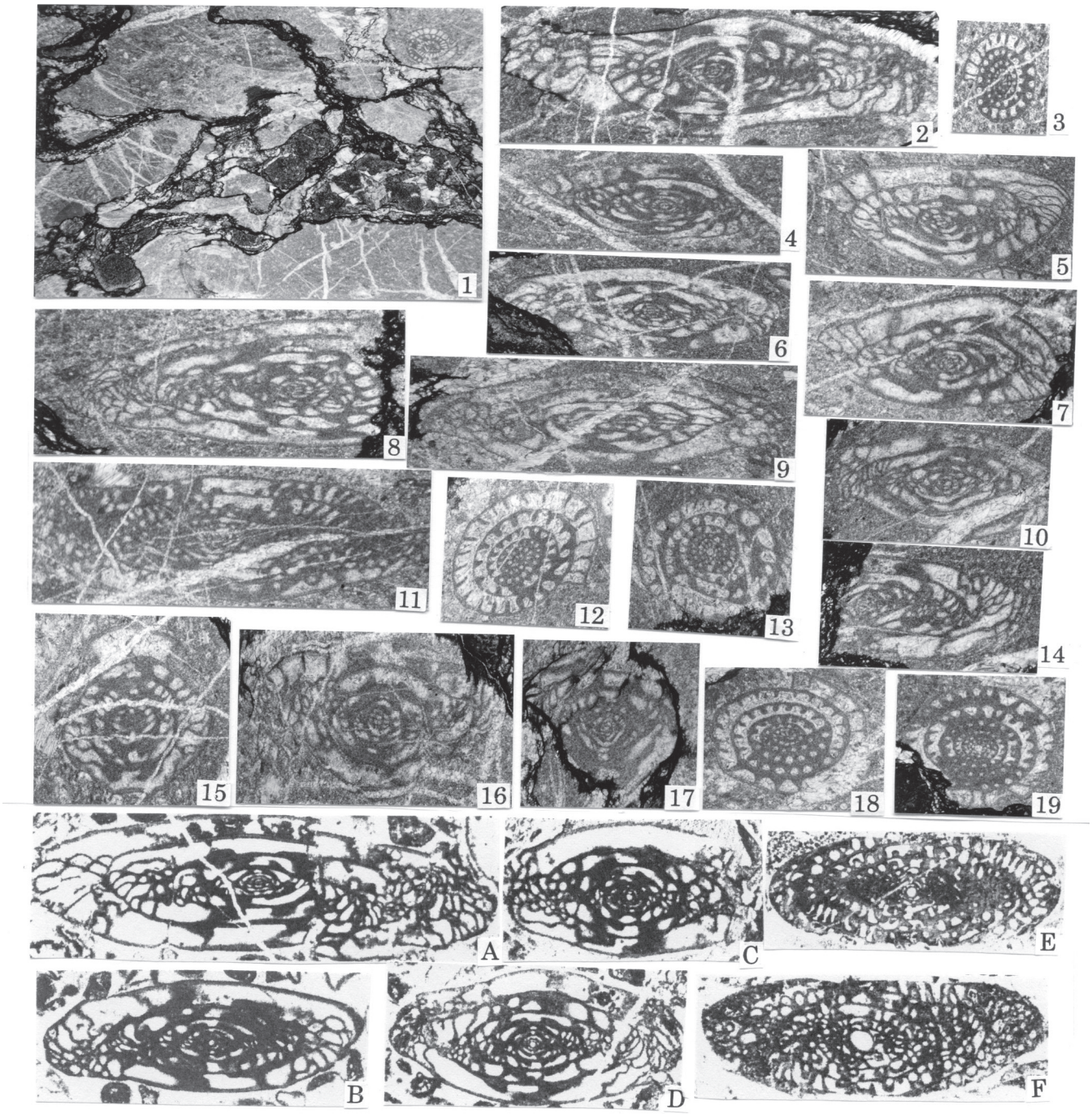

Fig. 2. 1: Brecciated limestone contained in altered basic pyroclastic rock, ×5.　**2–19**: Fusulines contained in brecciated limestone. **2–10**, **12–14**: *Obsoletes obsoletus* (Schellwien), 2: D2-035493, 3: D2-035483, 4: D2-035494, 5: D2-035490, 6: D2-035500, 7: D2-035506, 8: D2-035508, 9: D2-035490, 10: D2-035498, 12: D2-035490, 13: D2-035503, 14: D2-035504. **11**: *Quasifusulinoides* sp., D2-035509. **15–19**: *Protriticites* cf. *subschwagerinoides* Rozovskaya, 15: D2-035502, 16: D2-035497, 17: D2-035501, 18: D2-035496, 19: D2-035504. All ×15.　**A–F**: Fusulines from the Akiyoshi Limestone. **A, B**: *Obsoletes obsoletus* (Schellwien), ×15. **C, D**: *Protriticites subschwagerinoides* Rozovskaya, ×15. E, F: *Quasifusulinides ohtanii* (Kanmera, 1954), ×10.

the test, weak septal folds confined to polar regions and degree of development of chomata, the Akiyoshi specimens including two ones illustrated herein (Fig. 2-C, 2-D) are certainly assigned to the types. However, one specimen illustrated by Ozawa and Kobayashi (1990, pl. 3, fig. 29) is separated from this species and transferred to *Protriticites variabilis* Bensh, 1972 by its more inflated test with more weakly folded septa in polar regions.

The Kamiazahara specimens are assigned to *Protriticites* from its more inflated test than those to *Obsoletes* and from the wall composition of tectum and protheca. Although axial sections were not obtained, five specimens illustrated are comparable to *Protriticites subschwagerinoides* from their similarities of shape and size of the test, and mode of septal folding. On the other hand, the chamber height in the terminal whorl of two tangential sections (Fig. 2-15, 2-16) is larger than that of the types from Russia and Akiyoshi ones. Further comparison is refrained on account of insufficiency of the present material.

