

FUSULINIDS FROM THE TYPE-LOCALITY OF THE CHANGHSING LIMESTONE

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The present brief communication is published in order to demonstrate a small fusulinid fauna found from the Changhsing limestone at the type-locality in the Changhsing coal fields, some 25 km northwest of the Changhsing city, northeastern Chekiang Province by W. S. Wu, H. L. Liang, L. H. Lu and the writers in a field trip to Changhsing in the spring of 1956. Although the limestone and its fauna of this region have been the subject of some studies, the fusulinids have not yet been described.

The Changhsing limestone in this coal field is well exposed in the southern slope of the western part of Tameishan, a hilly ridge about one kilometre northwest of the small village, Baotsun, and some three kilometres southwest of the Meishan town, Changhsing County. Here, it measures about 34 metres in thickness, it is underlain by the *Gigantopteris* coal series and is overlain by the Lower Triassic thin-bedded Chinglung limestone. Lithologically, it can be generally divided into three parts. Stated in descending order they are as follows:

Lower Triassic: Thin-bedded Chinglung limestone.

- (3) Rather thick-bedded, pinkish gray, subcrystalline limestone yields *Bairdia* spp. (Ostrocods), *Hustedia indica* (Waagen), *Marginifera* sp., *Athyris* sp., *Rhipidomella* sp., *?Hemiptychina* sp. (Brachiopods), *Lophophyllum* (coral) and some Ammonoids. In the upper part of this bed, the minute fusulinids, *Reichelina changhsingensis* Sheng and Chang (sp. nov.) and *Palaeofusulina* cf. *sinensis* Sheng were obtained 11.5 m
- (2) Blackish thin-bedded (3—9 cm) cherty bands intercalated with deep gray limestone having a bituminous odour and containing *Bairdia* spp. (Ostrocods), *?Linoproductus* sp. (Brachiopods) 11.28 m
- (1) Deep gray thick-bedded limestone bearing bituminous odour, seldom with chert nodules and cherty bands yielding *Chonetes* sp. (Brachiopods) and some Ostrocods 11.95 m.

The *Gigantopteris* coal series.

The Changhsing limestone is not well exposed in the Taotuishan, another hill ridge neighbouring the Tameishan. At this locality, only the upper part of the limestone is cropped out, while the middle and the lower parts are covered by recent deposits. Here, we found the following species:

Ostrocods:

Bairdia spp.

Microcheilinella sp.

Bythocypris sp.

?Cavellina sp.

Brachiopods:

Uncinulus timorensis (Beyrich)

Chonetes sp.

Marginifera sp.

Punctospirifer sp.

Avonia sp.

?Rhipidomella sp.

Fusulinids:

Reichelina changhsingensis Sheng and Chang (sp. nov.)*Palaeofusulina* cf. *sinensis* Sheng*Palaeofusulina minima* Sheng and Chang (sp. nov.)*?Palaeofusulina simplex* Sheng and Chang (sp. nov.)

At the southern foot of Chingtangshan, some three kilometres southwest of the Tameishan locality, only the uppermost part, about 6 metres thick of the Changhsing limestone, is exposed. This locality yields only one characteristic fusuline species *Palaeofusulina* cf. *sinensis* Sheng in association with other foraminifers, *Pachyphloria* sp. and *Nodosaria* sp.

The matrix of the fusulinids found at these two localities is pinkish gray and subcrystallized limestone. According to lithological character, the fusulinid beds of these two localities are also believed to be corresponding to that of the Tameishan locality. The diagram of sections of the Changhsing limestone in this region, showing the fusulinid faunas, is given in page 206.

As stated above, it appears clear that in this region, i. e. the type-locality of the Changhsing limestone, the most important and most characteristic fusulinid genera which occur in the upper part of the limestone, are *Palaeofusulina* and *Reichelina*. They are the index fossils of the Changhsing limestone in Kiangsi and Kueichow Provinces (Sheng, 1955), and they are the most important numbers of the *Palaeofusulina* zone. This zone is therefore believed to represent the uppermost fusulinid zone in South China and probably in the whole world as well.

