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Fusulinids from the Middle Upper Carboniferous Itadorigawa Group in Western Shikoku, Japan* Part II. Genus *Fusulinella* and other Fusulinids

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(With 11 Tables and Plates VI-XII)

Description of species (continued)

Family **Fusulinidae** Möller, 1878

Subfamily Staffellinae A. M.-Maclay, 1949

Genus *Pseudoendothyra* Michailov, 1939

Pseudoendothyra sp.

(Plate VI, Figure 14)

Only one axial section was obtained, which is highly replaced by secondary mineralization. The following brief accounts are given on the base of this specimen. Shell small, with broadly angular central portion, but with narrowly rounded central portion in inner volutions. Lateral slopes nearly straight or slightly concave. Number of volutions seems to be about 4. Diameter is about 0.754 mm. Form ratio is 0.5. Mode of spirotheca, chomata and tunnel can hardly be described owing to secondary mineralization. In general shell features the present specimen belongs to the genus *Pseudoendothyra*.

Material: — Reg. no. PF 1275, loc. 2, the It_1 fossil zone at Itadorigawa.

Occurrence: — Only one specimen occurs in the It_1 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Higashiuwa-gun, Ehime Prefecture.

Pseudoendothyra ? sp.

(Plate VI, Figures 10-13)

Several incomplete axial sections are at hand. They are so highly replaced by secondary mineralization that they cannot be determined exactly. The following brief accounts are given for these specimens: Shell subspherical with a round periphery. Inner volutions seem to possess a subangular or narrowly rounded periphery. Number of volutions is at least 4 to 5. Diameter is 1.148 to 1.763 mm. Chomata and tunnel are indistinct. Proloculus is spherical and its outside diameter is 49 microns in a sagittal section. In a well preserved part of the outer volutions spirotheca is thick and consists of a indistinct tectum, a thick diaphanotheca, and thin upper and lower tectoria.

* Contribution from the Department of Geosciences, No. 79.

Material: — Reg. no. PF 1243, 1244, 1245, 1246, loc. 2, the It_1 fossil zone.

Remarks: — The present specimens differ from the type-species of *Pseudoendothyra*, *Fusulinella struvii* Möller, in shell form which is lenticular in the latter. According to Rauser (1959, p. 207), shell form of *Pseudoendothyra* is lenticular, nautiloid, to spherical in adult stage with umbilical areas from angular to concave. In shell form, the present specimens resemble some spherical forms of *Pseudoendothyra* and of *Staffella*. In smaller number of volutions, however, the present specimens resemble *Pseudoendothyra* more than *Staffella*.

Occurrence: — The present specimens occur rarely in the It_1 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village Higashiuwa-gun, Ehime Prefecture. One doubtful specimen occurs from the It_3 fossil zone at loc. 62 of Itadorigawa.

Subfamily Ozawainellinae Thompson et Forster, 1937

Genus *Eostaffella* Rauser, 1948

1948 Rauser, Тр. Инст. геол. наук АН СССР, вып. 66, стр. 15-16
1951 Rauser, Тр. Инст. геол. наук АН СССР, справ-опред., стр. 46
1956 Putrja, Тр. ВНИГРИ, нов. сер., вып. 98, "Микрофауна СССР", сб. 8, стр. 78
1958 Sheng, Palaeont. Sinica no. 143, new ser. B, no. 7, p. 12, 70
1959 Rauser, АН СССР Москва, "Основы Палеонтологии", справоч. палеонт. геол. СССР, ч. простейшие, стр. 208

Type-species: — *Eostaffella parastruvei* Rauser, 1948

Remarks: — According to Rauser 1959 (p. 208), *Eostaffella* has the following shell character: Shell discoidal or lenticular to nautiloid, involute; spirotheca undifferentiated or with a tectum, a protheca and a weak outer tectorium; Pseudochomata, and weak chomata present.

Eostaffella differs from *Millerella* Thompson, 1942 by that the latter has the more flattened shell, and the more rapidly expanding and evolute outer volutions. Likeweise, *Paramillerella* Thompson, 1951 is distinguished from *Millerella* by its more nearly involute shell, more massive chomata and more nearly spherical shell (Thompson, 1954, p.7). If the above cited difference in chomata is ignored, *Paramillerella* is quite similar to *Eostaffella*. Since the mode of chomata may not be a difference of generic rank in this case, *Paramillerella* may be included within *Eostaffella* either as a synonym or as a subgenus. Shell forms of their type-species are somewhat different from each other. Whether this difference can serve as a subgeneric character must await for future investigation. Here, the generic name *Eostaffella* is applied in wide sense including *Paramillerella*.

Eostaffella sp. cfr. *Eostaffella bigemmicula* (Igo), 1957

(Plate VI, Figures 1-5)

Compare:

1957 *Millerella bigemmicula* Igo, Sci. Rep. Tokyo Kyoiku Daigaku, sec. C, vol. 5, no. 47, p. 172-174, pl. I, figs. 1-4, 6, 9, 15, not 7, 8, 27

Description of specimens from the Itadorigawa group: — Shell very small, usually symmetrical and plano-lenticular, median portion angular in outer volutions and rounded in inner volutions, but in a small specimen (Pl. VI, Figs. 5) median portion is rounded

even in outer volutions. In general, volutions are in contact one after another at umbilical areas. Form ratio is 0.3 to 0.4. Length is 0.082 to 0.189 mm; diameter is 0.226 to 0.389 mm. Number of volutions is 3 to 4.

Proloculus is 29 to 49 microns. Shell expands gradually. Spirotheca is usually undifferentiated and very thin. In outer volutions a tectum appears sometimes. Chomata are asymmetrical, weakly developed and sometimes indistinct.

Measurement: — See Table 1, p. 29.

Material: — Reg. no. PF 1218, 1220, loc. 32; PF 1223, loc. 20; PF 1067b, loc. 37; PF 1222, loc. 35, the It_2 fossil zone at Itadorigawa, PF 1196, 1147a, loc. 62, the It_3 fossil zone at Itadorigawa.

Remarks: — *Millerella bigemmicula* IGO, 1957 must be referred to *Eostaffella*, above mentioned, with regard to the very narrow umbilical areas and the rather involute shell form. The present specimens closely resemble some specimens, including the holotype, of "*Millerella*" *bigemmicula* IGO, 1957 (pl. 1, figs. 1-4, 6, 9. 10, 15) from the *Millerella bigemmicula-Pseudostaffella kanumai* subzone of the zone of *Millerella* in Fukuji, the Hida Massif, but the chomata are not so well developed in the present ones as in the holotype. Therefore the present specimens are here cited as a comparable form of *Eostaffella bigemmicula*. In Fukuji specimens there are some other ones (pl. 1, figs. 7, 8, 27) in which the last volution is more nearly rounded and the umbilical area is wider and more concave. In these respects they resemble more closely *Eostaffella* (*Millerella*) *umbilicata* KIREEVA, 1951 (p. 62, pl. 2, figs. 1, 2) [=*Millerella*] from the upper Namurian to the Verei bed of the Russian Platform and adjacent districts than *E. bigemmicula*.

The present specimens differ from *Eostaffella multabilis* RAUSER, 1951 (p. 56, 57, pl. 1, figs. 23-25) from the upper Kayalian Stage to the Kashir bed of the southeastern part of the Moscow Basin, in symmetrical shell, more indistinct chomata and not endothyroid coiling.

Occurrence: — The present specimens occur rarely from the It_2 and It_3 fossil zones of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Higashiuwa-gun, Ehime prefecture.

Eostaffella sp.

(Plate VI, Figure 6)

Shell very small inflated lenticular, with sharply angular central portion, convex umbilical areas, and straight lateral sides. Central portion of shell becomes angular in outer three volutions. Form ratio is 0.53. Diameter is 0.291 mm. Length is 0.156 mm. Number of volutions is 4. Shell expands uniformly, but in last volution height of chamber expands only slightly. Spirotheca is usually undifferentiated. Chomata are weakly developed and indistinct. Tunnel is indistinct.

Measurement: — See Table 1, p. 29.

Material: — Reg. no. PF 1221, loc. 37, the It_2 fossil zone.

Remarks and Comparison: — This species is represented by only one axial section. Accordingly, the above description cannot be regarded as being sufficient. However, this specimen is supposed to resemble *Eostaffella kashirica* RAUSER, 1951 (p. 53, pl. 1, figs. 13, 14) from the western part of the Moscow Basin in the form, size and poor development of the chomata. More detailed comparison between the two is difficult until more sufficient material becomes available.

Occurrence: — The It_2 fossil zone of the Itadorigawa group at Itadorigawa, Kurose-

gawa-village, Higashiuwa-gun, Ehime Prefecture.

Genus *Millerella* THOMPSON, 1942

Millerella ? sp.

(Plate VI, Figures 7-9)

Shell discoidal, with angular central portion and slightly concave umbilical areas. Shell usually slightly asymmetrical and highly variable from volution to volution. Last volution seems to be evolute in umbilical areas. Form ratio of axial length to maximum diameter is 0.2 to 0.3. Length is 0.086 to 0.111 mm. Diameter is 0.361 to 0.406 mm. Number of volutions is 3 to 3 1/2. Proloculus is 41 to 45 microns in diameter. Shell coils loosely and expands uniformly. Spirotheca is very thin and usually undifferentiated. In outer volutions a tectum appears sometimes. Chomata weak, discontinuous, or indistinct. Tunnel indistinct.

Measurement: — See Table 2, p. 29.

Material: — Reg. no. PF 1195a, loc. 73; PF 1194a, 1207b, loc. 57, the It_2 fossil zone, PF 1193b, loc. 62, the It_3 fossil zone at Itadorigawa.

Remarks: — Since the last volution seems to be evolute and since the shell coils loosely, these specimens may belong to the genus *Millerella*. Since this form is represented by only three axial sections, and the preservation is very poor, it is better to leave this species unnamed until more sufficient material becomes available.

Occurrence: — The present specimens occur rarely in the It_2 and It_3 fossil zones of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Higashiuwa-gun, Ehime Prefecture.

Genus *Ozawainella* THOMPSON, 1935

Ozawainella angulata (COLANI), 1924

(Plate VI, Figures 15-22)

1924 *Fusulinella angulata* COLANI, Serv. Géol. Indochine, Mém., vol. 11, fasc. 1, p. 74, 75, 132, 133, pl. 2, figs. 12-14, 16-18, 20, 21, 35.

1930 *Staffella angulata*, LEE & CHEN, Nat. Res. Inst. Geol., Mem., no. 16, p. 117, 118, pl. 7, figs. 12-21.

1934 *Orobias angulata*, CHEN, Nat. Res. Inst. Geol., Mem., no. 16, p. 38, 39, pl. 6, figs. 1-4, 6, 20.

1941 *Ozawainella angulata*, TORIYAMA, Geol. Soc. Japan, Jour., vol. 48, p. 564, figs. 1-5.

(cfr) 1944 *Ozawainella* sp. cfr. *Ozawainella angulata*, TORIYAMA, Japan. Jour. Geol. Geogr., vol. 19, nos. 1-4, p. 69, 70, pl. 6, figs. 1, 2.

1951 *Ozawainella angulata*, RAUSER. Тр. Инст. геол. наук АН СССР, справ-опред., стр. 140, табл. 11, фиг. 6, 7

1957 *Ozawainella angulata*, IGO, Sci. Rep. Tokyo Kyoiku Daigaku, Sec. C, vol. 5, no. 47, p. 181-183, pl. 3, figs. 1-3.

1958 *Ozawainella angulata*, SHENG, Palaeont. Sinica. no. 143, new ser. B, no. 7, p. 14, 72, pl. 1, figs. 22-24

Description of specimens from the Itadorigawa group: Shell very small, and lenticular; involute from inner volution. Central portion is sharply angular and lateral slopes are almost straight. Polar regions are broadly and slightly inflated. In two axial sections length is 0.213 to 0.230 mm, diameter is 0.475 to 0.557 mm and form ratio is 0.38 to 0.43.

In an oblique section diameter attains to more than 0.918 mm. Number of volutions is about 3 to 4. Proloculus is spherical; its diameter is 33 to about 49 microns. Spirotheca is thin, composed of a tectum and upper and lower layer, but differentiation of spirotheca into layers is indistinct. Chomata are ribbon-like (RAUSER, 1951, p. 28), and gently slope poleward from tunnel. Tunnel is indistinct.

Material: — Reg. no. PF 1136b, 1253, 1256d, loc. 57; PF 1010b, 1254, 1257, loc. 44; PF 1030b, loc. 35; PF 1034b, loc. 73, the It_2 fossil zone at Itadorigawa.

Remarks: — This is not richly represented in the Itadorigawa collection. However, the present specimens, especially two axial sections may be identifiable with one of the original figures (pl. 2, fig. 17) of *Ozawainella angulata* (COLANI) by the above shell characters.

Some oblique sections show larger diameter and may not possibly be conspecific with the typical form. However the former may, if restored, resemble the latter in shell form and mode of chomata. Furthermore, it may be nearly as large as some Russian examples of this species in shell size (RAUSER, 1951, p.140). Accordingly, at present the writer identifies also these larger specimens with *Ozawainella angulata*.

Occurrence: — The present specimens occur rarely in the It_2 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Higashiuwa-gun, Ehime Prefecture.

Subfamily Schubertellinae SKINNER, 1931

Genus *Eoschubertella* THOMPSON, 1931

Eoschubertella toriyamai ISHII, sp. nov.

(Plate VI, Figures 23-37)

1958 *Eoschubertella obscura*, TORIYAMA, Mem. Fac. Sci., Kyushu Univ., Ser. D, Geol., vol. 7, p.25-27, pl. 1, figs. 11, 13, ? 10, 14.

Diagnosis: — Shell very small, subspherical; first volution nautiloid to endothyroid; proloculus moderate; shell loosely coiled; height of chamber of last volution expands rapidly; chomata generally not present, but in some specimens very rudimentary; spirotheca generally represented by an undifferentiated layer.

Description: — Shell very small, subspherical with rounded poles. Number of volutions is usually 3 to 3 1/2. Axial length is 0.230 to 0.525 mm. Median width is 0.230 to 0.458 mm. Form ratio is 1.0 to 1.4. First volution of some specimens is staffelloid, slightly irregularly coiling at a large angle to axis of outer volutions. In some other specimens (Pl. VI, Figs. 35-37) first volution is endothyroid, coiling at a right angle to axis of outer volutions.

Proloculus is moderate and spherical. Its outside diameter is about 41 to 78 microns. Shell coils loosely. In some specimens, including holotype, height of chamber of last volution expands considerably rapidly.

Spirotheca is generally represented by an undifferentiated layer which is, however, not a single dark homogeneous layer. In outer volutions it is rarely composed of a tectum and a diaphanotheca-like transparent layer. Tectoria cannot be clearly recognized. Septa are not fluted.

Chomata are generally not present, but in some specimens (Pl. VI, Figs. 32-34) they exist though very rudimentary.

Measurement: — See Table 3, p. 30.

Material: — Holotype, Reg. no. PF 1098b, loc. 35, the It_2 fossil zone of the Itadori-

gawa group at Itadorigawa. Other specimens, PF 1022b, 1205, 1216, loc. 32; PF 1202, 1203, loc. 35; PF 1207a, 1209, 1210, 1215a, 1256e, loc. 57; PF 1217, loc. 20; PF 1208, loc. 43; PF 1132a, loc. 73, the It_2 fossil zone at Itadorigawa. PF 1276, loc. 29, the It_1 fossil zone at Itadorigawa.

Remarks: — This species shows a wide range of variation. Broadly speacking, it is divided into three groups on the basis of the following shell characters:

1) the first group represented by the holotype (Pl.VI, Fig.31): 1. comparatively large size, 2. subspherical form, 3. rudimentary chomata, 4. the last volution expanding rapidly.

2) the second group represented by the specimen Reg. no. PF 1210 (Pl.VI, Fig.28): 1. small size, 2. more nearly spherical form, 3. rudimentary chomata.

3) the third group represented by the specimen Reg. no PF 1216 (Pl. VI, Fig. 36) 1. subspherical form, 2. rudimentary chomata, 3. the first volution endothyroid.

Comparison: — This species is compared with *Eoschubertella obscura* (Lee et Chen), 1930 from Huanglungshan and Chuanshan of China. This species resembles especially the subellipsoidal specimens of *E. obscura* (Lee & Chen, 1930, pl. 6, figs. 12-15). The former, however, differs from the latter in mode of the chomata. That is to say, the chomata of *E. obscura* are prominent even in the outer volutions, while in the present species the chomata are hardly recognized or exist rarely as rudimentary form.

The third group of the present species resembles the lectotype of *E. obscura* (Lee & Chen, 1930, pl. 6, fig. 12) in shell form. The former, however, differs from the latter in its more rudimentary chomata, larger proloculus and the endothyroid first volution. The third group resembles *Schubertella obscura* in Rauser (1951, pl. 2, fig. 22) and *Schubertella gracilis* Rauser, 1951 (pl. 2, figs. 29, 30) from the Russian platform and adjacent districts in the shell form and the mode of coiling. The present species can easily be distinguished from these Russian species by its more rudimentary or absent chomata.

Some specimens (samples: D 291, 263, pl. 1, figs. 11, 13) of *Eoschubertella obscura* which was reported from Akiyoshi by Toriyama resemble the present species more than the above-mentioned specimens in Lee & Chen and in Rauser in the subspherical form, undeveloped or rudimentary chomata and other characters, therefore Toriyama's specimens may be conspecific with the present species.

Occurrence: — This species is abundant in the It_2 fossil zone and it is rare in the It_1 and It_3 fossil zones of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Higashiuwa-gun, Ehime Prefecture.

Eoschubertella sp. cfr. *Eoschubertella lata* (Lee et Chen), 1930

(Plate VI, Figures 38-40)

Compare:

1930 *Schubertella lata* Lee et Chen, Nat. Res. Inst. Geol. Mem., no. 9, p. 119, pl. 6, figs. 9-11.

1951 *Schubertella lata*, Rauser, Тр. Инст. геол. наук. АН СССР, справ-опред., стр. 81, табл. 3, фиг. 14

1956 *Schubertella lata*, Putrja, Тр. ВНИГРИ, нов. сер., вып. 98, "Микрофауна СССР", сб 8, стр. 410, 411, табл. 6, фиг. 9

1957 *Eoschubertella lata*, Igo, Sci. Rep. Tokyo Kyoiku Daigaku, sec. C, vol. 5, no. 47, p. 186, 187, pl. 3, figs. 6-8.

1958 *Schubertella lata*, Sheng, Palaeont. Sinica, no. 143, new ser. B, no. 7, p. 19, 20, pl. 2, figs. 7-12.

Description: — Shell very small, subellipsoidal with bluntly pointed poles. Central

portion usually flattened or slightly convex. First volution is endothyroid, coiling at a nearly right angle to axis of outer volutions. Second volution is nautiloid, somewhat irregularly coiling at a large angle to axis of first and outer volutions. Number of volutions is usually 4. Axial length is 0.410 to 0.557 mm. Median width is 0.262 to 0.361 mm. Form ratio is 1.5 to 1.6. Proloculus is very small and spherical. Its outside diameter is 25 to 41 microns. Shell coils tightly in first two volutions but expands more or less rapidly from third volution onward. Height of chambers of last volution is lowest immediately above tunnel, and increases rapidly poleward from tunnel.

Spirotheca is very thin; it is represented by an undifferentiated layer in first to second volution, which is not a single dark homogeneous layer. From third volution onward it is differentiated into two layers; namely a tectum and a less dense diaphanotheca-like layer. Transparency of a diaphanotheca-like layer increases from fourth volution. In addition upper tectorium is sometimes observed around chomata as thin and discontinuous dense layer, but generally it can hardly be recognized. Septa are unfluted except for polar regions, where they are very weakly fluted.

Chomata are comparatively prominent in outer volution. Their polar sides gently extend to polar ends. Tunnel is narrow.

Measurement: — See Table 3, p. 30.

Material: — Reg. no. PF 1213, 1214, loc. 73; PF 1199, loc.43, the It_2 fossil zone at Itadorigawa, PF 1200a, loc. 60, the It_3 fossil zone.

Remarks: — THOMPSON (1937, p. 118-124) divided the genus *Schubertella* into two subgenera, *Schubertella* s.s (type-species: *Schubertella transiforia* STAFF et WEDEKIND, 1910) and *Eoschubertella* (type-species: *Schubertella lata* LEE et CHEN, 1930). Later, he (1948) raised them subgenera to generic rank. He stated the differences between the two genera as follows: "the spirotheca of the former [*Eoschubertella*] is composed of a tectum and upper and lower tectoria, whereas that of the latter is composed of a tectum and a diaphanotheca. Also, the shell of *Eoschubertella* is more highly ellipsoidal and more loosely coiled than that of *Schubertella*" (THOMPSON, 1948, p.33). The lower tectorium of *Eoschubertella* mentioned by THOMPSON corresponds to the diaphanotheca-like layer in the above description of the present paper.

In the specimens of *Eoschubertella* sp. cfr. *E. lata* from the Itadorigawa group, as well as of *E. toriyamai* and *E.* sp. cfr. *E. obscura* described below, the lower layer (THOMPSON's lower tectorium) is transparent (diaphanotheca-like) or not transparent (tectorium-like). In the younger stages of the ontogeny the spirotheca is undifferentiated layer, but in the early mature stage it becomes differentiated into a tectum and a lower dark layer; in full mature stage this lower dark layer becomes in some specimens gradually transparent. In addition to these two essential layers, namely, the tectum and the lower layer, the discontinuous upper tectorium appears at a few volution of some specimens, but it is not recognizable in others. In short, among specimens of one species some have clear diaphanotheca in the adult stage of the ontogeny, but others have dark lower layer even to the adult stage. Similarly, some specimens have an upper tectorium, but others of the same species have no upper tectorium. It follows, therefore, that among the specimens of the Itadorigawa group belonging to a single species the spirotheca of both the *Eoschubertella* and *Schubertella* types are found. In describing *Schubertella lata* from the Taitzeho valley SHENG (1958, p. 19, 78) states that the spirotheca consists of a tectum and a discontinuous and less dense lower layer. Weighing these facts, concerning the type-species of *Eoschubertella*, the present writer thinks that *Eoschubertella* and *Schubertella* cannot be discriminated on the basis of spirotheca. Thus the difference between *Eoschubertella* and

Schubertella appears to be very slight, lying barely in general size, shell form and mode of coiling.

The Itadorigawa specimens of *Eoschubertella* sp. cfr. *E. lata* very closely resemble the original specimens of *S. lata* from the Huanglung limestone in general shell characters, but the former are smaller in size, form ratio and proloculus than the latter.

Occurrence: — This species occurs rarely in the upper part of the It_2 fossil zone and the It_3 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Higashiuwa-gun, Ehime Prefecture.

Eoshubertella sp. cfr. *Eoschubertella obscura* (LEE et CHEN), 1930

(Plate VI, Figures 41-44)

Compare:

1930 *Schubertella obscura* LEE et CHEN, Nat. Res. Inst. Geol. Mem., no. 9, p. 112-113, pl. 6, figs. 12-22.

1941 *Eoschubertella obscura*, TORIYAMA, Jour. Geol. Soc. Japan, vol. 48, no. 579, p. 566, 567, text-figs. 10, 11.

1944 *Eoschubertella obscura*, TORIYAMA, Japan, Jour. Geol. Geogr., vol. 19, nos. 1-4, p. 77, 78, pl. VI, figs. 18-22.

1951 *Schubertella obscura*, RAUSER, Тр. Инст. геол. наук АН СССР, справ-опред., стр. 71, 72, табл. 2, фиг. 22

1957 *Eoschubertella obscura*, IGO, Sci. Rep. Tokyo Kyoiku Daigaku, sec. C. vol. 5, no. 47, p. 187, 188, pl. 3, figs. 9-11.

1958 *Schubertella obscura*, SHENG, Palaeont. Sinica, no. 143, new ser. B no. 7, p. 20, pl. 2, figs. 21-26.

Description: — Shell very small, subspherical to subellipsoidal with bluntly pointed or rounded poles, and a gentle dome-like central portion in outer volutions. Number of volutions is usually 3 1/2. Axial length is 0.426 to 0.541 mm. Median width is 0.361 mm. Form ratio is commonly 1.5, but in subspherical form down to 1.2. In some specimens first volution is nautiloid, slightly irregularly coiling at a large angle to axis of outer volutions.

Proloculus is moderate and spherical. Its outside diameter is 62 to 74 microns. Shell loosely coils.

Spirotheca is represented by an undifferentiated layer in first or second volution, which is not a single dark homogeneous layer. In outer one to two volutions it is differentiated into two layers; namely, a tactum and a transparent diaphanotheca-like layer. Upper tectorium is sometimes observed around chomata as thin and discontinuous dense layer, but generally it can hardly be recognized. Septa are unfluted. Chomata are comparatively distinct in outer volutions. Tunnel is comparatively narrow.

