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Material

Morphologic variation of five species of *Parafusulina* from the Middle Permian Nabeyama Formation in the Kuzu area, Tochigi Prefecture, Japan

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Abstract

Morphologic variation of five species of *Parafusulina* (*P. yabei*, *P. tomeganensis*, *P. shimotsukensis*, *P. tochigiensis*, and *P. japonica*) are described among samples from twelve stratigraphic levels in the Middle Permian Nabeyama Formation, Tochigi Prefecture, Japan. Variabilities of them were analyzed by showing many microphotographs and histograms of the frequency distribution of some measurable characters of the test, proloculus size, and length, width, form ratio, thickness of wall, and septal counts in the seventh whorl. Highly variable morphologic characters gradually changing from specimen to specimen distinguished in these five species are thought to serve as a reference also for recognition and classification of other fusulinoidean species, and important for recognizing biodiversity of the past and for discussing related problems.

Key words: morphologic variation, five species of *Parafusulina*, Middle Permian

Introduction

Since the first recognition of *Miliolites secalicus* Say in James, 1823 (=*Triticites secalicus*), from the Upper Carboniferous of Nebraska (Douglass, 1966), a great number of species of fusulinoideans have been proposed and described. They are regarded to amount up to several thousands or more, inferred from the bibliographic works by Kahler and Kahler (1966–1967), Toomey (1956), Toomey and Sanderson (1965), Sanderson (1966–1974), and later many new species proposed by many specialists. In Japan, they exceed more than 500. Most of the Japanese materials were described from the 1950’s to early 1960’s in the culminating time of Japanese fusulinoidean works aiming for age determination, regional and international correlation, and biostratigraphic division of limestone-bearing formations. Most of them were proposed on the basis on the typological concept, and some of them were created optionally by the use of few, unfavorably-oriented, or incomplete specimens, and furthermore based on insufficient or little recognition of morphologic variation, thus resulting a lot of confusions concerning the discussion of their taxonomic independencies.

There are few in common consensus of rules and methods to define species and supra-specific taxon among fusulinoidean paleontologists and many have been proposed only by their own judgments and experiences. Other fossil groups embrace similar or the same problems which may be inevitable and rather fateful for extinct taxa. These circumstances, however, are conflict with the aim of taxonomy itself that elucidates the biodiversity of living and ancient organisms and considers the mechanism of their speciation. On the other hand, we can find out noteworthy works on fusulinoidean taxonomy, such as by Douglass (1970) suggesting his recognition of fusulinoidean species based on broad intra-populational variation of *Eoparafusulina kattaensis* (Schwager, 1887) and by Ozawa (1975) embodying his view of evolutionary species by analyzing morphologic variation of test characters of *Lepidolina multiseptata* (Deprat, 1912) through time and space.

The Nabeyama Formation in the Kuzu area, Tochigi Prefecture is famous in its abundant occurrence of well-preserved fusulinoideans, especially of *Parafusulina*, from many stratigraphic levels. Fusulinoideans of the formation were described only from the restricted levels of the lower part of the formation (Hanzawa, 1942; Igo, 1964; Chisaka and Fuse, 1973) until Kobayashi (2006a, 2006b). The author began his paleontologic work of fusulinoideans in 1974. Original and basic paleontologic data, including 2,911 thin sections had been prepared by the end of 1970's. However, systematic description of fusulinoideans had been postponed about 25 years later mainly due to taxonomic problems of *Parafusulina*.

The purpose of this paper is to show intra- as well as inter-populational variation recognized in five species of *Parafusulina, P. yabei* Hanzawa, 1942, *P. tomeganensis* Morikawa, 1958 (=*P. kuzuensis* Chisaka and Fuse, 1973), *P. shimotsukensis* Kobayashi, 2006a, *P. tochigiensis* Kobayashi, 2006a, and *P. japonica* (Gümbel in Schwager, 1883) from the Nabeyama Formation. In addition to many histograms and appendix tables of some measurable characters, many specimens are illustrated so as to understand broad morphologic variations in many characters. The result of the present study is thought to serve as a reference for recognition and classification of other fusulinoidean species, and important for recognizing biodiversity of the past and for discussing related problems. All the specimens illustrated in this paper are stored in the collection of Museum of Nature and Human Activities, Hyogo (Fumio Kobayashi Collection, MNHA), with prefix D2

Material

The Nabeyama Formation is originated from a seamount and surrounded by Jurassic terrigenoeus rocks in the Kuzu area, Tochigi Prefecture (Fig. 1). The upper part of the Nabeyama Formation is massive, middle part is strongly dolomitized, and lower part conformably overlying the Izuru Formation is bedded and intercalates basic pyroclastic rocks (Kobayashi, 1979). The *Parafusulina nakamigawai*, *P. yabei*, and *P tochigiensis* zones were established from lower to upper in these two formations based on the stratigraphic distribution of these fusulinoideans, (Fig 2; Kobayashi, 2006a; 2006b). Five species of *Parafusulina*, *P. yabei*, *P. tomeganensis*, *P. shimotsukensis*, *P. tochigiensis*, and *P. japonica* occur

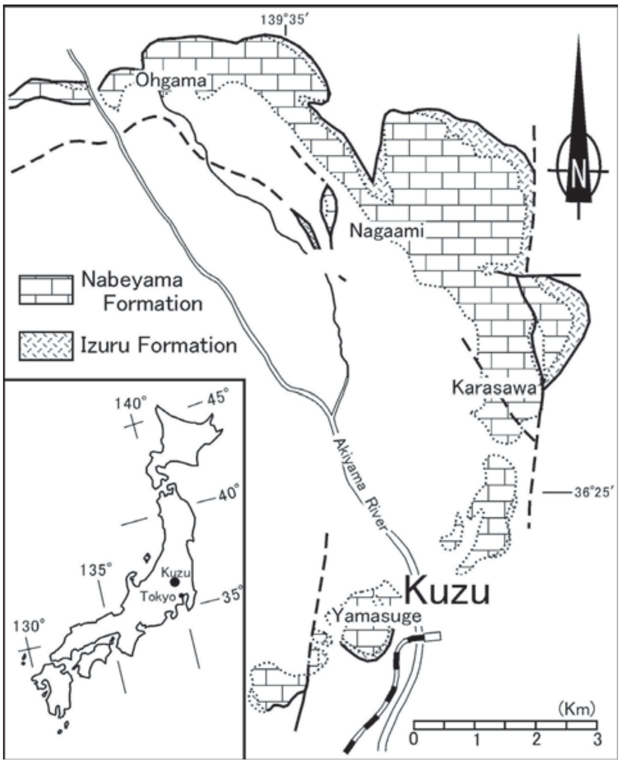

Figure 1. Index map showing the distribution of the Nabeyama and Izuru formations in the Kuzu area. Sample Ya and Ka is collected from the Yamasuge and Karasawa area, rescectively, where the lower and upper parts of the Nabeyama Formation are typically developed (Kobayashi, 2006a; see also Fig. 2).

in more than 30 stratigraphic levels of the Nabeyama Formation. *P. kuzuensis* in Kobayashi (2006a) is reassigned herein to *P. tomeganensis* Morikawa, 1958 because of its synonymous with the latter based on the reexamination of topotype material of the latter from the Akasaka Limestone (Kobayashi, 2011).

Among 40 and 88 limestone samples, 602 and 1611 thin sections were prepared. They were collected respectively at Yamasuge and Karasawa, where the lower and the upper part of the Nabeyama Formation are typically developed (Kobayashi, 1979; 2006a). 1,034 limestone thin sections from twelve samples were selectively chosen herein for the morphologic analysis of these five species of *Parafusulina*. Although neoschwagerinids and verbeekinids are common in the Middle Permian limestone of Japan, no individuals of them are contained in these thin sections.

Lithology, stratigraphic level, the number of thin section, individuals of axial and sagittal sections illustrated, and associated fusulinoideans are summarized below.

Samples from the lower part of the Nabeyama

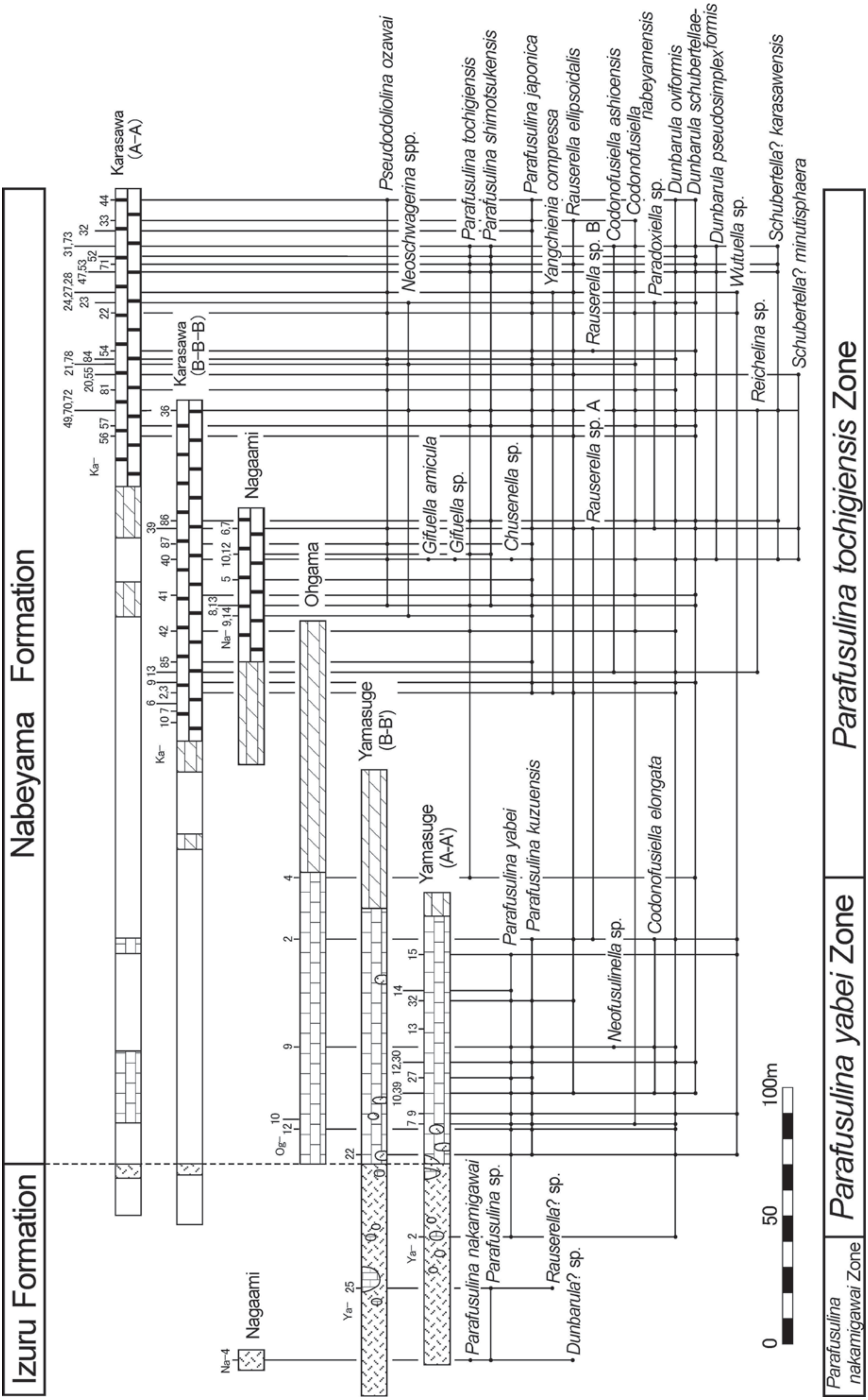

Figure 2. Stratigraphic distribution of fusulinoideans in the Izuru and Nabeyama formations, by which the *Parafusulina nakamigawai*, *P. yabei*, and *P. tochigiensis* zones were established from lower to upper (after Kobayashi, 2006b). For more geologic information see Kobayashi (2006a).

Formation

Ya-27: Brownish dark gray limestone, partially weakly dolomitized, containing abundant fusulinoideans, common brachiopods, and others packed within lime-silt having styolite seams of tuffaceous materials (Fig. 3.1)/ 34 m above the base of the formation/ 24 thin sections/ seven axial and five sagittal sections of *Parafusulina yabei*, and three axial sections of *P. tomeganensis* (Fig. 4)/ no other fusulinoideans associated.

Ya-30: Nearly the same lithology as that of Ya-27, but more bituminous and containing more common sponge and marine algae/ 40 m above the base of the formation/ 125 thin sections/ 52 axial and four sagittal sections of *Parafusulina yabei* (Figs. 5, 6), and 13 axial and one sagittal sections of *P. tomeganensis* (Fig. 7)/ *Dunbarula oviformis* Kobayashi and *Dunbarula schubertellaeformis* Sheng associated.

Ya-32: Yellow-brownish dark gray, weakly to moderately dolomitized limestone containing many fusulinoideans, and less dominant small bioclasts of marine algae, crinoids, and sponge spicules packed within lime-mud to lime-silt matrix/ 63 m above the base of the formation/ 134 thin sections/ 48 axial and 23 sagittal sections of *Parafusulina yabei* (Figs. 8, 9), and 26 axial and four sagittal sections of *P. tomeganensis* (Fig. 10)/ *Rauserella ellipsoidalis* Sosnina associated.

Samples from the upper part of the Nabeyama Formation

Ka-2: Gray, highly fossiliferous limestone with lime-mud matrix, pelloids and small bioclasts also contained (Fig. 3.2)/ 184 m above the base of the formation/ 19 thin sections/ ten axial and five sagittal sections of *Parafusulina japonica* (Fig. 11)/ *Rauserella ellipsoidalis* and *Dunbarula oviformis* associated.

Ka-86: Gray limestone with lime-mud matrix, containing abundant fusulinoideans, and partially small bioclasts and pelloids/ 248 m above the base of the formation/ 77 thin sections/ 42 axial and nine sagittal sections of *Parafusulina shimotsukensis* (Figs. 12, 13), and four axial and four sagittal sections of *P. tochigiensis* (Fig. 13)/ *Codonofusiella nabeyamensis* Kobayashi, *Dunbarula oviformis*, *D. schubertellaeformis*, *D. pseudosimplex* (Sheng), and *Schubertella? karasawensis* Kobayashi associated.

Ka-57: Gray limestone containing abundant fusulinoideans and small amount of pelloids and small bioclasts packed within lime-mud, similar to the limestone of Ka-86, but having more homogeneous and finer lime-mud matrix, and smaller amount of bioclasts (Fig. 3.3)/ 286 m above the base of the formation/ 46 thin sections/ 11 axial and five sagittal sections of *Parafusulina shimotsukensis* (Fig. 14), and 12 axial and five sagittal sections of *P. tochigiensis* (Fig. 15)/ *Parafusulina japonica*, *Codonofusiella nabeyamensis*, *Dunbarula oviformis*, and *D. schubertellaeformis* associated.

Ka-70: Nearly the same lithology as that of Ka-57/ 293 m above the base of the formation/ 279 thin sections/ 100 axial (Figs. 16-19) and 41 sagittal sections (Fig. 20) of *Parafusulina shimotsukensis*, and 64 axial and 22 sagittal sections of *P. tochigiensis* (Figs. 21, 22)/ *Rauserella ellipsoidalis*, *Codonofusiella ashioensis* Kobayashi, *Schubertella? karasawensis*, and *Reichelina* sp. associated.

Ka-28: Similar lithology to that of Ka-2/ 338 m above the base of the formation/ 46 thin sections/ 32 axial and seven sagittal sections of *Parafusulina japonica* (Fig. 23)/ *Dunbarula oviformis* associated.

Ka-47: Nearly the same lithology as that of Ka-57/ 346 m above the base of the formation/ 39 thin sections/ 17 axial and two sagittal sections of *Parafusulina shimotsukensis* (Fig. 24), and 10 axial and four sagittal sections of *P. tochigiensis* (Fig. 25)/ *Codonofusiella nabeyamensis*, *Dunbarula schubertellaeformis*, *D. pseudosimplex*, and *Schubertella? karasawensis* associated.

Ka-71: Nearly the same lithology as that of Ka-57 (Fig. 3.4)/ 350 m above the base of the formation/ 141 thin sections/ Eight axial and five sagittal sections of *Parafusulina shimotsukensis* (Fig. 26)/ *Parafusulina tochigiensis*, *Rauserella ellipsoidalis*, *Dunbarula schubertellaeformis*, and *Schubertella? karasawensis* associated.

Ka-73: Similar lithology to that of Ka-57/ 356 m above the base of the formation/ 82 thin sections/ 35 axial and seven sagittal sections of *Parafusulina shimotsukensis* (Figs. 27, 28), and 15 axial and one sagittal sections of *P. tochigiensis* (Fig. 29)/ *Codonofusiella ashioensis*, *C. nabeyamensis*, *Dunbarula oviformis*, *D. pseudosimplex*, and *Schubertella? karasawensis* associated.

Ka-33: Similar lithology to that of Ka-2/ 367 m above the base of the formation/ 22 thin sections/ 12 axial and two sagittal sections of *Parafusulina japonica* (Fig. 30)/ *Rauserella ellipsoidalis* and *Codonofusiella nabeyamensis* associated.

As summarized above, three and nine limestone samples from the lower and upper part of the Nabeyama Formation, respectively, have similar to closely similar lithology in each other (Fig. 3). All fusulinoideans are packed within fine to very fine muddy matrix and the outermost whorl is generally preserved well without any significant abrasion of the test, especially those in samples from the upper part. No fusulinoidean tests display any preferred alignment. Immature specimens of *Parafusulina* with a few whorls are also contained in these twelve samples. These taphonomic features suggest that fusulinoideans contained in these limestone samples were buried virtually *in situ*, and there are no evidence suggesting any significant post-mortem long-distance transportation prior to burial.

Method

Parafusulina specimens of the Nabeyama Formation are highly variable in many characters such as size and shape of proloculus, size, shape, and expansion of the test, morphology of septal folds in tunnel and polar regions of axial section, the number of septa, wall thickness, and development of axial filling. All these characters vary from specimen to specimen in a sample as well as from in sample to in sample. These changes are gradual, resulting many difficulties for taxonomy of these specimens. Taking many intermediate features of many characters always appearing in and among samples into consideration, Kobayashi (2006a) concluded that parafusulinids of the Nabeyama Formation are classified into five species: *P. yabei* and probably its direct descendant *P. shimotsukensis*; *P. tochigiensis* as a species group of *P. japonica*; and a distinct species of *P. kuzuensis* (=*P. tomeganensis*), based on the frequency distribution of some characters among samples and stratigraphic occurrence. The author has tried to measure some test characters of these species of *Parafusulina* sample by sample. They are size of proloculus, and length, width, form ratio, wall thickness, and septal count in the seventh whorl (Fig. 31).

Proloculus size was determined by its longest diameter in thin sections regardless its shape. Other characters were represented by the measured value in the seventh whorl rather arbitrarily based on the following respects of evidence in these five species of *Parafusulina*: (1) the increase rate of width of the spiral generally tends to become constant beyond the third to fourth whorl; (2) each specimen attains to the mature stage at least in the seventh whorl; (3) there are small number of specimens having more than eight whorls in *P. japonica*, and more measurement values can be obtained precisely in the seventh whorl than in more outward whorl; and (4) inter- and intra-specific comparison is possible in the corresponding same numbered whorl in these five species.

Based on these measurements of characters of the five species in each sample and in the total twelve samples, histograms showing the frequency distribution of each character were figured by samples (Figs. 32–34) and by species (Fig. 35). Mean value and standard deviation were calculated for numerical comparison, even when the normal distribution in a sample was not drawn in the histogram. Basic data of measurements are shown in Appendix Table 1–20.

Results

Closely similar to similar tendency in morphologic variation of each character is deciphered from the histograms in the same species among samples (Figs. 32–35) except for those poor in the number of measurements (e.g., histograms of septal counts in most samples). The mode and pattern of a histogram are more or less changeable according to the width of range of the character, but in any cases they are not so different from but essentially the same as a whorl. Five characters (proloculus size, and length, width, form ratio, and wall thickness in the seventh whorl) except for the septal counts in the seventh whorl are variable even in an individual, depended upon its orientation of thin sections.

For example, the width of the seventh whorl is exactly measured only by in the sagittal section (Fig. 31). It is, however, represented by the width at the whorl from more than 6.5th to less than 7.0th in the axial section. Therefore, in the axial section the width in the seventh always becomes smaller than the real width of the seventh. The seventh whorl length in a thin section equals the real seventh length in a specimen with the completely straight axis of coiling, but always becomes shorter in those whose axis is more or less curved, resulting smaller form ratio appearance. This is true not only in the seventh but also in other whorls. However, these measurement errors caused by an orientation of thin sections are gradually decreasing and measurement values are averaged by the increase of the number of individuals examined.

Although the number of measurement is too insufficient to conclude, rather clear difference in the septal counts in the seventh whorl appears between *Parafusulina yabei* and *P. shimotsukensis*, and other three species. Frequency distribution of other characters is also characteristic, especially of the width of the seventh whorl (Fig. 35). Are these difference and similarity related to the phylogeny of these five species, mere appearance of the result, or anything else? Anyhow, general tendency of the morphologic variation of characters examined in the *Parafusulina* species are easily recognizable from the histograms.

To summarize, these results show that: (1) *Parafusulina yabei* and *P. shimotsukensis* are closely similar in proloculus size and form ratio in the seventh whorl, and easily distinguishable by their difference of width; (2) *Parafusulina tochigiensis* is more similar to *P. tomeganensis* than other three species, but has shorter fusiform test than *P. tomeganensis*; (3) *Parafusulina japonica* is distinguished from *P. tochigiensis* and *P. tomeganensis* by having larger proloculus, and from *P. shimotsukensis* and *P. yabei* by its smaller test. Although not examined in this paper on account of difficulties of its quantitative analysis, the mode of setal folding is somewhat different between *P. yabei* and *P. shimotsukensis* (*P. yabei* group), and *P. japonica*, *P. tochigiensis*, and *P. kuzuensis* (*P. japonica* group).

The morphologic comparison among five species examined in this paper agrees with and supports the result of Kobayashi's (2006a) classification of *Parafusulina* based on the population concept and the morphologic analysis of the overall test characters by the use of more than 2,500 microphotographs of specimens from various stratigraphic levels of the Nabeyama Formation.

Concluding remarks

Some significant differences and similarities are detected biometrically in the examined characters of *Parafusulina* from the Nabeyama Formation. They are suggestive to classify them into five as done by Kobayashi (2006a), but do not always lead to the conclusion either actual taxonomic validity and independency are inspected or not. There are no criteria to recognize as a biological species among Paleozoic foraminifers. Recently some paleontologists have paid their special attention to the biodiversity of the past which is important and interesting in relation to rapid and remarkable changes of an ancient biotope event. This and similar discussions require and are only possible after the biological species concept or general consensus among taxonomists for the species definition and its validity of extinct fossil groups.

