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A New Species of *Paraschwagerina, P. taishakuensis*, n. sp. from the Taishaku Limestone in Hiroshima Prefecture, Western Japan

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広島県帝釈石灰岩より産する *Paraschwagerina* の新種, *P. taishakuensis*, n. sp.

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In this paper are given the description of large species of *Paraschwagerina, P. taishakuensis* Sada and Fukuda, n. sp. from the *Pseudofusulina vulgaris* Subzone and the brief summary of the stratigraphy and the Permian fusulinacean zones of the Taishaku Limestone in Hiroshima Prefecture, western Japan.

Key Words (キーワード)
Paraschwagerina taishakuensis. (パラシュワゲリナ・タイシャクエンシス), *Pseudoschwagerina* Zone (シュウドシュワゲリナ帯), *Pseudofusulina vulgaris* Subzone (シュウドフズリナ・ブルガリス亜帯), Permian (二畳系), Taishaku Limestone (帝釈石灰岩), Hiroshima Prefecture (広島県)

Introduction

The Carboniferous and Permian Taishaku Limestone forming the limestone upland is located near Tojo Town of Hiroshima Prefecture, about 90 km to the northeast of Hiroshima City and it has been known as well as the Atetsu and the Akiyoshi Limestone in western Japan. The studies of the stratigraphy and fusulinacean biostratigraphy of the Taishaku Limestone have been carried out by many workers. Previous papers are : Akagi (1958)[1], Hase et al. (1974)[2], Hanzawa (1942)[3], Hayasaka et al.(1966)[4], Oho et al. (1984)[5], Okimura (1966)[6], Sada (1967[7], 1969[8], 1970[9], 1972[10], 1974[11], 1975[12], 1980[13], Sada et al. (1966[14], 1984[15], 1993[16], 1994[17]), Ueno et al. (1993)[18] and Yoshida et al. (1986)[19]. However, the Lower Permian to the Middle Permian fusulinacean faunas in the *Pseudoschwagerina* Zone, the *Parafusulina* Zone and the *Neoschwagerina* Zone have not been studied yet. Thus, we studied the Lower Permian fusulinaceans in order to clarify the specific compositions in these zones and we discovered a new species of *Paraschwagerina, P. taishakuensis*, n. sp. from the upper part of the *Pseudoschwagerina* Zone

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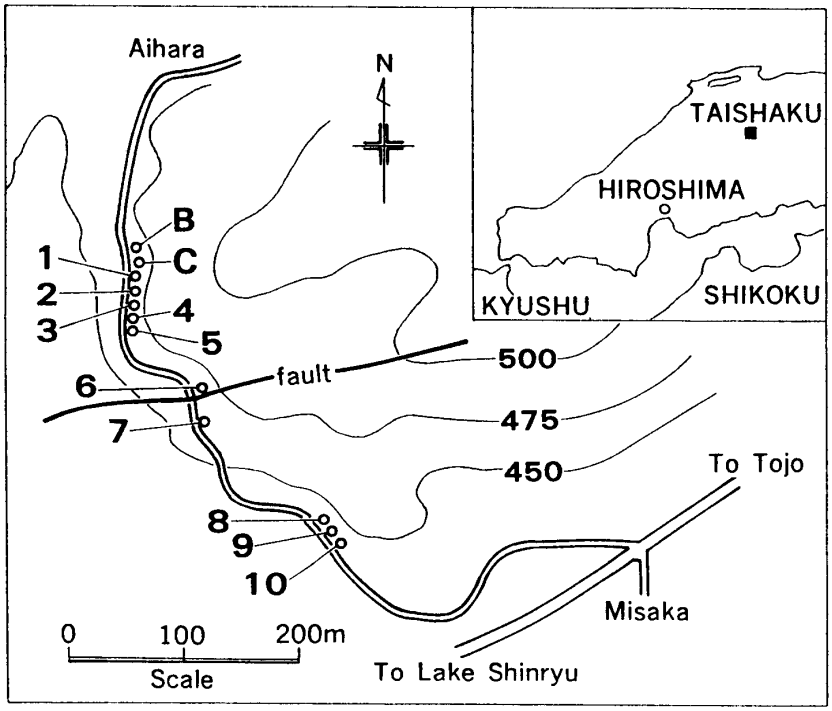


Figure 1. Map showing the localities of fusulinaceans in the Misaka area of Taishaku, Hiroshima Prefecture.

of the Taishaku Limestone. In this paper we described *Paraschwagerina taishakuensis* Sada and Fukuda, n. sp.