Measurement: — See Table 3, p. 30, 31.

Material: — Reg. no. PF 1195b 1198,, 1212, 1oc. 73; PF 1204, 1oc. 35, the It_2 fossil zone at Itadorigawa.

Remarks: — Judging from the original figures, *Eoschubertella obscura* (LEE et CHEN), 1930 from the Huanglung limestone of China seems to include fusiform to subellipsoidal forms. Its lectotype (pl. 6, fig. 12) was selected by RAUSER (1951). Many original specimens including the lectotype have the prominent chomata, excepting two specimens (pl. 6, figs. 16, 17). The present specimens of the Itadorigawa group may resemble some specimens of *E. obscura* (LEE & CHEN, 1930, pl. 6, figs. 13-15) in the prominent chomata of the outer volutions, shell form and other shell features, but the lectotype differs from the

present specimens in the more rounded form and in the less loose coiling in inner volutions. Accordingly, the writer does not identify the present specimens with *E. obscura*.

One specimen (Pl. VI. Fig. 41) is distinguished from the above-mentioned specimens in its subspherical form. It resembles the first group of *E. toriyamai* in shell form, but it differs from the latter in its more distinct chomata of the outer volutions.

The present specimens resemble *Eoschubertella* sp. A in TORIYAMA, 1958 (p. 27, 28, pl. 1, figs. 15, 16) from Akiyoshi. The former, however, differs from the latter in the smaller size and smaller proloculus.

Occurrence: — This species occurs rarely in the upper part of the It_2 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Higashiuwa-gun, Ehime Prefecture.

Genus *Fusiella* LEE et CHEN, 1930

Fusiella typica sparsa SHENG, 1958

(Plate VI, Figures 45, 46, Plate VII, Figures 1-15, 17, 18)

1958 *Fusiella typica* var. *sparsa* SHENG, Palaeont. Sinica, no. 143, new ser. B, no. 7, p. 23, 24, pl. 3, figs. 3-8.

Description: — Shell very small and highly elongated fusiform, having inflated central portion and concave lateral slopes, and being slightly bent in axial direction; poles are somewhat pointed or bluntly pointed. Mature shells having 4 to 5 volutions are 0.721 to 1.541 mm in length and 0.295 to 0.475 mm in width. Form ratio is about 2.3 to 3.3. Inner two volutions are endothyroid, coiling at a large angle to axis of outer volutions.

Spirotheca is thin, composed of three layers, namely, a tectum, a dark layer and an upper tectorium. Septa are unfluted throughout length of shell.

Proloculus is very small and spherical. Its outside diameter is 29 to 49 microns. Chomata are asymmetrical and low. Tunnel is low and becomes gradually wide outward.

Measurement: — See Table 4, p. 31.

Material: — Reg. no. PF 1237, 1238, loc. 31; PF 1266a 1266b, loc. 32; PF 1234, loc. 35; PF 1137b, 1215b, 1256a, 1256b, loc. 57; PF 1025b, 1127b, 1258b, loc. 44, all from the It_2 fossil zone at Itadorigawa. PF 1193a, 1224, 1225, 1277, 1278a, loc. 62; PF 1226, loc. 61; PF 1265, loc. 51, the It_3 fossil zone.

Remarks: — *Fusiella typica sparsa* SHENG, 1958 was originally reported from the Penchi Series of the Taitezho valley, Liaoning, China. The Itadorigawa specimens are identifiable with this subspecies with regard to essential shell features. However, the variation range of the present specimens is wider than that of *F. typica sparsa* as described by SHENG. That is to say, the length of 14 specimens of the Itadorigawa group having 4 to 5 volutions varies from 0.721 to 1.541 mm, and the form ratio from 2.3 to 3.3, while the length of the Chinese specimens varies from 0.84 to 1.29 mm and the form ratio from 3.0 to 3.2. However, the present specimens cannot be separated into specifically different two species as to the other characters, and should therefore be referred, as a whole, to *F. typica sparsa*.

Fusiella typica sparsa resembles *F. typica typica* LEE et CHEN, 1930 (p. 107, 108, pl. 4, figs. 1-6) from the Huanglung limestone of Nanking Hill, but the former has 4 to 5 volutions, whereas the latter has 6 or 6 1/2 volutions. The axial fillings of the former are weaker than those of the latter.

Occurrence: — This subspecies is abundant in the It_2 fossil zone and common in the

It_3 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Higashiuwa-gun, Ehime Prefecture.

Fusiella sp.

(Plate VII, Figures 16, 19)

Description: — Shell very small, fusiform with highly inflated central portion and very slightly concave or nearly straight lateral slopes. Poles are somewhat pointed. Mature shells having 4 to 5 volutions are 0.689 to 0.869 mm in length and 0.410 to 0.426 mm in width. Form ratio is about 2.0. First volution is endothyroid, coiling at a large angle to axis of outer volutions. Proloculus is very small and spherical. Spirotheca is thin and generally undifferentiated. However, it is sometimes composed of three layers, namely, a tectum, a lower dark layer and an upper tectorium. Septa are not fluted throughout length of shell. Chomata are asymmetrical and low. Tunnel is low and becomes gradually wide outward. Axial fillings of dense calcite are weakly developed in extreme polar regions.

Measurement: — See Table 4, p. 31.

Material: — Reg. no. PF 1028b, 1oc. 32; PF 1256c, 1oc. 57, the It_2 fossil zone at Itadorigawa.

Remarks: — The present specimens resemble *Fusiella typica sparsa* SHENG, mentioned above, in general characters. The former, however, differs from the latter in smaller size and smaller form ratio. The present form is distinguished from *Fusiella mui* SHENG, 1958 (p. 23, 24, pl. 3, figs. 9-12) of the Penchi Series of Liaoning, North China in smaller form ratio. It resembles *Fusiella pulchella* SAFONOVA, 1951 (p. 88, 89, pl. 6, figs. 11, 12) from the Podol horizon of the Russian platform and adjacent districts in shell form, size and form ratio, but the former differs from the latter in smaller number of volutions, smaller chomata and smaller proloculus.

More sufficient material of this form is necessary before a definite specific assignment can be made.

Occurrence: — This species occurs rarely in the It_2 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Higashiuwa-gun, Ehime Prefecture.

Subfamily Fusulininae MÖLLER, 1878, nom. transl. RHUMBLER, 1895

Genus *Fusulinella* MÖLLER, 1877

Fusulinella minutissima ISHII, sp. nov.

(Plate VII, Figures 20-33, Plate VIII, Figures 1-6)

Diagnosis: — Shell very small, inflated fusiform; inner one or two volutions coiling endothyroid or staffelloid; proloculus very small, generally 37 to 66 microns; spirotheca thin, consisting of schubertellinoid wall with undifferentiated diaphanotheca in inner volutions, becoming fusulinellioid wall outward; shell tightly coiled in inner volutions, loosely coiled in outer volutions; chomata generally weak, asymmetrical.

Description: — Shell very small for genus, inflated fusiform with rounded or bluntly pointed poles. Central portion is inflated dome-like; lateral slopes are generally convex. Inner one to two volutions are endothyroid or staffelloid, coiling at a large angle to axis of outer volution. Mature shells having 4 1/2 to 6 volutions are 0.787 to 1.639 mm in length and 0.458 to 0.885 mm in width. Form ratio is about 1.5 to 1.9.

Proloculus very small and spherical. Its outside diameter is commonly 37 to 66 microns, rarely up to 94 microns. Inner two or three volutions coil tightly and outer volutions coil loosely and uniformly.

Spirotheca is relatively thin and composed of a tectum, a diaphanotheca and thin upper and lower tectoria. Spirotheca of inner two volutions consists of three layers; a tectum, an intransparent diaphanotheca and an upper tectorium. Thin, transparent diaphanotheca becomes clear from third volution. Tectoria are generally thin; lower tectorium is generally thicker than upper one, but is discontinuous in outer volutions.

Chomata are weak and asymmetrical, but in some specimens they are prominent. Their tunnel sides are steep and their poleward sides extend often poleward. Tunnel is low and narrow. Its path is straight or slightly irregular in outer three volutions.

Measurement: — See Table 5, p. 32, 33.

Material: — Holotype, Reg. no. PF 1131, loc. 73, the It_2 fossil zone of the Itadorigawa group at Itadorigawa. PF 1123a, 1123b, 1125, 1126, 1127a, 1251, loc. 44; PF 1108, loc. 19; PF 1133, 1134, 1219, 1252, loc. 35; PF 1120, 1250, loc. 32; PF 1129b, 1130, 1132b, 1195c, 1240, loc. 73; PF 1267, loc. 20; PF 1121, loc. 57, all from the It_2 fossil zone at Itadorigawa; PF 1128a, loc. 62, the It_3 fossil zone at Itadorigawa.

Remarks and Comparison: — This species is one of the smallest species of *Fusulinella* in the Itadorigawa group. The specimens are abundant at the It_2 fossil zone.

This species belongs to the group of *Fusulinella schubertellinoides* by RAUSER, 1951. This group is characterized as follows (RAUSER, 1951, p.213): In the younger stages wall has a weakly differentiated diaphanotheca; shell is staffelloid or endothyroid form; spiral is tightly coiled; chomata are broad and low. In the adult stages, tunnel is wide; chomata are heavy; spiral is coiled. This species resembles closely *F. rjasanensis* RAUSER, 1951 (p. 214, pl. 28, figs. 5, 6) belonging to this group in the size of shell, mode of the coiling of the younger and adult stages and the degree of the growth of the chomata. *F. rjasanensis*, however, is more elongate than this species. Therefore, so far as the form ratio is concerned, this species can be distinguished from *F. rjasanensis*. However, these two species closely resemble with each other in many important characters. Accordingly, it is highly probable that these two species will turn out to be conspecific, if they are restudied by comparison of actual specimens.

The present species resembles *Fusulinella oliviformis* THOMPSON, 1935* (p.23-24, pl. 5, figs. 1-5) from the Atokan formation of Coal County, Oklahoma in the shell form, the size of shell and the shape of chomata. However the former species differs from the latter by its larger size, larger form ratio, smaller proloculus and thinner tectoria though the differences are slight on measurement. This species resembles also *F. irumensis* FUJIMOTO, 1936 (p. 38-40, pl. 2, figs. 1-8) from the Kwanto-Mountainland. This species, however, is clearly distinguished from the latter by the diaphanotheca, which is absent in the latter. In this respect *F. irumensis* may belong to the genus *Schubertella*.

Occurrence: — *Fusulinella minutissima* is abundant in the It_2 fossil zone and is rare in the It_3 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Higashiuwa-gun, Ehime Prefecture.

Fusulinella itadorigawensis ISHII, sp. nov.

(Plate VIII, Figures 7-25)

1956 *Fusulinella itadorigawensis* ISHII, (MS.), p. 23 (listed)

* THOMPSON, in 1937, cited *Fusulinella oliviformis* as *Eoschubertella*.

Diagnosis: — Shell comparatively elongated fusiform in outer volutions, spherical to fusiform in inner volutions; lateral slopes slightly concave in outer volutions; extension of shell along axis rapid in outer two volutions; shell tightly coiled in inner volutions, uniformly coiled in outer volutions; proloculus generally small; chomata asymmetrical, becoming low, elongated asymmetrical outward; tunnel low and broad.

Description: — Shell fusiform to elongated fusiform with almost straight axis of coiling; polar ends bluntly pointed or pointed, lateral slopes slightly concave. Mature shells having commonly 6 to 6 1/2, dominantly 6, volutions are 2.050 to 3.362 mm long and 1.066 to 1.517 mm wide. Form ratio is 1.9 to 2.6. A mature specimen (PF 1113, Pl. VIII, Fig. 25), which has exceptionally 5 1/2 volucions, is 3.444 mm long and 1.312 mm wide, form ratio being 2.6. Holotype is 2.911 mm long and 1.271 mm wide, giving form ratios of first to sixth volution 1.2, 1.4, 1.9, 2.0, 2.3 and 2.3, respectively. Shell form is subspherical in inner two or three volutions, and fusiform in outer volutions. In many specimens first volution is staffelloid, and in some other specimens endothyroid coiling at a right angle to outer volution.

Proloculus is generally small and spherical. Its outside diameter is 62 to 148 microns, commonly 66 to 82 microns. Inner two to three volutions are tightly coiled, and the following three to four volutions are coiled uniformly. Shell extends rapidly along axis from third volution. Heights of first to sixth volution of holotype are 33, 49, 66, 114, 164 and 180 microns, repectively.

Spirotheca is thin, composed of a tectum, a comparatively thick diaphanotheca, and upper and lower tectoria. Diaphanotheca appears from second to last volution. Upper tectorium is very poorly developed; lower tectorium is discontinuous and thick near central portion of volution. Thicknesses of diaphanotheca of second to sixth volution of holotype are 4, 8, 12, 16 and 20 microns, respectively. Septa are plane in central portions of shell, but are weakly fluted in polar regions.

Tunnel is narrow in inner two or three volutions but becomes rapidly wide outward. Chomata asymmetrical, and well developed, except in outer volutions where they are sometimes very weak or not developed. Their heights are a half or less than one-half of chambers in third or fourth volution of shell; their tunnel sides are usually steep, sometimes overhanging, but poleward slopes are very gentle, extending considerable distance to poles. In some specimens chomata are rounded hillock-shape (округлый, бугорковидный, in Rauser, 1951, p. 28) in outer volutions.

Measurement: — See Table 7, p. 32-35.

Material: — Holotype, Reg. no. PF 1077, loc. 2, the It_1 fossil zone of the Itadorigawa group at Itadorigawa. Other specimens, PF 1076, 1078a, 1078b, 1082a, 1083, 1084, 1085b, 1086, 1109, 1112, 1114, 1116, 1117, loc. 2; PF 1110, 1113, 1118, loc. 29; PF 1081, loc. 38; PF 1111, loc. 41, the It_1 fossil zone at Itadorigawa.

Remarks: — The present species is abundant in the It_1 fossil zone, and shows a wide range of variation. Specimens having 5 to 5 1/2 volutions are rather commonly met with, but most of them are immature ones. Mature specimens have commonly 6 to 6 1/2 volutions. In the fifth volution these mature specimens show the following measurements: H. L., 0.738-1.197 mm; R. V., 0.393-0.574 mm; H. L./R. V. ratio, 1.7-2.3. The above-mentioned immature specimens with 5 to 5 1/2 volutions fall within these measurements and are also otherwise similar to the immature stage of abundantly represented adult individuals. Only one specimen, having 5 1/2 volutions (PF 1113) among the present rich collection, is regarded as mature because it has the following measurements of the fifth volution: H.L., 1.577 mm; R.V., 0.607 mm; H.L/R.V. ratio, 2.6.

Two forms may be recognized among specimens of this species. One is fusiform and small (for example, Pl. VIII, fig. 9), the other is elongate fusiform and large (Pl. VIII, Fig. 15). However, these two forms cannot be distinguished with respect to the other shell characters and there exist some intermediate forms between them. Therefore they are regarded as conspecific.

Comparison: — The present species appears to be closely allied to *F. colaniae* LEE et CHEN, 1930 which is said to have variable shell form. The specimens illustrated in Pl. 11, Fig. 9 of LEE & CHEN (1930) was subsequently selected by RAUSER (1951, p.217) as the lectotype of *F. colaniae*. According to her, the ratio of the length to the diameter of this lectotype is 2.85. In addition, *F. colaniae* was characterized by her as follows: Inner whorls flattened; shell elongated; chomata ribbon-like, low; aperture low and broad; septa straight, but undulate at the very ends of the axis. However, her description about the inner volutions and chomata is difficult to understand from the original description and original illustrations of the poorly preserved lectotype. If *F. itadorigawensis* is compared with *F. colaniae* as interpreted by RAUSER, the present species can be distinguished from *F. colaniae* in RAUSER by its inflated inner volutions and asymmetrical to elongated asymmetrical poleward elongated chomata. Specimens, hitherto reported by LEE & CHEN, RAUSER and PUTRJA, as *F. colaniae*, show wide range of variation in size, form ratio and size of proloculus, as shown in table 6. In these respects it is rather difficult to distinguish *F. itadorigawensis* from *F. colaniae*.

	No. vol.	L. (mm)	W. (mm)	F.R.	Pr. (μ)
F. colaniae LEE et CHEN, 1930	5 1/2 (5 1/2-6)	2.12	0.86	2.4 (lecto-type) 2.8	50
F. colaniae, in RAUSER, 1951	5-6	2.92-3.94	1.60-1.38	2.7-2.8	50-80
F. colaniae, in PUTRJA, 1948	6-6 1/2	3.2-3.9	1.1-1.5	1.8-2.7	62-131
F. itadorigawensis ISHII	6-6 1/2	2.05-3.36	1.07-1.52	1.9-2.6	52-131
F. colaniae var. *borealis* RAUSER, 1951	5-5 1/2	3.6-3.9	1.23-1.05	2.9-3.2	50-80
F. colaniae var. *meridionalis* RAUSER, 1951	5-6	2.76-3.5	1.14-1.50	2.3-2.5	80
F. paracolaniae RAUSER, 1951	6 1/2-7	2.6-2.95	1.26-1.43	2.3	45-60

Table 6. Table showing the differences in the length (L.), width (W.), form ratio (F. R.) and proloculus size (Pr.) among *Fusulinella itadorigawensis*, *F. colaniae* and *F. paracolaniae*.

The present species is comparable with the group of *F. colaniae* in RAUSER (1951, p. 216) with respect to the length, form ratio, number of volutions and comparatively small size proloculus. The present species closely resembles *F. colaniae* var. *meridionalis* RAUSER, 1951 (pl. 30, figs. 5, 6) from the Russian platform, but can be distinguished from the holotype of the latter variety in the asymmetrical chomata and slightly concave lateral slopes and from another illustrated specimen of the variety in slightly concave lateral slopes in outer volutions.

Fusulinella haymondensis SKINNER et WILDE, 1954 (pl. 96, figs. 8-12) from the Haymond formation of northeastern Brewster County, Texas, differs distinctly from the present species in having only five volutions not beyond six volutions, in the smaller size

and in the different shell form. It is, however, worthy of note that immature specimens of the present species, having 5 to 5 1/2 volutions (for example, Pl. VIII, Figs. 7, 18, 21 -23), are hardly distinguishable from *F. haymondensis*.

Occurrence: — *Fusulinella itadorigawensis* is abundant in the It_1 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Higashiuwa-gun, Ehime Prefecture.

Fusulinella iyoensis ISHII, sp, nov.

(Plate X, Figures 3, 4)

Diagnosis: — Shell large, 3.81 to 4.43 mm long, 1.80 to 1.93 mm wide, typically fusiform; lateral slopes tightly concave; shell uniformly coiled; proloculus moderate; tunnel narrow, becoming wide gradually; chomata asymmetrical, becoming comparatively weak and rounded hillock-shape in outer volutions.

Description: — Shell large for *Fusulinella* of Itadorigawa group, typically fusiform with almost straight axis of coiling and inflated central portion. Lateral slopes are slightly, but distinctly concave. Poles are bluntly pointed. Mature specimens having 6 to 6 1/2 volutions are 3.813 to 4.428 mm long and 1.804 to 1.927 mm wide, giving form ratio of 2.1 to 2.3.

Form ratios of first to sixth volution of holotype are 1.2, 1.5, 1.8, 1.9 and 2.1, respectively. First two volutions are subspherical to short fusiform. In short, shell extends rapidly along axis from first to last volution.

Proloculus is moderate in size and spherical in shape. Its outside diameter is 131 microns in holotype, but 98 microns in another specimen. Shell coils uniformly. Heights of first to sixth volution of holotype are 49, 66, 114, 164, 246 and 279 microns, respectively. Chambers are almost of same in height in third to fourth volution, but height increases slightly poleward in outer two volutions.

Spirotheca is typical for genus, composed of a tectum, a diaphanotheca, and upper and lower tectoria. Diaphanotheca is generally thin. It appears from first volution though it is indistinct here, becoming distinct from third volution onward. In general lower tectorium is thin in inner three volutions. It becomes rapidly thick from fourth volution outward, but decreases in thickness poleward from central portion. Thickness of diaphanotheca of first to sixth volution in holotype is 4, 8, 12, 12, 16 and 20 microns, respectively. Septa are essentially plane in central portion and are fluted in polar regions. Tunnel is narrow and becomes gradually wide outward. Its path is almost straight throughout growth. Tunnel angles of first to fifth volution of holotype are 19, 23, 28, 28 and 38 degrees, respectively. Chomata are prominent in inner four volutions and become slightly weak outward and are absent in last volution. They are asymmetrical; tunnel side is vertical or overhanging; poleward slopes extend almost whole way to poles in inner four volutions, but become steep in outer two volutions. Their heights are more than two-thirds to half of heights of chambers.

Measurement: — See Table 7, p. 34, 35.

Material: — Holotype, Reg. no. PF 1087, 1oc. 2, the It_1 fossil zone of the Itadorigawa group at Itadorigawa. Other specimen, PF 1079, 1oc. 2, the It_1 fossil zone at Itadorigawa.

Remarks and Comparison: — Only two specimens are found from the It_1 fossil zone. As these materials are well preserved, the writer described this form as a new species. The second specimen is more slender in shape and larger in size than the holotype. But the other characters of this specimen is similar to that of the holotype.

This species resembles *Fusulinella pseudobocki* LEE et CHEN, 1930 (p. 122, 123, pl. 9, figs. 10-14; pl. 10, figs. 1-7) from the Huanglung limestone of China in the shell form and shell size. In *F. pseudobocki*, however, the inner volutions are more compactly coiled than in the present species, outer volutions are more loosely coiling and chomata are more prominent, becoming subrectangular in outer volutions.

From *Fusulinella simplicata onoi*, this species is easily distinguished by its more concave lateral slopes, smaller proloculus, and more tight coiling.

Occurrence: — *Fusulinella iyoensis* occurs rarely in the It_1 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Higashiuwa-gun, Ehime Prefecture.

Fusulinella simplicata TORIYAMA, 1958

1958 *Fusulinella simplicata* TORIYAMA, Mem. Fac. Sci., Kyushu Univ., Ser. D, Geol., Vol. 7, p. 36-39, pl. 2, Figs. 7-13.

Diagnosis: — Shell fusiform with dome-like central portions and bluntly pointed poles. Lateral slopes convex in inner volutions, tending to become almost straight to concave in outer volutions, especially near poles. Proloculus small to large; its outside diameter 82 to 197 microns. Shell tightly coiled in inner volutions, expanding more or less rapidly and uniformly from third or fourth volutions outward. In some specimens septa weakly fluted in last volution. Spirotheca comparatively thin. Tunnel narrow in inner two or three volutions, becoming rapidly wide in outer two or three volutions. Chomata asymmetrical in inner volutions and rounded hillock-shape in outer volutions, becoming very weak outward.

Remarks: — In the Itadorigawa group following subspecies and varietal forms are discriminated:

Fusulinella simplicata simplicata

F. simplicata onoi ISHII, subsp. nov.

F. simplicata var. α

F. simplicata var. β

The above diagnosis is drawn from TORIYAMA's original description and from the writer's observation on the Itadorigawa specimens. Beside *F. simplicata simplicata* which is delimited in the present paper, *F. simplicata onoi* and *F. simplicata* var. α are represented also among TORIYAMA's paratypes, as will be mentioned below.

Fusulinella simplicata simplicata

(Plate IX, Figures 4, 5, 7-9)

1956 *Fusulinella simplicata* TORIYAMA s.s. (MS.), ISHII p. 22 (listed).

1956 *Fusulinella ichikawai* ISHII (MS.), p. 22 (listed).

1958 *Fusulinella simplicata* TORIYAMA. p. 36-39, pl. 2, figs. 7, 9 (?), 13 (?), not 8, 10, 11, 12.

Description of the specimens from the Itadorigawa group: — Shell inflated fusiform, with bluntly pointed poles. Shell form excepting last volution is inflated fusiform with dome-like central portions. In last volution lateral slopes tend to become slightly concave near poles. Mature specimens of 5 to 6 volutions are 2.419 to 3.116 mm long and 1.353 to 1.722 mm wide. Form ratio is 1.9 to 2.1. First volution is spherical and second to fourth volution subspherical to ellipsoidal, and last volution is fusiform. Most typical specimen in the Itadorigawa group with 5 volutions is 2.952 mm long and 1.558

mm wide, giving form ratios of first to fifth volution 1.0, 1.2, 1.2, 1.7 and 1.9, respectively.

Proloculus is small in size and spherical, and its outside diameter measures 110 to 148 microns. Shell coils tightly in first two volutions. In outer two volutions shell extends rapidly along axis throughout growth. From third or rarely fourth volution outward height increases rapidly and uniformly. Heights of first to fifth volution of typical specimen (PF 1093) are 66, 82, 148, 180 and 246 microns, respectively. Rates of expansion are 1 : 1.2 (1 vol. : 2 vol.), 1 : 1.8 (2 vol. : 3 vol.), 1 : 1.2 (3 vol. : 4 vol.), and 1 : 1.3 (4 vol. : 5 vol.), respectively. Chambers increase slowly in height poleward from tunnel.

