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Fusulinids from Portuguese Timor
(Palaeontological Study of Portuguese Timor, 1)*

By

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(Received November 30, 1962)

Abstract

Four fusulinid-species from the Portuguese Timor Island are described. Among them, *Codonofusiella weberi*, *Schwagerina nakazawae* n. sp. and *Parafusulina* sp. collected from Pualaca indicate probably the earlier Permian in age, while *Triticites* sp. from Hato-Builico the earliest Permian.

Introduction and Acknowledgement

The Timor Island situated in the eastern part of the East Indies Archpelago is very famous for the occurrence of splendid fossils, especially, of the Permian and Triassic period. Prof. K. NAKAZAWA and two students of the University of Kyoto made a preliminary survey of Portuguese Timor in the summer of 1961, and collected many fossils containing cephalopods, pelecypods, brachiopods, corals, fusulinids, crinoids and others. Among these the former three groups are predominant.

Prof. NAKAZAWA has kindly offered several samples of fusulinids at my disposal. In comparison with molluscas and brachiopods the fusulinids are very rarely found in this area like in the Indonesian Timor, and have been obtained from only two localities, Hato-Builico and Pualaca (see textfigure). Among them four genera and four species are descriminated.

Two papers concerning fusulinids of Timor were already published.

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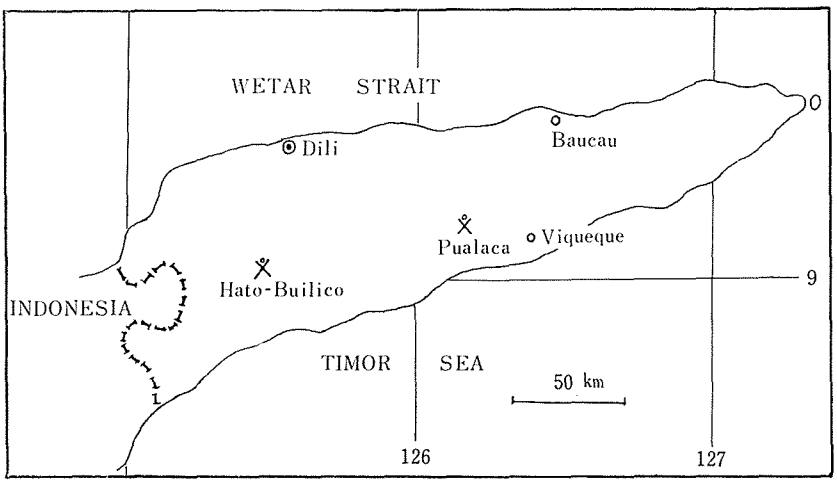
* The Scientific Research of the Portuguese Timor Island was planned by the Exploration Club of the University of Kyoto, and performed by three members for two months from the middle of August to the middle of October in 1961. The members were K. NAKAZAWA, Professor of Geology at the Geological and Mineralogical Institute, Faculty of Science; Hiroyuki SUZUKI, student of the same Institute; Toru TAKAHASHI, student of the Faculty of Agriculture.

The fossil-collections are under study by each specialist of palaeontology. For several reasons the results cannot be published in a monograph and the other studies will be reported separately.



Text-figure. Fossil-locality of fusulinids in the Portuguese Timor Island

SCHUBERT (1915) first studied fusulinids of Timor which had been obtained by members of three expeditions and reported one previously described species, *Fusulina granum-avenae* ROEMER, and three new species, *Fusulina wanneri*, *F. molengraaffi* and *F. weberi*. These new names were devoted to the directors of the three expeditions. In 1949 THOMPSON summarized all available data concerning fusulinids from Timor and added new information from the samples obtained by BROUWER and the members of the 1937 expedition to Timor. He described and finely illustrated five species, *Palaeofusulina weberi* (SCHUBERT), *Schwagerina brouweri* Thompson, *S.* ? *molengraaffi* (SCHWAGER), *S.* sp. and *Parafusulina wanneri* (SCHUBERT).

