A Brief Critical Revision of the Fusulina-Species Recently Described, with Additional Studies on Japanese Fusulinae.

By

Yoshiaki Ozawa.

With 2 Plates.

Recently a number of papers on Fusulinae have been published, by Yabe, Hayasaka, Lee, Colani and me. The titles¹⁾ of these papers by the other authors are given in the footnotes below. I will here briefly review the species described by them.

Prof. Yabe and Assist. Prof. Hayasaka of the Tohoku imperial University figured and named the following species of Fusulina from China, but so far as I am aware, not described.

Fusulinella deprati n. sp.

Fusulinella sphaerica n. sp.

Fusulina sino-indica n. sp.

Schwagerina princeps (Ehrenb.)

Schwagerina (Verbeekina) verbeeki (Geinitz)

Doliolina lepida Schwager

Doliolina gigantea n. sp.

Of these, *Doliolina gigantea* would seem from the illustrations

1) Yabe and Hayasaka: Atlas of Fossils in Geographical Research of China. Pl. XVII and Pl. XXI. 1920.

J. S. Lee: A graphic Method to aid specific Determination of Fusulinoids and some Results of its Application to the Fusulinae from North China. Bull. Geol. Soc. China, Vol. II., No. 3-4. pp. 51-86.

I. Hayasaka: On the Fauna of the Anthracolithic Limesthne of Omi-mura in the western Part of Echigo. Sci. Rep. Tohoku Imp. Univ. II Series (Geol.) Vol. VIII., No. I. 1924.

Colani: Nouvelle Contribution à l'Étude des Fusulinidés de l'Extrême-Orient. Mém. Serv. Géol. d'Indochine, Vol. XI, fas. 1.

given to be *Verbeekina verbeeki*, and the name of *Fusulinella sphaerica*¹⁾ is preoccupied by Abich.

The following is the revised list.

Staffella deprati Yabe

Staffella n. sp.

Fusulina (*Schellwienia*) *sino-indica* Yabe

Fusulina (*Schwagerina*) *princeps* (Ehrenb.)

Verbeekina verbeeki (Geinitz)

Doliolina lepida (Schwager)

In 1924 J. S. Lee described and figured the following species from North China.

Fusulina vulgaris Schellwien

Fusulina tenuissima Schellw.

Fusulina longissima n. var. *arca*

Fusulina californica (var. Staff)

Fusulina elongata (= *extensa*) n. var. *minoris*

Fusulina verneuili cf. var. *sapperi* Staff

Fusulina pusilla Schellw.

Fusulina variata n. sp.

The central chamber of the type specimen of *Fusulina vulgaris* Schellwien is large (0.25–0.4 mm), whereas in the forms described by Lee its average diameter measures at 0.09 mm. Though Lee's figures are not very clear, the only one which appears to show the central chamber being cut through almost the center. The fact droofs the correctness of his measurement. Then it is possible that Lee's specimens may represent the microsphaeric form of *Schellwienia vulgaris*. Yet I identified Lee's specimens with my new species *Schellwienia satoi*²⁾ which is described in my recent paper titled "Paleontological Studies on the Limestone of Nagato".

1) V. v. Möller: Die spiral-gewundenen Foraminiferen des russischen Kohlenkalks. p. 114.

2) Jour. Coll. Sci. Imp. Univ. Tokyo, Vol. XLV., art. 6. 1925.

The third species in the above list, *Fusulina longissima* n. var. *arca* judging from his figures, is characterized by the well-marked folding of septa, and it is more nearly related to *Fusulina tenuissima* than *Fusulina longissima*.

The revised list is

Fusulina satoi Ozawa

Fusulina tenuissima Schellwien

(=*Fusulina longissima* n. var. *arca*)

Fusulina californica Staff

Fusulina elongata Shumard em. Girty var. *minoris*

Fusulina verneuili cf. var. *sapperi* Staff

Fusulina pusilla Schellwien

Fusulina variata Lee.

Quite Recently Assist. Prof. Hayasaka of the Tohoku Imperial University published one of the most important contributions to the study of the Paleozoic system in Japan. In this work, the author described the following species of *Fusulina* obtained from the upper part of the anthracolithic limestone of Omi-mura¹⁾.

Neofusulinella biconica n. sp.

Fusulina brevicula Schwager

Fusulina cfr. *japonica* Gümbel

Doliolina lepida (Schwager)

Schwagerina (*Verbeekina*) *deprati* Yabe

Neoschwagerina craticulifera (Schwager).

Of these, *Fusulina brevicula*, judging from the figures given by Hayasaka, contains at least two types. The one² is represented by Plate II, figures 9, 10, 12 and Plate III, figure 2 and

1) In the paper "Notes on the *Fusulina* limestone of Omi-mura" (Jour. Geol. Soc. Tokyo, Vol. XXXII, No. 376, p. 27. -in Japanese- 1925), I have not only critically revised the *Fusulina* fossils described by Hayasaka, but also listed several Upper Permian fossils such as *Sumatina annae*, *Neoschwagerina douvillei*, *Yabeina hayasakai* (*Y. multiseptata*), *Mizzia velebitana* and *Lonsdaleia* (*Waagenophyllum*) *timorica* Gerth, etc.

