

Fusuline Fossils from Thailand, Part IX Permian
Fusulines from the Rat Buri Limestone in the
Khao Phlong Phrab Area, Sara Buri, Central
Thailand : Contribution to the Geology and
Palaeontology of Southeast Asia, CLXX

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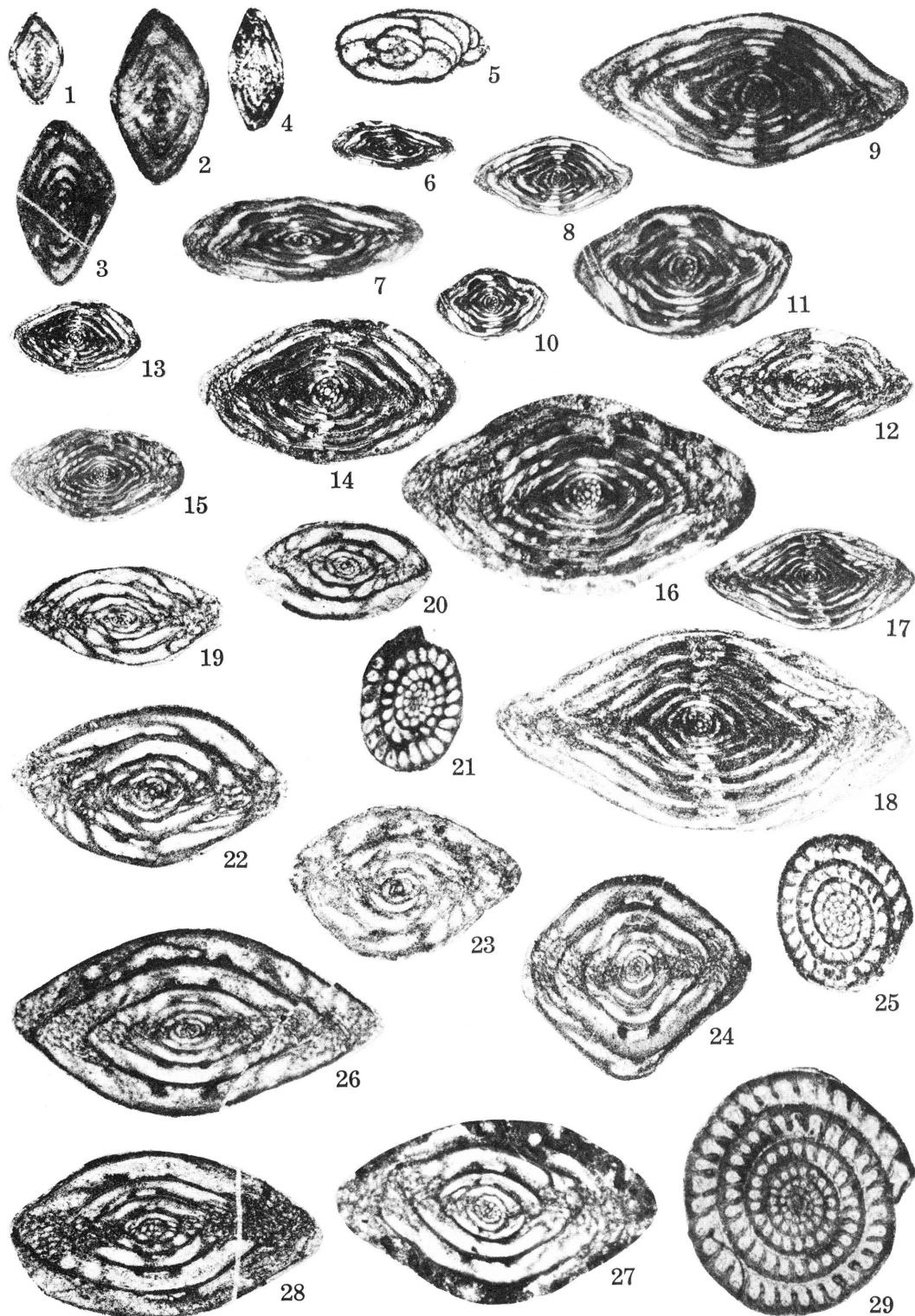
Ryuzo TORIYAMA

Fusuline Fossils from Thailand, Part IX
Permian Fusulines from the Rat Buri Limestone in the Khao
Phlong Phrab Area, Sara Buri, Central Thailand

Plates 1~21

Explanation of Plate 1

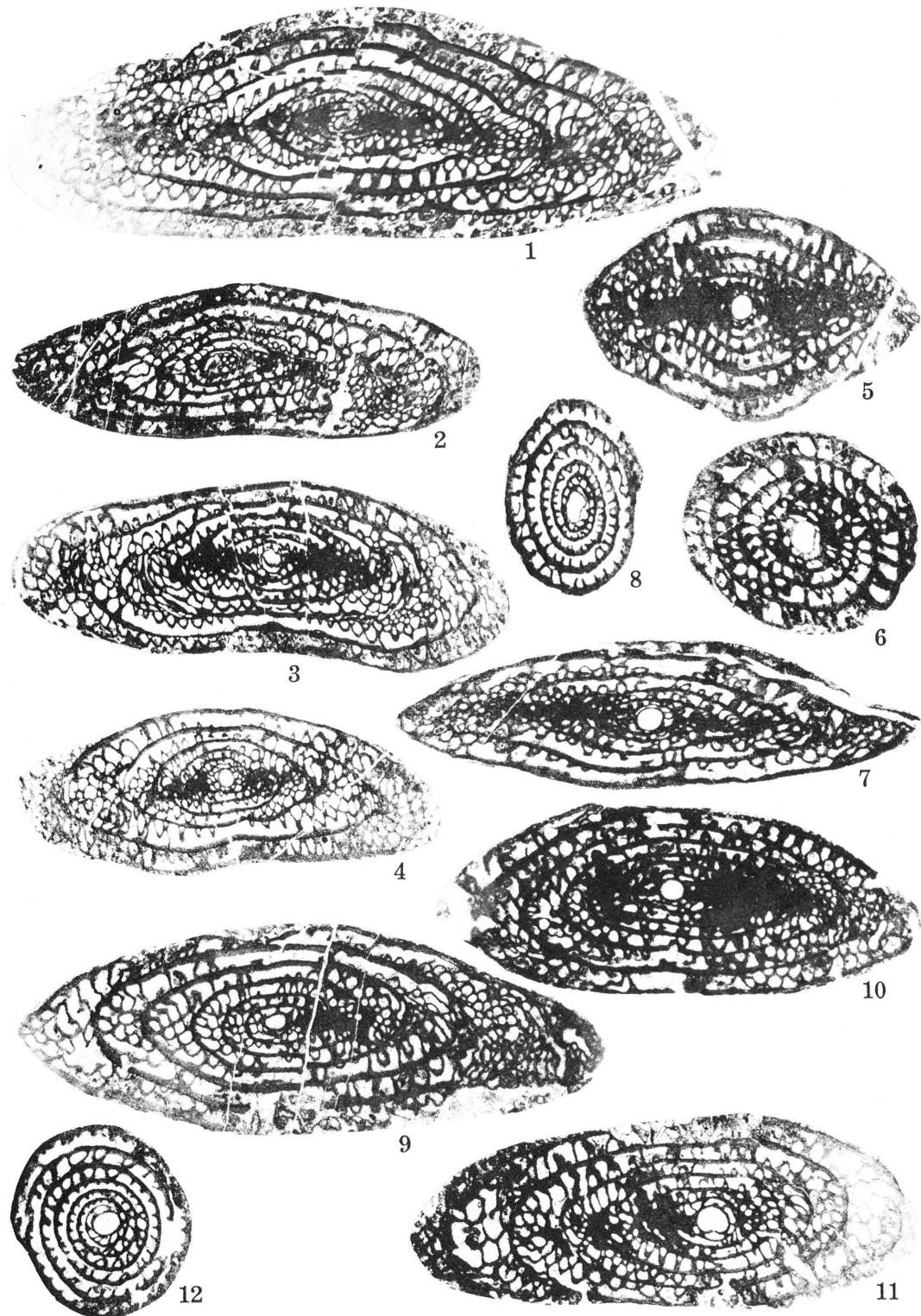
- Figs. 1–3. *Ozawainella* cfr. *akiyoshiensis* TORIYAMA Page 5
1, 3. Axial sections, GK.D 13128c and 13375; 2. Same as fig. 1: 1 (=2) from Kpp-39, 3 from Kpp-53. 1 ×10; 2, 3 ×20.
- Fig. 4. *Ozawainella* sp. Page 6
Axial section, GK.D 13043 from Kpp-29. ×10.
- Fig. 5. *Toriyamaia* sp. Page 6
Oblique section, GK.D 13646 from Kpp-60. ×10.
- Figs. 6–7. *Yangchienia* cfr. *compressa* (OZAWA) Page 7
6 (=7). Axial section, GK.D 13018 from Kpp-37. 6 ×10; 7 ×20.
- Figs. 8–12. *Yangchienia haydeni* THOMPSON Page 8
Axial sections, 8 (=9), GK.D 13475a; 10 (=11), GK.D 13592c; 12, GK.D 13487. All from Kpp-61. 8, 10, 12 ×10; 9, 11 ×20.
- Figs. 13–16. *Yangchienia tobleri* THOMPSON Page 9
Axial sections, 13 (=14), GK.D 13520. 15 (=16), GK.D 13596. Both from Kpp-71. 13, 15 ×10; 14, 16 ×20.
- Figs. 17–18. *Yangchienia thompsoni* SKINNER and WILDE Page 11
Axial sections, 17 (=18), GK.D 13825 from Kpp-76. 17 ×10; 18 ×20.
- Figs. 19–21. *Neofusulinella saraburiensis* TORIYAMA, KANMERA and INGAVAT
19–20. Axial sections, GK.D 13134 and 13163; 21. Sagittal section, GK.D 13145a. 19 from Kpp-39; 20 from Kpp-7; 21 from Kpp-35. All ×20.
Figs. 19–21 were illustrated as Figs. 1, 2 and 8 of Plate III in the original description of TORIYAMA, KANMERA and INGAVAT (1969).
- Figs. 22–25. *Neofusulinella praecursor* DEPRAT
22–24. Axial sections, GK.D 13460, 13643 and 13491; 25. Sagittal section, GK.D 13463a. 22 and 25 from Kpp-60; 23 from Kpp-47; 24 from Kpp-61. All ×20.
Figs. 21–25 were illustrated as Figs. 11, 13, 15, and 17 of Plate III by TORIYAMA, KANMERA and INGAVAT (1969).
- Figs. 26–21. *Neofusulinella lantenoisi* DEPRAT
26–28. Axial sections, GK.D 13914, 13561 and 13457; 29. Sagittal section, GK.D 13599. 26 from Kpp-38; 27 from Kpp-53; 28 from Kpp-58; 29 from Kpp-71. All ×20.
Figs. 26–29 were illustrated as Figs. 1, 2, 4, and 11 of Plate IV by TORIYAMA, KANMERA and INGAVAT (1969).



Explanation of Plate 2

All $\times 10$

- Figs. 1–4. *Schwagerina* cfr. *gangpianshanensis* SHENG Page 12
1, 3, 4, Axial sections, GK.D 13739, 13745, and 13744; 2, Tangential section,
GK.D 13592b. 1, 3, 4 from Kpp-54; 2 from Kpp-61.
- Figs. 5–6. *Pseudofusulina kueichowensis obesa* SHENG Page 14
5. Axial section, GK.D 13215; 6. Sagittal section GK.D 13222. Both from
Kpp-21.
- Figs. 7–8. *Pseudofusulina regularis* (SCHELLWIEN) Page 15
7. Axial section, GK.D 13216; 8. Sagittal section GK.D 13218. Both from
Kpp-21.
- Figs. 9–12. *Pseudofusulina* cfr. *uenoensis* KOBAYASHI (See also Plate 3) ...
..... Page 16
9–11. Axial sections, GK.D 13821, 13547 and 13814; 12. Sagittal section, GK.D
13552. 9, 11 from Kpp-76; 10, 12 from Kpp-80.



