STROMATOPORELLIDA, STROMATOPORIDA, SYRINGOSTROMATIDA, AMPHIPORIDA, AND GENERA WITH UNCERTAIN AFFINITIES: SYSTEMATIC DESCRIPTIONS

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Order STROMATOPORELLIDA Stearn, 1980

[Stromatoporellida STEARN, 1980, p. 891]

Stromatoporoids with extensive, thick, prominent laminae, marked by an axial zone or zones (light or dark, ordinicellular, cellular, or tubulate) and short, generally simple pillars confined to an interlaminar space. *Silurian (Pridoli)–Upper Devonian (Famennian).*

Family STROMATOPORELLIDAE Lecompte, 1951

[Stromatoporellidae LECOMPTE, 1951 in 1951–1952, p. 152] [=Simplexodictyidae LESSOVAJA, 1972, p. 47; =Stictostromatidae KHALFINA & YAVORSKY, 1973, p. 26 [148]; =Diplostromatidae STEARN, 1980, p. 890; =Clathrocoilonidae BOGOYAVLENSKAYA, 1984, p. 73]

Genera of stromatoporellids with short pillars, not superposed from one interlaminar space to another. *Silurian (Wenlock)–Devonian (Frasnian, ?upper Famennian).*

Stromatoporella NICHOLSON, 1886a, p. 92 [**Stromatopora granulata* NICHOLSON, 1873, p. 94; OD; =*Stromatopora (Coenostroma?) granulata* NICHOLSON & MURIE, 1878, p. 218–219, pl. 1; =*Stromatoporella granulata* NICHOLSON, 1886a, p. 93; neotype, NHM P6021 (Nicholson No. 329), MELVILLE, 1982, p. 126] [=*Stictostromella* GALLOWAY & ST. JEAN in FRITZ & WAINES, 1956, p. 92 (no type specified, but *Stictostroma eriense* PARKS, 1936, p. 81, implied), genus proposal withdrawn, p. 126; =*Pseudostictostroma* FLEROVA, 1969, p. 26 (type, *P. mitriformis,* OD); =?*Cancellatodictyon* KHALFINA & YAVORSKY, 1971, p. 119 (type, *Stromatoporella granulata sensu* YAVORSKY, 1951, p. 14, SD KHALFINA & YAVORSKY, 1971, p. 119); =*Pseudostromatoporella* KAŹMIERCZAK, 1971, p. 76 (type, *Stictostroma huronense* PARKS, 1936, p. 83, OD)]. Extensive, thick laminae and short pillars confined to interlaminar space, not superposed, many formed by upward inflection of laminae into cones (ring pillars), others simple, spool-shaped posts; microstructure of laminae ordinicellular but appearing in various states of preservation as transversely porous, tripartite, cellular, tubulate, or fibrous. Pillars cellular to fibrous. [The wide range of microstructures shown by the laminae may be partially accounted for by diagenesis but is likely also to be influenced by original variation. Controversy over the definition of the genus has focused on the correlation, or lack of it, between the ring pillars and the microstructures. Summaries of these discussions can be found in the work of ST. JEAN (1962, 1977), STEARN (1966), KAŹMIERCZAK (1971), and MISTIAEN (1985).] *Lower Devonian (Pragian)–Upper Devonian (Frasnian)*: Australia (Victoria), Czech Republic (Bohemia), *Pragian;* Afghanistan, Australia (Queensland), Canada (Arctic Island, Ontario), Russia (Salair), USA (Kentucky), *Emsian–Eifelian;* Belgium, Canada (Ontario, Manitoba), China (Sichuan), Germany (Eifel), Russia (Altai-Salair, Kuznetsk Basin), Spain (Calabria), USA (Indiana, Kentucky), *Eifelian;* Canada (Ontario), Russia (Kuznetsk Basin, Tyrgan), USA (Michigan), Ukraine, *Givetian;* Belgium (Ardennes), Kazakhstan, Poland, *Frasnian;* England (Devon), Germany (Büchel), Mongolia, Russia (Kuznetsk Basin, Urals), USA (Missouri, Indiana, Kentucky, Michigan), *Middle Devonian.*——FIG. 434*a–d.* **S. granulata* (NICHOLSON), Hamilton Formation, Arkona, Ontario, holotype, NHM P6021; *a,* longitudinal section, Nicholson slide 329b, ×10; *b,* tangential section showing ring pillars, Nicholson slide 329, ×10; *c,* tangential section, Nicholson slide 329a, showing cellular nature of pillars, ×70; *d,* longitudinal section, Nicholson slide 329c, showing ordinicellular laminae, ×60 (Stearn, 2011b).——FIG. 434*e. S. perannulata* GALLOWAY & ST. JEAN, Blue Fiord Formation, Ellesmere Island, arctic Canada, GSC no. 108175, tangential section showing ring pillars, ×10 (Prosh & Stearn, 1996).

Clathrocoilona YAVORSKY, 1931, p. 1394 [**C. abeona*; OD; holotype, CNIGR 3338/8a,b (KOSAREVA, 1976)]. Laminae extensive, thick (of thickness comparable to gallery height) of tripartite, ordinicellular, microreticulate or tubulate microstructure. Pillars postlike, commonly spool shaped, confined to interlaminar spaces, not superposed, compact or obscurely cellular. Commonly irregular, incrusting in growth, with algal interlayers. [The laminae may appear to be stranded, showing less opaque zones. Several layers of cellules in the laminae may give the appearance of microreticulation. In tangential section, the thick skeletal material may appear to be tubulate (described as felted by KOSAREVA, 1976). The genus has been confused with *Synthetostroma,* but in this genus the pillars are well superposed.] *Lower Devonian (?Emsian), Middle Devonian (Eifelian)–Upper Devonian (Frasnian)*: Austria (Carnic Alps), Canada (Arctic Island), Russia (northeastern Siberia, Salair), *?Emsian;* Belgium (Ardennes), Canada (Arctic Island, Manitoba), Central Asia (Altai), Germany (Eifel), Russia

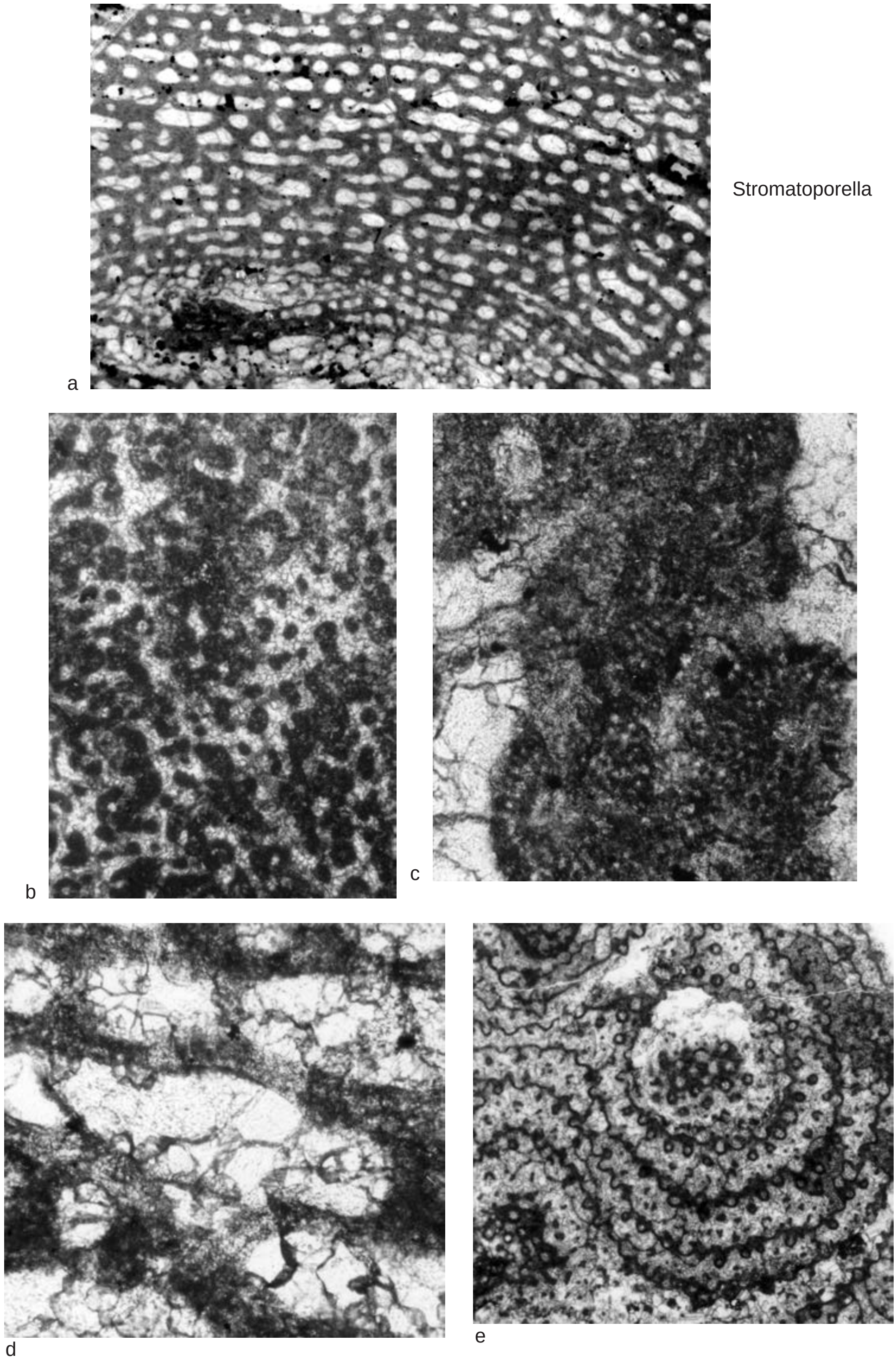


FIG. 434. Stromatoporellidae (p. 781).

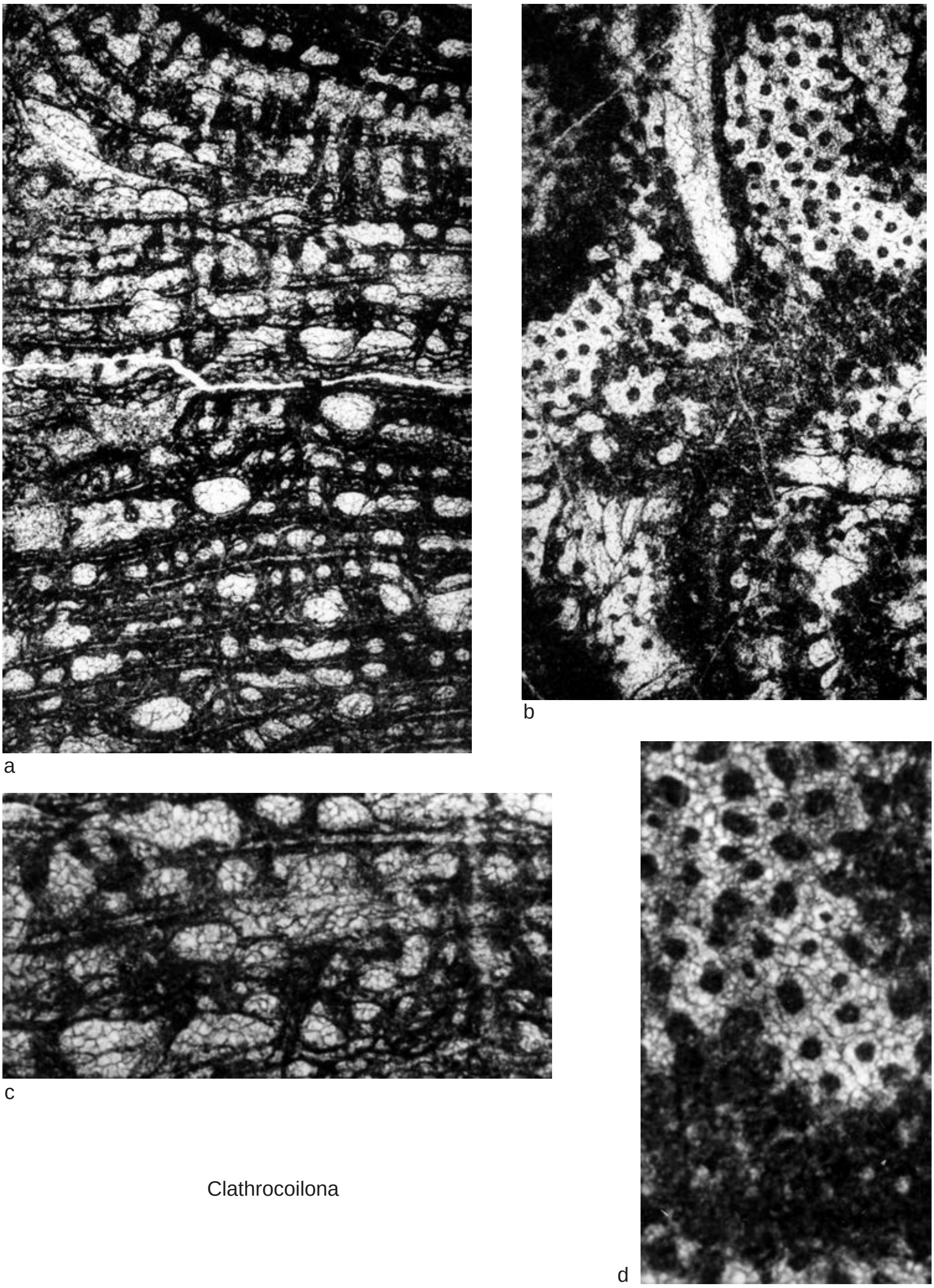
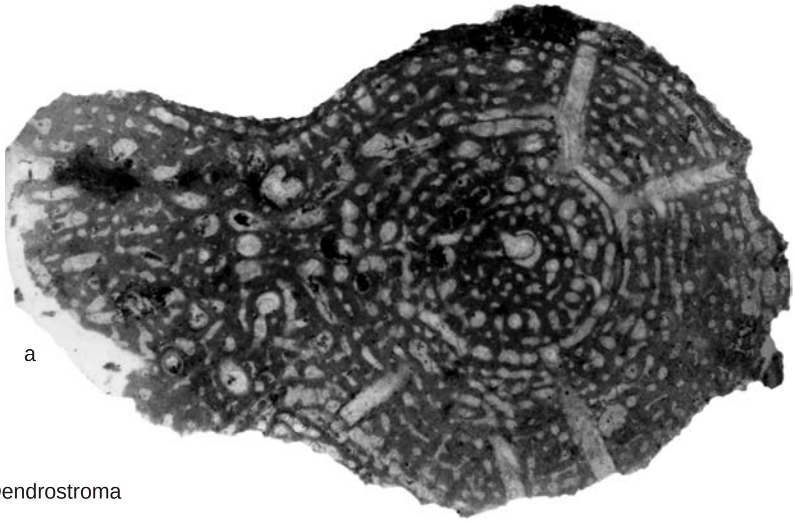


FIG. 435. Stromatoporellidae (p. 781–784).



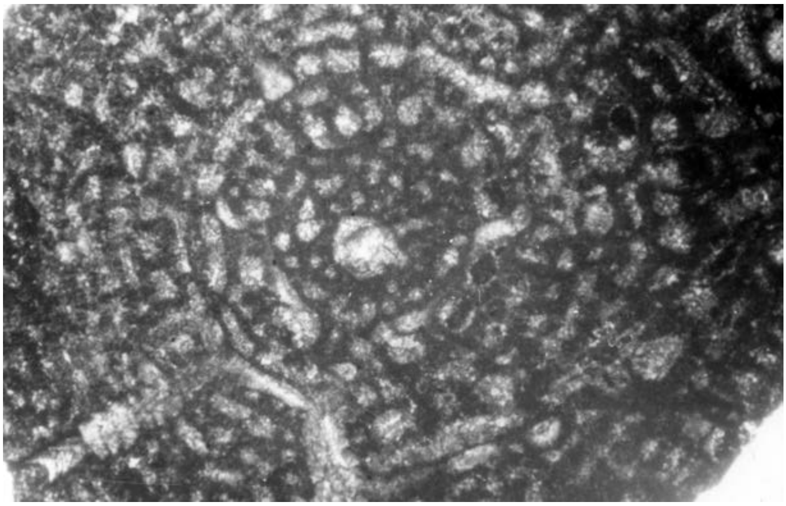


FIG. 436. Stromatoporellidae (p. 784–785).

(northeastern Siberia, Salair), *Eifelian;* Belgium (Ardennes), Canada (northern Alberta, Manitoba), Czech Republic (Moravia), France (Boulonnais), Iran (central), USA (Indiana, Michigan), *Givetian;* Australia (Queensland), China (Guangxi, Sichuan), Czech Republic (Moravia), Germany (Eifel), Russia (Kuznetsk Basin, northeastern Siberia, Salair), *Middle Devonian;* Australia (Canning Basin), Belgium (Ardennes), Canada (Alberta, Manitoba), Czech Republic (Moravia), France (Boulonnais), Russia (Russian platform, Kuznetsk Basin), USA (Iowa), *Frasnian.*——FIG. 435*a–d.* **C. abeona*, Middle Devonian, Kuznetsk Basin, Russia, holotype, CNIGR 3338/8; *a*, longitudinal section, ×10; *b*, tangential section, ×10; *c,* longitudinal section showing thick, tripartite laminae, ×25; *d*, tangential section showing round pillars, ×25 (Stearn, 2011b).

Dendrostroma LECOMPTE, 1952 in 1951–1952, p. 320–321 [**Idiostroma oculatum* NICHOLSON, 1886a, p. 101; OD; holotype, NHM P6073 (Nicholson No. 403)]. Dendroid skeleton with axial tube; laminae distinct, thick, extensive, compact to fibrous, commonly obscurely tripartite with axial dark or light zone; pillars postlike, confined to interlaminar spaces, not superposed, compact to fibrous. *Lower Devonian (Pragian)–Upper Devonian (Frasnian, ?upper Famennian)*: Australia (?Victoria), *Pragian;* Canada (Manitoba), Czech Republic, France (Boulonnais), Germany (Eifel), Russia a

b

Dendrostroma

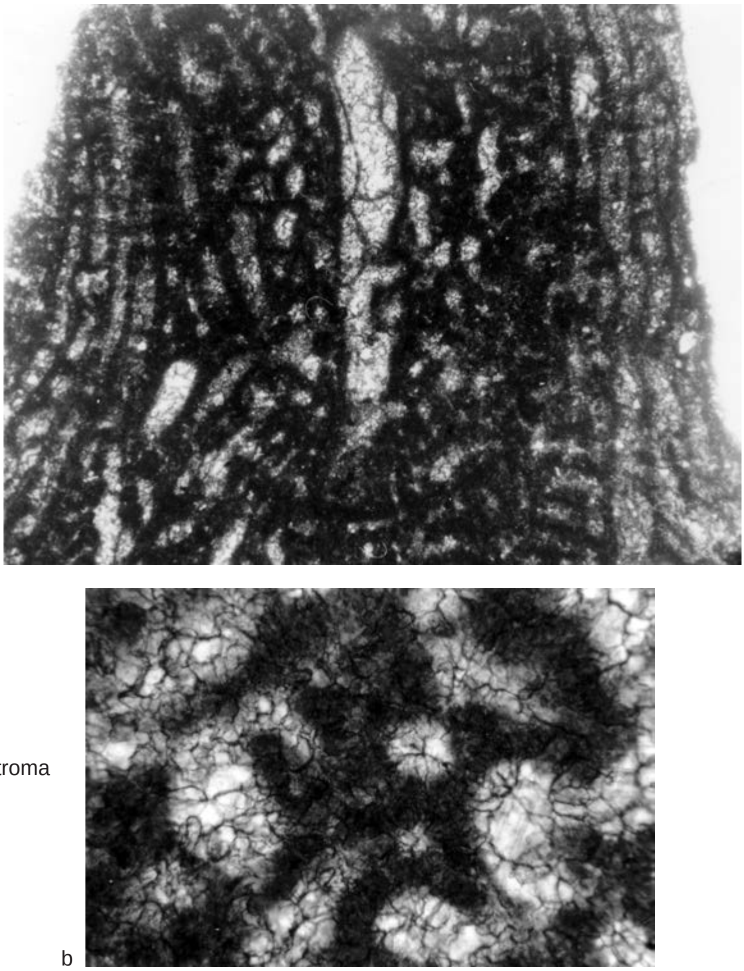


FIG. 437. Stromatoporellidae (p. 784–785).

(northeastern Siberia), USA (Michigan), *Givetian;* Germany (Eifel), India (Himalaya), Russia (Urals), Vietnam, *Middle Devonian;* Australia (Canning Basin, Carnarvon Basin), Czech Republic, Iran (Kerman), Russia (Kuznetsk Basin), *Frasnian;* ?Kazakhstan, Russia (?Donetsk Basin), *?upper Famennian.*——FIG. 436*a–b.* **D. oculatum* (NICHOLSON), Middle Devonian, Büchel, Germany, holotype, NHM P6073; *a,* complete transverse section of dendroid skeleton showing central and radiating canals and continuous laminae, ×6; *b*, transverse section of columnar skeleton showing short pillars, ×10 (Stearn, 2011b).——FIG. 437*a–b.* **D. oculatum* (NICHOLSON), Middle Devonian, Büchel, Germany, holotype, NHM P6073; *a*, longitudinal axial section showing axial canal with tabulae, ×10; *b*, tangential section showing fibrous microstructure, ×50 (Stearn, 2011b).

Simplexodictyon BOGOYAVLENSKAYA, 1965b, p. 110 [**Clathrodictyon regulare* var. nov. YAVORSKY, 1929, p. 83; OD; CNIGR 2595/30(6); =*C. regulare podolica* YAVORSKY, 1955, p. 43; see STEARN, 1991, for full discussion of the type. Although some authors have attributed the varietal name *podolica* to YAVORSKY, 1929, it was not formally proposed until 1955] [=*Diplostroma* NESTOR, 1966a, p. 27–28 (type, *Clathrodictyon pseudobilaminatum* KHALFINA, 1961b, p. 47); =*Nuratadictyon* LESSOVAJA, 1972, p. 48 (type, *N. duplexolaminum,* OD)]. Laminae extensive, composed of two compact layers separated (in the same skeleton) by either or all of 1) spar cement, 2) sediment, 3) epibionts, 4) a line of cellules; or fused into a single layer. Pillars compact, simple, postlike, commonly incomplete or oblique. *Silurian (Wenlock)–Middle Devonian (Eifelian):* Estonia (Saaremaa), Russia (Moiero River, Siberian

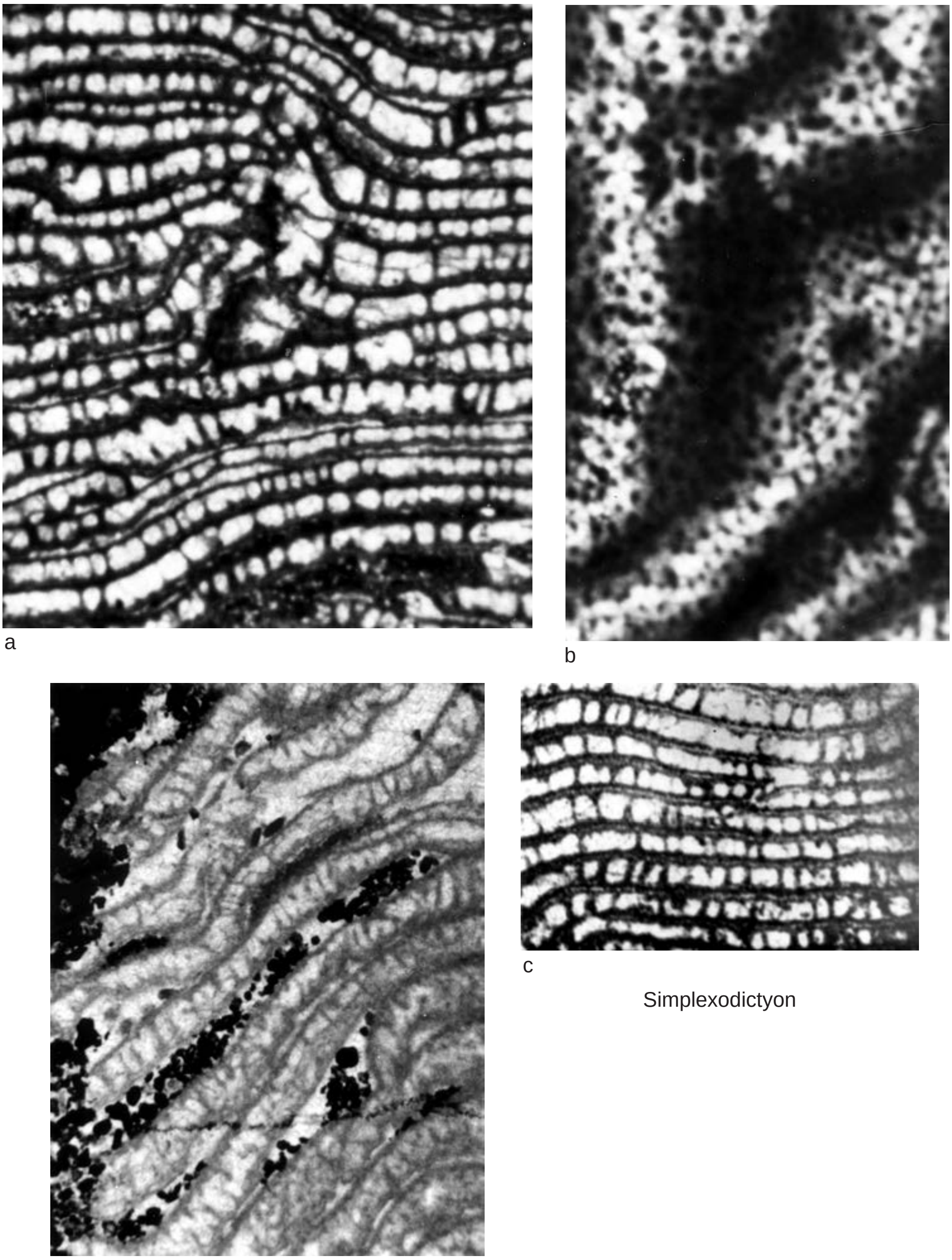


FIG. 438. Stromatoporellidae (p. 785–787).

platform), USA (Kentucky), *Wenlock;* Australia (Queensland), Central Asia (Tien Shan), Estonia, Russia (Salair, Altai), Ukraine (Podolia), *Ludlow;* Australia (Victoria, northern Queensland), *Emsian;* Canada (Arctic Island, Yukon), *Eifelian.*——FIG. 438*a–c.* **S. podolicum* (YAVORSKY), holotype, Ludlow, Smotrich River, Ukraine; *a*, longitudinal section, ×10; *b*, topotype, tangential section, ×10 (Stearn, 2011b); *c,* longitudinal section, ×10 (Yavorsky, 1929).——FIG. 438*d. S. vermiformis* (STEARN & MEHROTRA, 1970), Eifelian, Blue Fiord Formation, Cameron Island, Canada, GSC

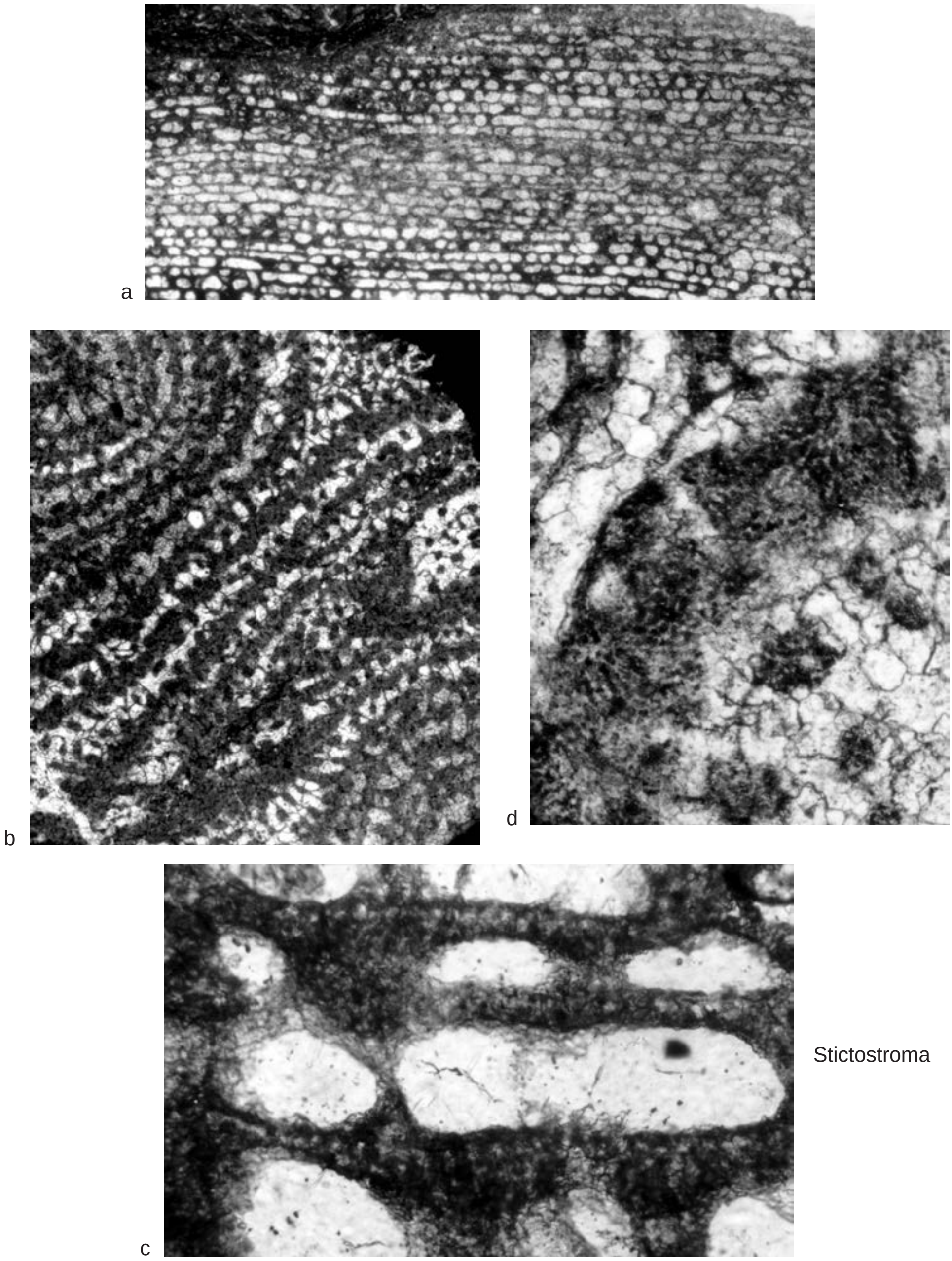


FIG. 439. Stromatoporellidae (p. 787–789).

116284, longitudinal section, showing separated laminae, ×10 (Stearn, 2011b).