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DESCRIPTION OF SPECIES

Subfamily Ozawainellinae Thompson and Foster, 1937**Genus *Reichelina* Erk, 1941, emend. K. M.-MacLay, 1951*****Reichelina changhsingensis* Sheng and Chang' (sp. nov.)**

(Pl. I, figs. 1—11)

Test minute and lenticular; axis of coiling short; periphery sharply angulate. The final $\frac{1}{2}$ volution greatly expanded in height or uncoiled to produce a stout, hornlike flaring terminus to the shell. Mature specimen of $3\frac{1}{2}$ volutions measuring about 0.13 mm to 0.14 mm in length and 0.51 mm to 0.54 mm in width. Form ratio 0.24:1 to 0.27:1, averaging 0.25:1.

Spirotheca exceedingly thin, composed seemingly of a tectum and upper and lower tectoria. Diaphanotheca not seen.

Septa also thin and straight. In the sagittal section, they are distinctly arcuate anteriorly, even in the uncoiled part.

Chomata weakly developed in all of the volutions. Tunnel slit-like. Proloculus minute, about 0.3 mm to 0.38 mm in outside diameter.

Remarks: The present species is closely similar to *Reichelina minuta* Erk described by K. M. -MacLay from the Upper Permian of North Caucasus but differs from the latter in having more smaller proloculus and fewer whorls. It can be distinguished from *Reichelina simplex* Sheng

from the Changhsing limestone of Kueichow Province, by its more shorter axis of coiling and its greater number of volutions at maturity. It resembles *Reichelina media* K. M. MacLay in some respects but has fewer volutions at maturity.

Measurements (in mm) of *Reichelina changhsingensis* Sheng and Chang

Specimen	L	W	F. R.	Diam. Prol.	Width of Volutions				Form Ratio of Volutions			
					1	2	3	3½	1	2	3	3½
9042	0.14	0.51	0.27	0.038	0.09	0.15	0.326	0.51	0.64	0.60	0.30	0.27
9043	0.14	0.52	0.27	0.03	0.08	0.14	0.29	0.52	0.63	0.55	0.41	0.27
9045	0.14	?	?	0.03	0.09	0.16	0.32	?	0.64	0.55	0.40	?
9046	0.13	0.54	0.24	0.038	0.09	0.15	0.32	0.54	0.56	0.56	0.38	0.24

Occurrence: This species was collected from the upper part of the Changhsing limestone at the southern slopes of Tameishan and Taotuishan. Cat. Nos. 9042 (holotype), 9043—9052 (paratypes).

Subfamily Boultoninae Skinner and Wilde, 1954

Genus *Palaeofusulina* Deprat, 1912

Palaeofusulina cf. *sinensis* Sheng

(Pl. I, figs. 21—25)

1955, *Palaeofusulina sinensis* Sheng, Acta Palaeontologia Sinica, Vol. 3, No. 4, pp. 295, 305, Pl. IV, figs. 1—15.

We have found three sagittal sections and two incompletely preserved axial sections of the genus *Palaeofusulina* in our collection from Changhsing coal fields. These specimens compare favorably with those from the Changhsing limestone of Kiangsi and Kueichow Provinces identified by Sheng (1955) as *Palaeofusulina sinensis*. They are closely similar in shape, septal fluting, septal counts, number of volutions and outer diameter of proloculus; but the axial sections of the present specimens are so incompletely preserved, it is therefore difficult to refer them to this species with certainty.

Occurrence: These specimens were collected from a pinkish gray and subcrystalline limestone in the upper part of the Changhsing limestone at the southern slopes of Tameishan and Taotuishan, and at the southern foot of Chingtangshan. Cat. Nos. 9062—9066 (Plesiotype).

Palaeofusulina minima Sheng and Chang (sp. nov.)