Explanation of Plate 3

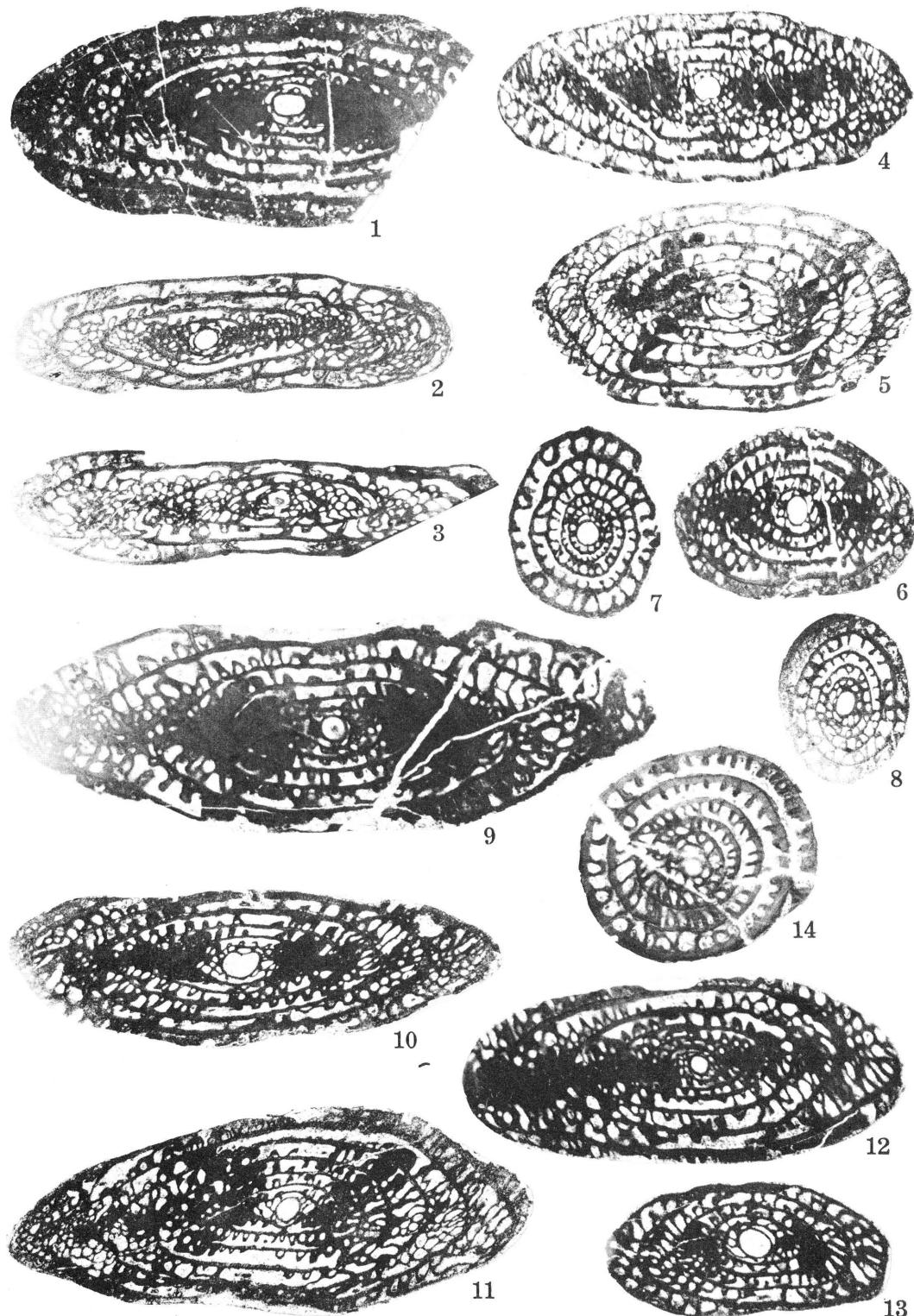
All $\times 10$

Fig. 1. *Pseudofusulina* cfr. *uenoensis* KOBAYASHI (See also Plate 2) ..Page 16
Axial section, GK.D 13467 from Kpp-61.

Figs. 2-3. *Pseudofusulina* sp.
2, 3. Axial sections, GK.D 13049 and 13032. Both from Kpp-29.

Figs. 4-8. *Parafusulina* cfr. *elliptica* SHENGPage 18
4-6. Axial sections, GK.D 13934, 14099 (slightly tangential) and 13250 (im-
mature individual). 7, 8. Sagittal sections, GK.D 13705 and 13121. 4 from
Kpp-38; 5 and 7 from Kpp-5; 6 from Kpp-26; 8 from Kpp-39.

Figs. 9-14. *Parafusulina* *gruperaensis* *gruperaensis* THOMPSON and MILLER
(See also Plate 4)Page 20
9-13. Axial sections, GK.D 13315, 13090c, 13090d, 13067, and 13198: 14. Sagit-
tal section, GK.D 13317. 9 and 14 from Kpp-22; 10, 11 from Kpp-24; 12
from Kpp-39; 13 from Kpp-18.



Explanation of Plate 4

All $\times 10$

- Fig. 1. *Parafusulina gruperaensis gruperaensis* THOMPSON and MILLER (See also Plate 3) Page 20
Axial section, GK.D 13072 from Kpp-39.
- Fig. 2. *Parafusulina gruperaensis brevica* SHENG Page 22
Axial section, GK.D 13154 from Kpp-7.
- Figs. 3-4. *Parafusulina quasigruperaensis* SHENG Page 23
3-4. Axial sections, GK.D 13549 and 14048. 3 from Kpp-80; 4 from Kpp-82.
- Figs. 5-9. *Parafusulina yabei* HANZAWA Page 23
5-8. Axial sections, GK.D 13951, 13946, 13948 and 13950: 9. Tangential section showing regularly fluted septa, GK.D 13951. All from Kpp-38.



Explanation of Plate 5

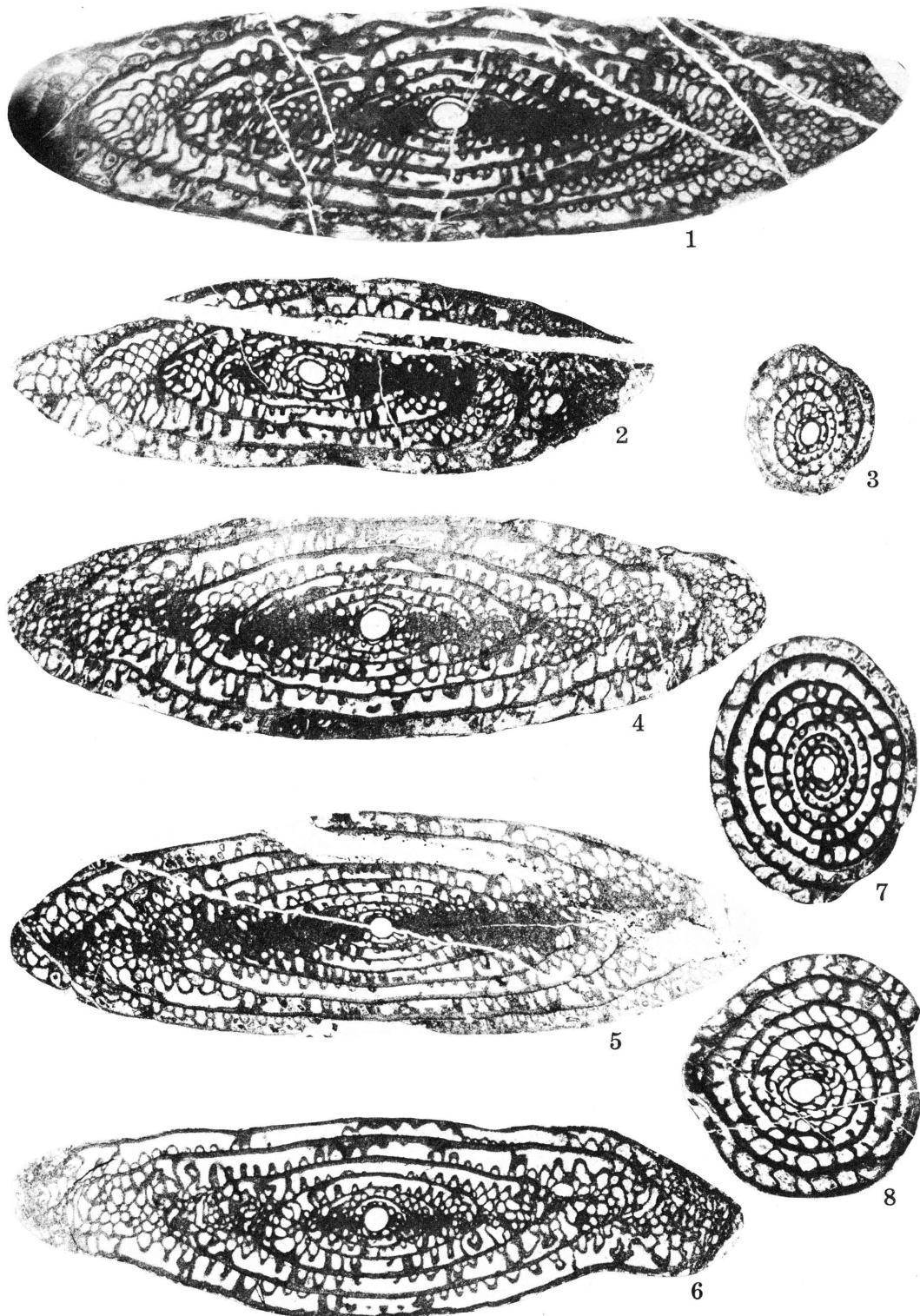
All $\times 10$

Figs. 1–3. *Parafusulina* cfr. *sapperi* (STAFF)Page 28

1. Axial section, GK.D 13214; 2. Axial section referred to this species with a query, GK.D 13144; 3. Sagittal section, GK.D 13022 (immature individual). 1 from Kpp-21; 2, 3 from Kpp-35.

Figs. 4–8. *Parafusulina japonica* (GÜMBEL) (See also Plate 6)Page 25

4–6. Axial sections, GK.D 13923, 13919 and 13965; 7, 8. Sagittal sections, GK.D 13925 and 13078. 4, 5, 7 from Kpp-38; 6 from Kpp-42; 8 from Kpp-37.

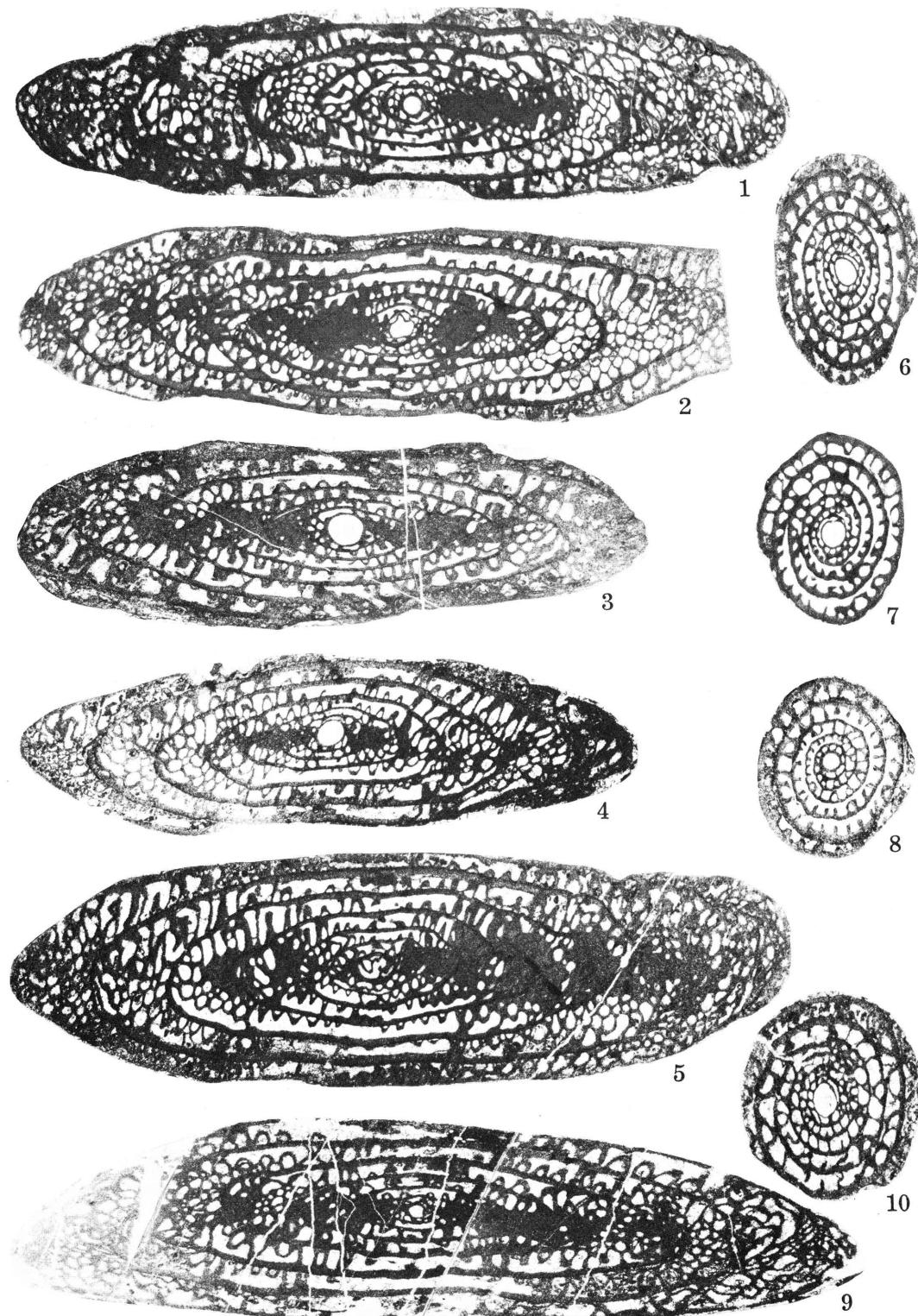


Explanation of Plate 6

All $\times 10$

Figs. 1-8. *Parafusulina japonica* (GÜMBEL) (See also Plate 5) Page 25
1-5. Axial sections, GK.D 13010b, 13079, 13937, 13014 and 13019; 6-8. Sagittal sections, GK.D 13019, 13928 and 13152. 1, 2, 4-6, 8 from Kpp-37; 3, 7 from Kpp-38.