Spirotheca is composed of a tectum, a diaphanotheca, and upper and lower tectoria. Diaphanotheca becomes clear from second volution. Lower tectorium becomes rapidly thick from third volution. In typical specimen, thickness of protheca of first to fifth volution is 12, 12, 16, 20 and 20 microns, respectively. Septa are plane in central part of inner three volutions, but are irregulaly fluted in extreme polar regions. In some specimens septa are irregularly undulated from poles nearly to edges of chomata in outer one or two volutions of mature specimens.

Tunnel is low. It is narrow in inner three volutions and becomes wide in outer volutions. Chomata are present in all volutions of shell excepting last one, but they are comparatively weak in outer volutions. Their tunnel sides are usually steep, sometimes overhanging. Their poleward slopes are gentle in inner three volutions, extending considerable distance to poles, but are steep in outer two volutions.

Measurement: — See Table 8, p. 34-37.

Material: — Reg. no. PF 1093, 1oc. 40; PF 1082b, 1179, 1262, 1oc. 2; PF 1089, 1oc. 29; PF 1088, 1oc. 38, the It_1 fossil zone at Itadorigawa.

Remarks: — *Fusulinella simplicata* was originally described from the lower part of the *Fusulinella biconica* zone, $Cm\beta$ of the Akiyoshi Limestone by TORIYAMA in 1954.

This species may be considerably variable as understood from the seven original specimens (axial section) shown in plate 2 of TORIYAMA (1958). In the holotype the following characters are remarkable:

1) Respective volutions are inflated dome-like.

2) In the last volution the lateral slopes tend to become concave near to the polar ends.

3) The shell coils tightly in the inner two volutions and expands rapidly and uniformly from the third volution outward.

4) The chomata are weak. Their tunnel sides are usually steep, sometimes overhanging, and their poleward slopes extend considerable distance to the poles in the inner three volutions, but their slopes are steep in the outer volutions.

The writer considers the above shell characters as the important features of *Fusulinella simplicata* s.s.

The Itadorigawa specimen illustrated in Pl.IX, Fig.5 (PF 1093) shows very distinctly the above shell characters. In these typical specimens of *F. simplicata* septa of the last volution are not undulated.

Among Itadorigawa specimens, however, there are found a few specimens, in which septa are fluted in the last volution. The writer intended formerly to separate this form as *Fusulinella ichikawai* (MS.) from *F. simplicata*. If the weak septal fluting of the last volution of this form is regarded as important, this form must be classed within the genus *Dagmarella*. Before preceding further, mention must be made about the *Dagmarella*. SOLOVJEVA (1955) set up the genus *Dagmarella* on the basis of *D. prima* SOLOVJEVA, 1955 from the Moscovian of Mt. Nura-Tau and Aristan-Tau. According to her *Dagmarella*

may be characterized as follows: Septa plain in the inner volutions and weakly fluted along the whole length of the shell in the outer one or two volutions; the wall has three layers, a tectum, protheca and outer tectorium; the inner chambers are covered with an extraordinarily heavy layer of inner tectorium. She referred *Fusulinella iowensis* THOMPSON, *F. gephyrea* DUNBAR et HENBEST, and *F. cadyi* D. et H. to the genus *Dagmarella* on the basis of the weakly fluted septa in the outer volutions. The writer thinks, however, that the aforementioned form from the Itadorigawa group belongs to a varietal form of *Fusulinella simplicata simplicata*, because the other shell characters of this form correspond to those of *F. simplicata simplicata*, and because it is quite small in individual number and occurs always together with *F. simplicata simlicata*.

In general shell characters *F. simplicata simplicata* from the Itadorigawa group closely resembles *Fusulinella laxa* SHENG, 1958 (p. 33, 92, pl. 8, figs. 17-21, pl. 9, figs. 1-4) from the Penchi Series, the middle Upper Carboniferous of Taitzeho valley, Liaoning. The present subspecies, however, can be distinguished from *F. laxa* in that in the latter the shell is larger, with smaller proloculus and that the inner two volutions coil more tightly.

Occurrence: — *Fusulinella simplicata simplicata* occurs in the It_1 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Higashiuwa-gun, Ehime Prefecture.

Fusulinella simplicata onoi ISHII, subsp. nov.

(Plate IX, Figures 10-19, Plate X, Figures 1, 2)

1956 *Fusulinella simplicata onoi* ISHII (MS.), p. 22 (listed)
1958 *Fusulinella simplicata* TORIYAMA, Mem. Fac. Sci. Kyushu Univ., Ser. D, Geol., Vol. 7, p. 36-39, pl. 2, fig. 8 only.

Description: — Shell large in general, typically fusiform with almost straight axis of coiling and with bluntly pointed poles. Lateral slopes are almost straight to slightly concave. Number of volutions of mature shells is usually 5 to 5 1/2, rarely 6. Mature shells are 2.050 to 3.731 mm long and 1.189 to 1.968 mm wide. Form ratio is 1.7 to 2.1. Holotype with 5 1/2 volutions is 3.444 mm long and 1.845 mm wide, giving form ratios of first to fifth volution 1.1, 1.5, 1.6, 1.7 and 1.9, respectively. In most specimens first volution is almost spherical, second to last volutions are fusiform.

Proloculus is large in size and spherical in shape. Its outside diameter is 131 to 197 microns, rarely 114 microns. Shell coils loosely. From third to fourth volution outward shell exapnds rapidly and uniformly. Heights of chambers from first to fifth volution are 49-66, 82-114, 98-164, 148-213 and 180-295 microns, respectively. Chambers increase slightly in height poleward from tunnel.

Spirotheca is composed of a tectum, a diaphanotheca, and upper and lower tectoria. Diaphanotheca appears from first or second volution. Tectorium is generally thin, especially upper tectorium is very thin. Lower tectorium is discontinuous and decreases in thickness poleward from edge of chomata. In last volution spirotheca is composed of a tectum and a diaphanotheca. Thickness of spirotheca, i.e. protheca plus epitheca, on base of tunnel of first to fifth in many specimens is 12-33, 16-41, 29-49, 25-74 and 16-98 microns, respectively. Thickness of diaphanotheca of first to fifth volution of holotype is 4, 8, 12, 16 and 20 microns, respectively.

Septa are almost plane in central portion and are fluted in polar regions. Meshwork is seen in the umbilical ends. In some specimens, for instance PF 1092 (Pl. IX, Fig. 13) septa are irregularly fluted in central portion of last volution.

Tunnel is narrow in inner two or three volutions and becomes rapidly wide in outer two or three volutions. Its path is generally straight. Tunnel angles of first to fifth volution of many specimens vary between 10-28, 17-29, 20-34, 27-51 and 30-62 degrees, respectively. Chomata are present in all volutions, but they are very weak in outer volutions and mostly absent in last volution. Their heights are more than a half of those of chambers in inner two or three volutions. But beyond second or third volution their heights decrease and are less than a half of chambers. Tunnel sides of chomata are usually steep, but poleward slopes are gentle. Poleward sides of chomata of inner two or three volutions extend down lateral slopes of volutions into polar regions, but in outer volutions they do not extend into polar regions.

Measurement: — See Table 8, p. 34-37.

Material: — Holotype, Reg. no. PF 1090, loc. 2, the It_1 fossil zone of the Itadorigawa group at Itadorigawa. Other specimens, PF 1074, 1091, 1100, 1101, 1102, 1104, 1105, 1106, loc. 2; PF 1092, 1107, loc. 38; the It_1 fossil zone at Itadorigawa. PF 1099, loc. 62, the It_3 fossil zone at Itadorigawa.

Remarks: — *Fusulinella simplicata onoi* is one of the largest species among *Fusulinella* of the Itadorigawa group.

Fusulinella simplicata onoi can be distinguished from *F. simplicata simplicata* in that in the former the shell is larger at maturity, with larger proloculus and that the shell coils loosely. However, *F. simplicata onoi* resembles *F. simplicata simplicata* in many essential features, especially in the shell form, the development of the chomata and in the rapid expansion from the third or fourth volution. Furthermore, there exist some intermediate forms (for instance, PF 1074 (Pl. X, Fig. 1)), which are conveniently referred to *F. simplicata onoi*. Like *F. simplicata simplicata* they have comparatively smaller proloculus and tightly coiled shell, but in the shell form and in the mode of the expansion of the outer volutions they resemble some specimens of *F. simplicata onoi*. Owing to some common shell characters and the presence of intermediate forms, *onoi* is here regarded as a subspecies of *F. simplicata*. In these respects one of the paratypes of *F. simplicata* TORIYAMA (Reg. no. G.-K. D 225, pl. 2, fig. 8) belongs to the present new subspecies.

This subspecies is named in honour of Mr. Sakutaro ONO, an ardent amateur of geology of Ehime Prefecture.

Occurrence: — *Fusulinella simplicata onoi* is abundant in the It_1 fossil zone of the Itadorigawa group. It rarely occurs also in the It_3 fossil zone.

Fusulinella simplicata var. α

(Plate IX, Figures 1-3, 6)

1958 *Fusulinella simplicata* TORIYAMA, Mem. Fac. Sci. Kyushu Univ., Ser. D, Geol., vol. 7, p. 36-39, pl. 2, figs. 10-11 only.

This variety is distinguished from *F. simplicata simplicata* in the following characters: Shell generally small, inflated fusiform with short axis; form ratio, 1.6 to 1.9; proloculus smaller; extension of shell along axis not rapid; volutions not rapidly increasing their height through growth; cancave lateral slopes in last volution not distinct.

Among these different points especially important ones are that expansion of this variety is not so rapid as that of *F. simplicata simplicata* and that shell of former is short inflated fusiform.

Some specimens (PF 1094, PF. 1103, Pl. IX, Figs. 1,2) included in this variety resemble typical form, including holotype, of *F. jamesensis* THOMPSON, PITRAT et SANDERSON

(1953, p. 548-550, pl. 57, figs. 8-10, 16-17) from the Cache Creek limestone in Central British Columbia. Former can be distinguished from latter in larger height of chambers in outer volutions, larger proloculus and more prominent chomata.

Measurement: — See Table 8, p. 36-37.

Material: — Reg. no. PF 1094, 1oc. 41; PF 1095, 1103, 1oc. 2; PF 1098a, 1oc.29, the It_1 fossil zone at Itadorigawa.

Occurrence: — *Fusulinella simplicata* var. *α* occurs in the It_1 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Higashiuwa-gun, Ehime Prefecture.

Fusulinella simplicata var. *β*

(Plate VIII, Figures 26-28)

This variety differs from *F. simplicata simplicata* in the following features: — Shell smaller; central portion of outer volution comparatively gently arched; lateral slopes slightly convex even in last volution; volutions not rapidly increasing their height through growth.

This variety resembles a paratype (pl. 7, fig. 11) of *Fusulinella asiatica* Igo, 1957. However, this variety can be distinguished from many specimens including holotype of *F. asiatica* in that latter are more inflated fusiform with short axis, more tightly coiled in early volutions, and provided with a smaller proloculus.

Measurement: — See Table 8, p. 36-37.

Material: — Reg. no. PF 1075, 1085a, 1096, 1oc. 2, the It_1 fossil zone at Itadorigawa.

Occurrence: — *Fusulinella simplicata* var. *β* occurs in the It_1 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Higashiuwa-gun, Ehime Prefecture.

Fusulinella pygmaea Ishii, sp. nov.

(Plate X, Figures 8-19)

Diagnosis: — Shell very small, subrhomboidal with somewhat tapering polar regions; inner one or two volutions coiling endothyroid or staffelloid; proloculus small, 37 to 57 microns; number of volutions generally 5 to 5 1/2; spirotheca of inner volutions single layered or undifferentiated; tectoria very thin or indistinct; tunnel narrow; chomata weak, asymmetrical.

Description: — Shell very small for genus, subrhomboidal with inflated median part, slightly concave lateral slopes, polar regions somewhat tapering and its ends bluntly or moderately pointed. Inner one to two volutions are endothyroid or staffelloid, coiling at a large angle to axis of outer volutions. Mature shells having commonly 5 to 5 1/2 volutions and rarely 4 1/2 to 6 volutions are 0.836 to 1.574 mm long and 0.410 to 0.787 mm wide. Form ratio is 1.8 to 2.3.

Proloculus is very small and spherical. Its outside diameter is 37 to 57 microns. Shell coils uniformly. Heights of chambers are about same throughout length of shell. Septa are straight, but they are weakly fluted at polar regions.

Spirotheca is relatively thin, composed of a tectum, a diaphanotheca and thin upper and lower tectoria. Spirotheca of inner two or three volutions is single layered or undifferentiated. Tectoria are very thin and discontinuous. Diaphanotheca becomes distinct from fourth volution (rarely from third volution) onward. Thickness of diaphanotheca from third to fifth volution of holotype (PF 1152) is 4, 8, and 8 microns, respectively.

Tunnel is narrow, about one-half as high as chamber. Chomata weak and asymmetrical.

Measurement: — See Table 9, p. 38, 39.

Material: — Holotype, Reg. no. PF 1152, loc. 73, the It_2 fossil zone at the Itadorigawa group at Itadorigawa. Other specimens, PF 1003b, 1058b, 1153, loc. 44; PF 1136a, 1137a, 1137c, loc. 57; PF 1143, loc. 35, the It_2 fossil zone. PF 1154, 1156, loc. 60; PF 1226, loc 51, all from the It_3 fossil zone at Itadorigawa.

Remarks: — This species is one of the smallest species of *Fusulinella* from the Itadorigawa group. Among the known species of the group of *F. pulchra-alta* (Ishii, 1958, p. 48, Rauser, 1951, p.234), this species resembles most closely *Fusulinella elegantula* in the shape of the shell, the mode of coiling and the shape of the tunnel and chomata. However this species is distinguished from *F. elegantula* in the smaller size, the small proloculus and the weaker chomata.

This species resembles *F. subpulchra* Putrja in Rauser from the Kashir horizon of the Russian platform and adjacent districts in the ontogenetical development of the spirotheca and shell form. It can be, however, distinguished from *F. subpulchra* in the smaller size, the smaller number of volutions and the weaker chomata.

This species resembles in some respects the group of *Profusulinella librovichi* (Rauser, 1951, p. 173), especially *P. prolibrovichi* Rauser 1951 and *P. pseudolibrovichi* Safonova 1951 which was reported from the Russian platform and adjacent districts. However these species of *Profusulinella* have three layered spirotheca of *Profusulinella* type. These species have often the axial fillings in the polar regions as seen on figures 1-9, plate 18 of Rauser (1951), although Rauser did not mention of this in the text. In these two features *Fusulinella pygmaea* can clearly be distinguished from the above two species.

Occurrence: — *Fusulinella pygmaea* is abundant in the It_2 fossil zone, especially the upper part, and occurs rarely in It_3 fossil zone of the Itadorigawa group at Itadorigawa.

Fusulinella elegantula Ishii, sp. nov.

(Plate X, Figures 20-34)

1956 *Fusulinella elegantula* Ishii, (MS.), p. 23 (listed)

Diagnosis: — Shell small subrhomboidal with tapering polar regions; lateral slopes concave; early volutions coiling endothyroid or staffelloid; shell coiling tightly and uniformly; number of voutions generally 6 to 7; proloculus small, 41 to 66 microns; spirotheca relatively thin; tectoria generally thin, becoming comparatively thick in outer volutions; tunnel narrow; chomata prominent, subtriangular and asymmetrical.

Description: — Shell small for genus, subrhomboidal with inflated median portion and concave lateral slope. Polar regions are tapering and poles are somewhat pointed. Inner one to two volutions are endothyroid or staffelloid, coiling at a large angle to axis of outer volutions. Mature shells having commonly 6 to 7 volutions are 1.722 to 2.706 mm long and 0.902 to 1.148 mm wide. Form ratio is 1.8 to 2.3, rarely up to 2.8. Holotype is 2.009 mm long and 1.025 mm wide, giving form ratio of first to seventh volution 1.4, 1.5, 1.6, 2.0, 1.9, 1.9 and 2.0, respectively.

Proloculus is small and spherical. Its outside diameter is 41 to 66 microns. Shell coils tightly and uniformly. Heights of chambers are about same from tunnels to poles. Septal counts of first to seventh volution are 6, 6-8, 10-12, 14-15, 18, 19-22 and 24, respectively. Septa are almost plane in central portions and are weakly fluted in polar regions.

Spirotheca is relatively thin. Diaphanotheca is not differentiated in inner two

volutions, but becomes distinct from third to last volution. Tectoria are generally thin. Lower tectorium becomes comparatively thick in outer two volutions, except last volution where tectoria are usually absent. Thickness of diaphanotheca from third to sixth volution of holotype (PF 1144) is 4, 8, 8 and 16 microns, respectively.

Tunnel is narrow. Height of tunnel equals one-half of height of chambers. Chomata are asymmetrical and well developed except for inner two volutions. Tunnel sides of chomata are very steep, perpendicular or sometimes overhanging. Poleward slopes of chomata are extending to polar ends in inner volutions, but are steep and subtriangular in outer volutions.

Measurement: — See Table 9, p. 38-39.

Material: — Holotype, Reg. no. PF 1144, loc. 62, the It_3 fossil zone of the Itadorigawa group at Itadorigawa. Other specimens, PF 1268, loc. 32, the It_2 fossil zone at Itadorigawa. PF 1145a, 1145b, 1147b, 1148, 1149, 1150a, 1196b, loc. 62; PF 1139, 1140, 1141, 1142, 1270, loc. 51; PF 1269, loc. 60, the It_3 fossil zone at Itadorigawa.

Remarks and Comparison: — This species belongs to the group of *Fusulinella alta* (Ishii, 1958, p.48). The group of *F. alta* is distinguishable from typical *Fusulinella* (group of *Fusulinella bocki*) in the following shell characters: Shell subrhomboidal in shape, with inflated median portion, concave lateral slope, tapering toward polar ends, which are sharply or bluntly pointed; chomata more asymmetrical and subtriangular. After the writer's 1958 paper was published, he was able to refer fully to Rauser (1951), in which she recognized the group of *Fusulinella pulchra*. The above shell characters of the group of *F. alta* are similar to those of the group of *F. pulchra* by Rauser, 1951. Therefore the both are synonymous and the latter can be used instead of the former. This group includes following species:

Fusulinella alta Verville, Thompson et Lokke, 1956
Fusulinella elegantula Ishii, sp. nov.
Fusulinella eopulchra Rauser, 1951
Fusulinella itoi Ozawa, 1925
Fusulinella nevadensis Verville, Thompson et Lokke, 1956
Fusulinella paraiowensis Putrja, 1956
Fusulinella pulchra Rauser et Beljaev, 1940
Fusulinella pygmaea Ishii, sp. nov.
Fusulinella subpulchra Putrja, 1937
Fusulinella usvae Dutkevitch, 1932
? *Neofusulinella biconica* Hayasaka, 1924

Most of these species are larger than *F. elegantula*. It can be distinguished from *F. pulchra* in the smaller size, the smaller proloculus and the smaller number of volutions. From *F. itoi*, which is abundantly represented in Akiyoshi, it differs in its smaller size, smaller proloculus and more steep poleward slope of chomata in the outer volutions.

In general this species has some resemblance with *Wedekindellina prolifica* Kanmera, 1954 (p. 130-133. pl. 12, figs. 29-36; pl. 13, figs. 1-8) from the zone of "*Fusulina*" [=*Beedeina*], the Kurikian Stage of the Yayamadake limestone, Kyushu, Japan, in the shell form, the growth of the shell and the shape of the chomata. However this species differs distinctly from *W. prolifica* in the absence of the axial fillings in the polar region, though they are very weak in the latter species. Furthermore, this species is distinguishable from the latter in the smaller size, smaller number of volutions and endothyroid form in inner two volutions.

Occurrence: — *Fusulinella elegantula* is common in the It_3 fossil zone of the Itadori-

gawa group at Itadorigawa. It rarely occurs in the It_2 fossil zone.

Fusulinella bocki Möller, 1878

In this paper the following subspecies of this species are discriminated:
Fusulinella bocki bocki
F. bocki rotunda Ishii subsp. nov.
F. bocki biconiformis Ishii subsp. nov.
The diagnostic features of these subspecies are given below:

character / name	shell form	no. of vol.	coiling	length (mm)	width (mm)	size of proloc. (μ)	form ratio
F.bocki bocki	inflated fusiform to spherical	5 1/2 to 6 1/2 rarely 7 to 8	uniform	2.0 to 3.1	1.3 to 1.8	medium 82 to 131	1.6 to 2.0 rarely 1.2 to 1.5
F. bocki rotunda	subspherical to ellipsoidal	5 1/2 to 6 1/2 rarely 7 to 7 1/2	loose	2.2 to 3.2	1.4 to 2.5	large 148 to 180 rarely 131	1.4 to 1.6
F. bocki biconiformis	inflated fusiform to biconical	6 1/2 to 8	tight	2.4 to 3.6	1.6 to 2.1	minute to medium 49+to 114	1.4 to 1.7 rarely 1.9 to 2.0

Fusulinella bocki bocki

(Plate XI, Figures 1-13)

1878 *Fusulinella bocki* Möller, Mem. Acad. Imp. Sci., st. Pétersb., 7, ser., tome 25, p. 104-107, pl. 5, figs. 3a-g, pl. 14, figs. 1-4.
1927 *Neofusulinella bocki*, Lee, Palaeont. Sinica, ser. B, vol. 4, fasc. 1, p. 16-18, pl. 1, fig. 2, pl. 2, figs. 12, 13, 17.
1930 *Fusulinella* (*Neofusulinella*) *bocki*, Lee & Chen, Mem. Nat. Res. Inst. Geol., no. 9, p. 121, pl. 8, figs. 8-12, pl. 9, figs. 1-3.
1940 *Fusulinella bocki*, Rauser, Beljaev & Reitlinger, Тр. Нефт. геол.-развед. ин-та., нов. сер., вып 7, табл. 5, фиг. 11-13
1945 *Fusulinella bocki*, Thompson, Amer. Jour. Sci., vol. 243, p. 447-450, pl. 1, fig. 15.
1951 *Fusulinella bocki*, Rauser, Тр. Инст. геол. наук. АН СССР, справ-опред., стр. 223, табл. 231, фиг. 7-9
1958 *Fusulinella bocki*, Sheng, Palaeont. Sinica, no. 143, new ser. B, no. 7, p. 31, pl. 7, figs. 14, 15, 17, ? 16.
(cfr.) 1934 *Fusulinella bocki*, Chen, Mem. Nat. Res. Inst. Geol., no. 14, p. 36, 37, pl. 6, figs. 1-3.
(cfr.) 1944 *Fusulinella bocki*, Toriyama, Japan. Jour. Geol. Geogr., vol. 19, nos. 1-4, p. 70-72, pl. 6, figs. 3-8.
(cfr.) 1948 *Fusulinella bocki*, Putrja & Leontovich, Бюлл. Моск. об-ва испыт. природы, отд. геол., т. 23 (4), стр. 31, табл. 2, рис. 7
(cfr.) 1958 *Fusulinella* sp. cfr. *Fusulinella bocki*, Toriyama, Mem. Fac. Sci., Kyushu Univ. Ser. D, geol., vol. 7, pl. 2, figs. 20-22, pl. 3, figs. 1, 2.
(not) 1925 *Fusulinella bocki*, Ozawa, Jour. Coll. Sci. Imp. Univ. Tokyo, vol. 45, art. 6, p. 17, 18, pl. III, figs. 7, 9, 10.

Description of the specimens from the Itadorigawa group: — Shell inflated fusiform with pointed or bluntly pointed poles, sometimes* subspherical or ellipsoidal with rounded poles. Central portion is inflated dome-like and later slopes are generally convex. Number of volutions of mature shell is usually 5 1/2 to 6 1/2, rarely 7 to 8. Mature shells vary from 1.968 to 3.075 mm in length and from 1.271 to 1.763 mm in width. Form ratio is 1.6 to 2.0, rarely 1.2 to 1.5. Form ratio does not very much increase from early to last volution. Inner two or three volutions are spherical. A typical specimen (PF 1161) is 2.870 mm long and 1.640 mm wide, giving form ratios of first to sixth volution 1.0, 1.3, 1.3, 1.3, 1.4 and 1.7, respectively. Proloculus is medium in size and spherical. Its outside diameter is 82 to 131 microns. Shell coils uniformly. Heights of first to sixth volution vary between 33-49, 49-66, 82-114, 82-164, 148-230 (rarely 98) and 131-262 microns, respectively. Heights of chambers are essentially same throughout length of shell, except for extreme polar regions of outer volutions of fusiform specimens where chambers become slightly higher than in median part of shell.