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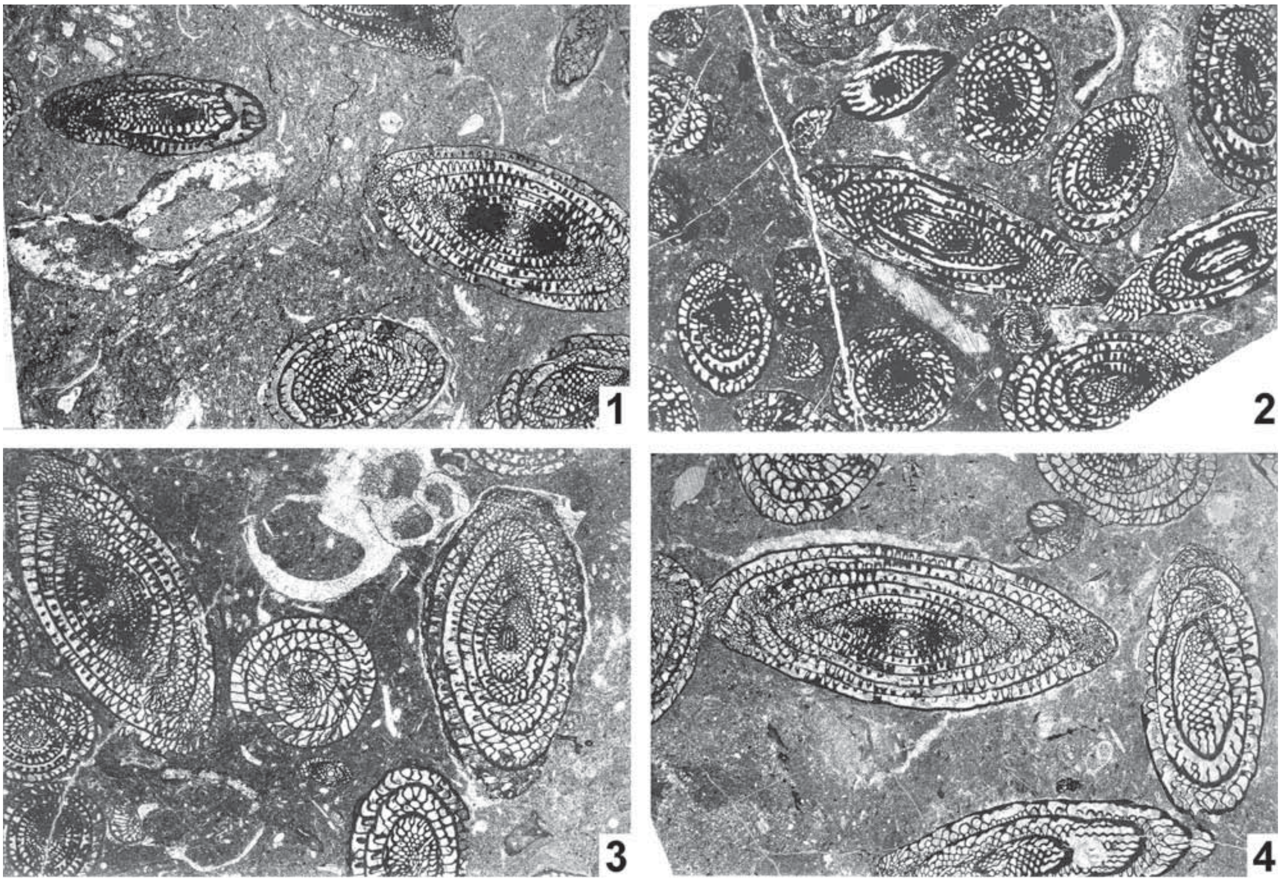

Figure 3. Photomicrographs of the limestone showing the occurrence of parafusulinids packed within lime-mud matrix. Other large fusulinoideans are not contained and smaller fusulinoideans and non-fusulinoidean foraminifers are rare not only in these four but also other eight limestone samples. All ×3.5, 1: Ya-27; 2: Ka-2; 3: Ka-57; 4: Ka-71

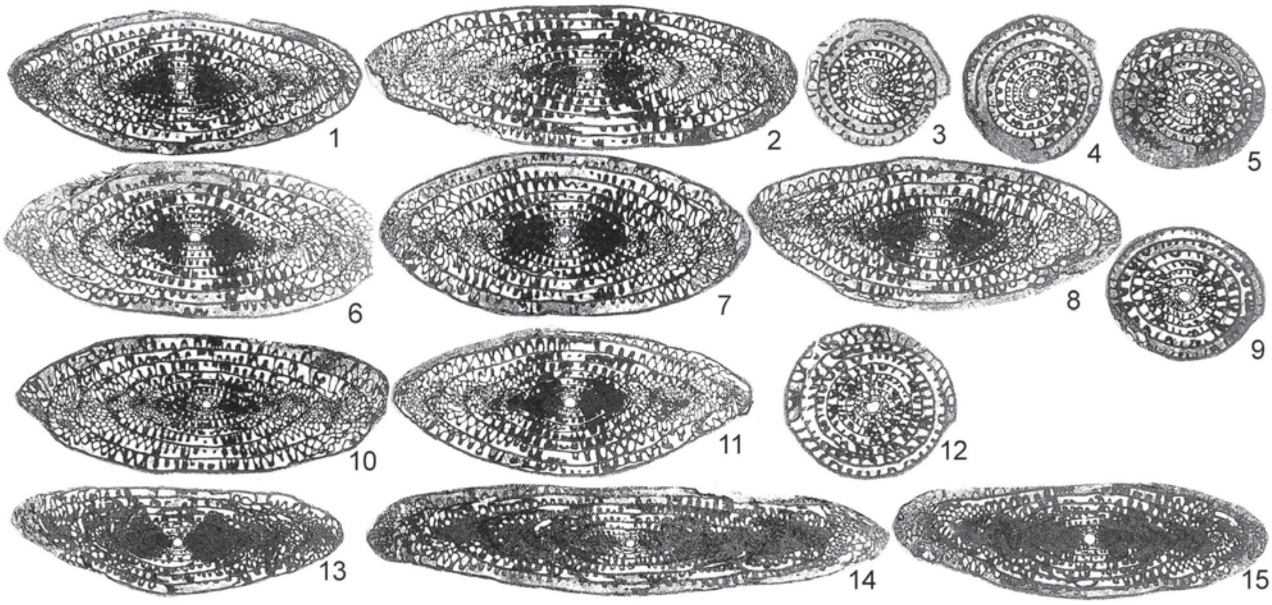

Figure 4. *Parafusulina yabei* (1-12) and *Parafusulina tomeganensis* (13-15) in the Sample Ya-27. 3-5, 9, 12: sagittal sections; others: axial sections, all ×4.

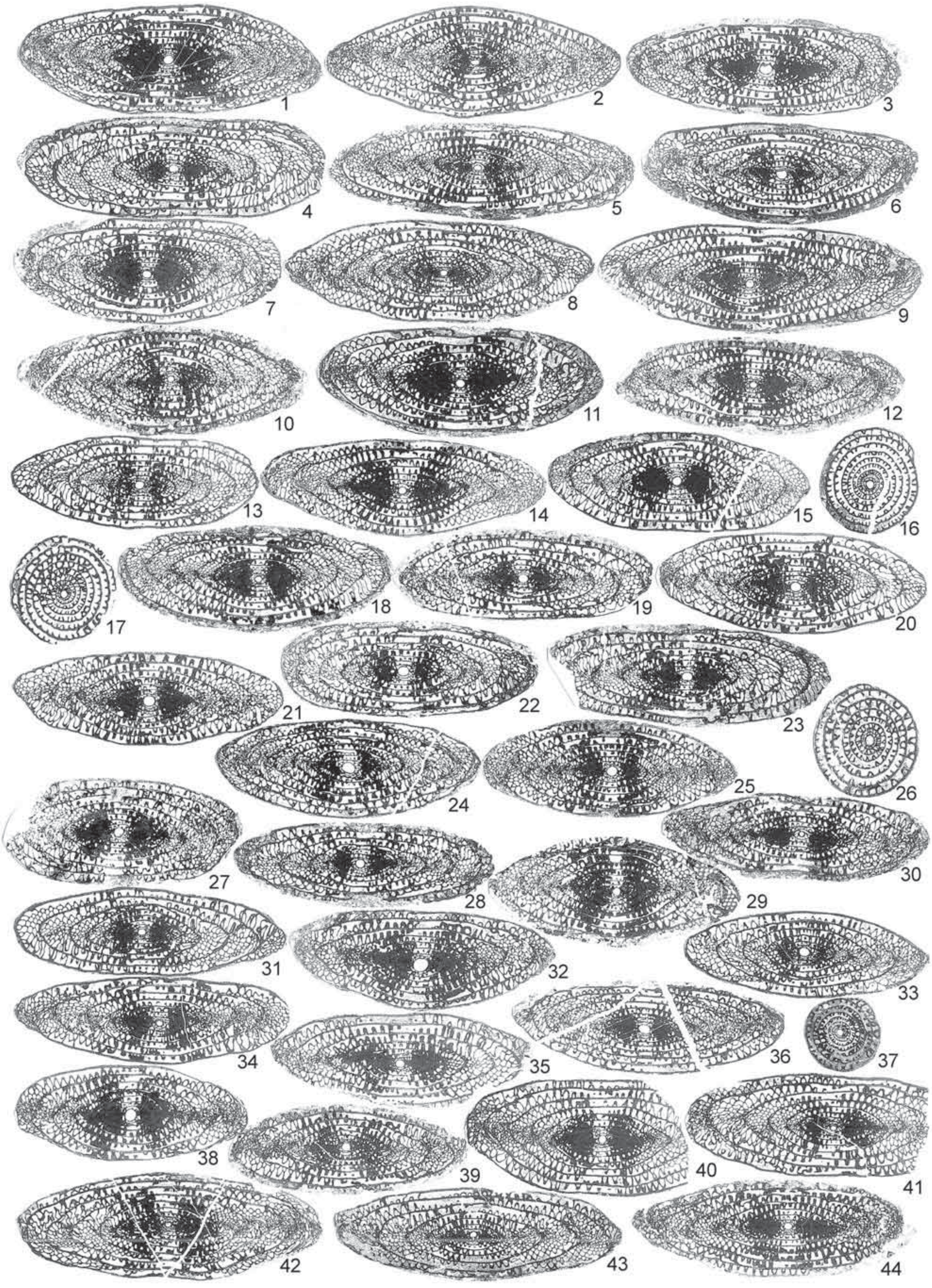

Figure 5. *Parafusulina yabei* in the Sample Ya-30 (Part 1). 16, 17, 26, 37: sagittal sections; others: axial sections, all ×4.

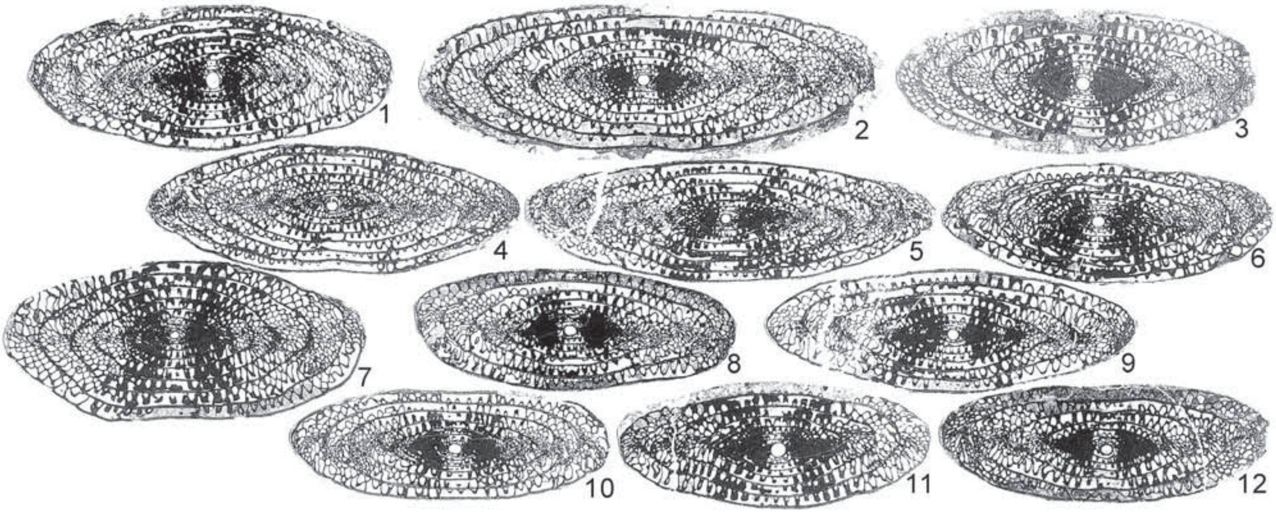

Figure 6. *Parafusulina yabei* in the Sample Ya-30 (Part 2). All axial sections, ×4.

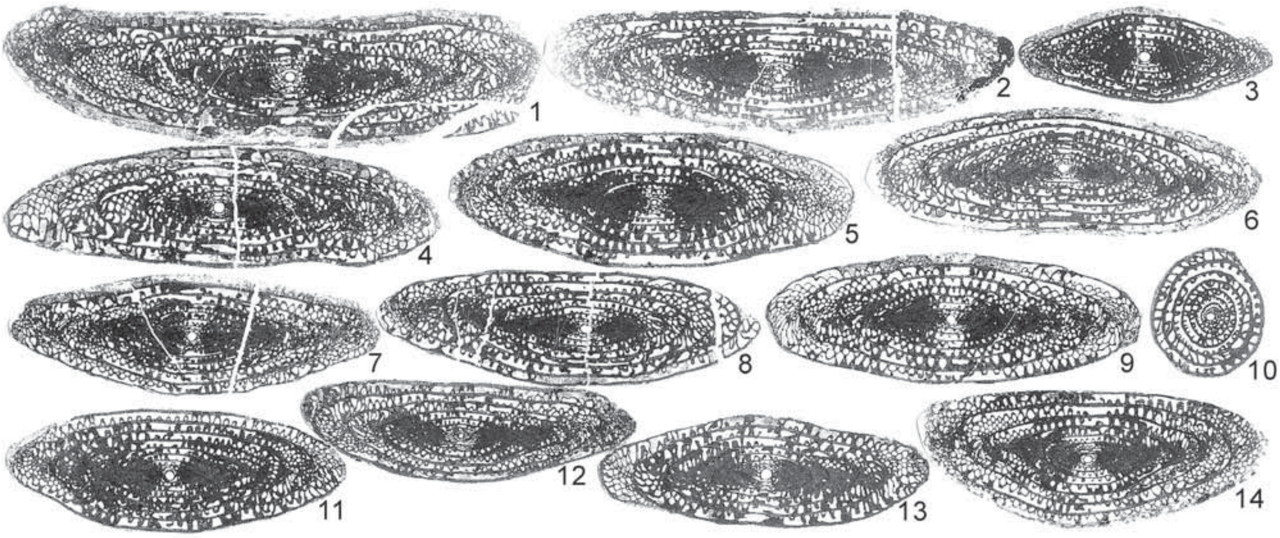

Figure 7. *Parafusulina tomeganensis* in the Sample Ya-30. 10: sagittal section; others: axial sections, all ×4.

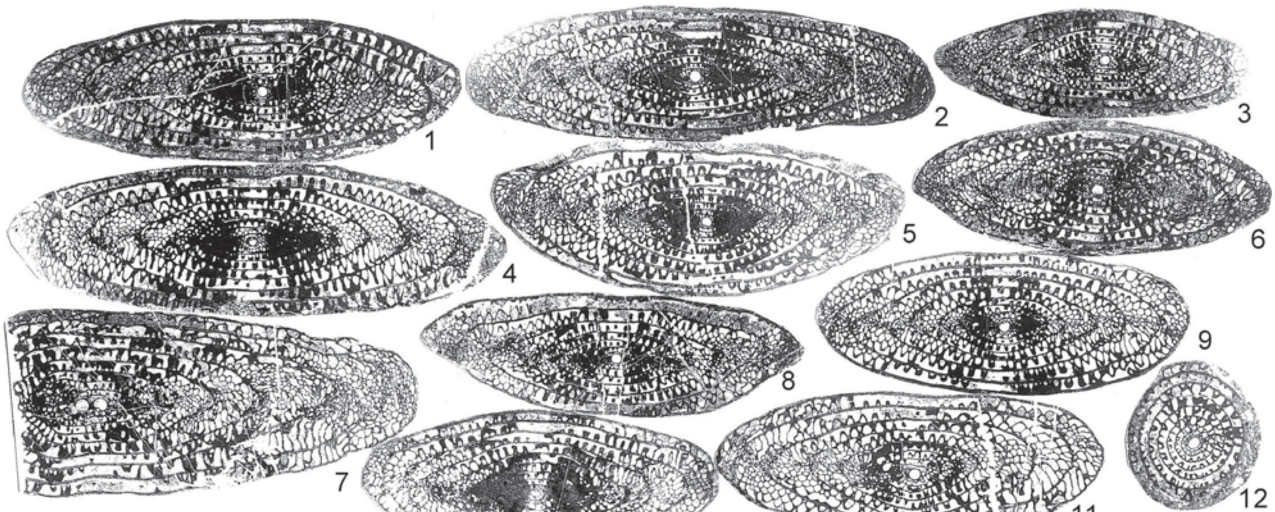

Figure 8. *Parafusulina yabei* in the Sample Ya-32 (Part 1). 12: sagittal section; others: axial sections, all ×4.

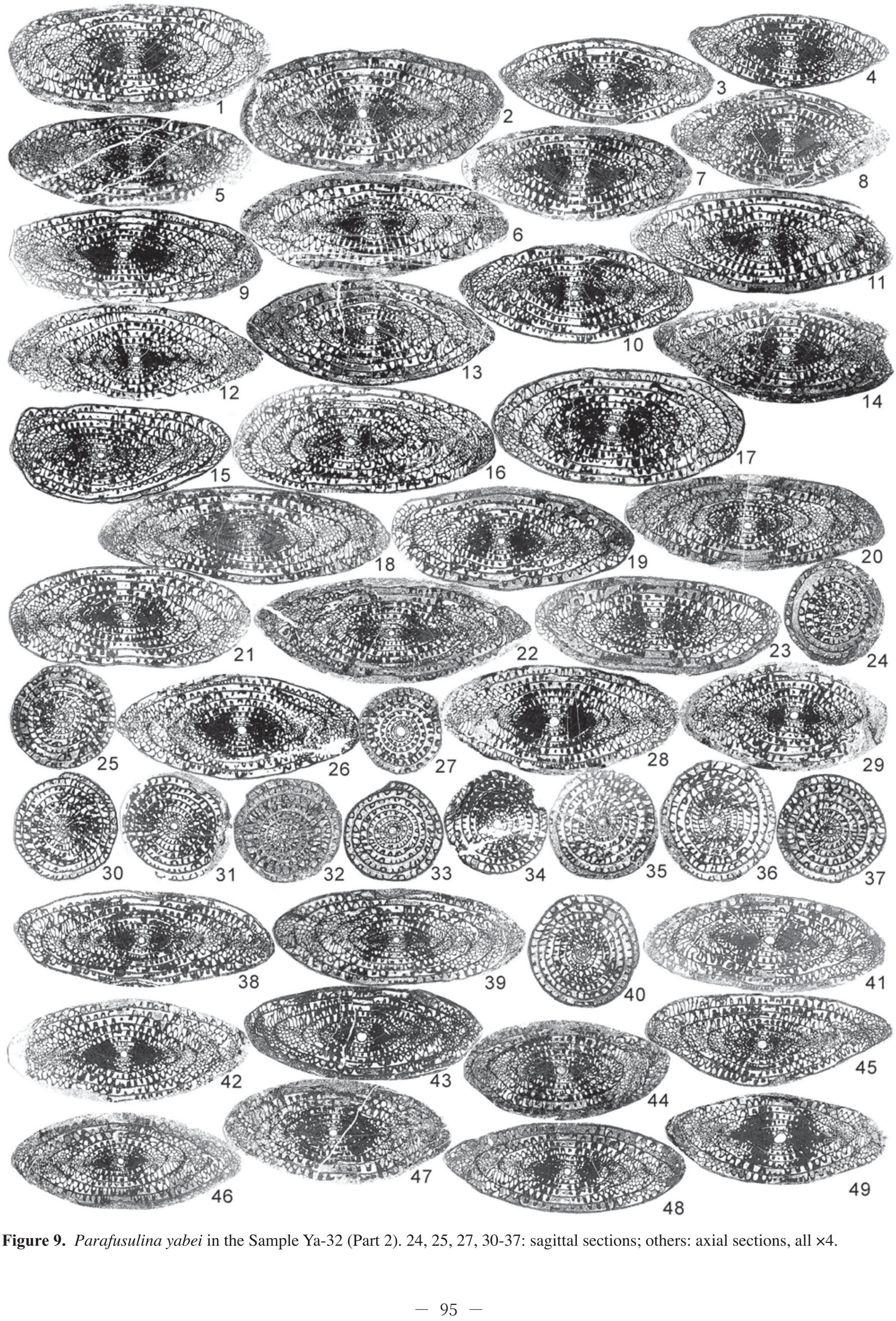

Figure 9. *Parafusulina yabei* in the Sample Ya-32 (Part 2). 24, 25, 27, 30-37: sagittal sections; others: axial sections, all ×4.

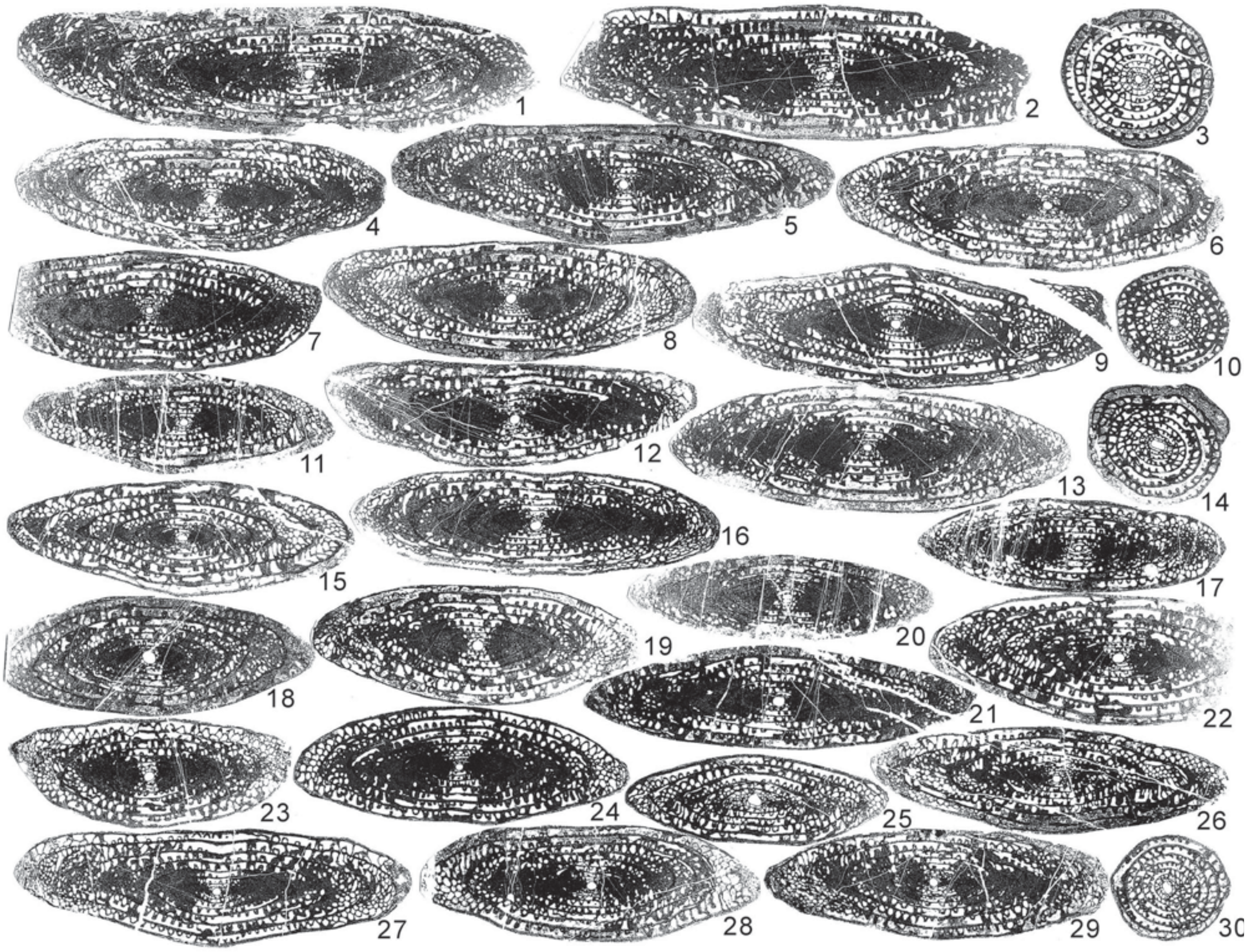

Figure 10. *Parafusulina tomeganensis* in the Sample Ya-32. 3, 10, 14, 30: sagittal sections; others: axial sections, all ×4.

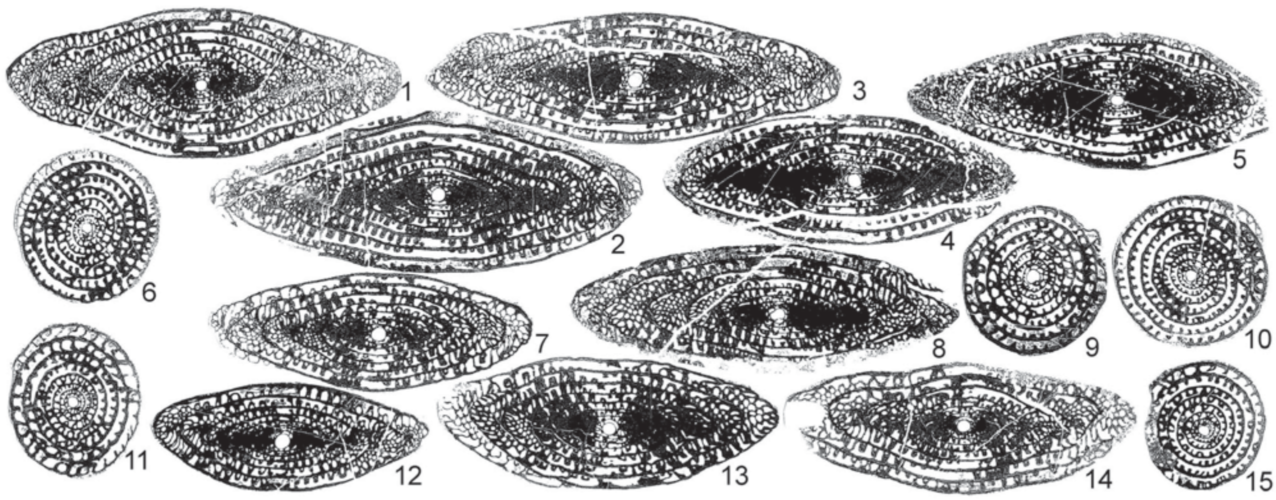

Figure 11. *Parafusulina japonica* in the Sample Ka-2. 6, 9-11, 15: sagittal sections; others: axial sections, all ×4.