(Pl. I, figs. 13—18)

Test very small, thickly fusiform. Adult specimens having 3 volutions about 0.67—0.91 mm in length and 0.43—0.58 mm in width. Form ratio 1.56:1 to 1.57:1.

Spirotheca very thin, about 0.025 mm in the thickest part of the second volution. It composed distinctly of a tectum and a diaphanotheca.

Septa highly and narrowly fluted, with its parallel-sided folds sometimes reaching the coilings of the chamber. Tunnel distinct, chomata not observed. Proloculus minute and spherical, about 0.075—0.08 mm in outer diameter,

Measurements (in mm) of *Palaeofusulina minima* Sheng and Chang

Specimen	L	W	F. R.	Diam. Prol.	Widths of Volutions			Form Ratio of Volutions		
					1	2	3	1	2	3
9054	0.91	0.58	1.57	0.075	0.13	0.29	0.58	1.3	1.65	1.57
9056	0.76	0.44	1.72	0.08	0.13	0.29	(2½)0.44	1.3	1.5	1.72
9055	0.67	0.43	1.56	0.08	0.11	0.22	0.43	1.54	1.54	1.56

Remarks: Superficially, this species resembles the immature specimen of *Palaeofusulina sinensis* Sheng from the Changhsing limestone of Kiangsi and Kueichow Provinces, but is distinguished easily from the latter by its more smaller diameters in the corresponding volutions and having a more smaller proloculus. It differs from *Palaeofusulina nana* Licharev in having more smaller size, smaller proloculus and fewer volutions.

Occurrence: Specimens are abundant in a pinkish gray and subcrystalline limestone bed at the southern slopes of Tameishan and Taotuishan, where they are associated with *Reichelina changhsingensis* Sheng and Chang (sp. nov.), *Palaeofusulina* cf. *sinensis* Sheng, and ?*P. simplex* Sheng and Chang (sp. nov.). Cat. Nos. 9054 (holotype), 9055—9059 (paratypes).

?*Palaeofusulina simplex* Sheng and Chang (sp. nov.)

(Pl. I, figs. 19—20)

We have found two minute axial sections of the genus *Palaeofusulina* with question in our collection from Changhsing. These specimens of about $2\frac{1}{2}$ volutions are about 0.3—0.39 mm in length and 0.26—0.28 mm in width with a form ratio about 1.15:1 to 1.4:1. The spirotheca is exceedingly thin and is composed distinctly of a tectum and a diaphanotheca. The septa are also thin, they are loosely and broadly fluted throughout the length of the shell, looks as many rounded loops in the axial section. The chomata are small and are only developed in the first volution; they are obscure in the outer ones. The tunnel is well defined. The tunnel path is slightly irregular. The proloculus is minute, and its outside diameter ranges from 0.04 mm to 0.05 mm.

Measurements (in mm) of ?*Palaeofusulina simplex* Sheng and Chang

Specimen	L	W	F. R.	Diam. Prol.	Width of Volutions			Form Ratio of Volutions		
					1	2	2½	1	2	2½
9060	0.39	0.28	1.40	0.05	0.11	0.20	0.28	1.21	1.33	1.40
9061	0.30	0.26	1.15	0.04	0.10	0.19	0.26	1.16	1.14	1.15

Remarks: In the presence of chomata, the gentle septal fluting and the minute size, this form bears a superficial resemblance to the genus *Schubertella*; but in the general shape, the coiling of the whorl and the juvenarium is not endothyroid, it resembles the genus *Palaeofusulina* more

closely. It is thought that *?Palaeofusulina simplex* Sheng and Chang may not only be the smallest but structurally the primitive form of *Palaeofusulina*.

Occurrence: This form occurs in the upper part of the Changhsing limestone at the southern slope of Taotuishan, Cat. Nos. 9060 (holotype), 9061 (paratype).