Speirotheca consisting of a tectum, a diaphanotheca, and upper and lower tectoria. Diaphanotheca is visible from second to last volution. Lower tectorium is well developed on inner surface of protheca, especially in central portion of shell, except for last volution where tectoria are usually lacking. Upper tectorium decreases in thickness poleward from edge of chomata. Thickness of protheca of second to seventh and a half volution of a typical specimen is 4, 4, 8, 16, 20 and 20 microns, respectively.

Septa are almost plane in central portion of shell, but are weakly fluted in polar regions. Tunnel is narrow, and becomes gradually wide outward. Its height is half or more of that of chamber. Chomata are well developed from first to last volution. Tunnel sides of chomata are very steep, sometimes almost perpendicular, but their poleward slopes are very gentle in most of volutions, extending down lateral slope of volutions into polar regions. In outer volutions of some specimens, poleward slopes of chomata are limited to one-third or one-fourth of distance between center and pole.

Measurement: — See Table 10, p. 40, 41.

Material: — Reg. no. PF 1080, loc. 2, the It_1 fossil zone at Itadorigawa. PF 1161, loc. 61; PF 1190, loc. 45; PF 1187, loc. 68; PF 1157, 1158, 1159, loc. 51; PF 1150b, 1164, 1165, 1167a, 1128b, loc. 62; PF 1174, 1200b, loc. 60, all form the It_3 fossil zone at Itadorigawa.

Observation: — Beside typical specimens there are found some subspherical or ellipsoidal specimens, in which the number of volutions is 6 1/2 to 8 and the form ratio is 1.2 to 1.5. The lines marked with * in the above description refer to these less nearly typical specimens.

Remarks: — *F. bocki* was restudied by THOMPSON (1945) who described and illustrated the topotype specimen from Kresty, Government of Tver, Russia, since MÖLLER's original description and illustration were inadequate.

In 1951 numerous species of the genus *Fusulinella* in the Russian platform were treated by RAUSER and others. She described the basic shell characters of *F. bocki* as follows: Inflated, short shell, with convex central portion of the shell, shell form not changing throughout all volutions and hardly making clear extension throughout growth; bluntly pointed axial ends; very narrow tunnels and massive, subrectangular chomata, broader in early volutions. The above shell characters given by RAUSER agree well

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* see p. 23 (*Observation*)

with what THOMPSON described about the topotype specimen.

Though the Itadorigawa specimens show a wide range of variation, they have such essential characters as follows: 1) inflated shell form with convex central portion; 2) form ratios which hardly change throughout growth; 3) very narrow tunnel; 4) well developed chomata which often become rectangular and massive in outer volutions; 5) thick spirotheca, especially well developed lower tectorium.

RAUSER did not discuss about the thickness of all four layers. However THOMPSON said on the spirotheca: "The spirotheca is composed of a thin tectum, a thin diaphanotheca, and relatively thick upper and lower tectoria," furthermore; "The thicknesses of all four layers of the spirotheca immediately over the tunnel in the second to the fifth volution of this specimen are about 30, 40, 60 and 62 microns, respectively".

In the Itadorigawa specimens the thickness of spirotheca in the second to the third volution is generally thinner than that of THOMPSON's topotype, though there are some Itadorigawa specimens which have spirotheca of 40 microns in thickness in the third volution.

The present specimens do not belong to *Fusulinella asiatica* IGO,* 1956 (p. 202-205, pl. 6, figs. 4-22), because of their larger size and well developed massive chomata. IGO (op. cit.) included *Fusulinella bocki* in LEE (1927) and CHEN (1930) within the synonym list of his *F. asiatica*. But these Chinese specimens cannot be distinguished from *F. bocki bocki* with regard to the above-mentioned features, which are essential for *F. bocki*.

Some specimens (PF 1174, PF 1190, PF 1200b) which are characterized by the subspherical form, minute proloculus and a large number of volutions (7 to 8 volutions). resemble *F. subspherica* TORIYAMA (1958, p. 52-54, pl. 4, figs. 7-11) from the *Fusulinella biconica* zone of the Akiyoshi limestone than *F. bocki bocki* so far as the shell form is concerned. These specimens, however, can be distinguished from *F. subspherica* in the smaller proloculus and the slightly smaller size of the shell. These differences do not seem to be of specific importance. Unfortunately, however, *F. subspherica* is represented by poorly preserved specimens and any more exact comparison between them is at present impossible. Since the present subspherical specimens from Itadorigawa are not numerous and since there exist transitional forms between these forms and more typical *F. bocki bocki*, these forms are here retained within *F. bocki bocki*.

Occurrence: — The present species is abundant in the It_3 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Higashiuwa-gun, Ehime Prefecture. It occurs very rarely in the It_1 fossil zone.

Fusulinella bocki rotunda ISHII, subsp. nov.

(Plate XI, Figures 14-18, Plate XII, Figures 1-7)

1956 *Fusulinella rotunda* ISHII (MS.), p. 24 (listed)
1958 *Fusulinella rotunda* ISHII, p. 34 (listed)

Description: — Shell subspherical to ellipsoidal, with bluntly pointed or rounded poles. Central portion of shell is inflated dome-like and lateral slopes convex. Number of volutions of mature shells is usually 5 1/2 to 6 1/2, rarely 7 1/2. Mature shells vary from 2.214 to 3.157 mm in length and from 1.517 to 2.460 mm in width. Form ratio is 1.4 to 1.6. Form ratio hardly increases from early volution to last. Form ratios of first to

* Postscript: Recently IGO regarded *F. asiatica* as a subspecies of *F. bocki* (IGO, 1960, p. 10)

seventh volution of holotype are 1.0, 1.2, 1.2, 1.3, 1.3, 1.3 and 1.4, respectively.

Proloculus is large and spherical. Its outside diameter is 148 to 180 microns, and rarely 131 microns. Shell coils loosely and uniformly. Heights of chambers above tunnel in first to sixth volution are 33-82, 66-98, 82-131, 114-180, 98-230 and 180-262 microns, respectively. Rates of growth of first to sixth volution of holotype are 1:1.3 (1 vol.: 2 vol.), 1:1.3 (2 vol. : 3 vol.), 1:1.6 (3 vol. : 4 vol.), 1:1.3 (4 vol. : 5 vol.), 1:1.2 (5 vol. :6 vol.) and 1:1.3 (6 vol. : 7 vol.), respectively. Chambers are essentially same in height poleward from tunnel. Spirotheca is thick and composed of a tectum, a diaphanotheca, and upper and lower tectoria. Diaphanotheca cannot be clearly observed in first volution, but appears clearly from second volution. Tectorium, especially lower tectorium becomes rapidly thick from third volution. Thickness of protheca of second to sixth volution of holotype is 4, 8, 12, 12, 20 and 25 microns, respectively. Septa are plane in central portions, but are irregularly fluted in extreme polar regions except for first volution. Septa are relatively closely spaced. Almost all of septa except for septa of a few outer chambers are coated thickly by secondary deposits which continue to inner tectorium of preceding and succeeding chambers. Septal counts of first to seventh volution of typical sagittal specimen are 7, 12, 16, 22, 22, 25 and 20, respectively. Tunnel is narrow and its path is somewhat irregular. Tunnel angles of first to seventh volution of holotype are 19, 18, 17, 20, 20, 23 and 26 degrees, respectively. Tunnel is about a half as high as chambers in almost all volutions. Chomata are well developed throughout shell except for last volution of some specimens. They are massive and asymmetrical. Tunnel sides of chomata are very steep, vertical, or sometimes overhanging. Poleward slopes are very gentle, extending nearly to poles in inner volutions. In outer volutions their poleward slopes become steep and their forms become often rectangular.

Measurement: — See Table 10, p. 40-43.

Material: — Holotype, Reg. no. PF 1176, loc. 60, the It_3 fossil zone of the Itadorigawa group at Itadorigawa. Other specimens, PF 1177, 1180, 1181, 1182, 1184, 1271, loc. 60; PF 1162, 1279, loc. 61; PF 1169, 1170, loc. 62; PF 1160, loc. 51, the It_3 fossil zone at Itadorigawa.

Remarks: — This subspecies belongs to the group of *F. bocki* in RAUSER (1951, p. 223) by the character of the shell form, the massive chomata, the narrow tunnel, the thick spirotheca, and the form ratio which hardly changes throughout the growth.

The present subspecies can be distinguished from *F. bocki bocki* by that in the former the proloculus is larger and shell coils more loosely. Compared with typical *F. bocki bocki*, it can be pointed out, furthermore, that the form ratio is smaller, that the poles are rounded and that the shell form is rather ellipsoidal or subspherical in *F. bocki rotunda*. There exist, however, some intermediate forms (PF 1174, PF 1200b, PF 1190, PF 1164) which are conveniently referred to *F. bocki bocki*. Like *F. bocki bocki* they have comparatively small proloculus and tightly coiled shell, but the shell form is rather subspherical or ellipsoidal as in *F. bocki rotunda*. Owing to the presence of these intermediate forms, *rotunda* is here regarded as a subspecies of *F. bocki*.

Occurrence: — The present subspecies is common in the lower and middle parts of the It_3 fossil zone and abundant in the uppermost part of this fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Higashiuwa-gun, Ehime Prefecture.

Fusulinella bocki biconiformis ISHII, subsp. nov.

(Plate XII, Figures 8-17)

1956 *Fusulinella biconica kurosegawensis* Ishii, (MS.), p. 24 (listed)
1958 *Fusulinella kurosegawensis biconiformis* Ishii, (MS.), p 36, pl. 2, fig. 4.

Description: — Shell inflated fusiform or biconical, having bluntly pointed poles. Central parts are inflated dome-like and lateral slopes are generally straight. Number of volutions of mature shells is usually 6 1/2 to 8. These mature specimens are 2.378 to 3.608? mm long and 1.599 to 2.091 mm wide. Form ratio is 1.4 to 1.7, rarely 1.9 to 2.0. Form ratio shows almost no change during growth. Shell forms are spherical in inner three or four volutions and become gradually biconical outward. Form ratios of first to eighth volution of holotype are 1.0, 1.1, 1.1, 1,2. 1.3, 1.3, 1.6 and 1.5, respectively.

Proloculus is minute to medium and spherical. Its outside diameter is 49+ to 114 microns. Shell coils tightly and uniformly. Heights of chambers above tunnel in first to seventh volution are 33-49, 49-66, 66-98, 82-131, 114-197, 164-279 and 213-293 microns, respectively. Chambers are nearly same in height poleward from tunnel.

Spirotheca is thick and composed of a tectum, a diaphanotheca, and upper and lower tectoria. Diaphanotheca cannot be clearly observed in first two volutions and well discernible from third volution. Tectorium, especially lower tectorium becomes rapidly thick from fourth volution. Tectoria decrease in thickness poleward from edge of chomata. Thickness of protheca of first to eighth volution of holotype is 4, 4, 4, 8, 12, 12, 20 and 20 microns, respectively. Septa are plane in central parts, but are irregularly fluted in extreme polar regions, except for early two volutions. Tunnel is narrow, becomes gradually wide outward, and is almost a half as high as chambers. Its path is somewhat irregular. Tunnel angles of second to sixth volution of holotype are 16, 16, 16, 25 and 26 degrees, respectively. Chomata are well developed from second volution. Tunnel sides are very steep, vertical, or sometimes overhanging. Poleward slopes of chomata are very gentle, extending almost to poles in inner volutions. In outer volutions their poleward slopes are steep and their forms become often subrectangular.

Measurement: — See Table 10, p. 40-43.

Material: — Holotype, Reg. no. PF 1072, loc. 60, the It_3 fossil zone of the Itadorigawa group at Itadorigawa. Other specimens, PF 1178, 1183, 1185, 1186, loc. 60; PF 1171, 1172, 1278a, loc, 62; PF 1163, loc. 61; PF 1191, loc. 65, the It_3 fossil zone at Itadorigawa.

Remarks:— This subspecies has the following essential characters of *F. bocki*: 1) inflated shell form with convex central portion; 2) form ratios hardly changing through growth; 3) very narrow tunnel; 4) well developed chomata which are massive and subrectangular in outer volutions; 5) thick spirotheca. Therefore it should be included within *F. bocki* (s.l.). However, this subspecies is distinguishable from *F. bocki bocki* in its biconical shell form, larger size, and generally smaller proloculus. Number of volutions tends to be larger in *F. bocki biconiformis*.

Some specimens, including the holotype, somewhat resemble *Fusulinella biconica* (Hayasaka) so that the writer previously called the present form *F. biconica kurosegawensis*. However, *F. biconica* has more typical biconical form with slightly concave lateral slopes and more slender poleward slope of the chomata in the outer volutions.

Occurrence:— The present subspecies is common in the It_3 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Higashiuwa-gun, Ehime Prefecture.

Fusulinella spp.

(Plate X, Figures 5, 6, 7)

Three axial sections of *Fusulinella* among the present collection are not referable

to any of the above described species. Two forms can be distinguished. They are here mentioned as *Fusulinella* spp.

First form, represented by Pl. X, Fig. 5, has following shell characters: Shell large for genus, inflated fusiform with bluntly pointed poles and slightly concave lateral slopes; number of volutions 6 1/2; dimension: length 3.516 mm; width 1.722 mm; form ratios of first to sixth volution 1.1, 1.3, 1.6, 1.9, 2.0 and 2.2, respectively; first volution coiling at a large angle to axis of outer volutions; shell coiled tightly and uniformly; chamber almost same in height within each volution except for inner two volutions; proloculus small, its outside diameter 66-82 microns; spirotheca composed of four layers, lower tectorium becoming rapidly thick from third or fourth volution outwards, but upper tectorium very thin; tunnel low, becoming rapidly wide outwards; chomata asymmetrical, very weak from first to last volution.

Second form, which is represented by Pl. X, Figs. 6, 7, resembles first form in shell size, number of volutions, mode of coiling and size of proloculus, though there is only slight difference in shell size and proloculus size. However, second form is inflated fusiform shell with convex or straight lateral slopes, with narrow tunnel, becoming gradually wide and with prominent and asymmetrical chomata.

Measurement:— See Table 11, p. 42, 43.

Material:— Reg. no. PF 1247, 1249, loc. 2; PF 1248, loc. 39, the It_1 fossil zone at Itadorigawa.

Comparison:— The first form resembles *F. iyoensis* in shell form and shell size. The former, however, differs distinctly from the latter in its weaker chomata, wider tunnel, more tight coiling in inner volutions and smaller proloculus. The second forms resemble *F. iyoensis* in shell form and the mode of the chomata and of the tunnel. It can be distinguished from *F. iyoensis* in its smaller size, convex lateral slope and smaller proloculus.

Occurrence: — This species rarely occurs in the It_1 fossil zone of the Itadorigawa group, Itadorigawa, Kurosegawa-village, Higashiuwa-gun, Ehime Prefecture.

Addendum to Part I.

Fusulina ehimensis, a new name for *Fusulina regularis* Ishii, 1958.

In the previous paper "Fusulinids from the Middle Upper Carboniferous Itadorigawa Group in Western Shikoku, Japan, Part I. Genus *Fusulina*" (Ishii, 1958, Jour. Inst. Polytechnics, Osaka City Univ., Ser. G, vol. 4, p. 5-7, pl. I, fig. 2; pl. III, figs. 7-13), the name *Fusulina regularis* was proposed as new.

Prof. Em. H. Yabe has kindly called the writer's attention to the fact that this trivial name is preoccupied by *Fusulina regularis* Schellwien, 1898, which the latter is now classed under the genus *Schwagerina*. Hence the present writer proposes here the new substitute name *Fusulina ehimensis* for *Fusulina regularis* Ishii, 1958.

Postscript:

The name, "Kurosegawa-village" in this paper should be repaced by "Shirokawa-town". The former is at present included within the latter.

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Table 1. Measurements of *Eostaffella* sp. cfr. *Eostaffella bigemmicula* (Igo) and *Eostaffella* sp.

Eostaffella sp. cfr. *E. bigemmicula* (Igo)

Lo.	Reg. no.	Pl.	Fig.	L.	W.	R.	P.	Vol. no.	Diameter V1	2	3	4	Height of volution (mm.) V1	2	3	4
32	PF1218	6.	1	.184	.389	0.42	.041	3½	.082	.164	.295	—	.029	.053	.070	.090 (V3½)
37	PF1067b	6.	2	.131	.360	0.36	.049	4	.074	.123	.196	.360	.029	.025	.033	.094
20	PF1223	6.	3	.189	.348	0.34	—	3	.123	.209	.348		.041	.053	.082	—
62	PF1147a	6.	4	.082	.282	0.29	.037	3	—	.172	.282	—	.029	.045	.062	—
35	PF1222		—	.094	.274	0.34	.037	3	.082	.164	.274	—	.020	.041	.070	—
62	PF1196	6.	5	.086	.226	0.38	.029	3	.086	.139	.226	—	.020	.033	.041	—
32	PF1220		—	.123	.389	0.32	.045	3½	.082	.155	.299	—	.020	.041	.078	.090 (V3½)

Eostaffella sp.

Lo.	Reg. no.	Pl.	Fig.	L.	W.	R.	P.	Vol. no.	Diameter V1	2	3	4	Height of volution (mm.) V1	2	3	4
37	PF1221	6.	6	.156	.291	0.53	—	4	.062	.098	.172	.291	.012	.020	.037	.062

Lo.	Reg. no.	Thickness of spirotheca (mm.) V1	2	3	4	Form ratio of volution V1	2	3	4
32	PF1218	.008	.008	.012	.012 (V3½)	0.7	0.7	0.4	—
37	PF1067b	.004	.008	.012	.016	0.6	0.6	0.5	0.4
20	PF1223	.008	.008	.012	—	0.6	0.4	0.3	—
62	PF1147a	.008	.008	.012	—	—	0.4	0.3	—
35	PF1222	.008	.012	.012	—	0.7	0.4	0.3	—
62	PF1196	.008	.008	.008	—	0.6	0.5	0.4	—
32	PF1220	.008	.008	.012	.012 (V3½)	0.6	0.5	0.4	—

Lo.	Reg. no.	Thickness of spirotheca (mm.) V1	2	3	4	Form ratio of volution V1	2	3	4
37	PF1221	.004	.008	.012	.016	0.8	0.7	0.6	0.5

L., length (mm.); W., width (mm.); R., ratio of length to width; P., proloculus diameter (mm.); V1, 2, 3, volutions 1, 2, and 3; Lo., locality.

Table 2. Measurements of *Millerella* ? sp.

Lo.	Reg. no.	Pl.	Fig.	L.	W.	R.	P.	Vol. no.	Diameter (mm.) V1	2	3	4	Height of volution (mm.) V1	2	3	4
73	PF1195a		—	.094	.381	0.25	.041	3½	.090	.168	.287	—	.020	.041	.062	.082 (V3½)
57	PF1207b	6.	8	.111	.361	0.30	.041	3½	.090	.168	.282	—	.029	.045	.049	.082 (V3½)
57	PF1194a	6.	7	.086	.406	0.20	.045	3	.156	.267	.406	—	.037	.070	.098	—

Lo.	Reg. no.	Thickness of spirotheca (mm.) V1	2	3	4	Form ratio of volution V1	2	3	4
73	PF1195a	.008	.012	.008	.012 (V3½)	0.5	0.4	0.3	—
57	PF1207b	.008	—	.008	.012 (V3½)	0.5	0.5	0.4	—
57	PF1194a	.004	.008	.012	—	0.4	0.4	0.2	—

Table 3. Measurements of *Eoschubertella toriyamai* Ishii, *Eoschubertella* sp. cfr. *E. lata* (Lee et Chen) and *Eoschubertella* sp. cfr. *E. obscura* (Lee et Chen)

Eoschubertella toriyamai Ishii, sp. nov.

Lo.	Reg. no	Pl.Fig.	L.	W.	R.	P.	Vol. no.	Radius vector (mm.) V1	2	3	4	Ratio of Hl./Rv. V1	2	3	4
32	PF1205	6.23	.525	.458	1.14	.041	3½	.066	.098	.213	.246 (V3½)	1.0	0.9	0.8	1.1(V3½)
32	PF1022b	6.24	.492	.393	1.25	.049	3	.066	.114	.197	—	1.0	1.3	1.3	—
43	PF1208	6.27	.410	.361	1.14	.057	3	.066	.114	.197	—	1.0	1.0	1.2	—
57	PF1207a	6.26	.475	.344	1.38	.062	3½	.049	.098	.148	.197 (V3½)	1.0	0.8	1.1	1.3(V3½)
35	*PF1098b	6.31	.492	.443	1.11	.070	3	.066	.131	.262	—	1.2	0.9	0.9	—
35	PF1202	6.32	.410	.344	1.19	.066	3	.066	.114	.197	—	0.8	0.9	1.0	—
57	PF1209	6.33	.262	.279	0.95	.053	3	.049	.098	.164	—	1.0	0.8	0.8	—
57	PF1210	6.28	.230	.230	1.00	.045	3	.033	.082	.131	—	1.5	1.0	0.9	—
35	PF1203	6.34	.328	.311	1.05	.057	3	.066	.098	.164	—	0.8	1.0	1.0	—
20	PF1217	6.35	.295	.262	1.13	.062	3	.049	.082	.148	—	1.0	1.2	1.1	—
57	PF1215a	6.37	.393	.328	1.20	.078	3	.066	.114	.164	—	1.0	1.1	1.3	—
32	PF1216	6.36	.475	.377	1.26	.062	3½	.066	.098	.164	.213 (V3½)	0.8	0.8	0.9	1.2(V3½)

Eoschubertella sp. cfr. *E. lata* (Lee et Chen)

73	PF1214	6.39	.410	.279	1.47	.025	4	.033	.066	.098	.164	1.3	1.0	1.1	1.5
43	PF1199	6.38	.410	.262	1.56	.025	4	.033	.049	.082	.148	0.7	0.7	1.4	1.6
73	PF1213	—	.557	.361	1.55	.041	4	.049	.082	.148	.197	0.8	1.0	1.3	1.6
60	PF1200a	6.40	.361	.238	—	.029	4	.033	.066	.114	.180	1.0	1.4	1.4	?

Eoschubertella sp. cfr. *E. obscura* (Lee et Chen)

35	PF1204	6.42	.492	.361	1.36	.062	3½	.049	.098	.164	.197 (V3½)	1.3	1.2	1.2	1.3(V3½)
73	PF1195b	6.44	.541	.361	1.47	.062	3	.066	.114	.197	—	0.9	1.4	1.5	—
73	PF1212	6.43	.492	.361	1.36	.074	3	.049	.114	.197	—	1.3	1.4	1.8	—
73	PF1198	6.41	.426	.361	1.18	.070	3	.066	.098	.164	—	0.8	1.2	1.2	—

* Holotype; Hl, half length; Rv, Radius vector.

Table. 3. (continued)

Eoschubertella toriyamai Ishii, sp. nov.

Lo.	Reg. no.	Height of volution (mm.) V1	2	3	4	Thickness of spirotheca V1	2	3	4	Tunnel angle (degree) V1	2	3	4
32	PF1205	.033	.033	.066	.098(V3½)	.004	.008	.012	.012(V3½)	—	—	—	—
32	PF1022b	.033	.033	.082	—	.008	.012	.012	—	—	—	—	—
43	PF1208	.033	.066	.098	—	.008	.012	.016	—	—	—	—	—
57	PF1207a	.033	.049	.049	.082(V3½)	.004	.008	.012	.008(V3½)	—	—	—	—
35	*PF1098b	.033	.049	.148	—	.008	.008	.012	—	—	—	—	—
35	PF1202	.033	.049	.082	—	.008	.008	.008	—	—	—	23	(V2½)
57	PF1209	.033	.049	.066	—	.008	?	.008	—	—	—	—	—
57	PF1210	.033	.049	.066	—	.004	.008	.012	—	—	—	—	—
35	PF1203	.033	.049	.082	—	.008	.008	.016	—	—	—	26	—
20	PF1217	.033	.033	.066	—	.004	.008	.012	—	—	—	25	—
57	PF1215a	.033	.049	.066	—	.004	.012	.004	—	—	—	—	—
32	PF1216	.033	.033	.049	.082(V3½)	.004	.008	.012	.012(V3½)	—	—	—	—

Eoschubertella sp. cfr. *E. lata* (Lee et Chen)

73	PF1214	.016	.016	.049	.049	.004	.004	.008	.012	—	—	—	23
43	PF1199	.016	.016	.049	.066	.004	.004	.008	.008	—	—	—	24
73	PF1213	.033	.033	.066	.049	.004	.004	.008	.012	—	—	13	21
60	PF1200a	.016	.033	.049	.066	.004	.008	.012	.012	—	—	—	—

Eoschubertella sp. cfr. *E. obscura* (LEE et CHEN)

Lo.	Reg. no.	Height of volution (mm.) V1	2	3	4	Thickness of spirotheca V1	2	3	4	Tunnel angle (degree) V1	2	3	4
35	PF1204	.033	.049	.066	.082(V3½)	.008	.012	.016	.016(V3½)	—	—	—	—
73	PF1195b	.033	.049	.082	—	.008	.008	.012	—	—	14	21	—
73	PF1212	.033	.049	.082	—	.004	.008	.016	—	—	12	19	—
73	PF1198	.033	.033	.066	—	.004	.008	.016	—	—	—	18	—

Table 4. Measurements of *Fusiella typica sparsa* SHENG and *Fusiella* sp.