The samples at my hand were obtained from the southeast foot of Fatu Auveon (Mt. Auveon) in the central part of Portuguese Timor and from the north of Hato-Builico in the western part of Portuguese Timor. To my regret, the specimens are neither so good in preservation nor so abundant as those of SCHUBERT and THOMPSON. The samples from the first locality contain fairly abundantly *Codonofusiella weberi* (SCHUBERT) and *Schwagerina nakazawae* sp. nov., and exceedingly rarely a species of *Parafusulina*. Those from the second locality yield poor specimens of *Triticites*. *Codonofusiella weberi* was considered by THOMPSON to belong to the genus *Palaeofusulina*. *Schwagerina nakazawae* was described first by Schubert as *Fusulina granum-avenae* ROEMER and afterwards by THOMPSON as *Schwagerina* sp.. *Parafusulina* sp. indet. and *Triticites* sp. indet. will be reported for the first time in this paper, but they occur so rarely that they are not specifically determined. These four species shall be described and illustrated below.

Before going further, I wish to express my hearty thank to Prof. K.

NAKAZAWA who offered kindly the samples of fusulinids at my disposal. My thank is also due to Prof. S. MATSUSHITA and Lecture K. ISHII for their effective counsel.

Description of species

Family Fusulinidae MÖLLER, 1878

Subfamily Schubertellinae SKINNER, 1931

Genus *Codonofusiella* DUNBAR et SKINNER, 1937

Codonofusiella weberi (SCHUBERT)

Plate 3, figures 1-9.

Fusulina weberi SCHUBERT, 1915, Paläontologie von Timor, Lief. 2, S. 57, 58, Taf. 40, Fig. 3, 4; Taf. 41, Fig. 6.

Palaeofusulina weberi, THOMPSON, 1949, Jour. Paleont., Vol. 23, pp. 186, 187, Pl. 34, figs. 4, 15.

Description: The shell is minute and short subcylindrical. It has half-round poles, gently convex lateral slopes and slightly inflated central portion. The mature specimens, possessing generally $6\frac{1}{2}$, rarely 7 volutions, are 3.4 to 4.1 mm. long and 1.3 to 1.7 mm. wide. The form ratio is 2.2 to 3.0.

The proloculus is rather minute; its outside diameter is 60 to 100 microns. The first $1\frac{1}{2}$ volutions are tightly coiled and discoidal, with narrowly rounded periphery and short axis of coiling at angles up to 90 degrees to the axis of the outer volutions. The following 2 volutions are rather tightly coiled and elongate fusiform, and beyond them the shell expands rapidly and becomes subcylindrical. The last $\frac{1}{2}$ volution is flaring and increases in height so remarkably that it measures 300 to 850 microns.

The spirotheca is thin and seems to be composed of a tectum and a lower less dense layer. The thickness of the spirotheca is 5 to 10 microns even at the thickest portion of the outer volutions.

The septa are thin. The septal counts of the 2nd to the 6th volution are 13 to 19, 16 to 22, 20 to 28, 28 to 34 and 40 or more, respectively. The septa are fluted slightly in the 2nd to the 3rd volution, narrowly and highly in the 4th to the ultimate $\frac{1}{2}$ volution, and very irregularly and highly in the last $\frac{1}{2}$ volution.

The chomata are minute and asymmetrical in the inner 2 volutions, small and bandform in the 3rd volution, and they become indistinct in the outer volutions. The axial fillings extend weakly along the axis of coiling.

Materials: JPF-10505 to JPF-10513 deposited in Geol. & Miner. Inst., Univ. Kyoto.

Remarks: Judging from the shape of the present form, it is rather difficult to obtain a exact axial section with the flaring last $\frac{1}{2}$ volution. Moreover, most specimens are eroded away its outer 1 or 2 volutions, owing to

the ill state of preservation. So the axial sections at hand have mostly 5 to 6 volutions, but rarely $6\frac{1}{2}$ to 7 volutions.