Stictostroma PARKS, 1936, p. 78 [**Stromatopora mammillata* NICHOLSON, 1873, p. 94; OD; *non* SCHMIDT, 1858; holotype, ROM 9360; =*Stromatopora mamilliferum* GALLOWAY & ST. JEAN, 1957, p. 125; =*Stictostroma gorriense* STEARN, 1995a, p. 26, designated the type in a ruling by ICZN (1996). The type specimen that PARKS (1936) designated as *Stromatopora mammillata* NICHOLSON, 1873, and renamed *S. mamilliferum* GALLOWAY & ST. JEAN by GALLOWAY and ST. JEAN (1957) to avoid homonymy,

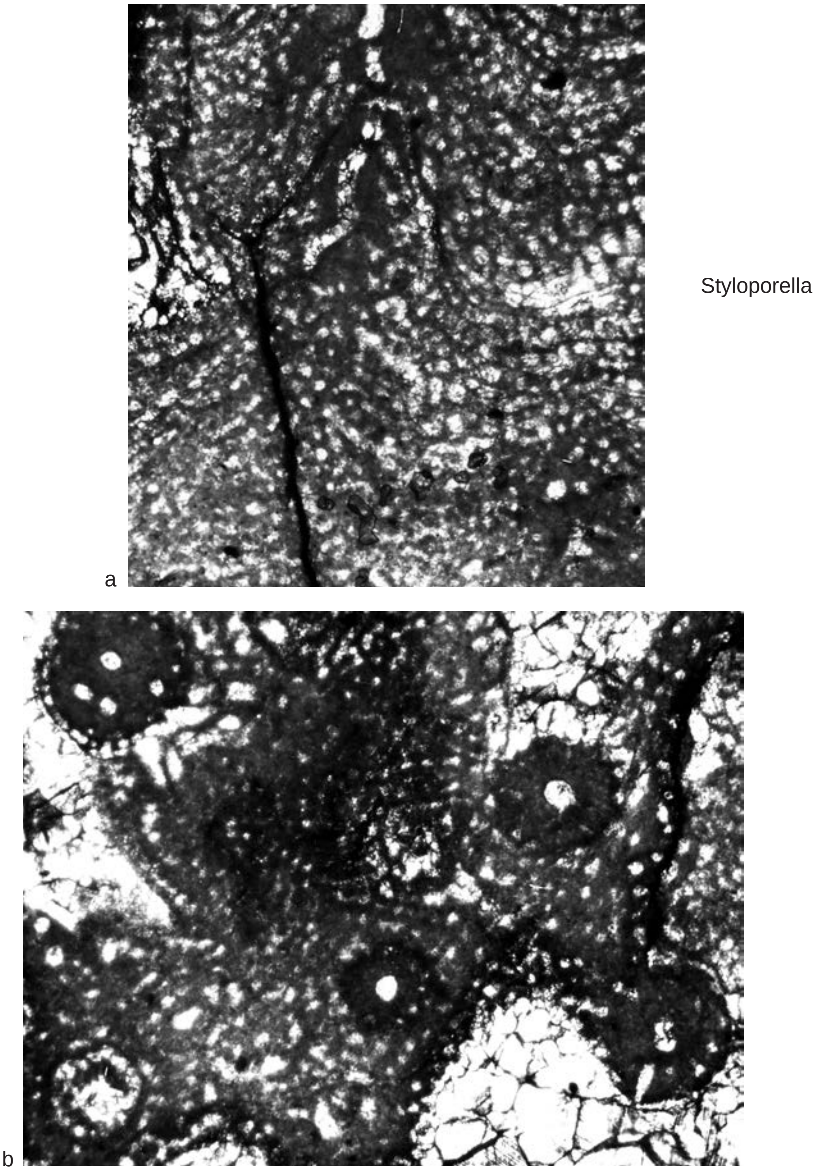


FIG. 440. Stromatoporellidae (p. 789).

had unknown internal structure, because NICHOLSON's (1873) types were not sectioned. PARKS's (1936) descriptions were based on specimens from Gorrie, Ontario, recognized as holotypes by ICZN Opinion 1843, Case 2109 (1996), because NICHOLSON's (1873) specimens, when sectioned, were indeterminate in diagnostic internal structure]. Laminae thick, extensive, ordinicellular in microstructure but commonly appearing transversely porous, tripartite, fibrous, rarely tubulate; pillars confined to interlaminar spaces, not systematically superposed, postlike, only rarely ring pillars, cellular where best preserved, commonly fibrous. *Lower Devonian (Pragian)–Upper Devonian (Frasnian)*: Czech Republic (Bohemia), *Pragian;* Australia (Victoria), Canada (Arctic Island, Northwest Territories, Ontario), New Zealand (Reefton), *Emsian;* Australia (Queensland), Belgium (Ardennes), Canada (Manitoba, Ontario), Czech Republic, western Germany (western), Russia (Kuznetsk Basin, Salair), USA (Michigan, Ohio), *Eifelian;* Afghanistan, Belgium (Ardennes), Canada (British Columbia, Ontario), France (Boulonnais), Germany (Sauerland), Russia (Kuznetsk Basin), USA (Missouri), *Givetian;* Canada (northern Ontario), China (Guangxi), Russia (Omolov, Kuznetsk Basin, Urals), USA (Missouri), Vietnam, *Middle Devonian*; Belgium (Ardennes), Canada (Alberta), China (Xizang), France (Boulonnais), Iran (Kerman), Russia (Kuznetsk Basin), USA (Iowa), *Frasnian.*——FIG. 439*a–d.* **S. gorriense* STEARN, holotype, ROM 9360, Bois Blanc Formation, Gorrie, Ontario; *a*, longitudinal section 2149, ×10; *b*, tangential section 2152, ×10; *c*, longitudinal section 2151, showing microstructure of laminae, ×55; *d*, tangential section 2150, showing microstructure of pillars, ×55 (Stearn, 2011b).

Styloporella KHALFINA, 1956, p. 62 (as subgenus of *Stromatoporella*, elevated to generic rank by KHALFINA, 1961d, p. 338) [**Stromatoporella (Styloporella) grata* KHALFINA, 1956, p. 62; OD; holotype, SOAN 402/67b]. Similar to *Stromatoporella* but with structural elements thickened into astrorhizal columns with prominent axial canals where laminae inflected upward. *Upper Devonian (Frasnian)*: Russia (Kuznetsk Basin, eastern Siberia).——FIG. 440*a–b.* **S. grata*, holotype, SOAN 402/67b, Kuznetsk Basin; *a*, longitudinal section showing column with axial canal, ×10; *b*, tangential section showing cross sections of columns, ×10 (Stearn, 2011b).

Syringodictyon ST. JEAN, 1986, p. 1050 [**Stromatopora tuberculata* NICHOLSON, 1873, p. 92–93; OD; NHM P5627 (type specimen never illustrated in thin section)]. Laminae extensive, thick, inflected upward in invaginating cones into vertically extensive columns with narrow openings. Pillars formed by superposition of upward extensions of laminae, other pillars scarce. [The difference between *Syringodictyon* and *Tubuliporella* is in the size and nature of the vertical tubes formed by the upwardly inflected laminae—small and formed of invaginating cones in the former, and large and continuous in the latter—and in the absence of ring pillars between the columns in the former.] *Middle Devonian (lower Eifelian)*: Canada (southern Ontario).——FIG. 441*a–c.* **S. tuberculatum* (NICHOLSON), topotypes, Onondaga Formation, Empire Beach; *a*, longitudinal section showing columns of skeletal material, topotype, YPM222128; *b*, longitudinal section, showing inverted cones of laminae inflected into columns, topotype, YPM222129; *c*, tangential section showing cross sections of columns and lack of other pillars, topotype, YPM222128, ×10 (St. Jean, 1986).

Tubuliporella KHALFINA, 1968a, p. 150 [**T. lecompti*; OD (as *T. lecomti*, *lapsus calami)*]. Similar to *Stromatoporella,* but some ring pillars superposed, forming vertical open channels crossed by thin dissepiments. *Lower Devonian–Middle Devonian (Eifelian)*: Russia (Altai), *Lower Devonian;* Australia (Victoria), *Pragian;* Russia (Kuznetsk Basin, Altai, Salair), *Eifelian.*——FIG. 442*a–c.* **T. lecompti*, holotype, CSGM409/3a, Salair, Eifelian, Shandinskie Stage; *a,* longitudinal

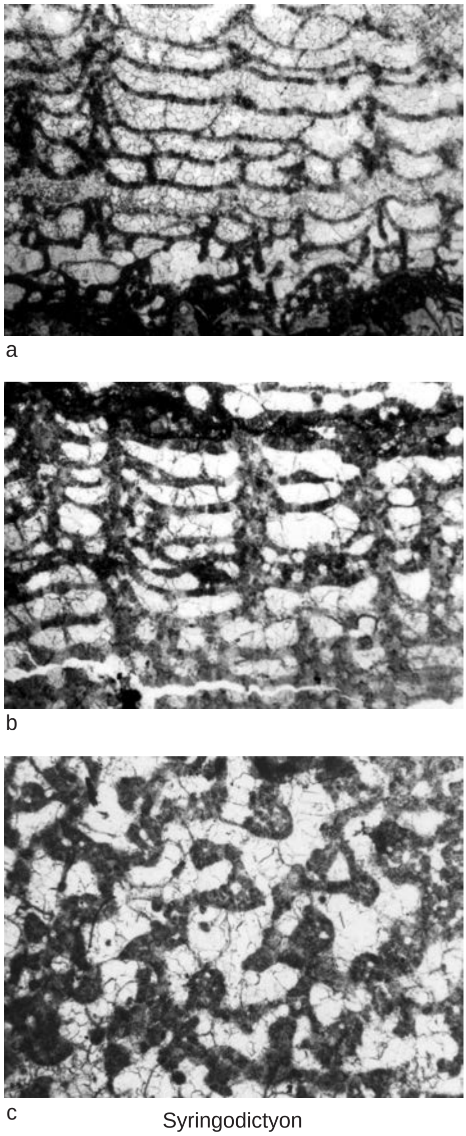


FIG. 441. Stromatoporellidae (p. 789).

section, ×10; *b*, tangential section, ×10; *c,* tangential section through a mamelon, ×10 (Khalfina, 1968a).

Family TRUPETOSTROMATIDAE Germovsek, 1954

[*nom. correct.* STEARN & others, 1999, p. 43 *pro* Trupetostromidae GERMOVSEK, 1954, p. 361] [=Hermatostromatidae NESTOR, 1964a, p. 13; =Synthetostromatidae KHROMYKH, 1969, p. 35; =Imponodictyidae KHALFINA & YAVORSKY, 1971, p. 119]

Stromatoporellids with superposed, postlike pillars or, rarely, pachysteles and

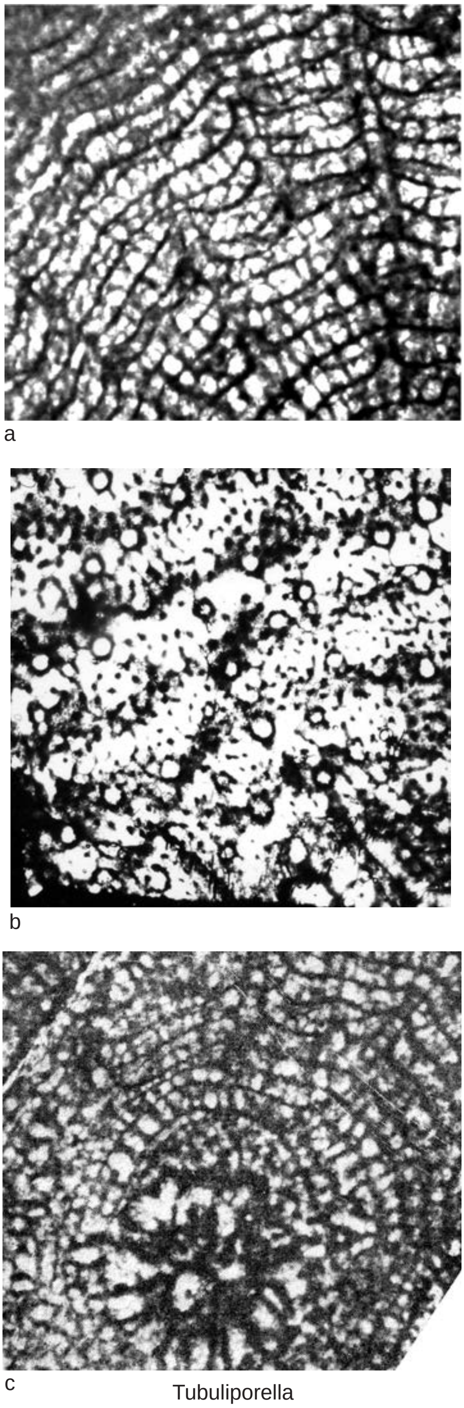


FIG. 442. Stromatoporellidae (p. 789).

tripartite or ordinicellular laminae forming a grid in longitudinal section. [Many of the genera of this family contain species that have compact-vacuolate microstructure and some that are cellular. Microstructure is therefore not considered diagnostic of the family.] *Silurian (Pridoli)–Upper Devonian (Famennian).*

Trupetostroma PARKS, 1936, p. 55 [**T. warreni*; OD; holotype, ROM 12197 (thin sections only), specimen DU677, referred to by PARKS as the type, is lost] [=*Flexiostroma* KHALFINA, 1961d, p. 345 (type, *F. flexuosum* KHALFINA, 1961d, p. 346, OD, see also STOCK, 1982, p. 666); =*?Imponodictyon* KHALFINA & YAVORSKY, 1971, p. 119 (type, *Stromatoporella loutouguini* var. *postera* KHALFINA, 1956, p. 60, OD)]. Laminae extensive, thick, typically ordinicellular but commonly showing a central clear zone or opaque axis, pierced by large pores joining the galleries above and below. Pillars short, expanded above and below at laminae, systematically superposed across successive laminae, forming grid with laminae; microstructure vacuolate, cellular, compact. *?Lower Devonian, Middle Devonian (Eifelian)–Upper Devonian (Famennian)*: China (Guangxi), *?Lower Devonian;* Australia (Broken River), China (Guangxi, Guizhou, Hunan, Yunnan), Czech Republic (Bohemia), Mongolia, Poland (Holy Cross), Russia (Kuznetsk Basin, Salair, South Urals), USA (Missouri), *Middle Devonian;* Canada (Arctic Island, Northwest Territories), China (Guangxi), Russia (Magadan), USA (Indiana), *Eifelian;* Belgium (Ardennes), Canada (Manitoba, Northwest Territories, northeastern British Columbia), China (Guangxi, Yunnan), Germany (Sauerland), Russia (Kuznetsk Basin, Salair, Urals), Vietnam, *Givetian;* Australia (Canning Basin), Belgium (Ardennes), Canada (Alberta, Manitoba, Saskatchewan), China (Guangxi, Guizhou), Russia (Kolymy, West pre-Urals), Vietnam, *Frasnian;* Kazakhstan, *Famennian;* China (Guangxi), Poland (Sudetes Mountains), *upper Famennian.*——FIG. 443*a–d*. **T. warreni,* holotype, ROM 12197, Presqu'ile Dolomite, Great Slave Lake, Canada; *a,* longitudinal section showing thin laminae and superposed pillars, ×10; *b*, tangential section showing large circular pores through cut laminae, ×10; *c,* longitudinal section showing compact vacuolate pillars and tripartite laminae, ×30; *d*, tangential section showing vacuolate pillars, round in cross section; a lamina is cut obliquely on right side, ×30 (Stearn, 2011b).

Hermatostroma NICHOLSON, 1886a, p. 105 [**H. schlueteri* NICHOLSON, 1886a, p. 105–106; OD; NICHOLSON, 1892, p. 215–219, holotype, NHM P5527] [=*Argostroma* YANG & DONG, 1979, p. 45 (type, *A. typicum*, OD); MISTIAEN (1985, p. 189–190) showed that *Argostroma* is a diagenetic phase of

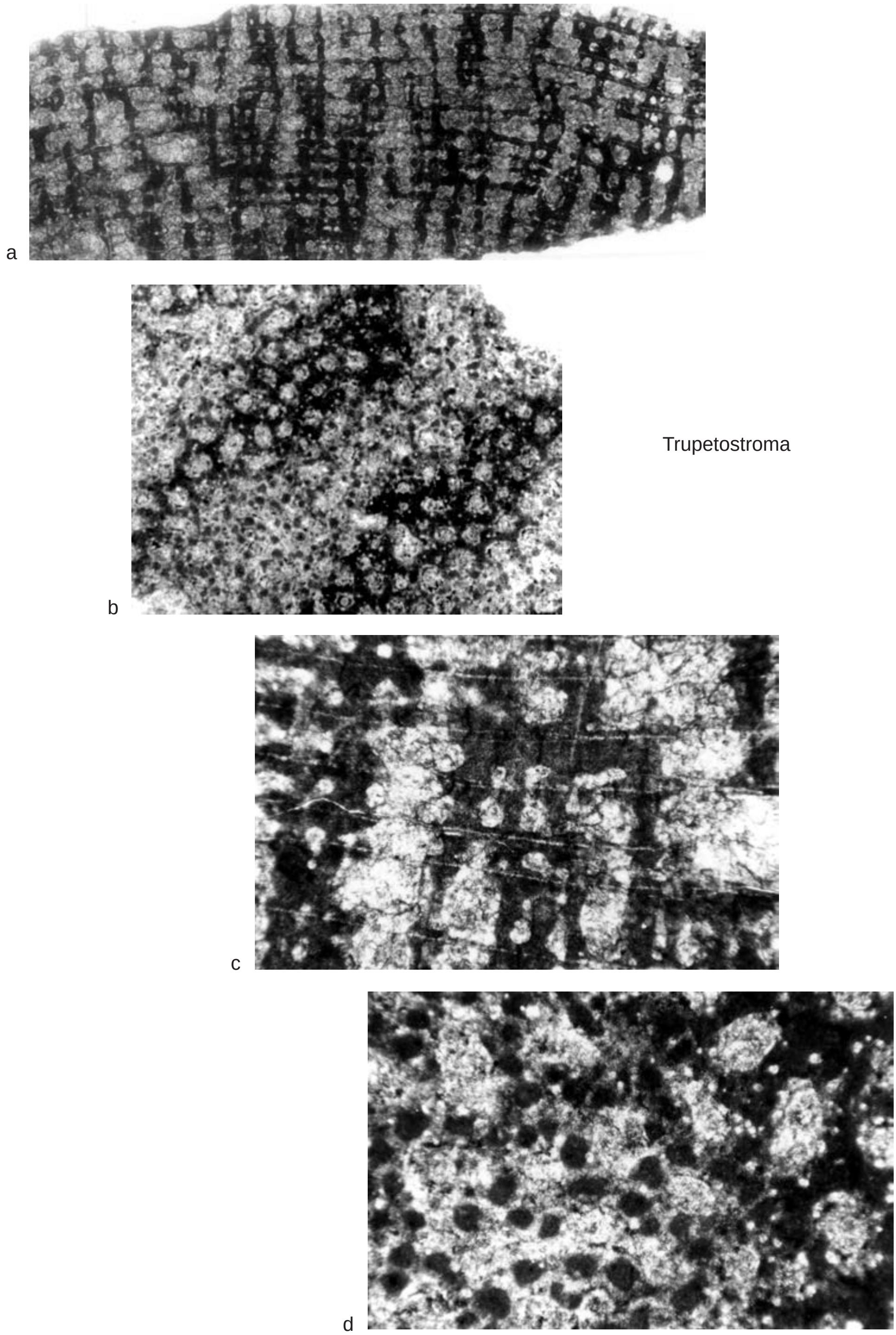


FIG. 443. Trupetostromatidae (p. 790).

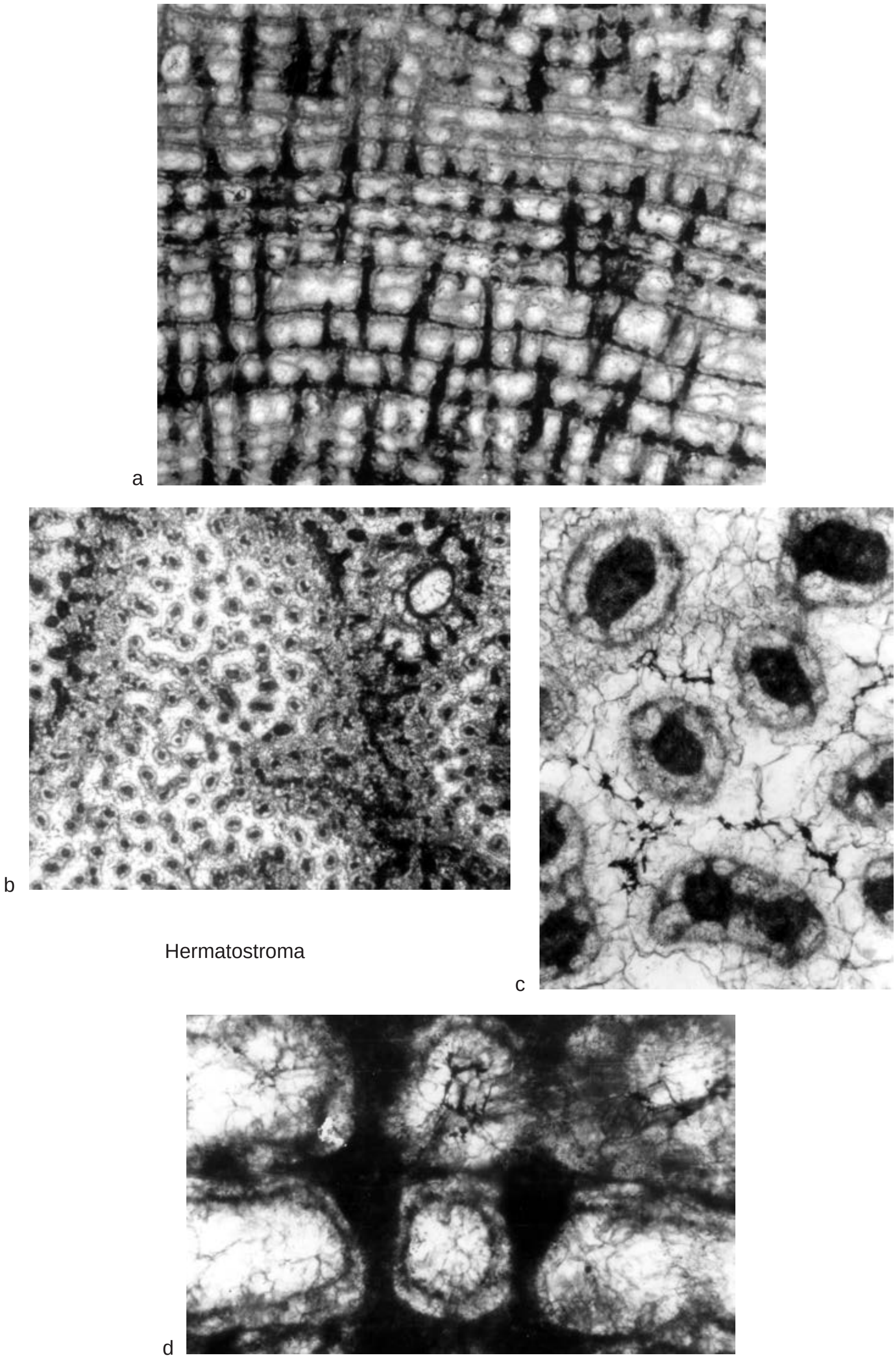
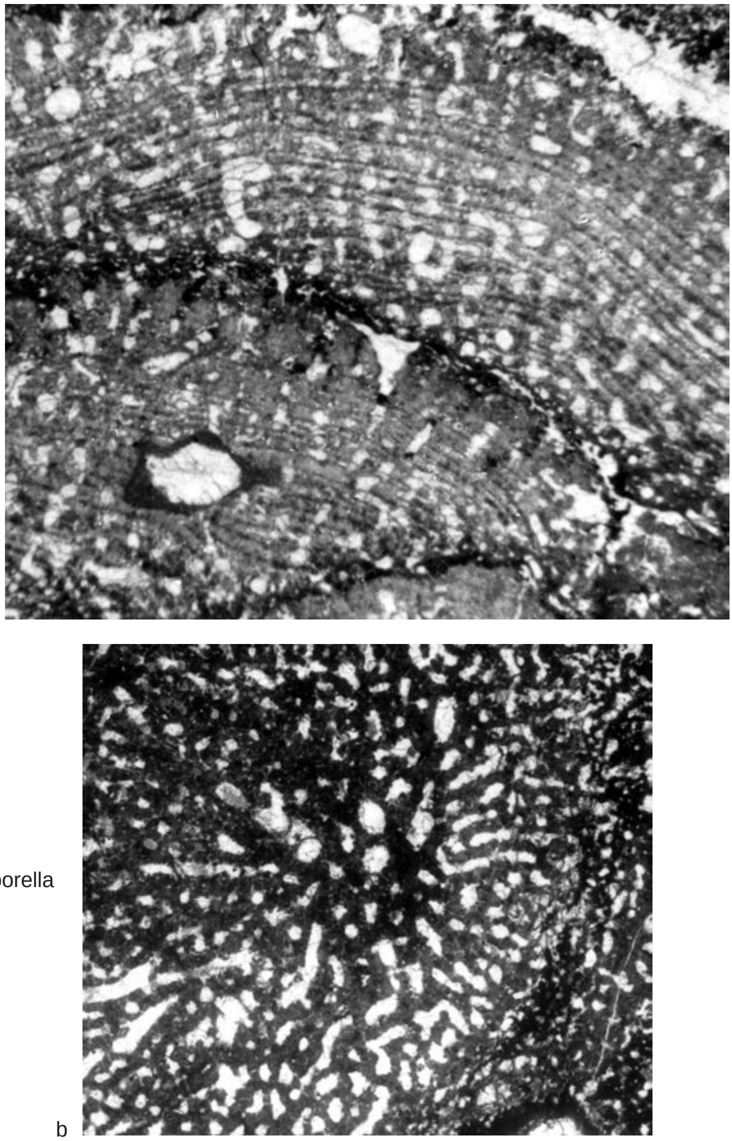


FIG. 444. Trupetostromatidae (p. 790–794).



a

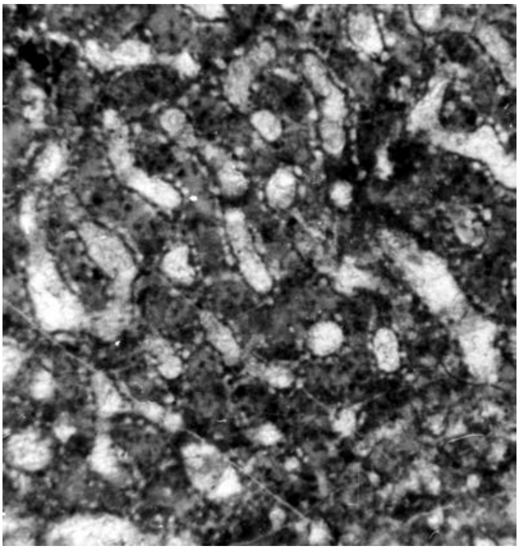
Hermatoporella

b

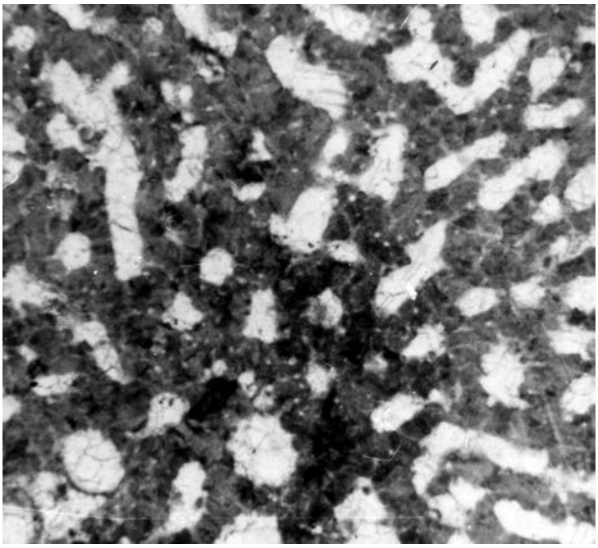
FIG. 445. Trupetostromatidae (p. 794–796).

Hermatostroma]. Laminae extensive, prominent, tripartite with central dark zone, or light zone and more opaque lateral zones, penetrated by large pores between the pillars; pillars spool shaped, confined to interlaminar spaces, regularly superposed in longitudinal section, subcircular in tangential section, surrounded by peripheral cyst plates or bordered by peripheral vesicles. Microstructure compact, vacuolate, cellular. [*Hermatostroma* may grade into *Trupetostroma* through forms with lines of vacuoles along the pillar edges.] *Middle Devonian (Eifelian)–Upper Devonian (Frasnian)*: Australia (Queensland), Russia (Kuznetsk Basin), *Eifelian;* Australia (Canning Basin, Queensland), Belgium (Ardennes), China (Guangxi, Guizhou, Yunnan), France (Boulonnais, Ancenis), Poland (Holy Cross Mountains), Thailand, *Givetian;* Czech Republic (Bohemia), England (Devon), Germany (Eifel), China (Guangxi, Sichuan, Yunnan), USA (Missouri), *Middle Devonian;* Australia (Canning Basin), Belgium (Ardennes), Canada (Alberta, Manitoba, Saskatchewan), China

Hermatoporella



a



b

FIG. 446. Trupetostromatidae (p. 794–796).

(Sichuan, Yunnan), Czech Republic (Moravia), Germany, Poland (Holy Cross Mountains), Russia (northeastern Siberia), USA (Iowa), *Frasnian.*——FIG. 444*a–d.* **H. schlueteri*, holotype, NHM P5527, Middle Devonian, Hebborn, Paffrath District, Germany; *a*, longitudinal section, showing grid of pillars and laminae; *b*, tangential section, showing pillars, round in cross section, ×10; *c*, longitudinal section showing peripheral vesicles and compact pillars, ×50; *d,* tangential section, showing peripheral vesicles, ×50 (Stearn, 2011b).

Hermatoporella KHROMYKH, 1969, p. 34 [**Trupetostroma maillieuxi* LECOMPTE, 1952 in 1951–1952, p. 237–239; OD; holotype, IRScNB 5760a]. Irregular grid formed by pachysteles and microlaminae intersecting pachysteles, locally replaced by aligned dissepiments; pachysteles superposed systematically, with peripheral vacuoles in parts of type, in tangential section forming a labyrinthine network, rarely cut as isolated subcircular masses; microstructure compact, vacuolate, or cellular. *Middle Devonian (?Eifelian, Givetian)–Upper Devonian (Frasnian)*: Morocco, *?Eifelian;* Canada (Northwest Territories, northeastern British Columbia), Russia (Omolon, South Urals), Vietnam, *Givetian;* China (Guizhou), Russia (Salair), *Middle Devonian;* Australia

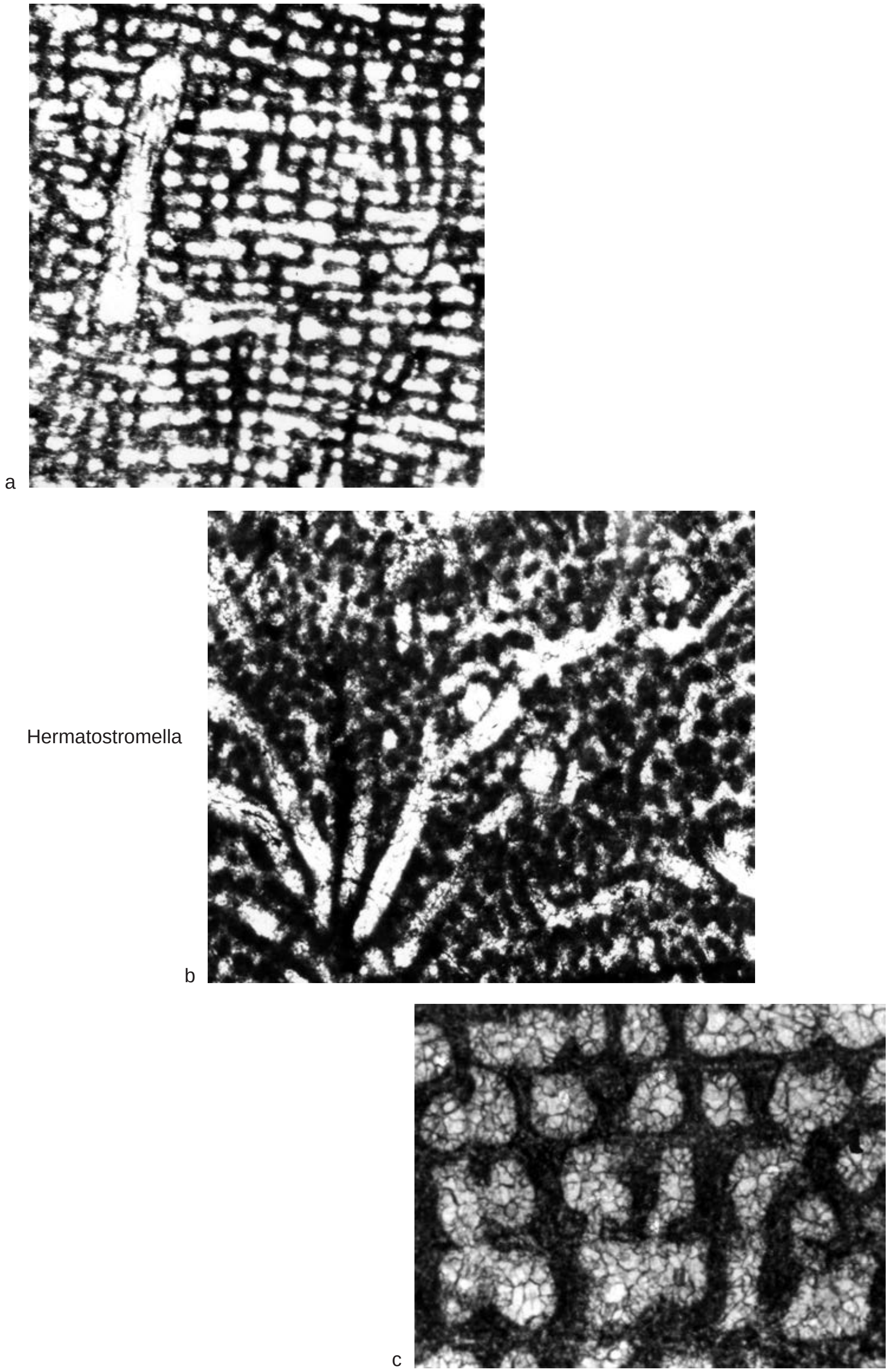
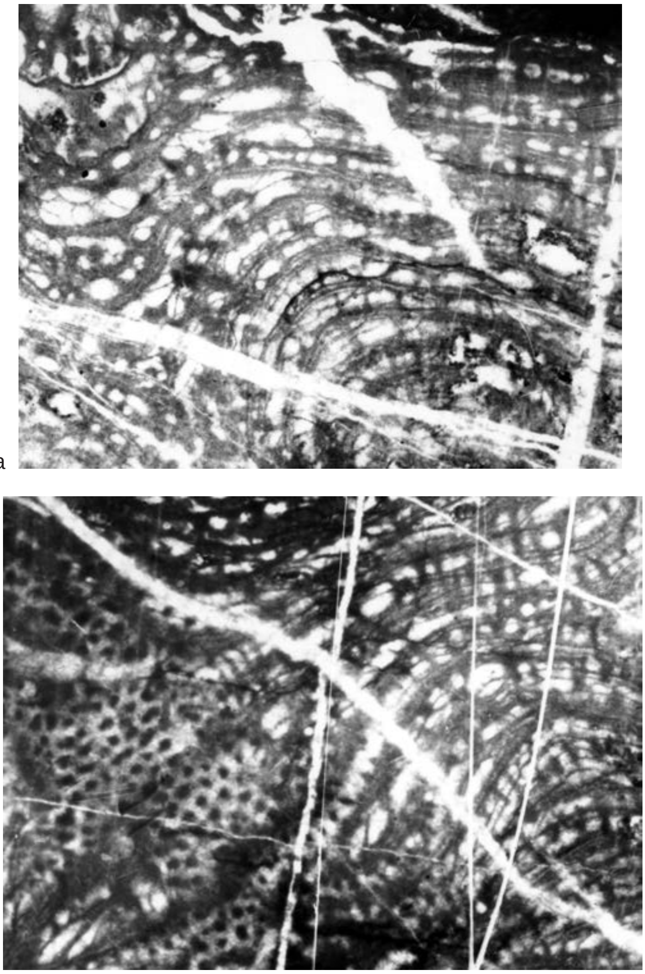


FIG. 447. Trupetostromatidae (p. 796–797).