2) This species will be described in the following pages of this paper under the name *Fusulina prisca* var. *parvula*.

evidently belongs to the group of *Fusulina prisca* or *Fusulina centralis* and the other, because of the insufficient illustrations, is undeterminable. *Schwagerina deprati* Yabe, so far as I am aware, has been neither described nor illustrated by Yabe. This species is undoubtedly *Verbeekina verbeeki*. The illustrations of *Neoschwagerina craticulifera* (Pl. III., figs. 9, 10) given by Hayasaka show the characteristic peculiarities of *Neoschwagerina globosa*, and moreover one of them has a large initial chamber. Therefore they are none but *Neoschwagerina multiseptata*.¹⁾

The revised list is as follows.

Fusulinella biconica (Hayasaka)

Fusulina prisca var. *parvula* Schellwien

Fusulina cfr. *douvillei* Colani

Doliolina lepida Schwager

Verbeekina verbeeki (Geinitz)

Neoschwagerina (*Yabeina*) *multiseptata* (Deprat)

Miss M. Colani's paper on the study of Fusulinae is very voluminous and well illustrated. It contains several new species, of which *Fusulinella inflata* seems to be identical with *Fusulinella deprati* Yabe; and of the figures included under the name of *Schwagerina princeps* var. *magnae-sphaerae*²⁾, there are some (Pl. XVIII., figs. 3, 4, 7, 8, 9, 10 and Pl. XIX., figs. 9, 12) which closely resembles *Schwagerina amedai* Deprat and I see no reason to doubt that they are really identical.

Neoschwagerina parva which M. Colani considered to be an affinity of *Neoschwagerina globosa* (= *Neoschwagerina douvillei*) is the same as *Neoschwagerina schellwieni* (Deprat).

Of the species identified by Colani, the following species

1) Formerly I described the form having the septa of *globosa*-type and larger initial chamber (0.8 mm. in diameter) by the name *Yabeina hayasakai* n. sp.

2) On *Schwagerina amedai* she remarks "*Schwagerina amedai* Dep., ne donnerait, semblerait-il, pas lieu à des critiques", but, when she diagnoses her new variety *Schwagerina princeps* var. *magnae-sphaerae*, she does not make any reference to *Schwagerina amedai*.

listed on the left column are synonyms of the species of the right column.

Colani's determination	Revised names
<i>Doliolina</i> cf. <i>neoschwagerinoides</i>	<i>Neoschwagerina</i> (<i>Cancellina</i>)
Deprat	<i>primigena</i> Hayden
<i>Neoschwagerina globosa</i> Yabe	<i>Neoschwagerina douvillei</i>
	Ozawa
<i>Neoschwagerina inouyei</i> Deprat	<i>Neoschwagerina globosa</i> Yabe.

Description of the Species.

Fusulinella (*Girtyina*) **konnoi** OZAWA

Pl. X., figs. 1, 2, 3.

1925. *Fusulinella konnoi* Y. Ozawa: On the Classification of Fusulinidae. Jour. Coll. Sci. Tokyo Imp. Univ., Vol. XLV., art. 4. Pl. IV., figs. 6, 7.

Shell spindle shaped, small. Ratio of length to breadth 2.5:1. Septa and shell-wall covered by deposition layers. Septa intensely folded. Buccal aperture small. Initial chamber small and rate of growth of whorls slow as seen from the following measurements of a specimen having axial length of 4 mm.

Volution	Rate of growth
Initial chamber	0.1–0.12 mm
1st Volution	0.26
2nd ,,	0.34
3rd ,,	0.51
4th ,,	0.77
5th ,,	1.07
6th ,,	1.46

Remarks and Occurrence:—The present specimens belong to Staff and Wedekind's *Girtyina*. There are none confounded with this species. It occurs associated with indeterminable *Fusulina* and *Staffella*, etc. in the *Fusulina* limestone overlain by the coal-bearing sandstone group in Manchuria and Korea. The localities are the Heijo coal-field¹⁾ in Korea, Yentai²⁾ and Penhsi-hu³⁾ coal-field in Sheng-sching, Manchuria.

Age: Upper Carboniferous.

***Fusulinella praecursor* (DEPRAT)**

Pl. IX., figs. 5, 6. Pl. X., figs. 4, 5, 6, 7, 8.

1913. *Neofusulinella praecursor* Deprat: Fusulinidés de Chine et d'Indochine. Mém. Serv. Géol. d'Indochine, Vol. II., fas. I. p. 40. Pl. VII., figs. 6-16.

1924. *Neofusulinella praecursor* Colani; Contribution à l'Étude des Fusulinidés, Mém. Serv. Géol. d'Indochine, Vol. XI., Fas. 1, p. 101. Pl. XVI., figs. 6, 11, 17, 23-43. Pl. XVII., figs. 1-22.