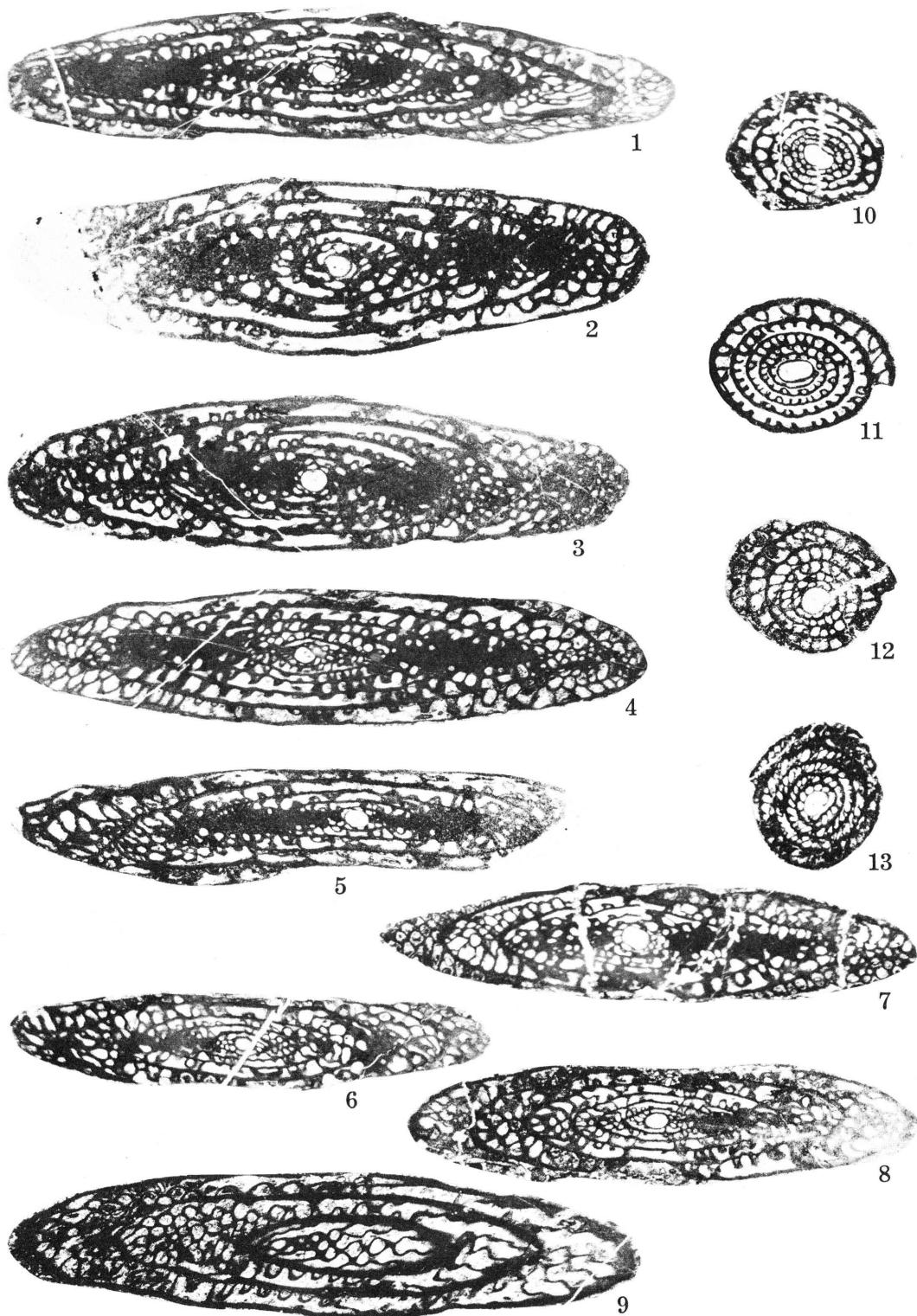
Figs. 9-10. *Parafusulina granumavenae* (ROEMER) (See also Plate 7) .. Page 29
9. Axial section, GK.D 13394; 10. Sagittal section, GK.D 14046. 9 from Kpp-57; 10 from Kpp-36.



Explanation of Plate 7

All $\times 10$

Figs. 1–13. *Parafusulina granumavenae* (ROEMER) (See also Plate 6). . Page 29
1–8. Axial sections. GK.D 13293, 14025, 14021, 14050, 13041, 13068, 13300, and
13746; 9. Tangential section, GK.D 14050: 10–13, Sagittal sections, GK.D
13737, 14027, 13301, and 14021. 1, 5 from Kpp-29; 2, 3, 11, 14 from Kpp-14; 4,
9 from Kpp-36; 6 from Kpp-39; 7, 12 from Kpp-6; 8, 10 from Kpp-54.



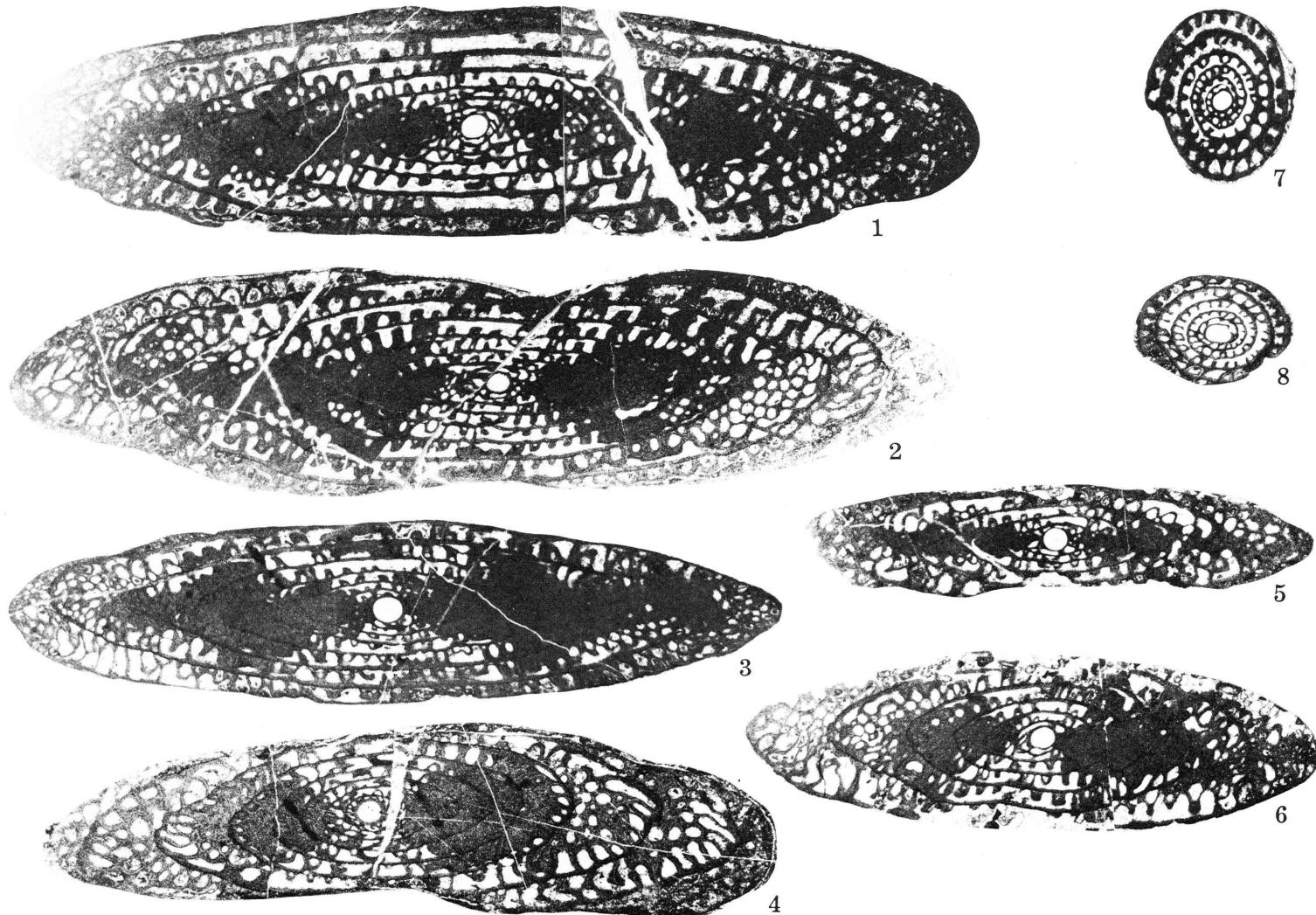
Explanation of Plate 8

All $\times 10$

Figs. 1-8. *Parafusulina kaerimizensis* (OZAWA)Page 32

1-6. Axial sections, GK.D 13944, 13141, 13922, 13061, 13149, and 13081.

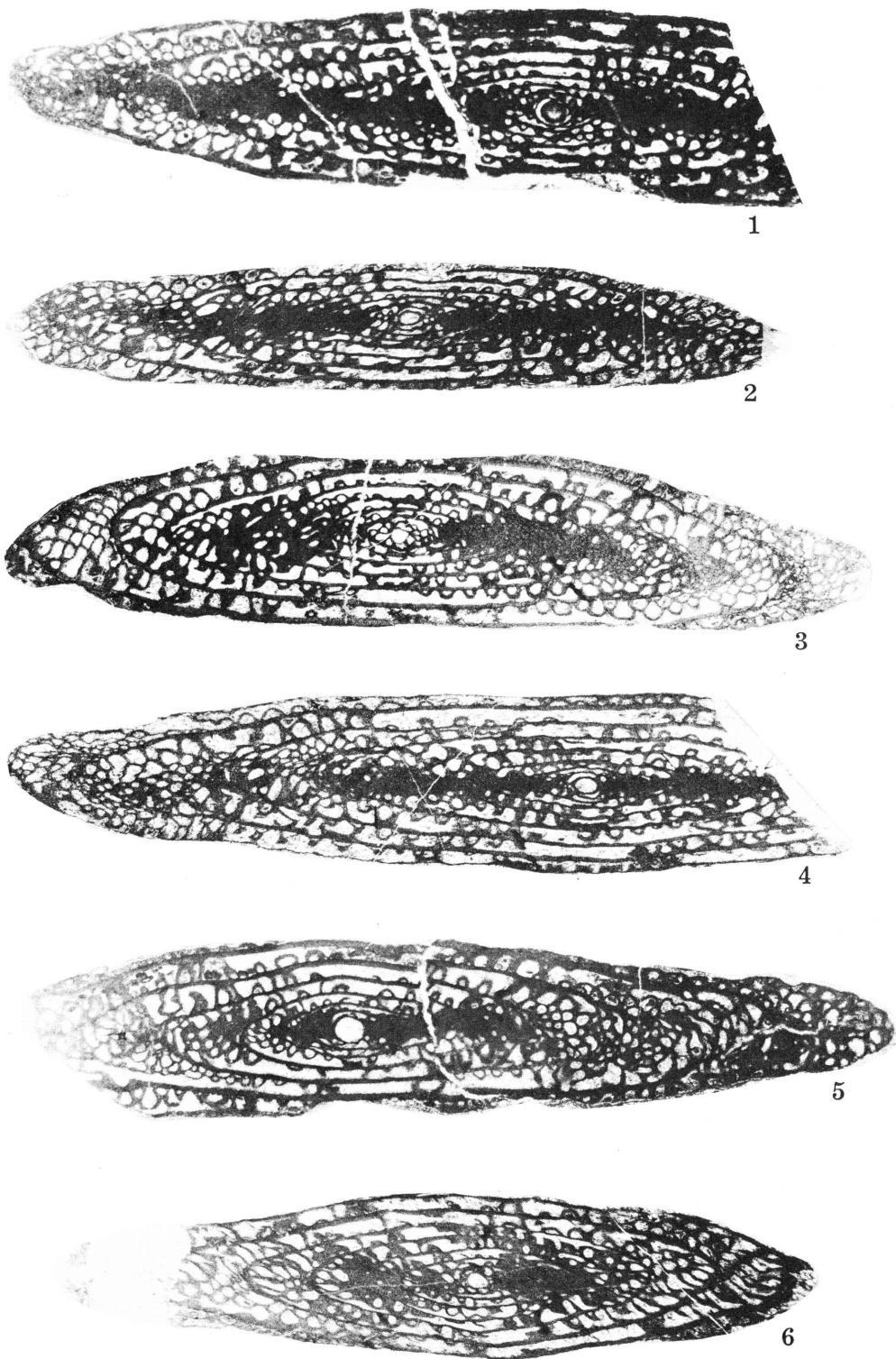
7-8. Sagittal sections, GK.D 13006 and 13083. 1, 3 from Kpp-38; 2 from Kpp-35; 4 from Kpp-30; 5-8 from Kpp-37.



Explanation of Plate 9

All $\times 10$

Figs. 1-6. *Parafusulina nosonensis* THOMPSON and WHEELER Page 34
1-6. Axial sections, GK.D 13212, 14041, 13024, 14048, 13633, and 14047.
1 from Kpp-21; 2, 4, 6 from Kpp-36; 3 from Kpp-35, 5 from Kpp-46.