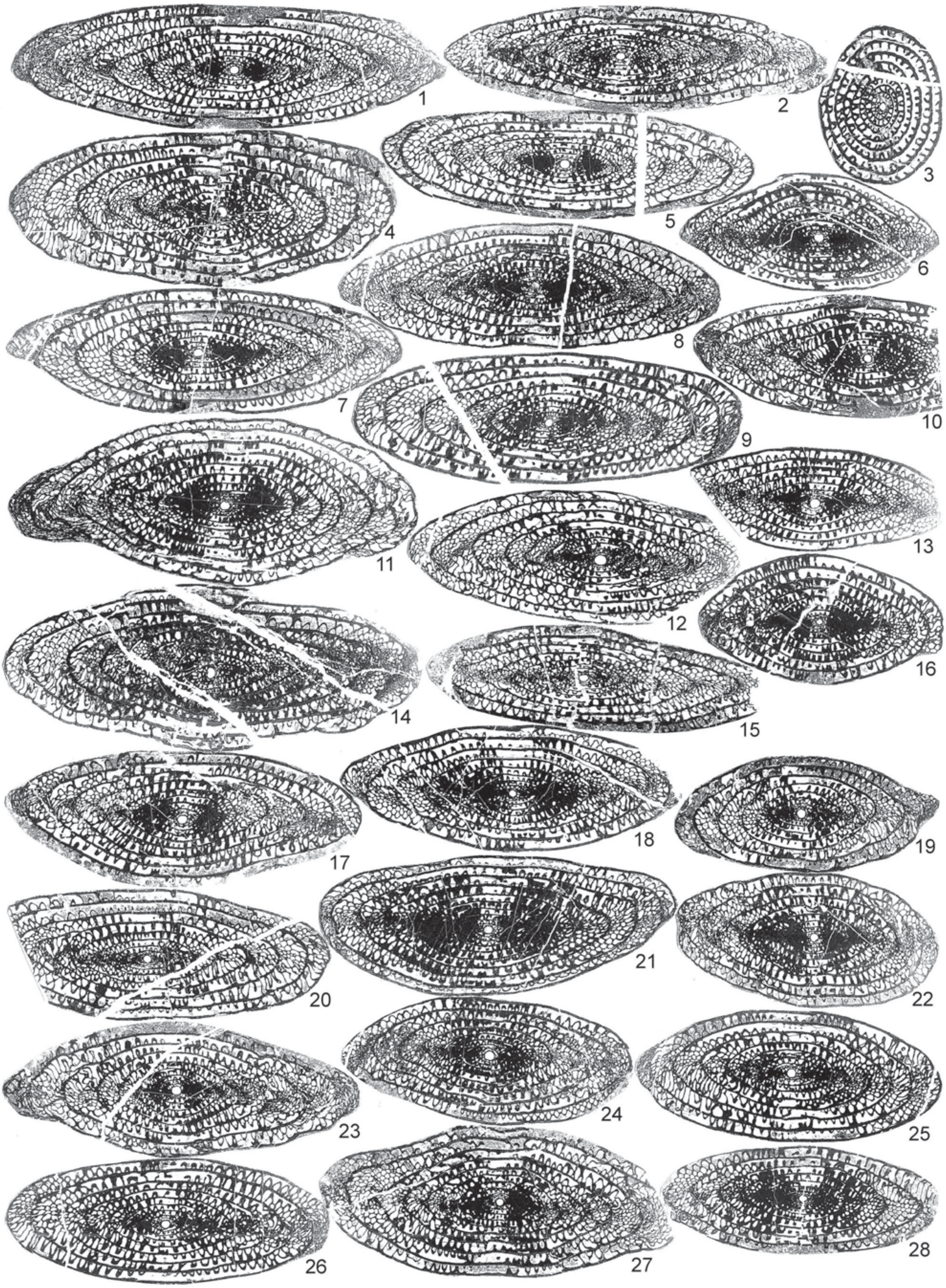

Figure 12. *Parafusulina shimotsukensis* in the Sample Ka-86 (Part 1). 3: sagittal section; others: axial sections, all ×4.

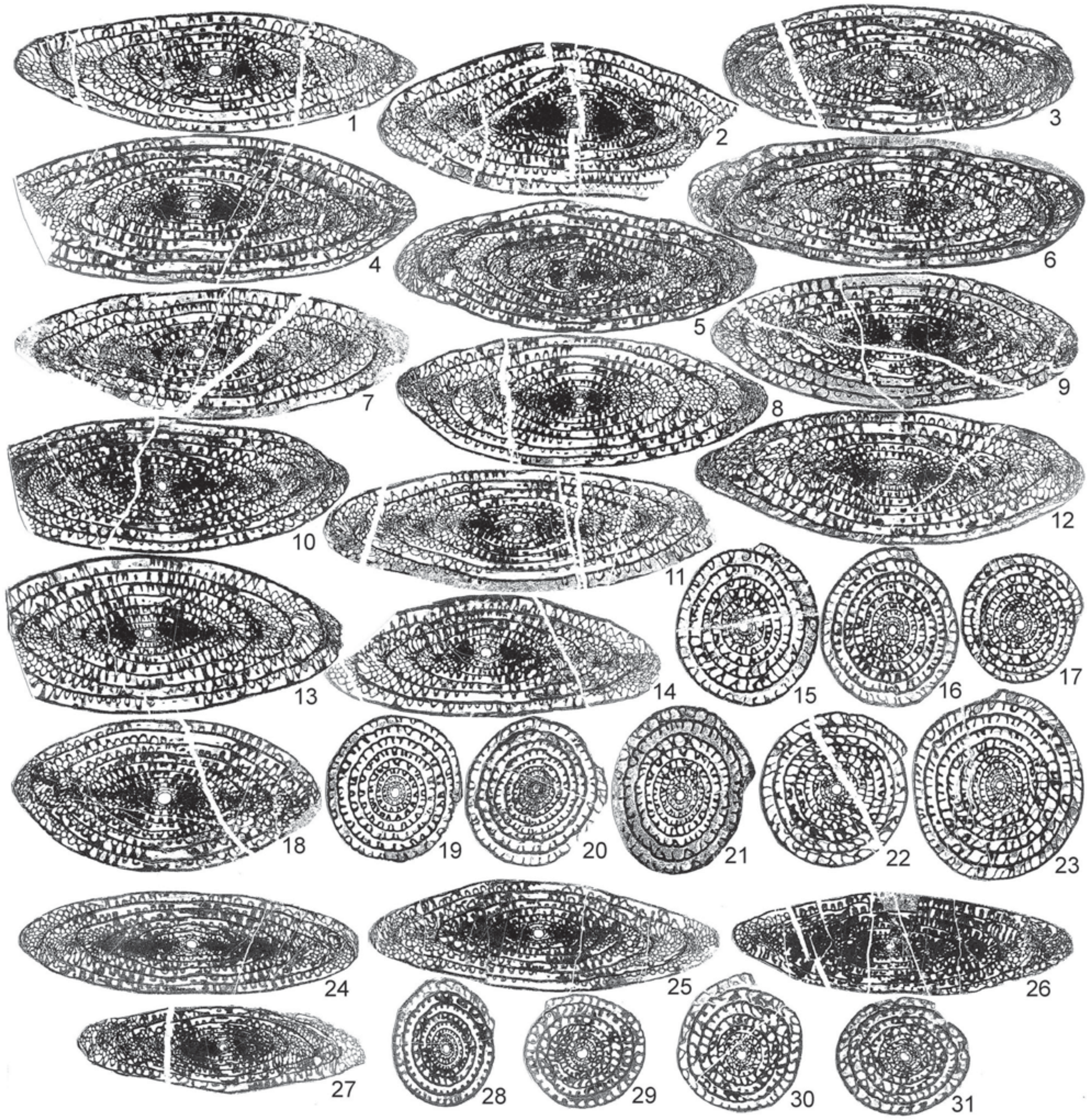

Figure 13. *Parafusulina shimotsukensis* (1-3) (Part 2) and *Parafusulina tochigiensis* (24-31) in the Sample Ka-86. 15—17, 19-23, 28—31: sagittal sections; others: axial sections, all ×4.

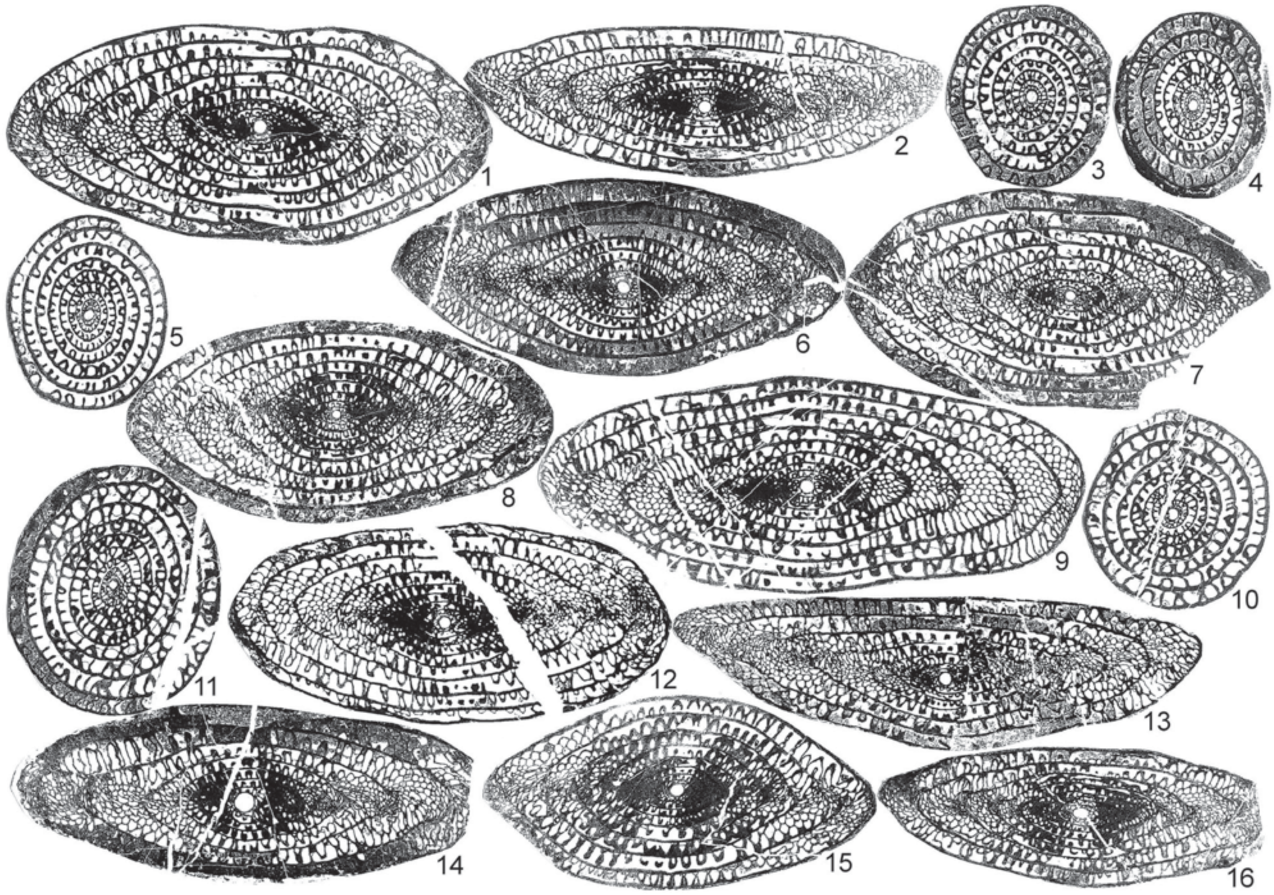

Figure 14. *Parafusulina shimotsukensis* in the Sample Ka-57. 3-5, 10, 11: sagittal sections; others: axial sections, all ×4.

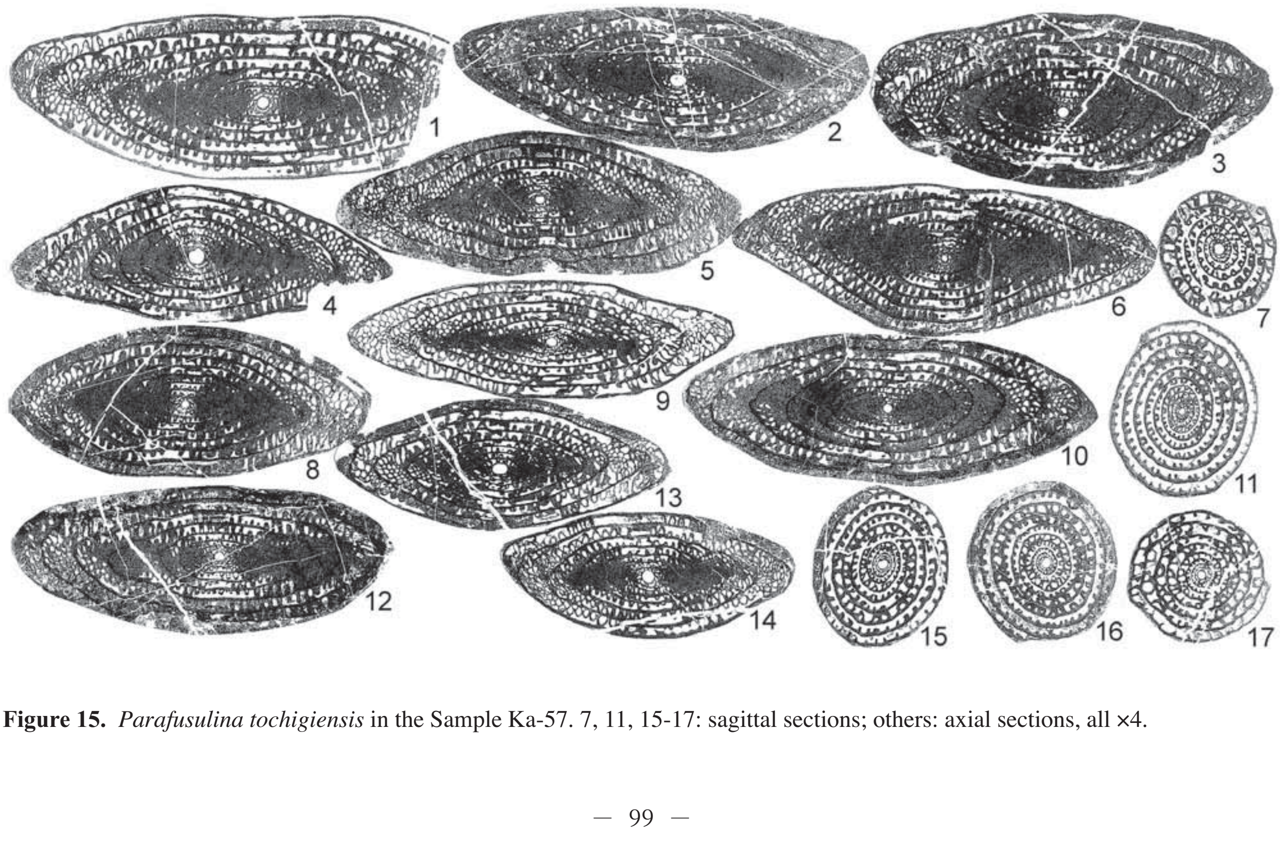

Figure 15. *Parafusulina tochigiensis* in the Sample Ka-57. 7, 11, 15-17: sagittal sections; others: axial sections, all ×4.

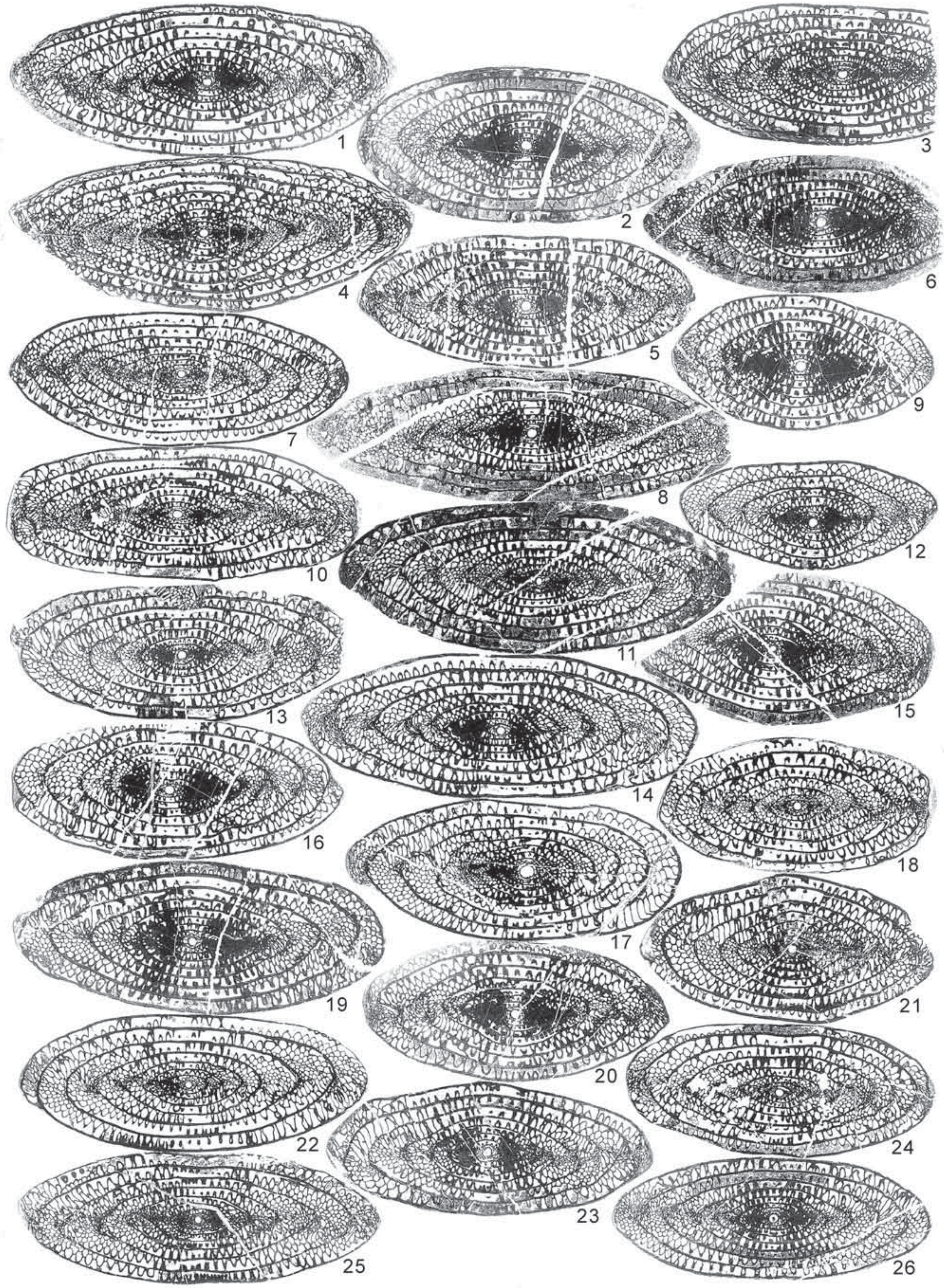

Figure 16. *Parafusulina shimotsukensis* in the Sample Ka-70 (Part 1). All axial sections, ×4.

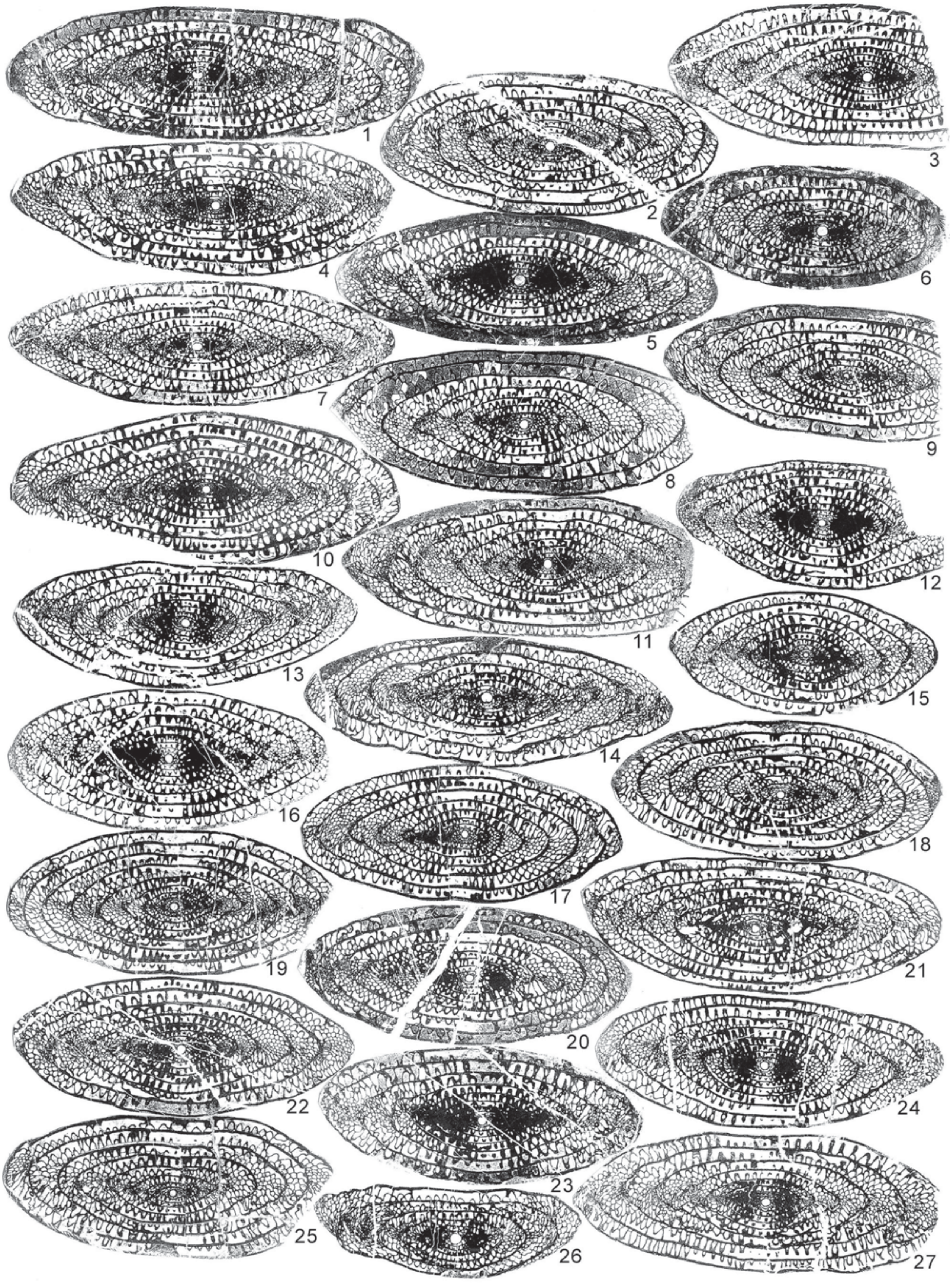

Figure 17. *Parafusulina tshimotsukensis* in the Sample Ka-70 (Part 2). All axial sections, ×4.

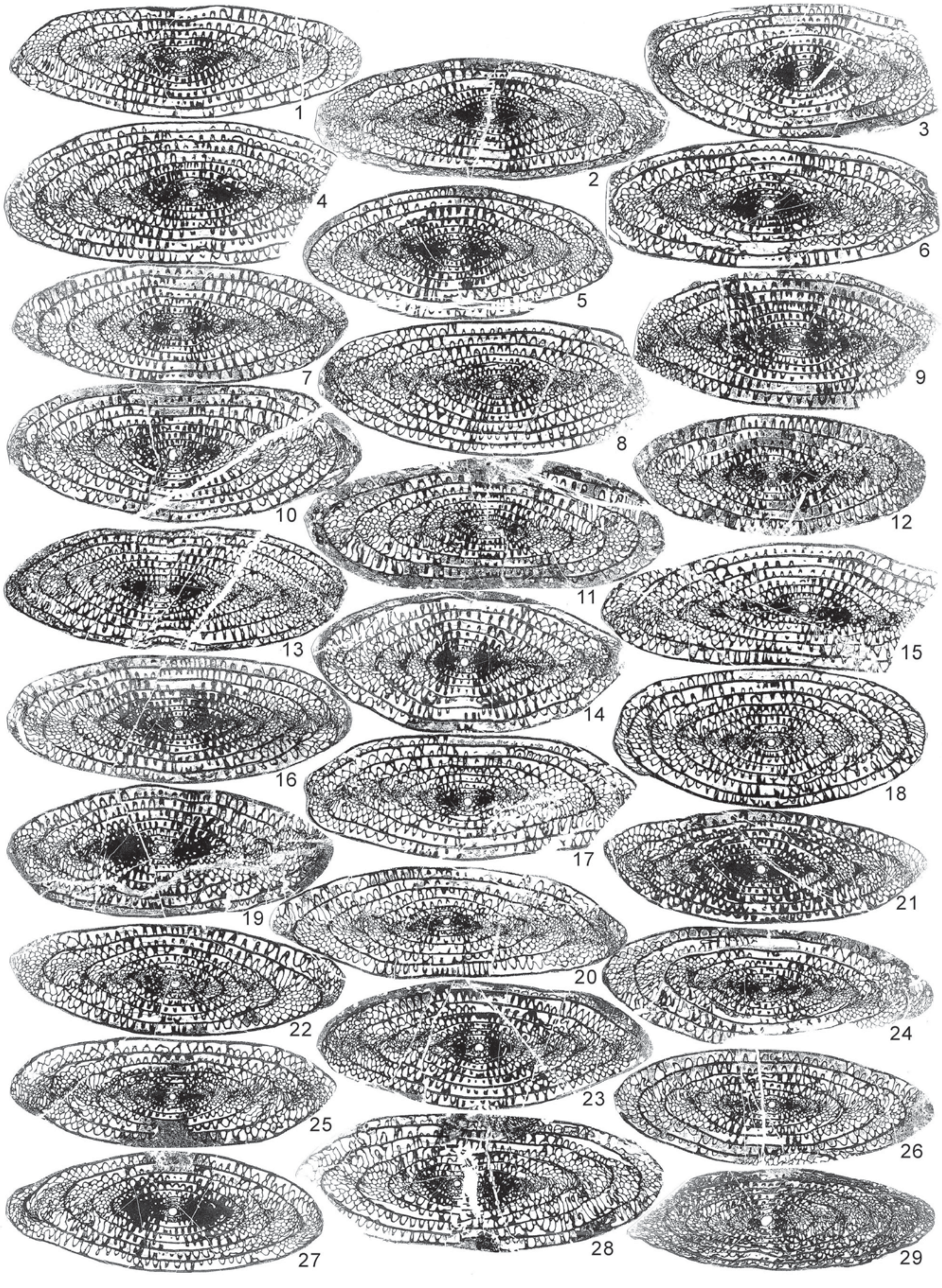

Figure 18. *Parafusulina shimotsukensis* in the Sample Ka-70 (Part 3). All axial sections, ×4.