This species is well illustrated and described by Colani. The following table contains the measurements made on the present specimens.

Volution	No. of septa	Rate of growth
Initial chamber	5-7	0.08 mm
1st Volution	11	0.17
2nd	12	0.31
3rd	14	0.41
4th	16	0.58
5th	16	0.86
6th	18	1.24

1) 平壤炭田

2) 煙台

3) 盛京省本溪湖炭田

Remarks :—Deprat's description of his species has been considerably amplified by Colani, whose beautiful figures have enabled me to recognize *Fusulinella praecursor* among my collection of Japanese Fusulinae. The masses of rock specimen are composed almost exclusively of this species.

Locality ;—From the Fusulina limestone of Tahara¹⁾, at about 18 kilometers west of Nariwa in the Province of Bitchu.

Age : Permian.

***Fusulina (Schellwienia) prisca* var. *parvula* SCHELLW.**

Pl. IX., figs. 2, 3, 4. Pl. X., fig. 9.

1908-'09 *Fusulina prisca* var. *parvula* H. v. Staff: Monographie der Fusulinen. Paleontographica Vol. 55, p. 184. Pl. XIX., figs. 14, 15.

1912.? *Fusulina centralis* var. *irregularis* H. v. Staff: Monographie der Fusulinen. Teil. 3. pp. 178-179. Pl. XVI., figs. 7, 9. Pl. XVII., figs. 5, 7, 10, ? 11.

1924. *Fusulina brevicula* Schwager, Hayasaka: On the Fauna of the Anthracolithic Limestone of Omi-mura. p. 15, pl. II., figs. 9, 10, 12, Pl. III., fig. 2.

1925. *Fusulina* cf. *prisca* var. *parvula* Schellwien, Ozawa: Paleontological Studies of the Limestone of Nagato. p. 39. Pl V., fig. 3.

Shell small, longly fusiform, more or less rounded at ends. The proportion of length to width ranges from 2.8 to 3.2. The largest number of whorls observed is 6. The rate of growth of the whorls and the number of the septa in each whorl are given in the next page.

Remarks :—According to Schellwien, the chief features by which the present variety can be distinguished from *Fusulina prisca* are the small dimensions and the slow rate of growth of

1) 備中國吹屋村田原

Volution	No. of septa	Rate of growth
Initial chamber		0.15 mm
1st volution	11	0.26
2nd	13	0.39
3rd	15	0.60
4th	19	0.99
5th	22	1.60
6th	25	2.10

the whorls. V. Staff compared a North American *Fusulina centralis* var. *irregularis* with *Fusulina regularis* Schellwien, but there is in many respects a close relationship between the former and *Fusulina prisca* var. *parvula*. The only points in which *Fusulina centralis* var. *irregularis* shows any difference from *Fusulina prisca* var. *parvula* are the slender shell-wall and more or less pointed ends of the shell. But in examining a large number of specimens which I identified with *Fusulina prisca* var. *parvula* I am struck by the fact that the above differences are not so important as to separate the species.

It occurs very abundantly in the *Fusulina* limestone of Omi-mura¹⁾, Prov. of Echigo.

Age: Upper Carboniferous.

***Verbeekina aliciae* (DEPRAT)**

Pl. VIII., fig. 1.

1912. *Doliolina aliciae* Deprat: Fusulinidés de Chine et d'Indochine Mém. Serv. Géol. d'Indochine Vol. I, fas. 3. p. 43, Pl. V., figs. 11-14.

A glance at Plate VIII., fig. 1 will show that the present specimens correspond exactly with Deprat's type of the species though they are not the orientated sections.

1) 越後國青海村

This species associated with *Fusulina* cf. *ambigua* Deprat and *Mizzia velebitana* Schubert is found in the *Fusulina* limestone collected at Shirai, twelve miles east-east-north of Takayama in the province of Hida.¹⁾

Age : Permian.

Explanation of Plates.

PLATE IX.

- Fig. 1. *Verbeekina aliciae* (Deprat). Loc. Shirai, Prov. Hida.
Figs. 2, 3, 4. *Fusulina* (*Schellwienia*) *prisca* var. *parvula* Schellwien.
Loc. Omi-mura, Prov. Echigo.
Figs. 5, 6. *Fusulinella praecursor* (Deprat).
Loc. Tahara, Prov. Bitchu.

PLATE X.

- Figs. 1, 2, 3. *Fusulinella konnoi* Ozawa.
Loc. Pen-hsi-hu coal-field in Manchuria.
Figs. 4, 5, 6, 7, 8. *Fusulinella praecursor* (Deprat).
Loc. Tahara, Prov. Bitchu.
Fig. 9. *Fusulina* (*Schellwienia*) *prisca* var. *parvula* Schellwien.
Loc. Omi-mura, Prov. Echigo.

1) 飛騨國白井