The figured specimens seem at a glance to be different from the type-ones described and illustrated by SCHUBERT (1915) as *Fusulina weberi* in having more numerous volutions, and accordingly larger and slender shell. But these differences are caused from the inattentive preparation of the type-sections. On the other hand, the specimens at hand are identical with the type-ones in the degree of septal fluting, mode of coiling, height of each volution and other important specific features. The former are also common with the latter in the occurrences. From these reasons the identification of the present form is probably beyond doubt.

THOMPSON (1949) considered the present form as *Palaeofusulina*, because of the structure of spirotheca and of the degree of septal fluting. But the form has the flaring last $\frac{1}{2}$ volution, in which the septa are fluted very irregularly and highly. Further the axial fillings of the form are indeed weak, but they are present along the axis of coiling. So it is better that the form should be included in the genus *Codonofusiella*. The form is, however, rather characteristic for the genus in having more numerous volutions, so larger shell and more weakly flaring last volution than any species of the genus.

Occurrences: The specimens at hand have been obtained from the yellowish limestone containing basaltic fragments at the southeast foot of Fatu Auveon (Mt. Auveon), about 2 km to the northwest of Pualaca, central part of Portuguese Timor. It occurs fairly abundantly together with *Schwagerina nakazawae* sp. nov. and *Parafusulina* sp. indet..

Horizon: probably lower Permian.

Subfamily Schwagerininae DUNBAR et HENBEST, 1930

Genus *Triticites* Girty, 1904

Triticites sp. indet.

Plate 3, figures 10–12.

Description: The shell is small and bulged fusiform. It has bluntly pointed poles, slightly convex to nearly flat lateral slopes and inflated central portion. The mature specimens of 6 to 7 volutions are 4.6 to 5.3 mm. long and 1.9 to 2.4 mm. wide. The form ratio is 2.0 to 2.3.

The proloculus is small and spherical. Its outside diameter is 120 to 240 microns. The chambers are low in the innner 2 or 3 volutions, and increase in height rather rapidly beyond the 3rd volution.

The spirotheca is composed of a tectum and keriotheca with rather coarse alveoli. The outside of the spirotheca is covered with dark materials.

The septa are spaced closely. The septal counts of the 1st to the 5th volution are 9 to 11, 13 to 16, 18 to 21, 21 to 24 and 25 to 29, respectively. The septa are fluted highly and closely for the genus.

The chomata are slightly asymmetrical, small and half-round in cross section. The tunnel is narrow and low.

Materials: JPF-10514 to JPF-10516 deposited in Geol. & Miner. Inst., Univ. Kyoto.

Remarks: The present form is a single species of the genus *Triticites* from Timor. To my reglet, the form is represented by several specimens which are in ill state of preservation. The inadequate materials let me hesitate to compare the form with other species.

Occurrences: The present form has been obtained rarely with calcareous algae and bryozoas from the white bedded limestone at the north of Hato-Builico in the western part of Portuguese Timor.

Horizon: probably lowest Permian.

Genus *Schwagerina* MÖLLER, 1877

Schwagerina nakazawae sp. nov.

Plate 3, figures 13–17.

Synonym

Fusulina granum-avenae, SCHUBERT, 1915, Paläontologie von Timor, Lief. 2, S. 53, Taf. 39, Fig. 1 (?); Taf. 41, Fig. 5 (?), 6.

Schwagerina brouweri, THOMPSON, 1949, (partim), Jour. Paleont., Vol. 23, pp. 187, 188, Pl. 34, fig. 4? (non Pl. 34, figs. 5–14; Pl. 35, fig. 9)

Schwagerina sp., THOMPSON, 1949, ibid., p. 189, Pl. 35, figs. 7 (?), 8 (?).