Explanation of Plate 10

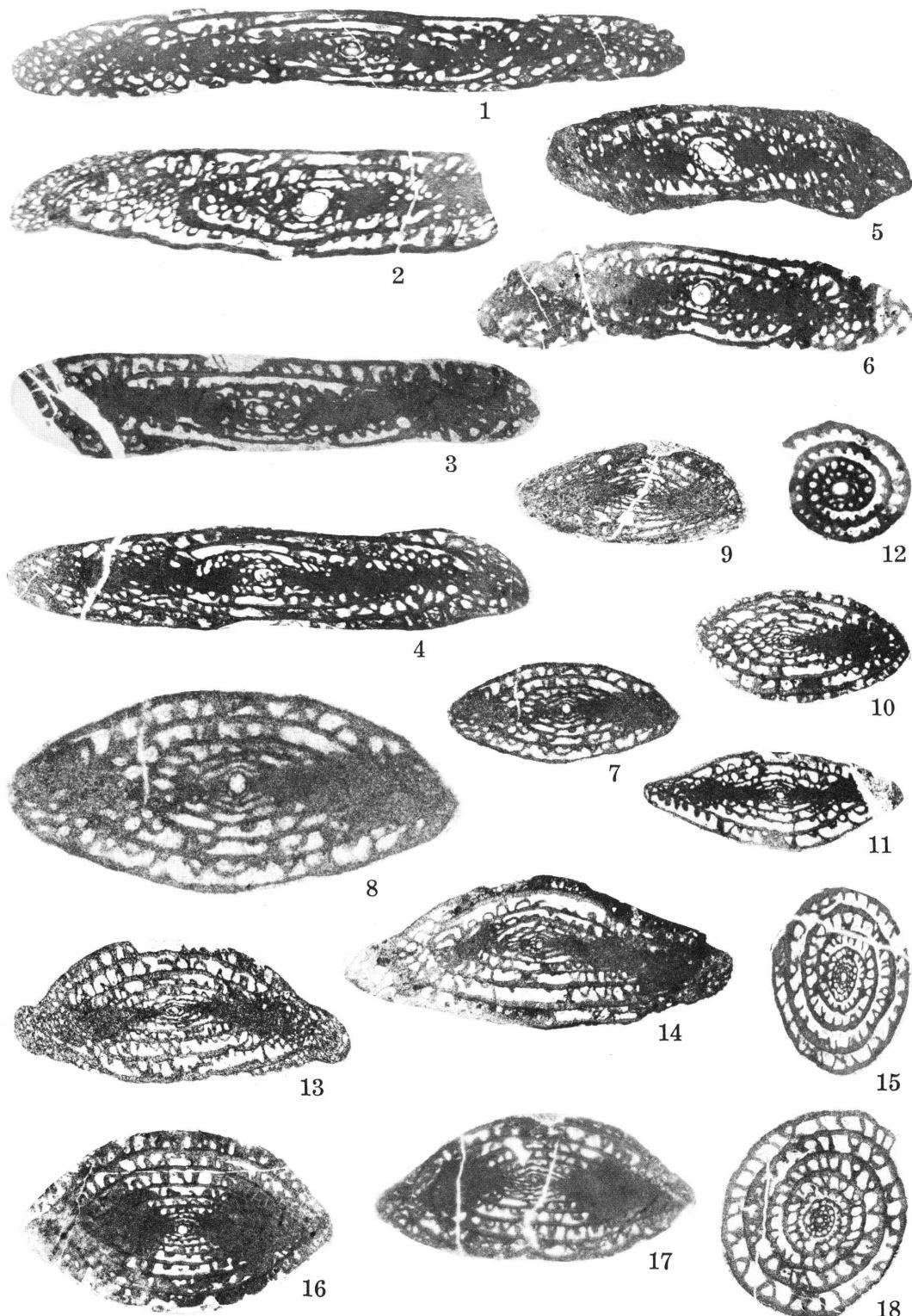
All $\times 10$, unless otherwise stated

Figs. 1-6. *Monodioxodina* sp. Page 36
Axial section, GK.D 13033; Axial sections referred to this species with a query, GK.D 13050, 13284, 13040, 13291, and 13031. All from Kpp-29.

Figs. 7-12. *Chusenella cheni* SKINNER and WILDE Page 37
7(=8). Axial section, GK.D 13294b; 9, 10. Slightly diagonal axial sections, GK.D 13616 and 13127; 11. Axial section referred to this species with a query, GK.D 13127; 12. Sagittal section, GK.D 13285. 7(=8), 12 from Kpp-29; 9, 11 from Kpp-46; 10 from Kpp-39. 8 $\times 20$.

Figs. 13-15. *Chusenella schwagerinaeformis* SHENG Page 37
13, 14. Axial sections, GK.D 13046 and 13316; 15. Sagittal section, GKD 13289. 13, 15 from Kpp-29; 14 from Kpp-22.

Figs. 16-18. *Chusenella* cfr. *alpina* (KOCHANSKY-DEVIDÉ and RAMOVS) . Page 40
16, 17. Axial sections, GK.D 13810 and 13604a; 18. Sagittal section, GK.D 13825. 16 from Kpp-75; 17 from Kpp-71; 18 from Kpp-76.



Explanation of Plate 11

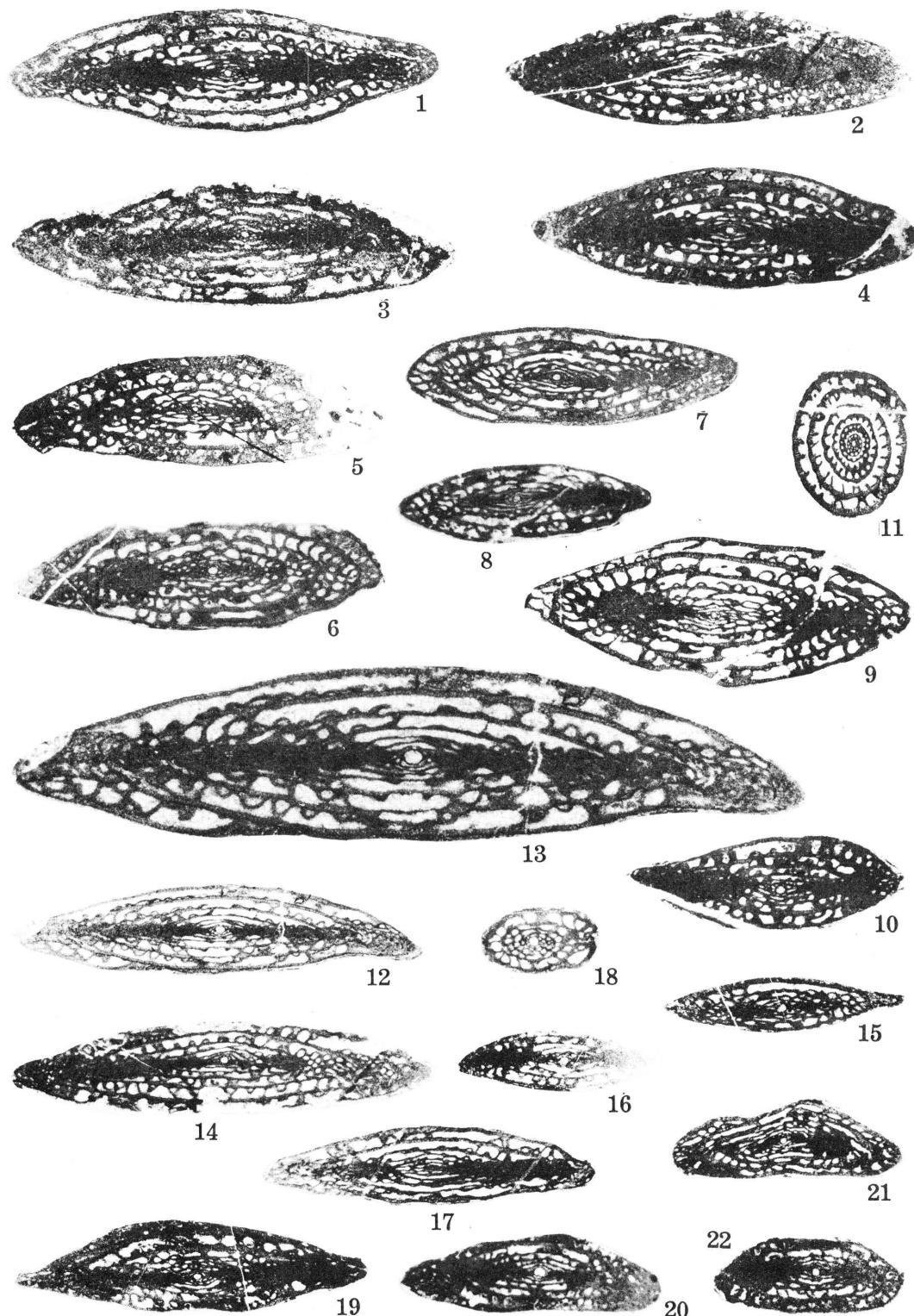
All $\times 10$, unless otherwise stated

Figs. 1–11. *Chusenella? chihsiaensis* (LEE)Page 41
1–6. Axial sections, GK.D 13132, 13826, 13424, 13606, 13063, and 13918; 7. Slightly diagonal axial section, GK.D 13624; 8. Axial section of immature specimen, GK.D 13574d; 9, 10. Axial sections referred to this species with a query, GK.D 13061 and 13808; 11. Sagittal section, GK.D 13054. 1 from Kpp-39; 2 from Kpp-76; 3 from Kpp-57; 4, 7 from Kpp-46; 5, 9, 11 from Kpp-30; 6 from Kpp-38; 8 from Kpp-55; 10 from Kpp-75.

Figs. 12–18. *Chusenella tenuis* TORIYAMA and KANMERA, n. sp.Page 43
12(=13). Axial section of the holotype, GK.D 13631. Paratypes: 14. Axial section, GK.D 13136; 15, 16. Axial sections of immature individual, GK.D 13583 and 13534; 17. Tangential section, GK.D 13639; 18. Sagittal section, GK.D 13592. 12(=13), 17 from Kpp-46; 14 from Kpp-39; 15, 18 from Kpp-61; 16 from Kpp-71. 13 $\times 20$

Fig. 19. *Chusenella* sp. APage 45
Axial section, GK.D 13186 from Kpp-10.

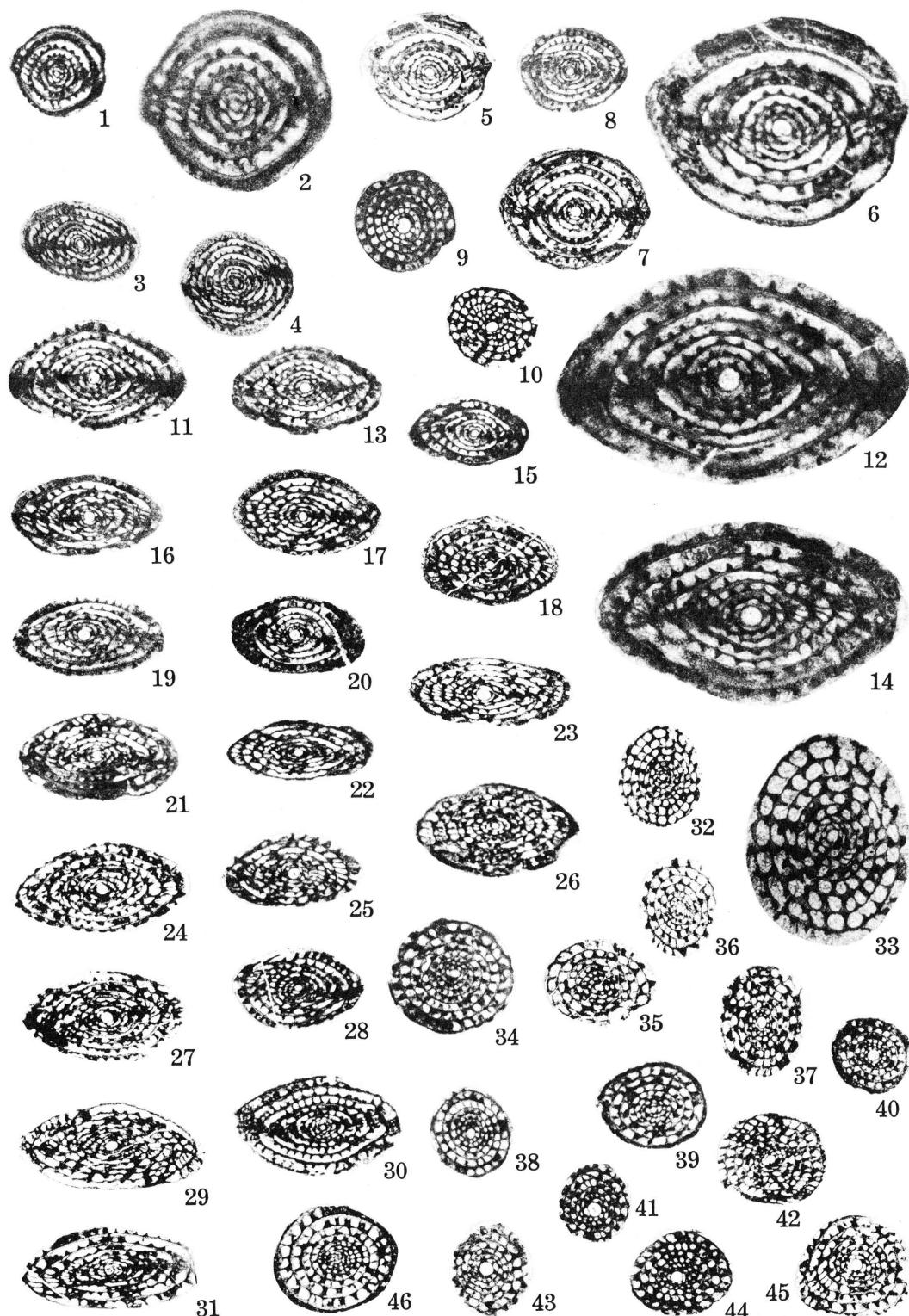
Figs. 20–22. *Chusenella?* sp. BPage 46
Axial sections, GK.D 13118, 13716 and 13240. 20 from Kpp-39; 21 from Kpp-23; 22 from Kpp-22.