Permian fusulinacean zones of the Taishaku Limestone and remarks on *Paraschwagerina taishakuensis* fauna

The Permian of the Taishaku Limestone was divided into the following formations as shown in Table 1, namely, the Uyamanoro, the Arito, the Maedani, the Yasumoto and the Notabiyama Formation in ascending order. In the Permian of the Taishaku Limestone the five fusulinacean zones are established as follows: the *Pseudoschwagerina* Zone, the *Parafusulina* Zone, the *Colania douvillei* Zone, the *Yabeina multiseptata shiraiwensis* Zone and the *Yabeina elongata* Zone in ascending order. Furthermore, the *Pseudoschwagerina* Zone is subdivided into two subzones in upward sequence: the *Pseudoschwagerina miharanoensis* Subzone and the *Pseudofusulina vulgaris* Subzone. The *Parafusulina* Zone is subdivided into three subzones in upward sequence: the *Pseudofusulina kraffti magna* Subzone, the *Parafusulina edoensis* Subzone and the *P. kaerimizensis* Subzone.

Paraschwagerina taishakuensis, n. sp. described in this paper came from the *Pseudofusulina vulgaris* Subzone cropping out at Misaka near Uyama in the Taishaku Limestone Upland and is associated with *Pseudofusulina vulgaris* (Schellwien), *Pseudoschwagerina* sp., *Triticites kuroiwaensis* Toriyama and *Chusenella sinensis* Sheng at Localities of B and C. The fauna is composed of the species listed above can be cor-