圖版 I 說明

本文中所描述的薄片均保存在中國科學院古生物研究所。這些標本均系採自浙江長興煤田長興灰岩的上部。所有圖影未加任何潤飾。袁曉初同志攝影。

- 圖 1—11. *Reichelina changhsingensis* Sheng and Chang sp. nov. (新種) (207)
1. 正型標本, 軸切面 ($\times 50$)。產地: 大煤山南坡。登記號: 9042.
 4. 6. 7. 三個副型標本, 軸切面 ($\times 50$)。產地: 同上。登記號: 9045, 9047, 9048.
 2. 3. 5. 8. 9. 五個副型標本, 軸切面 ($\times 50$)。產地: 稻堆山南坡。登記號: 9043, 9044, 9046, 9049, 9050.
 10. 11. 兩個副型標本, 中切面 ($\times 50$)。產地: 同上。登記號: 9051, 9052.
- 圖 12. *Reichelina* sp., 中切面 ($\times 50$)。產地: 同上。登記號: 9053
- 圖 13—18. *Palaeofusulina minima* Sheng and Chang sp. nov. (新種) (208)
13. 正型標本, 軸切面 ($\times 50$)。產地: 稻堆山南坡。登記號: 9054.
 - 14.—18. 五個副型標本, 軸切面 ($\times 50$)。產地: 同上。登記號: 9055—9059.
- 圖 19—20. *?Palaeofusulina simplex* Sheng and Chang sp. nov. (新種) (208)
- 正型標本及副型標本, 軸切面 ($\times 50$)。產地: 同上。登記號: 9060—9061.
- 圖 21—25. *Palaeofusulina* cf. *sinensis* Sheng (207)
21. 25. 兩個近型標本, 不完整的軸切面 ($\times 30$)。產地: 同上。登記號: 9062, 9066.
 22. 近型標本, 中切面 ($\times 30$)。產地: 大煤山南坡。登記號: 9063.
 23. 24. 兩個近型標本, 中切面 ($\times 30$)。產地: 青塘山南麓。登記號: 9064, 9065.

Explanation of Plate I.

The specimens described in this paper are now kept in the Institute of palaeontology, Academia Sinica. They are all found in the upper part of the Changhsing limestone. All figures are unretouched photographs taken by Mr. H. T. Yuan.

- Figs. 1—11. *Reichelina changhsingensis* Sheng and Chang (sp. nov.) (211)
1. Axial section ($\times 50$) of the holotype from the southern slope of Tameishan, Cat. No. 9042.
 - 4, 6, 7. Three axial sections ($\times 50$) of paratypes from the same locality, Cat. Nos. 9045, 9047, 9048.
 - 2, 3, 5, 8, 9. Five axial sections ($\times 50$) of paratypes from the southern slope of Taotuishan, Cat. Nos. 9043, 9044, 9046, 9049, 9050.
 - 10, 11. Two sagittal sections ($\times 50$) of paratypes from the same locality, Cat. Nos. 9051—9052.
- Fig. 12. *Reichelina* sp. ($\times 50$) From the same locality, Cat. No. 9053.
- Figs. 13—18. *Palaeofusulina minima* Sheng and Chang (sp. nov.) (212)
13. Axial section ($\times 50$) of the holotype from the southern slope of Taotuishan, Cat. No. 9054.
 - 14—18. Five axial sections ($\times 50$) of paratypes from the same locality, Cat. Nos. 9055—9059.
- Figs. 19—20. *?Palaeofusulina simplex* Sheng and Chang (sp. nov.) (213)
- Two axial sections ($\times 50$) of the holotype and a paratype from the same locality, Cat. Nos. 9060—9061.
- Figs. 21—25. *Palaeofusulina* cf. *sinensis* Sheng (212)
- 21, 25. Two incompletely axial sections ($\times 30$) from the southern slope of Taotuishan, Cat. Nos. 9062, 9066.
 22. Sagittal section ($\times 30$) from the southern slope of Tameishan, Cat. No. 9063.
 - 23, 24. Two sagittal sections ($\times 30$) from the southern foot of Chingtangshan, Cat. Nos. 9064, 9065.