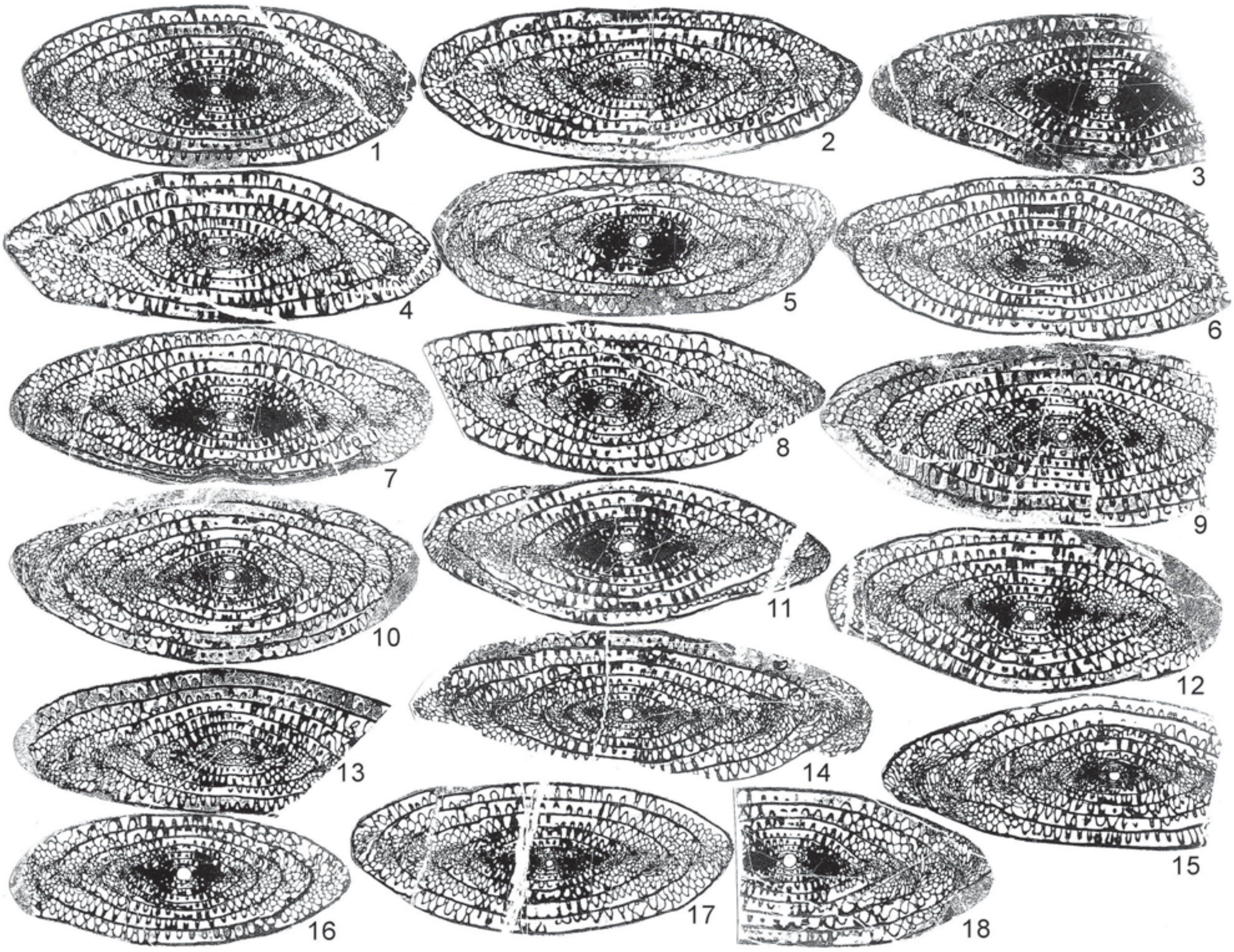

Figure 19. *Parafusulina shimotsukensis* in the Sample Ka-70 (Part 4). All axial sections, ×4.

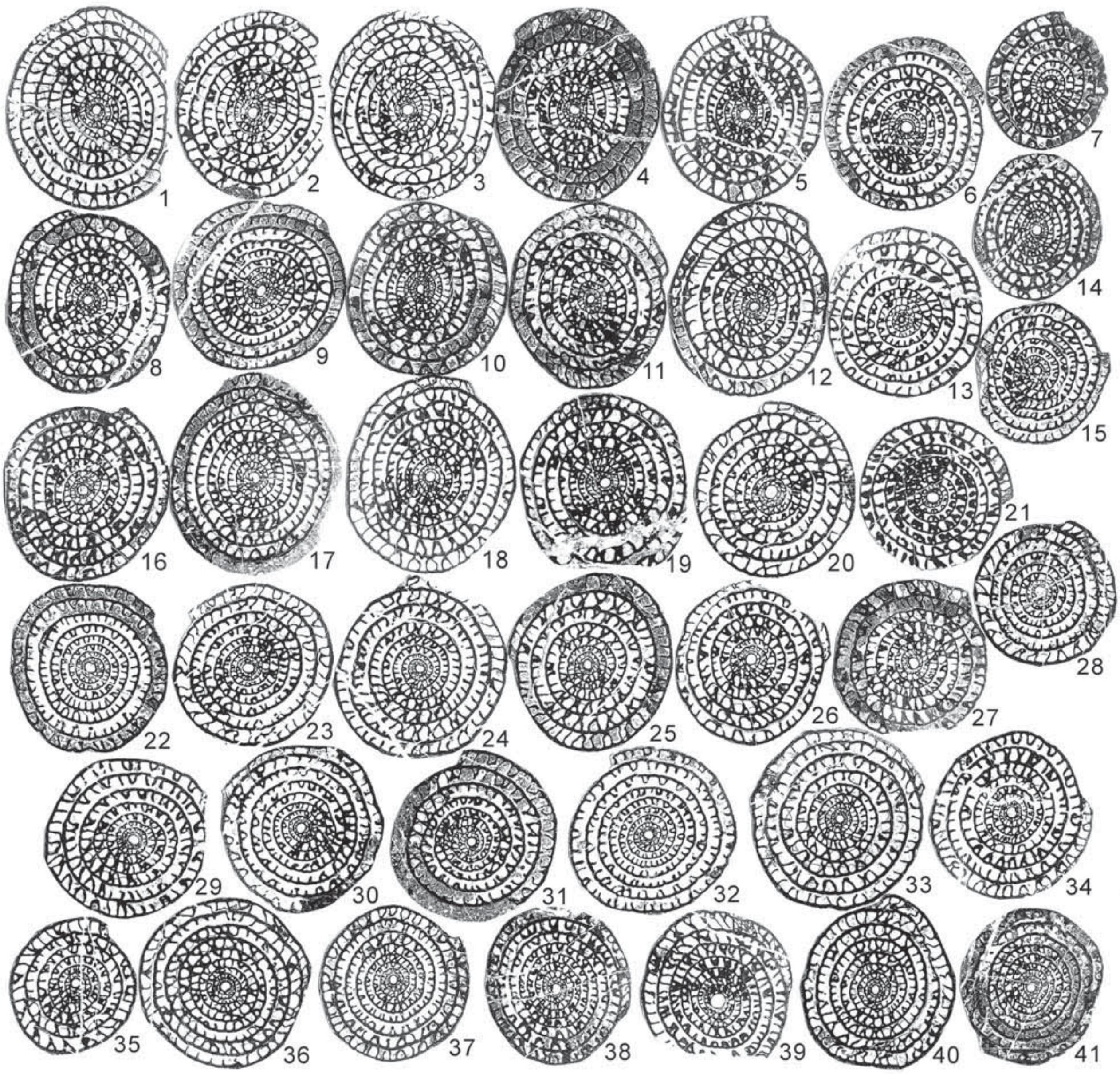

Figure 20. *Parafusulina shimotsukensis* in the Sample Ka-70 (Part 5). All sagittal sections, ×4.

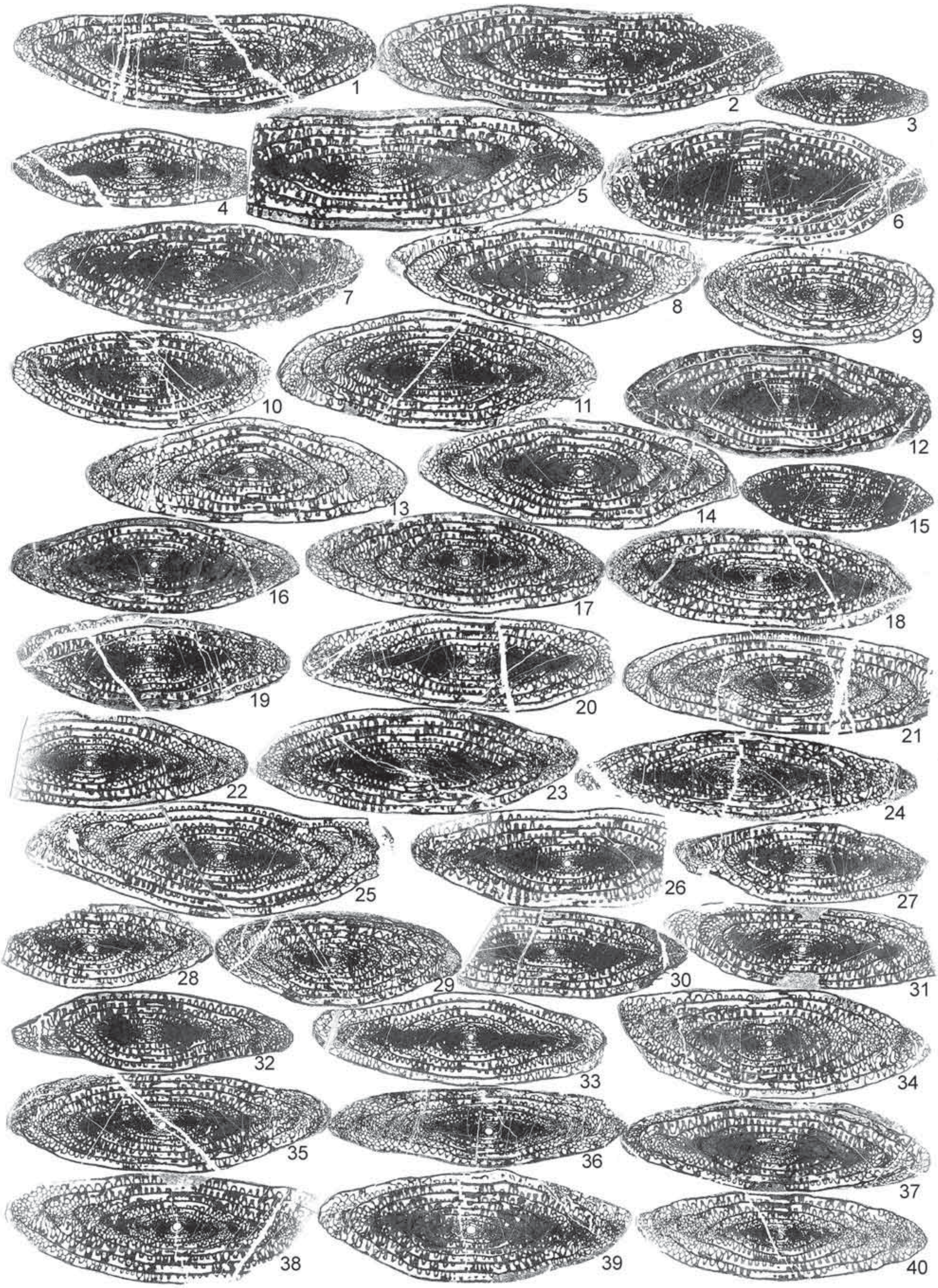

Figure 21. *Parafusulina tochigiensis* in the Sample Ka-70 (Part 1). All axial sections, ×4.

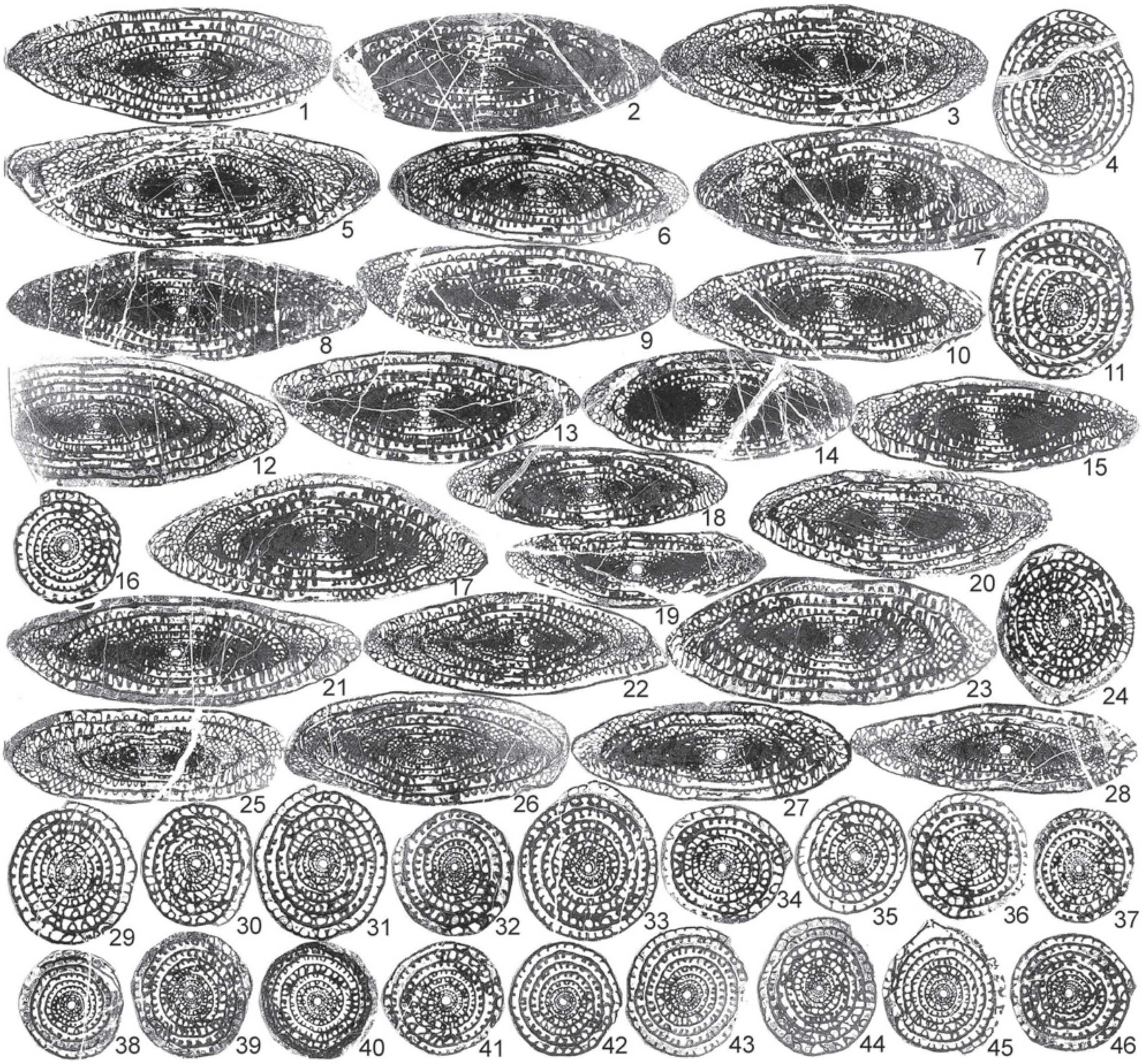

Figure 22. *Parafusulina tochigiensis* in the Sample Ka-70 (Part 2). 4, 11, 16, 24, 29-46: sagittal sections; others: axial sections, all ×4.

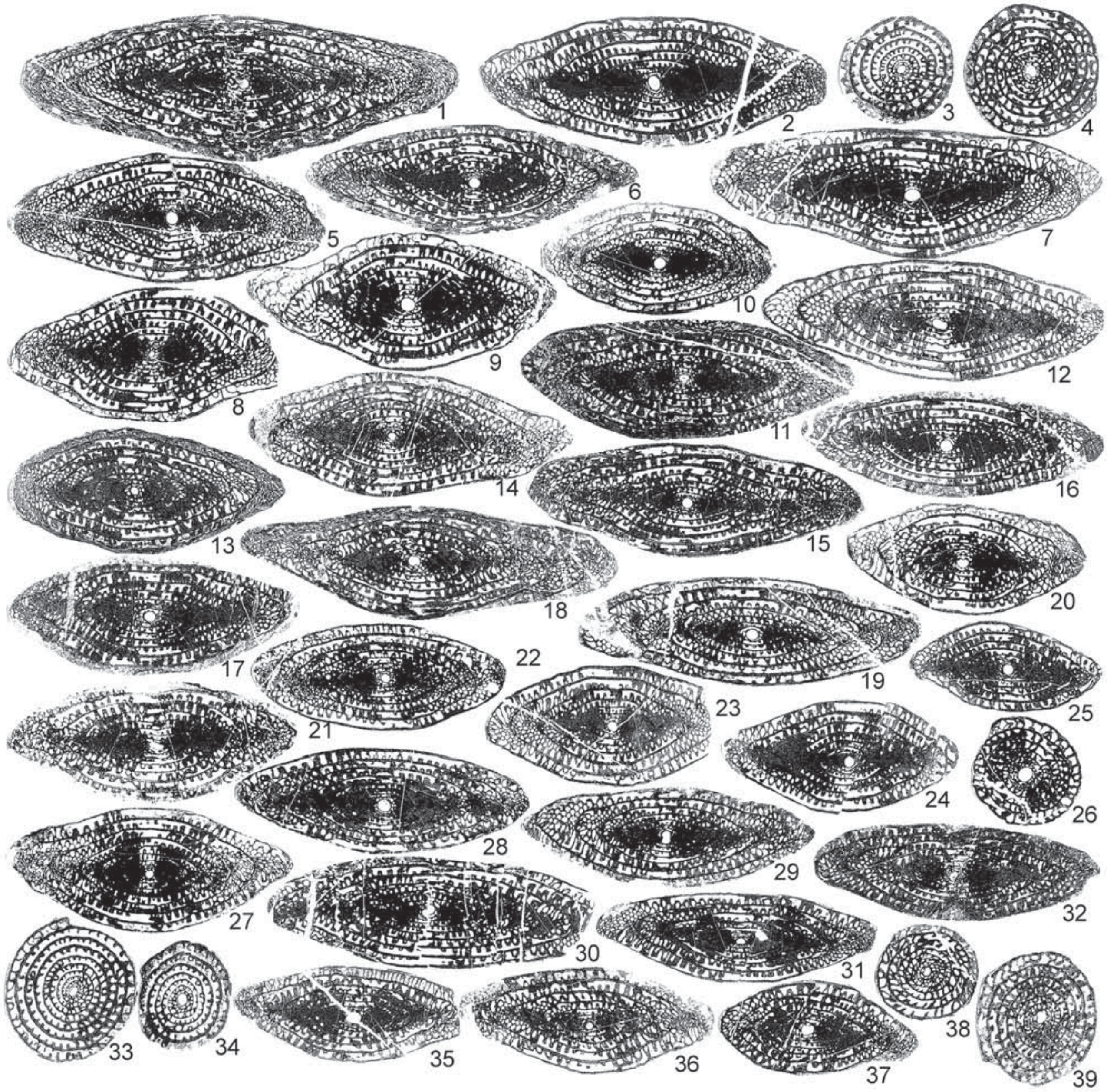

Figure 23. *Parafusulina japonica* in the Sample Ka-28. 3, 4, 26, 33, 34, 38, 39: sagittal sections; others: axial sections, all ×4.

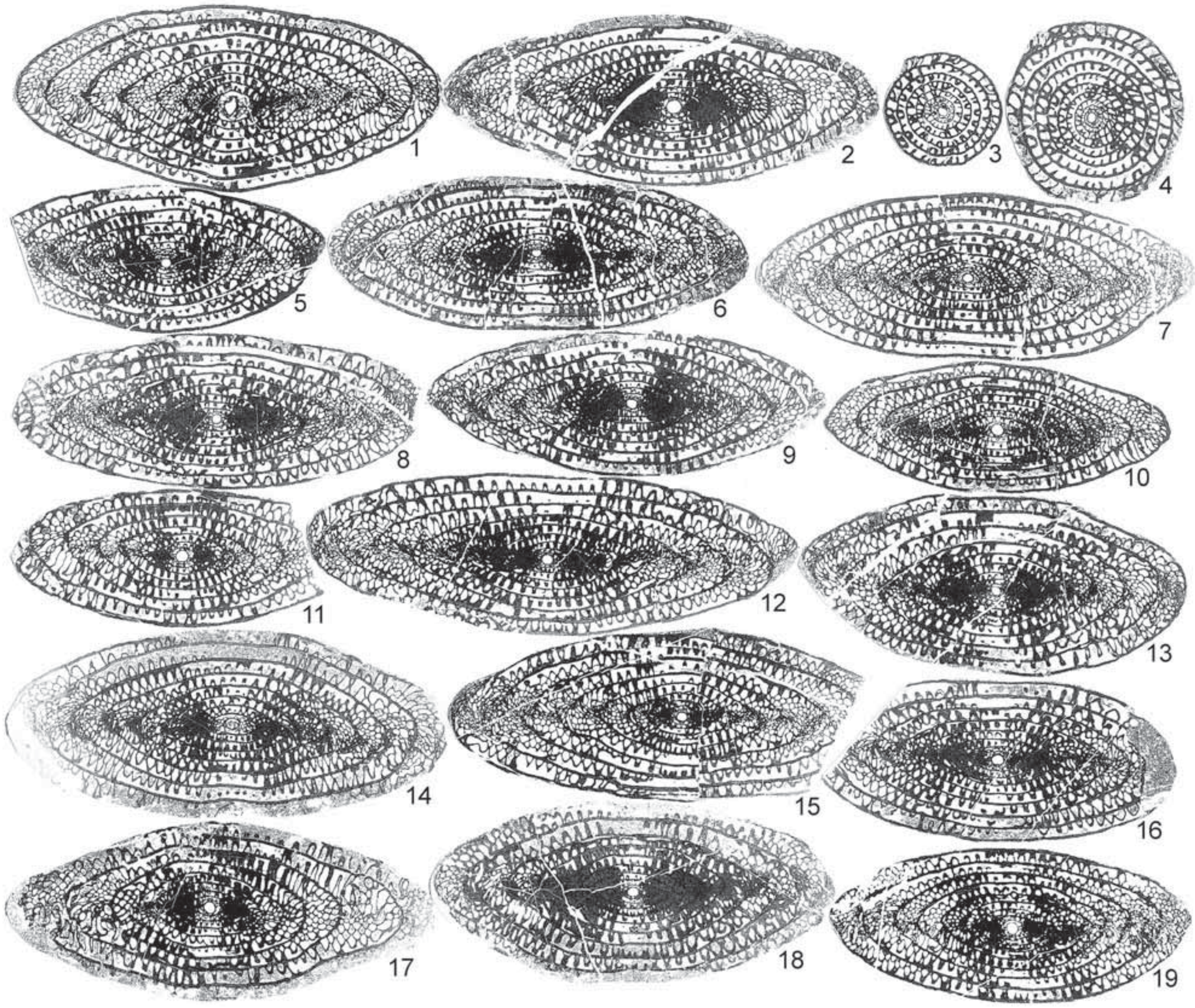

Figure 24. *Parafusulina shimotsukensis* in the Sample Ka-47. 3, 4: sagittal sections; others: axial sections, all ×4.

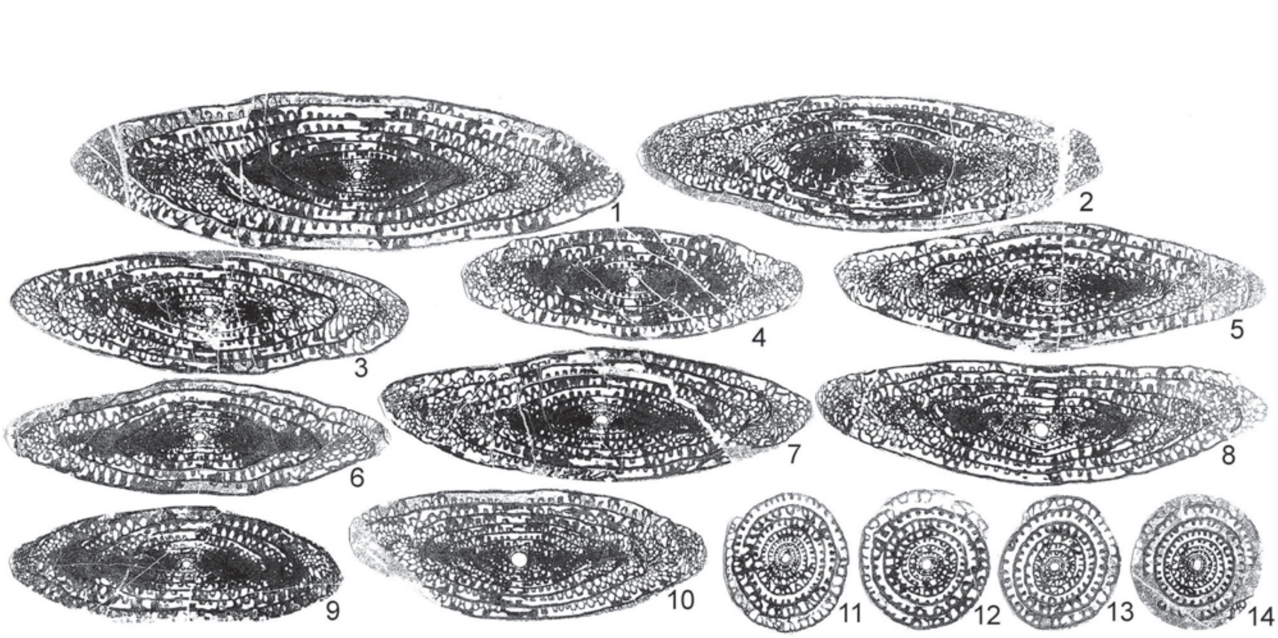

Figure 25. *Parafusulina tochigiensis* in the Sample Ka-47. 11–14: sagittal sections; others: axial sections, all ×4.