Fusiella typica sparsa SHENG

Lo.	Reg. no.	Pl.	Fig.	L.	W.	R.	P.	Vol. no.	Radius vector (mm.) V1	2	3	4	5	Ratio of Hl./Rv. V1	2	3	4	5
62	PF1224	7.	2	1.311	.393	3.33	.037	5	.049	.066	.098	.131	.213	1.0	1.3	2.3	3.5	3.2
44	PF1127b	7.	8	1.066	.426	2.50	.045	4	.066	.098	.148	.230	—	1.3	2.0	2.6	2.2	—
61	PF1226	7.	13	1.410	.426	3.31	.041	5	.049	.078	.098	.148	.230	0.8	0.7	2.2	2.3	2.6
62	PF1225	7.	4	.918	.377	2.43	.037	5	.033	.053	.082	.114	.197	1.0	1.0	1.4	2.1	2.4
44	PF1025b	7.	11	1.082	.458	2.36	.041	4	.066	.098	.148	.246	—	1.3	1.8	2.4	2.3	—
31	PF1238	6.	46	1.131	.458	2.46	.037	5	.045	.053	.114	.164	.262	0.5	1.5	2.3	2.6	2.2
57	PF1256a	7.	18	.902	.361	2.56	.029	4	.041	.070	.114	.180	—	1.3	1.2	2.6	2.7	—
35	PF1234	7.	15	1.541	.475	3.24	—	5	.037	.066	.114	.180	.262	1.1	2.5	2.9	2.7	3.0
32	PF1266b	7.	6	1.033	.393	2.63	.041	5	.049	.053	.098	.148	.230	0.7	1.5	2.5	2.4	2.4
44	PF1258b	7.	7	1.328	.443	3.00	—	4½?	—	.066	.098	.164	.262(V4½)	1.3	2.5	3.0	2.6(V4½)	
57	PF1215b	6.	45	.918	.393	2.33	.033	4½	.041	.066	.114	.180	.197	0.9	1.0	1.6	1.8	2.2(V4½)
31	PF1237	7.	12	1.172	.475	2.48	.049	5	.041	.066	.098	.164	.246	0.7	0.7	2.5	2.3	2.4
57	PF1137b	7.	5	1.016	.393	2.48	—	4	.045	.082	.114	.197	—	1.1	1.0	2.4	2.7	—
57	PF1256b	7.	14	.721	.295	2.44	.037	4½	.033	.053	.082	.131	.164	1.3	1.2	2.2	2.1	2.2(V4½)

Fusiella sp.

32	PF1028b	7.	19	.869	.426	2.04	.029	5	.029	.041	.082	.148	.246	0.7	1.4	1.2	2.0	1.8
57	PF1256c	7.	16	.689	.410	2.00	.033	4	.057	.082	.131	.213	—	1.0	1.2	1.9	1.5	—

Table. 4 (continued)

Fusiella typica sparsa SHENG

Lo.	Reg. no.	Height of volution (mm.) V1	2	3	4	5	Thickness of spirotheca V1	2	3	4	5	Tunnel angle (degree) V1	2	3	4	5
62	PF1224	.025	.029	.029	.037	.070	.004	.004	.008	.008	.012	—	—	19	21	34
44	PF1127b	.025	.020	.053	.070	—	.004	.008	.012	.016	—	—	—	17	35(V3½)	
61	PF1226	.025	.020	.033	.041	.078	.004	.004	.008	.008	.012	—	—	13	19	—
62	PF1225	.025	.025	.037	.033	.049	.004	.004	.008	.008	.012	—	—	22	26	28
44	PF1205b	.029	.033	.049	.094	—	.004	.004	.008	.016	—	—	—	17	28	—
31	PF1238	.020	.029	.045	.057	.090	.004	.004	.008	.008	.012	—	—	14	25	31
57	PF1256a	.020	.037	.045	.070	—	—	.004	.008	.012	—	—	—	10	22	—
35	PF1234	—	.037	.041	.049	.070	—	.004	.008	.008	.012	—	—	—	17	29
32	PF1266b	.029	.033	.037	.057	.082	.004	.004	.008	.008	.012	—	—	15	27	—
44	PF1258b	—	.029	.041	.070	.094(V4½)	—	.004	.008	.008	.012(V4½)	—	13	33	30(V4½)	
57	PF1215b	.020	.025	.041	.074	.074(V4½)	.004	.008	.012	.016	.012(V4½)	—	14	22	26(V4½)	
31	PF1237	.020	.025	.037	.062	.082	.004	.004	.008	.008	.012	—	—	12	15	35(V4½)
57	PF1137b	.025	.041	.045	.082	—	.004	.004	.008	.008	—	—	—	15	39	—
57	PF1256b	.020	.020	.033	.041	.049	.004	.008	.008	.008	.012	—	—	16	?	20

Fusiella sp.

32	PF1028b	.016	.041	.033	.049	.082	.004	.004	.008	.008	.012	—	1	?	12	—
57	PF1256c	.041	.033	.045	.078	—	.004	.004	.008	.012	—	—	12	12	28	—

Table 5. Measurements of *Fusulinella minutissima* Ishii, sp. nov.

Fusulinella minutissima Ishii, sp. nov.

Lo.	Reg. no.	Pl. Fig.	L.	W.	R.	P.	Vol. no.	Radius vector (mm.) V1	2	3	4	5	6
44	PF1123a	7. 24	1.082	.639	1.69	.053	4½	.066	.114	.197	.311	.458(V4½)	
44	PF1123b	7. 33	1.475	.820	1.80	.057	5	.066	.114	.197	.295	.361	—
19	PF1108	—	1.066	.574	1.86	.049	4½	.049	.082	.148	.246	.328(V4½)	
62	PF1128a	7. 30	.951	.622	1.52	.037	5	.066	.098	.148	.230	.328	—
73	PF1129b	7. 25	1.475	.869	1.69	.049	5	.098	.131	.213	.311	.458	—
35	PF1134	7. 22	1.639	.869	1.89	.045	6	.049	.082	.131	.213	.311	.475
73	*PF1131	7.21,26	.787	.492	1.60	.062	4½	.066	.082	.148	.213	.279(V4½)	
73	PF1195c	8.4, 5	.902	.541	1.69	.057	4½	.066	.098	.148	.230	.311(V4½)	
44	PF1125	7. 28	1.574	.820	1.92	.057	6	.066	.082	.131	.213	.295	.475
73	PF1130	7. 27	1.049	.622	1.68	.062	5	.049	.082	.131	.213	.328	—
32	PF1120	7. 23	1.262	.672	1.87	.057	5	.049	.098	.148	.246	.377	—
57	PF1121	—	.820	.458	1.79	.041	4½	.049	.082	.131	.213	.262	—
35	PF1133	—	—	.852	—	.062	5½	.066	.098	.164	.262	.393	.443
44	PF1126	7. 20	—	.885	—	.045	5½	.066	.114	.180	.279	.410	.443
44	PF1127a	—	—	.639	—	.041	5	.066	.098	.148	.230	.328	—
73	PF1132b	7. 29	—	.738	—	.041	5	.066	.098	.164	.246	.393	—

Lo.	Reg. no.	Height of volution (mm.) V1	2	3	4	5	6	Thickness of spirotheca (mm.) V1	2	3	4	5	6
44	PF1123a	.033	.049	.066	.114	.131(V4½)		.008	.012	.012	.008	—	—
44	PF1123b	.049	.049	.082	.114	.164	—	.004	.008	—	.012	.008	—
19	PF1108	.033	.033	.066	.114	.114(V4½)		.004	.008	.012	.016	.008(V4½)	
62	PF1128a	.033	.049	.066	.082	.098	—	.004	.008	.012	.020	.008	—
73	PF1129b	.033	.049	.066	.098	.148	—	.004	.008	.016	.020	.033	—
35	PF1134	.033	.049	.049	.082	.098	.164	.004	.008	.012	.016	.020	.020
73	*PF1131	.033	.033	.049	.066	.098(V4½)		.004	.008	.012	.016	.008(V4½)	
73	PF1195c	.033	.049	.049	.082	.098(V4½)		.004	.008	.012	.016	.008(V4½)	
44	PF1125	.033	.033	.049	.066	.082	.164	.004	.004	.008	.012	.016	.020
73	PF1130	.016	.033	.049	.082	.114	—	.004	.008	.008	.016	.020	—
32	PF1120	.033	.033	.049	.098	.131	—	.004	.008	.012	.016	.020	—
57	PF1121	.029	.029	.049	.074	.094	—	.008	.012	.016	.020	.012	—
35	PF1133	.033	.049	.066	.082	.131	.148(V5½)	.004	.008	.012	.020	.025	.008(V5½)
44	PF1126	.033	.049	.066	.098	.148	.131(V5½)	.004	.012	.016	.020	.020	.020(V5½)
44	PF1127a	.033	.049	.049	.082	.098	—	.004	.008	.016	.016	.008	—
73	PF1132b	.033	.049	.066	.098	.131	—	.004	.008	.016	.020	.008	—

Table 7. Measurements of *Fusulinella itadorigawensis* Ishii, sp. nov. and *Fusulinella*

Fusulinella itadorigawensis Ishii, sp. nov.

Lo.	Reg. no.	Pl.Fig.	L.	W.	R.	P.	Vol. no.	Radius vector (mm.) V1	2	3	4	5	6	7
2	PF1082a	8. 8	2.952	1.148	2.61	.082	6½	.066	.114	.197	.279	.426	.607	.615(V6½)
2	PF1083	8. 13	3.116	1.271	2.45	.082	6½	.082	.131	.197	.279	.393	.607	.672(V6½)
2	PF1109	8. 12	2.911	1.189	2.53	.057+	6	.066	.098	.180	.279	.426	.639	—
2	PF1076	8. 11	2.788	1.025	2.75	.114	5½	.082	.131	.197	.311	.458	.574(V5½)	
29	PF1110	8. 24	3.250	1.271	2.56	.098	6	.082	.148	.230	.344	.475	.656	—
38	PF1081	8. 20	3.321	1.393	2.38	—	6	.082	.148	.246	.377	.541	.738	—
41	PF1111	8. 19	2.993	1.230	2.43	.082	6	.082	.131	.213	.328	.492	.672	—
2	*PF1077	8. 10	2.911	1.271	2.29	.115	6	.098	.148	.213	.311	.475	.656	—
29	PF1118	8. 16	2.952	1.189	2.57	.114	5½	.098	.164	.262	.393	.557	.607(V5½)	
2	PF1117	8. 14	3.239	1.312	2.47	.082	6½	.082	.131	.197	.279	.426	.574	.721(V6½)
2	PF1086	8. 15	3.280	1.517	2.16	.094	6	.114	.164	.279	.426	.574	.803	—
2	PF1116	8. 9	2.827	1.271	2.22	.082	6	.082	.131	.197	.311	.475	.672	—
2	PF1112	8. 22	2.583	1.148	2.25	.082	5	.098	.180	.279	.426	.607	—	—
2	PF1085b	8. 23	2.542	1.148	2.21	.148	5	.114	.197	.279	.443	.622	—	—
2	PF1084	8. 17	2.501	1.107	2.26	.082	5½	.082	.131	.197	.328	.475	.622(V5½)	
29	PF1113	8. 25	3.444	1.312	2.63	.131	5½	.114	.197	.295	.458	.607	.738(V5½)	
2	PF1078a	8. 18	2.131	.943	2.26	.082	5½	.082	.131	.197	.295	.492	.508(V5½)	
2	PF1114	8. 7	1.927	.943	2.04	.082	5	.082	.131	.213	.344	.508	—	
2	PP1078b	8. 21	1.968	.943	2.09	.107	5	.082	.148	.230	.344	.508	—	

Ratio of Hl/Rv.					
V1	2	3	4	5	6
1.0	1.3	1.7	1.8	1.6	?(V4½)
1.0	1.1	1.3	1.4	1.5	—
0.7	1.0	1.3	1.7	1.6	?(V4½)
0.8	0.6	1.0	1.1	1.4	—
0.6	1.1	1.2	1.3	1.5	—
1.0	1.0	1.3	1.5	1.6	1.8
0.7	1.2	1.3	1.3	1.4	—
0.8	1.0	1.4	1.4	1.5	—
1.0	1.4	1.5	1.5	1.5	1.8
0.7	0.8	1.3	1.3	1.7	—
1.0	1.0	1.3	1.7	1.7	—
1.0	0.8	1.1	1.5	1.5	—
(V5½)	—	—		—	—
(V5½)	—	—		—	—
—	—	—		—	—
—	—	—		—	—

Tunnle angle (degree)						Septal count					
V1	2	3	4	5	6	V1	2	3	4	5	6
—	17	29	29	—	—	—	—	—	—	—	—
—	18(V1½)	30(V2½)		33(V4)		—	—	—	—	—	—
—	—	30	28	—	—	—	—	—	—	—	—
—	—	17	24	21	—	—	—	—	—	—	—
—	14	17	27	26	—	—	—	—	—	—	—
—	—	14	21	28	37	—	—	—	—	—	—
—	—	24	28	37(V4½)		—	—	—	—	—	—
—	—	25	27	31(V4½)		—	—	—	—	—	—
—	—	24	36	39	46	—	—	—	—	—	—
—	—	26	38	39	—	—	—	—	—	—	—
—	—	17	21	31	—	—	—	—	—	—	—
—	13	21	23	—	—	—	—	—	—	—	—
—	—	—	—	—	—	8	11	12	13	16	8(V5½)
—	—	—	—	—	—	8	10	11	14	15	4(V5½)
—	—	—	—	—	—	8	11	13	15	11?	—
—	—	—	—	—	—	8	10	11	14	10	—

iyoensis Ishii, sp. nov.

Ratio of Hl/Rv.						
V1	2	3	4	5	6	7
1.0	1.1	1.4	1.6	1.9	2.4	2.4(V6½)
1.0	1.1	1.5	1.7	1.9	2.0	2.2(V6½)
1.0	1.3	1.5	1.8	2.1	2.4	—
1.0	1.4	1.7	2.1	2.2	2.5(V5½)	
1.0	1.3	1.8	2.1	2.4	2.5	—
1.2	1.2	1.5	1.7	2.1	2.2	—
1.0	1.3	1.8	2.0	2.3	—	—
1.2	1.1	1.5	1.7	2.0	2.3	—
1.3	1.5	1.6	1.8	2.0	2.3(V5½)	
1.0	1.0	1.4	1.8	1.9	2.1	2.2(V6½)
0.9	1.4	1.5	1.7	2.3	2.1	—
0.9	1.0	1.4	1.6	1.7	2.0	—
1.0	1.4	1.7	2.0	2.1	—	—
1.1	1.2	1.5	1.9	2.1	—	—
1.0	1.1	1.7	1.8	1.9	2·1(V5½)	
0.9	1.3	1.9	2.1	2.6	2.4(V5½)	
1.0	1.2	1.5	1.7	2.1	2.1(V5½)	
0.8	1.1	1.4	1.7	2.0	—	—
1.0	1.2	1.5	1.8	2.0	—	—

Table 7. (continued)

Fusulinella iyoensis Ishii, sp. nov.

Lo.	Reg. no.	Pl. Fig.	L.	W.	R.	P.	Vol. no.	Radius vector (mm.) V1	2	3	4	5	6	7
2	*PF1087	10. 3	3.813	1.804	2.11	.131	6	.098	.180	.279	.443	.689	.967	—
2	PF1079	10. 4	4.428?	1.927	2.30	.098	6½	.082	.148	.246	.410	.622	.885	1.016(V6½)

Table 7. (continued)

Fusulinella itadorigawensis Ishii, sp. nov.

Lo.	Reg. no.	Height of volution (mm.) V1	2	3	4	5	6	7	Thickness of spirotheca (mm.) V1	2	3	4	5	6	7
2	PF1082a	.033	.049	.066	.082	.148	.180	.180(V6½)	.008	.012	.020	.037	.037	.041	—
2	PF1083	.033	.049	.066	.098	.114	.197	.164(V6½)	.008	.012	.020	.029	.033	.037	.020(V6½)
2	PF1109	.033	.049	.066	.098	.164	.197	—	.008	.012	.020	.033	.053	.037	—
2	PF1076	.033	.049	.082	.114	.164	.148(V5½)		.008	.012	.020	.041	.053	.037(V5½)	
29	PF1110	.033	.049	.082	.114	.131	.180	—	.008	.020	.029	.020	.033	.020	—
38	PF1081	.049	.066	.082	.148	.164	.197	—	.008	.012	.016	.029	.025?	.025	—
41	PF1111	.033	.049	.082	.114	.164	.180(V5½)		.008	.012	.025	.037	.045	—	—
2	*PF1077	.033	.049	.066	.114	.164	.180	—	.008	.012	.016	.041	.041	.041	—
29	PF1118	.033	.049	.082	.114	.131	.131(V5½)		.008	.012	.016	.041	.037	.033	—
2	PF1117	.033	.049	.066	.082	.148	.148	.197(V6½)	.008	.012	.016	.033	.045	.041	.029(V6½)
2	PF1086	.049	.066	.098	.148	.164	.213	—	.008	.012	.020	.049	.033	.016	—
2	PF1116	.033	.049	.082	.114	.164	.197	—	.008	.012	.025	.041	.041	.041	—
2	PF1112	.049	.082	.114	.148	.197	—	—	.008	.020	.029	.037	.041	—	—
2	PF1085b	.049	.066	.098	.164	.180	—	—	.008	.012	.025	.033	.029	—	—
2	PF1084	.033	.049	.066	.114	.164	.197(V5½)		.008	.012	.020	.033	.041	.025(V5½)	
29	PF1113	.049	.082	.098	.148	.164	.230(V5½)		.008	.016	.029	.037	.041	.020(V5½)	
2	PF1078a	.049	.049	.066	.098	.131	.148(V5½)		.008	.008	.020	.025	.033	.029(V5½)	
2	PF1114	.033	.049	.082	.131	.164	—	—	.008	.012	.016	.041	.041	—	—
2	PF1078b	.033	.066	.082	.114	.180	—	—	.008	.012	.020	.037	.020	—	—
		Fusulinella iyoensis Ishii, sp. nov.													
2	PF1087	.049	.066	.114	.164	.246	.279	—	.012	.025	.041	.062	.082	.037	—
2	PF1079	.033	.066	.098	.164	.213	.279	.279(V6½)	.012	.020	.029	.062	.070	.082	.025(V6½)

Table 8. Measurements of *Fusulinella simplicata simplicata* Toriyama, *F. simplicata F. simplicata* var. α and *F. simplicata* var. β.

Fusulinella simplicata simplicata Toriyama

Lo.	Reg. no.	Pl. Fig.	L.	W.	R.	P.	Vol. no.	Radius vector (mm.) V1	2	3	4	5	6
40	PF1093	9. 5	2.952	1.558	1.90	.148	5	.131	.213	.361	.541	.820	—
2	PF1179	9. 4	3.116	1.681	1.93	.131	5	.148	.262	.410	.607	.902	—
29	PF1089	9. 7	2.870	1.434	2.00	.131	5½	.114	.197	.311	.458	.656	.787(V5½)
2	PF1082b	—	2.788	1.353	2.06	.110	6	.082	.148	.230	.377	.508	.705
38	PF1088	9. 8	2.419+	1.722	?	.131	5½	.114	.197	.328	.525	.754	.934(V5½)
		Fusulinella simplicata onoi Ishii, subsp. nov.											
2	*PF1090	9. 14	3.444	1.845	1.87	.180	5½	.148	.246	.393	.590	.869	1.016(V5½)
38	PF1092	9. 13	3.731	1.968	1.90	.164	5½	.148	.230	.361	.557	.885	1.033(V5½)
2	PF1102	9. 19	3.362	1.845	1.82	.148	6	.131	.213	.344	.508	.738	.951
2	PF1104	9. 16	2.911	1.476	1.97	.164	5½	.114	.197	.328	.458	.705	.770(V5½)
2	PF1105	9. 11	2.870 ?	1.599	1.79	.164	5½	.131	.230	.361	.541	.738	.885(V5½)
2	PF1091	9. 17	2.501	1.394	1.79	.131	5½	.114	.197	.295	.458	.656	.738(V5½)
2	PF1100	9. 10	2.706	1.353	2.00	.164	5	.131	.213	.328	.492	.705	—
2	PF1106	9. 12	3.116	1.517	2.05	.148	5	.131	.213	.344	.557	.820	—
2	PF1101	9. 18	3.198	1.681	1.90	.148	5½	.131	.197	.328	.492	.754	.918(V5½)
38	PF1107	10. 2	2.050	1.189	1.79	.114	5	.114	.180	.295	.443	.639	—
62	PF1099	9. 15	2.870	1.476	1.94	.180	5	.131	.197	.295	.443	.689	—
2	PF1074	10. 1	3.116	1.476	2.11	.131	5½	.114	.180	.295	.458	.689	.803(5V½)

Ratio of Hl/Rv.						
V1	2	3	4	5	6	7
1.2	1.5	1.8	1.8	1.8	2.0	—
1.4	1.8	1.7	1.8	1.8	2.1	2.0(V6½)

Tunnel angle (degree)						
V1	2	3	4	5	6	7
11	22	22	29	34	56	—
22	29	30	46	—	—	—
—	—	21	25	31	—	—
17	17	32	34	39	—	—
25	25	31	34	43	—	—
18	30	32	41	43	—	—
16	24	20	24	37	49	(V5½)
10	21	24	25	36	46	—
—	13	20	35	38	—	—
—	21	26	32	41	—	—
17	19	25	30	45	—	—
—	20	20	21	42	—	—
—	30	30	47	86	—	—
21	23	24	25	36	—	—
19	19	24	30	43	—	—
—	26	36	49	—	—	—
14	17	21	23	34	39	(V5½)
—	24	28	34	43	—	—
—	20	30	38	—	—	—
19	23	28	28	38	—	—
—	23	27	28	40	40	—

onoi Ishii, subsp. nov.,

Ratio of Hl/Rv.					
V1	2	3	4	5	6
1.1	1.4	1.4	1.7	1.8	—
1.1	1.2	1.3	1.5	1.8	—
1.1	1.3	1·4	1.4	1.7	1.9(V5½)
1.0	1.1	1.4	1.5	1.7	2.0
1.0	1.3	1.4	1.4	1.5	—
1.0	1.3	1.3	1.6	1.6	1.6(V5½)
0.8	1.1	1.4	1.5	1.6	1.8(V5½)
1.1	1.3	1.3	1.8	1.9	1.8
1.3	1.1	1.2	1.5	1.6	1.9(V5½)
1.1	1.1	1.3	1.4	1.5	1.6(V5½)
1.1	1.3	1.5	1.7	1.8	1.7(V5½)
1.3	1.5	1.6	1.7	2.0	—
1.3	1.5	1.7	1.9	2.0	—
1.0	1.3	1.6	1.6	1.5	1.7(V5½)
1.1	1.4	1.6	1.7	1.6	—
1.3	1.7	2.0	2.2	2.1	—
1.1	1.4	1.6	1.6	1.7	1.9

Table 8. (continued)

Fusulinella simplicata var. *α*

Lo.	Reg. no.	Pl.	Fig.	L.	W.	R.	P.	Vol. no.	Radius vector (mm.) V1	2	3	4	5	6
41	PF1094	9.	1	2.747	1.681	1.63	.131	6	.098	.164	.262	.426	.639	.869
2	PF1103	9.	2	2.583?	1.476	1.75	.098	6	.082	.131	.213	.361	.541	.787
2	PF1095	9.	3	2.337	1.271	1.84	.114+	5	.114	.197	.311	.492	.705	—
29	PF1098a	9.	6	2.419	1.271	1.90	.098	5	.114	.180	.311	.475	.721	—

Fusulinella simplicata var. *β*

2	PF1085a	8.	27	2.296	1.189	1.92	.114	5½	.098	.164	.246	.377	—	—
2	PF1075	8.	26	2.050	.984	2.08	.098	5	.082	.148	.246	.508	—	—
2	PF1096	8.	28	2.131	1.148	1.86	.094	6	.082	.131	.197	.426	.590	—

Table 8. (continued)

Fusulinella simplicata simplicata TORIYAMA

Lo.	Reg. no.	Height of volution (mm.) V1	2	3	4	5	6	Thickness of spirotheca (mm.) V1	2	3	4	5	6
40	PF1093	.066	.082	.148	.180	.246	—	.020	.033	.049	.053	.057	—
2	PF1179	.066	.098	.148	.197	.295	—	.012	.029	.045	.053	.062	—
29	PF1089	.049	.082	.114	.148	.197	.213(V5½)	.012	.020	.029	.037	.041	.025(V5½)
2	PF1082b	.033	.066	.098	.148	.148	.197	.008	.016	.029	.033	.041	.033
38	PF1088	.049	.082	.148	.180	.230	.279(V5½)	.012	.025	.033	.062	.045	.029(V5½)

Fusulinella simplicata onoi ISHII, subsp. nov.