Synthetostroma



a

b

Fig. 448. Trupetostromatidae (p. 17).

(Canning Basin), Belgium (Ardennes), Canada (Alberta, Northwest Territories, Saskatchewan), China (Xinjiang), Czech Republic (Moravia), Iran (Kerman), Russia (North Urals, South Urals), USA (Iowa, Missouri), Vietnam, *Frasnian.*——Fig. 445*a–b.* **H. maillieuxi* (Lecompte), holotype, IRScNB 5760a, Fromelennes Assise, Frasnian, Senzeille, Belgium; *a*, longitudinal section showing pachysteles and microlaminae, ×10; *b*, tangential section showing pachysteles around an astrorhizal center, ×10 (Stearn, 2011b).——Fig. 446*a–b.* **H. maillieuxi* (Lecompte), holotype, IRScNB a 5760, Fromelennes Assise, Frasnian, Senzeille, Belgium; *a*, tangential section showing peripheral vacuoles at edges of pachysteles, ×25; *b*, tangential section showing vacuolate microstructure of pachysteles but lack of peripheral vacuoles, ×25 (Stearn, 2011b).

Hermatostromella Khalfina, 1961a, p. 52 [**H. parasitica*; OD; holotype, CSGM 401/33] [=*Amnestostroma* Bogoyavlenskaya, 1969b, p. 22 (type, *Syringostroma federovi* Yavorsky, 1929, p. 109, OD; Stearn & others, 1999, p. 45); =*Gerronostromina* Khalfina & Yavorsky, 1971, p. 119 (type, *Gerronostroma kitatense* Yavorsky, 1961, p. 12, OD; Stearn & others, 1999, p. 45)]. Laminae and pillars subequal in thickness forming grid; laminae extensive, locally with axial dark or light zone, or ordinicellular; pillars postlike, locally appearing continuous, locally superposed and interrupted by lighter central zone in laminae, mostly discrete and subcircular in tangential section; microstructure compact, vacuolate, rarely cellular. [The most extensive discussion of this genus is that of Khromykh (1974a) who emphasized as diagnostic characters the equal thickness of pillars and laminae, the dark or light central line in the laminae, the superposed pillars, and the cellular microstructure. *Amnestostroma* is intermediate between *Hermatostromella* and *Trupetostroma*; however, the features of the type species are basically those of *Hermatostromella* and therefore difficult to justify as a separate genus. See STEARN and others (1999, p. 45) for discussion.] *Silurian (Pridoli)–Lower Devonian (Emsian), Middle Devonian (?Givetian)*: Russia (eastern Siberia, Urals), *Pridoli;* Canada (Arctic Island), Central Asia (Tien Shan), Russia (Salair, Urals), *Lochkovian;* Australia (Victoria), *Pragian;* Australia (New South Wales), *Emsian;* Russia (eastern Siberia, Altai Sayan), Central Asia (Tien Shan), *Lower Devonian;* Queensland, *?Givetian.*——FIG. 447*a–b*. **H. parasitica*, holotype, CSGM 401/33a, Tom'chumyshskii Horizon, Lower Devonian, Salair, Russia; *a*, longitudinal section, ×10; *b*, tangential section, showing astrorhizal canals, ×10 (Stearn, 2011b).——FIG. 447c. *H. federovi* (YAVORSKY), type species of *Amnestostroma*, holotype, CNIGR 2595, showing cellular microstructure, ×25 (Stearn, 2011b).

Synthetostroma LECOMPTE, 1951 in 1951–1952, p. 193 [**S. actinostromoides* LECOMPTE, 1951 in 1951–1952, p. 194; OD; holotype, IRScNB7296]. Laminae extensive, continuous, composed of multiple microlaminae or imbricating dissepiments giving tangled appearance, commonly with central lighter zone or zones. Pillars postlike, confined to interlaminar spaces but systematically superposed. Microstructure compact. [The genus differs from *Clathrocoilona* with which it has been confused (NESTOR, 1966a; KAŹMIERCZAK, 1971; KOSAREVA, 1976) in having well-superposed pillars that appear to be continuous.] *Middle Devonian (Givetian)–Upper Devonian (Frasnian)*: Belgium (Ardennes), *Givetian;* Czech Republic, *Frasnian.*——FIG. 448*a–b*. **S. actinostromoides*, holotype, IRScNB7296a, Givetian, Surice, Belgium; *a*, longitudinal section showing multiple-stranded laminae and superposed pillars, ×10; *b*, partly tangential and partly longitudinal section showing pillars round in cross section, ×10 (Stearn, 2011b).

Family IDIOSTROMATIDAE Nicholson, 1886

[*nom. correct.* GALLOWAY, 1957, p. 440, *pro* Idiostromidae NICHOLSON, 1886a, p. 98]

Family diagnosis as for genus. [The family name came to be used for any dendroid genus, although the original diagnosis noted that growth form was not a diagnostic feature; it originally included disparate genera that are now assigned to three different orders.] *Middle Devonian (Eifelian)–Upper Devonian (Frasnian)*.

Idiostroma WINCHELL, 1867, p. 99 [**Stromatopora caespitosa* WINCHELL, 1866, p. 91; OD; lectotype, UMMP 32401A (slides W2-17,18), GALLOWAY & EHLERS, 1960, p. 63]. Growth form dendroid with axial tabulated canal and, in some species, subsidiary canals. Axial zone of amalgamate structure in transverse section, passing outward into peripheral zone of well-defined continuous or superposed pachysteles, intervening allotubes crossed by dissepiments and concentric laminae. Laminae variably expressed by alignment of opaque dissepiments to form microlaminae, by well-defined opaque microlaminae passing through pachysteles, and/or by tripartite laminae with central light zone. Laminae forming parabolas parallel to successive growth surfaces in longitudinal section. Microstructure coarsely and irregularly vacuolate. [Vacuolate microstructure, tripartite laminae, and the tendency for the dominance of concentric laminae over pachysteles are distinguishing features of the lectotype, but parts of it resemble *Stachyodes* in microstructure. NICHOLSON's (1886a) description of the genus, which was widely accepted by later workers, was based on *I. roemeri* NICHOLSON, in the absence at that time of adequate descriptions of the type species.] *Middle Devonian (Eifelian)–Upper Devonian (Frasnian):* Germany (Sauerland), *Eifelian;* Australia (Queensland), China (Guizhou, Guangxi, Hunan, southern Tien Shan, Xizang), Mongolia, Spain (Cantabria), USA (Iowa, Michigan), Vietnam, *Givetian;* Uzbekistan, China (Sichuan), Germany, Russia (Urals), *Middle Devonian;* Australia (Canning Basin), Canada (northern Alberta), Uzbekistan, China (Sichuan), Czech Republic (Moravia), western Germany, *Frasnian.*——FIG. 449*a–c*. **I. caespitosum* (WINCHELL), lectotype, UMMP 32401A, Petoskey Formation, Little Traverse Bay, Michigan; *a*, axial section showing central canal, ×10; *b*, cross section of skeleton showing axial canal and vacuolate pachysteles, ×10; *c*, cross section of laminae showing vacuolate microstructure, ×25 (Stearn, 2011b).——FIG. 450*a–c*. *I. roemeri* NICHOLSON, 1886a, holotype, NHM P6076, Middle Devonian, Hebborn, Germany; *a*, cross section showing extensive laminae and radial pachysteles, ×10; *b*, longitudinal section, ×10; *c*, longitudinal section showing microstructure of peripheral vesicles and tripartite laminae, Nicholson section 406c, ×50 (Stearn, 2011b).

Order STROMATOPORIDA Stearn, 1980

[Stromatoporida STEARN, 1980, p. 892]

Stromatoporoids with cellular or obscurely cellular microstructure and structure dominated by pachysteles and pachystromes forming amalgamate networks. *Silurian (upper Llandovery)–Upper Devonian (Frasnian).*

Family STROMATOPORIDAE Winchell, 1867

[Stromatoporidae WINCHELL, 1867, p. 98] [=Angulatostromatidae KHALFINA, 1968a, p. 151]

Genera of the Stromatoporida dominated by pachystromes, laminae, and/or cassiculate structure. *Silurian (upper Llandovery)–Upper Devonian (Frasnian).*

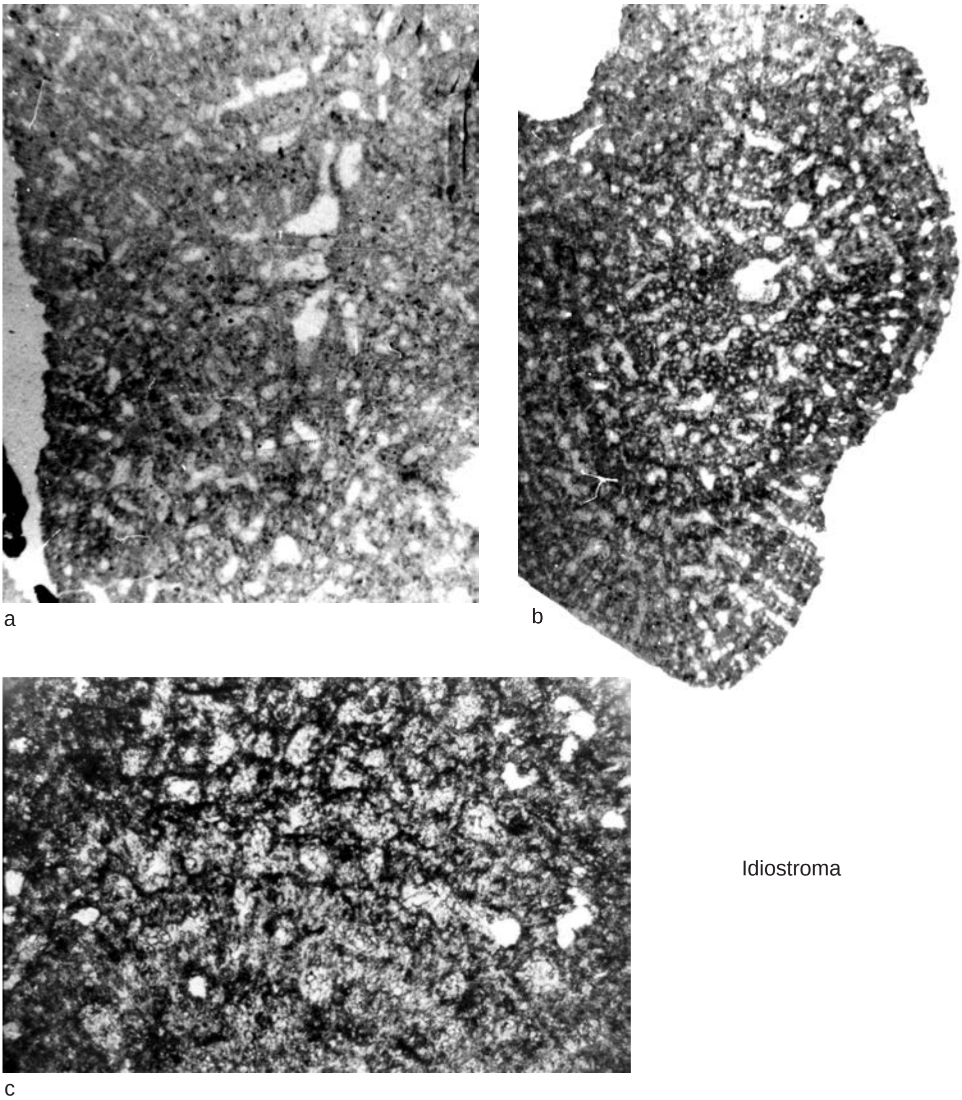
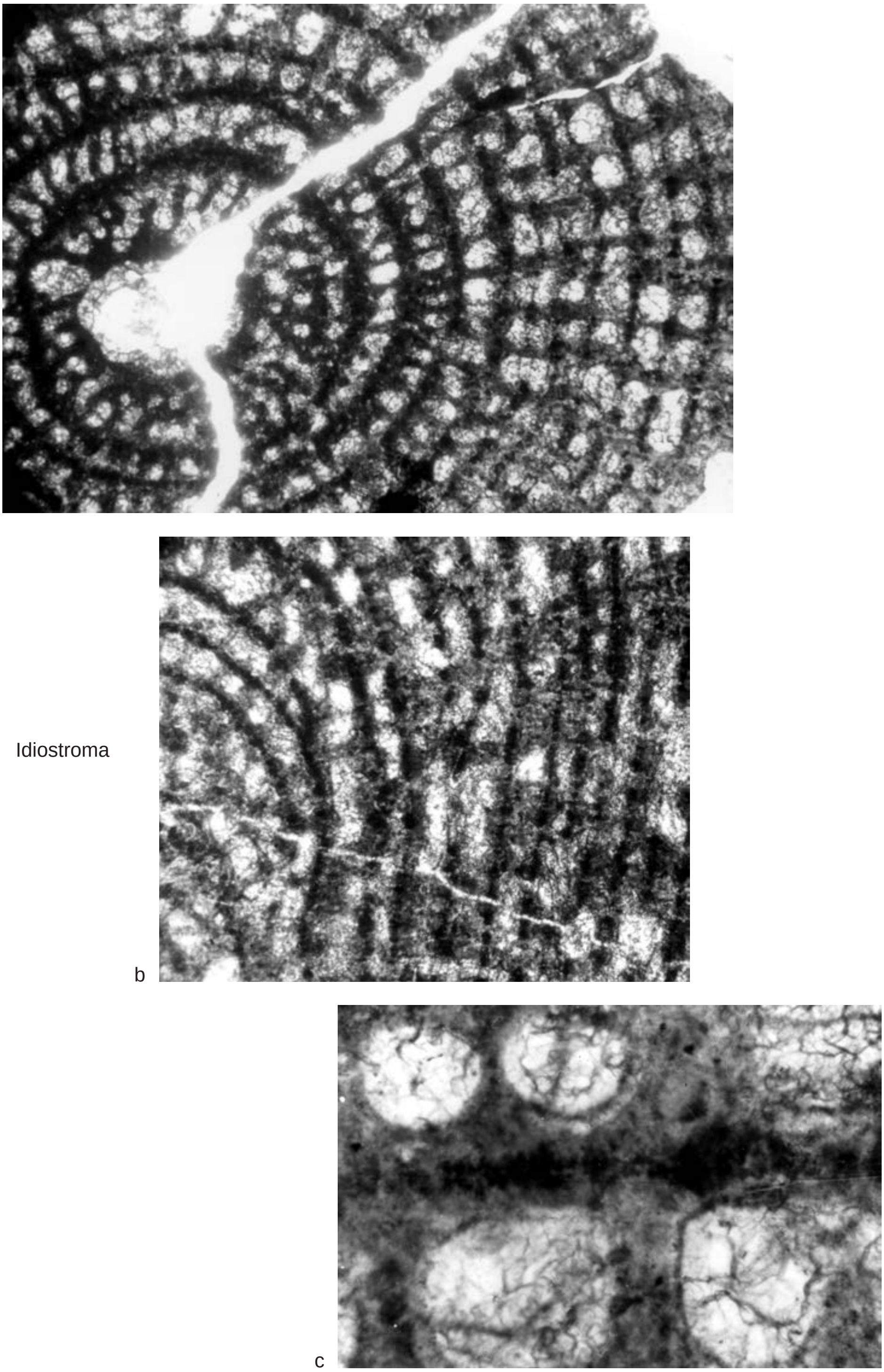


FIG. 449. Idiostromatidae (p. 797).



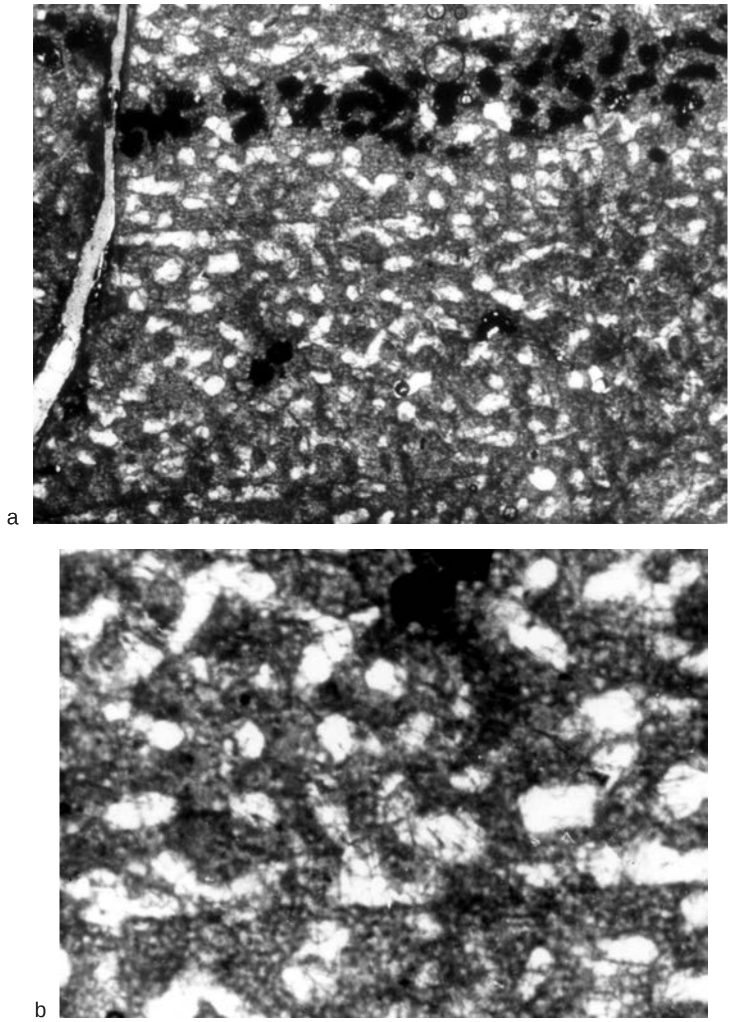
a

Idiostroma

b

c

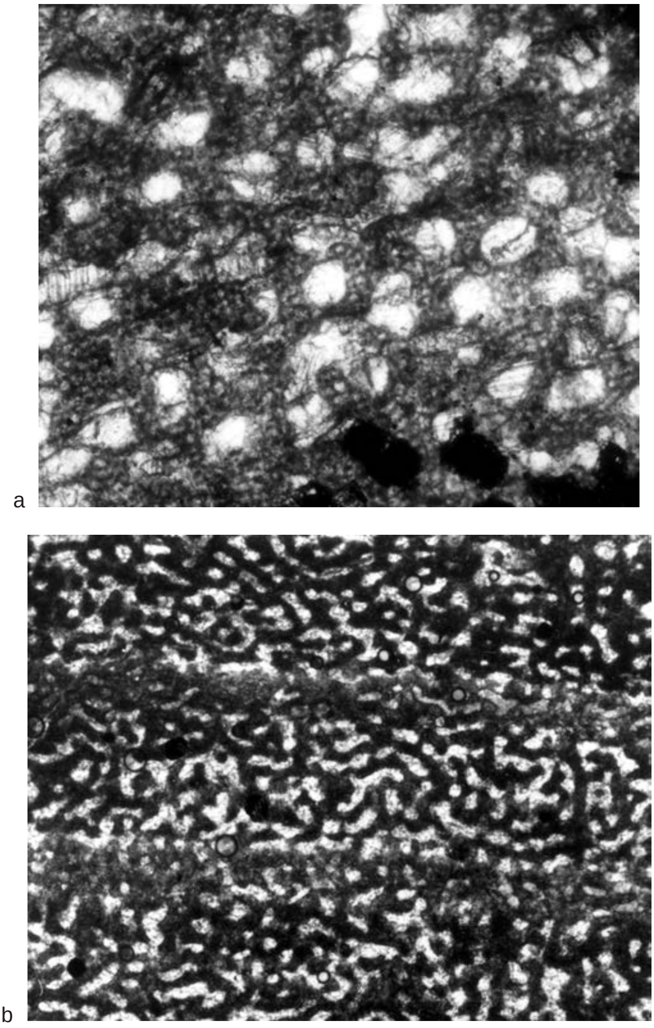
FIG. 450. Idiostromatidae (p. 797).



Stromatopora

FIG. 451. Stromatoporidae (p. 800–801).

Stromatopora GOLDFUSS, 1826, p. 21 [**S. concentrica* GOLDFUSS, 1826, p. 22; OD; holotype, IPB 80] [=*Angulatohtroma* KHALFINA, 1968a, p. 152, *lapsus calami pro Angulatostroma* (type, *Stromatopora angulata* YAVORSKY, 1947, p. 10, OD)]. Skeleton of cellular, cassiculate, oblique pachystromes and scattered dissepiments, in some successive phases including short pachysteles; structural elements in tangential section cut as labyrinthine network or discrete vermiform elements. [Problems concerning the type and definition of the genus have been discussed by STEARN (1993)]. *Silurian (Wenlock)–Upper Devonian (Frasnian)*: Czech Republic (Bohemia), Russia (Kuznetsk Basin, Lena River, Vaigach Island), Ukraine (Podolia), *Wenlock;* Czech Republic (Bohemia), Estonia, Russia (Vaigach Island, Siberian platform), USA (New York), *Ludlow–Pridoli;* Australia (Victoria, New South Wales), Canada (Arctic Island), China (Guangxi), Spain (south), *Lower Devonian;* Australia (Queensland), Belgium (Ardennes), Canada (Arctic Island, Northwest Territories), China (Sichuan, Guangxi, Yunnan), Morocco, New Zealand (Reefton), Russia (Kuznetsk Basin, Petchora Basin, Salair), USA (Missouri), *Middle Devonian;* Belgium (Ardennes), Canada (Alberta, Saskatchewan, Northwest Territories), Poland (Holy Cross Mountains), Russia (Novaya Zemlya), *Frasnian.*——FIG. 451*a–b*. **S. concentrica,* holotype, IPB 80, Middle Devonian, Gerolstein, Eifel, Germany; *a*, longitudinal section



Stromatopora

FIG. 452. Stromatoporidae (p. 800–801).

showing cassiculate structure, ×10; *b*, longitudinal section showing cellular microstructure, ×25 (Stearn, 2011b).——FIG. 452*a–b*. **S. concentrica; a,* holotype, longitudinal section cut for LECOMPTE (1952 in 1951–1952) showing microstructure, ×25; *b,* specimen IRScNB 6212a of LECOMPTE (1952 in 1951–1952), Eifelian, Chimay, Ardennes, Belgium, longitudinal section showing latilamination and cassiculate structure, ×10 (Stearn, 2011b).

Climacostroma YANG & DONG, 1979, p. 72 [**C. guangxiense*; OD; holotype, NIGP 33129, 33130] [=*Lineastroma* KHALFINA & YAVORSKY, 1973, p. 31, *partim* (type, *Stromatopora vorkutensis* YAVORSKY, 1961, p. 39, of STEARN, 1993, p. 213) see *Lineastroma* below and STEARN (in STEARN & others, 1999, p. 47) for further discussion]. Structure dominated by thick, discontinuous pachystromes associated with microlaminae. Pachysteles short, confined to space between pachystromes, not superposed, forming a closed network in tangential section. Microstructure cellular. *Middle Devonian:* Belgium (Ardennes), Canada (Northwest Territories), China (Guangxi, Sichuan), Poland (Holy Cross Mountains), Russia (Pechora Basin, South Urals, Kuznetsk Basin), USA (Missouri).——FIG. 453*a–b*. **C. guangxiense*, holotype, 331229-30, Guangxi, China; *a*, longitudinal section, ×10; *b,* tangential section, ×10 (Dong, 2001).

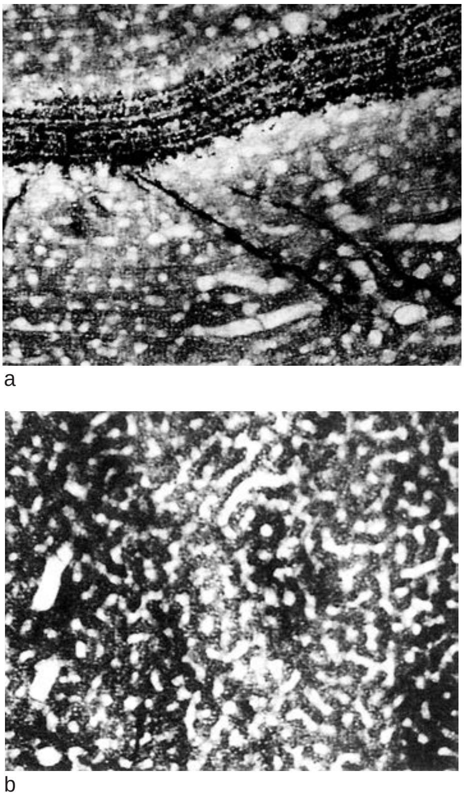


Fig. 453. Stromatoporidae (p. 801).

Eostromatopora Nestor, 1999a, p. 120 [**Stromatopora impexa* Nestor, 1966a, p. 44–45; OD; holotype, IGTUT Co3168]. Structure amalgamate, structural elements occupying most of skeleton, pierced by thin, tangential, vermiform canals and short, curved autotubes and allotubes with tabulae. Tangential canals in irregular layers simulating galleries and vaguely defining thick, irregular pachystromes. Microstructure compact or obscurely cellular. [This earliest representative of the order Stromatoporida appears to be the only genus without clear cellular microstructure.] *Silurian (upper Llandovery–Wenlock)*: Canada (Arctic Island), Ireland, Norway, *Telychian;* Estonia, Sweden (Gotland), *Wenlock.*——Fig. 454*a–c.* **E. impexa* (Nestor), holotype, IGTUT Co3168, Jaani Formation, Saaremaa, Estonia; *a,* longitudinal section, ×10 (Nestor, 1966a); *b,* tangential section, ×10; *c,* tangential section showing poorly defined microstructure, ×10 (Stearn, 2011b).

Glyptostromoides Stearn, 1983a, p. 553 [**Glyptostroma simplex* Yang & Dong, 1979, p. 66; OD; holotype, NIGP33083-4] [=*Glyptostroma* Yang & Dong, 1979, p. 65 (based on *Stromatopora beuthii sensu* Yavorsky, 1955, p. 106; *non S. beuthii* Bargatzky, 1881a)]. Structure in longitudinal section cassiculate, formed by network of oblique structural elements penetrated by thick, cellular, long pachysteles; in tangential section, pachysteles merging into labyrinthine network with oblique structural elements. [The type species of *Glyptostromoides* was designated by Yang and Dong (1979) as *Stromatopora beuthii* Bargatzky, and they referred to the citation of this species by Yavorsky (1955). However, the type specimens of *S. beuthii* had been identified as a species of the much different genus *Hermatostroma* Nicholson by Lecompte (1952 in 1951–1952, p. 253) and Stearn (1980, p. 898–899). *Glyptostroma* therefore became a junior synonym of *Hermatostroma* and the generic grouping distinguished by Yang and Dong required a new name.] *Lower Devonian (Emsian)–Middle Devonian (Givetian)*: Canada (Arctic Island), *Emsian;* Spain (Cantabria), *Emsian–Eifelian;* China (Guangxi), Russia (Kuznetsk Basin, Salair), *Middle Devonian;* Canada (British Columbia), Russia (Kuznetsk Basin), *Givetian.*——Fig. 455*a–d.* **G. simplex* (Yang & Dong); *a–b,* holotype, NIGP33083-4, Middle Devonian, Guangxi, China; *a,* longitudinal section, ×10; *b,* tangential section, ×10 (Yang & Dong, 1979); *c,* hypotype, GSC108894, Blue Fiord Formation, Ellesmere Island, arctic Canada, longitudinal section, ×10; *d,* drawings of type specimen, ×10 (Stearn, 1993).

Lineastroma Khalfina & Yavorsky, 1973, p. 31 [**Stromatopora vorkutensis* Yavorsky, 1961, p. 39; OD; holotype, CNIGR 7354/420; the type is synonymized with *Stromatopora sibirica* Riabinin, 1928, p. 1046, and *Stromatopora elegestica* Riabinin, 1937, p. 16; Nestor, 1976, p. 78; if the synonymy is confirmed by comparison of the type specimens, then *L. sibirica* Riabinin, 1928, is the type species.] Structure of prominent, extensive but interrupted pachystromes and short, mostly longitudinal but locally oblique pachysteles, mostly confined to space between pachystromes, only locally superposed or more continuous longitudinally; in tangential section cut as isolated dots or irregular vermiform masses, rarely joined. Microstructure finely and inconspicuously cellular. [Stearn (1993) included both forms with postlike pillars and pachysteles in the genus, which resulted in a widely split temporal range, with a gap of late Silurian and Early Devonian. Transferring the species that have pachysteles forming a closed network in tangential section to *Climacostroma* makes better sense of the stratigraphic distribution of *Lineastroma* and *Climacostroma.*] *middle Silurian*: Russia (Siberian platform, Pre-Urals, Tuva), Ukraine (Podolia).——Fig. 456*a–b.* **L. vorkutense* (Yavorsky), holotype, CNIGR 7354/420, Pre-Urals, Russia; *a,* longitudinal section, ×10; *b,* tangential section, ×10 (Khalfina & Yavorsky, 1973).

Neosyringostroma Kaźmierczak, 1971, p. 117 [**Hermatostroma logansportense* Galloway & St. Jean, 1957, p. 219; OD; holotype, YPM222127]. Long pillars of cellular-melanospheric microstructure pass through amalgamate structure of

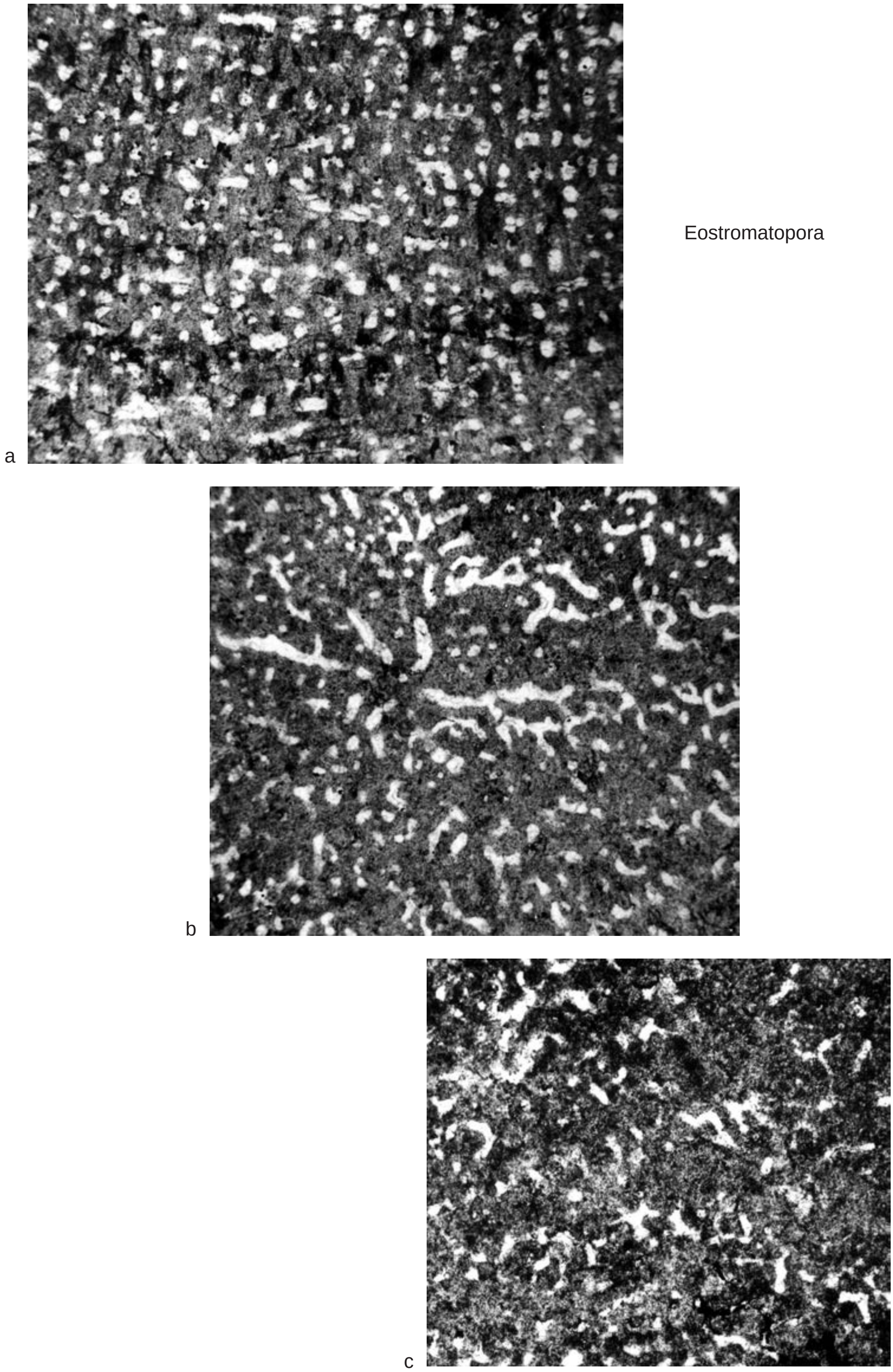


FIG. 454. Stromatoporidae (p. 802).