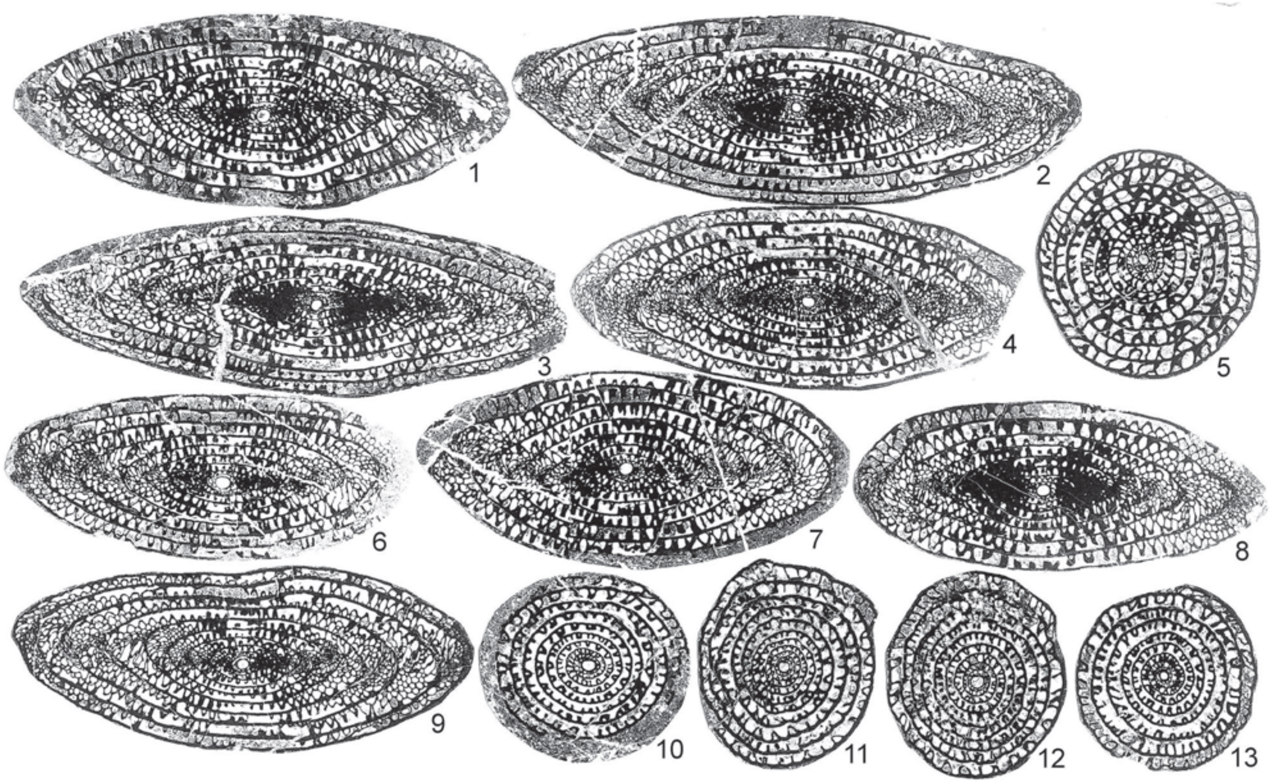

Figure 26. *Parafusulina shimotsukensis* in the Sample Ka-71. 5, 10-13: sagittal sections; others: axial sections, all ×4.

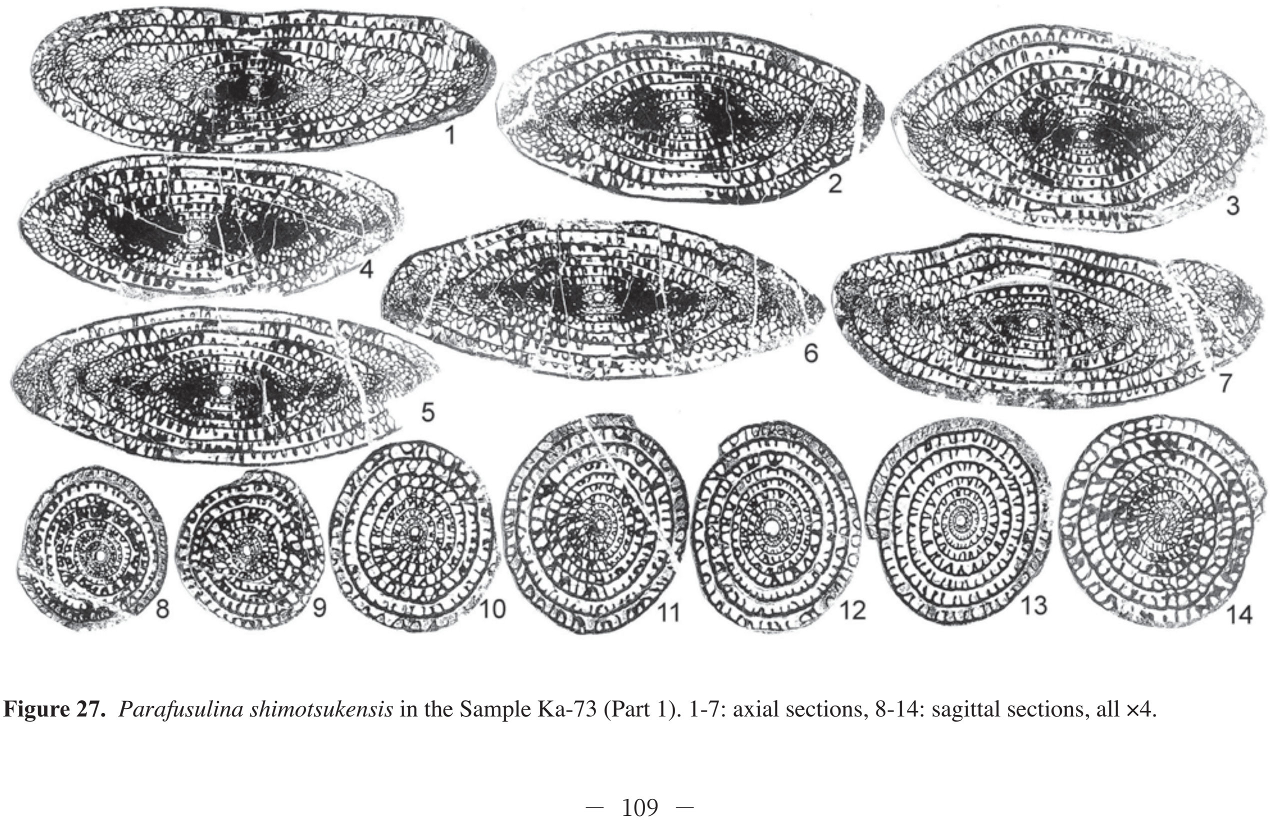

Figure 27. *Parafusulina shimotsukensis* in the Sample Ka-73 (Part 1). 1-7: axial sections, 8-14: sagittal sections, all ×4.

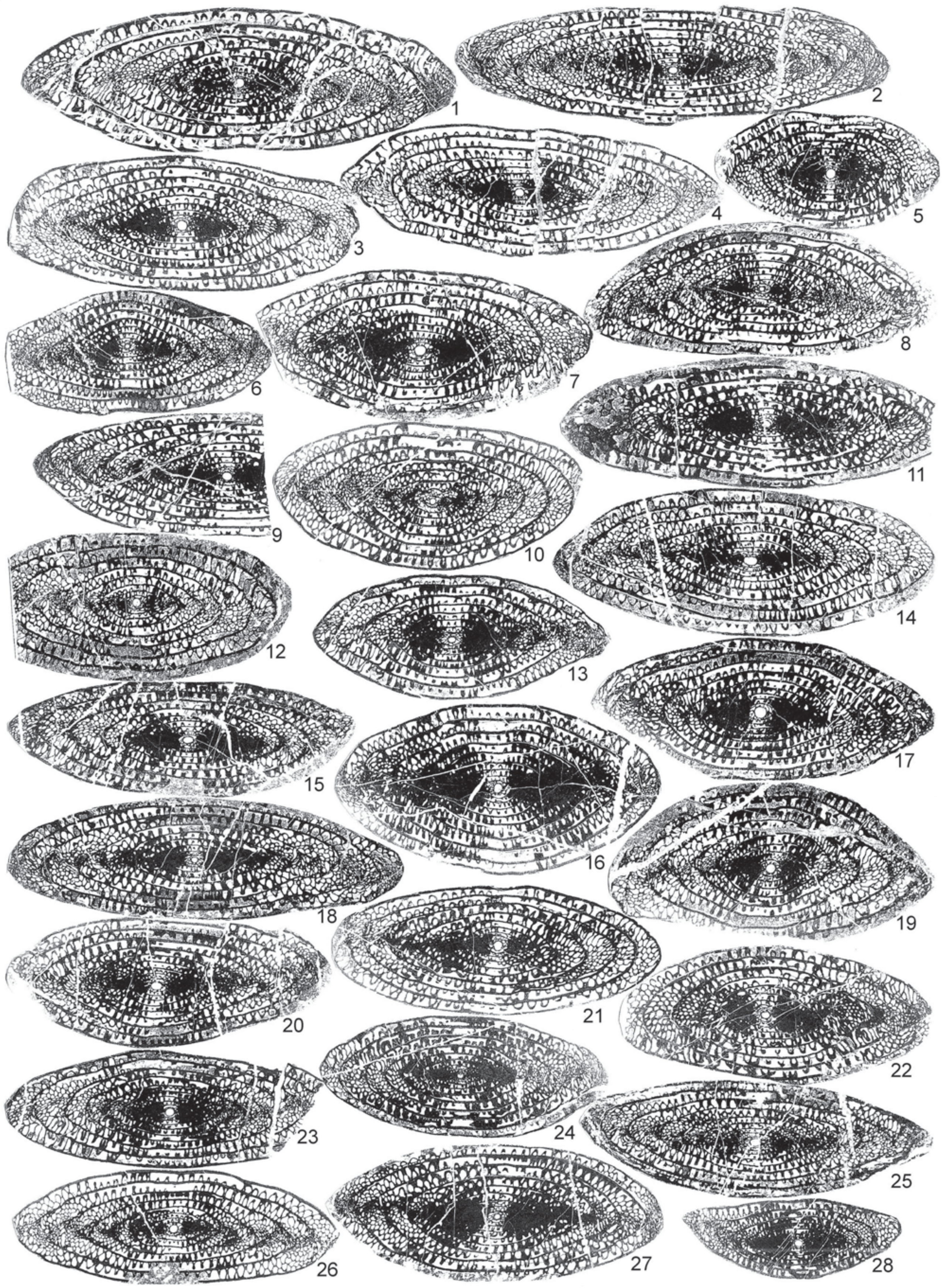

Figure 28. *Parafusulina shimotsukensis* in the Sample Ka-73 (Part 2). All axial sections, ×4.

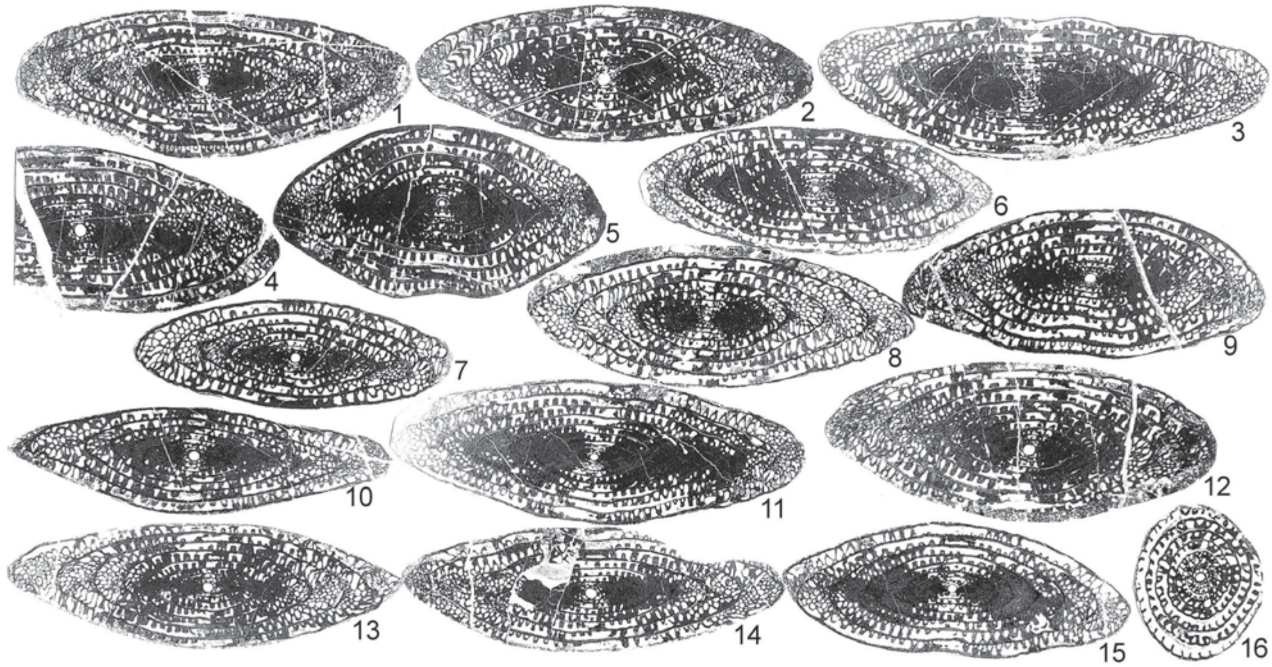

Figure 29. *Parafusulina tochigiensis* in the Sample Ka-73. 16: sagittal section; others: axial sections, all ×4.

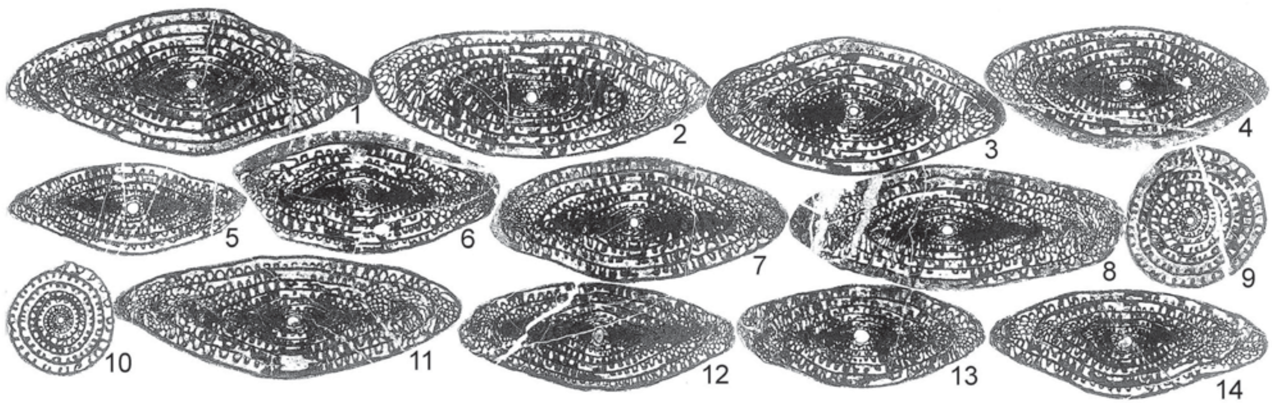

Figure 30. *Parafusulina japonica* in the Sample Ka-33. 9, 10: sagittal sections; others: axial sections, all ×4.

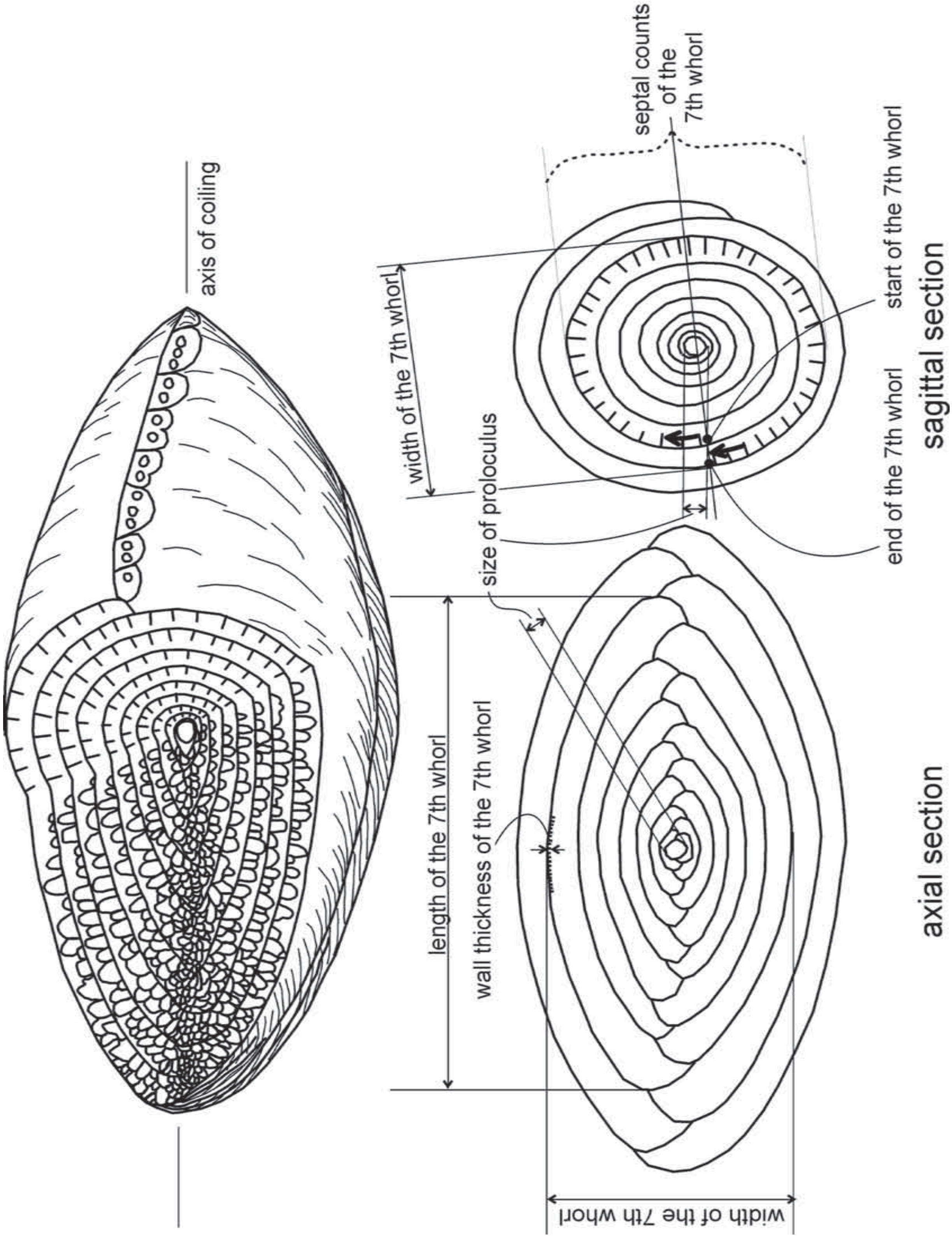

Figure31. Measurement scheme for five species of *Parafusulina.*

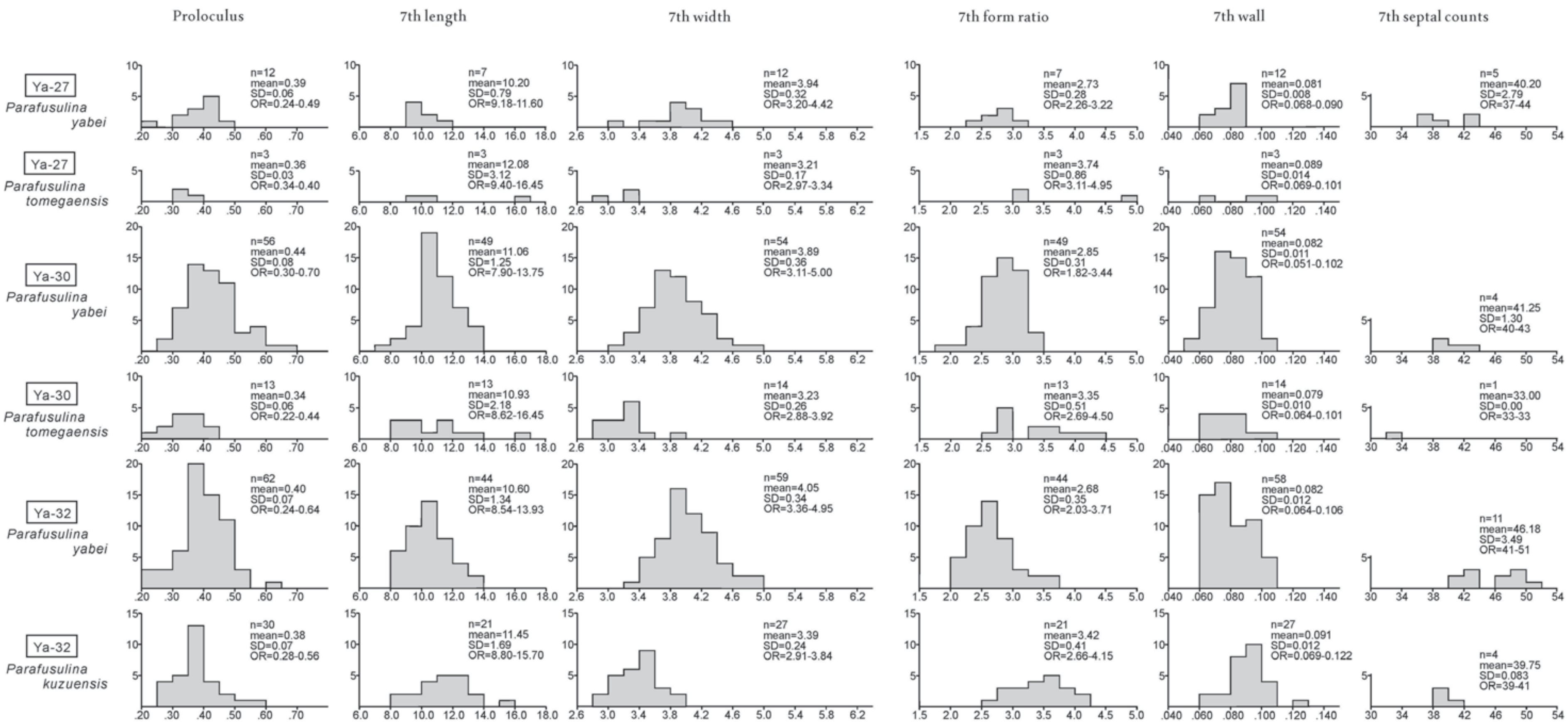

Figure 32. Frequency distribution histograms and statistical values [number of specimens (n), mean value, standard deviation (SD), and observed range (OR)] of diameter of six characters in *Parafusulina yabei* and *P. tomeganensis* from three samples of the lower part of the Nabeyama Formation. Numerical values in the vertical axis show the frequency and those in the horizontal axis in proloculus, 7th length, 7th width, and 7th wall (wall thickness of the seventh whorl) are shown in mm. These alphabetical symbols and numerical values in the vertical and horizontal axes are common in Figs. 32-35.