2	*PF1090	.066	.098	.148	.213	.279	.279(V5½)	.020	.029	.037	.049	.062	.020(V5½)
38	PF1092	.066	.082	.131	.213	.295	.279(V5½)	.012	.041	.049	.062	.098	.045(V5½)
2	PF1102	.049	.082	.131	.180	.230	.213	.012	.029	.037	.053	.066	.033
2	PF1104	.049	.082	.131	.148	.230	.213	.012	.029	.033	.053	.074	.033
2	PF1105	.049	.082	.131	.164	.213	.246(V5½)	.012	.025	.045	.053	.066	.037(V5½)
2	PF1091	.049	.082	.098	.148	.213	—	.012	.016	.039	.049	.049	.020(V5½)
2	PF1100	.066	.082	.114	.164	.213	—	.020	.020	.037	.033	.016	—
2	PF1106	.049	.082	.131	.213	.262	—	.012	.025	.029	.062	.049	—
2	PF1101	.049	.082	.114	.180	.262	.279(V5½)	.020	.029	.041	.062	.057	.041(V5½)
38	PF1107	.049	.082	.114	.148	.197	—	.012	.020	.033	.053	.025	—
62	PF1099	.066	.082	.098	.148	.230	—	.033	.037	.041	.062	.016	—
2	PF1074	.049	.066	.114	.164	.230	.246(V5½)	.012	.020	.029	.025	.057	.025(V5½)

Fusulinella simplicata var. *α*

41	PF1094	.049	.066	.098	.164	.213	.230	.012	.012	.033	.049	.062	.025
2	PF1103	.049	.049	.082	.148	.180	.262	.008	.012	.025	.041	.062	.016
2	PF1095	.066	.082	.114	.180	.213	—	.012	?	.037	.041	.016	—
29	PF1098a	.066	.082	.114	.180	.246	—	.012	.020	.041	.045	.020	—

Fusulinella simplicata var. *β*

2	PF1085a	.049	.066	.082	.114	.164	—	.008	.012	.025	.029	.033	—
2	PF1075	.033	.066	.082	.114	.148	—	.008	.016	.029	.033	.033	—
2	PF1096	.049	.049	.066	.098	.131	.148	.008	.012	.020	.025	.029	.016

Ratio of Hl/Rv.					
V1	2	3	4	5	6
1.3	1.6	1.6	1.5	1.6	1.5
1.0	1.4	1.5	1.5	1.6	1.7
1.1	1.3	1.6	1.6	1.7	—
1.3	1.5	1.6	1.7	1.7	—
1.0	1.1	1.3	1.6	2.0	—
1.2	1.2	1.5	1.8	1.9	—
0.8	1.1	1.5	1.6	1.7	1.8

Tunnel angle (degree)					
V1	2	3	4	5	6
18	28	34	37	—	—
20	20	21	31	34	—
13	23	22	33	35	—
18	21	15	23	31	—
—	26	30	33	37	—
24	20	31	38	44	—
21	20	31	41	49	—
28	25	23	30	35	—
10	21	24	30	45	—
22	29	29	33	47	—
22	29	31	34	42	—
20	25	27	38	62	—
26	24	30	51	—	—
—	17	25	27	37	—
15	27	30	31	30	—
31	31	34	35	—	—
18	27	29	34	—	—
16	?	23	29	38	—
22	22	23	29	34	—
—	24	29	36	—	—
—	17	21	35	39(V4½)	
23	20	22	28	37	—
18	22	29	36	—	—
—	18	23	30	33	—

Table 9. Measurements of *Fusulineila pygmaea* Ishii, sp. nov. and *F.*

Fusulinella pygmaea Ishii, sp. nov.

Lo.	Reg. no.	Pl.Fig.	L.	W.	R.	P.	Vol. no.	Radius vector (mm.) V1	2	3	4	5	6	7
44	PF1058b	10. 9	1.361	.672	2.03	—	6	.049	.082	.114	.164	.246	.377	—
35	PF1143	10. 17	1.574?	.787	2.00	—	5½	.066	.098	.164	.262	.377	.426(V5½)	
57	PF1137a	10. 13	1.377?	.705	1.95	.053	6	.049	.082	.114	.180	.262	.361	—
57	PF1136a	10. 14	1.295	.574	2.26	.057	4½	.066	.114	.180	.262	.328(V4½)	—	
44	PF1153	10. 19	1.557	.705	2.21	—	6	—	.082	.114	.180	.262	.377	—
60	PF1154	10. 15	1.475?	.721	2.05	.053	5½	.049	.098	.148	.246	.344	.393(V5½)	
57	PF1137c	10. 18	.836	.410	1.96	.053	4½	.049	.082	.131	.197	.230(V4½)	—	
60	PF1156	10. 8	1.115	.622	1.79	.037	5½	.049	.082	.131	.197	.279	.361(V5½)	
73	*PF1152	10.10,11	1.082	.525	2.06	.041	5½	.049	.066	.114	.164	.246	.295(V5½)	

Fusulinella elegantula Ishii, sp. nov.

62	*PF1144	10. 25	2.009	1.025	1.96	.041	7	.049	.082	.114	.197	.295	.426	.557
51	PF1139	10. 24	2.501	1.107	2.26	.045	7	.066	.098	.148	.230	.328	.443	.607
62	PF1145a	10. 28	1.968	.902	2.18	.057	6	.066	.114	.164	.246	.344	.492	—
62	PF1145b	10. 21	2.050	.943	2.17	—	6	—	.082	.148	.230	.361	.508	—
62	PF1147b	10. 22	2.131	.943	2.26	.066	6½	.082	.098	.131	.197	.311	.458	.525(V6½)
62	PF1148	10. 23	2.173	1.066	2.03	.053	7	.066	.082	.148	.213	.311	.443	.574
62	PF1149	10. 32	1.722	.902	1.83	.041	6	.066	.114	.180	.262	.377	.525	—
51	PF1140	10. 27	1.968	1.066	1.85	.057	6½	.066	.082	.131	.213	.328	.475	.557(V6½)
51	PF1141	10. 31	2.173	1.148	1.89	—	7	—	.082	.131	.213	.311	.458	.590
51	PF1142	10. 26	2.706?	.984	2.75	—	6½	.049+	.082	.131	.213	.311	.443	.541(V6½)
62	PF1196b	10. 30	—	1.049	—	.053	7	.066	.098	.148	.213	.295	.410	.557
62	PF1150a	10. 29	—	.984	—	.041+	6½	.049	.098	.148	.230	.328	.443	.508

Table 9. (continued)

Fusulinella pygmaea Ishii, sp. nov.

Lo.	Reg. no.	Height of volution (mm.) V1	2	3	4	5	6	7	Thickness of spirotheca V1	2	3	4	5	6	7
44	PF1058b	.016	.033	.033	.049	.066	.131	—	.004	.004	.008	.012	.016	.016	—
35	PF1143	.033	.033	.066	.098	.114	.131(V5½)		.004	.008	.012	.016	.020	.016(V5½)	
57	PF1137a	.016	.016	.033	.049	.082	.098	—	.004	.004	.008	.012	.020	.012	—
57	PF1136a	.033	.033	.066	.098	.098(V4½)	—		.004	.008	.012	.016	.020(V4½)	—	
44	PF1153	—	.033	.049	.066	.082	.114	—	—	—	.008	.016	.020	.012	—
60	PF1154	.033	.033	.066	.082	.114	.114(V5½)		.008	.012	.012	.020	.025	.012(V5½)	
57	PF1137c	.033	.033	.049	.066	.066(V4½)	—		.004	.008	.012	.016	.008	—	—
60	PF1156	.016	.033	.049	.066	.098	.114(V5½)		—	.008	.012	.016	.020	—	—
73	*PF1152	.016	.049	.049	.049	.066	.098(V5½)		.004	.008	.008	.012	.020	.012(V5½)	

Fusulinella elegantula Ishii, sp. nov.

62	*PF1144	.033	.033	.049	.066	.098	.131	.131	.004	.008	.012	.020	.033	.041	.025
51	PF1139	.033	.033	.049	.082	.098	.114	.180	.004	.008	.012	.016	.020	.037	.020
62	PF1145a	.033	.033	.049	.082	.098	.148	—	.004	.012	.020	.025	.029	.016	—
62	PF1145b	.033	.049	.066	.082	.131	.148	—	—	—	.012	.020	.029	.016	—
62	PF1147b	.033	.033	.049	.066	.114	.131	.148(V6½)	.004	.008	.012	.020	.025	.033	.012
62	PF1148	.033	.033	.049	.082	.082	.131	.131	.004	.008	.012	.020	.029	.033	.012
62	PF1149	.033	.049	.066	.082	.131	.131	—	.004	.008	.016	.020	.025	.012	—
51	PF1140	.033	.033	.066	.082	.114	.164	.164	.004	.012	.016	.020	.033	.025	.020
51	PF1141	—	.033	.066	.082	.114	.148	.148	—	.008	.016	.020	.029	.041	.033
51	PF1142	—	.033	.049	.066	.114	.131	.131(V6½)	.004	.012	.012	.016	.025	.033	.012
62	PF1196b	.033	.033	.049	.066	.082	.131	.148	.004	.008	.012	.016	.025	.029	.012
62	PF1150a	.033	.049	.049	.082	.114	.131	.131(V6½)	.004	.008	.012	.020	.025	.025	.012

elegantula Ishii. sp. nov.

Ratio of Hl/Rv						
V1	2	3	4	5	6	7
1.0	1.0	1.0	1.5	1.6	1.8	—
1.2	1.0	1.3	1.6	1.7	1.8(V5½)	
1.0	1.0	1.3	1.8	2.1	1.8?	—
1.3	1.4	1.7	1.9	2.0(V4½)	—	
—	1.2	1.4	1.8	2.2	2.1	—
1.3	1.0	1.2	1.4	1.8	1.9(V5½)	
0.7	1.2	1.5	1.6	1.9(V4½)	—	
0.7	1.0	1.3	1.4	1.5	1.6(V5½)	
0.7	1.2	1.3	1.5	1.7	1.9(V5½)	
1.3	1.4	1.7	1.8	1.7	1.7	1.8
1.3	1.3	1.7	2.2	2.4	2.3	2.2
1.3	1.3	1.7	1.7	2.0	2.0	—
—	1.4	1.7	2.0	1.9	2.0	—
0.8	1.0	1.8	1.9	1.9	1.9	2.1(V6½)
1.3	1.2	1.7	1.9	2.1	2.1	2.0
1.0	1.3	1.5	1.6	1.5	1.7	—
0.5	1.0	1.3	1.5	1.8	1.7	1.8(V6½)
—	1.2	1.5	1.7	2.1	2.0	1.9
1.3	1.4	2.0	2.2	2.2	2.2	2.6(V6½)
—	—	—	—	—	—	—
—	—	—	—	—	—	—

Tunnel angle (degree)							Septal count						
V1	2	3	4	5	6	7	V1	2	3	4	5	6	7
—	—	5	15	16	20	—	—	—	—	—	—	—	—
—	—	—	18	18	—	—	—	—	—	—	—	—	—
—	—	—	11	20	21	—	—	—	—	—	—	—	—
—	9	11	18	21(V4½)		—	—	—	—	—	—	—	—
—	—	12	11	19	—	—	—	—	—	—	—	—	—
—	13	20	17	24	25(V5½)		—	—	—	—	—	—	—
—	—	10	13	—	—	—	—	—	—	—	—	—	—
—	—	—	12	15	—	—	—	—	—	—	—	—	—
—	—	—	18	19	27(V5½)		—	—	—	—	—	—	—
—	—	8	9	10	17	21(V6½)	—	—	—	—	—	—	—
—	—	10	11	16	25	18	—	—	—	—	—	—	—
—	—	14	17	23	26	—	—	—	—	—	—	—	—
—	—	15	19	17	20	—	—	—	—	—	—	—	—
—	—	14	18	17	20	24(V6½)	—	—	—	—	—	—	—
—	—	15	14	22	16	—	—	—	—	—	—	—	—
—	11	14	17	17	23	—	—	—	—	—	—	—	—
—	16	16	18	25	26	—	—	—	—	—	—	—	—
—	—	12	14	18	19	19	—	—	—	—	—	—	—
—	—	18	18	24	19	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	6	10	15	18	19	24
—	—	—	—	—	—	—	6	8	12	14	18	22	13(V6½)

Table 10. Measurements of *Fusulinella bocki bocki* MÖLLER, *F. bocki rotunda* ISHII, subsp. nov.

Fusulinella bocki bocki MÖLLER

Lo.	Reg. no.	Pl.Fig.	L.	W.	R.	P.	Vol. no.	Radius vector (mm.) V1	2	3	4	5	6	7	8
51	PF1157	11. 2	2.870	1.599	1.79	.114	6½	.098	.148	.246	.361	.525	.738	.852(V6½)	
62	PF1164	11. 5	2.829	1.763	1.60	.114	6½	.114	.180	.279	.410	.607	.820	.951(V6½)	
61	PF1161	11. 1	2.870	1.640	1.75	.131	6	.114	.180	.279	.443	.622	.885	—	—
62	PF1165	11. 8	2.788	1.640	1.70	.098	6	.098	.148	.262	.410	.622	.869	—	—
62	PF1150b	11.13	2.788	1.599	1.74	.114	6	.131	.197	.279	.410	.622	.852	—	—
51	PF1158	11. 7	2.911	1.558	1.87	.098	6	.082	.148	.246	.377	.574	.820	—	—
62	PF1128b	11.10	3.075	1.681	1.83	.098	6½	.082	.148	.246	.393	.557	.754	.902(V6½)	
62	PF1167a	— —	2.419	1.640	1.50	.114+	6	.098	.164	.279	.426	.607	.869	—	—
2	PF1080	11.12	2.214	1.517	1.46	.114	6	.098	.164	.279	.443	.656	.820	—	—
51	PF1159	11.11	3.034	1.517	2.00	.114	6½	.082	.148	.230	.344	.492	.672	.852(V6½)	
45	PF1190	11. 9	2.501	1.640	1.53	.098	8	.082	.114	.180	.262	.377	.508	.689	.852
60	PF1174	11. 3	1.968	1.558	1.26	.098	7	.082	.131	.213	.311	.458	.622	.885	—
60	PF1200b	11. 6	2.091	1.681	1.24	.082+	7	.066	.131	.230	.344	.492	.672	.803	—
68	PF1187	11. 4	2.542	1.353	1.88	.131	5½	.114	.180	.295	.377	.622	.754(V5½)	—	

Fusulinella bocki rotunda ISHII, subsp. nov.

60	*PF1176	11.15	3.075	2.091	1.47	.148	7½	.098	.164	.262	.377	.541	.738	1.000	1.082(V7½)
60	PF1181	11.18	2.542	1.763	1.44	.164	6½	.131	.197	.311	.458	.607	.820	.967(V6½)	
60	PF1182	12. 5	2.542	1.845	1.38	.164	6½	.114	.197	.295	.443	.622	.820	1.016(V6½)	
60	PF1177	11.16	3.157	1.927	1.63	.180	6	.164	.262	.377	.541	.738	1.000	—	—
60	PF1180	11.17	3.116?	1.968?	1.51	.164	6	.148	.246	.377	.525	.738	.984	—	—
51	PF1160	12. 3	2.419	1.558	1.55	.164	5½	.164	.262	.361	.508	.705	.820(V5½)	—	
62	PF1169	12. 2	2.214	1.558	1.42	.131	6	.114	.197	.295	.443	.590	.852	—	—
61	PF1162	12. 4	2.542	1.640	1.55	.164	6	.131	.197	.295	.443	.622	.885	—	—
60	PF1184	12. 6	1.517	1.230	1.20	.148	5	.114	.197	.311	.443	.672	—	—	—
62	PF1170	12. 1	2.296	1.558	1.47	.148	6	.148	.213	.295	.426	.607	.820	—	—

Fusulinella bocki biconiformis ISHII, subsp. nov.

62	PF1172	12.13	3.034	1.763	1.72	.114	7	.082	.131	.230	.328	.475	.656	.902	—
60	PF1183	12.17	3.362	1.927	1.74	.082	7½	.082	.131	.213	.344	.508	.656	.869	1.016(V7½)
60	PF1178	12. 9	2.993	1.927	1.55	.082	8	.082	.131	.197	.311	.443	.607	.853	1.016
60	*PF1072	12.10	3.116	2.091	1.49	—	8	—	.098	.164	.262	.393	.557	.820	1.098
60	PF1185	12. 8	2.665	1.722	1.44	.082+	7	.082	.148	.246	.361	.475	.639	.885	—
60	PF1186	12.12	2.542	1.722	1.48	.082	6½	.066	.131	.213	.344	.525	.803	.885(V6½)	
62	PF1278a	12.11	2.665	1.845	1.44	—	7	.082	.148	.230	.361	.525	.738	.967	—
65	PF1191	12.16	3.608?	1.804	2.00	.082	6½	.098	.164	.279	.410	.607	.852	1.016(V6½)	
62	PF1171	12.15	2.829	1.722	1.64	.049+	7	.066	.114	.180	.279	.443	.672	.869	—
61	PF1163	12.14	2.911	1.886	1.54	—	7	—	.131	.213	.344	.508	.721	.984	—

Table 10. (continued)

Fusulinella bocki bocki MÖLLER

Lo.	Reg. no.	Height of volution (mm.) V1	2	3	4	5	6	7	8	Thickness of spirotheca (mm.) V1	2	3	4	5	6	7
51	PF1157	.049	.066	.098	.114	.164	.213	.230(V6½)		.008	.012	.020	.041	.041	.053	.041(V6½)
62	PF1164	.049	.066	.098	.131	.197	.213	.213(V6½)		.012	.020	.041	.049	.053	.053	.020(V6½)
61	PF1161	.049	.066	.098	.164	.197	.262	—	—	.012	.012	.029	.053	.078	.049	—
62	PF1165	.049	.066	.114	.148	.213	.246	—	—	.012	.020	.037	.049	.053	.016	—
62	PF1150b	.049	.066	.082	.131	.213	.230	—	—	.012	.020	.029	.029	.078	.049	—
51	PF1158	.049	.066	.098	.148	.197	.246	—	—	.012	.020	.029	.041	.057	.066	—
62	PF1128b	.049	.066	.098	.148	.164	.213	.180(V6½)		.012	.020	.020	.053	.049	.053	.037(V6½)
62	PF1167a	.049	.066	.114	.148	.180	.246	—	—	.012	.029	.029	.041	.049	.033	—
2	PF1080	.033	.066	.114	.164	.230	.246	—	—	.012	.020	.041	.070	.098	.037	—
51	PF1159	.033	.049	.082	.114	.148	.180	.246(V6½)		.008	.016	.020	.041	.062	.045	.070(V6½)
45	PF1190	.033	.049	.066	.082	.098	.131	.180	.180	.008	.008	.020	.029	.033	.049	.053
60	PF1174	.049	.066	.082	.098	.148	.164	.180	—	.012	.016	.029	.041	.053	.053	.074
60	PF1200b	.033	.066	.082	.114	.148	.180	.213	—	.012	.020	.029	.029	.049	.074	.078
68	PF1187	.049	.066	.114	.131	.197	.213(V5½)		—	.012	.029	.041	.045	.041	.025	—

and *F. bocki biconiformis* Ishii. subsp. nov.

Ratio of Hl/Rv							
V1	2	3	4	5	6	7	8
1.0	1.4	1.7	1.6	1.5	1.6	1.7(V6½)	
1.0	1.2	1.2	1.3	1.5	1.6	1.5(V6½)	
1.0	1.3	1.3	1.3	1.4	1.7	—	—
0.8	1.4	1.4	1.5	1.7	1.5	—	—
0.9	1.3	1.5	1.4	1.4	1.6	—	—
1.4	1.4	1.5	1.5	1.5	1.8	—	—
1.4	1.4	1.5	1.5	1.5	1.6	1.7(V6½)	
1.2	1.1	1.3	1.3	1.5	1.3	—	—
1.0	1.2	1.3	1.5	1.5	1.3?	—	—
1.0	1.1	1.1	1.4	1.7	2.0	1.8(V6½)	
1.0	1.0	1.1	1.1	1.1	1.3	1.3	1.4
1.0	1.0	1.2	1.2	1.3	1.2	1.3	—
1.0	1.3	1.2	1.2	1.2	1.2	1.1	—
1.0	1.4	1.5	1.9	1.9	1.7(V5½)		—
1.0	1.2	1.2	1.3	1.3	1.3	1.3	1.4(V7½)
1.1	1.2	1.2	1.1	1.1	1.2	1.3(V6½)	
1.3	1.3	1.3	1.3	1.2	1.3	1.3(V6½)	
1.0	1.1	1.1	1.4	1.3	1.6	—	—
1.1	1.4	1.3	1.4	1.6	1.6	—	—
1.1	1.1	1.2	1.3	1.3	1.5(V5½)		—
1.3?	1.4	1.3	1.3	1.5	1.3	—	—
1.0	1.1	1.3	1.3	1.5	1.4	—	—
1.1	1.3	1.3	1.2	1.1	—	—	—
0.9	1.1	1.3	1.2	1.3	1.4	—	—
1.0	1.1	1.2	1.3	1.5	1.8	1.7	—
1.0	1.1	1.4	1.4	1.5	1.6	1.7	1.9(V7½)
0.8	1.0	1.0	1.1	1.1	1.1	1.3	1.5
—	1.0	1.1	1.3	1.2	1.3	1.3	1.4
1.0	1.0	1.0	1.2	1.4	1.4	1.5	—
1.2	1.0	1.2	1.1	1.3	1.2	1.4(V6½)	
1.2	1.1	1.1	1.1	1.3	1.3	1.4	—
0.8	1.0	1.4	1.4	1.6	1.6	1.7(V6½)	
0.8	1.0	1.2	1.3	1.4	1.5	1.6	
—	1.6	1.5	1.5	1.5	1.5	1.5	

Tunnel angle (degree)								
8	V1	2	3	4	5	6	7	8
—	—	25	27	22	25	29	—	—
—	—	18	14	17	20	29	—	—
—	—	16	22	22	34	33	—	—
—	13	18	19	26	27	—	—	—
—	16	19	19	26	34	40	—	—
—	—	22	22	25	30	37	—	—
—	17	18	23	23	28	34	31(V6½)	
—	—	11	19	17	20	32	—	—
—	—	22	24	24	38	—	—	—
—	—	16	20	26	35	42	42(V6½)	
.033	16	16	19	20	21	28	—	—
—	—	13	14	16	14	18	17	—
—	—	16	14	15	18	22	23	—
—	—	21	26	25	36	—	—	—

Table 10. (continued)

Fusulinella bocki rotunda Ishii, subsp. nov.

Lo.	Reg. no.	Height of volution (mm.)								Thickness of spirotheca (mm.)						
		V1	2	3	4	5	6	7	8	V1	2	3	4	5	6	7
60	*PF1176	.049	.066	.082	.131	.164	.197	.262	.213(V7½)	.016	.020	.029	.041	.066	.082	.090
60	PF1181	.066	.082	.114	.131	.164	.213	.230(V6½)		.012	.016	.037	.053	.057	.070	.062
60	PF1182	.049	.082	.098	.148	.180	.213	.246(V6½)		.016	.033	.045	.053	.074	.082	.053
60	PF1177	.066	.098	.131	.164	.197	.262	—	—	.020	.025	.045	.053	.070	.053	—
60	PF1180	.066	.098	.131	.164	.197	.246	—	—	.016	.037	.062	.062	.062	.020	—
51	PF1160	.082	.082	.098	.131	.197	.180(V5½)	—		.012	.033	.041	.062	.041	.029(V5½)	
62	PF1169	.049	.082	.098	.148	.148	.246	—	—	.012	.020	.041	.037	.053	.025	—
61	PF1162	.049	.066	.098	.148	.180	.246	—	—	.016	.020	.037	.049	.049	.020	—
60	PF1184	.049	.082	.114	.131	.230	—	—	—	.016	.033	.045	.053	.037	—	—
62	PF1170	.066	.066	.082	.148	.180	.213	—	—	.012	.020	.025	.041	.053	.041	—

Fusulinella bocki biconiformis Ishii, subsp. nov.