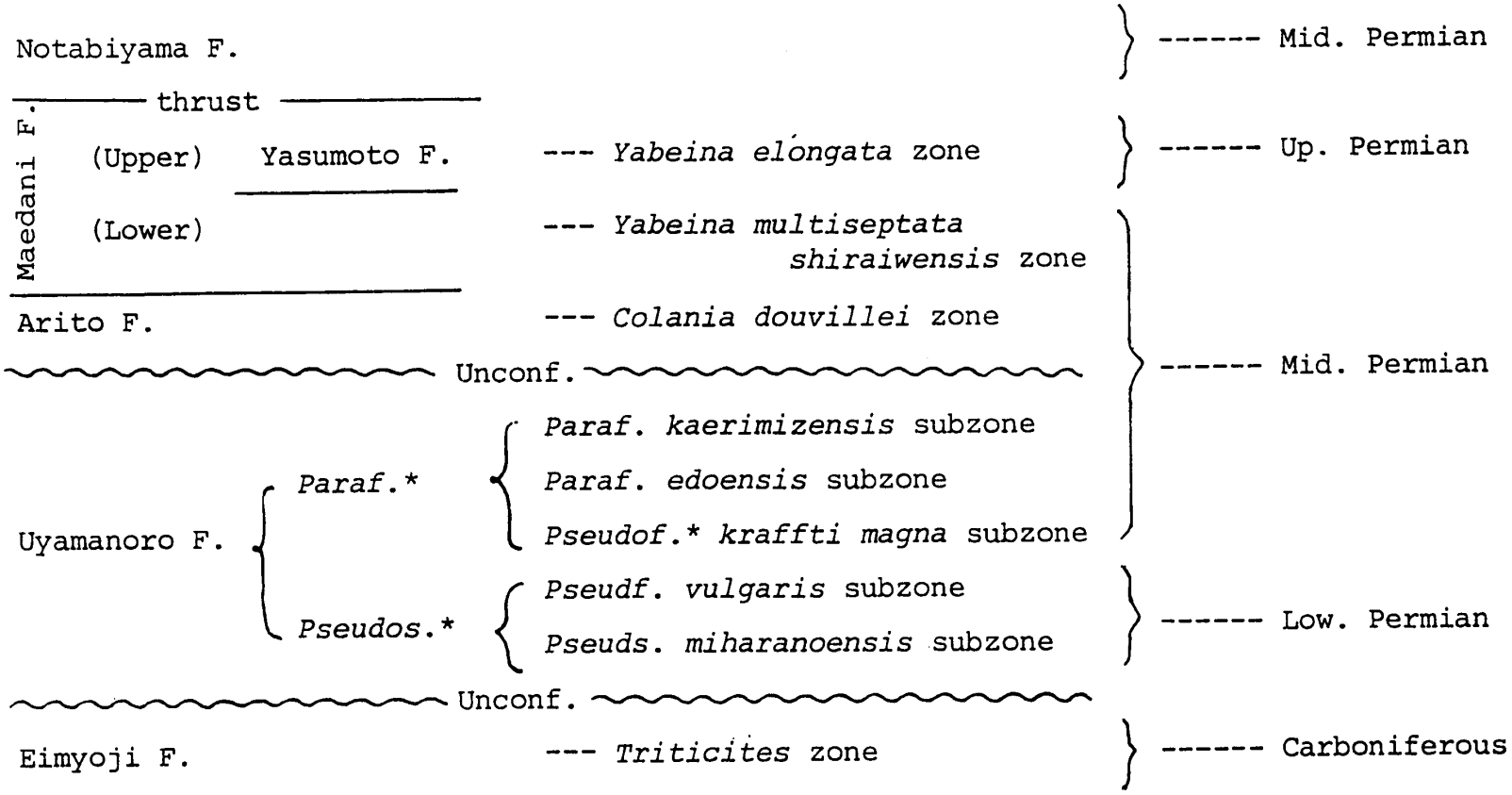


Table 1. Stratigraphic division of the Permian in the Taishaku Limestone Upland. *Paraf** means *Parafusulina, Pseudof* Pseudofusulina and Pseudos* Pseudoschwagerina,* respectively.

Formation	UYAMANORO FORMATION											
Fusulinacean zone	*Pseudoschwagerina*					*Parafusulina*						
Fusulinacean subzone	*Pseudofusulina vulgaris*					*Pseudofusulina krafti magna*			*Parafusulina edoensis*			
Locality	B	C	1	2	3	4	5	6	7	8	9	10
(species)												
Schwagerina etoi Toriyama					×	×						×
S. tschernychewi (Schellwien)									×			×
Triticites kuroiwaensis Toriyama	×	×	×			×				×		×
T. pseudosimplex Chen								×	×	×	×	×
Chusenella sinensis Sheng		×	×									
Pseudoschwagerina sp.		×										
Pseudofusulina vulgaris (Schellwien)	×			×	×							
P. kraffti magna Toriyama						×	×	×	×			
Paraschwagerina taishakuensis	×	×										
Parafusulina edoensis (Ozawa)									×		×	×

Table 2. Stratigraphic ranges of fusulinaceans in the *Pseudoschwagerina* Zone and the lower part of *Parafusulina* Zone.

related with the *Pseudoschwagerina kanmerai* fauna in the Iwamoto Formation of the Atetsu Limestone in Okayama Prefecture (Sada, 1964[20], 1965[21]) and the Late Wolfcampian fusulinacean faunas in North America. The fusulinacean faunas from Loc. 1 to 10 are listed in Table 2.