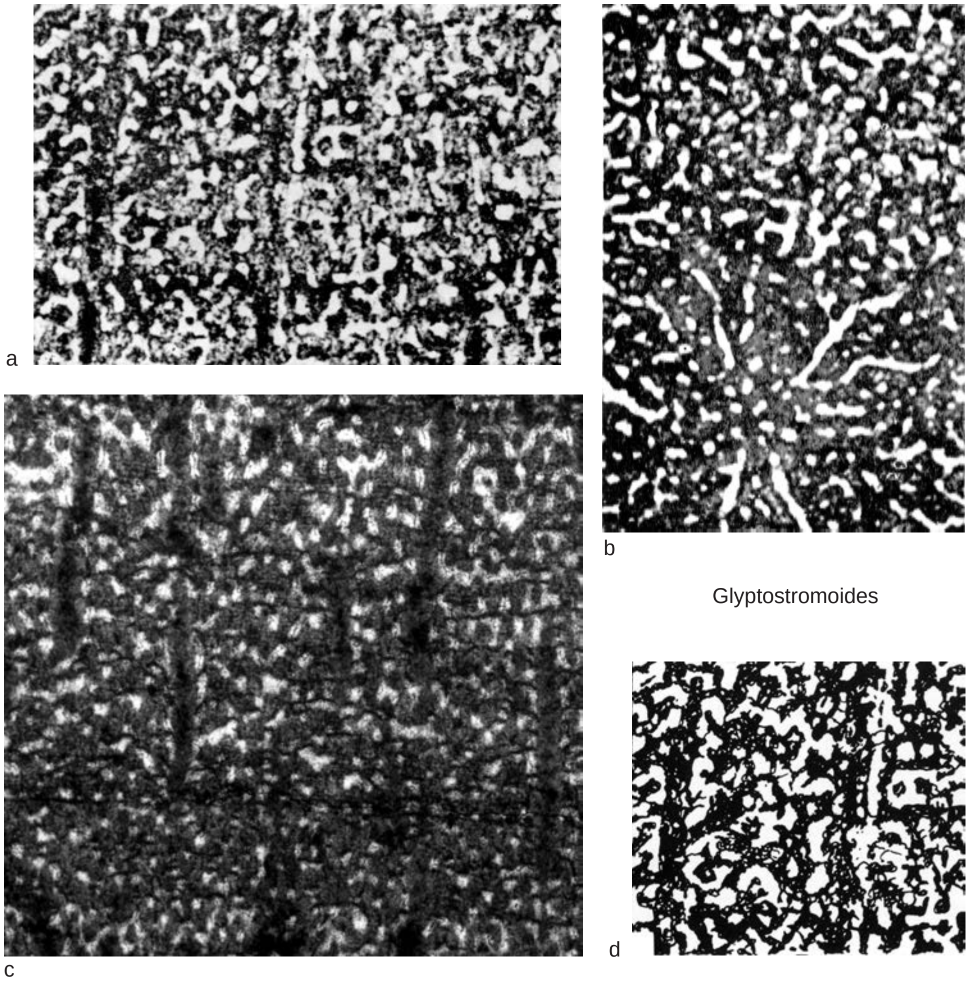


FIG. 455. Stromatoporidae (p. 802).

short pachysteles, pachystromes, and cassiculate structural elements, commonly chevron shaped in longitudinal section. In tangential section, pillars circular within amalgamate structural elements. *Lower Devonian (Emsian)–Middle Devonian (Givetian)*: Spain (Cantabria), *Emsian–Eifelian;* Afghanistan, *?upper Emsian;* Belgium (Ardennes), Russia (Kuznetsk Basin), *Eifelian;* China (Guangxi, Guizhou, Hunan), *Middle Devonian;* Afghanistan, Canada (British Columbia, Manitoba), Poland, USA (Indiana), *Givetian*.——FIG. 457*a–d*. **N. logansportense* (GALLOWAY & ST. JEAN), hypotype, GSC 104075 (illustrated as *Taleastroma logansportense* in QI & STEARN, 1993), Slave Point Formation, Evie Lake Field, northeastern British Columbia, Canada; *a*, longitudinal section, ×10; *b*, tangential section, ×10 (Qi & Stearn, 1993); *c–d*, holotype, original illustrations highly retouched; *c*, longitudinal section; *d*, tangential section, ×10 (Galloway & St. Jean, 1957).

Pseudotrupetostroma KHALFINA & YAVORSKY, 1971, p. 120 [**Stromatopora pellucida artyschtensis* YAVORSKY, 1955, p. 100; OD; holotype (apparently lost), CNIGR 7351/132, elevated to species rank by KHALFINA and YAVORSKY (1971, p. 120)]. Pachysteles confined to interlaminar space, commonly well superposed, very coarsely cellular. Tangential elements fine microlaminae coated with coarsely cellular material like that of pillars. In tangential section, longitudinal elements (pachysteles) cut as a closed network or as vermiform isolated masses. [The type specimen of *P. artyschtense* is apparently lost, but as originally defined as a variety, it had the same specimen and type number as the species *S. pellucida* YAVORSKY from the same locality and was very similar in form (*fide* NESTOR, personal communication, 2003). The figures of the variety from YAVORSKY, 1955, and of the species *S. pellucida* are therefore used here to illustrate the genus.] *Lower Devonian (?Pragian, Emsian)–Middle Devonian (Givetian)*: Australia (Victoria), *?Pragian;* Australia (New South Wales, Victoria), Spain (Moreno Mountains), *Emsian;* Canada (Arctic Island), *Emsian–Eifelian;* Russia (Kuznetsk Basin), *Eifelian;* Russia (Salair), *Middle Devonian;* Australia (Queensland), Canada (northeastern British Columbia, Northwest Territories), China (Guizhou), Russia (Kuznetsk Basin, Salair), *Givetian.*——FIG. 458*a–c*. **P. artyschtense* (YAVORSKY), holotype, 7351/132, Givetian, Artyschta River, Kuznetsk Basin, Russia; *a–b*, longitudinal and tangential sections, ×10; *c*, longitudinal section, ×25 (Yavorsky, 1955).——FIG. 458*d–e*. *P. pellucida* YAVORSKY, holotype, CNIGR 7351/132, locality as for *P. artyschtense; d*, tangential section, ×10; *e*, longitudinal section, showing coarsely cellular microstructure, ×25 (Yavorsky, 1955).

Taleastroma GALLOWAY, 1957, p. 448 [**Stromatopora cumingsi* GALLOWAY & ST. JEAN, 1957, p. 182; OD; holotype, YPM222129]. Structure amalgamate with small, round galleries, dominated by thick pachystromes, commonly showing microlaminae and traces of microreticulation. Pillars penetrate the structure, of melanospheric microstructure, commonly with clear axes, probably originally cellular. Round ends of pillars cut tangentially within amalgamate, melanospheric structural elements. [*Taleastroma* is similar to *Neosyringostroma* but has more prominent pachystromes. The clear zones in the pillar axes, which are exaggerated in the retouched original illustration, may be diagenetic in origin.] *Middle Devonian*: Belgium (Ardennes), Germany (Hebborn), USA (Indiana).——FIG. 459*a–b*. **T. cumingsi* (GALLOWAY & ST. JEAN), Logansport Limestone, holotype, YPM222129, unretouched; *a*, longitudinal section, ×10; *b*, tangential section, ×10 (Stearn, 2011b).

Family FERESTROMATOPORIDAE Khromykh, 1969

[Ferestromatoporidae KHROMYKH, 1969, p. 30]

Stromatoporids of melanospheric to obscurely cellular microstructure composed of oblique structural elements forming a closely spaced, cassiculate network. [The microstructure commonly appears to be finely melanospheric or compact and vacuolate. Uncertainty about its microstructure is reflected in the original description of YAVORSKY (1955) and in the discussion of FLÜGEL and FLÜGEL-KAHLER (1968).] *Lower Devonian (?Emsian), Middle Devonian–Upper Devonian (Frasnian).*

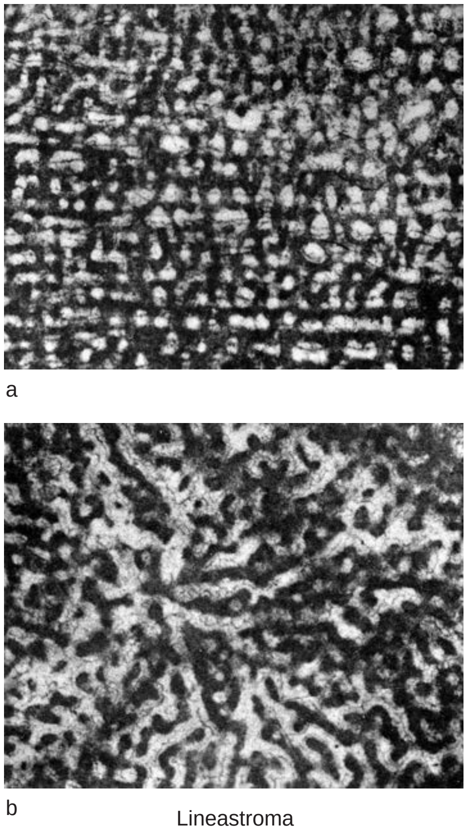


FIG. 456. Stromatoporidae (p. 802).

Ferestromatopora YAVORSKY, 1955, p. 109 [**F. krupennikovi*; OD; holotype, CNIGR 7351/165]. Structural elements largely oblique, forming cassiculate network traversed by thin, continuous paralaminae, forming a labyrinthine network in tangential section. Pachysteles absent. Microstructure obscurely cellular, commonly melanospheric. *Lower Devonian (?Emsian), Middle Devonian–Upper Devonian (Frasnian)*: Canada (Arctic Island), *?Emsian;* China (Sichuan, Guangxi), *Middle Devonian;* Germany (Rhineland), Poland (Holy Cross Mountains), Russia (Kuznetsk Basin, Salair), USA (Missouri), *Givetian;* Canada (Alberta), Poland (Holy Cross Mountains), Russia (eastern Siberia), *Frasnian.*——FIG. 460*a–c*. **F. krupennikovi*, holotype, CNIGR 7351/165, Givetian, near Safonov, southwest of Kuznetsk Basin, Russia; *a*, longitudinal section, ×6; *b*, tangential and oblique section, ×12; *c*, longitudinal section showing microstructure, ×25 (Yavorsky, 1955).

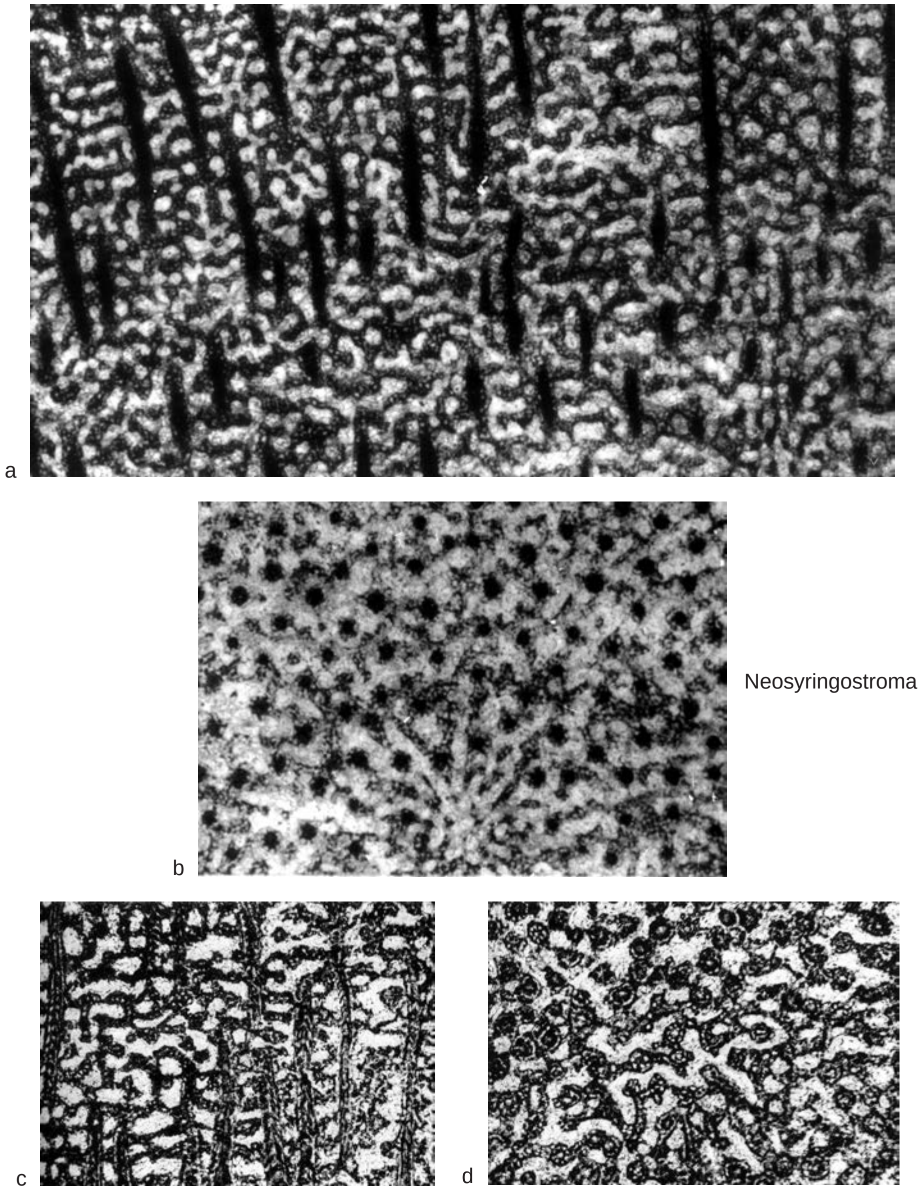


FIG. 457. Stromatoporidae (p. 802–804).

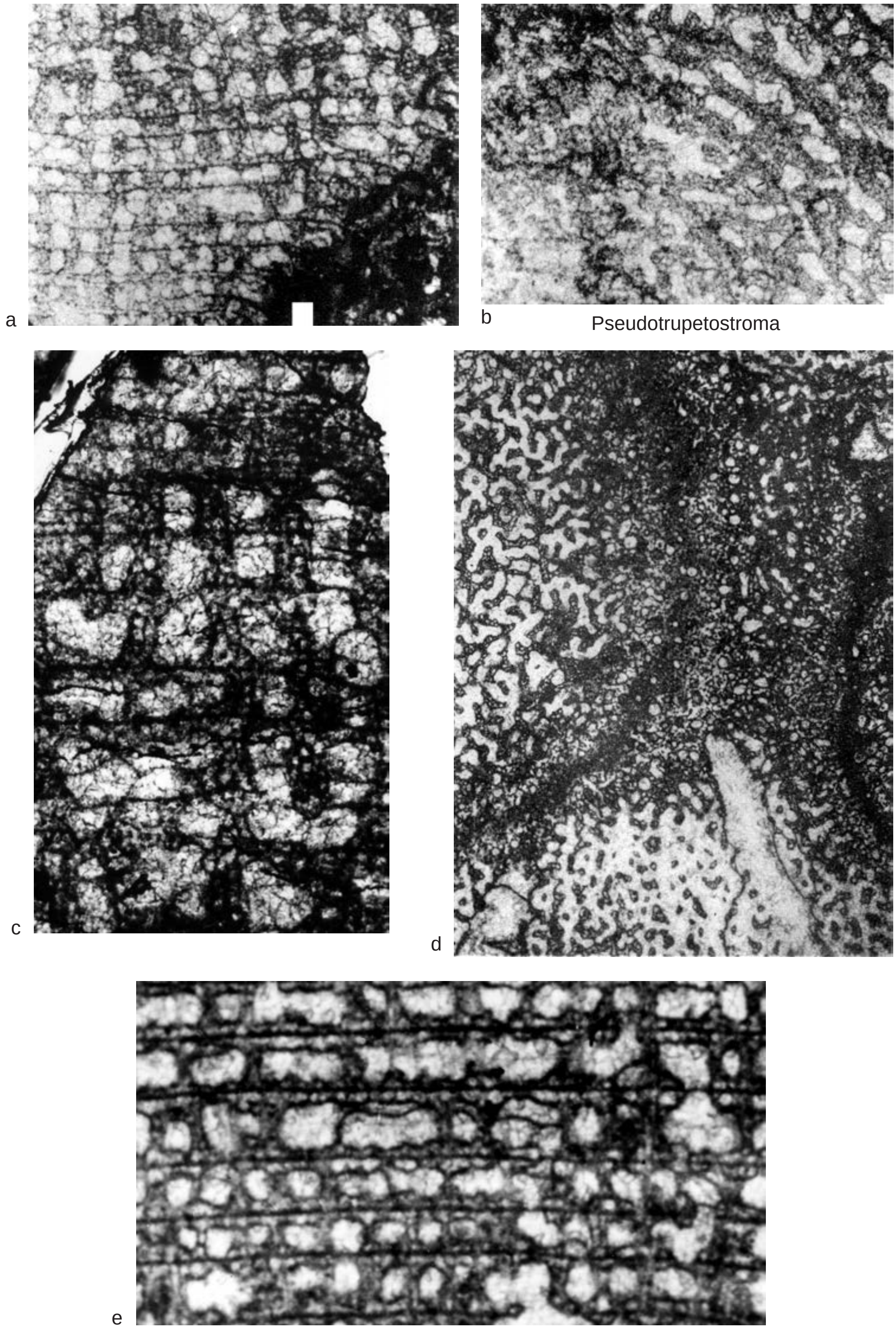


FIG. 458. Stromatoporidae (p. 804–805).

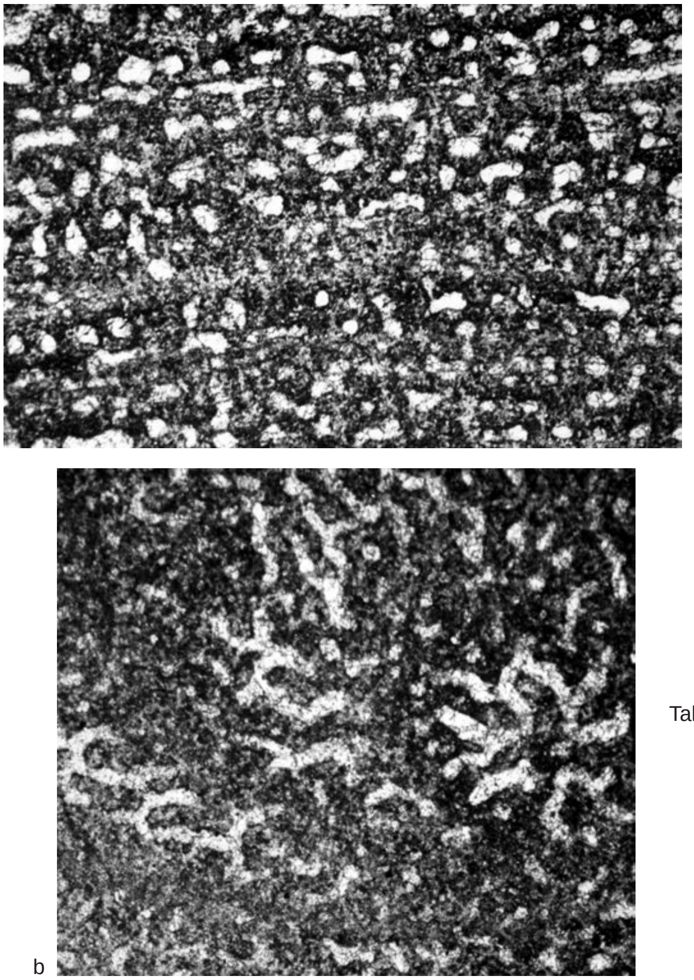


FIG. 459. Stromatoporidae (p. 805).

Arctostroma YAVORSKY, 1967, p. 30 [**A. ignotum*; OD; holotype, CNIGR No. unknown; =*Ferestromatopora contexta* STEARN, 1963, p. 666; STEARN, 1980, p. 898]. Oblique structural elements forming continuous cassiculate network in longitudinal section, enclosing galleries arched at top; neither pachysteles nor pachystromes prominent, but structural elements may align tangentially locally; structural elements cut as labyrinthine network in tangential section. Microstructure cellular, commonly altered to melanospheric with vertical alignment of melanospheres. [NESTOR (personal communication, 2009) asserted that until the identity of the two species is proven, *A. ignotum* should remain the type species.] *Middle Devonian (Givetian)–Upper Devonian (Frasnian):* Australia (Queensland), Belgium (Ardennes), *Givetian;* Australia (Canning Basin), Canada (Alberta, Manitoba, Saskatchewan), China (Guangxi), Germany (Rhineland), Russia (western Pre-Urals), *Frasnian.*——FIG. 461*a–b.* **A. contextum* (STEARN), holotype, GSC 29150, Mikkwa Formation, Frasnian, Mikkwa River, northern Alberta, Canada; *a*, longitudinal section, ×10; *b*, longitudinal section showing microstructure, ×25 (Stearn, 2011b).——FIG. 461*c–e*. *A. ignotum*; holotype, Frasnian, western Pre-Urals, Tshernysheva Mountains, Russia; *c–d*, longitudinal and tangential sections, ×10; *e*, longitudinal section, showing microstructure, ×25 (Yavorsky, 1967).

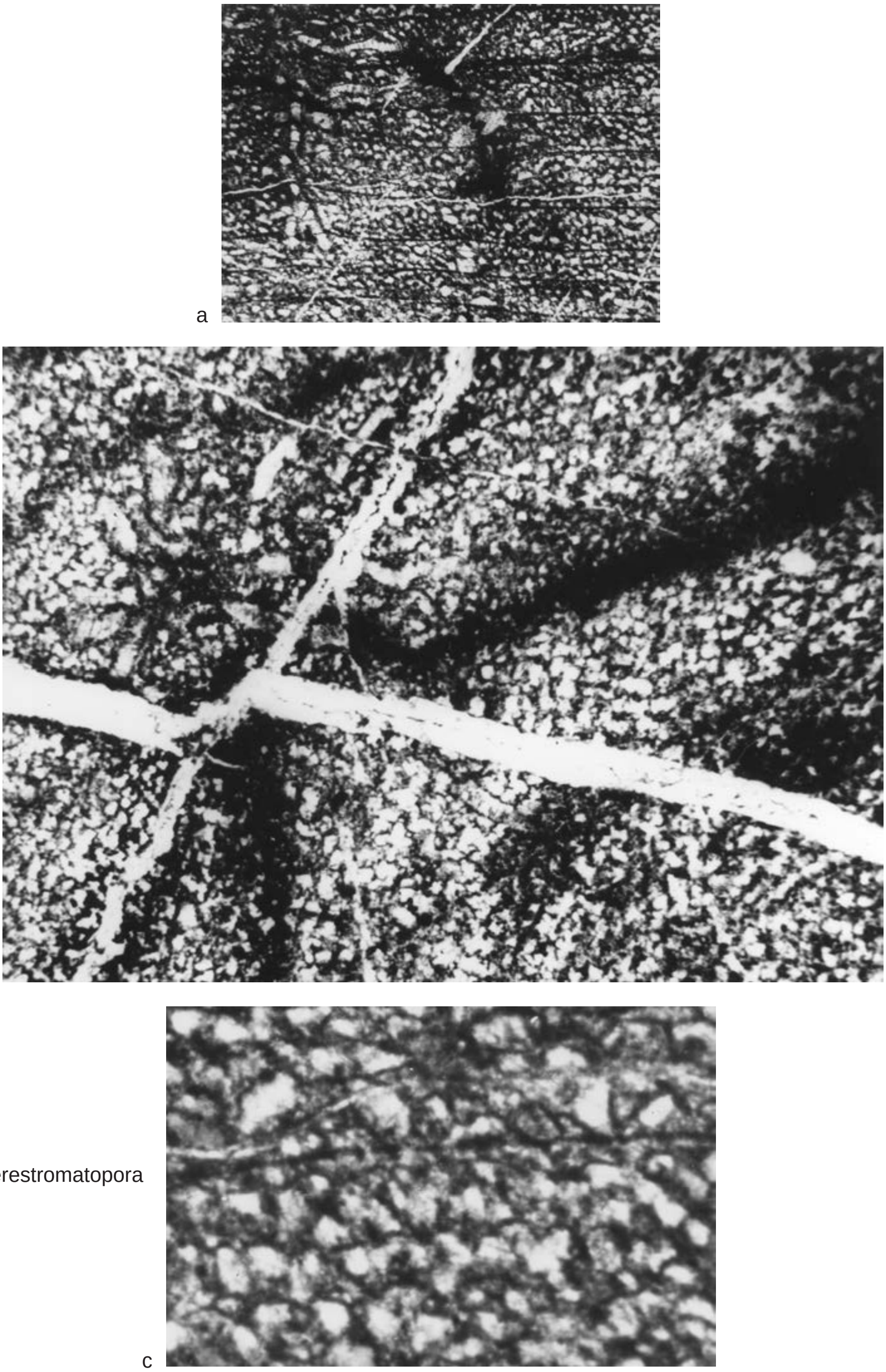
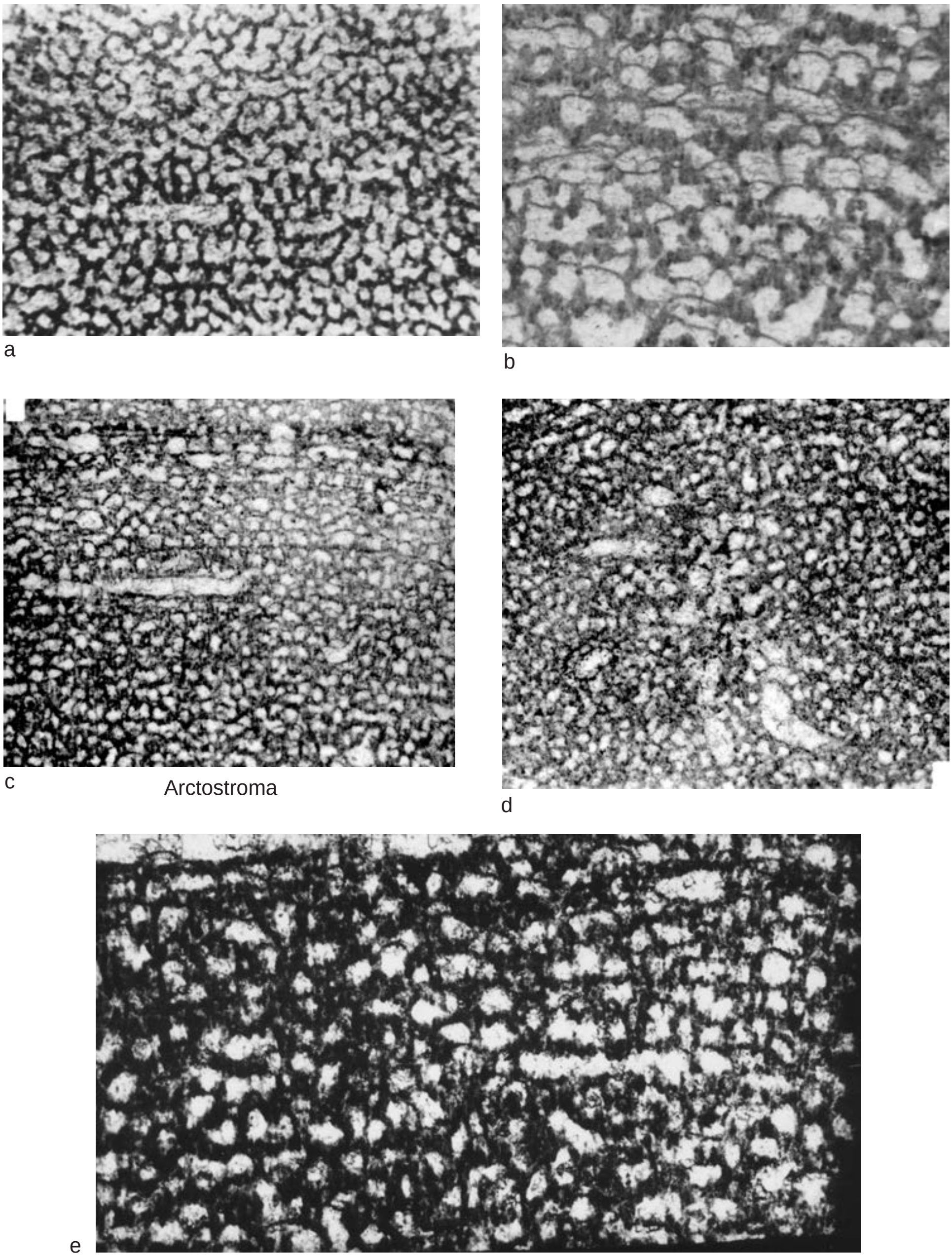


FIG. 460. Ferestromatoporidae (p. 805).



a b c Arctostroma d e

FIG. 461. Ferestromatoporidae (p. 808).

Family SYRINGOSTROMELLIDAE Stearn, 1980

[Syringostromellidae STEARN, 1980, p. 892]

Stromatoporida with structure dominated by pachysteles and dissepiments. *Silurian (upper Llandovery)–Upper Devonian (Frasnian).*

Syringostromella NESTOR, 1966a, p. 47 [**Stromatopora borealis* NICHOLSON, 1891b, p. 315; OD; holotype, NHM. P5894] [=*Yavorskiina* KHALFINA, 1968a, p. 148, *nom. nud.*]. Pachysteles long, continuous,

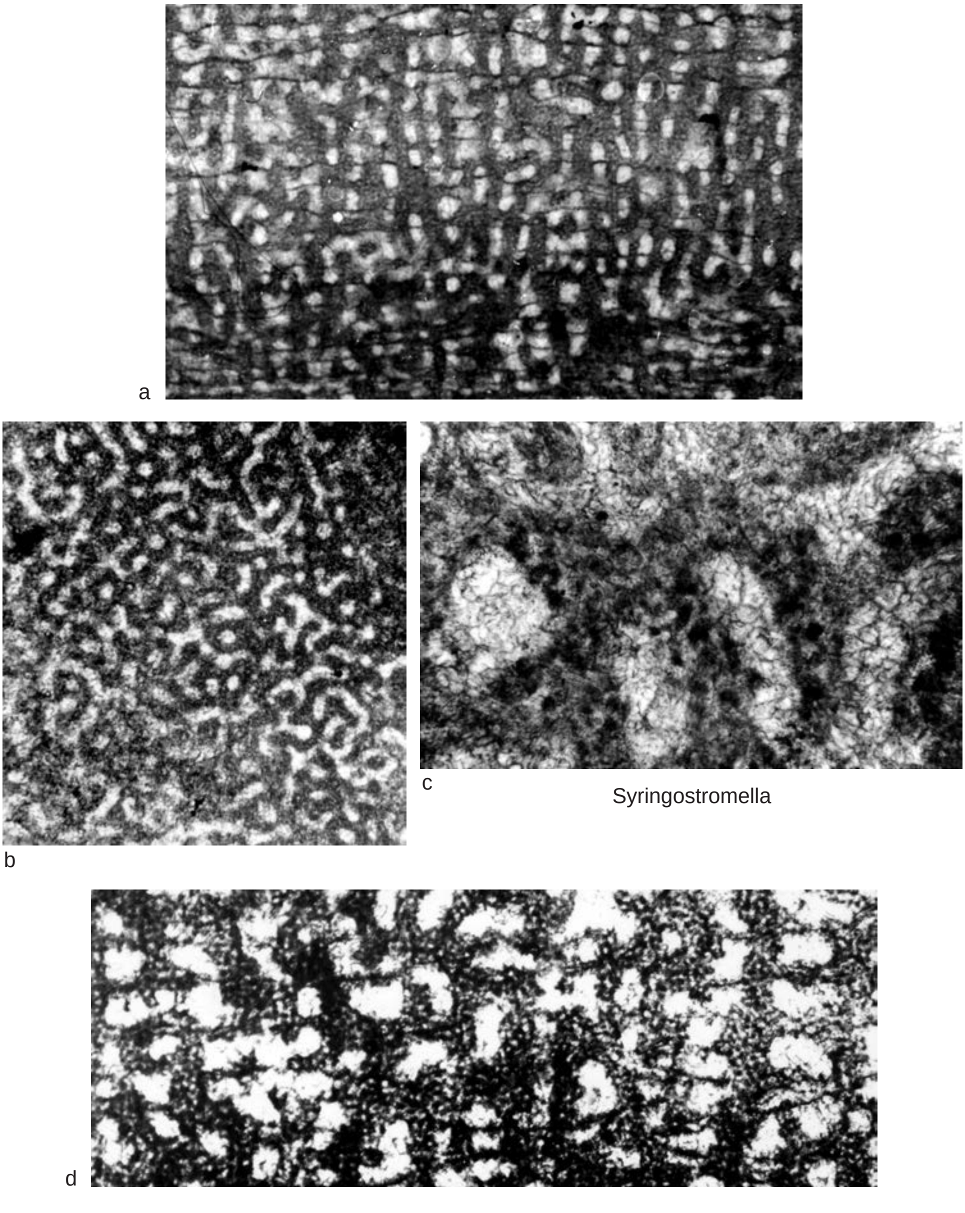
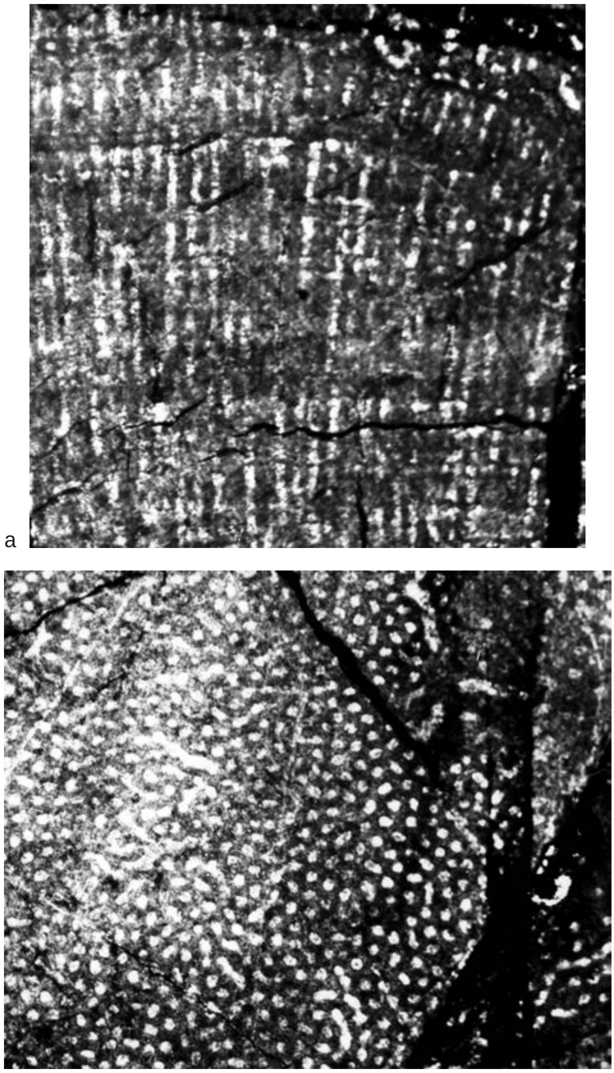


FIG. 462. Syringostromellidae (p. 810–812).

joining and dividing in longitudinal section; pachystromes rudimentary or absent, dissepiments common. In tangential section, pachysteles vermiform or loose labyrinthine network. Microstructure cellular, some species may appear microreticulate. *Silurian (upper Llandovery)–Lower Devonian, Middle Devonian (?Eifelian)*: Canada (Hudson Bay), *Telychian;* Canada (eastern Quebec), England (Wenlock), Japan, Russia (Moiero River, Tuva), Sweden (Gotland), Ukraine (Podolia), *Wenlock;* Canada (Chaleurs Bay), Turkestan Mountains, Estonia, Kazakhstan, Russia (Siberia), Sweden (Gotland), Ukraine (Podolia), *Ludlow;* China (Inner Mongolia), Mongolia, Ukraine (Podolia), Russia (eastern slope of Urals), USA (New York), *Pridoli;* Canada (Arctic Island), *Lochkovian;* Czech Republic (Bohemia), *Pragian;* Australia (Victoria), Canada (Arctic Island), Russia (Salair), *Lower*



Salairella

FIG. 463. Syringostromellidae (p. 812–813).