Explanation of Plate 12

All $\times 10$, unless otherwise stated

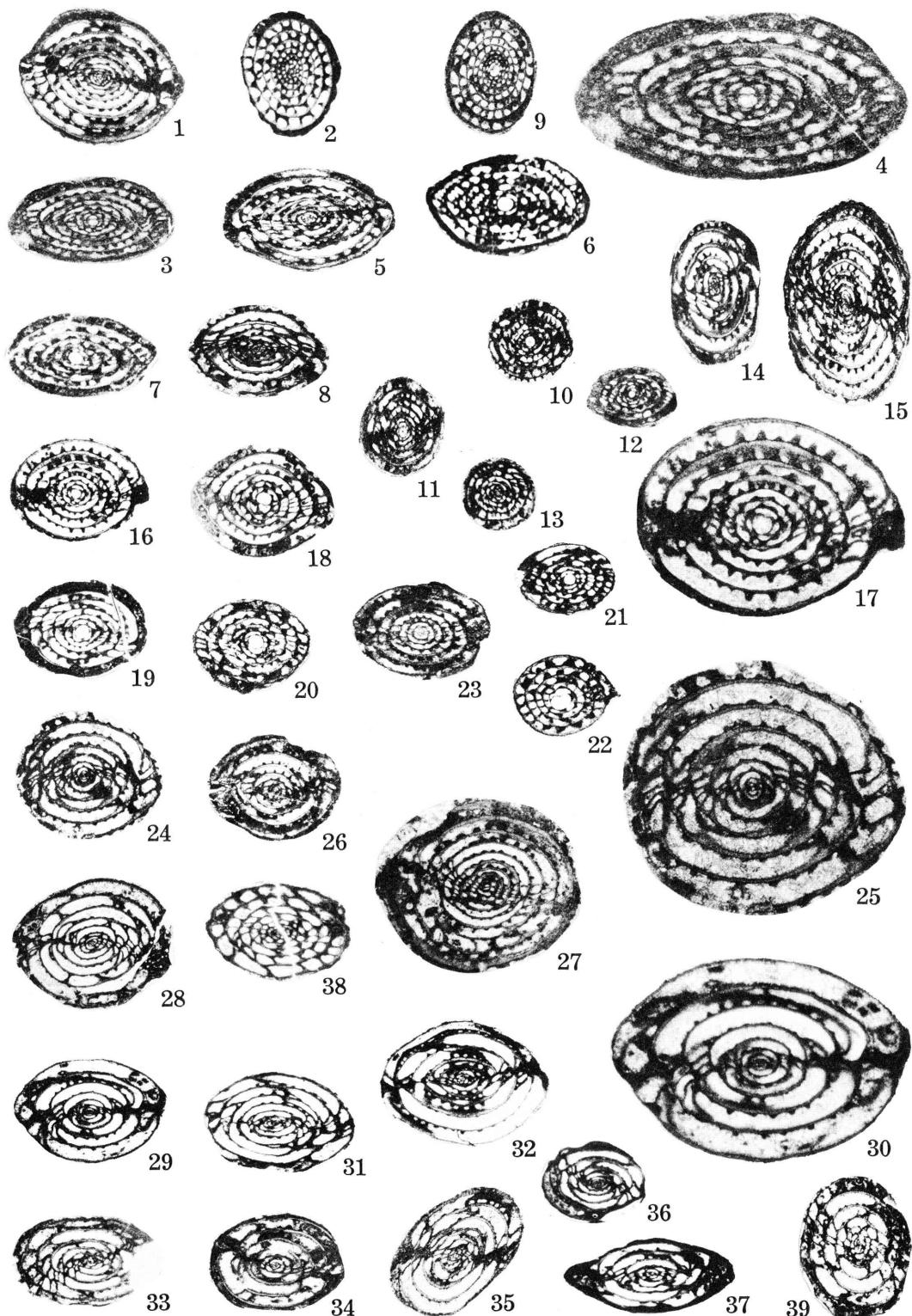
- Figs. 1-2. *Misellina otai* SAKAGUCHI and SUGANO Page 48
Axial section, 1 (=2). GK.D 13191 from Kpp-11. 1 $\times 10$; 2 $\times 20$.
- Figs. 3-4. *Misellina subelliptica* (DEPRAT) Page 51
Axial sections, GK.D 13107a and 13107b from Kpp-24.
- Figs. 5-10. *Misellina termieri* (DEPRAT) Page 49
5-7. Axial sections, 5 (=6), GK.D 13177, 7. GK.D 13171, 8. GK.D 13706a; 9, 10. Sagittal sections, GK.D 13179 and 13155b. 5 (=6) and 9 from Kpp-10; 7 from Kpp-9; 8 from Kpp-5; 10 from Kpp-7. 6 $\times 20$.
- Figs. 11-46. *Misellina confragaspira* LEVEN Page 53
11 (=12), 13 (=14), 15-31, Axial sections, GK.D 14098, 13101c, 13102, 13095, 13110a, 13110b, 14012, 13024, 13103, 13701, 13156a, 13166, 13112, 13902, 13102, 14006, 13155, 13904, and 13156b (slightly tangential); 32 (=33), 34-46. Sagittal sections, GK.D 13158, 14099, 13165a, 13156, 13165b, 13113, 13199, 13900, 13111, 13700, 13101b, 13702, 13107, and 13311 (slightly excentric). 11 (=12), 19, 22, 28, 34, 42, and 44 from Kpp-5; 13 (=14), 15-18, 20, 21, 25, 38, 41, and 43 from Kpp-24; 23, 24, 27, 29 31-33, 35-37, and 45 from Kpp-7; 26, 30 and 40 from Kpp-19; 39 from Kpp-18; 46 from Kpp-6. 12, 14 and 33 $\times 20$.



Explanation of Plate 13

All $\times 10$, unless otherwise stated

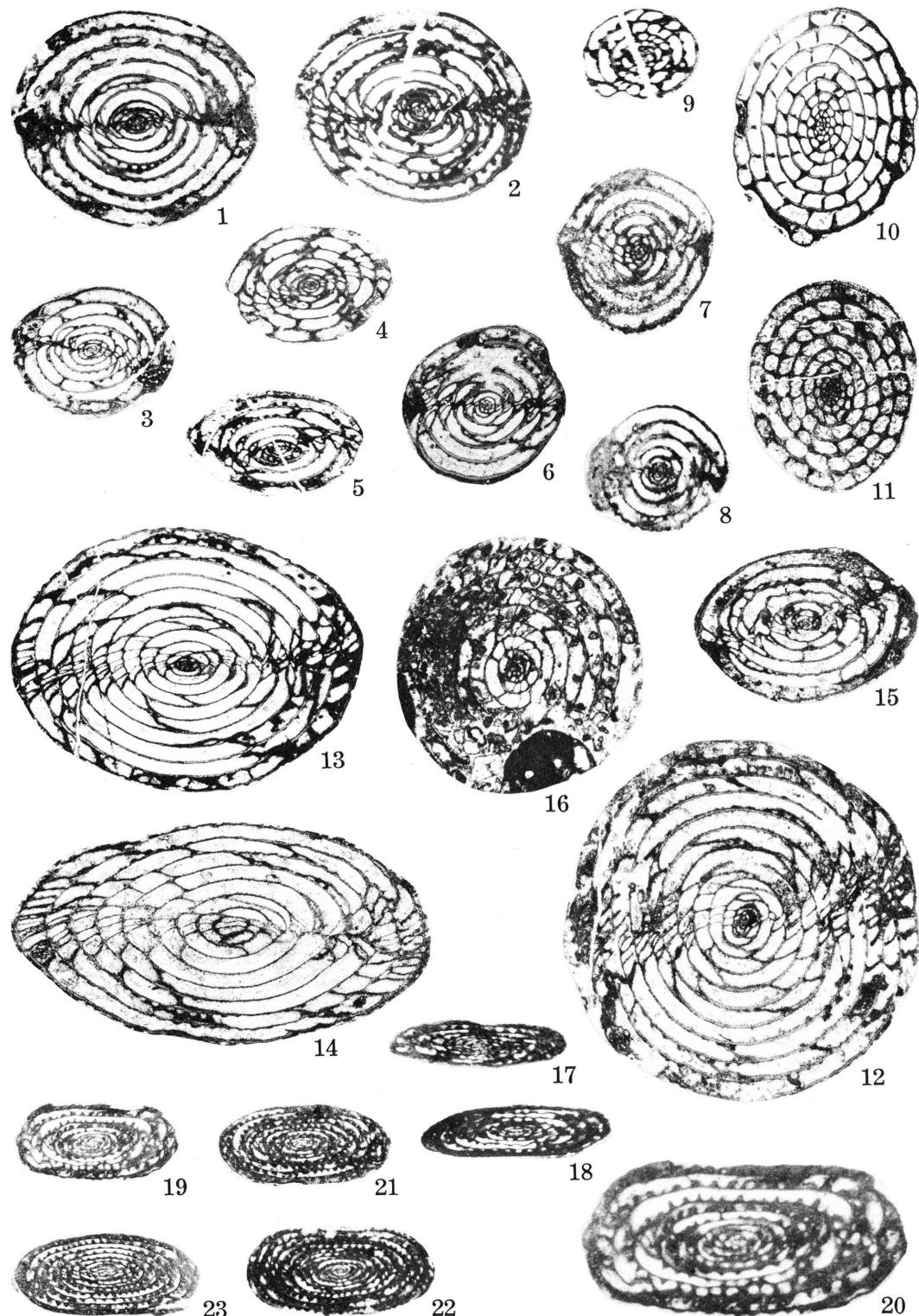
- Figs. 1-2. *Misellina claudiae* (DEPRAT) Page 55
1. Axial sections, GK.D 13724; 2. Sagittal section, GK.D 13714. Both from Kpp-23.
- Figs. 3-9. *Misellina ovalis* (DEPRAT) Page 57
3 (=), 6, 7. Axial sections, GK.D 13201, 13204 and 13207; 5, 8. Tangential sections, GK.D 14069 and 13015; 9. Sagittal section, GK.D 13200. 3 (=4), 6, 7, and 9 from Kpp-18; 5 from Kpp-39; and 8 from Kpp-37. 4 $\times 20$ (all others $\times 10$)
- Figs. 10-13. *Misellina* sp.
10, 11. Axial sections, GK.D 13099 and 13700; 12 Axial (somewhat excentric) section, GK.D 13103; 13. Tangential section, GK.D 13090. 10 from Kpp-5; 11-13 from Kpp-24.
- Figs. 14-15. *Misellina (Brevaxina) compressa* (DEPRAT) Page 58
Axial (more or less tangential) sections, GK.D 13125 and 14190. Both from Kpp-39.
- Figs. 16-23. *Verbeekina (Armenia) saraburiensis* TORIYAMA and KANMERA, n. sp. Page 59
16 (=17). Holotype, GK.D 13175 from Kpp-9. 18-21. Axial sections of paratypes, GK.D 13169, 13178, 13184, and 13176; 22. Excentric section, GK.D 13180; 23. Tangential section, GK.D 13180. 16 (=17) and 19 from Kpp-9; 19-23 from Kpp-10. 17 $\times 20$ (all others $\times 10$)
- Figs. 24-27. *Verbeekina (Armenia) karinae* (KOCHANSKY-DEVIDÉ and RAMOVS) Page 61
24 (=25). Axial (slightly tangential) section, GK.D 13901; 26, 27. Tangential sections, GK.D 13021 and 13326. 24 (=25) from Kpp-19; 26 from Kpp-35; 27 from Kpp-22. 25 $\times 20$
- Figs. 28-39. *Verbeekina (Armenia) prisca* TORIYAMA and KANMERA, n. sp. Page 62
29 (=30). Holotype, GK.D 13929. 28, 31, 32. Axial (more or less tangential) sections, GK.D 13142, 13049 and 13929; 33-37. Tangential sections, GK.D 13254, 13933, 14054 (deformed), 13953, and 13042; 38, 39. Sagittal (slightly excentric) sections, GK.D 13725 and 13933. 28 from Kpp-35; 29 (=30), 32, 34, 36, and 39 from Kpp-38; 31 from Kpp-29, 33 from Kpp-26; 35 from Kpp-36; 37 from Kpp-29; 38 from Kpp-34. 30 $\times 20$.