Systematic Description

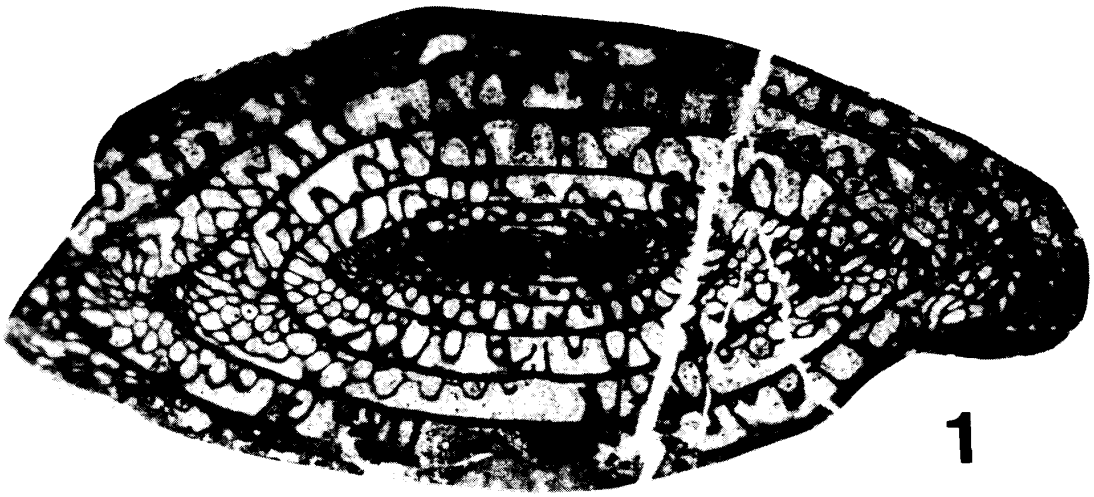
Superfamily Fusulinacea von Moller, 1876
Family Schwagerinidae Dunbar and Henbest, 1930
Subfamily Pseudoschwagerininae L. H. Chang, 1963
Genus *Paraschwagerina* Dunbar and Skinner, 1936

Type species: Schwagerina gigantea M. P. White, 1932

→

Figure 2-1-3, *Paraschwagerina taishakuensis* Sada and Fukuda, n. sp. **1-2,** Axial sections, 1, holotype, Rg. No. B-1-1, 2, paratype, Rg. No. B-1-2, respectively. **3,** Sagittal section, Rg. No. C-9.

2-4, *Pseudofusulina vulgaris* (Schellwien). Axial section, Rg. No. B-2.



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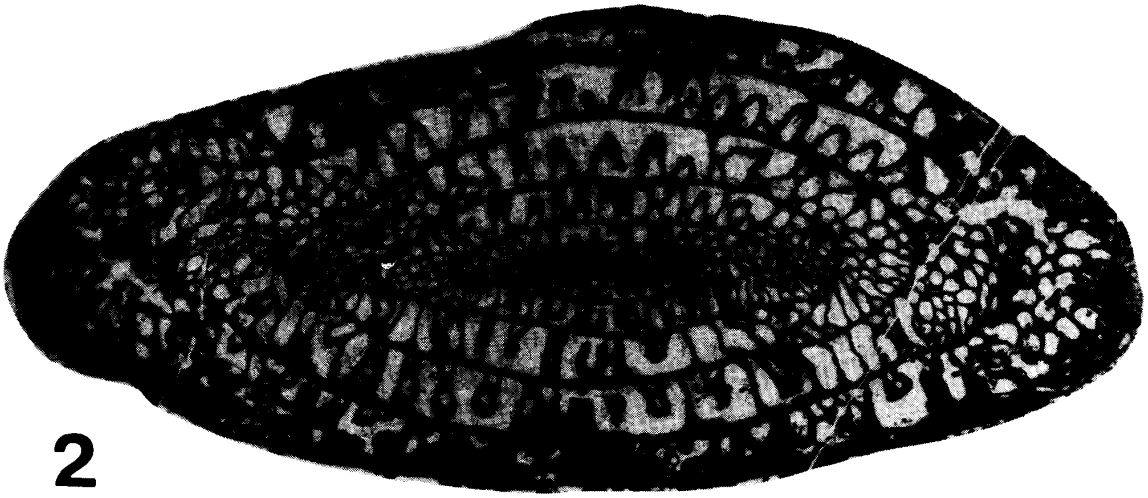