Devonian; Russia (Siberia, Omolov), *?Eifelian.*——FIG. 462*a–d.* **S. borealis* (NICHOLSON); *a–c*, holotype, NHM. P5894, Ludlow, Oesel Island, Estonia; *a*, longitudinal section showing long pachysteles, ×10; *b*, tangential section showing allotubes and autotubes, ×10; *c*, tangential section of pachysteles showing melanospheric microstructure, ×50 (Stearn, 2011b); *d,* topotype, IGTUT Co 3176, longitudinal section showing cellular microstructure and long pachysteles, ×25 (Nestor, 1966a).

Salairella KHALFINA, 1961d, p. 330 [**S. multicea* KHALFINA, 1961d, p. 331; OD; holotype, CSGM 402/37] [=*Lecomptella* KHALFINA, 1972, p. 151 (type, *Stromatopora racemifera* KHALFINA, 1961d, p. 327, OD); =?*Tubuliporellina* KOSAREVA in BOGOYAVLENSKAYA & KHROMYKH, 1985, p. 93 (type, *T. crispa*, ?SD)]. Pachysteles long, joining and dividing in longitudinal section, pachystromes rudimentary to absent, dissepiments common in autotubes between pachysteles. In tangential section, most pachysteles joined in closed network enclosing autotubes. Microstructure finely cellular. [Although the genus *Tubuliporellina* was attributed by BOGOYAVLENSKAYA and KHROMYKH to KOSAREVA (1968), a generic diagnosis was not published until that in BOGOYAVLENSKAYA and KHROMYKH in 1985, and the proposed type species was only illustrated at that time but not described. The status of the genus is therefore in doubt.] *Lower Devonian (Pragian)–Upper Devonian (Frasnian)*: Austria (Carnic Alps), Czech Republic (Bohemia), Mongolia, Russia (Salair, eastern Siberia), *Lower Devonian;* Australia (Victoria), Czech Republic (Koneprusy), *Pragian;* Australia (New South Wales), Canada (Arctic Island), *Emsian;* Altai, Zeravshan Mountains, Czech Republic (Bohemia), Russia (Salair, Kuznetsk Basin), *Eifelian;* China (Guangxi, Yunnan), Russia (eastern slope of Urals, Salair), *Middle Devonian;* Australia (Queensland), Belgium (Ardennes), Russia (Kuznetsk Basin), USA (Missouri), *Givetian;* Australia (Queensland), Belgium (Ardennes), Canada (Alberta, Manitoba), Russia (Russian platform), *Frasnian.*——FIG. 463*a–b.* **S. multicea*, holotype, CSGM 402/37, Podshandinskie stage, Gur'evska district, Salair, Russia; *a*, longitudinal section, ×10; *b*, tangential section, showing prominent autotubes, ×10 (Stearn, 2011b).

?Zeravshanella LESSOVAJA, 1986, p. 36 [**Z. cavernosa;* OD; holotype, GMU 270/7a-33/412]. Long pachysteles, highly irregular in outline in both longitudinal and tangential sections; tangential structural elements amalgamate, irregular, resembling those of *Glyptostromoides* and dissepiments. [Further study may show this genus to be based on a diagenetically altered specimen of *Syringostromella;* however, the microstructure of this genus resembles that of the Ferestromatoporidae. The name was first published by LESSOVAJA (1978a) as a *nomen nudum* in a caption to plate 1,*1.* The name is very similar to *Zeravschanella* LYASHENKO, 1969, a tentaculatid.] *Lower Devonian:* Tien Shan.——FIG. 464*a–b.* **Z. cavernosa*, holotype, GMU 270a-33/412, Kushnovin horizon (approximately Pragian), Mount Bursykhirman, Zeravshan Range, Uzbekistan; *a*, longitudinal section, ×10; *b*, tangential section, ×10 (Stearn, 2011b).

Order SYRINGOSTROMATIDA Bogoyavlenskaya, 1969

[Syringostromatida BOGOYAVLENSKAYA, 1969b, p. 21]

Stromatoporoids of microreticulate microstructure and skeleton composed of discrete structural elements rather than amalgamate networks, including commonly dominant pachystromes and microlaminae, pachysteles and pillars. [Microstructure alone does not define the order; several genera of the Stromatoporida also show traces of this microreticulation. The grouping of genera in the Syringostromatida is based partly on phylogenetic considerations that suggest that the order arose in Wenlock time from the actinostromatids: the Coenostromatidae from the Pseudolachiidae and the Parallelostromatidae from the Densastromatidae (NESTOR, 1974).] *Silurian (Wenlock)–Middle Devonian (Givetian), Upper Devonian (?Famennian).*

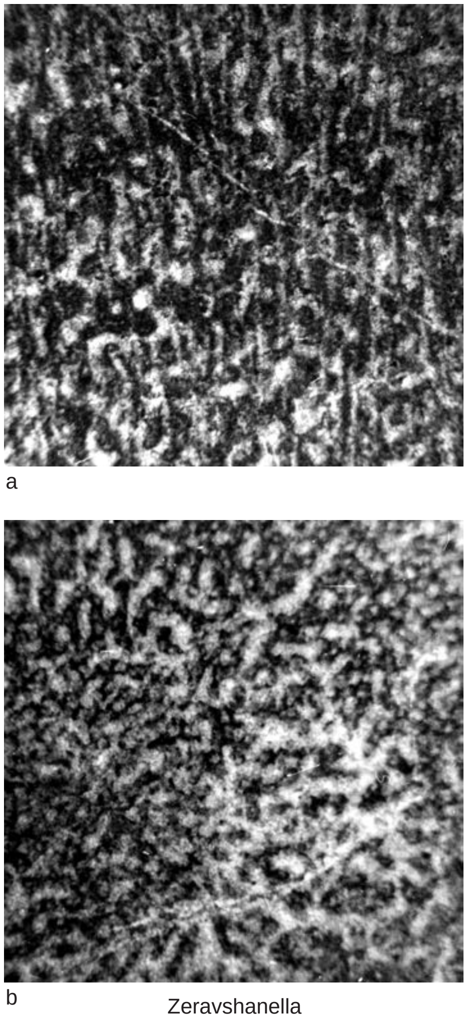


FIG. 464. Syringostromellidae (p. 813).

Family COENOSTROMATIDAE Waagen & Wentzel, 1887

[*nom. correct.* STEARN & others, 1999, p. 53, *pro* Coenostromidae WAAGEN & WENTZEL, 1887, p. 925] [=Syringostromidae LECOMPTE, 1951 in 1951–1952, p. 195]

Syringostromatida of laminar, bulbous, and domical growth form with structure dominated by longitudinal structural elements (pachysteles and pillars) of clinoreticular and acosmoreticular microstructure. *Silurian (Pridoli)–Upper Devonian (Frasnian).*

Coenostroma WINCHELL, 1867, p. 99 [**Stromatopora monticulifera* Winchell, 1866, p. 91; SD

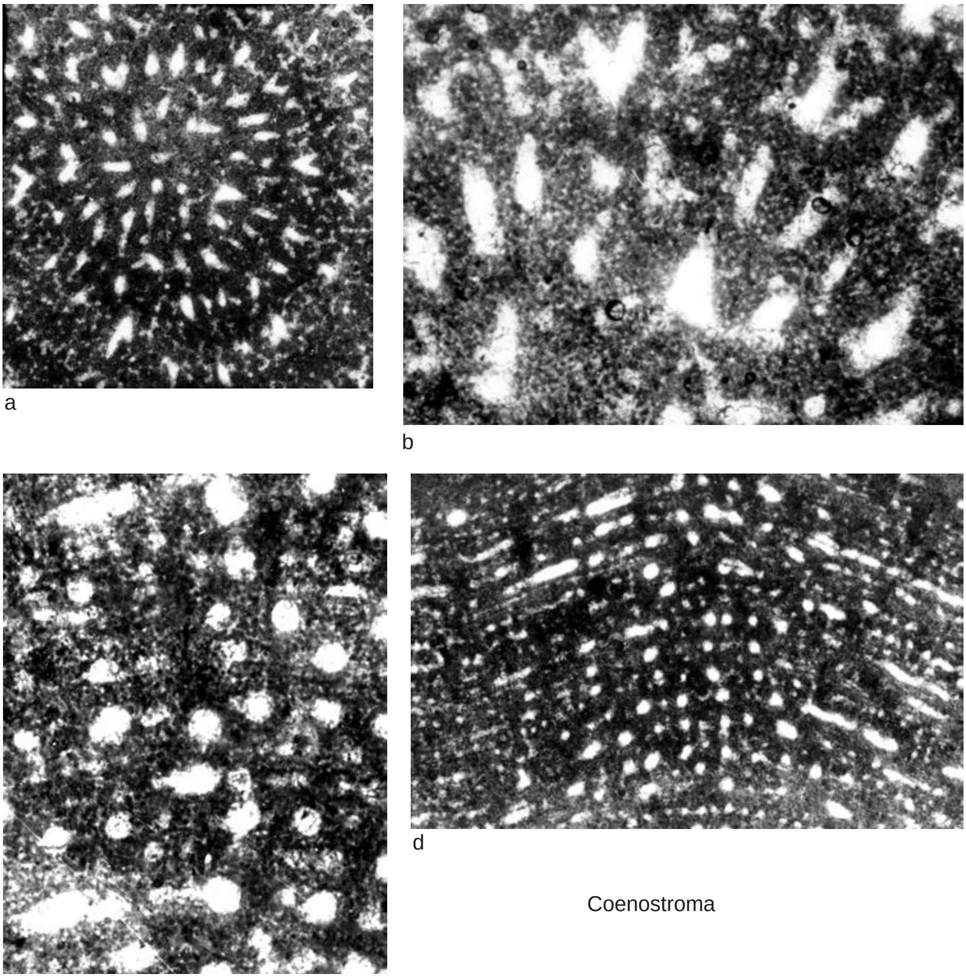


FIG. 465. Coenostromatidae (p. 813–814).

MILLER, 1889, p. 157; lectotype, UMMP 32409A, GALLOWAY & EHLERS, 1960, p. 51] [=?*Parallelostromella* KOSAREVA, 1968, p. 80 (type, *P. collina* KOSAREVA, 1968, p. 80–81, OD, *nom. nud.*, published without a diagnosis)]. Extensive, thick pachystromes, superposed pachysteles, and pillars forming an imperfect grid in longitudinal section; galleries small, irregular; microstructure of structural elements obscurely clinoreticular, locally with microlaminae in pachystromes. In tangential section, structural elements forming irregular network, or, in some species, longitudinal elements appear as dots (i.e., they are pillars). [Some of the species presently included in *Coenostroma* are acosmoreticular in microstructure and could form the basis of a new genus.] *Lower Devonian (Lochkovian)–Middle Devonian (Givetian), Upper Devonian (?Famennian)*: USA (New York), *Lochkovian;* Australia (Victoria), *Emsian;* Canada (southern Ontario), Germany (Eifel), Russia (Kuznetsk Basin, northeastern Siberia, ?Salair), *Eifelian;* Australia (Queensland), Canada (Manitoba, Northwest Territories), Czech Republic, Poland (Holy Cross Mountains), Russia (Kuznetsk Basin), USA (Michigan), *Givetian;* China (Guangxi), *Middle Devonian;* Russia (Novaya Zemlya), Australia (Canning Basin), *?Famennian.*——FIG. 465*a–d*. **C. monticuliferum* (WINCHELL), Gravel Point Formation, Traverse Group, Petosky, Michigan, USA; *a–c*, lectotype, UMMP 32409A; *a*, tangential section, ×10; *b*, tangential section showing cellular microstructure, ×25; *c*, longitudinal section showing traces of microreticulate microstructure, ×25; *d*, paralectotype, UMMP 32409B, longitudinal section, ×10 (Stearn, 2011b).

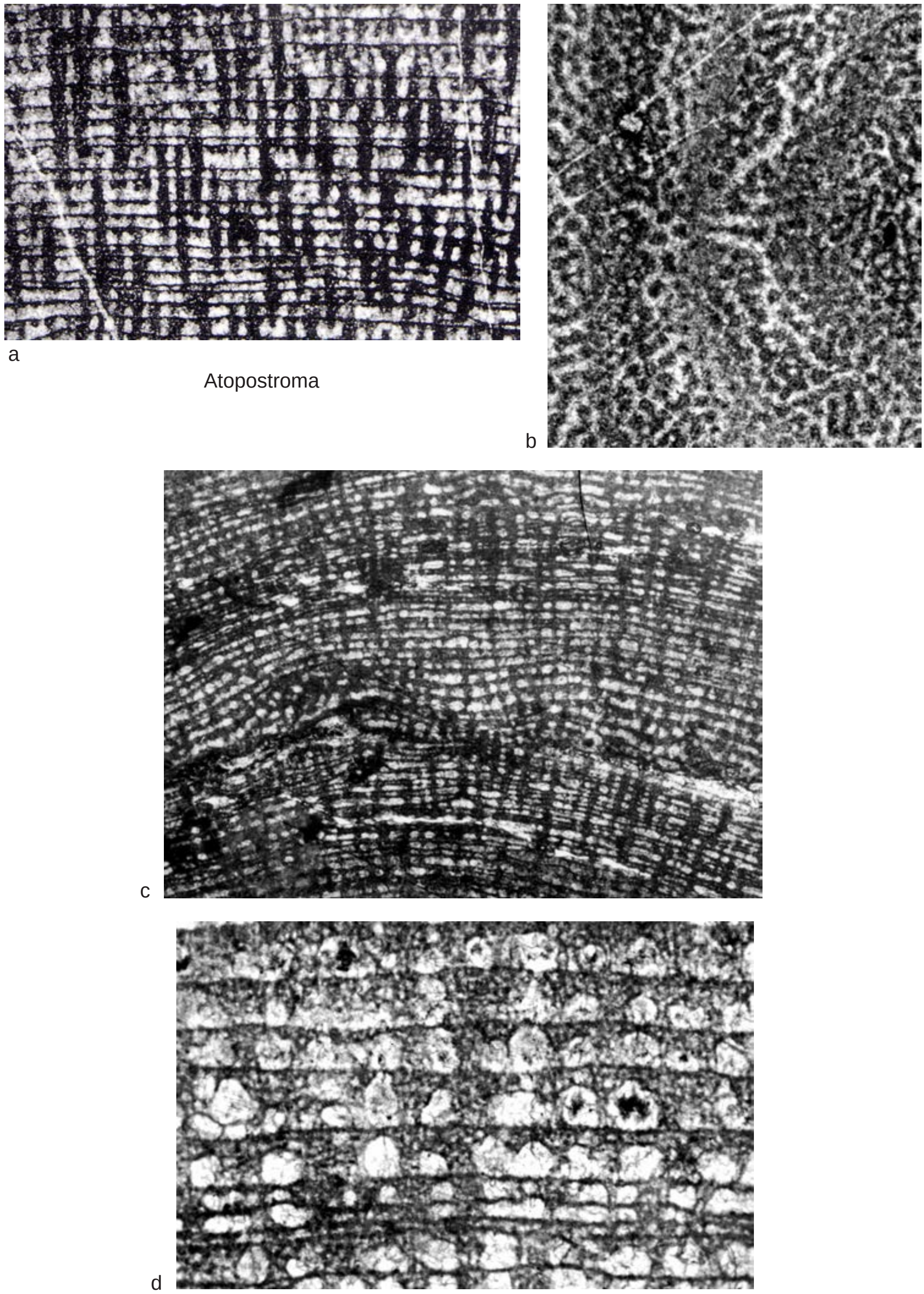
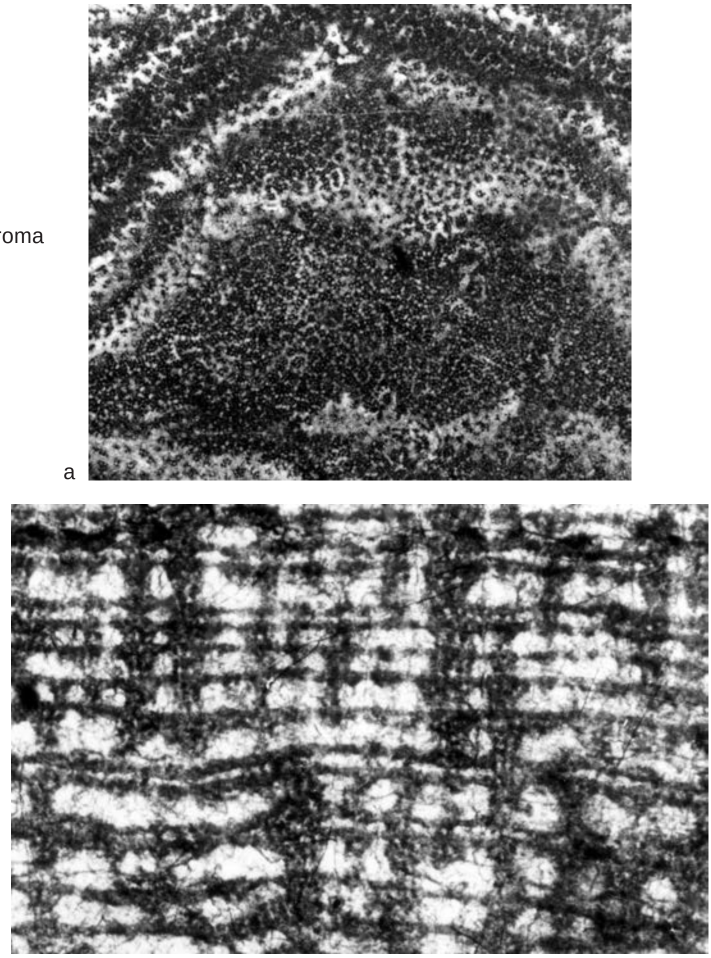


FIG. 466. Coenostromatidae (p. 816).

Atopostroma



a

b

FIG. 467. Coenostromatidae (p. 816).

Atopostroma YANG & DONG, 1979, p. 74 [**A. tuntouense*; OD; holotype, NIGP Bd343-9]. Laminae regular, extensive, formed of a single microlamina with skeletal material from pillars spread irregularly below; pillars typically superposed, narrow, subcircular in tangential section at base, composed of orthoreticular to clinoreticular skeletal material. *Lower Devonian (Lochkovian)–Middle Devonian (Eifelian, ?Givetian)*: Canada (Arctic Island), USA (New York), *Lochkovian;* Czech Republic (Bohemia), *Pragian;* Australia (New South Wales, Victoria), Canada (Arctic Island, Northwest Territories, Yukon), China (Sichuan, Yunnan, Guangxi), *Emsian;* Canada (Arctic Island), Russia (Kuznetsk Basin), *Eifelian;* Afghanistan, *?Givetian*.——FIG. 466*a–b*. **A. tuntouense*, holotype, NIGP Bd343-9, Yujiang Formation, Emsian, Guangxi, China; *a*, longitudinal section, ×10; *b*, tangential section, ×10 (Dong, 2001).——FIG. 466*c*. *A.* n. sp., = *A. tuntouense* STEARN, 1990, p. 496 (see WEBBY, STEARN, & ZHEN, 1993, p. 171–172), hypotype, GSC95786, Stuart Bay Formation, Bathurst Island, arctic Canada, longitudinal section, ×10 (Stearn, 2011b).——FIG. 466*d*. *A. stearni* WEBBY & ZHEN, 2008, holotype, Martin Wells Limestone, Queensland, Australia, AM.F 134883, longitudinal section, showing microstructure, ×35 (Webby & Zhen, 2008).——FIG. 467*a–b*. *A. n. sp.* (=*A. tuntouense* STEARN, 1990, p. 496), hypotype, GSC95786, Stuart Bay Formation, Bathurst Island, arctic Canada; *a*, tangential section, ×10; *b*, longitudinal section showing microstructure, ×25 (Stearn, 2011b).

Columnostroma BOGOYAVLENSKAYA, 1972b, p. 33 [**Coenostroma ristigouchense* SPENCER, 1884, p. 599; OD; specimen repository unknown, type slide 309, NHM. P5591]. Pillars (subcolumns) long,

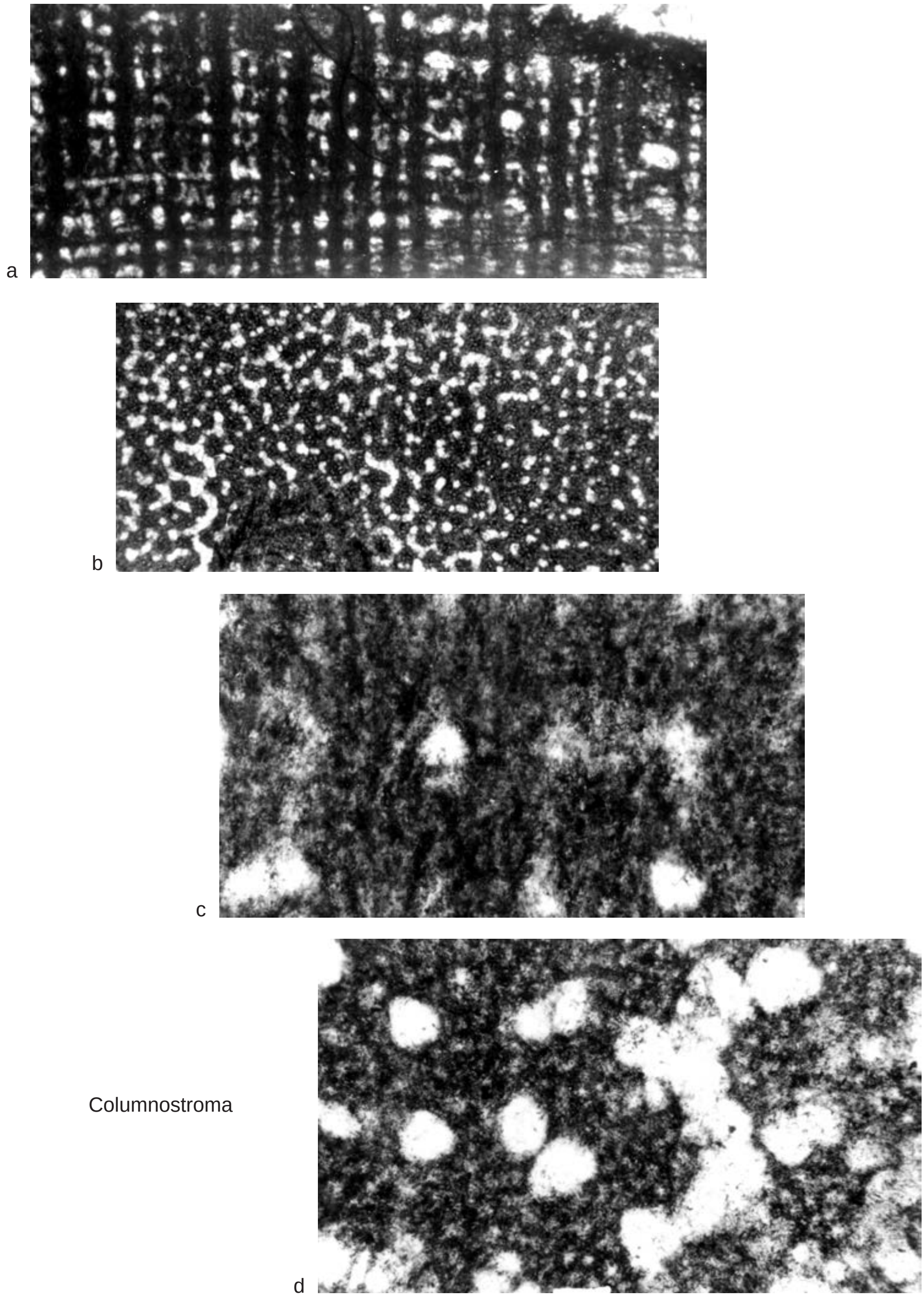


FIG. 468. Coenostromatidae (p. 816–818).

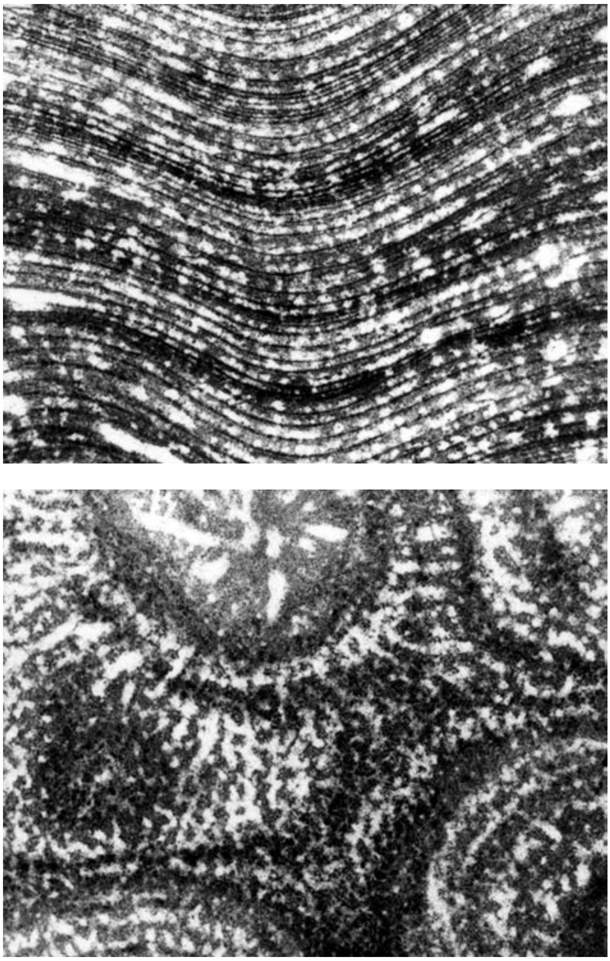


FIG. 469. Coenostromatidae (p. 818–819).

continuous, rarely joining or dividing, clinoreticular, round in tangential section and joined by radial processes (colliculi) forming colliculate laminae or locally thicker pachystromes; dissepiments common; pillars (subcolumns) separated by autotubes. *Lower Devonian (Lochkovian)–Middle Devonian (Givetian)*: Canada (New Brunswick), *Lochkovian;* Australia (Victoria), *Pragian;* Russia (eastern Urals), *Lower Devonian;* Canada (Hudson Bay), USA (Indiana, Ohio), *Emsian–Eifelian;* England (?Devon), Russia (northern Urals, eastern slope of Urals, Kuznetsk Basin), *Givetian.*——FIG. 468*a–d.* **C. ristigouchense* (SPENCER), holotype, NHM. P5591, ?Lochkovian, Dalhousie, New Brunswick, Canada; *a*, longitudinal section (section is thick), ×10; *b*, tangential section showing round pillars (subcolumns) joined by radial processes, ×10; *c*, longitudinal section showing clinoreticular nature of pillars (subcolumns), ×50; *d*, tangential section of microstructure, ×50 (Stearn, 2011b).

Habrostroma FAGERSTROM, 1982, p. 11 [**Stromatopora proxilaminata* FAGERSTROM, 1961, p. 8; OD; holotype, UMMP 36177]. Pachysteles short, irregular, largely confined between pachystromes, forming an irregular network of cellular skeletal tissue with diffuse boundaries in tangential section; pachystromes prominent, of similar cellular-to-acosmoreticular material containing one or more microlaminae. [This genus has been difficult to define, and at the beginning of its range near the Silurian-Devonian boundary, it is difficult to distinguish from *Parallelostroma* (FAGERSTROM, 1982; STOCK & HOLMES, 1986; STOCK, 1989).] *Silurian (Pridoli)–Upper Devonian (Frasnian)*: Estonia, USA (New York, Virginia), *Pridoli;* Canada (Arctic Island), USA (New York, Virginia), *Lochkovian;*

Australia (Victoria), *Pragian;* Australia (New South Wales), Canada (Arctic Island), *Emsian;* Belgium (Ardennes), Canada (Arctic Island, southern Ontario), Poland, Russia (Kuznetsk Basin, Russian platform, Urals), USA (Indiana, Missouri, Ohio), *Eifelian;* Belgium (Ardennes), China (Guizhou), Germany (Sauerland), USA (Indiana), *Givetian;* Canada (northern Alberta, Northwest Territories), France, Iran (Kerman), Russia (St. Petersburg), *Frasnian.*——Fig. 469*a–b.* **H. proxilaminatum* (Fagerstrom), holotype, UMMP36177, Formosa Reef Limestone, 4 km north of Formosa, Ontario, Canada; *a*, longitudinal section, ×10; *b*, tangential section, ×10 (Stearn, 2011b).——Fig. 470*a–b.* **H. proxilaminatum* (Fagerstrom), holotype, UMMP36177, Formosa Reef Limestone, 4 km north of Formosa, Ontario, Canada; *a*, longitudinal section showing microstructure and microlaminae, ×25; *b*, tangential section showing diffuse skeletal material of pillars, ×25 (Stearn, 2011b).

Syringostroma Nicholson, 1875, p. 251 [**S. densum*; SD Nicholson, 1886a, p. 98; holotype, NHM. P5598] [=*Stylodictyon* Nicholson & Murie, 1878, p. 221–222 (type, *Syringostroma columnaris* Nicholson, 1875, p. 263, OD); Galloway, 1957, p. 450; Stearn, 1966, p. 116]. Pachysteles short, irregular, coarsely cellular, without well-defined boundaries, irregular in shape in tangential section; subcolumns long, continuous, clinoreticular, round in tangential section; pachystromes persistent, thick, appearing cellular or acosmoreticular, containing one or more microlaminae; dissepiments rare. [A great majority of species that have been assigned to this genus do not have the prominent subcolumns characteristic of the type species and should be assigned to other genera, notably *Coenostroma* and *Habrostroma* (Stearn, 1993).] *Lower Devonian (Lochkovian)–Middle Devonian (Givetian)*: Canada (Arctic Island), *Lochkovian;* Canada (southern Ontario, Hudson Bay), USA (Michigan, Ohio), *Emsian–Eifelian;* USA (Missouri), *Middle Devonian;* USA (Indiana, Ohio), *Givetian.*——Fig. 471*a–c.* **S. densum; a–b,* holotype, NHM. P5598, Corniferous limestone (Columbus Limestone), Kelley's Island, Lake Erie, Ohio, USA; *a*, longitudinal section, ×10; *b*, tangential section, showing round cut ends of subcolumns, ×10; *c*, topotype, YPM 452617, longitudinal section showing loosely open microreticular microstructure, ×50 (Stearn, 2011b).

Family PARALLELOSTROMATIDAE Bogoyavlenskaya, 1984

[Parallelostromatidae Bogoyavlenskaya, 1984, p. 73]

Syringostromatida of laminar, bulbous, and domical growth forms with structure dominated by pachystromes and microlaminae; microstructure largely orthoreticular.

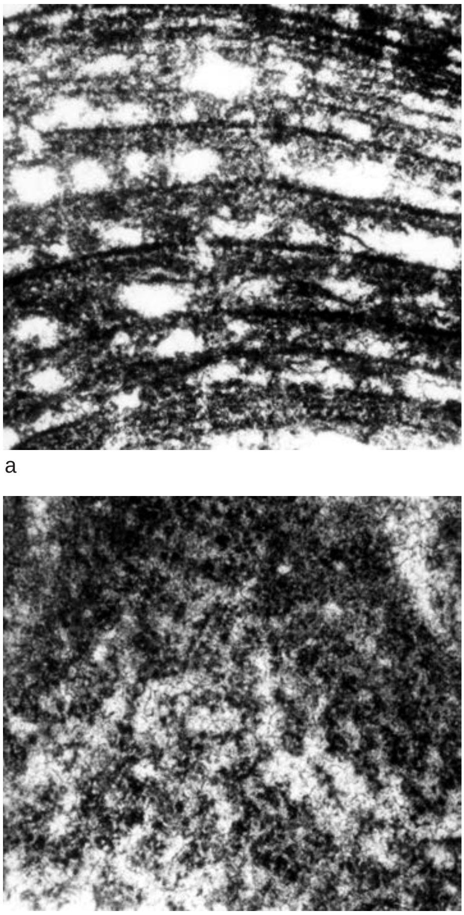


Fig. 470. Coenostromatidae (p. 818–819).