Explanation of Plate 14

All $\times 10$, unless otherwise stated

- Figs. 1-11. *Verbeekina (Armenia) sphaera* OZAWA Page 64
1, 2. Axial (slightly tangential) sections of fully grown shell, GK.D 13662 and 14079; 3-8 Axial (slightly tangential) sections of immature shell, GK.D 13142, 13567, 13435, 13146, 13661, and 13660a. 9. Excentric section of immature shell, GK.D 13267. 10, 11. Sagittal (slightly excentric) sections, GK.D 13062 and 13659. 1, 4, 7, 8, and 11 from Kpp-50; 2 from Kpp-51; 3 from Kpp-35; 5 from Kpp-58; 6 from Kpp-75; 9 from Kpp-27a; 10 from Kpp-30.
- Fig. 12. *Verbeekina (Verbeekina) verbeekii* (GEINITZ) Page 66
Axial (slightly tangential) section, GK.D 13816 from Kpp-76.
- Figs. 13-16. *Verbeekina (Paraverbeekina) pontica* MIKLUKHO-MAKLAY. Page 68
13. Axial (slightly tangential) section, GK.D 13837; 14. Tangential section, GK.D 14047; 15 Axial (slightly tangential) section of immature specimen, GK.D 14037; 16. Excentric section, GK.D 13840. 13 and 16 from Kpp-75; 14 from Kpp-82; 15 from Kpp-52.
- Figs. 17-18. *Pseudodoliolina* sp. A Page 69
17. Axial section, GK.D 13321; 18. Tangential section, GK.D 13206. 17 from Kpp-22; 18 from Kpp-18.
- Figs. 19-23. *Pseudodoliolina saraburiensis* TORIYAMA and KANMERA, n. sp. (see also Plate 15) Page 71
19 (=20). Axial section of the holotype, GK.D 13059; 21-23. Axial sections of paratypes, GK.D 13936 and 13128; 23. Axial (slightly tangential) section of a paratype, GK.D 13628. 19 (=20) from Kpp-30; 21 from Kpp-38; 22 from Kpp-39; 23 from Kpp-46. 20 $\times 20$



Explanation of Plate 15

All $\times 10$, unless otherwise stated

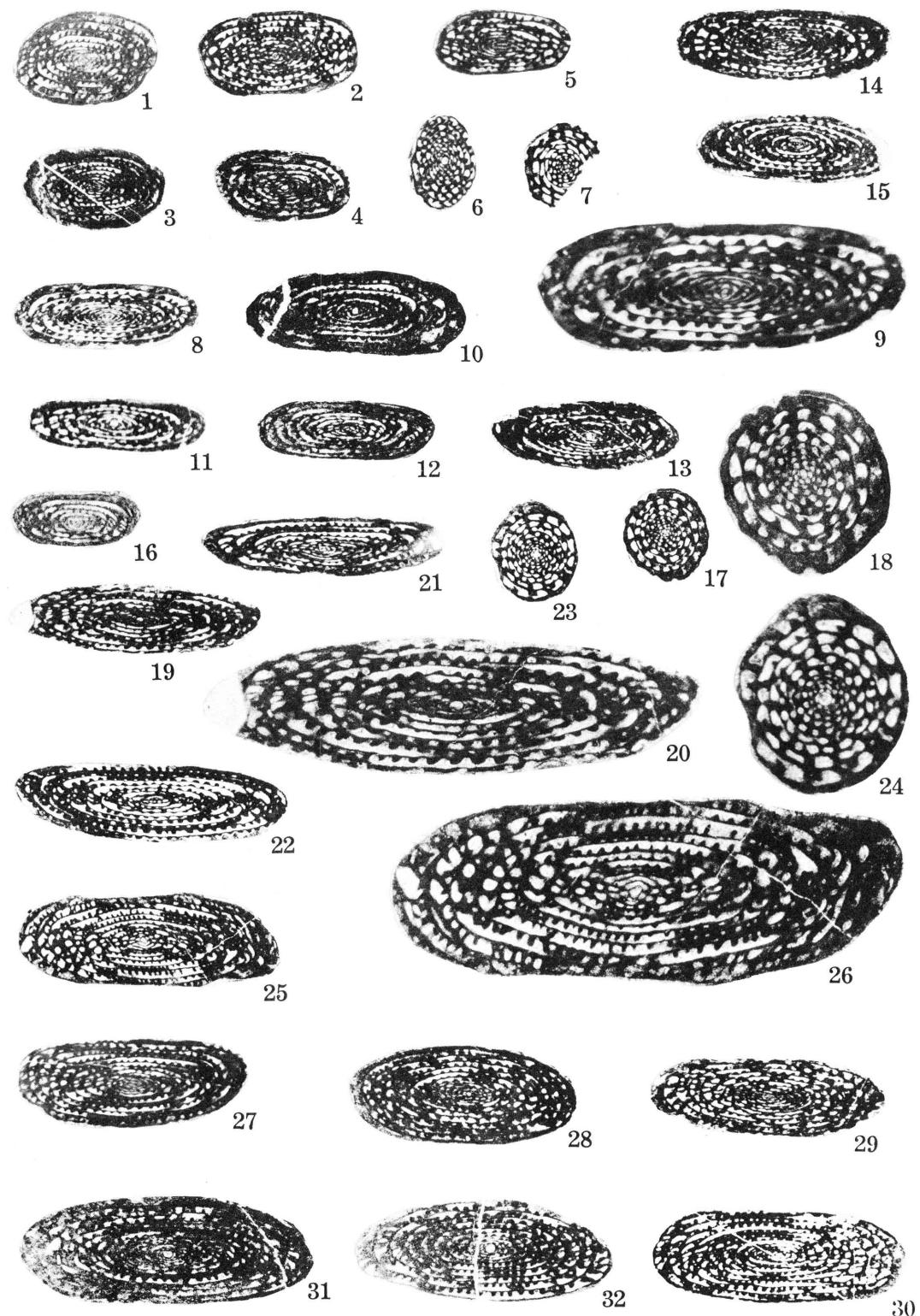
Figs. 1–7. *Pseudodoliolina saraburiensis* TORIYAMA and KANMERA, n. sp. (See also Plate 14) Page 71
1–4. Axial (more or less tangential) sections of paratypes, GK.D 13337, 13028b, 13641, and 13108; 5. Tangential section of a paratype, GK.D 13013; 6, 7. Sagittal sections of paratypes, 13338 and 13028c. 1 and 6 from Kpp-44a; 2 and 7 from Kpp-35; 3 from Kpp-47; 4 from Kpp-24; 5 from Kpp-37.

Figs. 8–18. *Pseudodoliolina primigena* TORIYAMA and KANMERA, n. sp. Page 73
8 (=9). Axial section of the holotype, GK.D 13741; 10–15. Axial sections of paratypes, GK.D 13930, 13921, 13912, 13992a, 13564a, and 13130 (slightly tangential); 16. Axial (more or less tangential) section of a paratype, GK.D 13076; 17 (=18). Sagittal section of a paratype, GK.D 13940. 8 (=9), 10–12, 17 (=18) from Kpp-38; 13 from Kpp-51; 14 from Kpp-52, 15 from Kpp-39; 16 from Kpp-54. 9 and 18 $\times 20$

Figs. 19–24. *Pseudodoliolina gracilis* TORIYAMA and KANMERA, n. sp. Page 75
19 (=20). Axial section of the holotype, GK.D 13741; 21. Axial section of a paratype, GK.D 13906; 22. Axial (more or less tangential) section of a paratype, GK.D 13935. 19 (=20) from Kpp-54; 21 and 23 (=24) from Kpp-38; 22 from Kpp-42. 20 and 24 $\times 20$

Figs. 25–30. *Pseudodoliolina ozawai minima* MIKLUKHO-MAKLAY Page 77
25 (=26), 28, 30. Axial sections, GK.D 13916, 14038 and 13578; 27, 29. Axial (slightly tangential) sections, GK.D 13978 and 13735. 25 (=26) from Kpp-38; 27 from Kpp-51; 28 from Kpp-52; 29 from Kpp-54; 30 from Kpp-55. 26 $\times 20$

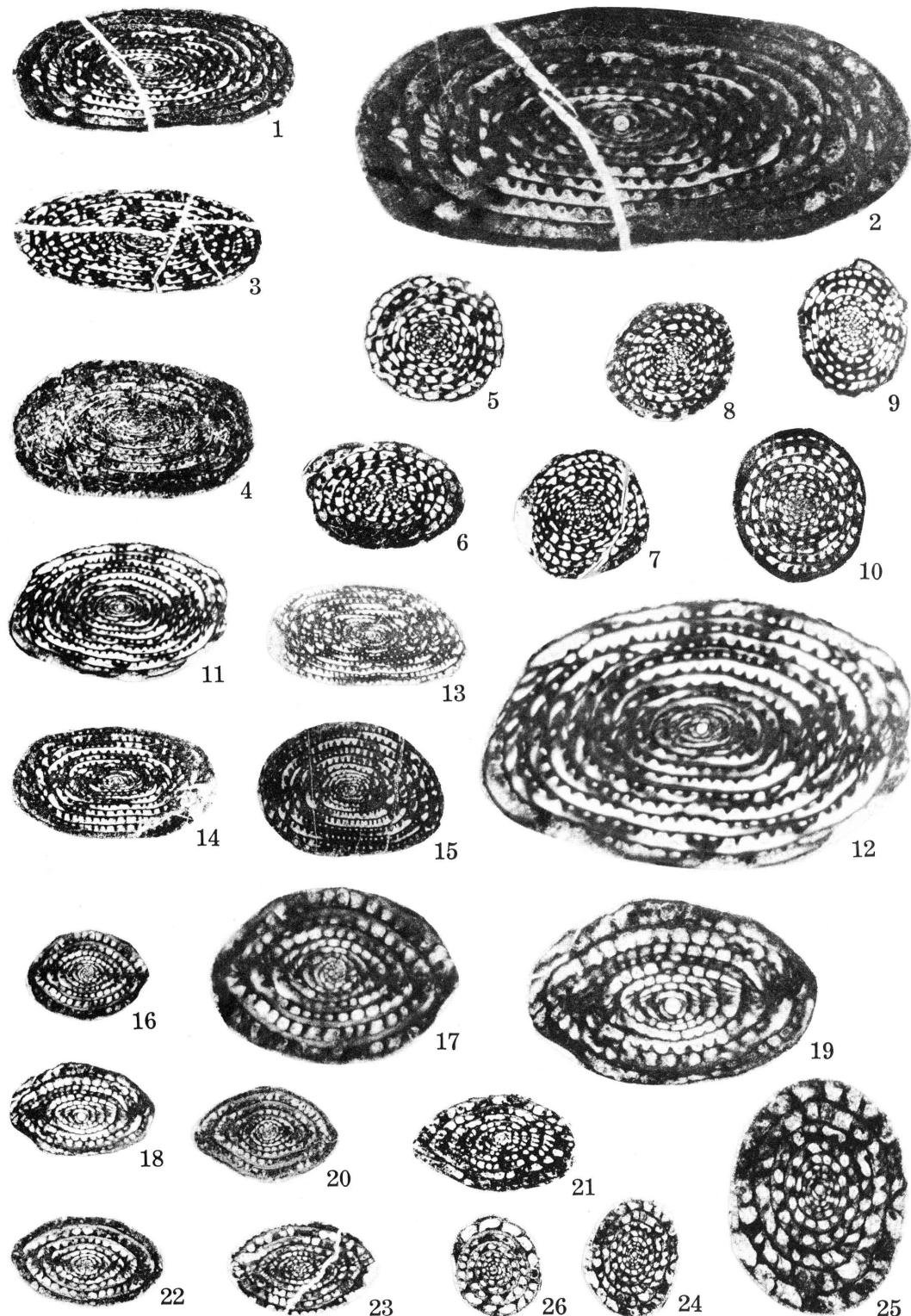
Figs. 31–32. *Pseudodoliolina ozawai ozawai* YABE and HANZAWA (See also Plate 16) Page 77
Axial sections, GK.D 13996 and 13827. 31 from Kpp-73; 32 from Kpp-76.