Derivatio nominis: devoted to Prof. K. NAKAZAWA who offered kindly the samples at my disposal.

Holotypus: specimen which is illustrated in fig. 13 of Plate 3; reg. no. JPF-10517 deposited in Geol. & Miner. Inst., Univ. Kyoto.

Locus typicus: at the southeast foot of Fatu Auveon (Mt. Auveon), about 2 km to the northwest of Pualaca in the central part of Portuguse Timor.

Diagnosis: about $\frac{1}{2}$ times in length as "*Fusulina*" *granum-avenae*; different from *Schwagerina brouweri* in having more loosely spaced septa and larger shell.

Description: The shell is moderate in size and elongate fusiform to subcylindrical in form. It possesses rather pointed poles, gently convex to fairly concave lateral slopes and slightly shifting axis of coiling. The mature specimens, seeming to have $6\frac{1}{2}$ to 7 volutions, are 8.9 to 9.7 mm. long and 2.2 to 2.5 mm. wide. The form ratio is 3.8 to 4.2.

The proloculus is short ellipsoidal and not small; its outside diameter measures 140 to 310 microns. The chambers are low in the inner 2 volutions, and increase rapidly in the 3rd to the last volution. The 1st volution is fusiform, the following 2 volutions are elongate fusiform, and beyond them the shell assumes to take its mature shape.

The spirotheca is relatively thin for the size of shell. It is coarsely alveolar. Its thickness is 10 to 30 microns in the inner volutions and 50 to 100 microns in the outer volutions.

The septa are loosely spaced. The average septal counts are 10, 15, 17 and 20, respectively, in the 1st to the 4th volution. The septa are fluted rather irregularly and highly in the outer 2 or 3 volutions.

The chomata are present and minute in the inner volutions, but absent in the outer volutions. The tunnel is low and its pass is not so remarkably irregular. The axial fillings extend weakly along the axis of coiling.

Materials: JPF-10517 (holotype) to JPF-10521 deposited in Geol. & Miner. Inst., Univ. Kyoto.

Remarks: SCHUBERT (1915) illustrated an oblique section (Taf. XLI, Fig. 1) and also a weathered surface of limestone filled with abundant specimens of elongate fusulinid (Taf. XXXIX, Fig. 1). SCHUBERT referred these specimens to *Fusulina granum-avenae* ROEMER. But pointed already by THOMPSON (1949), these specimens are different from ROEMER's type-ones. They are, however, much allied to *Schwagerina nakazawae* in the shape of shell, degree of septal fluting, height of each volution, size of proloculus, strength of axial fillings and other important features. So it is highly probable that these forms are conspecific with each other.

The specimen, which was first designated by SCHUBERT (1915) as *F. granum-avenae* (Taf. XLI, Fig. 6) and afterwards emended by THOMPSON (1949) with doubt as *Schwagerina brouweri* (Pl. 34, fig. 2), should be referred to *Schwagerina nakazawae*, judging from the counts of septa, thickness of spirotheca, association with *Codonofusiella weberi* and other features.

Schwagerina nakazawae can be distinguished from *Schwagerina brouweri* in having more numerous volutions, accordingly larger shell and wider space between septa. *S. nakazawae* resembles at a glance *Pseudofusulina chisiaensis* (LEE) described and illustrated by CHEN (1934) from South China in the shape of shell and degree of septal fluting, but the former is about twice as long as the latter. *S. nakazawae* is slightly allied to such species of the genus *Parafusulina* as *P. shaksgamensis* Reichel, *P. shaksgamensis crassimarginata* KNIGHT, *P. apliculata* KNIGHT and *P. communis* KNIGHT, but the former has more slender shell than the latter.

Occurrences: The specimens have been obtained from the yellowish limestone containing basaltic fragments at the southeast foot of Fatu Auveon (Mt. Auveon), about 2 km to the northwest of Pualaca in the central part of Portuguese Timor. They occur fairly abundantly together with *Codonofusiella weberi* (SCHUBERT), *Parafusulina* sp. indet. and calcareous algae.