Silurian (Wenlock)–Middle Devonian (Givetian), Upper Devonian (?Frasnian).

Parallelostroma Nestor, 1966a, p. 52 [**Stromatopora typica* Rosen, 1867, p. 58; OD; holotype, IGTUT Co3009]. Pachystromes thick, composed of orthoreticular skeletal material enclosing multiple microlaminae and micropillars; short autotubes separate pachysteles at their base. Pachysteles of orthoreticular microstructure, largely confined to space between pachystromes, some superposed; in tangential section forming closed network penetrated by autotubes. *Silurian (Wenlock)–Lower Devonian, ?Middle Devonian, Upper Devonian (?Frasnian)*: Mongolia, Russia (Pechora Basin, Pre-Urals), Ukraine (Podolia), *Wenlock;* Canada (Quebec), China (Inner Mongolia) Estonia, Russia (eastern Urals),

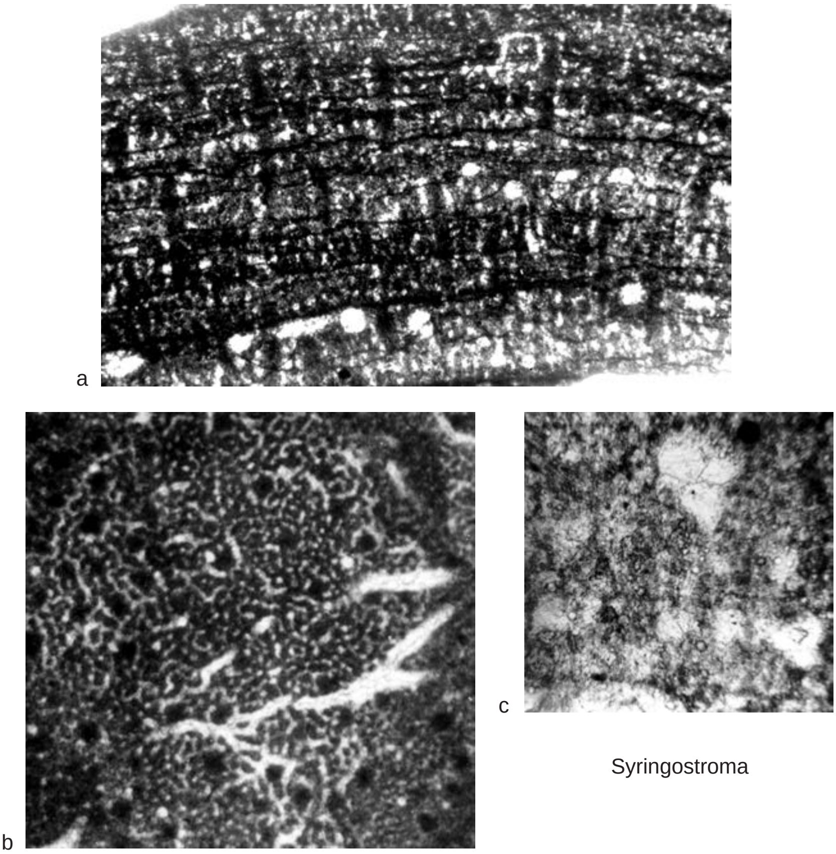


FIG. 471. Coenostromatidae (p. 819).

Sweden (Gotland), Ukraine (Podolia), USA (New York), *Ludlow–Pridoli;* Canada (Arctic Island), Estonia, Ukraine (Podolia), USA (New York), *Lochkovian;* China (Guangxi, Inner Mongolia, Sichuan), Russia (eastern Urals), *Lower Devonian;* China (Guangxi), Russia (western Urals, Arctic Island), ?*Middle Devonian;* China (Guangxi), *?Frasnian.*——FIG. 472*a–d.* **P. typicum* (ROSEN), holotype, IGTUT Co3009, Ludlow, Saaremaa, Estonia; *a*, longitudinal section, ×10; *b*, tangential section, ×10; *c*, longitudinal section showing orthoreticular microstructure, ×25; *d*, tangential section showing autotubes between pachysteles, ×25 (Stearn, 2011b).

Parallelopora BARGATZKY, 1881a, p. 291 [**P. ostiolata* BARGATZKY, 1881a, p. 292; OD; holotype, IPB 571b, also NHM. P5936 (slides 125); type illustrated by NICHOLSON (1886a, pl. 2), LECOMPTE (1952 in 1951–1952, pl. 51)]. Pachysteles long, continuous, branching and joining in longitudinal section, in tangential section mostly joined into closed network, enclosing autotubes; pachystromes suppressed or absent; dissepiments abundant. Microstructure of pachysteles coarsely microreticulate (orthoreticular), apparently formed of closely spaced, opaque micropillars and more widely spaced, short microcolliculi. *Silurian (upper Ludlow)–Middle Devonian (Givetian)*: Sweden (Scania, Gotland), *upper Ludlow;* Czech Republic (Bohemia), *Pragian;* Australia (Victoria), Canada (Arctic Island), *Emsian;* Canada (Arctic Island), Czech Republic (Bohemia), Morocco, USA (Indiana), *Eifelian;* Belgium (Ardennes), Canada (Manitoba), France (Boulonnais), Germany (Eifel, Rhineland, Sauerland), Russia (Kuznetsk Basin), *Givetian;* China (Guangxi, Hunan, Sichuan), Germany (Eifel), Russia (South Urals), *Middle Devonian.*——FIG. 473*a–d.* **P. ostiolata*, holotype, slides NHM. P5936, Middle Devonian, Büchel, Eifel, Germany; *a*, longitudinal section of Nicholson's sample of holotype, ×10; *b*, tangential section, showing continuous network of pachysteles, ×10; *c*, longitudinal section showing microstructure of micropillars, ×50; *d*, tangential section showing coarsely melanospheric microstructure, ×50 (Stearn, 2011b).

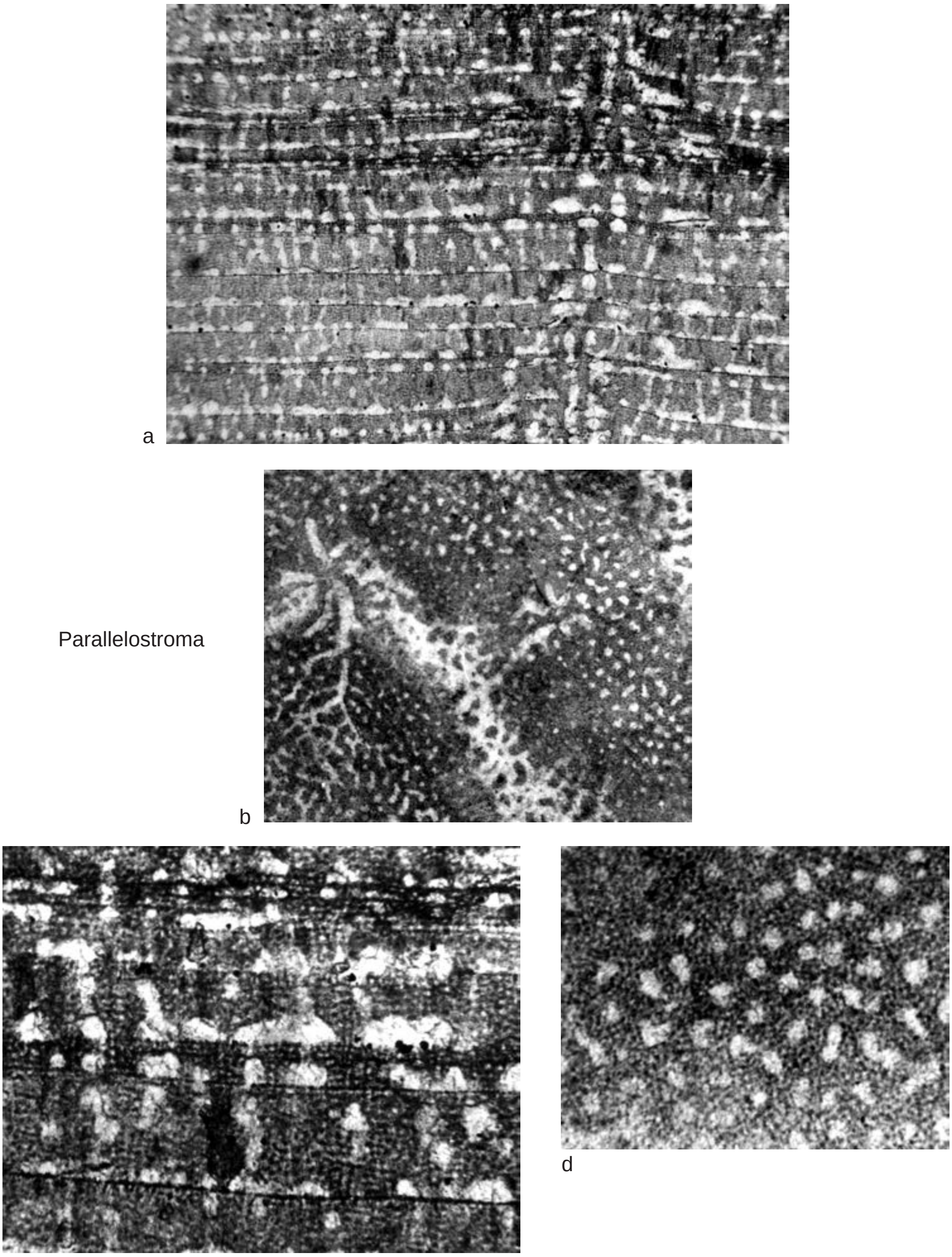


FIG. 472. Parallelostromatidae (p. 819–820).

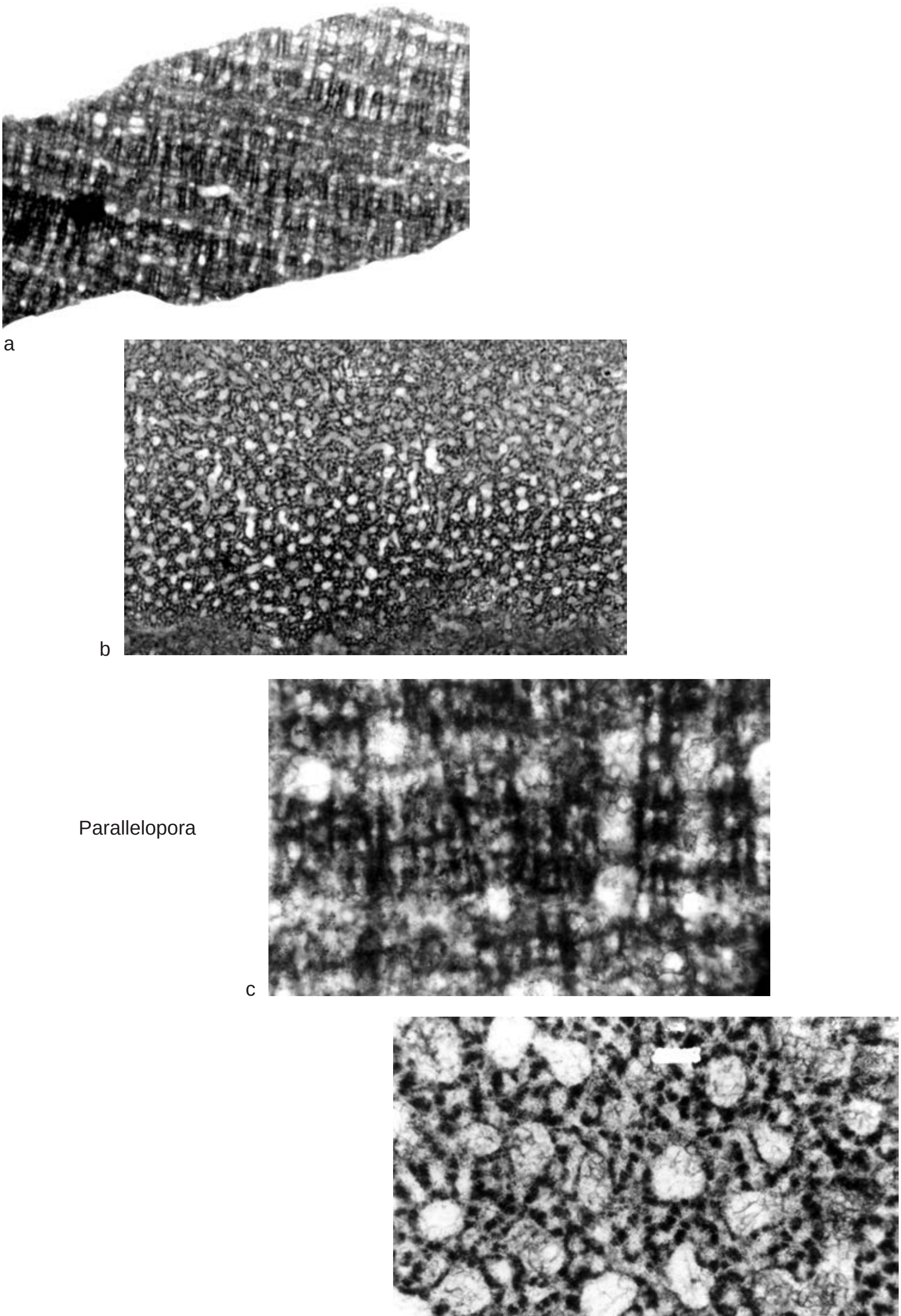


FIG. 473. Parallelostromatidae (p. 820).

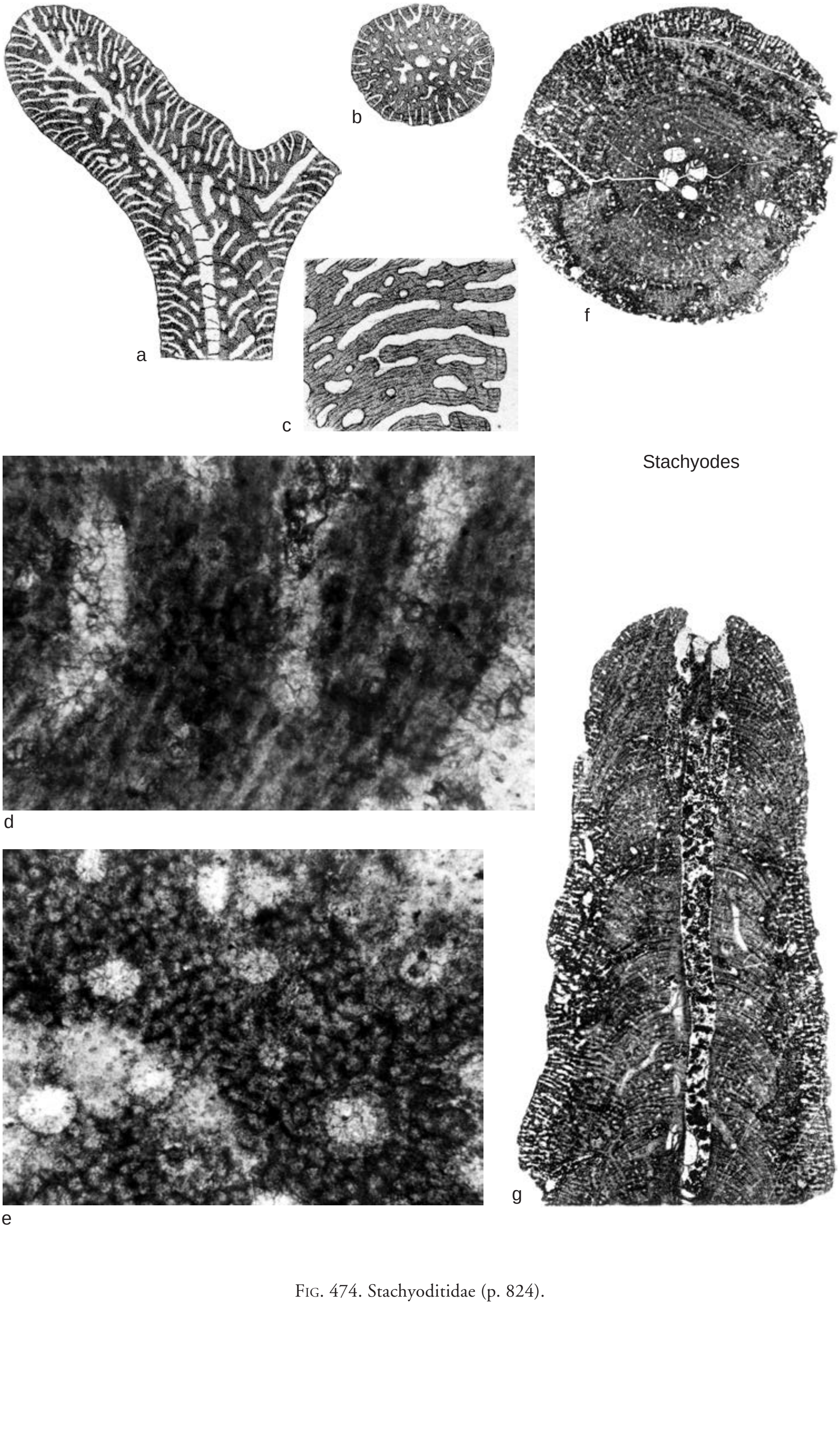


FIG. 474. Stachyoditidae (p. 824).

Family STACHYODITIDAE Khromykh, 1967

[*nom. correct.* KHROMYKH, 1969, p. 36, *pro* Stachyodidae KHROMYKH, 1967, p. 67]

Syringostromida of almost exclusively dendroid growth form with structure of prominent pachysteles separated by allotubes and microlaminae. Microstructure obscurely microreticulate. *Lower Devonian (?Lochkovian), Middle Devonian (Eifelian)–Upper Devonian (Frasnian, ?Famennian).*

Stachyodes BARGATZKY, 1881b, p. 688, *non* WRIGHT & STUDER, 1889, p. 55, an alcyonarian according to MISTIAEN (1985, p. 192) and *nomen oblitum* [**S. ramosa* BARGATZKY, 1881b, p. 691; OD; holotype specimen lost; synonymized by NICHOLSON, 1886a, p. 107, with *Stromatopora verticillata* M'COY, 1850, p. 377, type specimen at Cambridge University, apparently lost] [=*Sphaerostroma* GÜRICH, 1896, p. 127 (type, *S. exiguum* GÜRICH, 1896, p. 128, OD); =*Stachyodella* DELAGE & HÉROUARD, 1901, p. 162, see MISTIAEN, 1985, p. 192 for discussion of synonymy; =*Keega* WRAY, 1967, p. 18 (type, *K. australe*, OD), see RIDING, 1974b, for discussion of synonymy]. Growth form in most species dendroid, rarely laminar or combination of laminar growing into erect branches; with axial canal, or canals, crossed by tabulae. Smaller canals and pachysteles separated by allotubes radiating upward and outward to periphery in dendroid forms. Structure defined by canals, allotubes, and autotubes cut in axial parts of transverse sections as round and irregular voids and at periphery as irregular radial canals opening at margin (and covered in best-preserved specimens by an enveloping, thin, skeletal sheath). Peripheral allotubes separating irregular, radial pachysteles. Structure traversed by dark microlaminae parallel to successive growth surfaces, forming concentric rings only in peripheral zone of transverse sections, and parabolas in longitudinal sections. Structural elements thick, occupying most of the skeleton, microreticulate in well-preserved specimens, more commonly appearing striated, with vacuoles in some species, commonly recrystallized to diagenetic fibrous microstructures. [*Stachyodes* differs from most stromatoporoid genera in the consistency of its dendoid growth form, its central canal exiting at the top, its lack of strorhizae, the peripheral membrance in well-preserved specimens, and the obscure but striated nature of its microstructure. The last of these suggests that it may be a non-stromatoporoid sponge with poorly preserved spicules. Further study of teh specimen described by DA SILVA and others (2014) should determine whether it could be assigned to *Stachyodes.* In the absence of both possible type specimens, most research workers have accepted NICHOLSON's interpretation that *S. ramosa* and *S. verticillata* are the same species and have recognized the genus on the basis of his descriptions and illustrations.] *Lower Devonian (?Lochkovian), Middle Devonian (Eifelian)–Upper Devonian (Frasnian, ?Famennian)*: Australia (New South Wales), *?Lochkovian;* Afghanistan, Kara-Kalpak, China (Guangxi, Sichuan, Hunan), England (Devon), Germany (Eifel), Russia (Kuznetsk Basin, Pechora Basin, Urals, Pre-Urals), Uzbekistan, *Middle Devonian;* Belgium (Ardennes), Tien Shan, China (Qinghai), Germany (Sauerland), Russia (Kuznetsk Basin), Vietnam, *Eifelian;* Afghanistan, Australia (Canning Basin, Queensland), Belgium (Ardennes), Canada (Alberta, British Columbia, Manitoba), China (Guangxi, Guizhou, southern Qinghai), Czech Republic (Moravia), Germany (Eifel), Russia (Kuznetsk Basin), Thailand, USA (Missouri), *Givetian;* Afghanistan, Australia (Canning Basin, Queensland), Belgium (Ardennes), Canada (Alberta, Saskatchewan), Tien Shan, Zeravshan Ridge, China (Guangxi, Guizhou, Yunnan), Czech Republic (Bohemia), France (Boulonnais), Germany (Rhineland), Iran (Kerman), Poland (Holy Cross Mountains), Russia (northeastern Siberia, Pechora Basin, Timan), USA (Iowa, Missouri), Vietnam, *Frasnian;* Russia (western Pre-Urals), *?Famennian.*——FIG. 474*a–g*. **S. verticillata* (M'COY); *a–e*, Middle Devonian, Hebborn, Eifel, Germany, NICHOLSON's slide 397, NHM. P6069; *a–b,* axial and transverse section, ×1; *c*, longitudinal section of peripheral zone showing pachysteles and striation, ×12 (Nicholson, 1886a); *d–e*, longitudinal and tangential sections showing striated microstructure of pachysteles, ×50 (new); *f–g*, axial and transverse sections of hypotype, IRScNB5254, Givetian, Olloy, Ardennes, Belgium, ×3 (Lecompte, 1952 in 1951–1952).

Order AMPHIPORIDA Rukhin, 1938

[*nom. transl.* WEBBY, STEARN, & ZHEN, 1993, p. 174, *ex* Amphiporidae RUKHIN, 1938 p. 90]

Stromatoporoids of dominantly dendroid form composed of compact to fibrous, single layer skeletal elements, commonly arranged in irregular amalgamate networks but also in pillars radiating upward and outward from growth axis, with or without axial canals, obscure laminae, and peripheral sheaths enclosing skeleton. *?middle Silurian, upper Silurian (Ludlow)–Upper Devonian (upper Famennian).*

Family AMPHIPORIDAE Rukhin, 1938

[Amphiporidae RUKHIN, 1938, p. 90]

Diagnosis as for order. *?middle Silurian, upper Silurian (Ludlow)–Upper Devonian (upper Famennian).*

Amphipora SCHULZ, 1883, p. 245 [**Caunopora ramosa* PHILLIPS, 1841, p. 19, SD STEARN, 1997c, p. 839; holotype lost, neotype, NHM. P0308, sections A1 to A6] [=*Haraamphipora* RUKHIN, 1938, p. 93 (type, *H. pachyroides*, OD); =*Vicinustachyodes* YAVORSKY, 1961, p. 56 (type, *V. mirabilis*, OD); =*Vicinostachyodes*

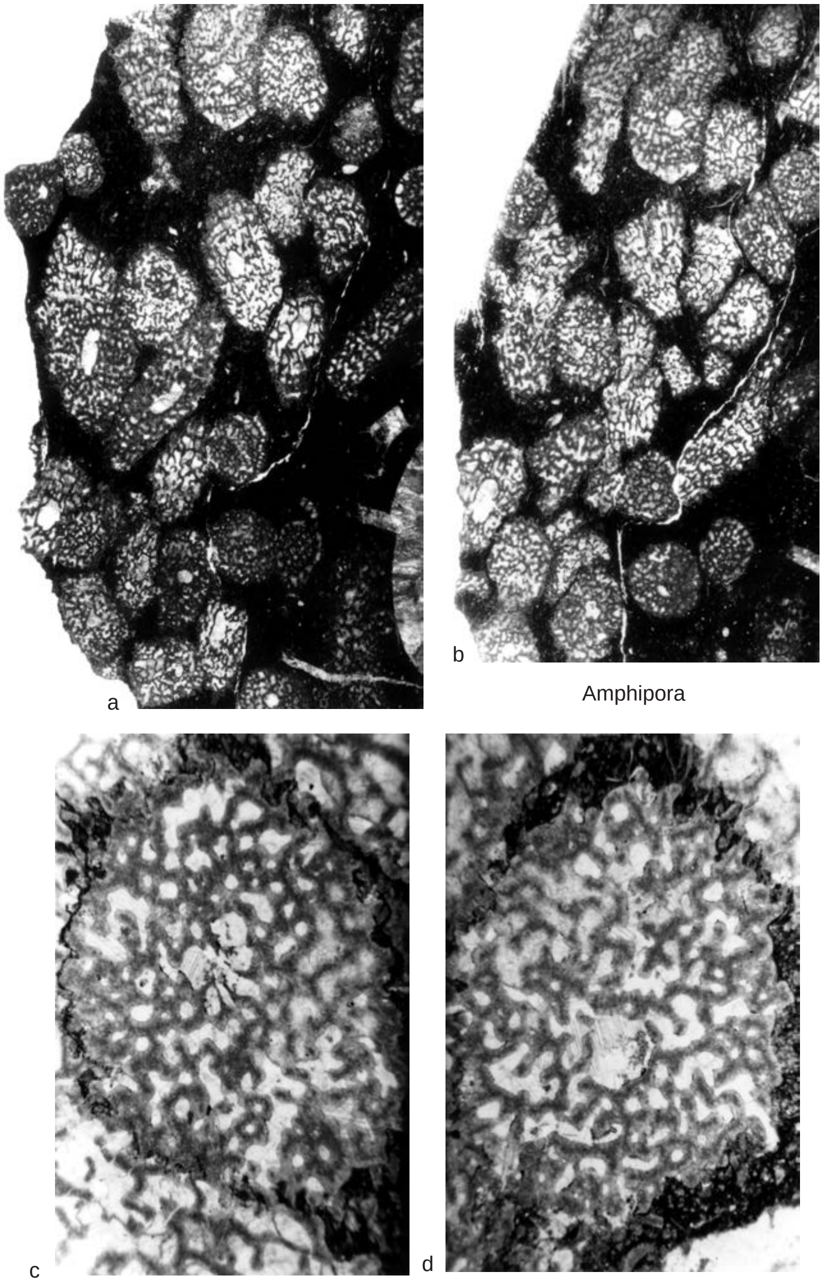


FIG. 475. Amphiporidae (p. 824–826).

YAVORSKY, 1967, p. 38, *lapsus calami pro Vicinustachyodes*; =*Stellopora* BOGOYAVLENSKAYA, 1972b, p. 27 (type, *Amphipora intexta* YAVORSKY, 1957, p. 62, OD), see WEBBY, STEARN, & ZHEN, 1993, p. 174–176 for discussion of date; =*Taeniostroma* DONG & WANG, 1982, p. 29 (type, *T. yunnanense*, OD); =*Columndictyon* DONG & WANG, 1982, p. 29 (type, *C. regulare* DONG & WANG, 1982, p. 30, OD); =*Tianshanostroma* DONG & WANG, 1984, p. 269 (type, *T. xinjiangense* DONG & WANG, 1984, p. 269–270, OD); =*Qinghaipora* DONG, 1991, p. 75 (type, *Q. gracilenta*, OD)] [STEARN (1997c) discussed the choice of a neotype and the variations in the neotype suite that justify placing in synonymy the

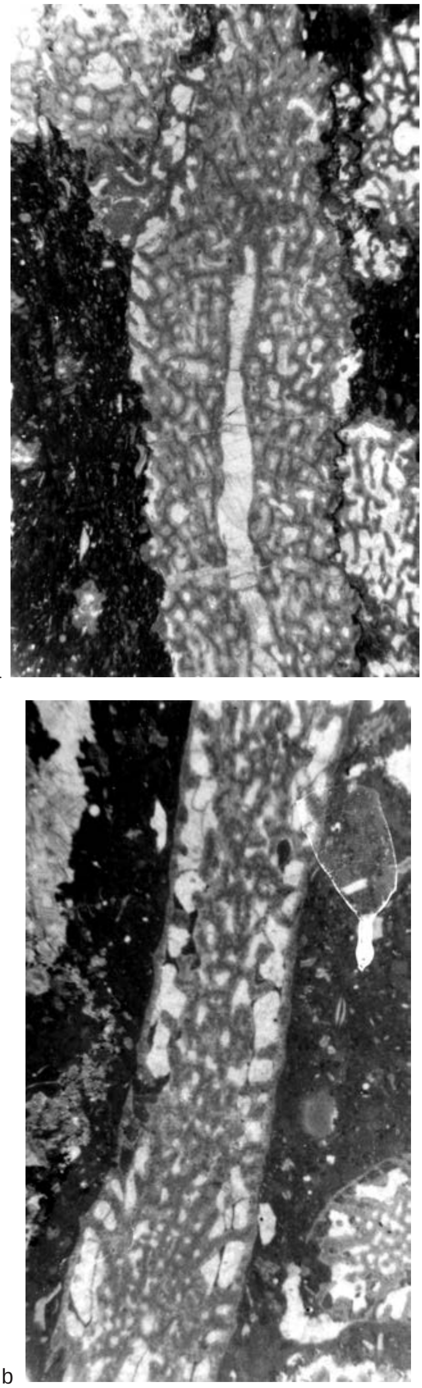


FIG. 476. Amphiporidae (p. 824–826).

genera listed above.] Skeleton dendroid, branching dichotomously, with axial canal locally absent, locally with well-defined wall, locally poorly defined, opening into interskeletal network of voids and irregular canals by pores. Skeletal network formed by pillars radiating upward and outward obliquely from axis, and short elements extending from and joining them to form an irregular structure that may, in transverse sections, define open or closed spaces. Peripheral sheaths sporadically developed in most species, as an imperforate, thin, skeletal wall supported beyond skeletal network by extensions of skeletal elements. Microstructure compact, fibrous. [The plethora of Middle and Upper Devonian occurrences and published species make the listing of their distribution impractical here.] *?middle Silurian, upper Silurian (Ludlow)–Upper Devonian (upper Famennian):* Russia (Belyj Island), *?middle Silurian;* Estonia, Russia (Urals, Kuznetsk Basin, central Siberia, Timan), Sweden (Gotland), Tien Shan, *Ludlow;* Canada (Arctic Island), China (Xinjiang), Russia (central and eastern Siberia, Salair, Kuznetsk Basin), Tien Shan, USA (Alaska), *Lower Devonian;* cosmopolitan at lower paleolatitudes, *Middle Devonian*; cosmopolitan at lower paleolatitudes, *Frasnian;* China (Guangxi), Russia (Pechora Basin), *Famennian;* Belgium, northeastern France, Germany (Sittard), *upper Famennian* or *Strunian.*——FIG. 475*a–d*. **A. ramosa* (PHILLIPS), neotype, NHM. P0308, Chercombe Bridge Limestone, near Newton Abbott, Devon, England; *a–b*, two sections through neotype suite, ×2.5; *c–d*, two transverse sections across neotype stem showing variations in skeletal network and central canal, ×10 (Stearn, 2011b).——FIG. 476*a–b*. **A. ramosa* (PHILLIPS), neotype, NHM. P0308, Chercombe Bridge Limestone, near Newton Abbott, Devon, England; *a*, longitudinal section from neotype suite showing axial canal, pillars, and peripheral sheath on only one side, ×10; *b*, axial to tangential section of stem from neoparatype, NHM. P0310, showing peripheral sheaths and well-developed pillars, ×10 (Stearn, 2011b).