Explanation of Plate 16

All $\times 10$, unless otherwise stated

- Figs. 1–10. *Pseudodoliolina ozawai ozawai* YABE and HANZAWA (See also Plate 15) Page 77
1 (=2), 3. Axial sections, GK.D 13834 and 13847b; 4. Axial (slightly tangential) section, GK.D 13379; 5–7. Sagittal sections, GK.D 13761, 13840c and 13347c; 8–10. Excentric sections, GK.D 13836, 13529 and 14106. 1 (=2), 6, and 8 from Kpp-75; 3 and 7 from Kpp-52; 4 from Kpp-55; 5 from Kpp-70; 9 from Kpp-71; 10 from Kpp-73. 2 $\times 20$
- Figs. 11–15. *Metadoliolina pinguis* TORIYAMA and KANMERA, n. sp. Page 81
11 (=12). Axial section of the holotype, GK.D 13693; 13–15. Axial sections of paratypes, GK.D 13430, 13480 and 13344. 11 (=12) from Kpp-51; 13 from Kpp-57; 14 from Kpp-61; 15 from Kpp-52. 12 $\times 20$
- Figs. 16–24. *Cancellina phlongphrabensis* TORIYAMA and KANMERA, n. sp. Page 83
16 (=17). Axial section of the holotype, GK.D 13133; 18 (=19). Axial section of a paratype, GK.D 13728; 20–23. Axial (slightly tangential) sections of paratypes, GK.D 13071b, 13282, 13065, and 13073; 24 (=25), 26. Sagittal sections of paratypes, 13122 and 13071c. 16 (=17), 20 and 22–26 from Kpp-39; 18 (=19) from Kpp-34; 21 from Kpp-27b. 17, 19 and 25 $\times 20$



Explanation of Plate 17

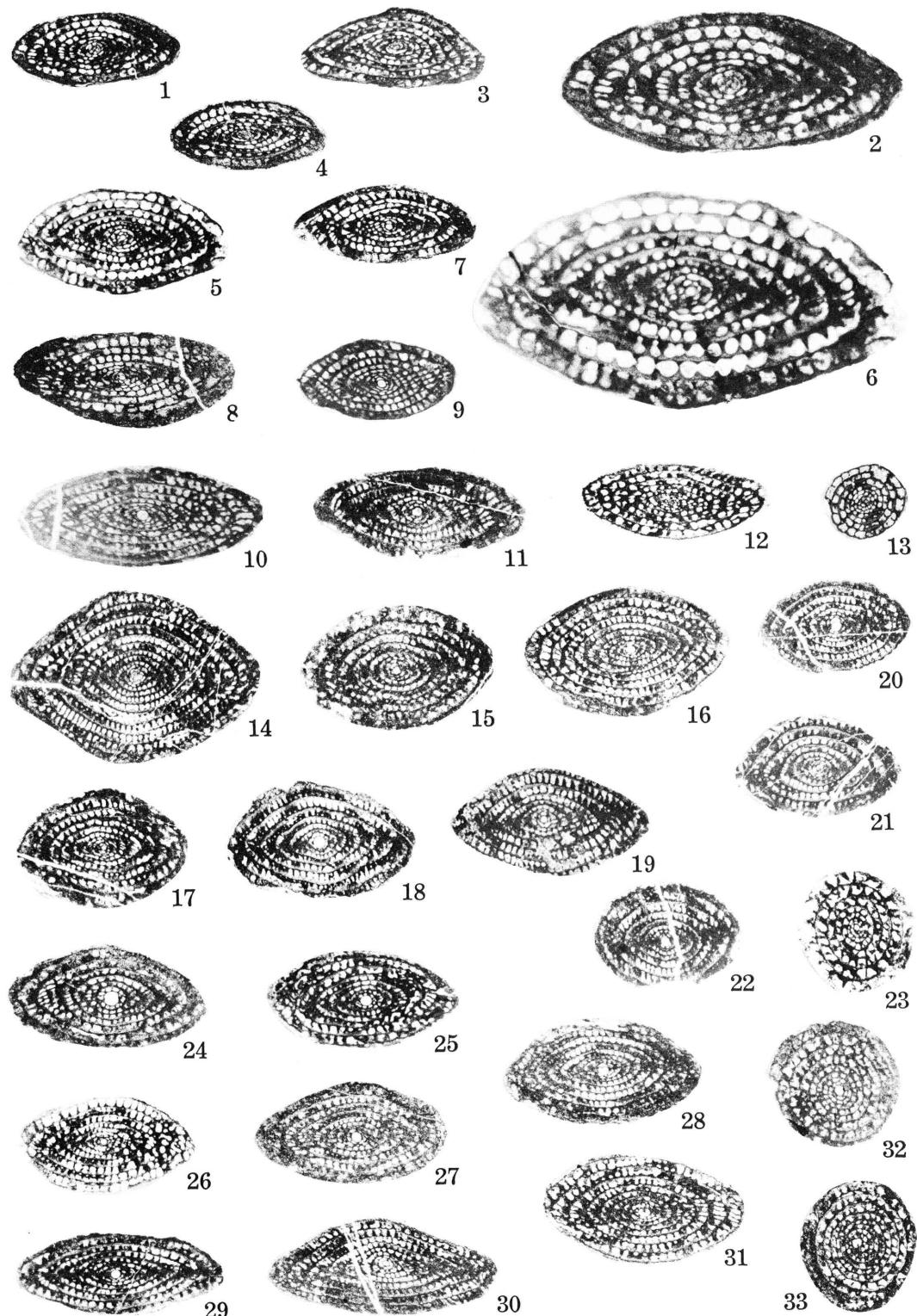
All $\times 10$, unless otherwise stated

Figs. 1-4. *Cancellina* sp. A Page 85
1 (=2), 3, 4. Axial sections, GK.D 13628, 13150d and 13651. 1 (=2) from Kpp-46; 3 from Kpp-37; 4 from Kpp-47. 2 $\times 20$

Figs. 5-13. *Cancellina tenuitestata* KANMERA Page 88
5 (=6), 7-11. Axial sections, GK.D 13678, 14097, 13680a, 13574b, 13428, and 13400; 12. Axial (slightly tangential) section, GK.D 13403; 13. Sagittal section, GK.D 13653. 5 (=6) and 8 from Kpp-51; 7 from Kpp-55; 9 from Kpp-55; 10-12 from Kpp-57; 13 from Kpp-50. 6 $\times 20$.

Figs. 14-23. *Presumatrina neoschwagerinoides* (DEPRAT) Page 88
14. Axial section of a fully grown shell, GK.D 13824; 15-19. Axial sections of submature shells, GK.D 13421, 13838, 13396, 13544a, and 13459; 20-22. Axial sections of immature shells, GK.D 13814d, 13432 and 13426; 23. Sagittal section, GK.D 13397. 14 and 20 from Kpp-76; 15, 17 and 21-23 from Kpp-57; 16 from Kpp-75; 18 from Kpp-71; 19 from Kpp-60.

Figs. 24-33. *Presumatrina schellwieni* (DEPRAT) (See also Plate 18) .. Page 90
24-31. Axial sections, GK.D 13540, 13535a, 13814d, 13811b, 13811a, 13533, 13823, and 13812; 32, 33. Sagittal sections, GK.D 13812b and 13811c. 24, 25 and 29 from Kpp-71; 26-28 and 30-33 from Kpp-76.



Explanation of Plate 18

All $\times 10$, unless otherwise stated

Figs. 1-5. *Presumatrina schellwieni* (DEPRAT) (See also Plate 17) ... Page 90
1-3. Axial sections, GK.D 14046, 13512 and 13808; 4. Axial (slightly tangential) section, GK.D 13481b; 5. Sagittal section, GK.D 14046. 1 and 5 from Kpp-82; 2 from Kpp-69; 3 from Kpp-75; 4 from Kpp-61.

Figs. 6-15. *Presumatrina* cfr. *grandis* LEVEN Page 93
6-9. Axial sections, GK.D 13994b, 13372, 14110, and 13815; 10, 11. Axial sections referred to this species with a quarry, GK.D 13840b and 13532; 12. Tangential section, GK.D 13835; 13, 14. Axial sections of immature shells, GK.D 13544b and 13815d. 6 and 8 from Kpp-76; 7 from Kpp-53; 9, 14 and 15 from Kpp-76; 10 and 12 from Kpp-75; 11 and 13 from Kpp-71.

Figs. 16-20. *Maklaya pamirica* (LEVEN)

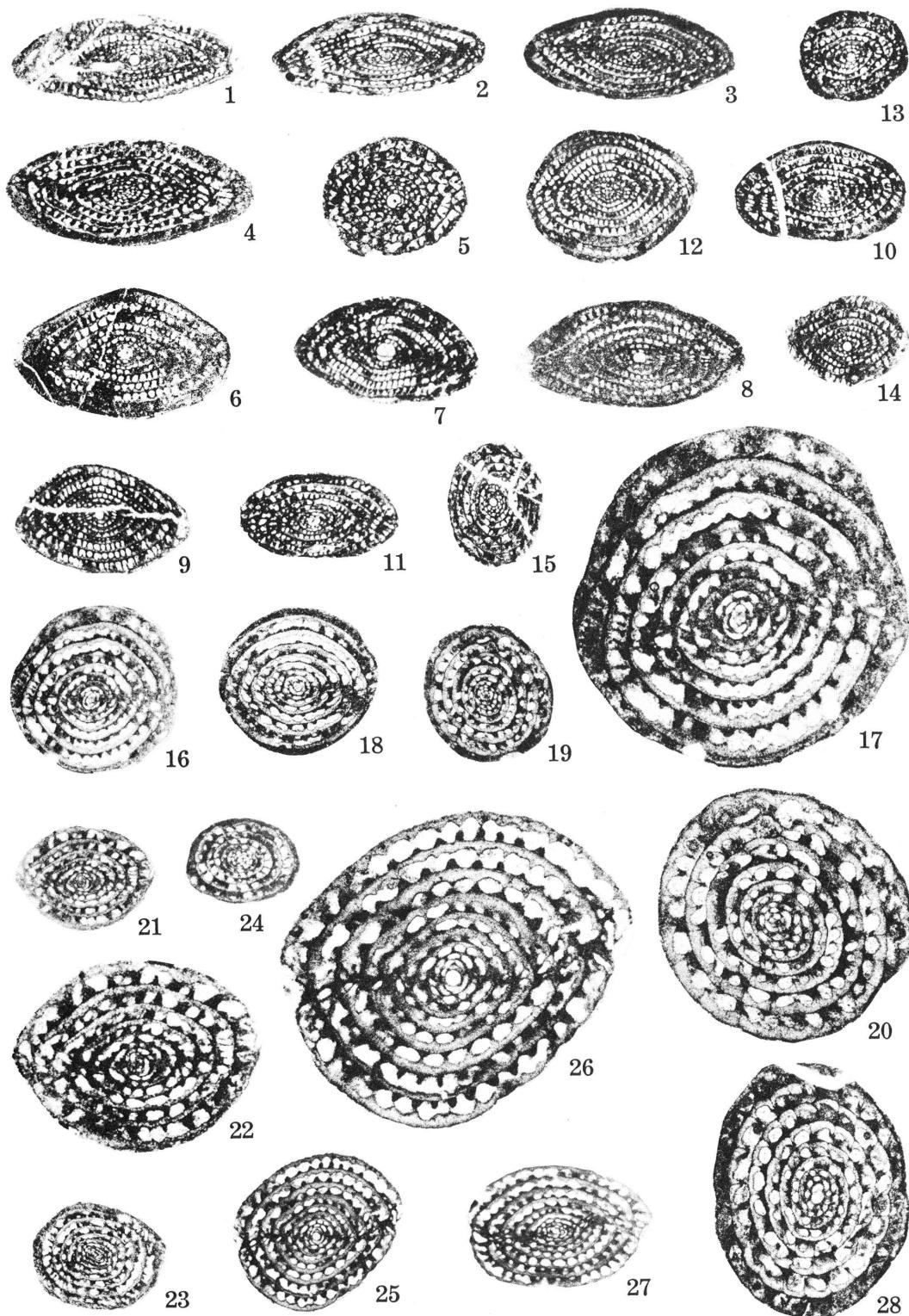
16 (=17). Axial section of the holotype, GK.D 13957; 18. Tangential section of a paratype, GK.D 13139; 19 (=20), Sagittal section of a paratype, GK.D 14061. All from Kpp-39. 17 and 20 $\times 20$. Figs. 16-20 were illustrated as Plate IV, figs. 1, 13, 2, 11, and 14, respectively in the original description of KANMERA and TORIYAMA (1968).

Figs. 21-24. *Maklaya saraburiensis* KANMERA and TORIYAMA

21 (=22). Axial section of the holotype, GK.D 13330; 23. Axial section of a paratype (compressed diagonally), GK.D 13720; 24. Sagittal section of a paratype, GK.D 13723. 21 (=22) from Kpp-22; 23 and 24 from Kpp-23. 22 $\times 20$. Figs. 21-24 were illustrated as Plate IV, figs. 17, 20, 18, and 19, respectively, in the original description of KANMERA and TORIYAMA (1968).