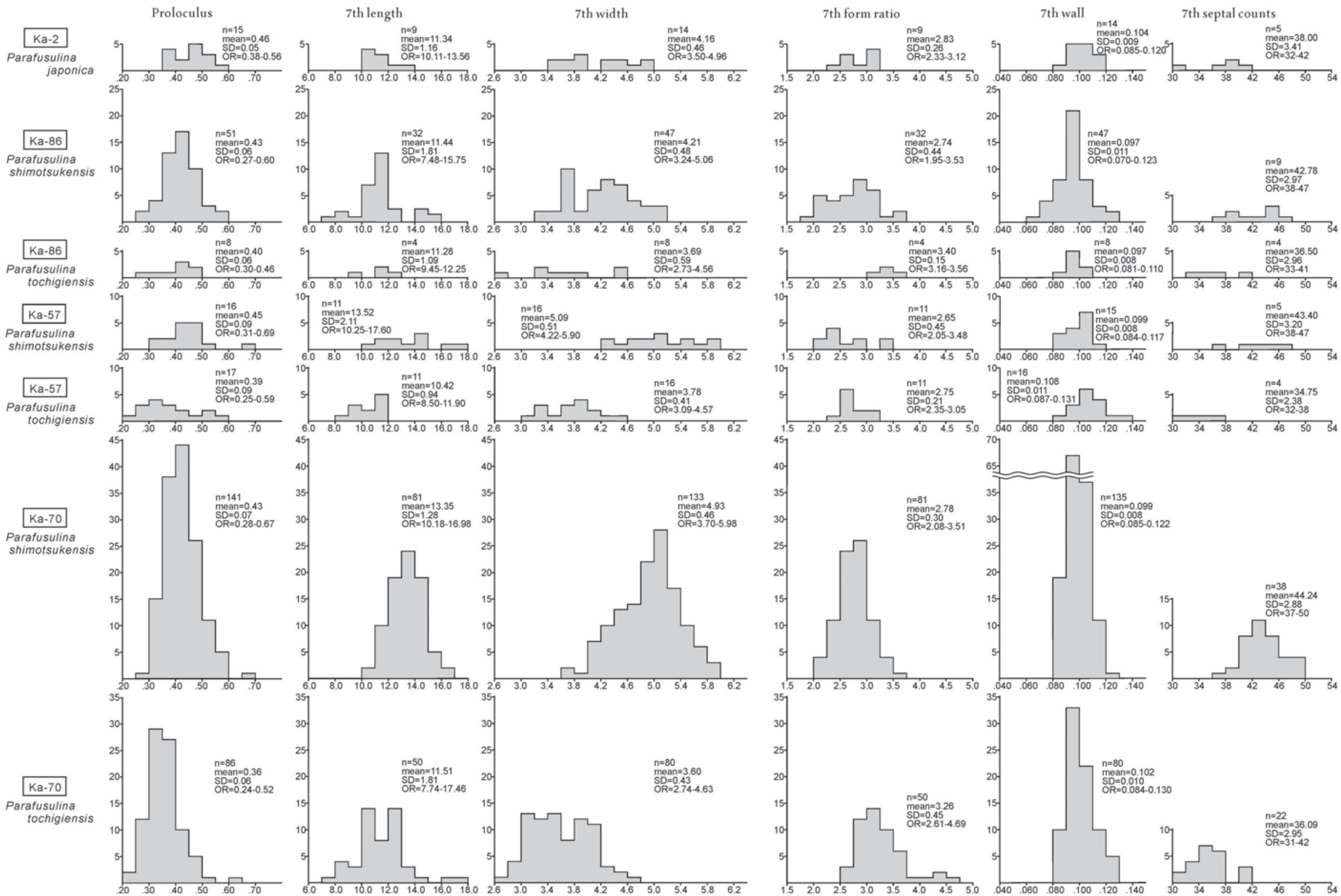

Figure33. Frequency distribution histograms and statistical values in *Parafusulina japonica*, *P. shimotsukensis*, and *P. tochigiensis* from nine samples of the upper part of the Nabeyama Formation (Part 1).

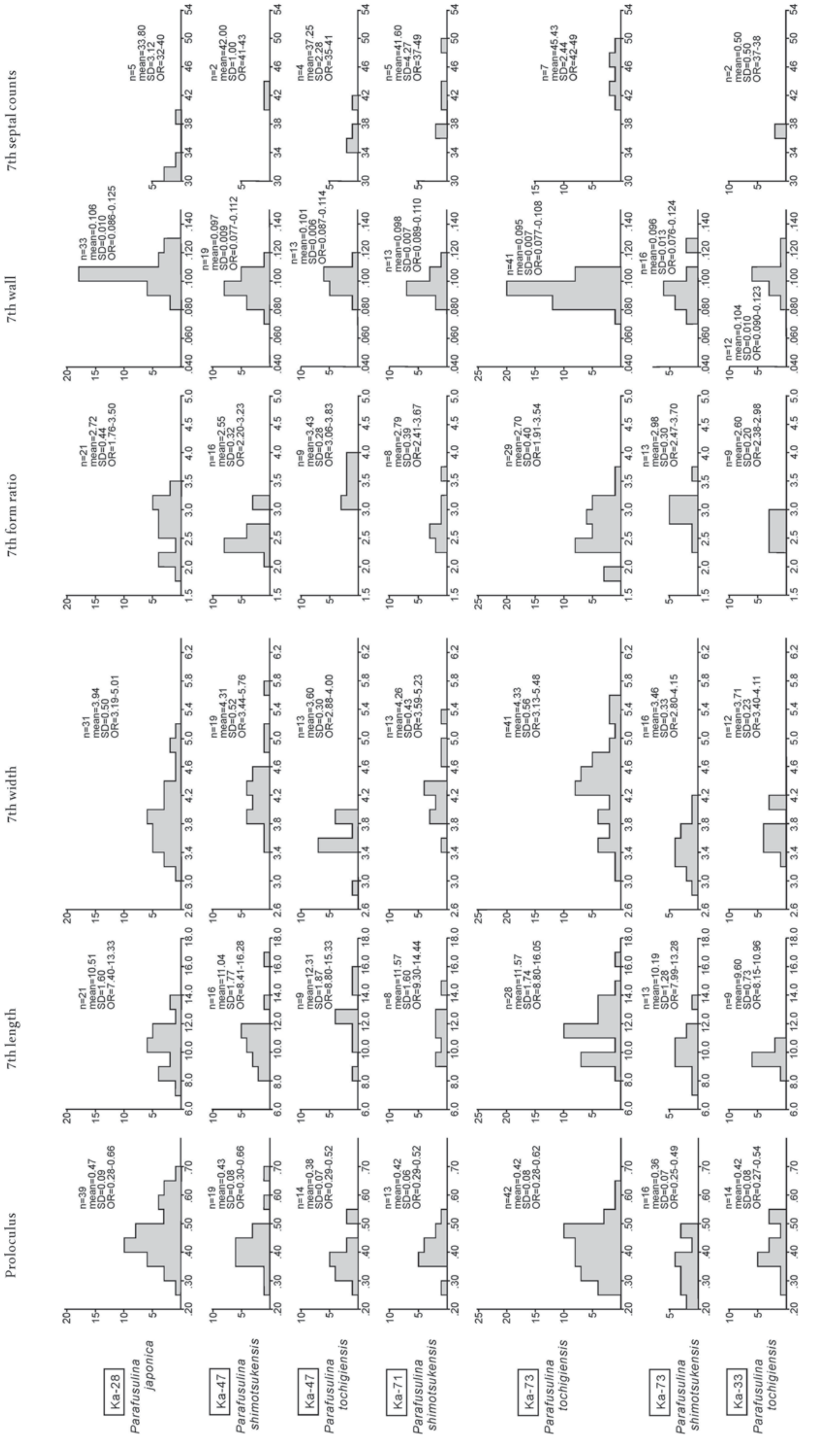

Figure34. Frequency distribution histograms and statistical values in *Parafusulina japonica*, *P. shimotsukensis*, and *P. tochigiensis* from nine samples of the upper part of the Nabeyama Formation (Part 2).

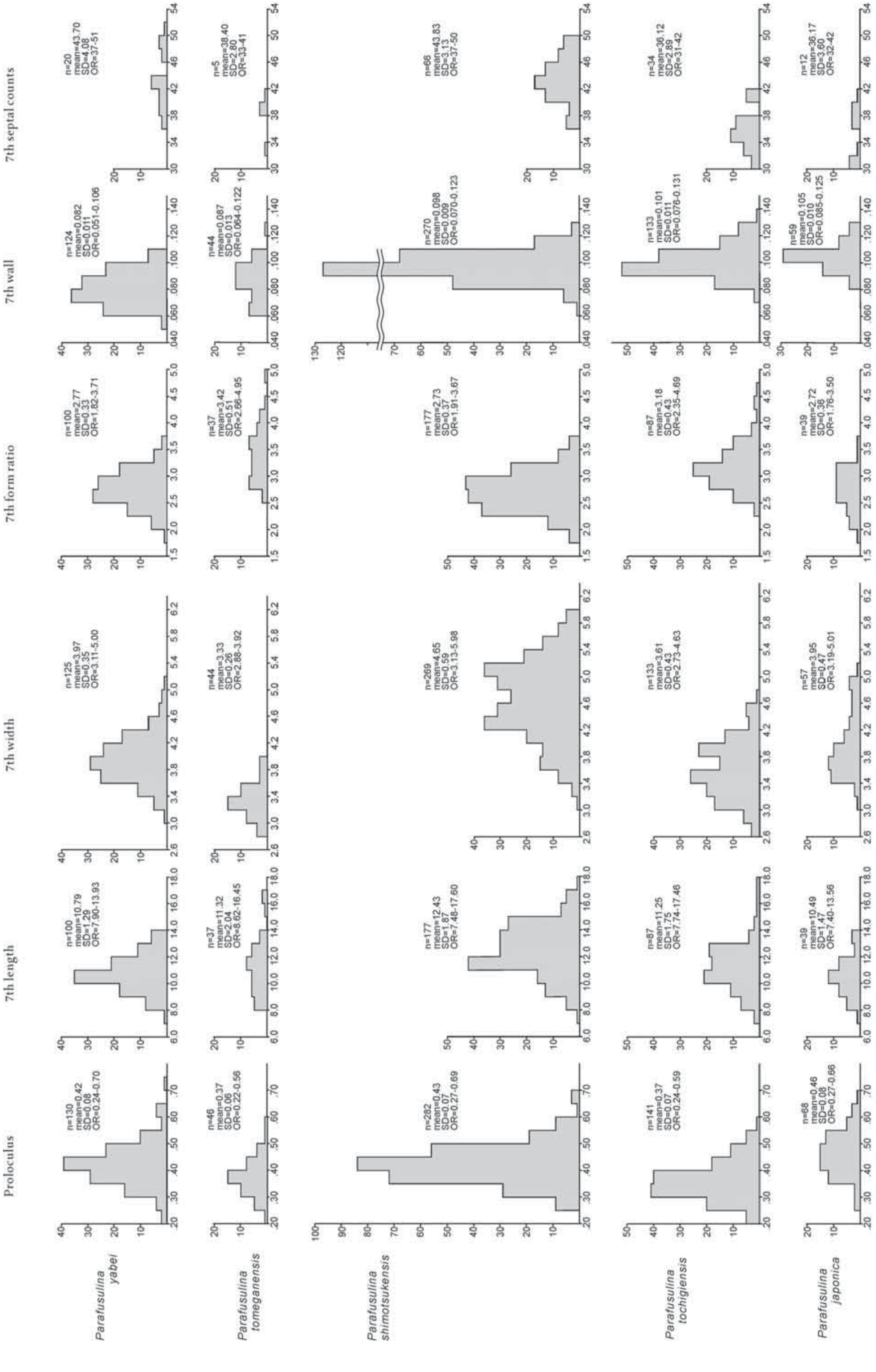

Figure35. Frequency distribution histograms and statistical values in *Parafusulina yabei*, *P. tomeganensis*, *P. shimotsukensis*, *P. tochigiensis*, and *P. japonica* in the Nabeyama Formation.

Appendix Tables 1-20 Abbreviations used in these tables are, Reg. No.: registered number of the specimen illustrated in this paper; Whorl: the number of whorl of the test; P: proloculus size in mm; 7th L: length of the seventh whorl in mm; 7th W: width of the seventh whorl in mm; 7th R: form ratio of the seventh whorl; 7th Wall: wall thickness of the seventh whorl in mm; 7th S: septal count of the seventh whorl; This paper: location of the specimen illustrated in this paper; K. ('06): location of the specimen illustrated in Kobayashi (2006a).

Tables 1 *Parafusulina yabei* Hanzawa in Ya-27

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-006368	8.5	0.42	9.47	4.19	2.26	0.090		Fig. 4-7	
D2-006369	8.5	0.38	9.99	3.86	2.59	0.078		Fig. 4-7	
D2-006373	8.6	0.49	—	4.36	—	0.086	43	Fig. 4-12	
D2-006374	8.5	0.33	11.60	3.60	3.22	0.090		Fig. 4-2	Fig. 7.20
D2-006377	8	0.31	10.43	3.74	2.79	0.086		Fig. 4-10	
D2-006378	8.3	0.44	—	3.92	—	0.089	38?	Fig. 4-5	
D2-006379	7.8	0.43	—	4.07	—	0.088	44	Fig. 4-9	
D2-006380	8.5	0.40	9.78	3.87	2.53	0.074		Fig. 4-11	
D2-006381	9	0.41	9.18	3.20	2.87	0.070		Fig. 4-6	
D2-006383	8	0.40	10.95	4.42	2.84	0.081		Fig. 4-8	
D2-006384	8.6	0.42	—	4.09	—	0.077	39	Fig. 4-4	
D2-006386	7.8	0.24	—	3.93	—	0.068	37	Fig. 4-3	

Tables 2 *Parafusulina tomeganensis* Chisaka and Fuse in Ya-27

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-006370	7.5	0.34	16.45	3.32	4.95	0.096		Fig. 4-14	Fig. 8.4
D2-006375	8	0.35	9.40	2.97	3.16	0.069		Fig. 4-13	
D2-006376	8.5	0.40	10.38	3.34	3.11	0.101		Fig. 4-15	

Tables 3 *Parafusulina yabei Hanza*wa in Ya-30

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-006402	7	0.37	13.08	4.46	2.93	0.085		Fig. 5-14	
D2-006403	7.5	0.48	10.42	4.00	2.61	0.085		Fig. 5-25	
D2-006404	7.5	0.70	11.56	4.13	2.80	0.081		Fig. 5-32	
D2-006405	7	0.46	10.49	3.63	2.89	0.099		Fig. 6-10	
D2-006406	7.5	0.41	12.40	4.13	3.00	0.088		Fig. 5-44	
D2-006407	7.5	0.39	11.83	3.77	3.14	0.070		Fig. 6-5	
D2-006408	8	0.56	10.70?	3.54	3.02?	0.073		Fig. 5-36	
D2-006411	8	0.40	10.13	3.59	2.82	0.072		Fig. 5-39	
D2-006412	7.5	0.33	13.25	4.16	3.19	0.080		Fig. 5-43	
D2-006414	7	0.52	10.45	4.27	2.45	0.093		Fig. 6-11	
D2-006415	8	0.38	10.22	3.24	3.15	0.074		Fig. 5-31	
D2-006416	7	0.33	12.60	4.00	3.15	0.077		Fig. 5-34	
D2-006417	8	0.50	11.30	3.79	2.98	0.080		Fig. 5-22	
D2-006418	8.5	0.41	10.41	3.78	2.75	0.086		Fig. 5-7	
D2-006419	7.5	0.40	11.85	3.60	3.29	0.089		Fig. 5-28	
D2-006421	9	0.48	10.28	3.57	2.82	0.086		Fig. 5-1	Fig. 7.1
D2-006422	8	0.53	11.92	3.90	3.06	0.101		Fig. 5-23	
D2-006424	8	0.44	10.04	3.83	2.62	0.097		Fig. 5-15	
D2-006428	8	0.50	11.12	3.90	2.85	0.087		Fig. 5-6	
D2-006429	8.5	0.43	11.05?	3.94	2.80?	0.058		Fig. 5-11	
D2-006430	7.5	0.30	12.05	3.50	3.44	0.086		Fig. 5-30	
D2-006433	6.5	0.39	—	—	—	—		Fig. 6-12	
D2-006434	8.5	0.31	9.08	5.00	1.82	0.070		Fig. 6-7	
D2-006436	8.5	0.45	7.90	3.11	2.54	0.064		Fig. 6-6	
D2-006437	8	0.41	10.95	3.61	3.03	0.075		Fig. 6-4	Fig. 7.13
D2-006438	7	0.53	12.48	4.25	2.94	0.078		Fig. 5-21	
D2-006439	8.5	0.42	8.48	3.81	2.23	0.051		Fig. 5-29	Fig. 7.2
D2-006440	9	0.37	8.78	3.69	2.38	0.090		Fig. 5-10	
D2-006441	8	0.42	13.75	4.38	3.14	0.098		Fig. 5-9	Fig. 7.18
D2-006442	8.5	0.30	10.42?	3.50	2.98?	0.077		Fig. 5-41	
D2-006444	7	0.60	10.67	4.32	2.47	0.091		Fig. 5-38	
D2-006445	9	0.38	9.75	3.66	2.66	0.074		Fig. 5-2	Fig. 7.10
D2-006446	8	0.47	10.55	3.89	2.71	0.079		Fig. 5-20	
D2-006447	7.5	0.45	11.92	4.13	2.89	0.064		Fig. 5-35	
D2-006448	8	0.35	10.99	3.76	2.92	0.093		Fig. 5-8	Fig. 7.4
D2-006450	8	0.47	11.21	4.30	2.61	0.069		Fig. 6-3	
D2-006452	7.5	0.33	12.58	3.92	3.21	0.072		Fig. 5-12	
D2-006454a	8.5	0.59	9.74	3.74	2.60	0.098		Fig. 6-1	Fig. 7.8
D2-006454b	8	0.44	13.21	3.90	3.39	0.093		Fig. 5-4	
D2-006457	6.5	0.49	—	—	—	—		Fig. 5-33	
D2-006461	9	0.41	10.82	4.06	2.67	0.088		Fig. 6-2	
D2-006462	7.5	0.44	11.35	3.76	3.02	0.090		Fig. 5-13	
D2-006463	7.5	0.46	11.32	3.70	3.06	0.083		Fig. 5-19	
D2-006466	7	0.60	12.92	4.50	2.87	0.072		Fig. 5-3	
D2-006467	7.5	0.61	11.40	4.26	2.68	0.072		Fig. 5-24	
D2-006468	8	0.49	9.90	4.12	2.40	0.070		Fig. 5-27	
D2-006469	7	0.41	12.18	4.16	2.93	0.094		Fig. 6-9	
D2-006472	8.5	0.37	10.90	3.37	3.23	0.102		Fig. 5-5	Fig. 7.17
D2-006489	9	0.39	—	3.67	—	0.076		Fig. 5-40	
D2-006490	9	0.32	10.75	3.47	3.10	0.092		Fig. 5-42	
D2-006492	7	0.40	10.55	4.02	2.62	0.085		Fig. 6-8	
D2-006493	8.5	0.38	10.01	3.69	2.71	0.094		Fig. 5-18	
D2-006496	8.8	0.40	—	3.84	—	0.082	40	Fig. 5-17	
D2-006497	8.6	0.39	—	3.90	—	0.074	42	Fig. 5-16	Fig. 7.16
D2-006498	7.3	0.33	—	3.30	—	0.070	40	Fig. 5-37	
D2-006502	7.3	0.49	—	4.67	—	0.094	43	Fig. 5-26	Fig. 7.6

Tables 4 *Parafusulina tomeganensis* Chisaka and Fuse in Ya-30

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-006413	7.5	0.37	9.84	3.29	2.99	0.064		Fig. 7-13	
D2-006473	7	0.37	8.62	3.21	2.69	0.070		Fig. 7-3	Fig. 8.17
D2-006474	8.5	0.33	8.95	3.00	2.98	0.081		Fig. 7-11	
D2-006476	9	0.22	8.84	3.02	2.93	0.094		Fig. 7-5	
D2-006478	8	0.31	11.31	3.31	3.42	0.071		Fig. 7-7	
D2-006479	8	0.37	16.45	3.58	4.50	0.070		Fig. 7-1	Fig. 8.2
D2-006480	8	0.44	11.15?	3.14	3.55?	0.079		Fig. 7-8	
D2-006481	7.5	—	10.42	2.96	3.52	0.101		Fig. 7-12	
D2-006482	9	0.42	9.49	2.88	3.30	0.083		Fig. 7-6	Fig. 8.9
D2-006483	7.5	0.32	11.75	3.92	3.00	0.088		Fig. 7-9	
D2-006485	8	0.38	12.35?	3.24	3.81?	0.068		Fig. 7-4	
D2-006488	8.5	0.28	9.14	3.24	2.82	0.088		Fig. 7-14	
D2-006494	8.5	0.31	13.74	3.34	4.01	0.074		Fig. 7-2	Fig. 8.6
D2-006499	8.4	0.30	—	3.13	—	0.080	33	Fig. 7-10	Fig. 8.5

Tables 5 *Parafusulina yabei* Hanzawa in Ya-32

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-006527	8	0.42	9.50	3.97	2.39	0.093		Fig. 9-47	
D2-006528	8	0.50	10.69	4.11	2.60	0.070		Fig. 9-41	
D2-006530a	9	0.46	—	4.31	—	0.089		Fig. 8-7	Fig. 7.5
D2-006530b		0.49							
D2-006531	9	0.38	10.47	3.79	2.76	0.070		Fig. 8-5	Fig. 7.11
D2-006533	7.5	0.37	10.25	4.25	2.41	0.085		Fig. 9-10	
D2-006534	8	0.49	10.76	4.31	2.50	0.067		Fig. 9-28	
D2-006535	8.5	0.40	8.57	3.84	2.23	0.078		Fig. 9-12	
D2-006536	8	0.36	9.90	3.87	2.56	0.069		Fig. 9-46	
D2-006537	8	0.43	9.05?	4.46	2.03?	0.078		Fig. 9-29	
D2-006538	8	0.37	10.99	3.36	3.27	0.095		Fig. 9-38	
D2-006539	6.5	0.64	—	—	—	—		Fig. 9-49	
D2-006540	8	0.40	10.66	3.84	2.78	0.091		Fig. 8-6	
D2-006541	7.7	0.42	—	4.51	—	0.096	43	Fig. 9-33	Fig. 7.7
D2-006542	9	0.46	8.65	3.56	2.43	0.073		Fig. 9-26	
D2-006543	7	0.36	12.72	3.93	3.24	0.078		Fig. 8-8	
D2-006544	8.5	0.39	10.33	3.59	2.88	0.104		Fig. 8-9	
D2-006545	7	0.37	11.55	4.31	2.68	0.069		Fig. 9-48	
D2-006546	8	0.44	11.65	3.84	3.03	0.100		Fig. 9-9	
D2-006547	8	0.41	10.29	3.75	2.74	0.069		Fig. 9-20	
D2-006551	7.5	0.48	10.02	3.79	2.64	0.074		Fig. 9-3	
D2-006552	7.5	0.25?	—	4.88	—	0.103	50	Fig. 9-37	
D2-006553	8	0.38	9.49	3.88	2.45	0.070		Fig. 9-7	
D2-006554	7.5	0.52	10.96	4.32	2.54	0.078		Fig. 9-21	
D2-006555	8.5	0.39	9.66	3.91	2.47	0.078		Fig. 9-42	
D2-006556	8	0.40	13.85	3.73	3.71	0.096		Fig. 8-2	Fig. 7.19
D2-006557	9	0.37	9.42	3.83	2.46	0.064		Fig. 8-10	
D2-006559	8.7	0.45	—	4.08	—	0.082	43	Fig. 9-36	
D2-006560	7.1	0.51	—	4.19	—	0.064	42?	Fig. 9-27	Fig. 7.3
D2-006561	8.2	0.45	—	4.11	—	0.066	—	Fig. 8-12	
D2-006562	8.2	0.43	—	4.66	—	0.075	47	Fig. 9-35	
D2-006566	8	0.37	8.54	3.93	2.17	0.078		Fig. 9-8	
D2-006572	8.5	0.49	11.35	4.78	2.37	0.092		Fig. 9-2	Fig. 7.9
D2-006573	8.5	0.34	9.68	3.53	2.74	0.078		Fig. 9-39	
D2-006574	7.5	0.47	11.03	3.95	2.79	0.081		Fig. 9-45	
D2-006599	8.5	0.41	10.94	4.08	2.68	0.102		Fig. 9-16	
D2-006601	8	0.30	13.93	4.20	3.32	0.080		Fig. 8-4	
D2-006614	7.8	0.47	—	4.44	—	0.078	49?	Fig. 9-34	
D2-006616	7	0.34	12.95	4.95	2.62	0.065		Fig. 9-6	
D2-006617	8.2	0.25?	—	4.48	—	0.070	51	Fig. 9-30	
D2-006621	8.6	0.41	—	4.34	—	0.089	48	Fig. 9-31	
D2-006622	9	0.31	—	4.10	—	0.066	—	Fig. 9-24	
D2-006623a	8.7	0.28	—	4.12	—	0.082	50	Fig. 9-32	Fig. 7.15
D2-006623b	8.3	0.27	—	4.34	—	0.077	44	Fig. 9-25	
D2-006624	8	0.52	8.82	3.98	2.22	0.088		Fig. 9-44	
D2-006626	9	0.44	8.88	3.96	2.24	0.088		Fig. 9-17	
D2-006629	8.5	0.37	12.95	3.68	3.52	0.077		Fig. 8-1	
D2-006630	9	0.38	8.60	3.55	2.42	0.069		Fig. 9-15	
D2-006633	8	0.50	—	3.78	—	0.106		Fig. 9-43	
D2-006635	8.5	0.47	9.84	4.12	2.39	0.096		Fig. 9-13	
D2-006637	8.5	0.36	11.07	3.95	2.80	0.071		Fig. 9-1	
D2-006639	7	0.38	10.50?	3.55?	2.96?	—		Fig. 8-3	
D2-006641	7	0.35	12.05	4.32	2.79	0.099		Fig. 9-5	
D2-006642	8	0.43	10.70?	4.18	2.56?	0.067		Fig. 9-14	
D2-006643	8	0.41	11.91	4.27	2.79	0.090		Fig. 9-11	
D2-006644	8.5	0.40	9.97	3.88	2.57	0.075		Fig. 9-19	
D2-006650	8.5	0.32	11.61	3.66	3.17	0.082		Fig. 9-18	
D2-006651	8	0.39	11.10	4.19	2.65	0.095		Fig. 8-11	
D2-006654	8	0.41	10.55	3.86	2.73	0.101		Fig. 9-23	
D2-006658	8.8	0.24?	—	4.19	—	0.076	41	Fig. 9-40	
D2-006659	6	0.41	—	—	—	—		Fig. 9-4	
D2-006660	9	0.34	9.93	3.67	2.71	0.096		Fig. 9-22	