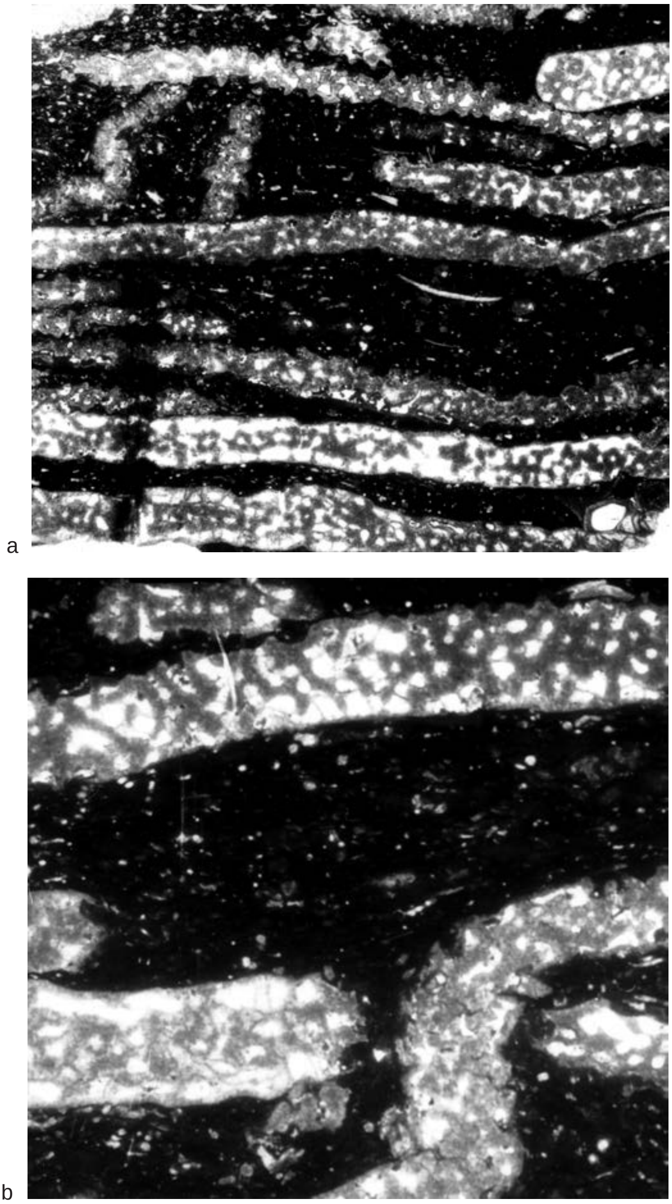
Clathrodictyella BOGOYAVLENSKAYA, 1965a, p. 42 [**Amphipora turkestanica* LESSOVAJA, 1962, p. 117; OD; holotype, GMU 46/489]. Similar to *Amphipora* in axial canal and peripheral sheaths, but in axial section, structural elements are gently arched, crumpled laminae or cysts, arranged in parabolic series transverse to axial canal. *Silurian (Ludlow):* Russia (eastern Urals), Uzbekistan (Tien Shan).——FIG. 477*a–b*. **C. turkestanica* (LESSOVAJA), holotype, GMU 46/489, Bankovyi horizon, eastern slope of Urals, axial and transverse sections, ×10 (Stearn, 2011b).

Euryamphipora KLOVAN, 1966, p. 14 [**E. platyformis*; OD; holotype, GSC 19834] [=*?Solidostroma* KHROMYKH, 1974a, p. 30 (type, *S. congesta,* OD)]. Growth form tabular, platelike; structure amalgamate in longitudinal section, with peripheral sheaths, may have long pillars evident in sections parallel to plate axes. [KLOVAN (1966) and MISTIAEN

FIG. 477. Amphiporidae (p. 826).

(1985) described the genus as growing as a horizontal plate; COCKBAIN (1984) reconstructed the skeleton as a vertical plate.] *Middle Devonian (Givetian)–Upper Devonian (Frasnian)*: Australia (Queensland), France (Boulonnais), *Givetian;* Afghanistan, Australia (West Australia), Canada (Alberta, Saskatchewan), *Frasnian.*——FIG. 478*a–b*. **E. platyformis*, holotype, GSC 19834, Leduc Formation, Redwater Field, Alberta, Canada; *a*, longitudinal section showing laminar growth form, ×5; *b*, longitudinal section showing amalgamate appearance and flexing of skeleton, ×10 (Stearn, 2011b).——FIG. 479*a–b*. **E. platyformis*, holotype, GSC 19834, Leduc Formation, Redwater Field, Alberta, Canada; *a*, longitudinal section showing peripheral sheaths, ×10; *b*, tangential section showing pillars at edge of skeleton and amalgamate structure, ×10 (Stearn, 2011b).

Novitella BOGOYAVLENSKAYA in BOGOYAVLENSKAYA & DAN'SHINA, 1984, p. 22 [**Paramphipora tchussovensis* YAVORSKY, 1955, p. 159; OD; holotype, CNIGR 7351/136]. Similar to *Amphipora* but with prominent, gently arched laminae in axial sections. *Upper Devonian (Frasnian)*: Russia (Tsaritsin, now Volgograd region, eastern and western Urals).——FIG. 480*a–b*. **N. tchussovensis*



Euryamphipora

FIG. 478. Amphiporidae (p. 826–827).

(Yavorsky), CNIGR 7351/136, Askynian horizon, Chusovaya River, western slope of Urals, transverse and axial to oblique transverse sections, ×10 (Yavorsky, 1955).

Paramphipora Yavorsky, 1955, p. 154 [**P. mirabilis*; OD; holotype, CNIGR 7351/236] [=*Vacuustroma* Nguyen Hung & Mistiaen, 1997, p. 193 (type, *V. michelini* Nguyen Hung & Mistiaen, 1997, p. 198, OD)]. Similar to *Amphipora* in structure but with skeletal elements of vacuolate microstructure without central axis. [Although several writers (Klovan, 1966; Stearn, 1966, 1997c; Flügel & Flügel-Kahler, 1968; Cockbain, 1984; Mistiaen, 1988) have questioned the validity of Yavorsky's genus because it was based on the absence of an axial dark line in the skeletal elements that they considered subject to diagenesis, Yavorsky insisted (1968, 1969a, 1971) that it was equally distinguished by vacuolate microstructure. Since the only characters separating both *Paramphipora* and *Vacuustroma* from *Amphipora* are the lack of the axial line and the presence of vacuoles, the latter *(Vacuustroma)* is listed as a junior synonym here. Nearly all the more than 60 species that have been ascribed to *Paramphipora* are found in Russia and China only. Because the diagnoses and types of these species have not been individually examined to see whether they conform to Yavorsky's definition, the list of occurrences is based on the original generic assignments and should be regarded as tentative.] *Silurian (?Wenlock, Ludlow)–Upper Devonian:* Russia (Belyj Island), *?Wenlock;* Russia (northwestern Kuznetsk Basin, Salair, western Pre-Urals, Ulachan Sis), *Ludlow;* Russia (northeastern Siberia, Salair), Uzbekistan, Vietnam, *Lower Devonian;* Kara Kalpaksk, China (Guizhou, Guangxi), Russia (Tyrgan), Turkey, *Middle Devonian;* France (Boulonnais), Russia (Lochitina Sea, northern Pre-Urals, western Pre-Urals, Kuznetsk Basin, Pechora Basin, Urals, River Chusovaya), Vietnam, *Frasnian;* Russia (Pechora Basin, western Pre-Urals), *?Famennian;* Russia (Urals, River Ai), Vietnam, *Givetian;* China (Guangxi), *Upper Devonian.*——Fig. 481*a. *P. mirabilis*, holotype, CNIGR 7351/236, Ludlow, River Chernevaya, Salair, axial to tangential sections showing vacuolate skeletal material, ×10 (Yavorsky, 1955).——Fig. 481*b–e. P. michelini* (Nguyen Hung & Mistiaen), Beaulieu Formation, Frasnian, Boulonnais, France; *b*, holotype, transverse section, GFCL 1507, showing vacuolate microstructure, ×20; *c*, holotype, drawing of transverse section, ×13; *d*, hypotype, drawing of transverse section, GFCL 1490, ×13; *e*, paratype, drawing of axial section, GFCL 149, ×13 (Nguyen Hung & Mistiaen, 1997).

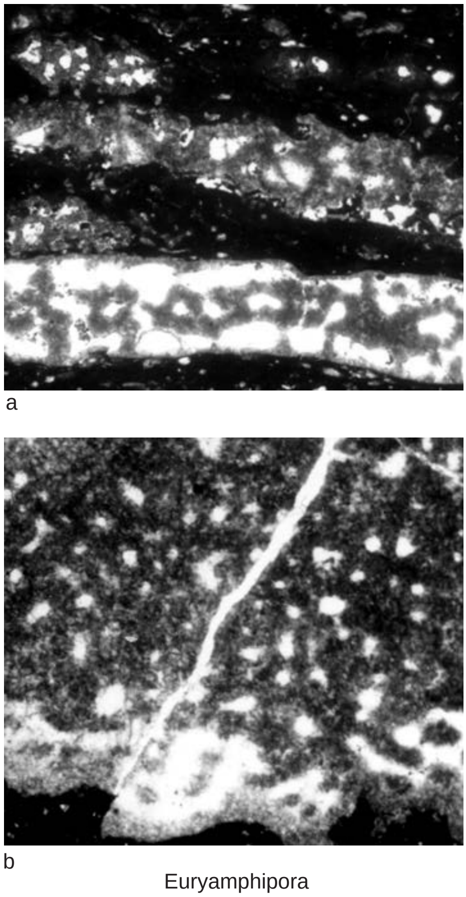


Fig. 479. Amphiporidae (p. 826–827).

ORDER AND FAMILY UNCERTAIN

Clavidictyon Sugiyama, 1939, p. 441 [**C. columnare*; OD; holotype, Tôhoku University, Sendai, 60,813]. Columnar, without axial canal, amalgamate in axial zone but with well-defined laminae and short pillars confined to interlaminar space in peripheral zone. Compact microstructure. [Some characteristics suggest affinity to the clathrodictyids, others to the amphiporids.] *middle Silurian–Upper Devonian (upper Famennian)*: Japan, *middle Silurian;* USA

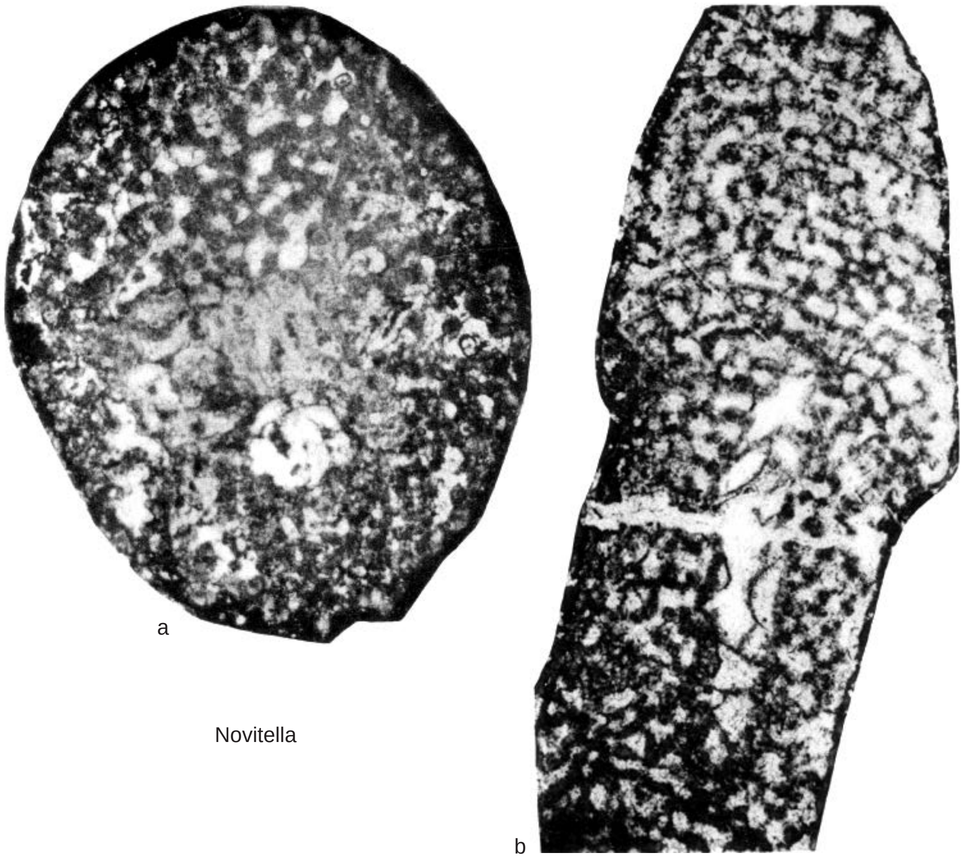


FIG. 480. Amphiporidae (p. 827–829).

(Michigan), *Middle Devonian;* China (Guangxi), *upper Famennian.*——FIG. 482*a–c*. **C. columnare*, holotype, 60,813, middle Silurian, Hikororoiti-mura, Japan; *a*, longitudinal sections, from type slide, ×6; *b*, transverse section, showing few laminae, ×10; *c*, transverse section showing well-defined laminae, ×10 (Stearn, 2011b).

Eostachyodes DONG & WANG, 1982, p. 28 [**E. compacta;* OD; holotype, NIGP 61351–61352]. Columnar growth form, without axial canal, structural elements in axial zone completely amalgamate, peripheral zone with pachystele-like elements; microstructure fibrous or melanospheric. [DONG and WANG (1982) placed the genus in the Idiostromatidae. DONG (1988) placed it in the Stachyoditidae. It differs from *Stachyodes* in lacking an axial canal, the extreme difference between axial and peripheral parts of the skeleton, and in its microstructure.] *Middle Devonian:* China (Yunnan).——FIG. 483,*1a–c*. **E. compacta*, holotype, NIGP61351-52, Gumu Formation, Wenshan, longitudinal and transverse sections, ×5 (Dong, 2001).

Lamellistroma BOGOYAVLENSKAYA, 1977b, p. 17 [**L. lamelliferum* BOGOYAVLENSKAYA, 1977b, p. 18; OD; holotype, SOAN 1089/101]. Thin, compact pillars and laminae forming regular, closely spaced grid. Pillars round in tangential section. [BOGOYAVLENSKAYA (1977b) placed this genus in the family Densastromatidae, but STEARN (1980) placed it in synonymy with *Actinostroma*. Other possibilities are *Coenostroma, Gerronostroma,* or *Densastroma.*] *Lower Devonian (Lochkovian)–Middle Devonian (Eifelian)*: Russia (eastern Urals), *Lochkovian;* Russia (eastern trans-Urals), *Pragian–Emsian;* Russia (eastern Urals), *Eifelian.*——FIG. 483,*2a–b.* **L. lamelliferum,* holotype, 1089/101,Tal'tiiskii horizon, Eifelian, River Saumy, eastern slope of Urals, Russia, longitudinal and tangential sections, ×10 (Stearn, 2011b).

Paschkoviella KOSAREVA, 1979, p. 43 [**P. aequicrassa*; OD; holotype, location of type specimen uncertain]. Spool-shaped pillars, superposed, and extensive laminae, locally with axial light zone. Microstructure finely porous. *Middle Devonian (Eifelian)*:

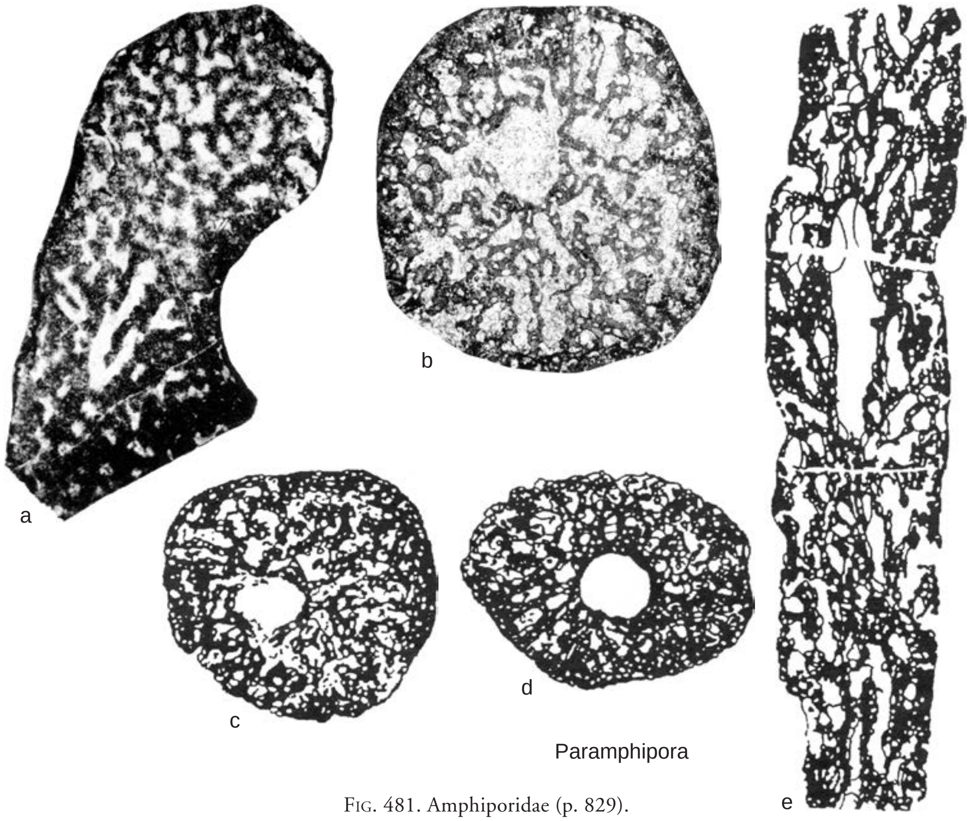


FIG. 481. Amphiporidae (p. 829).

Russia (River Zolotukha).——FIG. 483,*3a–b*. **P. aequicrassa;* holotype, longitudinal and tangential sections, ×10 (Kosareva, 1979).

Perplexostroma BOGOYAVLENSKAYA, 1981, p. 32 [**Stromatopora dzvenigorodensis* RIABININ, 1953, p. 51; OD; VNIGRI 153]. Pillars long, sinuous, anastomosing; tangential elements largely dissepiments. [This genus is probably synonymous with *Vikingia* on the basis that the type species *S. dvenogorodensis* RIABININ is a species of *Vikingia* comparable to *V. tenuis* (NESTOR), and the specimens illustrated by BOGOYAVLENSKAYA (1981, pl. 23,*2;* pl. 24,*1*) are not conspecific with the designated type species.] *Silurian (Ludlow–Pridoli)*: Ukraine (Podolia).——FIG. 484,*1a–b*. **P. dzvenigorodense* (RIABININ), holotype, VNIGRI 153, lower Ludlow, River Dneister, longitudinal and tangential sections, ×10 (Riabinin, 1953).

Praeidiostroma BOGOYAVLENSKAYA, 1971a, p. 108 [**P. praecox*; OD; holotype, SOAN 38a/982]. Dendroid growth form with axial canal branching into smaller canals. Pillars and laminae thin, long, apparently compact. [The type species appears to be a dendroid form of *Gerronostroma* with an axial canal.] *Silurian (Ludlow)*: Russia (eastern slope of Urals).——FIG. 485,*1a–b*. **P. praecox*, holotype, 38a/982, axial and transverse sections, ×10 (Stearn, 2011b).

Pseudoactinostroma LESSOVAJA, 1970, p. 81 [**P. hamidulense* LESSOVAJA, 1970, p. 82; OD; holotype, GMU 13/493]. Pillars confined to interlaminar space, compact, branching and joining, locally forming intermediate laminae; laminae extensive, widely spaced, formed of colliculi from pillars, making hexactinellid network in tangential section. [The laminae are much like those of an actinostromatid.] *Middle Devonian (Eifelian):* Central Asia (Zeravshan Mountains).——FIG. 484,*2a–b*. **P. hamidulense*, holotype, 38a/982, longitudinal and tangential sections, ×10 (Stearn, 2011b).

?Pseudostromatopora DONG, 1991, p. 70 [**P. yushuensis* DONG, 1991, p. 71; OD; holotype, NIGP 91933]. Structure irregular of dominant pachysteles, locally forming amalgamate network, cut as isolated masses of irregular outline in tangential section, separated by allotubes, cellular to diffuse in microstructure; tangential elements largely dissepiments. [The genus is a homonym of *Pseudostromatopora* SIMIONESCU, 1926, a bryozoan, and requires a new name.] *Middle Devonian–Upper Devonian*: China (Qinghai, Tibet).——FIG.

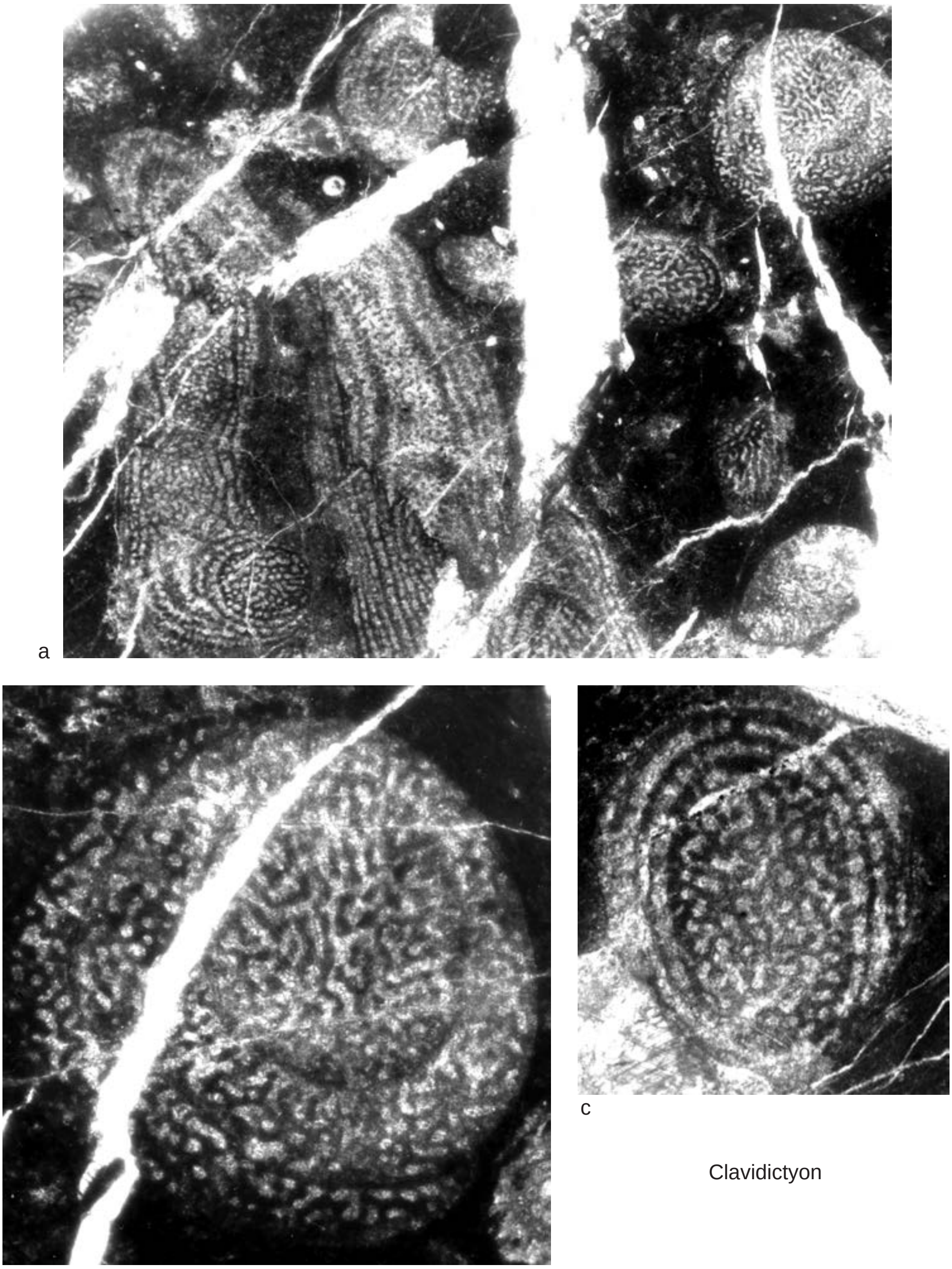


FIG. 482. Uncertain (p. 829–830).

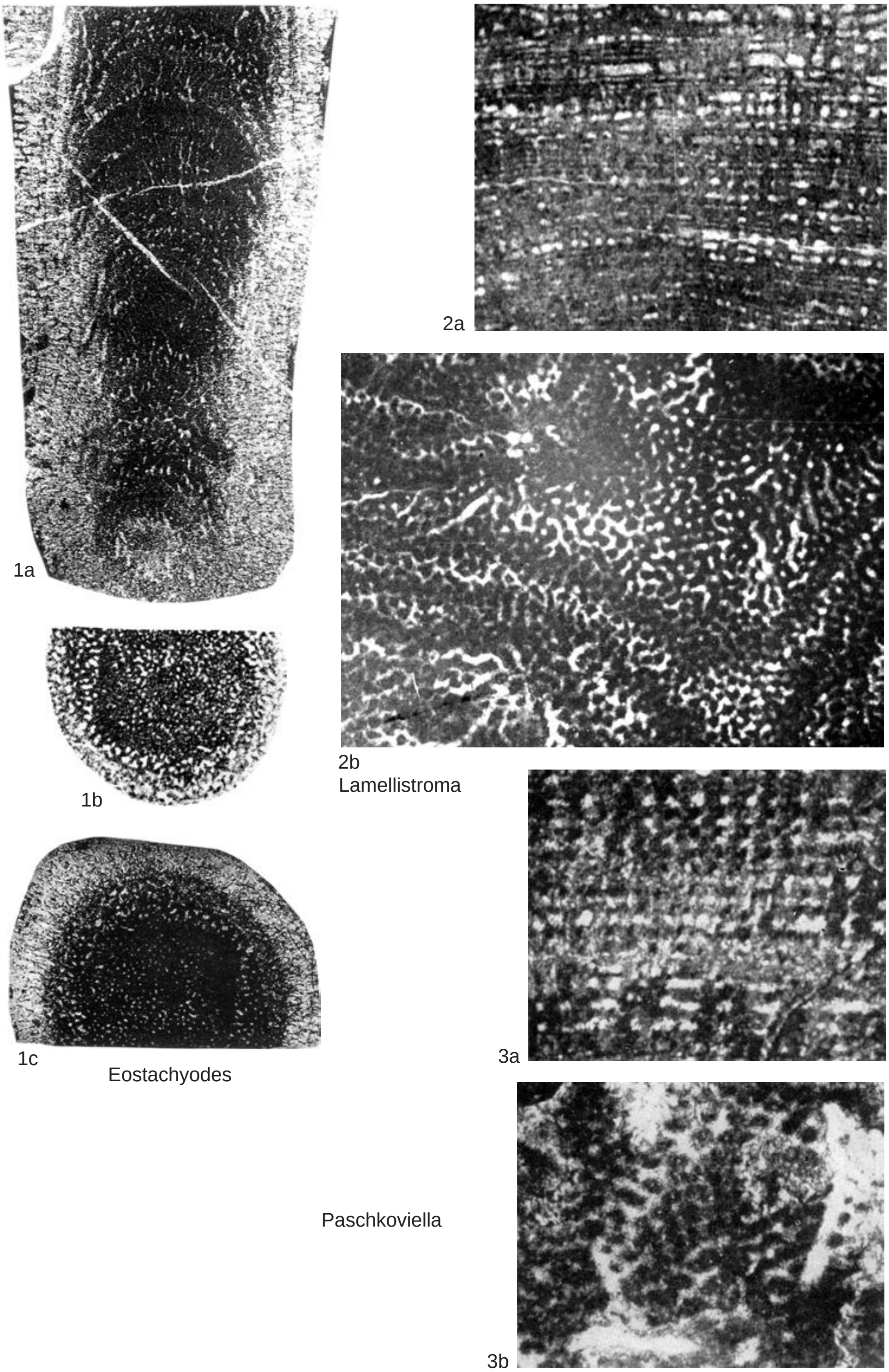
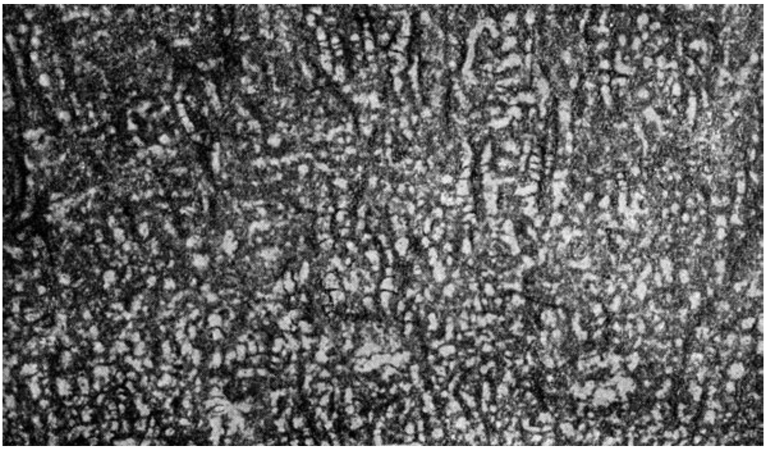
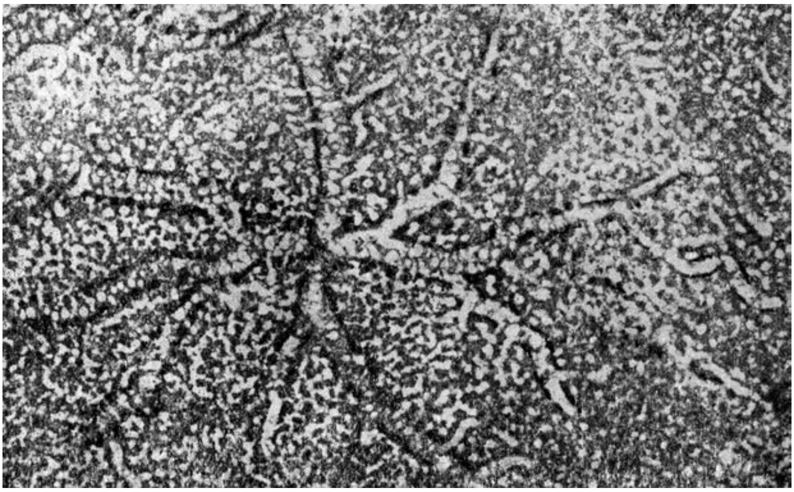
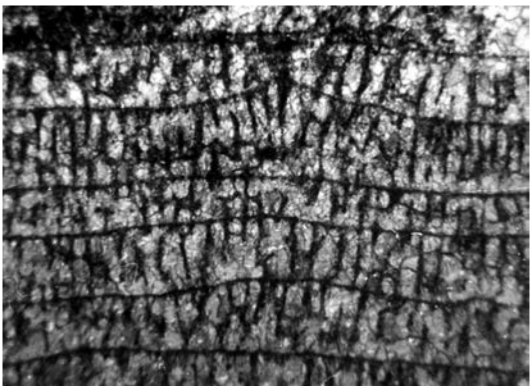


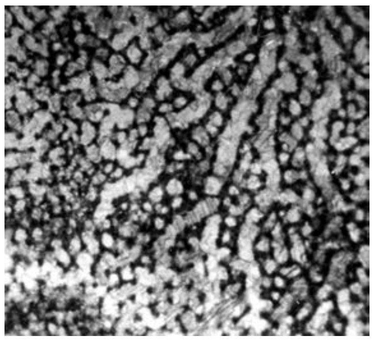
FIG. 483. Uncertain (p. 830–831).


1a


1b

Perplexostroma


2a


2b

Pseudoactinostroma

FIG. 484. Uncertain (p. 831).

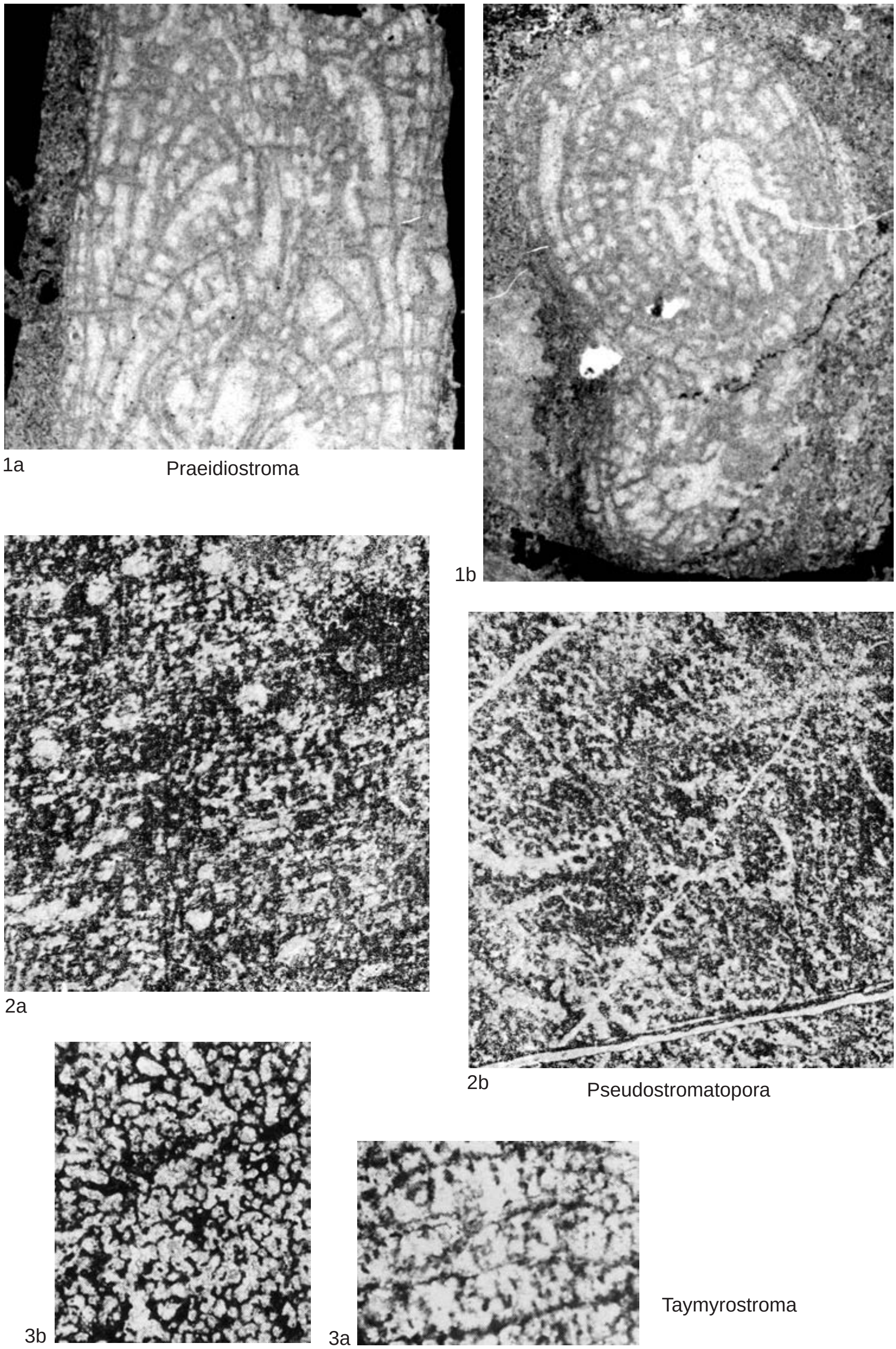


FIG. 485. Uncertain (p. 831–836).