Genus *Quasifusulinoides* Rauser-Chernousova and Rozovskaya in Rauser-Chernousova & Fursenko, 1959

Type species: *Pseudotriticites fusiformis* Rozovskaya, 1952, p. 29.

Quasifusulinoides sp.
Figure 2-11

Discussion.— One specimen illustrated is characteristic in its subcylindrical test with broadly arched periphery and rounded poles, and thin wall composed of tectum and translucent layer referable to protheca rather than to diaphanotheca. These characters indicate its probable assignment to *Quasifusulinodes*. Although the specimen available for comparison is restricted, this specimen might be allied to *Quasifusulinoides ohtanii* (Kanmera, 1954), proposed from the Yayamadake Limestone, Kyushu. *Q. ohtanii* is the zonal species of the middle part of the Kasimovian of the Akiyoshi Limestone Group (Ozawa and Kobayashi, 1990). The Akiyoshi specimens identified with this species show broad morphologic variations from specimen to specimen (e.g., Fig. 2-E, 2F). The Kamiazahara specimen has smaller test and smaller length and width in outer whorls than Akiyoshi ones. More specimens from Kamiazahara are needed for further comparison.

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兵庫県たつの市新宮町上莇原（かみあざはら）から産したカシモヴィアン前期（石炭紀後期）フズリナ類—兵庫県産古生代後期・中生代前期有孔虫類，その 13—

小 林 文 夫

兵庫県たつの市新宮町上莇原（かみあざはら）北方の沢で石灰岩角礫を含む変質した凝灰岩の転石から 3 種のカシモヴィアン前期（石炭紀後期）フズリナ類 *Obsoletes obsoletus*, *Protriticites* cf. *subschwagerinoides*, *Quasifusulinoides* sp. が得られた．この転石は超丹波帯上月層の塩基性凝灰岩に由来すると考えられる．これら 3 種を兵庫県産古生代後期・中生代前期有孔虫類，その 13 として記載・報告する．

連絡先：兵庫県立人と自然の博物館　自然・環境評価研究部　〒 669-1546 三田市弥生が丘 6.