Tables 6 *Parafusulina tomeganensis* Chisaka and Fuse in Ya-32

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-006529	6	0.47	—	—	—	—		Fig. 10-25	
D2-006545	8	0.40	11.10	2.91	3.81	0.092		Fig. 10-16	Fig. 8.18
D2-006548	7.7	0.37	—	3.41	—	0.102	39	Fig. 10-10	Fig. 8.12
D2-006549	7.5	0.38	8.96	3.37	2.66	0.098		Fig. 10-23	
D2-006550	8	0.33	12.57	3.31	3.80	0.105		Fig. 10-27	Fig. 8.10
D2-006563	8	0.43	10.17	3.56	2.86	0.087		Fig. 10-19	
D2-006567a	7.5	0.46	12.85?	3.37	3.81?	0.097		Fig. 10-21	
D2-006567b	8	0.37	11.25?	3.27	3.44?	0.081		Fig. 10-15	
D2-006568	9	0.40	13.65	3.29	4.15	0.071		Fig. 10-1	Fig. 8.1
D2-006569	8	0.39	12.95	3.57	3.63	0.094		Fig. 10-9	
D2-006570	8.5	0.36	12.16	3.45	3.52	0.094		Fig. 10-5	Fig. 8.11
D2-006571	9	0.31	10.05	2.94	3.42	0.086		Fig. 10-13	Fig. 8.15
D2-006575	7	0.40	—	—	—	—		Fig. 10-20	
D2-006576	8.5	0.37	11.38	3.20	3.56	0.084		Fig. 10-6	
D2-006578	8	0.29	10.63	3.09	3.44	0.072		Fig. 10-26	
D2-006581	8	0.38	11.78	3.26	3.61	0.095		Fig. 10-4	Fig. 8.8
D2-006583	8	0.37	15.70?	3.81	4.12?	0.105		Fig. 10-2	
D2-006584	7.5	0.43	12.66	3.84	3.30	0.110		Fig. 10-8	
D2-006586	7	0.39	13.05	3.55	3.68	0.070?		Fig. 10-12	
D2-006587	8.5	0.36	8.80	3.15	2.79	0.095		Fig. 10-28	
D2-006589	8	0.32	9.46	3.08	3.07	0.081		Fig. 10-29	
D2-006591	8	0.56	9.67	3.49	2.77	0.086		Fig. 10-18	
D2-006592	8.5	0.34	—	3.75	—	0.069	40	Fig. 10-3	
D2-006593	8.8	0.51	—	3.69	—	0.083	39?	Fig. 10-14	
D2-006594	7.6	0.45	—	3.52	—	0.086	41	Fig. 10-30	Fig. 8.3
D2-006600	6.5	0.28	—	—	—	—		Fig. 10-17	
D2-006646	8	0.29	—	3.45	—	0.098		Fig. 10-7	
D2-006648	8.5	0.45	—	3.44	—	0.093		Fig. 10-22	
D2-006652	7.5	0.32	10.10	3.15?	3.21?	0.095		Fig. 10-11	
D2-006657	8.5	0.28	11.56	3.67	3.15	0.122		Fig. 10-24	

Tables 7 *Parafusulina japonica* (Gumbel) in Ka-2

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-006763	7.9	0.40	—	4.51	—	0.099	40	Fig. 11-10	Fig. 12.25
D2-006764	7.9	0.38	—	4.48	—	0.098	42	Fig. 11-6	
D2-006765	8.5	0.40	10.19	3.86	2.64	0.110		Fig. 11-1	Fig. 12.1
D2-006767	8.5	0.48	12.90?	4.24	3.04?	0.112		Fig. 11-2	Fig. 12.10
D2-006768	7	0.53	13.56	4.35	3.12	0.104		Fig. 11-3	
D2-006769	7.4	0.41	—	3.56	—	0.109	37?	Fig. 11-15	
D2-006771	7	0.51	10.60	3.93	2.70	0.100		Fig. 11-7	
D2-006772	7.5	0.46	11.54	4.96	2.33	0.106		Fig. 11-14	
D2-006774	7.6	0.39	—	4.64	—	0.116	32	Fig. 11-11	
D2-006776	8	0.47	10.19	3.90	2.61	0.097		Fig. 11-13	
D2-006777	7.5	0.51	11.55	3.75?	3.08?	0.102		Fig. 11-8	
D2-006778	7.3	0.48	—	4.85	—	0.120	39	Fig. 11-9	
D2-006779	6.5	0.56	—	—	—	—		Fig. 11-12	
D2-006780	7.5	0.50	11.45	3.77?	3.04?	0.097		Fig. 11-4	
D2-006781	8.5	0.45	10.11	3.50	2.89	0.085		Fig. 11-5	

Tables 8 *Prafusulina shimotsukensis* Kobayashi in Ka-86

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-008278	8.5	0.42	11.45?	4.70	2.44?	0.119		Fig. 13-13	
D2-008279	8.5	0.42	—	4.30?	—	0.092		Fig. 12-10	
D2-008282	8.5	0.27	—	—	—	—		Fig. 13-2	
D2-008283	9	0.42	11.07?	3.69	3.00?	0.080		Fig. 13-10	
D2-008284	7.5	0.43	10.25	4.84	2.12	0.099		Fig. 12-19	
D2-008286	9.5	0.43	11.28	4.13	2.73	0.103		Fig. 12-21	
D2-008290	8.5	0.44	11.05?	4.60	2.40	0.095		Fig. 12-23	
D2-008292	8.5?	0.52	—	—	—	—		Fig. 12-14	
D2-008293	9	0.45	11.50	3.27	3.52	0.070		Fig. 12-2	
D2-008294	8	0.46	14.47	4.57	3.17	0.109		Fig. 12-7	
D2-008295	8.6	0.38	—	4.41	—	0.106	45?	Fig. 12-3	
D2-008296	8.4	0.42	—	4.21	—	0.088	40	Fig. 13-21	
D2-008297	8.8	0.42	—	4.49	—	0.089	40?	Fig. 13-22	
D2-008299	9.5	0.39	10.40	4.29	2.42	0.109		Fig. 12-27	
D2-008301	8	0.46	—	—	—	—		Fig. 13-7	
D2-008304	8.5	0.40	14.20?	4.42	3.21?	0.113		Fig. 12-9	
D2-008306	8.5	0.48	—	3.60	—	0.079		Fig. 12-5	
D2-008307	9.5	0.49	11.02	4.95	2.23	0.096		Fig. 12-11	
D2-008308	7.7	0.40	—	5.06	—	0.100	46	Fig. 13-15	
D2-008309	9	0.51	—	5.06	—	0.090		Fig. 12-4	
D2-008311	7.5	0.46	—	4.31	—	0.122		Fig. 13-14	
D2-008313	8.5	0.32	11.76	4.13	2.85	0.088		Fig. 13-12	
D2-008317	9	0.33	10.55?	3.72	2.84?	0.095		Fig. 13-8	
D2-008318	8.5	0.59	14.20?	4.77	2.98	0.100		Fig. 12-12	
D2-008320	8.5	0.44	—	—	—	—		Fig. 12-15	
D2-008322	8.5	0.38	—	4.41	—	0.101		Fig. 12-20	
D2-008323	9.6	0.37	—	3.49	—	0.095	38	Fig. 13-20	
D2-008326	8	0.45	11.60	5.01	2.32	0.112		Fig. 12-25	
D2-008327	9.5	0.36	—	3.24	—	0.096		Fig. 13-5	
D2-008329	9	0.30	7.48	3.84	1.95	0.088		Fig. 12-16	
D2-008330	8.5	0.40	9.60	4.66	2.06	0.090		Fig. 12-22	
D2-008331	9	0.33	10.29	3.70	2.78	0.099		Fig. 12-18	
D2-008332	8.6	0.41	—	3.73	—	0.091	43	Fig. 13-17	
D2-008333	10.2	0.35	—	4.13	—	0.089	45	Fig. 13-23	
D2-008334	8.5	0.47	11.80	4.16	2.84	0.104		Fig. 12-26	
D2-008335	8.5	0.48	10.77	4.25	2.53	0.123		Fig. 12-24	
D2-008336	8.3	0.39	—	4.51	—	0.098	47	Fig. 13-16	
D2-008337	7.5	0.49	11.10?	4.19	2.65?	0.085		Fig. 12-13	
D2-008338	7	0.54	15.75?	4.80	3.28?	0.102		Fig. 13-1	
D2-008339	9.5	0.60	8.20?	3.89	2.11?	0.078		Fig. 13-18	
D2-008340	9	0.40	10.69	3.67	2.91	0.096		Fig. 13-9	
D2-008341	8.5	0.44	8.39	4.10	2.05	0.099		Fig. 12-6	
D2-008342	8.5	0.44	12.35?	4.83	2.56?	0.105		Fig. 13-3	
D2-008344	8.6	0.43	—	4.30	—	0.077	41	Fig. 13-19	Fig. 10.2
D2-008348	8.5	0.38	10.46	3.68	2.84	0.091		Fig. 12-28	
D2-008349	9	0.37	12.14	3.79	3.20	0.096		Fig. 13-6	
D2-008350	9	0.39	11.75	3.73	3.15	0.094		Fig. 12-8	
D2-008351	8.5	0.46	12.02	3.77	3.19	0.099		Fig. 13-4	
D2-008352	9	0.50	11.56	4.33	2.67	0.100		Fig. 12-17	
D2-008353	8.5	0.44	15.09	4.28	3.53	0.098		Fig. 12-1	Fig. 10.1
D2-008354	8.5	0.43	11.70?	3.66	3.20?	0.094		Fig. 13-11	

Tables 9 *Parafusulina tochigiensis* Kobayashi in Ka-86

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-008288	8	0.30	12.25?	3.59	3.41	0.081		Fig. 13-26	
D2-008312	8.1	0.42	—	3.89	—	0.105	37	Fig. 13-31	
D2-008324	7.3	0.46	—	4.56	—	0.097	41	Fig. 13-29	
D2-008343	8	0.44	11.50	3.64	3.16	0.110		Fig. 13-25	
D2-008344	8	0.33	9.45?	2.73	3.46	0.097		Fig. 13-27	
D2-008345	7.8	0.46	—	4.53	—	0.097	35	Fig. 13-30	
D2-008346	8.5	0.37	—	3.21	—	0.094	33	Fig. 13-28	
D2-008347	8	0.45	11.92	3.35	3.56	0.098		Fig. 13-24	

Tables 10 *Parafusulina shimotsukensis* Kobayashi in Ka-57

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-007573	9	0.41	11.65?	4.71	2.47?	0.093		Fig. 14-12	
D2-007574	9	0.31	10.25	4.89	2.10	0.117		Fig. 14-8	
D2-007575	8	0.47	11.06	5.40	2.05	0.107		Fig. 14-15	
D2-007577	7.5	0.47	14.45	5.83	2.48	0.106		Fig. 14-6	Fig. 10.9
D2-007578	7	0.49	17.60?	5.06	3.48?	0.085		Fig. 14-13	
D2-007581	7.5	0.53	12.30?	4.22	2.91?	0.084		Fig. 14-16	
D2-007582	7.8	0.42	—	5.61	—	0.104	46	Fig. 14-3	
D2-007584	7.5	0.45	14.81	4.35	3.40	0.099		Fig. 14-2	
D2-007588	9	0.50	14.28	5.13	2.78	0.101		Fig. 14-9	
D2-007591	8.5	0.39	12.77	5.54	2.31	0.106		Fig. 14-7	
D2-007592	8.5	0.48	13.39	5.60	2.39	0.102		Fig. 14-1	
D2-007594	8.2	0.41	—	4.92	—	0.101	38	Fig. 14-10	
D2-007598	7	0.69	16.15?	5.90?	2.74?	—		Fig. 14-14	
D2-007606	8.3	0.40	—	4.41	—	0.090	44	Fig. 14-5	
D2-007609	7.6	0.42	—	4.75?	—	0.095	47	Fig. 14-4	
D2-007618	8.8	0.32	—	5.05?	—	0.098	42	Fig. 14-11	

Tables 11 *Parafusulina tochigiensis* Kobayashi in Ka-57

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-007576	8	0.55	11.90?	3.95	3.01?	0.114		Fig. 15-2	
D2-007579	9.4	0.29	—	3.31	—	0.096	36	Fig. 15-11	
D2-007580	9.5	0.33	—	3.74	—	0.110	38	Fig. 15-16	
D2-007583	8.5	0.28	10.09	3.94	2.56	0.112		Fig. 15-8	
D2-007585	9.5	0.33	8.50?	3.09	2.75?	0.097		Fig. 15-10	
D2-007586	8	0.32	11.13	3.84	2.90	0.108		Fig. 15-5	
D2-007590	8.2	0.30	—	3.72	—	0.096	32	Fig. 15-17	
D2-007597	8	0.46	—	4.57	—	0.124		Fig. 15-1	
D2-007602	7	0.42	9.85	4.20	2.35	0.110		Fig. 15-14	
D2-007603	9.3	0.40	—	3.26	—	0.105	33	Fig. 15-15	
D2-007604	7.5	0.59	11.10?	4.20	2.64?	0.105		Fig. 15-4	
D2-007607	8.5	0.40	11.30?	4.30	2.63	0.102		Fig. 15-3	
D2-007608	8	0.35	11.15?	3.73	2.99?	0.131		Fig. 15-12	
D2-007608	8	0.51	9.55?	3.60	2.65?	0.112		Fig. 15-13	
D2-007608	6.7	0.41	—	—	—	—	—	Fig. 15-7	
D2-007608	8.5	0.25	10.20	3.81	2.68	0.111		Fig. 15-6	
D2-007608	8	0.39	9.80	3.21	3.05	0.087		Fig. 15-9	

Tables 12 *Parafusulina shimotsukensis* Kobayashi in Ka-70

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-007635	8	0.31	11.78	3.73	3.16	0.096		Fig.. 18-25	
D2-007636	8	0.38	12.85	5.40	2.38	0.103		Fig.. 18-18	
D2-007638	8.5	0.41	11.45	5.21	2.20	0.090		Fig.. 16-21	
D2-007639	8	0.44	13.45	5.62	2.39	0.096		Fig.. 18-19	
D2-007642	8.4	0.40	—	5.16	—	0.091	46	Fig.. 20-4	
D2-007643	8.3	0.37	—	5.16	—	0.093	46	Fig.. 20-8	
D2-007644	9	0.35	—	4.12	—	0.091		Fig.. 17-12	
D2-007646	6.7	0.38	—	—	—	—		Fig.. 20-35	
D2-007649	8.5	0.50	—	5.11	—	0.097		Fig.. 18-4	
D2-007651	8.6	0.47	—	4.24	—	0.096	43	Fig.. 20-38	
D2-007653	8	0.44	13.80?	5.42?	2.55	0.120		Fig.. 17-2	
D2-007655	8.4	0.43	—	—	—	0.096	42	Fig.. 20-19	
D2-007656	8.5	0.36	11.54	3.88	2.97	0.098		Fig.. 18-24	
D2-007658	8.5	0.35	—	4.98	—	0.093	41	Fig.. 20-11	
D2-007663	8	0.40	13.25	5.28	2.51	0.103		Fig.. 17-18	
D2-007664	7.8	0.46	—	5.47	—	0.101	49	Fig.. 20-12	
D2-007666	7.5	0.60	—	5.46	—	0.095	50?	Fig.. 20-39	
D2-007668	9	0.47	—	4.50	—	0.102		Fig.. 16-3	
D2-007671	7.5	0.43	—	—	—	0.110		Fig.. 19-14	
D2-007672	8	0.31	—	4.90	—	0.120		Fig.. 17-9	
D2-007678	8	0.50	11.77	4.55	2.59	0.086		Fig.. 17-6	
D2-007682	8	0.60	—	—	—	—		Fig.. 18-29	
D2-007684	8	0.44	12.40	4.59	2.70	0.103		Fig.. 18-27	
D2-007689	8.7	0.36	—	4.46	—	0.090	—	Fig.. 20-41	
D2-007692	8.5	0.40	14.45	4.23	3.42	0.094		Fig.. 18-11	
D2-007695	8	0.54	14.51	4.96	2.93	0.098		Fig.. 18-6	
D2-007696	8.3	0.42	—	5.28	—	0.109	44	Fig.. 20-16	
D2-007699	8.3	0.37	—	4.91	—	0.100	43	Fig.. 20-10	
D2-007700	8.9	0.39	—	5.03	—	0.093	43	Fig.. 20-1	
D2-007701	8.5	0.45	12.33	4.96	2.49	0.104		Fig.. 17-19	
D2-007702	8.5	0.49	—	5.10	—	0.089	37	Fig.. 20-3	
D2-007703	8	0.60	14.60?	5.37?	2.72?	0.100		Fig.. 18-10	
D2-007705	8.3	0.47	—	4.80	—	0.097	44	Fig.. 20-5	
D2-007706	8	0.34	13.75?	5.20	2.64?	0.110		Fig.. 17-25	
D2-007711	8	0.44	14.66	5.14	2.85	0.103		Fig..16-13	
D2-007715	8	0.40	13.27?	5.29	2.51?	0.102		Fig.. 17-20	
D2-007718	8.5	0.44	13.02	4.63	2.81	0.098		Fig.. 17-27	
D2-007719	8	0.42	—	4.84	—	0.120	40	Fig.. 20-14	
D2-007720	8.5	0.39	15.06	5.36	2.81	0.116		Fig.. 16-11	
D2-007722	7.5	0.48	—	5.06	—	0.100		Fig.. 19-3	
D2-007728	8.5	0.33	—	4.86	—	0.100	42	Fig.. 20-40	
D2-007732	8	0.51	13.16	5.04	2.61	0.122		Fig.. 16-23	
D2-007734	7.5	0.36	13.90?	4.85	2.87	0.105		Fig.. 18-26	
D2-007735	8	0.33	—	5.98	—	0.101		Fig.. 16-15	
D2-007737	8.5	0.32	12.85	4.86	2.64	0.100		Fig.. 18-9	
D2-007738	8	0.57	13.93	4.64	3.00	0.098		Fig.. 19-11	
D2-007739	8	0.40	12.44	4.57	2.72	0.098		Fig.. 19-6	
D2-007740	8.5	0.43	12.04	5.13	2.35	0.100		Fig.. 18-14	
D2-007741	8	0.44	12.72	5.40	2.36	0.110		Fig.. 16-20	
D2-007742	7.5	0.40	14.14	4.69	3.01	0.105		Fig.. 18-22	
D2-007743	7.5	0.41	14.50	4.71	3.08	0.091		Fig.. 19-2	
D2-007744	7.5	0.28	13.14?	4.76	2.76?	0.100		Fig.. 19-17	
D2-007745	8	0.42	12.44	4.54	2.74	0.112		Fig.. 16-26	
D2-007746	7.5	0.49	12.74	4.57	2.79	0.095		Fig.. 19-5	Fig. 9.7
D2-007747	8	0.47	—	4.79	—	0.106		Fig.. 19-12	
D2-007748	7.5	0.48	—	5.11	—	0.106		Fig.. 18-15	
D2-007749	8.5	0.41	11.83	4.62	2.56	0.096		Fig.. 17-23	
D2-007750a	8.1	—	—	5.29	—	0.091	41	Fig.. 20-13	
D2-007750b	9	0.42	10.45	4.14	2.52	0.094		Fig.. 19-10	
D2-007752	7.5	0.40	12.31	5.80	2.12	0.109		Fig.. 16-18	
D2-007753	8	0.45	—	5.04	—	0.105		Fig.. 17-3	
D2-007754	8.5	0.43	12.09	4.85	2.49	0.105		Fig.. 18-3	
D2-007755	8	0.41	13.50	5.25	2.57	0.098		Fig.. 17-16	
D2-007756	8	0.33	13.29	4.60?	2.89?	0.086		Fig.. 19-7	
D2-007759	6.5	0.46	—	—	—	—		Fig.. 16-12	
D2-007760	8	0.42	14.40	5.05	2.85	0.100		Fig.. 18-23	
D2-007761	9	0.54	12.21	5.16	2.37	0.102		Fig. 16-2	Fig. 10.10
D2-007762	8.5	0.40	14.20	5.28	2.69	0.112		Fig.. 16-19	
D2-007763	9	0.49	14.55?	4.15	3.51	0.087		Fig.. 16-8	
D2-007764	8.5	0.38	14.15	4.80	2.95	0.100		Fig.. 17-21	
D2-007765	8.5	0.39	14.10	4.68	3.01	0.118		Fig.. 18-8	
D2-007766	8	0.38	14.38	4.83	2.98	0.106		Fig.. 16-25	
D2-007767	7.5	0.48	14.46	5.41	2.67	0.099		Fig.. 16-5	
D2-007768	8	0.42	15.52	5.33	2.91	0.110		Fig..16-14	
D2-007769	9.5	0.39	11.54	4.17	2.77	0.088		Fig.. 17-10	
D2-007770	8	0.47	13.40	5.29	2.53	0.109		Fig.. 17-22	
D2-007771	8.5	0.43	13.60?	4.84	2.81?	0.099		Fig.. 17-11	
D2-007772	8.5	0.44	12.69	4.39	2.89	0.103		Fig.. 18-16	
D2-007773	7.6	0.45	—	5.66	—	0.090	49	Fig.. 20-27	
D2-007774	9	0.46	13.36	4.91	2.72	0.102		Fig. 16-1	Fig. 9.4
D2-007775	8.5	0.42	14.58	4.37	3.34	0.085		Fig.. 17-4	Fig. 9.6
D2-007776	8	0.35	13.77	5.09	2.71	0.112		Fig.. 16-22	
D2-007777	8	0.57	15.07	5.06	2.98	0.094		Fig.. 17-5	Fig. 10.4
D2-007778	8	0.54	14.77	4.90	3.01	0.102		Fig.. 17-14	
D2-007779	7.5	0.45	15.48	4.69	3.30	0.099		Fig.. 18-1	
D2-007781	8.5	0.52	13.50?	4.39	3.08	0.098		Fig.. 17-1	
D2-007782	8.5	0.45	14.05	4.60	3.05	0.097		Fig.. 16-10	
D2-007783	8	0.48	14.90	4.58	3.25	0.098		Fig.. 18-2	
D2-007784	8.5	0.41	12.69	4.50	2.82	0.096		Fig.. 17-24	
D2-007785	8.6	0.43	—	5.08	—	0.106	44	Fig.. 20-30	
D2-007786	8.3	0.43	—	5.17	—	0.100	46	Fig.. 20-34	
D2-007787	8.8	0.40	—	4.83	—	0.090	43	Fig.. 20-32	Fig. 10.12
D2-007788	8.3	0.43	—	5.08	—	0.099	43	Fig.. 20-23	
D2-007789	8.2	0.49	—	5.47	—	0.092	44	Fig.. 20-22	Fig. 9.2
D2-007790	9.3	0.46	—	4.48	—	0.098	42	Fig.. 20-9	
D2-007791	8.8	0.49	—	5.10	—	0.095	47	Fig.. 20-6	
D2-007792	7.2	0.43	—	5.44	—	0.107	45	Fig.. 20-28	
D2-007793	7.3	0.50	—	5.79	—	0.093	47	Fig.. 20-21	
D2-007794	7.9	0.55	—	5.60	—	0.095	44	Fig.. 20-20	
D2-007795	9	0.44	—	4.87	—	0.109	40	Fig.. 20-36	
D2-007796	8.6	0.33	—	5.52	—	0.099	42	Fig.. 20-33	Fig. 9.8
D2-007797	7.6	0.39	—	5.88	—	0.106	48	Fig.. 20-25	
D2-007798	7.6	0.47	—	5.82	—	0.094	47	Fig.. 20-26	
D2-007799	6.6	0.37	—	—	—	—		Fig.. 20-7	
D2-007800	7.6	0.45	—	5.70	—	0.100	46	Fig.. 20-29	
D2-007801	8	0.42	12.57	5.16	2.44	0.112		Fig.. 16-24	
D2-007803	8	0.36	—	5.48	—	0.103	41	Fig.. 20-31	
D2-007804	9	0.39	10.18	3.70	2.75	0.090		Fig.. 19-1	
D2-007805	8	0.42	13.20	5.01	2.63	0.110		Fig.. 18-5	
D2-007806	8	0.44	13.10	4.36	3.00	0.087		Fig.. 18-7	
D2-007809	8.8	0.39	—	4.33	—	0.088	49	Fig.. 20-37	Fig. 10.11
D2-007812	7.5	0.52	11.70	5.63	2.08	0.089		Fig.. 16-9	
D2-007813	8.5	0.43	13.61	4.30	3.17	0.113		Fig.. 18-17	
D2-007814	7.5	0.34?	11.39	5.10	2.23	0.090		Fig.. 17-15	
D2-007815	8.2	0.40	—	5.16	—	0.094	46	Fig.. 20-24	
D2-007817	10	0.40	13.35	4.73	2.82	0.104		Fig.. 16-4	Fig. 9.1
D2-007818	8.5	0.37	13.10	4.36	3.00	0.098		Fig.. 16-7	
D2-007819	7.5	0.50	16.98	5.00	3.40	0.099		Fig.. 17-7	Fig. 9.5
D2-007820	8	0.40	13.47	4.72	2.85	0.092		Fig.. 17-13	
D2-007821	7	0.38	16.30	5.02	3.25	0.094		Fig.. 18-20	
D2-007822	8	0.46	12.80	4.34	2.95	0.087		Fig.. 18-21	
D2-007852	7.4	0.36	—	5.18	—	0.096	43	Fig.. 20-15	
D2-007868	7.5	0.38	—	4.71	—	0.101		Fig.. 19-8	
D2-007870	6	0.53	—	—	—	—		Fig.. 17-26	
D2-007871	8	0.39	12.70	5.11	2.49	0.111		Fig.. 17-17	
D2-007878	7.5	0.54	11.20	4.07	2.75	0.090		Fig.. 19-16	
D2-007880	8.8	0.45	—	4.92	—	0.090	46	Fig.. 20-18	
D2-007886	8.8	0.49	—	5.06	—	0.095	46	Fig.. 20-17	
D2-007887	8.5	0.43	—	4.89	—	0.094	42	Fig.. 20-2	
D2-007889	9	0.41	12.72?	4.02?	3.16?	0.086		Fig.. 18-13	
D2-007890	7	0.36	15.00	5.38	2.79	0.098		Fig.. 19-4	
D2-007891	8.5	0.39	—	4.90	—	0.100		Fig.. 19-9	
D2-007893	8	0.31	11.53	4.19	2.75	0.093		Fig.. 18-12	
D2-007894	7.5	0.53	—	4.96	—	0.094		Fig.. 19-18	
D2-007896	8	0.45	14.25	5.50	2.59	0.101		Fig.. 16-16	
D2-007898	8.5	0.34	—	—	—	—		Fig.. 18-28	
D2-007901	8	0.47	15.55	5.30	2.93	0.110		Fig.. 17-8	
D2-007906	8	0.67	13.00	5.27	2.47	0.100		Fig.. 16-17	
D2-007910	7.5	0.38	—	4.84	—	0.094		Fig.. 19-15	
D2-007911	8	0.54	13.05?	5.23	2.50	0.098		Fig.. 16-6	
D2-007912	7.5	0.33	—	4.45?	—	0.099		Fig.. 19-13	