485,*2a–b*. **P. yushuensis*, holotype, 91933ab, Xiongqin Formation, southern Qinghai, China, longitudinal and tangential sections, ×10 (Dong, 2001).

Taymyrostroma KHROMYKH, 2001, p. 13 [**T. taymyrensis;* OD; holotype, TsGM 2022/4]. Laminae thin, compact, single layer, extensive; longitudinal structural elements (possibly pillars) highly irregular, confined to interlaminar space, rarely extending directly across interlaminar space, forming a tangled mass in longitudinal section; thin, compact, in tangential section forming an irregular, fine meshwork enclosing rounded galleries; astrorhizae well developed, superposed. [Although placed in the Lophiostromatidae by KHROMYKH (2001), this genus is unlike the other genera in the family or any other late Ordovician stromatoporoid in its complex pillar structure between extensive thin laminae. In these features, it shows convergence with such younger genera such as *Intexodictyides* and *Atelodictyon.*] *Upper Ordovician (Katian):* Russia (Taimyr Peninsula).——FIG. 485,*3a–b*. **T. taymyrensis*, holotype, CSGM 2022/4, left bank of Parnaya River, Siberia, Burskii horizon, Nyun'skaya Subformation; *a,* longitudinal section, ×10; *b,* tangential section, ×10 (Khromykh, 2001).

CLASS UNCERTAIN, ORDER PULCHRILAMINIDA: SYSTEMATIC DESCRIPTIONS

B. D. Webby

Class UNCERTAIN
Order PULCHRILAMINIDA Webby, 2012

[Pulchrilaminida Webby, 2012a, p. 1]

Large, laminar, domical to columnar skeleton represented by thin latilaminae of mainly calcite spar–replaced skeletal elements that intercalate with mudrock layers; internally main skeletal elements preserved as erect, slender, upwardly tapering, spinose rods (walled but with spar-replaced centers); typically extending from tops of latilaminae into overlying mudrock layers; weakly developed meshworks also preserved in localized areas where rods combine with undulating rows of long, low cysts, or sometimes latilaminae exhibit intermingling wispy, threadlike elements; no astrorhizae known. *Lower Ordovician (upper Tremadocian)–Middle Ordovician (lower Darriwilian).*

This small group of large, hypercalcified, frame-building organisms occupies an important place in the development of Lower Ordovician–Middle Ordovician reefs in North America, the Argentine Precordillera, and southern China (Webby, 2002; Adachi, Liu, & Ezaki, 2011), but its affinities remain to be fully evaluated. The group has no apparent links with Cambrian hypercalcified sponges, but in exhibiting skeletons of large size, frayed lateral margins, and well-developed latilaminae, it shares certain resemblances with the nonspiculate Ordovician–Devonian labechiid stromatoporoids (and other stromatoporoids). The pulchrilaminids, however, differ morphologically in having a more loosely aggregated meshwork of skeletal elements, including slender, upwardly tapering, spinose rods that are spiculelike and may represent diagenetically altered styles. They therefore seem best regarded as a separate, independent group of hypercalcified sponges. Relationships with known spiculate sponge groups remain uncertain. Previously the family Pulchrilaminidae Webby, 1993, was doubtfully incorporated in the order Labechiida (Webby, 1993, 1994, 2004b; Webby in Stearn & others, 1999) but is excluded herein.

Bogoyavlenskaya (2001a, p. 46), adopted a different approach in introducing the order Protolabechiida to accommodate members of three families: the Lophiostromatidae Nestor, 1966a, Stratodictyidae Bogoyavlenskaya, 1977a, and Pulchrilaminidae Webby, 1993. But this is a heterogeneous grouping that bears little relation to the key morphological features of both pulchrilaminids and the other families. In this *Treatise* volume, the families Lophiostromatidae and Stratodictyidae are maintained as parts of the order Labechiida (see p. 709–754). Bogoyavlenskaya's family Stratodictyidae is recognized as a part of the family Labechiidae Nicholson, 1879b (based on genus *Stratodictyon* Webby, 1969), and a part of the family Rosenellidae Yavorsky in Khalfina & Yavorsky, 1973 (based on genus *Pseudostylodictyon* Ozaki, 1938, and its junior synonym *Parksodictyon* Bogoyavlenskaya in Bogoyavlenskaya & Lobanov, 1990), of the Labechiida. None of the characters used by Bogoyavlenskaya (2001a) to define the order Protolabechiida is diagnostic specifically of that order (for English translation of Bogoyavlenskaya's [2001a] diagnosis of order Protolabechiida, provided by Heldur Nestor, see p. 710). All listed morphological characters are present also in representatives of the order Labechiida. Consequently, the Protolabechiida is regarded in part as a junior synonym of the Labechiida. However, the family Pulchrilaminidae has fundamentally different diagnostic characters and must be separated from labechiids, including BOGOYAVLENSKAYA's two other protolabechiid families. The uniquely pulchrilaminid features are: (1) long, slender, spinose, spiculelike rods (usually erect but sometimes tilted) that characteristically protrude above tops of latilaminae into overlying mudrock, or more randomly spaced, oblique-to-erect threadlike elements; and (2) may, in localized areas (usually upper parts of latilaminae), combine in loosely aggregated meshworks with rows of finer, undulating cyst plates.

Family PULCHRILAMINIDAE Webby, 1993

[Pulchrilaminidae WEBBY, 1993, p. 58]

Characters as for order. [The pulchrilaminid skeleton is distinguished by its large size (commonly up to 300 mm in width and 500 mm in height), thin latilaminae, and mainly erect (in a few places tilted), slender, upwardly tapering, spinose (spiculelike) rods. The latilaminae vary from 0.1 to 3.0 mm in thickness and are characteristically bounded by growth interruptions, probably mainly caused by regular, episodic sedimentation events, resulting in the intercalated mudrock layers. The latilaminae are commonly frayed at lateral margins to give a markedly ragged appearance to the skeleton. Even the thinnest latilaminae (0.1–0.2 mm thick) were able to support the bases of long, slender, tapering, spinose rods in upright orientations, and they extend into overlying layers of mudrock (maintaining their orientation in the mud to a height of at least 0.5 mm) without much evidence of visible support (apart from a few wispy films of broken or incomplete cyst plates). Cyst plates generally are not well preserved in the *Pulchrilamina* skeleton, mainly occurring in localized areas near tops of latilaminae as rows of fine, closely spaced, undulating, platelike elements forming meshworks with the slender, upright, spinose rods. Only a few examples of rods tilted out of parallel alignments suggest that the overall structural meshwork of rods and cysts was rather weakly developed, with the cyst plates providing very limited support, unlike the larger, more compact and rigid skeletal frameworks of labechiid stromatoporoids. The intermingling, threadlike elements in some growth layers of *Zondarella* resemble the slender threads of a possible unnamed cyanobacterium (or possibly alga) that intergrew with the labechiid stromatoporoid *Cystostroma* in the Upper Ordovician Gordon Group, Tasmania (WEBBY, 1991, fig. 10a–c), which raises the possibility that *Zondarella* may have sometimes developed as an intergrowth of pulchrilaminid and cyanobacterial crusts. *Ianilamina* is another problematic genus that exhibits slender threadlike strands but differs in developing porous laminae]. *Lower Ordovician (upper Tremadocian)–Middle Ordovician (lower Darriwilian).*

Pulchrilamina TOOMEY & HAM, 1967, p. 983 [**P. spinosa* TOOMEY & HAM, 1967, p. 983, pl. 128,*1–4;* M; holotype, thin section, U.S. National Museum, Washington, no. USNM 155300, remains unfigured; three paratypes, USNM no. 155303, 155304, 155315, all longitudinal sections, have been figured (TOOMEY & HAM, 1967, pl. 128,*1–4*]. Large, strongly latilaminate, laminar, domical-to-columnar skeleton; latilaminae commonly ragged or frayed toward lateral margins, bounded top and bottom by growth interruptions, and alternating between wedges of mudrock; internally exhibit upwardly tapering long, slender, spinose (spiculelike) rods, characteristically protruding beyond tops of latilaminae into overlying mudrock; a few may be tilted out of an orderly, subparallel alignment; also, more localized rows of long, thin, low, undulating cyst plates may be preserved, forming meshworks in combination with the rodlike elements, but these appear, in a few places, to be rather loosely aggregated with some cyst plates not entirely fused to rods; in most areas, latilaminae are mainly replaced by spar, including crystalline calcite mosaics; no astrorhizae have been confirmed. *Lower Ordovician (upper Tremadocian–Floian):* Canada (Newfoundland), United States (Texas, Oklahoma), southern China (Guizhou, Hubei, Anhui).——FIG. 486*a–c*. **P. spinosa*; El Paso Group, McKelligon Canyon Formation, southern Franklin Mountains, western Texas, and Arbuckle Group, Kindblade Formation, Oklahoma; field photographs of outcrops showing growth form of skeletons; *a,* photograph of part of a reef mound, Kindblade Formation, dipping at 45° N, with exposure of individually

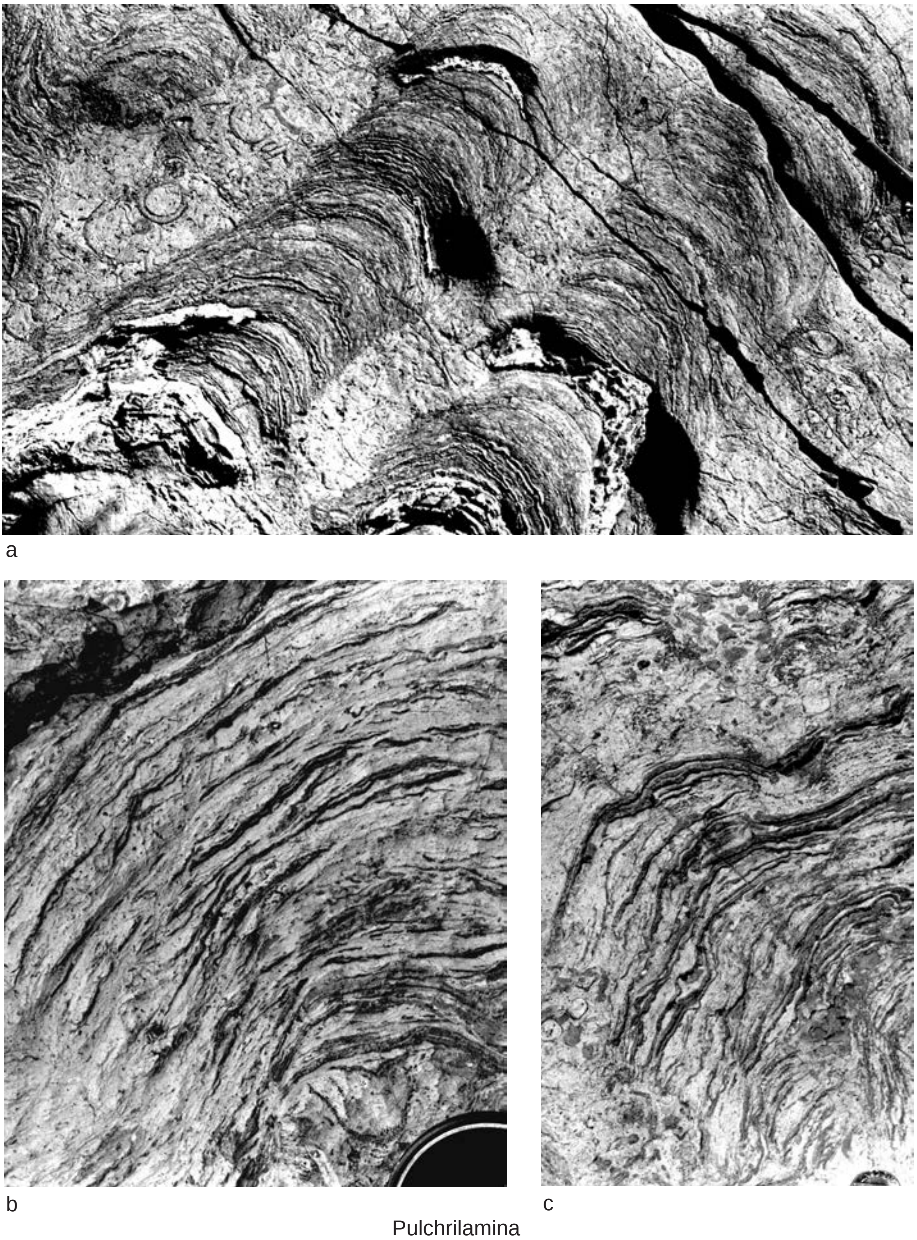


FIG. 486. Pulchrilaminidae (p. 838–841).

large *Pulchrilamina* skeletal mounds that exhibit a columnar shape and lateral margins that sometimes have a ragged appearance, but in other places have apparently been cut by narrow erosion channels and infilled by calcarenite deposits; structures exposed along Interstate Highway 35, southern Arbuckle Mountains, Oklahoma, ×0.24 (Webby, 2012a); *b,* more detailed characteristics of domical *Pulchrilamina* skeleton showing distinctive, slightly undulating laminae that appear to individually taper toward lateral margins of specimen (see area at lower left); exposed in reef mound, main biohermal interval, McKelligon Canyon Formation, southern Franklin Mountains, ×0.46 (Webby, 2012a); *c,* part

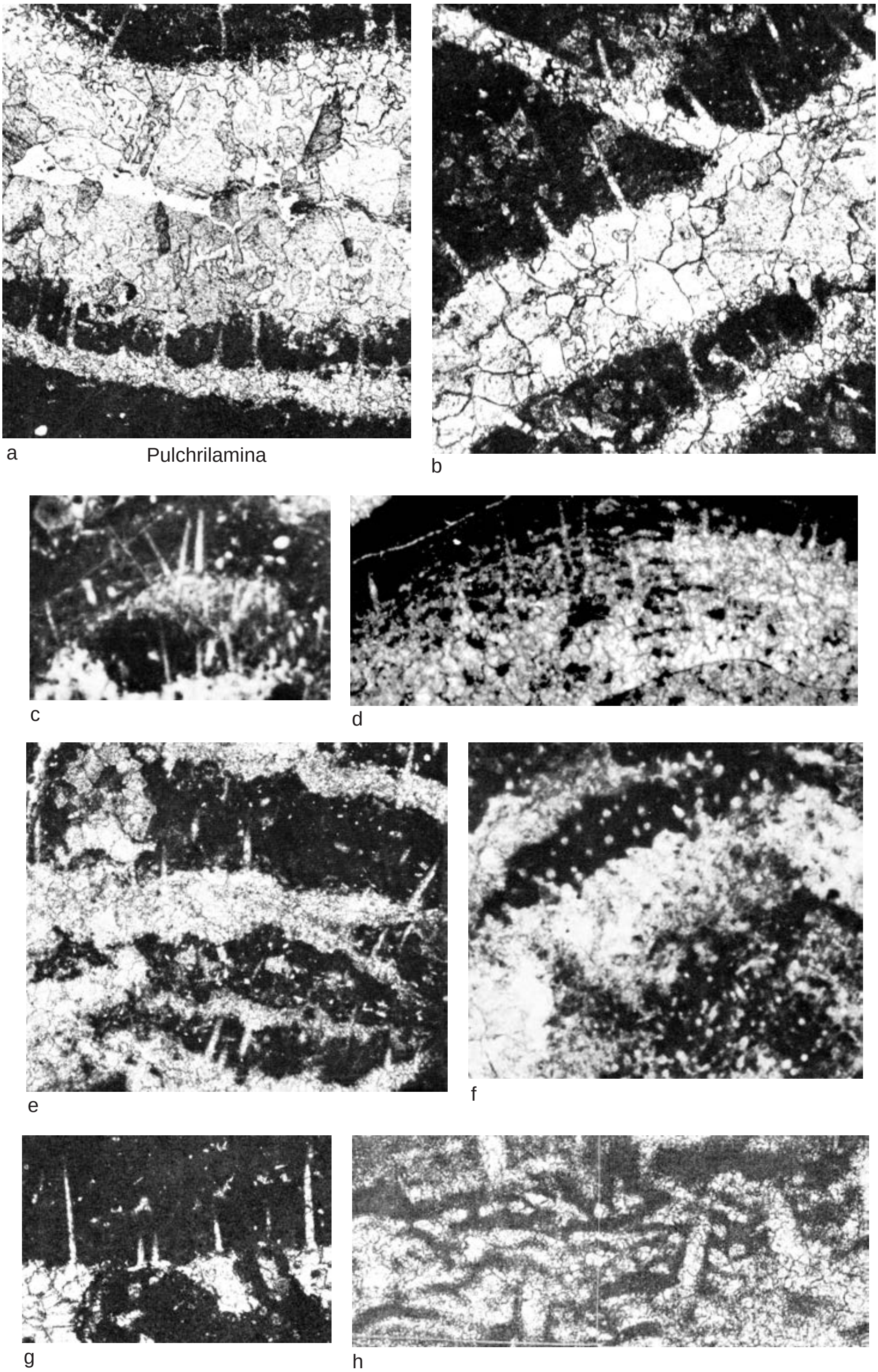


FIG. 487. Pulchrilaminidae (p. 838–841).

of domical *Pulchrilamina* skeleton, laminae (see area at lower left) on lateral margin appearing to be sharply truncated by an erosion channel; main biohermal interval, McKelligon Canyon Formation, southern Franklin Mountains, ×0.33 (for additional locality details, see TOOMEY & BABCOCK, 1983, p. 51–91, Stop 2) (Webby, 2012a).——FIG. 487*a–h*. **P. spinosa,* thin sections of type and other specimens; *a,* paratype, USNM 155315, ~137 m above base of Kindblade Formation, Mill Creek section, Arbuckle Mountains, Murray County, Oklahama, thin, lowermost, spar-filled latilamina and vertical spinose rods, continuous through a dark, mudrock inclusion into much thicker, overlying latilamina (completely replaced by mosaic calcite), ×20 (Toomey & Ham, 1967, pl. 128,*4*); *b,* paratype, USNM 155304, main mound section, lower part, McKelligon Canyon Formation, southern Franklin Mountains, western Texas, completely recrystallized main latilamina, and irregularly distributed, vertical, slightly tapering-upward, spinose rods that protrude upward into overlying mudrock, ×30 (Toomey & Ham, 1967, pl. 128,*3*); *c,* longitudinal section of specimen, MC-38-MB, D. V. LeMone collection, University of Texas, El Paso, McKelligon Canyon Formation, southern Franklin Mountains, divergent spinose rods, suggesting they formed in a loosely aggregated skeleton of weakly developed, very fine horizontal elements, unlike labechiid structures, ×20 (Webby, 1986, fig. 4B; reproduced with the permission of Oxford University Press: "Problematic Fossil Taxa," 1986, edited by A. Hoffman & M. H. Nitecki, p. 153, fig. 4B); *d,* longitudinal section, thin section no. PP22967, Toomey's collection, Field Museum of Natural History, Chicago, same horizon in Mill Creek section as view *a,* finely preserved meshwork of long, slender, spinose rods and undulating rows of long-low cyst plates in upper part of latilamina, ×40 (Webby, 1986, fig. 3E; reproduced with the permission of Oxford University Press: "Problematic Fossil Taxa," 1986, edited by A. Hoffman & M. H. Nitecki, p. 153, fig. 3E); *e,* longitudinal section of unnumbered specimen, mound horizon, lower portion of McKelligon Canyon Formation, southern Franklin Mountains, part of latilamina forking into two (right center of photo), and a markedly spinose rod that projects up into dark mudrock above upper splay of that latilamina (right center), ×20 (Toomey & Nitecki, 1979, fig. 12a; reproduced with permission of the Managing Editor of *Fieldiana,* Harold Voris, Field Museum of Natural History, Chicago); *f,* tangential section, thin section no. PP22845, Toomey's collection, Field Museum of Natural History, Chicago, mound horizon in lower part of McKelligon Canyon Formation, southern Franklin Mountains, showing round shapes of intersected spinose rods, ×20 (Webby, 1986, fig. 3C; reproduced with the permission of Oxford University Press: "Problematic Fossil Taxa," 1986, edited by A. Hoffman & M. H. Nitecki, p. 153, fig. 3C); *g,* longitudinal section of portion of paratype, USNM no. 155304, same horizon and locality as view *b;* very long, slender, upwardly tapering spinose rods from section of underlying latilamina that is only partially differentiated by spar-replacement structures (Toomey & Ham, 1967, pl. 128,*1*); *h,* enlarged longitudinal section of unnumbered specimen from same locality and horizon as view *e,* showing greater detail of meshwork of vertical rods (spar-replaced but not wall-less vertical structures) and undulating horizontal rows of variably sized cyst plates, from tiny vesicles to more moderately sized, elongate, low-convexity structures, ×80 (Toomey & Nitecki, 1979, fig. 13a; reproduced with permission of the Managing Editor of *Fieldiana,* Harold Voris, Field Museum of Natural History, Chicago.).

?Ianilamina PICKETT & ZHEN in ZHEN & PICKETT, 2008, p. 63 [**I. kirkupensis* PICKETT & ZHEN in ZHEN & PICKETT, 2008, p. 64, fig. 5A–H,J; M; Londonderry Geoscience Centre, Geological Survey of New South Wales, Australia, holotype, thin sections no. MMF29887a-b and five paratypes, MMF44870a-b, MMF35560a-b, MMF44875a-b, MMF44876, and MMF 44879; eight thin sections]. Skeleton laminar to broadly domical in shape, and composed of successive, comparatively thin latilaminae (incremental units) that are discontinuous laterally and subdivided into a lower part of thicker, poorly differentiated, vaguely meshwork-like areas of threadlike strands, flocculent structures and calcite spar replacement textures, and an upper part defined by a very thin, darker, densely porous lamina. In addition, succession of latilaminae may be interrupted by darker mudrock layers, lighter-colored spar-filled cavities and encrustations of organisms like cyanobacteria, sponges, and bryozoans. [The presence of porous laminae is not characteristic of other pulchrilaminid genera; therefore, the genus is only doubtfully referred to the group. Other features of *Ianilamina* are similar to *Zondarella*; however, *Zondarella* shows a few traces of very fine, rounded, dotlike shapes suggestive of spinose rods, but these still require to be positively confirmed; see further discussion of *Ianilamina* in PICKETT and ZHEN (in ZHEN & PICKETT, 2008, p. 64, 66)]. *Middle Ordovician (lower Darriwilian):* Australia (New South Wales).——FIG. 488*a–f*. **I. kirkupensis;* limestone lens from base of Goonumbla Volcanics, Kirkup property, near Gunningbland, central New South Wales; *a–c,* paratype MMF 44875a, longitudinal section showing different enlargements of the same thin section; *a,* general view of domical skeleton with extensive, thin latilaminae that encrusts an anthaspidellid sponge (lower right), ×1.2 (Zhen & Pickett, 2008, fig. 5B); *b,* enlarged view of upper right part of view *a* showing successive latilaminae with a mainly dark flocculent appearance, except where capped by even darker, crustlike laminae and in an area near the middle where latilaminae have been largely replaced by lighter sparry calcite infills, ×6.8 (Zhen & Pickett, 2008, fig. 5E); *c,* detailed view of small area in upper left part of view *b* showing regular latilaminar elements but may

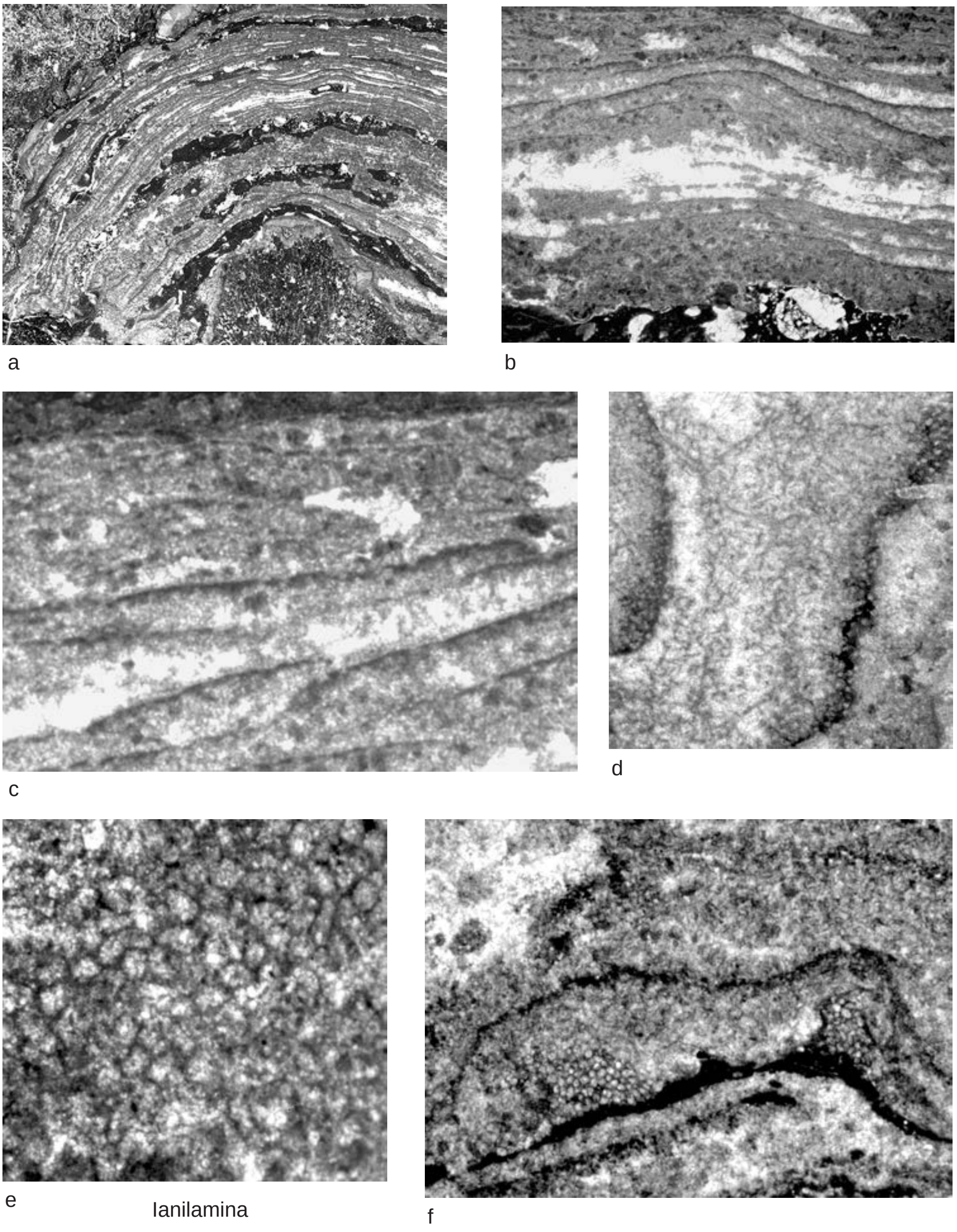


FIG. 488. Pulchrilaminidae (p. 841–843).

have only limited lateral continuity, as shown by a number of terminations where an upper lamina curves downward to a meet an underlying lamina abruptly; each crustlike lamina commonly exhibits a row of very small disruptions that represent pores; vaguely threadlike strands are only shown in a few small areas within latilaminae, whereas irregular, elongated areas with sparry calcite replacements are more common, ×16.7 (Webby, 2012a); *d,* oblique-tangential section of paratype MMF 44875b through a latilamina showing porous laminae along latilaminae boundaries and threadlike to vaguely cellular elements within the body of central latilaminar unit, ×8 (Zhen & Pickett, 2008, fig. 5F); *e,* tangential section of holotype MMF 29887b, illustrating details of the pores within a

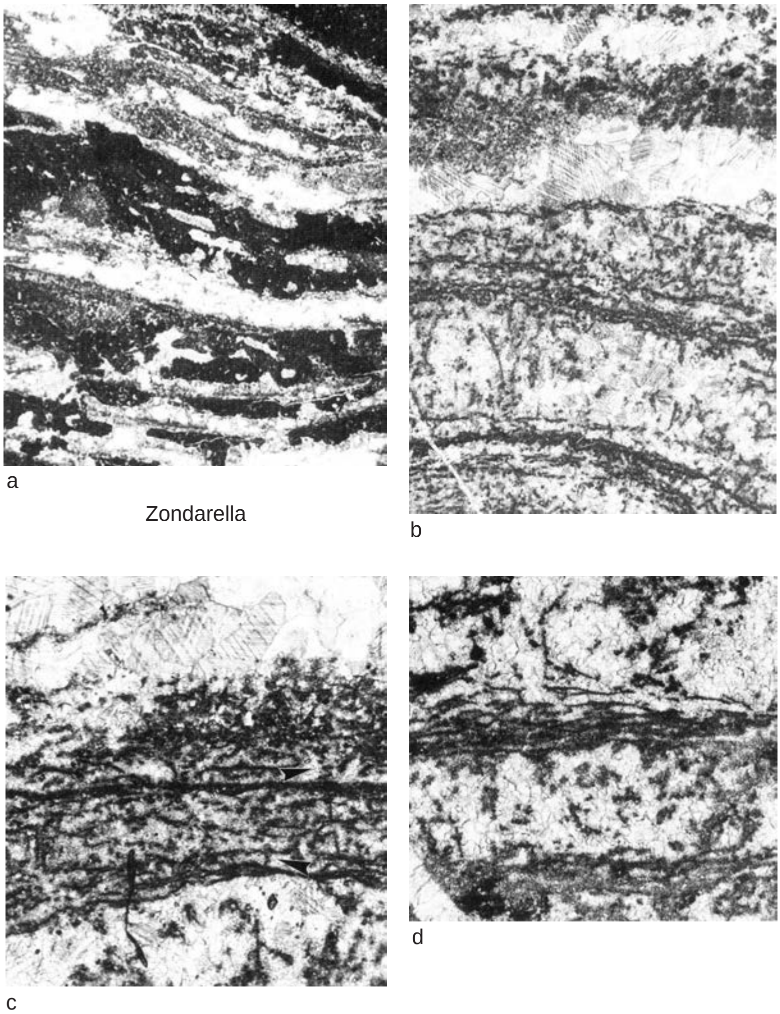


FIG. 489. Pulchrilaminidae (p. 843–844).

single lamina, ×40 (Zhen & Pickett, 2008, fig. 5J); *f,* longitudinal view of paratype MMF 44876 showing two small encrusting, rounded to irregular possible bryozoan colonies that grew above a dark mudrock sliver between underlying and overlying latilaminae of *Ianilamina,* ×10 (Zhen & Pickett, 2008, fig. 5G).

Zondarella KELLER & FLÜGEL, 1996, p. 188 [**Z. communis* KELLER & FLÜGEL, 1996, p. 188, pl. 47,*1,7,9;* pl. 48,*1–3;* M; Institute of Paleontology, University of Erlangen, Germany, no. RA 641; no illustrations of types or other material have yet been illustrated in tangential section]. Large, mainly domical to laminar skeleton characteristically composed of stacked, sheetlike growth layers, in places simulating latilaminae; both irregularly undulating, horizontal dark laminae, sometimes recognizable as less continuous discrete, elongated low convexity cyst plates or less continuous horizontal, spaced-out rows of colliculi-like rods, and more localized, randomly spaced, intermingling, oblique-to-vertical, threadlike elements (possibly rods) may occur and may alternate with bands filled with calcite spar and/or darker mudrock matrix. [Photos of tangential sections of specimens of *Z. communis* from the type locality (kindly provided courtesy of Marcelo Carrera, Córdoba, Argentina in 1999, 2008) show a pattern of very fine, rounded, dotlike shapes representing probable rods. Compared with the dotlike appearance of spinose rods in *Pulchrilamina spinosa* (see tangential section: Fig. 2*f*), these are much finer (about half the diameter), and they are more closely spaced]. *Middle*

Ordovician (Dapingian): Argentina (Precordillera), Canada (?Newfoundland).——FIG. 489*a–d.* **Z. communis*; upper San Juan Formation, Las Lajas section, 24 km southwest of San Juan, Argentine Precordillera; *a,* holotype, longitudinal section, showing nature of latilaminate growth layers and a number of intercalations of dark layers composed of sedimentary matrix, ×3.5 (Keller & Flügel, 1996, pl. 47,*7*); *b,* holotype, longitudinal section, contrasting zones of horizontal laminar and intermingling, oblique-to-vertical skeletal features in lower to middle parts, and zones of largely coarse, recrystallized sparite and fine matrix in the upper part, ×8.5 (Keller & Flügel, 1996, pl. 47,*9*); *c,* holotype, longitudinal section, showing more continuous dark lines bounding latilaminae, and incomplete, slightly undulating laminae that are interrupted by a few short vertical elements (*small arrowheads*) within the latilaminae, ×16 (Keller & Flügel, 1996, pl. 48,*1*); *d,* longitudinal section, specimen no. RA 542, *Z. communis,* Los Berros section, San Juan Formation; darker bands showing well-defined, elongated, low-convexity cyst plates, ×16 (Keller & Flügel, 1996, pl. 47,*2*).

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