62	PF1172	.033	.049	.082	.114	.148	.180	.246	—	.008	.016	.020	.041	.041	.041	.037
60	PF1183	.033	.049	.082	.131	.164	.164	.213	.230(V7½)	.012	.012	.029	.041	.062	.045	.074
60	PF1178	.033	.049	.082	.114	.131	.164	.213	.213	.008	.012	.016	.029	.041	.045	.082
60	*PF1072	—	.049	.066	.098	.131	.180	.246	.295	—	.012	.020	.033	.049	.066	.053
60	PF1185	.049	.066	.098	.114	.114	.164	.262	—	.008	.012	.016	.020	.041	.049	.082
60	PF1186	.033	.066	.082	.131	.180	.279	.230(V6½)		.012	.020	.033	.041	.057	.090	.033
62	PF1278a	.033	.066	.082	.114	.148	.213	.230	—	.008	.016	.029	.041	.041	.053	.016
65	PF1191	.049	.066	.082	.131	.197	.246	.230(V6½)		.008	.012	.025	.041	.041	.049	.041
62	PF1171	.049	.049	.066	.098	.164	.230	.197	—	.008	.012	.025	.045	.053	.057	.025
61	PF1163	—	—	.098	.114	.164	.213	.279	—	—	—	.029	.033	.033	.049	.029

Table 11. Measurements of *Fusulinella* spp.

Fusulinella spp.

Lo.	Reg. no.	Pl.	Fig.	L.	W.	R.	P.	Vol. no.	Radius vector (mm.)						
									V1	2	3	4	5	6	7
2	PF1247	10.	5	3.516	1.722	2.05	.066	6½	.066	.131	.230	.361	.541	.770	.934(V6½)
39	PF1248	10.	7	3.075	1.558	1.97	.082	6½	.082	.148	.213	.344	.508	.721	.820(V6½)
2	PF1249	10.	6	3.239	1.681	1.93	—	6½	.082	.148	.230	.361	.541	.770	.934(V6½)

Lo.	Reg. no.	Height of volution (mm.)							Thickness of spirotheca (mm.)						
		V1	2	3	4	5	6	7	V1	2	3	4	5	6	7
2	PF1247	.033	.066	.082	.131	.197	.230	.230(V6½)	.008	.012	.033	.041	.041	.074	.033V(6½)
39	PF1248	.033	.049	.082	.114	.180	.213	.180(V6½)	.008	.016	.025	.049	.074	.078	.020(V6½)
2	PF1249	—	.066	.082	.131	.180	.213	.279(V6½)	—	.016	.029	.041	.045	.078	.029(V6½)

	Tunnel angle (degree)							
8	V1	2	3	4	5	6	7	8
.029(V7½)	19	18	17	20	20	23	26	—
(V6½)	—	18	18	16	19	24	26(V6½)	
(V6½)	16	17	23	21	28	31	19(V6½)	
—	—	19	25	31	33	23	—	—
—	20	20	26	36	28	—	—	—
—	26	24	19	21	23	—	—	—
—	—	22	26	29	31	—	—	—
—	15	13	21	23	24	28	—	—
—	17	22	20	20	24	—	—	—
—	25	21	19	24	32	22	—	—

—	19	13	17	18	25	33	—	—
.025(V7½)	10	20	23	22	30	28	—	—
.041	—	21	16	17	17	20	22	—
.041	—	16	16	16	25	26	—	—
—	—	10	17	20	22	27	32	—
(V6½)	—	22	24	18	26	32	—	—
—	—	16	18	17	20	24	—	—
(V6½)	—	13	20	20	23	26	32(V6½)	
—	—	13	20	28	22	32	—	—
—	—	—	18	16	21	22	29	—

Ratio of Hl/Rv						
V1	2	3	4	5	6	7
1.3	1.3	1.6	1.8	2.0	2.1	1.8(V6½)
1.0	1.2	1.7	1.8	1.8	1.8	1.9(V6½)
1.0	1.1	1.4	1.5	1.5	1.6	1.7(V6½)

Tunnel angle (degree)						
V1	2	3	4	5	6	7
—	15	26	30	45	51	—
—	11	18	22	25	40	—
—	—	25	24	35	40	—

Plate VI

Explanation of Plate VI

page

Eostaffella sp. cfr. *Eostaffella bigemmicula* (Igo), 1957 2

Figs. 1-3, 5. Axial sections. 1-3 ×72, 5 ×90.
1, (PF 1218), loc. 32.
2, (PF 1067b), loc. 37.
3, (PF 1223), loc. 20.
5, (PF 1196), loc, 62.

Fig 4. Tangential section, (PF 1147a), loc 62. ×72.

Eostaffella sp. 2

Fig. 6. Tangential section, (PF 1221), loc. 37. ×72.

Millerella ? sp. 4

Figs. 7, 8. Axial sections. all ×72.
7, (PF 1194a), loc. 57.
8, (PF 1207b), loc. ditto.

Fig. 9. Tangential section, (PF 1193b), loc. 62. ×72.

Pseudoendothyra ? sp. 1

Figs. 10, 12, 13. Oblique sections. all ×20.
10, (PF 1243), loc. 2.
12, (PF 1245), loc. ditto.
13, (PF 1246), loc. ditto.

Fig. 11. Sagittal section, (PF 1244), loc. 2. ×20.

Pseudoendothyra sp. 1

Fig. 14. Tangential section, (PF 1275), loc. 2. ×40.

Explanation of Plate VI (continued) page

Ozawainella angulata (COLANI), 1924 4

Fig. 15. Tangential section, (PF 1256d), loc. 57. ×40.
Figs. 16, 17. Axial sections. all ×40.
16, (PF 1254), loc. 44.
17, (PF 1253), loc. 57.
Figs. 18, 19, 22. Oblique sections. all ×40.
18, (PF 1257), loc. 44.
19, (PF 1010b), loc. ditto.
22, (PF 1136b), loc. 57.
Figs. 20, 21. Sagittal sections. all ×40.
20, (PF 1034b), loc. 73.
21, (PF 1030b), loc. 35.

Eoschubertella toriyamai ISHII, sp. nov. 5

Figs. 23, 24, 28, 29, 34. Oblique sections. all ×40.
23, (PF 1205), loc. 32.
24, (PF 1022b), loc. ditto.
28, (PF 1210), loc. 57.
29, (PF 1256e), loc. ditto.
34, (PF 1203), loc. 35.
Fig. 25. Sagittal section, (PF 1132a), loc. 73. ×40.
Fig. 31. Axial section of the holotype (PF 1098b), loc. 35. ×40.
Figs. 26, 27, 30, 32, 33, 35-37. Axial sections. all ×40.
26, (PF 1207a), loc. 57.
27, (PF 1208), loc. 43.
30, (PF 1276), loc. 29.
32, (PF 1202), loc. 35.
33, (PF 1209), loc. 57.
35, (PF 1217), loc. 20.
36, (PF 1216), loc. 32.
37, (PF 1215a), loc. 57.

Eoschubertella sp. cfr. *Eoschubertella lata* (LEE et CHEN), 1930 6

Figs. 38-40. Axial sections. all ×40.
38, (PF 1199), loc. 43.
39, (PF 1214), loc. 73.
40, (PF 1200a), loc. 60.

Eoschubertella sp. cfr. *Eoschubertella obscura* (LEE et CHEN), 1930 8

Figs. 41-43. Axial sections. all ×40.
41, (PF 1198), loc. 73.
42, (PF 1204), loc. 35.
43, (PF 1212), loc. 73.
Fig. 44. Oblique section, (PF 1195b), loc. 73. ×40.

Fusiella typica sparsa SHENG, 1958. (See also Pl. VII, Figs. 1-15, 17, 18) 9

Figs. 45, 46. Axial sections. all ×40.
45, (PF 1215b), loc. 57.
46, (PF 1238), loc. 31.

10-14, 30 are from the It_1 fossil zone, 1-3, 6-8, 15-29, 31-39, 41-46 from the It_2 fossil zone and 4, 5, 9, 40 from the It_3 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Ehime Prefecture, Shikoku. All specimens here illustrated are collected by K. ISHII and are deposited in the Department of Geosciences, Osaka City University.

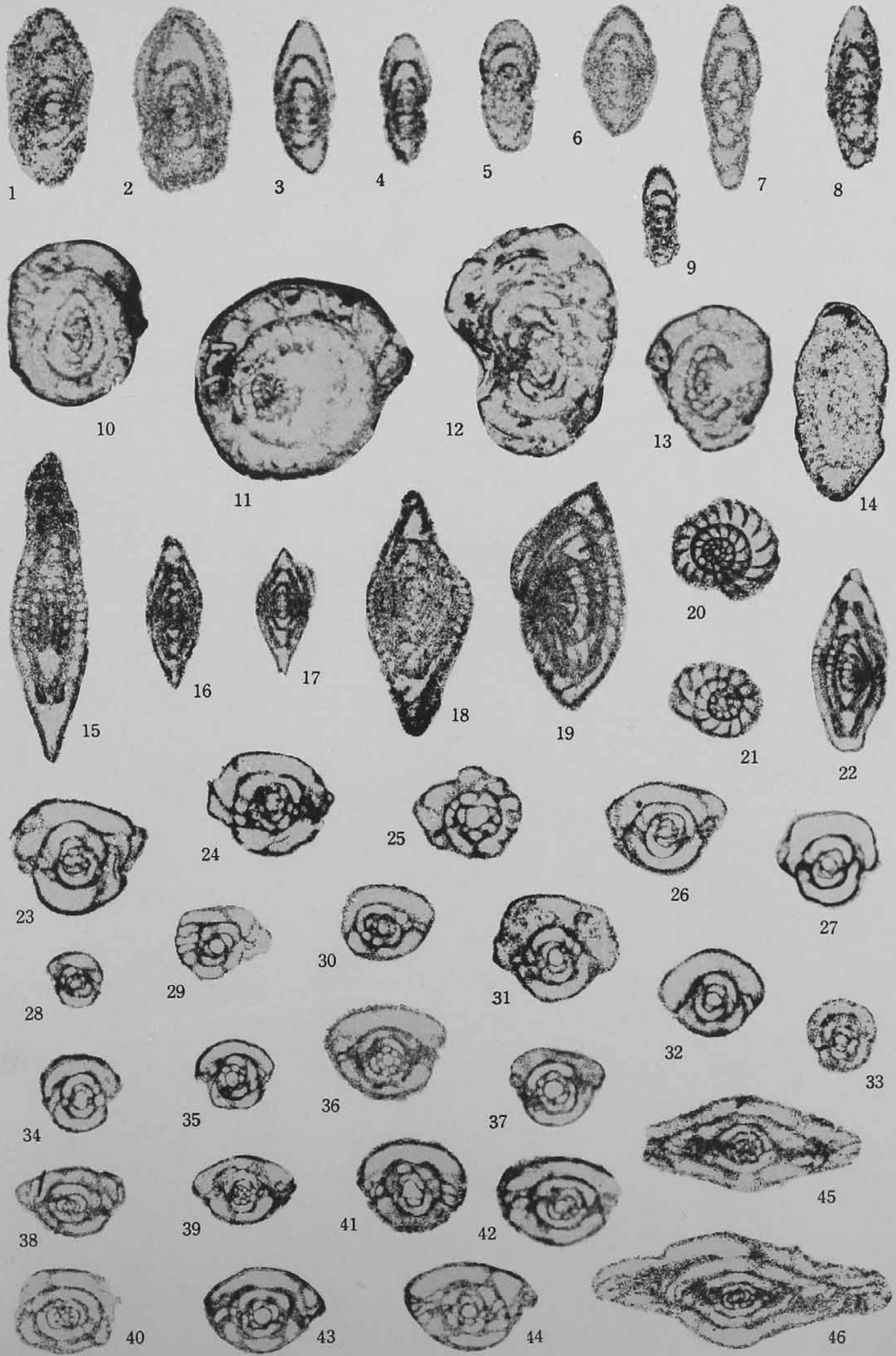
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Plate VII

Explanation of Plate VII

page

Fusiella typica sparsa SHENG, 1958. (See also Pl. VI, Figs. 45, 46)..... 9

Figs. 2, 4, 6, 8, 11, 12, 13, 14, 18. Axial sections. all ×40.
2, (PF 1224), loc. 62.
4, (PF 1225), loc. ditto.
6, (PF 1266b), loc. 32.
8, (PF 1127b), loc. 44.
11, (PF 1025b), loc. ditto.
12, (PF 1237), loc. 31.
13, (PF 1226), loc. 61.
14, (PF 1256b), loc. 57.
18, (PF 1256a), loc. ditto.

Figs. 1, 5, 7, 15, 17. Tangential sections. all ×40.
1, (PF 1266a), loc. 32.
5, (PF 1137b), loc. 57.
7, (PF 1258b), loc. 44.
15, (PF 1234), loc. 35.
17, (PF 1277), loc. 62.

Figs. 9. Oblique section, (PF 1278a), loc. 62. ×40.

Figs. 3, 10. Sagittal sections. all ×40.
3, (PF 1265), loc. 51.
10, (PF 1193a), loc. 62.

Fusiella sp. 10

Figs. 16, 19. Axial sections. all ×40.
16, (PF 1256c), loc. 57.
19, (PF 1028b), loc. 32.

Fusulinella minutissima ISHII, sp. nov. (See also Pl. VIII, Figs. 1-6)..... 11

Figs. 21, 26. Axial section of the holotype (PF 1131), loc. 73. 21×15, 26×40.

Figs. 23, 24, 27, 28, 30, 32, 33. Axial sections. 30×40, other figures ×15.
23, (PF 1120), loc. 32.
24, (PF 1123a), loc. 44.
27, (PF 1130), loc. 73.
28, (PF 1125), loc. 44.
30, (PF 1128a), loc. 62.
32, (PF 1267), loc. 20.
33, (PF 1123b), loc. 44.

Figs. 22, 25, 31. Tangential sections. all ×15.
22, (PF 1134), loc. 35.
25, (PF 1129b), loc. 73.
31, (PF 1240), loc. ditto.

Figs. 20, 29. Sagittal seiotcns. 20×15, 29×40.
20, (PF 1126), loc. 44.
29, (PF 1132b), loc. 73.

1, 5-8, 11, 12, 14-16, 18-29, 31-33 are from the It_2 fossil zone and 2-4, 9,10,13, 17, 30 from the It_3 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Ehime Prefecture, Shikoku. All specimens here illusrtated are collected by K. ISHII and are deposited in the Department of Geosciences, Osaka City University.

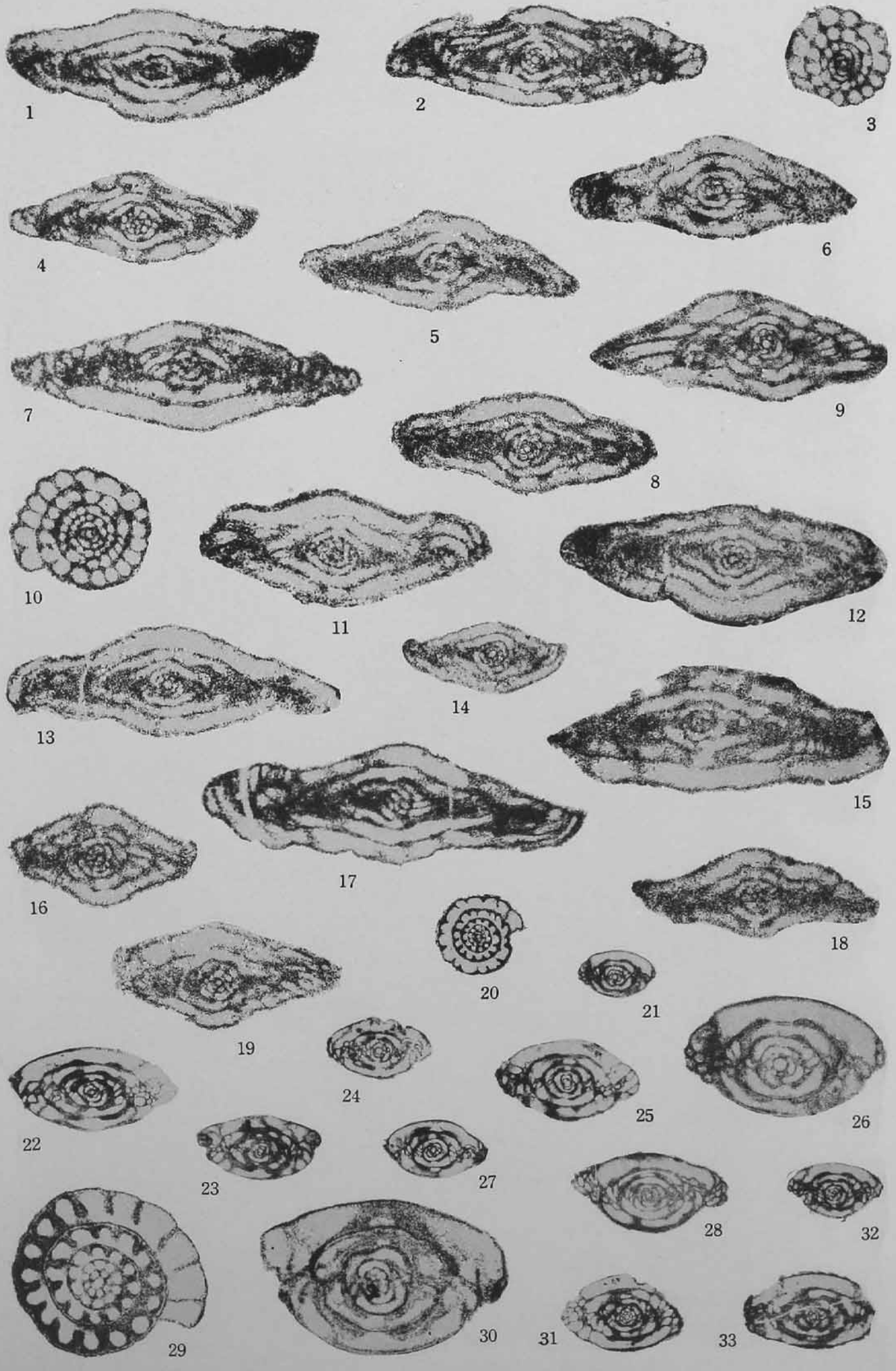
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Plate VIII

Explanation of Plate VIII

page

Fusulinella minutissima Ishii, sp. nov. (See also Pl. VII, Figs. 20-33) 10

Figs. 1-6, Axial sections. 4 ×40, other figures ×15.

1, (PF 1219), loc. 35.
2, (PF 1252), loc. ditto.
3, (PF 1251), loc. 44.
4, 5, same specimen (PF 1195c), loc. 73.
6, (PF 1250), loc. 32.

Fusulinella itadorigawensis Ishii, sp. nov. 11

Figs. 7-9, 11-15, 16-19, 21-23, 25. Axial sections. all ×15.

7, (PF 1114), loc. 2.
8, (PF 1082a), loc. ditto.
9, (PF 1116), loc. ditto.
11, (PF 1076), loc. ditto.
12, (PF 1109), loc. ditto.
13, (PF 1083), loc. ditto.
14, (PF 1117), loc. ditto.
15, (PF 1086), loc. ditto.
16, (PF 1118), loc. 29.
17, (PF 1084), loc. 2.
18, (PF 1078a), loc. ditto.
19, (PF 1111), loc. 41.
21, (PF 1078b), loc. 2.
22, (PF 1112), loc. ditto.
23, (PF 1085b), loc. ditto.
25, (PF 1113), loc. 29.

Fig. 10. Axial section of the holotype (PF 1077), loc. 2. ×15.
Fig. 20. Tangential section, (PF 1081), loc. 38. ×15.
Fig. 24. Oblique section, (PF 1110), loc. 29. ×15.

Fusulinella simplicata var. β 19

Figs. 26-28. Axial sections. all ×15.

26, (PF 1075), loc. 2.
27, (PF 1085a), loc. ditto.
28, (PF 1096), loc. ditto.

1-6 are from the It_2 fossil zone and 7-28 from the It_1 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Ehime Prefecture, Shikoku. All specimens here illustrated are collected by K. Ishii and are deposited in the Department of Geosciences, Osaka City University.

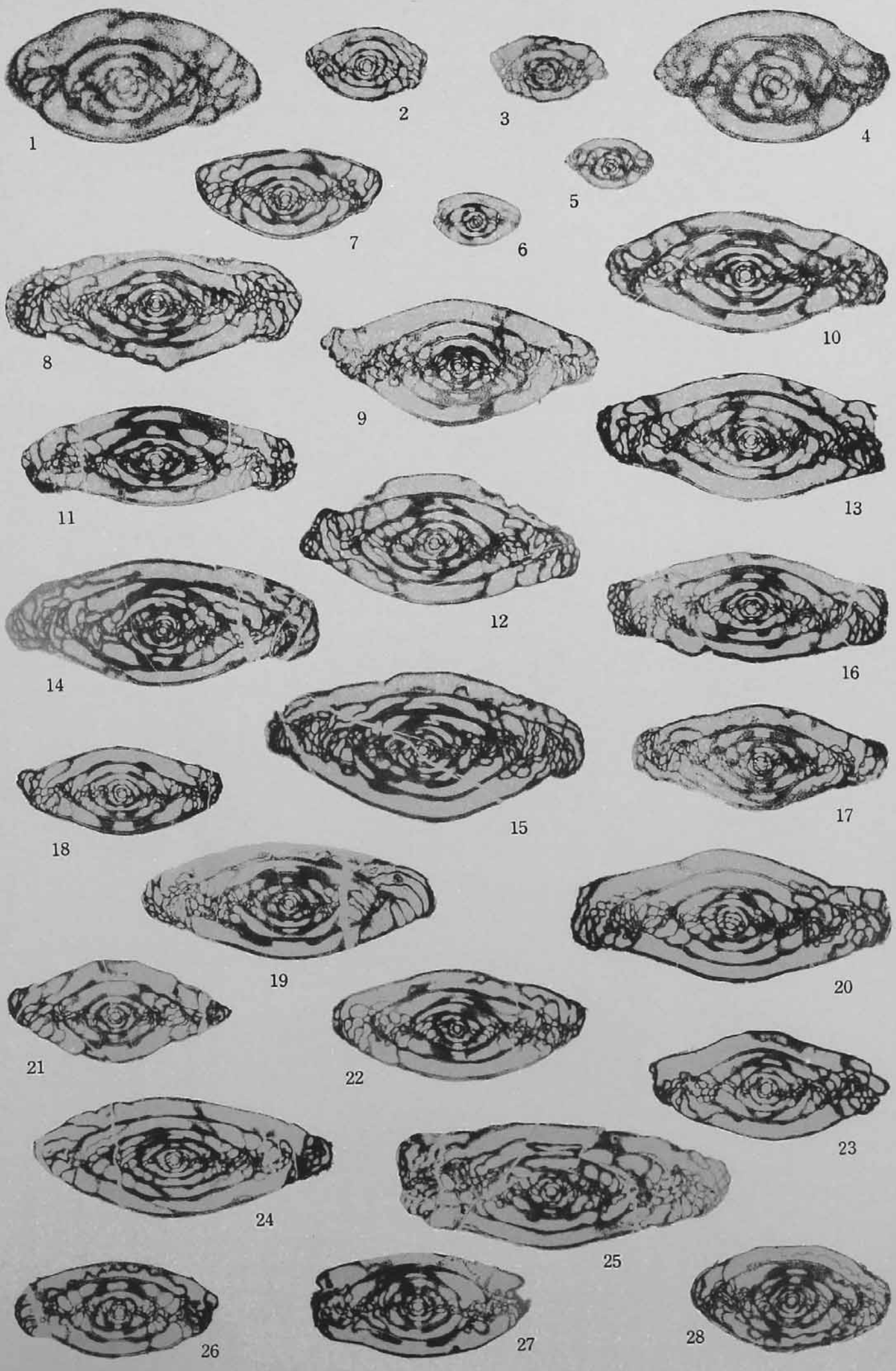
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Plate IX

Explanation of Plate IX

page

Fusulinella simplicata var. *α* 18

Figs. 1-3, 6. Axial sections. all ×15.
1, (PF 1094), loc. 41.
2, (PF 1103), loc. 2.
3, (PF 1095), loc. ditto.
6, (PF 1098a), loc. 29.

Fusulinella simplicata simplicata TORIYAMA, 1958. 15

Figs. 4, 5, 7-9. Axial sections. all ×15.
4, (PF 1179), loc. 2.
5, (PF 1093), loc. 40.
7, (PF 1089), loc. 29.
8, (PF 1088), loc. 38.
9, (PF 1262), loc. 2.

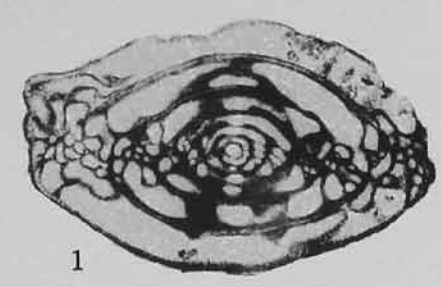
Fusulinella simplicata onoi ISHII, subsp. nov. (See also Pl. X, Figs. 1, 2) 17

Figs. 10, 12, 13, 15, 16, 18. Axial sections. all ×15.
10, (PF 1100), loc. 2.
12, (PF 1106), loc. ditto.
13, (PF 1092), loc. 38.
15, (PF 1099), loc. 62.
16, (PF 1104), loc. 2.
18, (PF 1101), loc. ditto.