Horizon: probably lower Permian.

Genus *Parafusulina* DUNBAR et SKINNER, 1931

Parafusulina sp. indet.

Plate 3, figure 17

Description: The shell is large and elongate subcylindrical, with pointed poles, gently convex to nearly flat lateral slopes, and largely shifting axis of coiling. The figured specimen of $7\frac{1}{2}$ volutions is 14.5 mm. long and 2.7 mm. wide.

The proloculus is small and spherical. The figured specimen has two proloculus; outside diameter 190 microns and 220 microns. The height of chambers of the figured specimen is 65, 50, 105, 120, 220, 305 and 300 microns,

Measurements (in micron)

Codonofusiella weberi (SCHUBERT)

Reg. No.	Fig.	L.	W.	L/W	Vn.	Pd.	Height						
							1	2	3	4	5	6	7
JPF-10505	1	3.6	1.4	2.6	$6\frac{1}{2}$	.070	.030	.030	.035	.055	.120	.185	.560
JPF-10506	2	3.9	1.3	3.0	$6\frac{1}{2}$	.065	.035	.030	.030	.065	.120	.170	.420
JPF-10507	3	4.1	1.4	2.9	$6\frac{1}{2}$	.080	.050	.035	.040	.100	.110	.185	.340
JPF-10508	4	2.9	1.0	2.9	$5\frac{1}{2}$	.085	.020	.035	.060	.125	.150		
JPF-10509	5	3.7	1.7	2.2	7	.080	.035	.060	.035	.050	.095	.175	.810
		3.4	1.3	2.6	$6\frac{1}{2}$	.065	.030	.025	.030	.055	.110	.190	.420
JPF-10510	6		1.1		6	.075	.035	.025	.035	.100	.135	.225	
JPF-10511	7		1.0		6	.060	.030	.040	.025	.070	.135	.220	
JPF-10512	8		1.0		$5\frac{1}{2}$	.095	.050	.030	.065	.135	.185		
JPF-10513	9		0.9		5	.100	.040	.035	.055	.110	.150		

Form ratio							Septal counts					
1	2	3	4	5	6	7	1	2	3	4	5	6
0.7	1.2	2.5	3.0	3.5	3.3	2.0						
0.5	1.3	1.9	2.4	3.1	3.5	2.7						
0.8	1.7	2.8	3.1	3.5	3.2	2.5						
1.0	1.7	2.3	2.5	3.0								
0.5	1.2	2.5	2.3	2.4	3.0	1.8						
0.9	1.5	2.2	2.2	3.0	2.5	2.4						
							0	8	17	20	28	40
							0	13	17	22	29	41
							0	11	19	29	36	
							9	18	22	28	31	

Triticites sp. indet.

Reg. No.	Fig.	L.	W.	L/W	Vn.	Pd.	Height					
							1	2	3	4	5	6
JPF-10514	10	4.8	2.1	2.3	6½	.130	.035	.050	.100	.150	.235	.290
JPF-10515	11	5.0	2.2	2.3	6½	.170	.050	.070	.100	.170	.305	.255
JPF-10516	12		1.7		5½	.165	.050	.085	.120	.205	.305	
			1.6		5	.160	.050	.070	.170	.290	.295	

Form ratio						Septal counts				
1	2	3	4	5	6	1	2	3	4	5
1.2	1.5	1.8	1.8	1.6	1.8					
1.0	1.4	1.9	2.1	2.0	2.2					
						11	14	18	22	29
						9	15	19	21	25

Schwagerina nakazawae sp. nov.