Tables 13 *Parafusulina tochigiensis* Kobayashi in Ka-70

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-007637	7	0.36	11.36	4.04	2.81	0.108		Fig. 22-6	
D2-007641	8	0.26	11.13	3.99	2.79	0.116		Fig. 22-17	
D2-007654	8	0.40	12.35	3.31	3.73	0.108		Fig. 21-17	
D2-007657	8.9	0.37	―	3.79	―	0.090	41	Fig. 22-24	
D2-007660	8.5	0.40	―	4.53	―	0.124	38	Fig. 22-33	Fig. 11.20
D2-007661	6.5	0.37	―	―	―	―		Fig. 22-15	
D2-007662	9	0.33	8.23	3.12	2.64	0.090		Fig. 21-29	
D2-007665	6.5	0.27	―	―	―	―		Fig. 22-18	
D2-007670	9.5	0.30	―	3.22	―	0.103		Fig. 22-12	
D2-007675	7	0.30	12.35	3.97	3.11	0.092		Fig. 21-40	
D2-007677	9	0.39	7.74	2.96	2.61	0.101		Fig. 21-9	
D2-007683	7	0.30	11.35	4.22	2.69	0.098		Fig. 22-26	
D2-007685	7.5	0.44	12.10	4.26	2.84	0.121		Fig. 22-23	
D2-007686	8	0.39	12.84	4.11	3.12	0.130		Fig. 21-14	
D2-007687	8.5	0.28	10.50	3.20	3.28	0.095		Fig. 22-2	
D2-007688	7	0.24	12.86	3.74	3.44	0.097		Fig. 21-32	
D2-007709	7.5	0.38	14.35?	4.01	3.58	0.106		Fig. 21-20	
D2-007710	7.5	0.32	10.46?	2.98	3.51?	0.100		Fig. 22-25	
D2-007713	10	0.38	―	3.51	―	0.098	35	Fig. 22-4	
D2-007716	8.5	0.34	―	3.33	―	0.120		Fig. 21-22	
D2-007717	7.5	0.36	13.60	3.40	4.00	0.102		Fig. 21-31	
D2-007721	7.6	0.30	―	4.14	―	0.109	36	Fig. 22-32	
D2-007723	7	0.35	11.95?	3.71	3.22?	0.092		Fig. 21-27	
D2-007725	8.8	0.35	―	3.20	―	0.096	33	Fig. 22-34	
D2-007726	8	0.38	―	3.17	―	0.090		Fig. 22-14	
D2-007730	7.5	0.41	―	4.26	―	0.102		Fig. 21-21	
D2-007735	8.5	0.31	9.98?	3.10	3.22	0.118		Fig. 21-19	
D2-007802	8.5	0.35	―	3.60	―	0.108	32	Fig. 22-46	
D2-007807	8	0.31	12.96	4.16	3.12	0.115		Fig. 21-34	
D2-007808	7	0.46	―	4.45	―	0.095	33	Fig. 22-35	
D2-007810	9	0.33	8.81	3.14	2.81	0.090		Fig. 21-10	
D2-007816	7.5	0.39	11.57	3.51	3.30	0.124		Fig. 22-9	
D2-007820	8	0.32	10.94	3.33	3.29	0.088		Fig. 22-20	
D2-007823	7.5	0.40	12.86	3.47	3.71	0.103		Fig. 21-36	
D2-007824	8	0.52	13.46	4.17	3.23	0.113		Fig. 21-8	Fig. 11.16
D2-007825	8.5	0.43	12.90	3.85	3.35	0.105		Fig. 21-38	
D2-007826	9.5	0.39	8.96	3.05	2.94	0.092		Fig. 22-5	
D2-007827	9.5	0.26	10.24	3.48	2.94	0.109		Fig. 21-11	Fig. 11.13
D2-007828	8.5	0.38	12.28	3.49	3.52	0.102		Fig. 21-18	Fig. 11.10
D2-007829	7.5	0.41	10.65	3.84	2.77	0.099		Fig. 22-13	
D2-007830	8	0.42	11.30	3.54	3.19	0.120		Fig. 22-21	
D2-007831	8	0.35	―	3.44	―	0.099		Fig. 21-26	
D2-007832	9	0.33	9.60	2.86	3.36	0.094		Fig. 21-16	
D2-007833	9	0.34	10.96	3.73	2.94	0.092		Fig. 21-12	
D2-007834	9.5	0.40	9.84	3.00	3.28	0.095		Fig. 21-35	
D2-007835	10	0.24	10.03	3.29	3.05	0.094		Fig. 21-6	
D2-007836	8	0.45	12.08	4.09	2.95	0.107		Fig. 21-39	
D2-007837	8	0.40	10.05	3.63	2.77	0.107		Fig. 22-3	
D2-007838	8.5	0.27	12.59	3.48	3.62	0.100		Fig. 21-37	
D2-007839	7.5	0.47	10.71	3.56	3.01	0.089		Fig. 22-22	
D2-007840	8	0.38	10.55	3.18	3.32	0.126		Fig. 22-10	
D2-007841	6	0.38	―	―	―	―		Fig. 21-3	
D2-007842	7.5	0.34	12.95	3.99	3.25	0.113		Fig. 22-1	
D2-007843	8.5	0.32	10.89	3.19	3.41	0.096		Fig. 21-33	
D2-007844	9.5	0.27	10.60	3.15?	3.37?	0.117		Fig. 21-23	
D2-007845	8	0.35	―	3.23	―	0.106		Fig. 21-30	
D2-007846	7	0.35	8.87	3.14	2.82	0.093		Fig. 21-15	
D2-007847	8	0.43	12.37	3.98	3.11	0.106		Fig. 21-13	
D2-007848	9.1	0.30	―	3.27	―	0.092	37	Fig. 22-39	
D2-007849	8.3	0.34	―	3.50	―	0.104	31	Fig. 22-42	Fig. 11.8
D2-007850	8.2	0.31	―	3.90	―	0.091	37	Fig. 22-36	
D2-007851	8.4?	0.35	―	3.15	―	0.097	33	Fig. 22-38	
D2-007852	9.3	0.35	―	3.08	―	0.095	36	Fig. 22-45	Fig. 11.5
D2-007853	8.3	0.37	―	3.82	―	0.097	42	Fig. 22-43	Fig. 11.7
D2-007854	8.8	0.28	―	3.28	―	0.094	33	Fig. 22-44	
D2-007855	8.6?	0.34	―	3.29	―	0.086	42	Fig. 22-40	Fig. 11.9
D2-007856	7.9?	0.39	―	3.98	―	0.102	38	Fig. 22-41	
D2-007857	7.9	0.35	―	3.50	―	0.100	36	Fig. 22-16	
D2-007858	8.5	0.37	―	4.12	―	0.106	35	Fig. 22-29	
D2-007860	8	0.42	17.46	4.03	4.33	0.105		Fig. 21-2	Fig. 11.15
D2-007861	8	0.34	13.30	4.13	3.22	0.099		Fig. 21-7	
D2-007862	9.5	0.35	―	3.29	―	0.102		Fig. 21-25	
D2-007863	9.5	0.35	11.60	2.74	4.32	0.093		Fig. 21-1	Fig. 11.17
D2-007864	9	0.36	16.35?	3.92	4.17?	0.112		Fig. 21-5	Fig. 11.1
D2-007866	9	0.31	10.75?	2.92	4.69?	0.092		Fig. 21-24	
D2-007869	6	0.47	―	―	―	―		Fig. 22-28	
D2-007873	7	0.40	―	4.63	―	0.094	35	Fig. 22-30	
D2-007876	7	0.41	―	3.90	―	0.087		Fig. 21-28	
D2-007881	7	0.47	10.60	3.69	2.87	0.099		Fig. 22-27	
D2-007884	8.4	0.31	―	3.10	―	0.088	38	Fig. 22-37	
D2-007885	6.5	0.46	―	―	―	―		Fig. 22-19	
D2-007897	6.5	0.34	―	―	―	―		Fig. 21-4	
D2-007899	8	0.38	11.25?	3.46	3.25?	0.084		Fig. 22-8	
D2-007902	8.8	0.38	―	3.75	―	0.118	36	Fig. 22-31	
D2-007903	8.6	0.36	―	4.00	―	0.096	37?	Fig. 22-11	
D2-007908	8	0.42	12.20	3.96	3.08	0.100		Fig. 22-7	

Tables 14 *Parafusulina japonica* (Gumbel) in Ka-28

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-007114	7.5	0.57	10.43	4.89	2.13	0.107		Fig. 23-9	Fig. 12.18
D2-007115	8	0.56	9.20	3.35	2.75	0.122		Fig. 23-28	
D2-007116	8.5	0.49	―	3.55	―	0.105		Fig. 23-18	
D2-007117	8	0.58	10.29	3.87	2.66	0.100		Fig. 23-21	Fig. 12.20
D2-007113	9	0.35	7.40	3.30	2.24	0.106		Fig. 23-14	
D2-007118	7.5	0.41	12.90	3.96	3.26	0.110		Fig. 23-15	Fig. 12.13
D2-007119	9.4	0.41	―	3.79	―	0.104	32	Fig. 23-33	Fig. 12.3
D2-007120	8	0.53	―	4.36	―	0.125		Fig. 23-5	Fig. 12.12
D2-007121	7	0.51	11.30	3.86	2.93	0.091		Fig. 23-29	
D2-007122	8.5	0.35	8.35	3.73	2.24	0.093		Fig. 23-27	
D2-007123	7	0.50	13.20	4.15	3.18	0.104		Fig. 23-19	
D2-007124	8	0.41	8.75	3.40	2.57	0.106		Fig. 23-22	
D2-007125a	7.5	0.45	8.55?	3.90?	2.19?	0.119		Fig. 23-24	
D2-007125b	8.4	0.51	―	4.39	―	0.106	32	Fig. 23-4	
D2-007126	8	0.45	10.67	3.74	2.85	0.106		Fig. 23-6	
D2-007127	7	0.50	―	3.73	―	0.120	―	Fig. 23-34	
D2-007128a	9	0.39	―	―	―	―		Fig. 23-1	
D2-007128b	8	0.62	10.87	3.81	2.85	0.105		Fig. 23-12	
D2-007129	7	0.44	―	4.60	―	0.109		Fig. 23-23	
D2-007130	7	0.37	10.79	3.41	3.16	0.086		Fig. 23-31	Fig. 12.19
D2-007133	8	0.49	11.25?	4.06	2.77?	0.096		Fig. 23-17	
D2-007135	7	0.62	―	3.19	―	0.088		Fig. 23-35	
D2-007137	8	0.39	9.38	4.07	2.30	0.110		Fig. 23-13	
D2-007138	7.3	0.49	―	4.69	―	0.109	40	Fig. 23-39	
D2-007139	6	0.45	―	―	―	―		Fig. 23-20	
D2-007140	9	0.66	10.55	3.46	3.05	0.124		Fig. 23-7	Fig. 12.6
D2-007143	6.5	0.43	―	―	―	―		Fig. 23-25	
D2-007144	6.5	0.32	―	―	―	―		Fig. 23-36	
D2-007145	7.5	0.45	―	―	―	―		Fig. 23-32	
D2-007146	6.5	0.49	―	―	―	―		Fig. 23-37	
D2-007148	9	0.28?	―	―	―	0.105		Fig. 23-8	
D2-007149	8	0.42	11.95?	3.41	3.50?	0.102		Fig. 23-30	
D2-007150	8.5	0.40	11.22	3.60	3.12	0.118		Fig. 23-11	
D2-007152a	7.3	0.38	―	3.82	―	0.091	33	Fig. 23-38	
D2-007152b	7.1	0.58	―	―	―	0.092	?	Fig. 23-26	
D2-007153	7.5	0.49	8.67	4.94	1.76	0.109		Fig. 23-10	Fig. 12.17
D2-007154	7.3	0.36	―	4.40	―	0.109	32	Fig. 23-3	
D2-007155	7.5	0.50	11.60	3.80	3.05	0.104		Fig. 23-16	
D2-007156	7	0.62	13.33	5.01	2.66	0.118		Fig. 23-2	Fig. 12.11

Tables 15 *Parafusulina shimotsukensis* Kobayashi in Ka-47

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-007424	9.5	0.33	11.11	3.44	3.23	0.090		Fig. 24-6	
D2-007425	8	0.66	13.12	5.76	2.28	0.112		Fig. 24-1	
D2-007426	9	0.48	9.90	4.35	2.28	0.105		Fig. 24-17	
D2-007427	9	0.40	11.50?	4.37	2.63?	0.100		Fig. 24-15	
D2-007428	8	0.36	10.10	4.41	2.29	0.098		Fig. 24-5	
D2-007429	9	0.41	8.41	3.82	2.20	0.077		Fig. 24-19	
D2-007430	9	0.38	9.95	4.38	2.27	0.090		Fig. 24-13	
D2-007431	8.5	0.47	10.95	4.60	2.38	0.105		Fig. 24-16	
D2-007432	8	0.45	9.84	3.73	2.64	0.092		Fig. 24-10	
D2-007433	9	0.43	10.85	4.06	2.67	0.094		Fig. 24-7	
D2-007434	8.5	0.58	11.90?	4.82?	2.47?	0.099		Fig. 24-2	
D2-007435	8.5	0.40	10.35	4.09	2.53	0.102		Fig. 24-9	
D2-007437	8.5	0.42	16.28	5.10	3.19	0.104		Fig. 24-12	Fig. 10.6
D2-007439	9.7	0.41	―	4.02	―	0.085	41	Fig. 24-4	
D2-007440	7.2	0.40	―	3.97	―	0.092	43	Fig. 24-3	Fig. 10.3
D2-007452	8.5	0.39	11.94	3.96	3.02	0.088		Fig. 24-8	
D2-007453	9.5	0.42	8.99	3.95	2.28	0.098		Fig. 24-18	Fig. 10.7
D2-007454	9	0.30?	11.44	4.60	2.49	0.110		Fig. 24-14	
D2-007456	7.5	0.46	―	4.40	―	0.097		Fig. 24-11	

Tables 16 *Parafusulina tochigiensis* Kobayashi in Ka-47

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-007423	7.5	0.29	10.70	3.47	3.08	0.104		Fig. 25-9	
D2-007436	7.5	0.52	12.10	3.91	3.09	0.102		Fig. 25-10	
D2-007438	8	0.32	12.30	3.50	3.51	0.101		Fig. 25-3	
D2-007441	8.5	0.32	12.55	3.42	3.67	0.097		Fig. 25-2	Fig. 11.12
D2-007442	8.5	0.31	15.33	4.00	3.83	0.099		Fig. 25-1	Fig. 11.14
D2-007443	7	0.51	14.96	3.96	3.78	0.100		Fig. 25-8	Fig. 11.2
D2-007444	6.5	0.39	―	―	―	―		Fig. 25-4	
D2-007445	7.5	0.41	12.06	3.49	3.46	0.102		Fig. 25-6	
D2-007446	8	0.45	11.97	3.51	3.41	0.108		Fig. 25-7	
D2-007447	7.5	0.36	―	3.88	―	0.100	37	Fig. 25-13	Fig. 11.6
D2-007448	8.1	0.39	―	3.80	―	0.114	35	Fig. 25-12	
D2-007449	8.1	0.38	―	3.49	―	0.087	41	Fig. 25-11	Fig. 11.3
D2-007450	8.7?	0.37	―	3.45	―	0.102	36	Fig. 25-14	Fig. 11.4
D2-007455	9	0.31	8.80	2.88	3.06	0.092		Fig. 25-5	

Tables 17 *Parafusulina shimotsukensis* Kobayashi in Ka-71

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-007918	9.4	0.44	—	4.32	—	0.089	49	Fig. 26-12	
D2-007940	10	0.39	—	4.01	—	0.110	37	Fig. 26-11	
D2-007959	9.6	0.39	—	4.95	—	0.102	38	Fig. 26-5	
D2-007960	9.4?	0.48	—	4.24	—	0.100	41	Fig. 26-10	Fig. 9.3
D2-007962	9.1	0.29	—	4.21	—	0.096	43	Fig. 26-13	
D2-007965	10	0.40	9.44	3.59	2.63	0.094		Fig. 26-9	
D2-007972	9	0.40	14.44	4.29	3.67	0.091		Fig. 26-3	
D2-007976	8.5	0.52	11.85?	4.19	2.83?	0.110		Fig. 26-6	
D2-007985	9.5	0.43	9.30	3.83	2.43	0.102		Fig. 26-4	
D2-008003	9.5	0.37	12.34	3.98	3.10	0.090		Fig. 26-2	
D2-008007	9.5	0.46	10.70	3.98	2.69	0.092		Fig. 26-1	
D2-008029	8.5	0.45	12.60	5.23	2.41	0.097		Fig. 26-7	
D2-008034	8	0.45	11.86	4.62	2.57	0.097		Fig. 26-8	

Tables 18 *Parafusulina shimotsukensis* Kobayashi in Ka-73

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-008132	8	0.44	16.05?	5.10	3.15?	0.102		Fig. 28-1	
D2-008133	9.5	0.44	11.32?	4.30	2.63?	0.099		Fig. 28-22	
D2-008134	9	0.40	13.60	4.35	3.13	0.100		Fig. 28-11	
D2-008135	8.5	0.40	11.65?	4.20?	2.77?	0.101		Fig. 27-7	
D2-008136	8.5	0.54	13.49	5.42	2.49	0.092		Fig. 28-7	
D2-008138	8	0.30	12.67	5.48	2.31	0.104		Fig. 28-10	
D2-008139	9	0.46	—	3.97	—	0.089		Fig. 28-9	
D2-008140	9	0.28	9.02	3.84	2.35	0.090		Fig. 28-24	
D2-008142	8	0.31	11.25	4.52	2.49	0.094		Fig. 28-6	
D2-008145	9	0.39	9.30	4.87	1.91	0.093		Fig. 27-3	
D2-008146	9	0.34	12.20?	3.45	3.54?	0.095		Fig. 27-1	
D2-008147	9.5	0.41	9.48	3.33	2.85	0.085		Fig. 28-23	
D2-008150	8.5	0.48	—	—	—	—		Fig. 28-19	
D2-008151	8.5	0.49	13.85	4.70	2.95	0.096		Fig. 28-3	
D2-008152	9	0.48	11.47	4.23	2.71	0.095		Fig. 28-21	
D2-008153	9	0.51	10.98	3.59	3.06	0.082		Fig. 28-15	
D2-008154	9	0.42	9.96	3.70	2.70	0.094		Fig. 27-5	
D2-008155	9	0.33	13.44	3.96	3.39	0.098		Fig. 28-18	
D2-008156	9	0.62	12.95	4.49	2.88	0.087		Fig. 28-14	
D2-008159	9	0.49	11.95?	3.70	3.23	0.088		Fig. 28-25	
D2-008160	9	0.49	—	4.09	—	0.098		Fig. 28-20	
D2-008161	8	0.35	11.35	4.72	2.40	0.098		Fig. 28-13	
D2-008162	7.5	0.40	14.10	4.69	3.01	0.100		Fig. 28-26	
D2-008165	8.5	0.29	12.55	4.66	2.69	0.098		Fig. 28-8	
D2-008168	8.5	0.42	—	5.22	—	0.108		Fig. 28-12	
D2-008169	8.5	0.40	12.00	4.24	2.83	0.090		Fig. 27-6	
D2-008170	9	0.45	—	3.91	—	0.091		Fig. 28-4	
D2-008173	8.5	0.50	9.88	4.22	2.34	0.108		Fig. 27-2	
D2-008175	8	0.45	8.80	4.46	1.97	0.077		Fig. 28-5	
D2-008176	9	0.42	—	3.56	—	0.087		Fig. 28-2	
D2-008177	8	0.47	11.16	4.27	2.61	0.099		Fig. 27-4	
D2-008178	9	0.58	11.17	4.50	2.48	0.103		Fig. 28-17	
D2-008179	9.5	0.47	9.55	4.94	1.93	0.098		Fig. 28-16	Fig. 10.5
D2-008181	9	0.32	11.08	4.47	2.48	0.092		Fig. 28-27	
D2-008186	9	0.39	—	4.51	—	0.094	48	Fig. 27-13	Fig. 10.13
D2-008188	8.2	0.40	—	4.26	—	0.103	43	Fig. 27-9	
D2-008191	8.4	0.33	—	4.63	—	0.101	47	Fig. 27-10	
D2-008194	8.4	0.47	—	5.25	—	0.090	42	Fig. 27-14	
D2-008184	8.8	0.55	—	4.52	—	0.099	49	Fig. 27-12	
D2-008185	9.2?	0.40	—	3.55	—	0.086	44	Fig. 27-8	
D2-008189	9.3	0.30	—	4.40	—	0.090	45	Fig. 27-11	
D2-008202	7.5	0.35	9.15	3.13	2.92	0.088		Fig. 28-28	

Tables 19 *Parafusulina tochigiensis* Kobayashi in Ka-73

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-008180	8.5	0.25	9.84	3.46	2.84	0.076		Fig. 29-8	
D2-008192	8.4	0.39	—	3.67	—	0.078		Fig. 29-16	
D2-008198	8	0.32	9.86	3.47	2.84	0.090		Fig. 29-15	
D2-008199	8.5	0.27	10.06	3.17	3.17	0.089		Fig. 29-6	
D2-008200	8.5	0.35	9.60	3.23	2.97	0.085		Fig. 29-13	
D2-008201	8	0.41	—	3.34	—	0.100		Fig. 29-14	
D2-008203	7.5	0.40	11.50	3.11	3.70	0.091		Fig. 29-10	
D2-008204	9	0.25?	10.15?	3.21	3.16?	0.097		Fig. 29-3	
D2-008206	8.5	0.37	10.29	3.53	2.92	0.124		Fig. 29-1	
D2-008207	8.5	0.49	11.25	3.85	2.92	0.102		Fig. 29-12	
D2-008208	7	0.35	10.65	3.53	3.02	0.102		Fig. 29-7	
D2-008209	9.5	0.29	8.50	2.80	3.04	0.088		Fig. 29-11	Fig. 11.11
D2-008210	7.5	0.47	13.28	4.15	3.20	0.096		Fig. 29-2	
D2-008211	8.5	0.38	9.45	3.77	2.51	0.121		Fig. 29-9	
D2-008212	9.5	0.30	7.99	3.23	2.47	0.100?		Fig. 29-5	
D2-008213	9	0.47	—	3.79	—	0.098		Fig. 29-4	

Tables 20 *Parafusulina japonica* (Gumbel) in Ka-33

Reg. No.	Whorl	P	7th L	7th W	7th R	7th Wall	7th S	This paper	K. ('06a)
D2-007201	7.5	0.41	10.96	3.68	2.98	0.110		Fig. 30-11	
D2-007202	7.1	0.27	—	3.78	—	0.095	38	Fig. 30-10	Fig. 12.24
D2-007203	7	0.39	9.96	4.11	2.42	0.102		Fig. 30-7	
D2-007204	6	0.44	—	—	—	—		Fig. 30-5	Fig. 12.4
D2-007205	7	0.53	9.26	3.60	2.57	0.109		Fig. 30-12	
D2-007206	6	0.54	—	—	—	—		Fig. 30-13	
D2-007207	9	0.38	8.15?	3.40	2.40?	0.104		Fig. 30-1	
D2-007208	7.5	0.48	9.24	3.67	2.52	0.091		Fig. 30-4	
D2-007209	8	0.40	—	3.44	—	0.107		Fig. 30-6	
D2-007210	8	0.40	10.15?	3.56	2.85?	0.090		Fig. 30-8	
D2-007211	7	0.52	9.31	3.65	2.55	0.118		Fig. 30-14	
D2-007212	7.5	0.39	9.69	4.07	2.38	0.103		Fig. 30-3	
D2-007215	7.9	0.31	—	4.02	—	0.096	37?	Fig. 30-9	
D2-007218	8	0.42	9.70	3.52	2.76	0.123		Fig. 30-2	

栃木県葛生地域の中部ペルム系鍋山層産 *Parafusulina* ５種の形態変異

小林文夫

栃木県葛生地域の中部ペルム系鍋山層の 12 層準から産する *Parafusulina* ５種 (*P. yabei, P. tomeganensis, P. shimotsukensis, P. tochigiensis* と *P. japonica*) の形態変異を記載した．多数の顕微鏡写真や定量化可能な殻形質 (初室の外径，第７旋回における長さと幅および両者の比，殻壁の厚さ，隔壁数) の頻度分布ヒストグラムを示しながら５種の多様性を解析した．これら５種の個体間で識別された幅広い形態変異は他種の認定やフズリナ類の分類の際にも有用と考えられ，過去の生物多様性の認識や関連する諸問題の議論に重要である．

(兵庫県立人と自然の博物館 / 兵庫県立大学自然・環境科学研究所)

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