Fig. 14. Axial section of the holotype (PF 1090), loc. 2. ×15.

Figs. 11, 17, 19. Oblique sections. all ×15.
11, (PF 1105), loc. 2.
17, (PF 1091), loc. ditto.
19, (PF 1102), loc. ditto.

1-15, 17-19 are from the It_1 fossil zone and 16 from the It_3 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Ehime Prefecture, Shikoku. All specimens here illustrated are collected by K. ISHII and are deposited in the Department of Geosciences, Osaka City University.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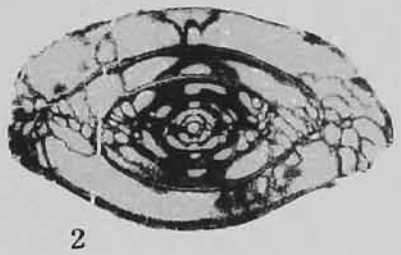
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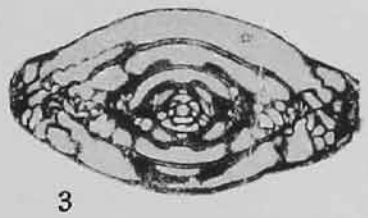
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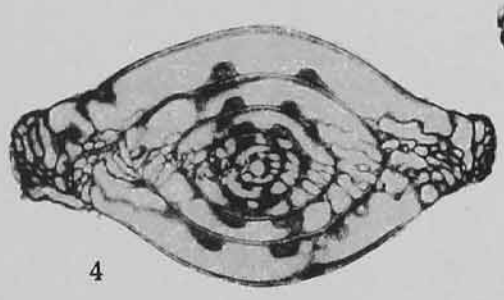
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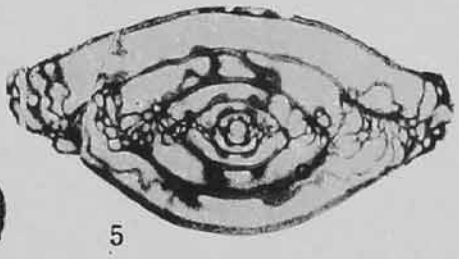
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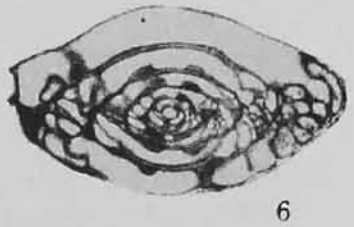
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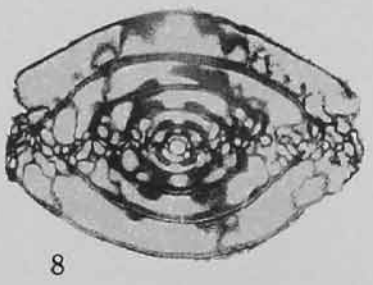
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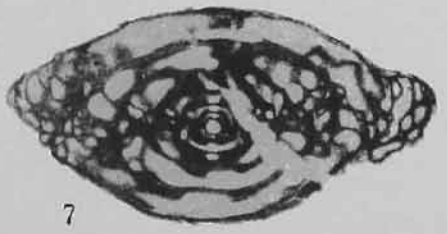
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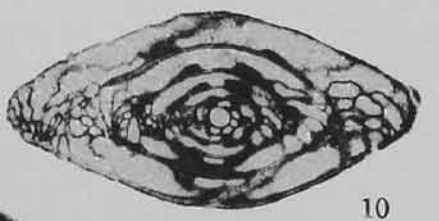
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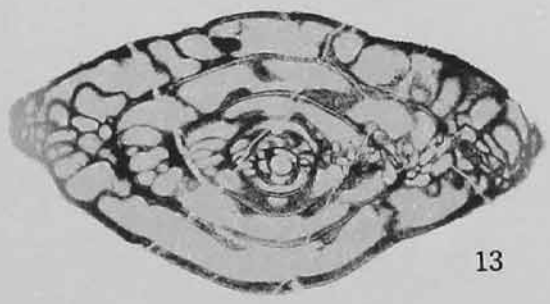
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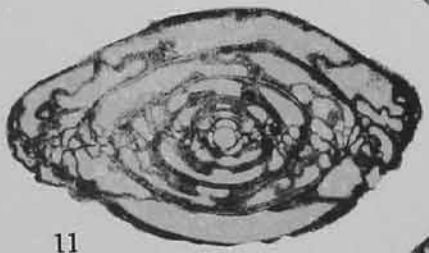
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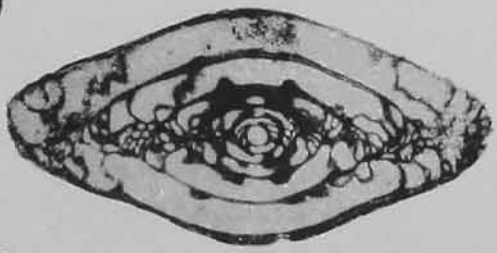
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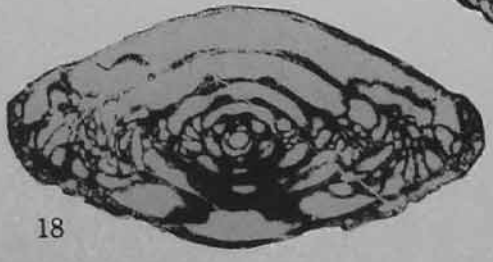
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Plate X

Explanation of Plate X

page

Fusulinella simplicata onoi Ishii, subsp. nov. (See also Pl. IX. Figs. 10-19) 17

Figs. 1, 2. Oblique sections. all ×15.
1, (PF 1074), loc. 2.
2, (PF 1107), loc. 38.

Fusulinella iyoensis Ishii, sp. nov. 14

Fig. 3. Axial section of the holotype (PF 1087), loc. 2. ×15.

Fig. 4. Axial section, (PF 1079), loc. ditto. ×15.

Fusulinella spp. 26

Figs. 5, 7. Axial sections. all ×15.
5, (PF 1247), loc. 2.
7, (PF 1248), loc. 39.

Fig. 6. Oblique section, (PF 1249), loc. 2. ×15.

Fusulinella pygmaea Ishii, sp. nov. 19

Figs. 8, 9, 12-15, 18. Axial sections. 8, 13 ×40, other figures ×15.
8, (PF 1156), loc. 60.
9, (PF 1058b), loc. 44.
12, (PF 1226), loc. 51.
13, (PF 1137a), loc. 57.
14, (PF 1136a), loc. ditto.
15, (PF 1154), loc. 60.
18, (PF 1137c), loc. 57.

Figs. 10, 11. Axial section of the holotype (PF 1152), loc. 73. 10 ×40, 11 ×15.

Figs. 16, 19. Tangential sections. all ×15.
16, (PF 1003b), loc. 44.
19, (PF 1153), loc. ditto.

Fig. 17. Oblique section, (PF 1143), loc. 35. ×15.

Fusulinella elegantula Ishii, sp. nov. 20

Figs. 20, 21, 26, 31. Tangential sections. all ×15.
20, (PF 1269), loc. 60.
21, (PF 1145b), loc. 62.
26, (PF 1142), loc. 51.
31, (PF 1141), loc. ditto.

Figs. 22-24, 28. Axial sections. all ×15.
22, (PF 1147b), loc. 62.
23, (PF 1148), loc. ditto.
24, (PF 1139), loc. 51.
28, (PF 1145a), loc. 62.

Fig. 25. Axial section of the holotype (PF 1144), loc. 62. ×15.

Figs. 27, 32-34. Oblique sections. all ×15.
27, (PF 1140), loc. 51.
32, (PF 1149), loc. 62.
33, (PF 1270), loc. 51.
34, (PF 1268), loc. 32.

Figs. 29, 30. Sagittal sections. all ×15.
29, (PF 1150a), loc. 62.
30, (PF 1196b), loc. ditto.

1-7 are from the It_1 fossil zone, 9-11, 13, 14, 16-19, 34 from the It_2 fossil zone and 8, 12, 15, 20-33 from the It_3 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Ehime Prefecture, Shikoku. All specimens here illustrated are collected by K. Ishii and are deposited in the Department of Geosci ences, Osaka City University.

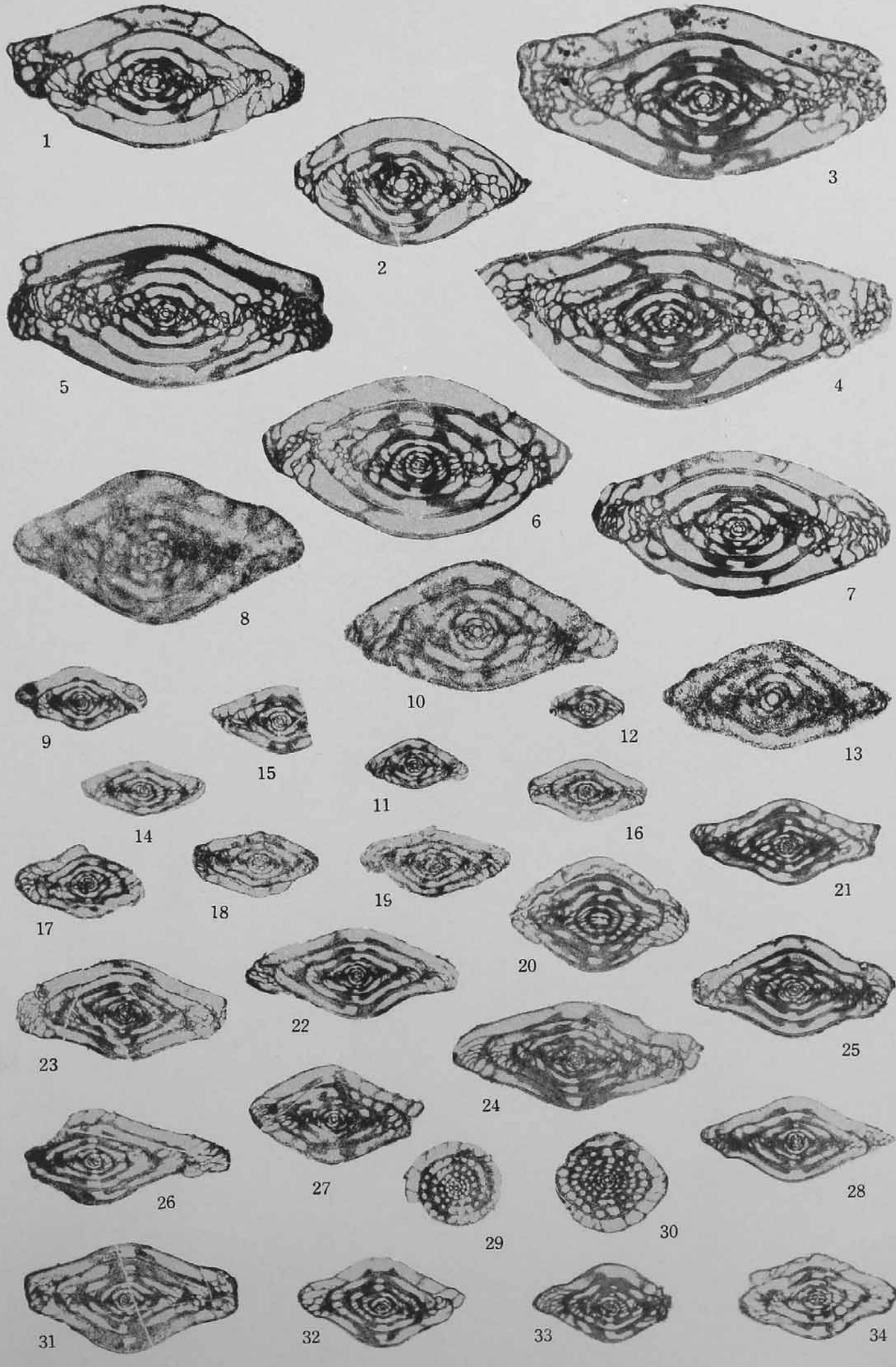
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Plate XI

Explanation of Plate XI

page

Fusulinella bocki bocki MÖLLER, 1878. 22

Figs. 1-8, 10, 11, 13. Axial sections. all ×15.
1, (PF 1161), loc. 61.
2, (PF 1157), loc. 51.
3, (PF 1174), loc. 60.
4, (PF 1187), loc. 68.
5, (PF 1164), loc. 62.
6, (PF 1200b), loc. 60.
7, (PF 1158), loc. 51.
8, (PF 1165), loc. 62.
10, (PF 1128b), loc. ditto.
11, (PF 1159), loc. 51.
13, (PF 1150b), loc. 62.

Figs. 9, 12. Oblique sections. all ×15.
9, (PF 1190), loc. 45.
12, (PF 1080) loc. 2.

Fusulinella bocki rotunda ISHII, subsp. nov. (See also Pl. XII, Figs. 1-7) 24

Fig. 14. Sagittal section, (PF 1271), loc. 60. ×15.

Fig. 15. Axial section of the holotype (PF 1176), loc. 60. ×15.

Figs. 16-18. Oblique sections. all ×15.
16, (PF 1177), loc. 60.
17, (PF 1180), loc. ditto.
18, (PF 1181), loc. ditto.

1-11, 13-18 are from the It_3 fossil zone and 12 from the It_1 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Ehime Prefecture, Shikoku. All specimens here illustrated are collected by K. ISHII and are deposited in the Department of Geosciences, Osaka City University.


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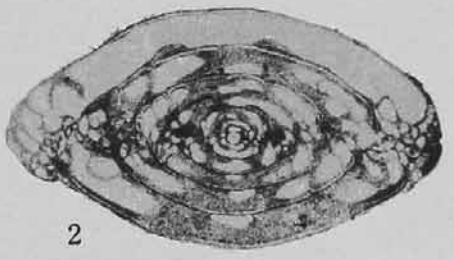
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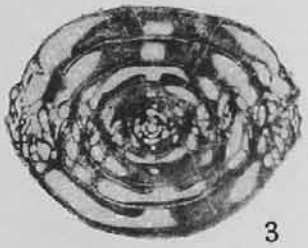
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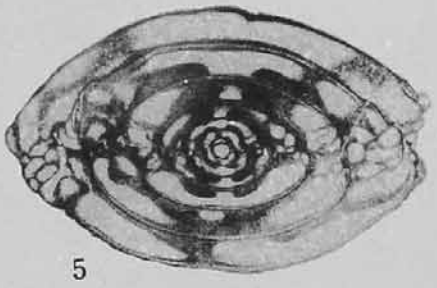
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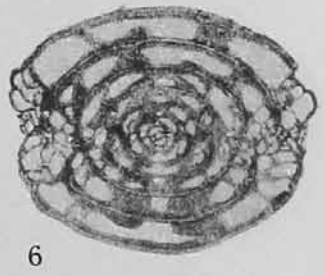
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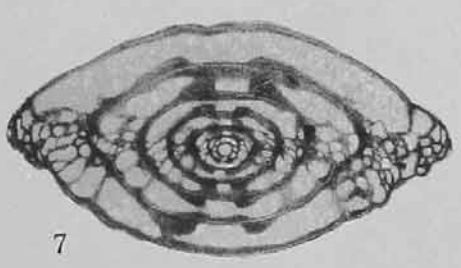
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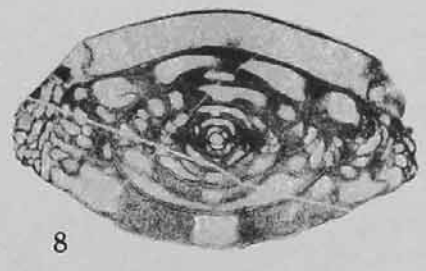
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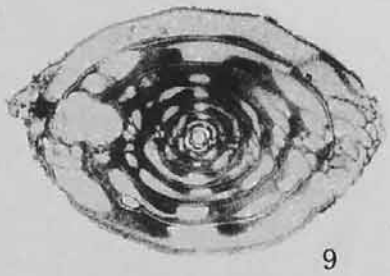
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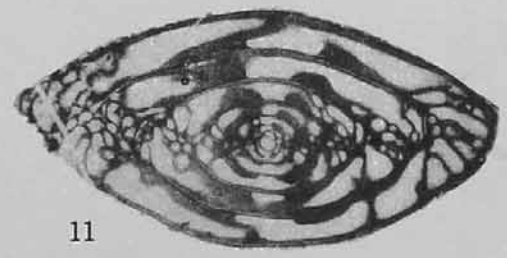
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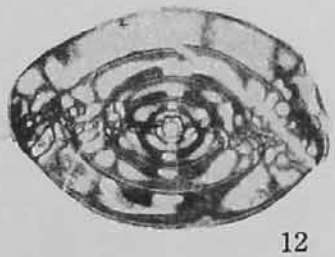
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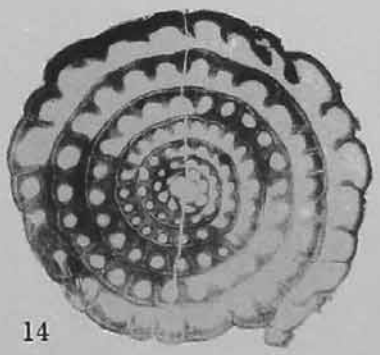
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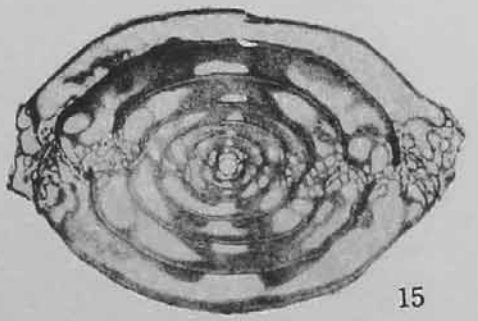
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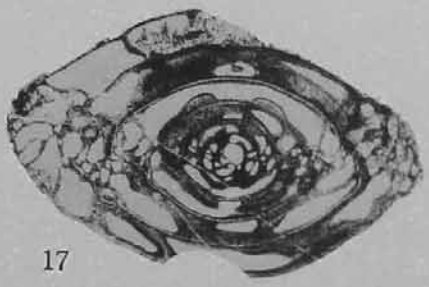
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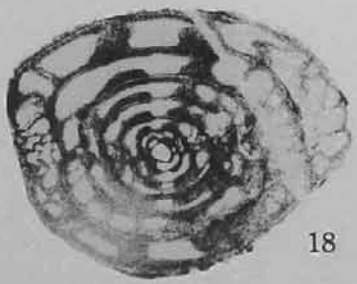
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Plate XII

Explanation of Plate XII

page

Fusulinella bocki rotunda Ishii, subsp. nov. (See also Pl. XI, Figs. 14-18) 24

Figs. 1-7. Axial sections. all ×15.
1, (PF 1170), loc. 62.
2, (PF 1169), loc. ditto.
3, (PF 1160), loc. 51.
4, (PF 1162), loc. 61.
5, (PF 1182), loc. 60.
6, (PF 1184), loc. ditto.
7, (PF 1279), loc. 61.

Fusulinella bocki biconiformis Ishii, subsp. nov. 25

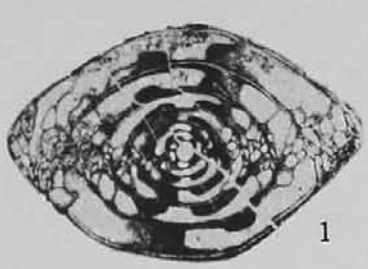
Figs. 9, 16. Oblique sections. all ×15.
9, (PF 1178), loc. 60.
16, (PF 1191), loc. 65.

Fig. 10. Tangential section of the holotype (PF 1072), loc. 60. ×15.

Figs. 8, 11, 14. Tangential sections. all ×15.
8, (PF 1185), loc. 60.
11, (PF 1278a), loc. 62.
14, (PF 1163), loc. 61.

Figs. 12, 13, 15, 17. Axial sections. all ×15.
12, (PF 1186), loc. 60.
13, (PF 1172), loc. 62.
15, (PF 1171), loc. ditto.
17, (PF 1183), loc. 60.

1-17 are from the It_3 fossil zone of the Itadorigawa group at Itadorigawa, Kurosegawa-village, Ehime Prefecture, Shikoku. All specimens here illustrated are collected by K. Ishii and are deposited in the Department of Geosciences, Osaka City University.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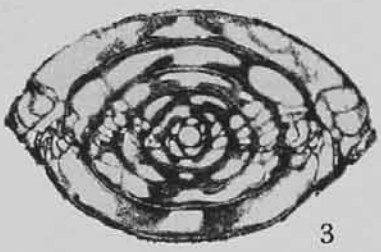
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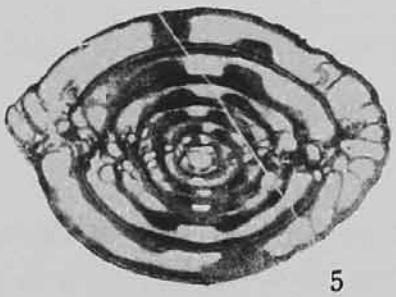
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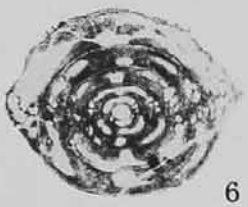
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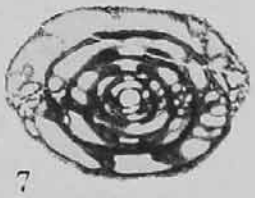
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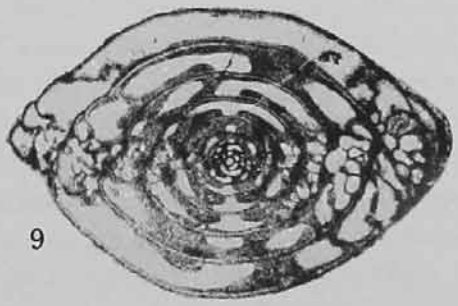
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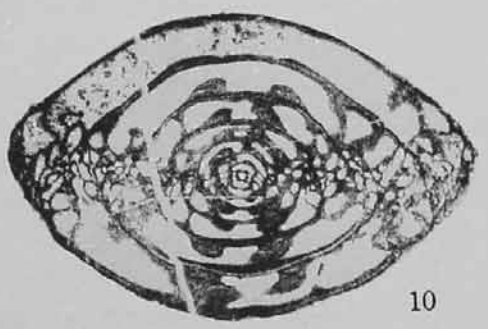
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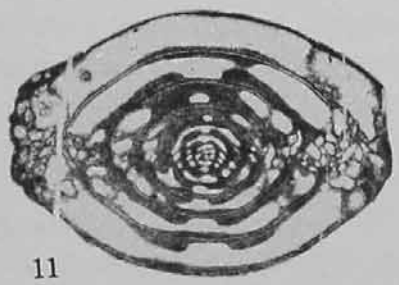
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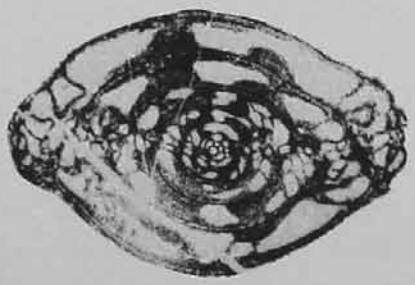
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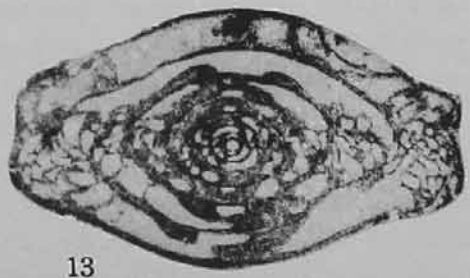
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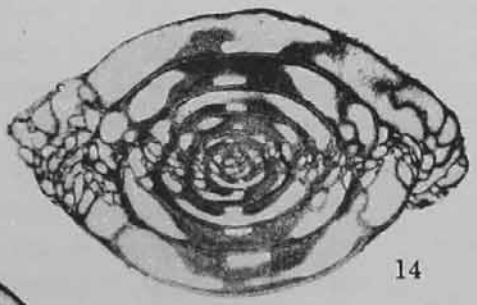
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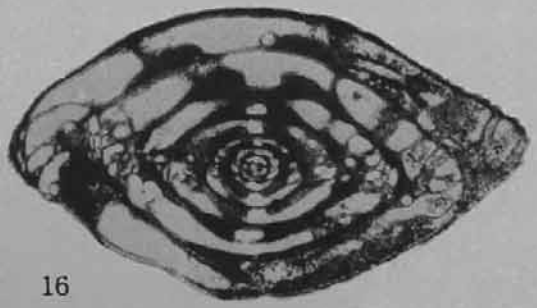
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