Reg. No.	Fig.	L.	W.	L/W	Vn.	Pd.	Height						
							1	2	3	4	5	6	7
JPF-10517	13	9.4	2.5	3.8	6½	.245	.065	.100	.120	.215	.245	.325	
JPF-10518	14	9.5	2.3	4.1	6½	.255	.055	.090	.115	.195	.205	.290	
JPF-10519	15	9.9	2.7	3.8	6	.270	.085	.135	.175	.255	.370	.395	
		9.1	2.3	3.9	7	.205	.050	.060	.085	.145	.155	.270	.360
		9.1	2.4	3.8	7	.140	.050	.075	.110	.150	.230	.340	.450
JPF-10520	16		2.5		6½	.195	.050	.060	.085	.125	.205	.270	.425
JPF-10521	17		1.8		5½	.270	.035	.085	.120	.180	.245		

Thickness of spirotheca							From ratio						
1	2	4	3	5	6	7	1	2	3	4	5	6	7
.020	.030	.035	.070	.075	.085		1.6	2.8	3.0	3.6	3.6	3.5	
.020	.030	.035	.055	.065	.065		2.3	3.0	3.3	4.0	4.0	4.0	
.030	.040	.045	.075	.100	.100		2.1	2.8	3.1	3.3	3.8	3.5	
.025	.030	.035	.060	.050	.070	.090	1.8	2.7	2.7	2.8	3.4	3.7	3.6
.020	.030	.035	.050	.075	.080	.100	2.0	3.1	3.5	3.6	3.8	4.0	3.6
.010	.035	.025	.040	.065	.070	.065	9	15	16	19	17	20	
.015	.015	.040	.060	.060			9	13	16	20	19		
							1	2	3	4	5	6	
							Septal counts						

respectively, from the 1st to the 7th volution.

The spirotheca is rather finely alveolar and relatively thin for the size of shell; thickness of the spirotheca of the figured specimen is 20, 20, 30, 45, 75 and 95 microns, respectively, from the 1st to the 6th volution.

The septa are spaced rather loosely. They are fluted narrowly and regularly.

The chomata are present only in the inner volutions. The tunnel is narrow. The axial fillings are extended along the axis of coiling.

Material: JPF-10522 deposited in Geol. & Miner. Inst., Univ. Kyoto.

Remarks: The present form is represented by only two axial sections, so the important specific features of the species cannot be adequately understood. The form is rather allied to *Parafusulina wanneri* (SCHUBERT), but the former has more pointed poles, less massive axial fillings and narrower chamblets.

Occurrence and *Horizon*: of the same as those of *Schwagerina nakazawae*.