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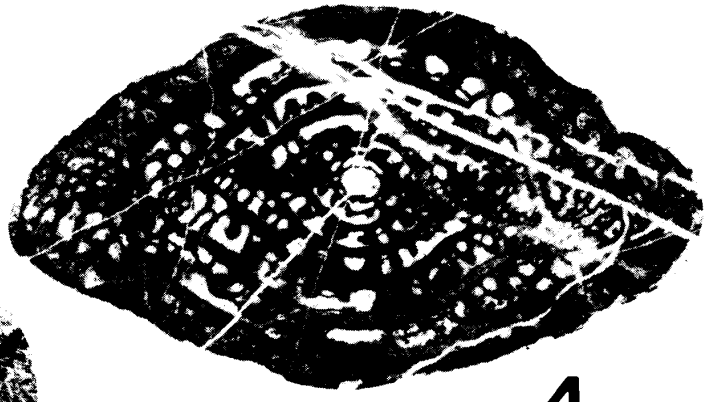

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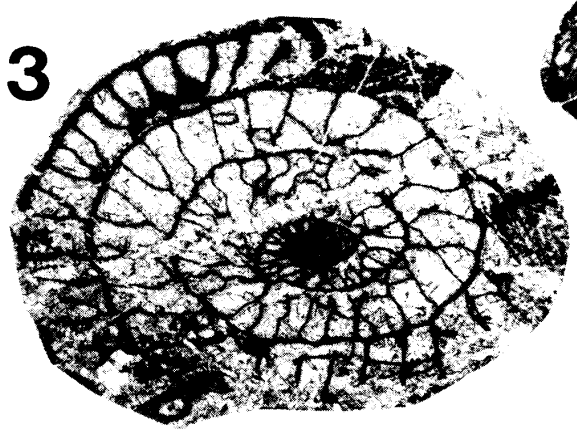

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Paraschwagerina taishakuensis Sada and Fukuda, n. sp.

Figure 2-1-3

Description: Shell of *Paraschwagerina taishakuensis*, n. sp. is large for the genus and inflated fusiform in shape with bluntly pointed poles. The species illustrated in Figure 2-1 has eight volutions and measures 13.00 mm in length and 5.75 mm in width, giving a form ratio of 2.26.

Proloculus is very small and its diameter measures 0.15 mm. Inner four volutions are very tightly coiled and beyond the 4th volution they expand very rapidly. They are loosely coiled. The radius vectors of the 1st to the 8th volution are 0.10, 0.25, 0.35, 0.65, 1.05, 1.75, 2.35 and 2.90 mm, respectively.

Spirotheca is composed of a tectum and coarse keriotheca and its thickness of the 1st to the 8th volution is 25, 32, 34, 64, 115, 121, 172 and 184 μm, respectively. Phrenotheca is developed in central part of shell.

Septa are strongly fluted and rather irregularly fluted from pole to pole and are strongly and highly folded. Chomata are very primitive in the inner four volutions.

Remarks: Paraschwagerina taishakuensis, n. sp. is different from *P. akiyoshiensis* Toriyama (1958[22], p. 155-158, pl. 18, figs. 1-14) from Akiyoshi in its size of shell. The present species somewhat resembles *Paraschwagerina kanmerai* Nogami (1961[23], p. 185-187, pl. 4, figs. 4-7) from the Atetsu Limestone in Okayama Prefecture. The former species, however, is different from the latter in having the inflated fusiform shell, bluntly pointed poles, larger axial length, smaller form ratio and stronger fluted septa.

Paraschwagerina taishakuensis, n. sp. can be distinguished from *P. shimodakensis* (Kanmera, 1958[24], p. 181-183, pl. 29, figs. 1-13) by its larger shell, more number of volutions and smaller form ratio.

The present species somewhat resembles to *Paraschwagerina tarda* (Skinner and Wilde, 1965[25], p. 70, pl. 56, figs. 7-11) from the McCloud Limestone in Shasta Lake area, California. However, the former species has the larger shell, more rapid expansion of the outer volutions and stronger septal fluting.

Occurrence: Rare in the *Pseudofusulina kraffti magna* Subzone and the associated species are *Triticites kuroiwaensis* Toriyama, *Chusenella sinensis* Sheng, *Pseudoschwagerina* sp. and *Pseudofusulina vulgaris* (Schellwien). Localities are B and C in the Misaka area.

Geological age: Early Wolfcampian.

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