Figs. 25-28. *Maklaya sethaputi* KANMERA and TORIYAMA

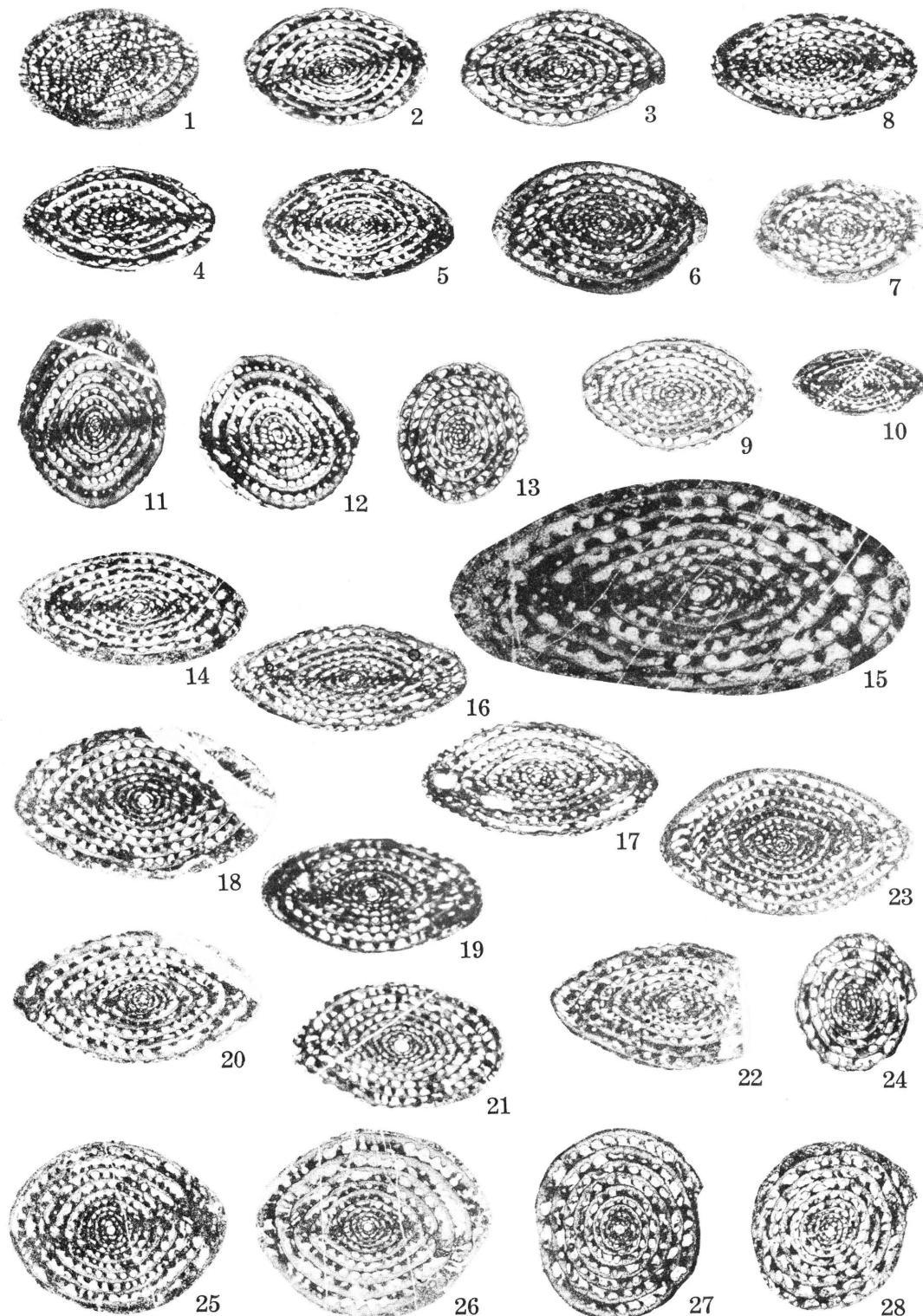
25 (=26). Axial section of the holotype, GK.D 13658; 27. Axial section of a paratype, GK.D 13664; 28. Sagittal section of a paratype, GK.D 13918. 25 (=26) and 27 from Kpp-50; 28 from Kpp-38. 26 and 28 $\times 20$. Figs. 25-28 were illustrated as Plate V, figs. 1, 13, 3, and 14, respectively, in the original description of KANMERA and TORIYAMA (1968).



Explanation of Plate 19

All $\times 10$, unless otherwise stated

- Fig. 1. *Neoschwagerina* sp. B Page 102
Axial section, GK.D 13840d from Kpp-75.
- Figs. 2–10. *Neoschwagerina schuberti* KOCHANSKY-DEVIDÉ Page 95
2–7. Axial sections, GK.D 13542c, 14082, 13754, 13534, 13340, and 13560; 8, 9.
Tangential sections, GK.D 13359 and 13566; 10. Axial section of immature
specimen, GK.D 13507b. 2 from Kpp-71; 3 from Kpp-51; 4 from Kpp-55; 5
from Kpp-77; 6–9 from Kpp-52; 10 from Kpp-63.
- Figs. 11–13. *Neoschwagerina* sp. A Page 101
11. Axial section, GK.D 14093; 12. Axial section (compressed diagonally),
GK.D 13441; 13. Sagittal section, GK.D 14092. All from Kpp-58.
- Figs. 14–24. *Neoschwagerina simplex tenuis* TORIYAMA and KANMERA, n. subsp.
..... Page 97
14 (=15). Axial section of the holotype, GK.D 13470; 16–22. Axial sections of
paratypes, GK.D 13740, 14032, 13743, 13989, 13742, 13749, and 13738; 23.
Tangential section, GK.D 13586; 24. Sagittal section, GK.D 13751. 14 (=15)
and 22 from Kpp-61; 16, 18–22 and 24 from Kpp-54; 17 from Kpp-52. 15 $\times 20$
- Figs. 24–28. *Neoschwagerina simplex simplex* OZAWA (See also Plate 20
..... Page 99
25, 26. Axial sections, GK.D 13475b and 13354; 27, 28. Sagittal sections, GK.D
13997 and 14097. 25 from Kpp-61; 26 from Kpp-52; 27 from Kpp-73; 28 from
Kpp-53.



Explanation of Plate 20

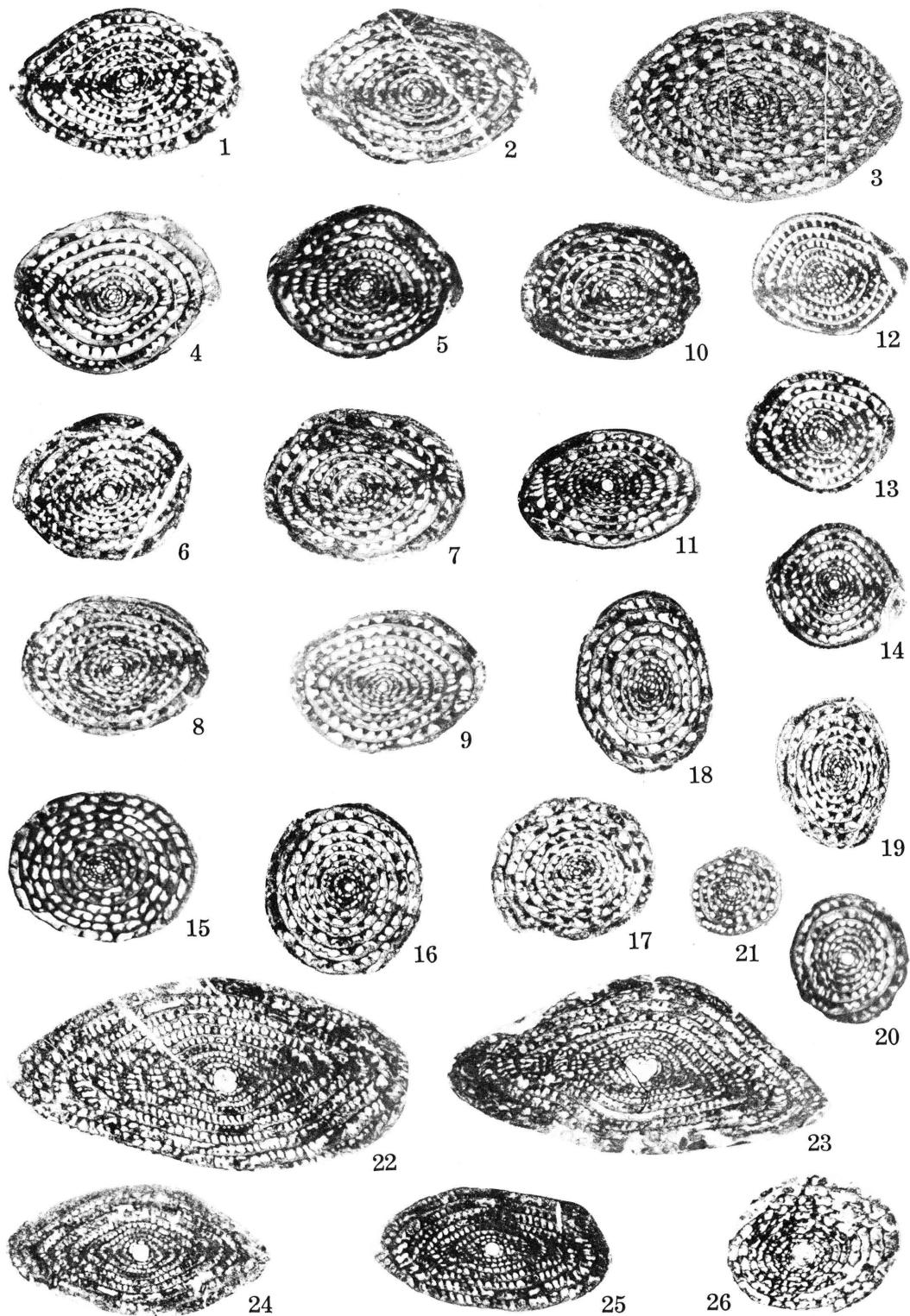
All $\times 10$

Figs. 1-21. *Neoschwagerina simplex simplex* OZAWA (See also Plate 19)

..... Page 99
1, 2, 4-9. Axial sections, GK.D 13509, 13234, 13674, 13363b, 13232, 13371c,
13362, and 13363c; 3. Axial section of a fully grown shell, GK.D 13486; 10, 11.
Axial (more or less diagonal) sections, GK.D 14097 and 13371a; 12-14. Axial
sections of immature shells, GK.D 13504, 13506 and 13367; 15-17 Sagittal
sections, GK.D 13981, 14097a and 13232; 18, 19. Sagittal (slightly excentric)
sections, GK.D 13371 and 13232; 20, 21. Sagittal sections of immature shells,
GK.D 13363a and 13564b. 1, 12, 13, and 19 Kpp-63; 2, 6, 17, and 21 from
Kpp-52; 3 from Kpp-61; 4 and 15 from Kpp-51; 5, 7-11, 14, 16, 18, and 20
from Kpp-53.

Figs. 22-26. *Colania douvillei* (OZAWA) Page 103

22, 23. Axial sections, GK.D 14103 and 14101; 24, 25. Axial sections of im-
mature shells, GK.D 14205 and 14100; 26. Sagittal section, GK.D 14208. All
from Kpp-77.



Explanation of Plate 21

All $\times 10$

- Figs. 1-8. *Nankinella hunanensis* (CHEN)Page 105
1-7. Axial (more or less tangential) sections, GK.D 13019, 13016a, 13017,
13388a, 13119, 13478, and 13481. 8. Sagittal section of immature specimen,
GK.D 13129. 1-3 from Kpp-37; 4 from Kpp-56; 5 and 8 from Kpp-39; 6 and
7 from Kpp-61.
- Figs. 9-12. *Nankinella* cfr. *inflata* (COLANI)Page 107
9. Axial section, GK.D 14208b; 10, 11. Sagittal sections, GK.D 14208a and
14210; 12. Excentric section, GK.D 14207. All from Kpp-77.
- Figs. 13-16. *Nankinella* cfr. *discoides* (LEE)Page 108
13-16. Axial (more or less tangential) sections, GK.D 13727, 13085, 13056, and
13490. 13 and 15 from Kpp-34; 14 from Kpp-37; 16 from Kpp-61.
- Figs. 17-18. *Nankinella* sp.
Axial (more or less tangential) sections, GK.D 13555 and 13556. Both from
Kpp-80.
- Figs. 19-20. *Eoverbeekina* spp.Page 110
Axial (slightly tangential) sections, GK.D 13087 and 14197a. Both from Kpp-
39.
- Fig. 21. *Sphaerulina* sp.Page 110
Excentric section, GK.D 13224 from Kpp-52.
- Figs. 22-23. *Thailandina buravasi* TORIYAMA and KANMERA
22. Axial section of the holotype, GK.D 14009; 23. Sagittal section, GK.13706b.
22 from Kpp-5; 23 from Kpp-24. Figs. 22 and 23 were illustrated as Plate VI,
figs. 1 and 9, respectively in the original description of TORIYAMA and KAN-
MERA (1968).
- Figs. 24-25. *Thailandina* sp. A
24. Axial section, GK.D 13181; 25. Sagittal section, GK.D 13170. 24 from Kpp-
10; 25 from Kpp-9. Figs. 24 and 25 were illustrated as Plate VI, figs. 16 and
18, respectively in the original description of TORIYAMA and KANMERA (1968).
- Fig. 26. *Thailandina* sp. B
Tangential section. GK.D 13029 from Kpp-35. Fig. 26 was illustrated as Plate
VI, fig. 22 in the original description of TORIYAMA and KANMERA (1968).
- Figs. 27-28. *Thailandina hongnusonthiae* TORIYAMA and KANMERA
27. Axial section of the holotype, GK.D 13712a; 28. Saggittal section, GK.D
13713b. Both from Kpp-20. Figs. 27 and 28 were illustrated as Plate VII, figs.
1 and 5, respectively in the original description of TORIYAMA and KANMERA
(1968).
- Figs. 29-30. *Neothailandina pitakpaivani* TORIYAMA and KANMERA
29. Axial section of the holotype, GK.D 13074a; 30. Sagittal section, GK.D
13064. 29 from Kpp-39; 30 from Kpp-30. Figs. 29 and 30 were illustrated as
Plate VII, fig. 9 and Pl. VIII, fig. 4, respectively in the original description
of TORIYAMA and KANMERA (1968).
- Fig. 31. *Neothailandina komalarjuni* TORIYAMA and KANMERA
Axial section of the holotype (microspheric specimen), GK.D 13759 from Kpp-
70. Fig. 31 was illustrated as Plate VIII, fig. 13 in the original description of
TORIYAMA and KANMERA (1968).