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Explanation of Plate 3

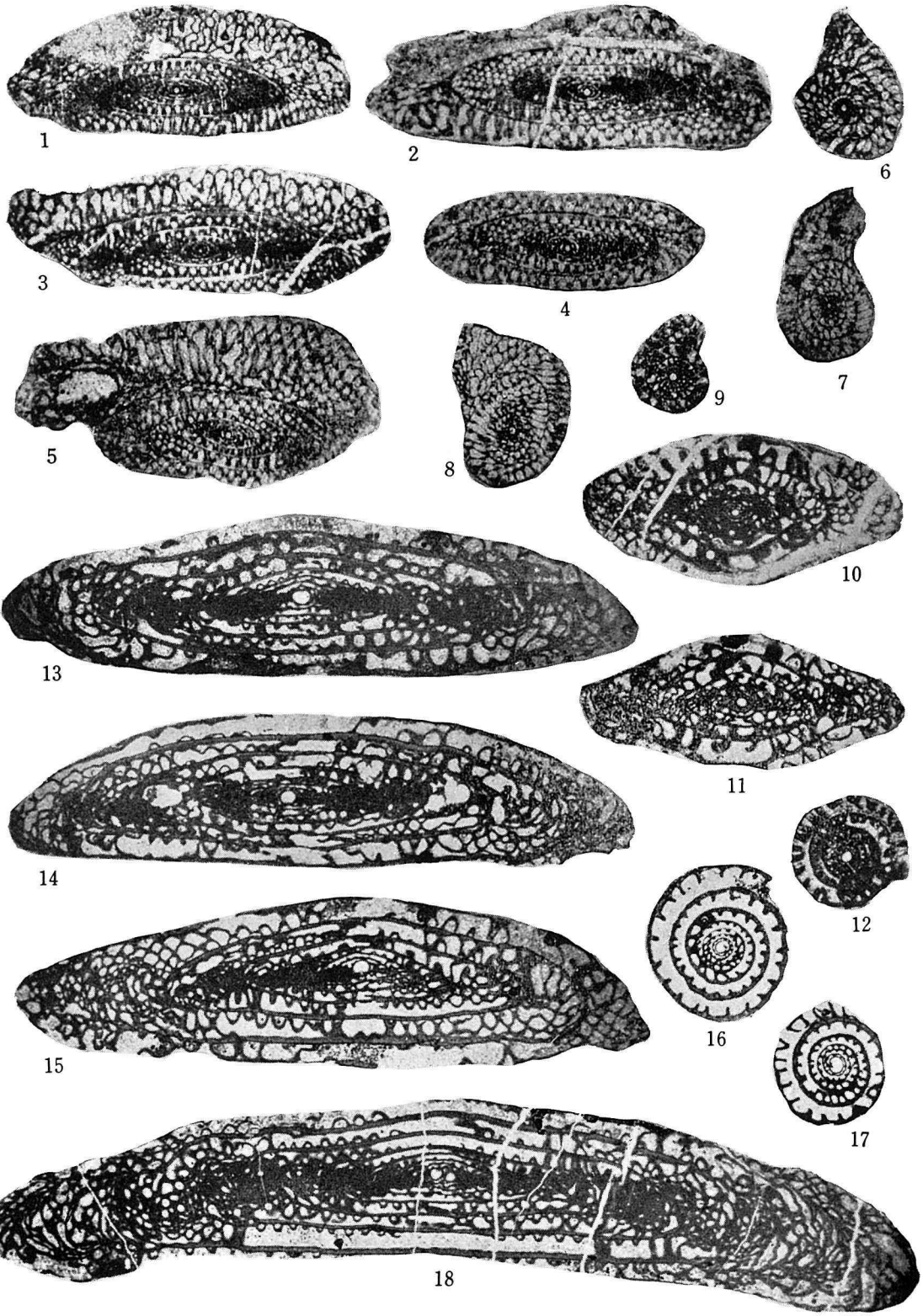
Figs. 1–9. ×15
Figs. 10–18. ×10

Figs. 1–9. *Codonofusiella weberi* (SCHUBERT) ..... p. 61
1. Axial section of a typical specimen, JPF–10505.
2. Axial section of a elongate specimen, JPF–10506.
3. Axial section of a slightly elongate specimen, JPF–10507.
4. Axial section of a specimen without a half flaring volution, JPF–10508.
5. Slightly oblique axial section of a specimen with a half high flaring volution, JPF–10509.
6. Sagittal section of a specimen, JPF–10510.
7. Sagittal section of a specimen with a half high flaring volution, JPF–10511.
8. Slightly oblique sagittal section, JPF–10512.
9. Sagittal section of a small specimen, JPF–10513.

Figs. 10–12. *Triticites* sp. indet. ..... p. 62
10. Axial section of a typical specimen, JPF–10514.
11. Axial section of an elongate specimen, JPF–10515.
12 Sagittal section, JPF–10516.

Figs. 13–17. *Schwagerina nakazawae* sp. nov. ..... p. 63
13. Axial section of the holotype, JPF–10517.
14. Axial section of a slightly small specimen, JPF–10518.
15. Slightly oblique axial section, JPF–10519.
16, 17. Sagittal sections, JPF–10520, JPF–10521.

Fig. 18. *Parafusulina* sp. indet. ..... p. 65
Axial section, JPF–10522.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