Part F

COELENTERATA

SUPPLEMENT 1

RUGOSA AND TABULATA

By DOROTHY HILL

Volume 2

[For table of contents see Volume 1, p. F1-F4]

Suborder LITHOSTROTIONINA Spasskiy & Kachanov, 1971

[Lithostrotionina SPASSKIY & KACHANOV, 1971, p. 48]

Compound Stauriida; commonly with axially somewhat thickened lathlike columella continuous in early stages with cardinal and counter septa but later commonly with counter septum only; tabular floors conical; tabulae complete or incomplete; diphymorphs in which columella fails and tabulae flatten are common, some develop an aulos; dissepimentarium commonly normal, concentric with subglobose dissepiments, and minor septa commonly continuous longitudinally; cardinal fossula not distinct. *Carb.-Perm.*

Family LITHOSTROTIONIDAE d'Orbigny, 1852

[Lithostrotionidae D'ORBIGNY, 1852, p. 184] [=Nematophyllinae McCOY, 1851b, p. 33; Stylaxidae DE FROMENTEL, 1861, p. 74, 313 (*nom. correct.* HILL, herein, *ex* Stylaxinidae GERTH, 1921, p. 69, *et* Stylaxiniens DE FROMENTEL, 1861, p. 74, 313); Diphyphyllidae DYBOWSKI, 1873c, *nom. transl.* GRABAU, 1936, p. 43, *ex* Diphyphyllinae DYBOWSKI, 1873c, p. 332; Lithostrotiontidae SMITH, 1917, p. 294; Lithostrotionicae, *nom. transl.* IVANOVSKIY, 1965a, p. 53]

Fasciculate or massive; commonly with axially somewhat thickened lathlike columella continuous in early stages with both cardinal and counter septa but in later stages with counter septum only; tabular floors conical, tabulae complete or incomplete; dissepimentarium commonly of normal concentric small plates with minor septa commonly longitudinally continuous; cardinal fossula not distinct. *L.Carb.-L. Perm.*

Subfamily LITHOSTROTIONINAE d'Orbigny, 1852

[*nom. transl.* HILL, herein, *ex* Lithostrotionidae D'ORBIGNY, 1852, p. 184] [=Nematophyllinae McCOY, 1851b, p. 33; Stylaxidae DE FROMENTEL, 1861, p. 74, 313 (*nom. correct.* HILL, herein, *ex* Stylaxinidae GERTH, 1921, p. 69, *et* Stylaxiniens DE FROMENTEL, 1861, p. 74, 313)]

Fasciculate or massive Lithostrotionidae with columella lenticular in section and commonly continuous with counter septum in late stages, with conical, complete or incomplete tabulae and with normal concentric dissepimentarium; diphymorphic corallites may occur; cardinal fossula indistinct. *L.Carb.-?L.Perm.*

Lithostrotion FLEMING, 1828, p. 508 [**L. striatum*; SD ICZN, Opin. 117; †1870.14.370, missing from FLEMING Coll., RSM, Edinburgh; lectotype by ?THOMSON, 1887, p. 377 and KATO, 1971, p. 2; L.Carb., Brit. I.] [=*Lithostrotium* AGASSIZ, 1846, p. 214, *nom. van.*, ICZN 1957, Dir. 76; *Nemaphyllum* McCOY, 1849, p. 15 (type, *N. arachnoideum*, SD MILNE-EDWARDS & HAIME, 1850, p. lxxi; †A2400, SM, Cambridge, lectotype by HUDSON, 1930, p. 97; L.Carb., Derbyshire); *Stylaxis* McCOY, 1849, p. 119 (type, *S. flemingi*, SD LANG, SMITH, & THOMAS, 1940, p. 127; †A2051, SM, Cambridge, lectotype here chosen; L.Carb., Derbyshire); *Lasmocyathus* D'ORBIGNY, 1849, p. 12 (type, *Astraea aranea* McCOY, 1844, p. 187, M; †81.1925 and slides 50.1926 and 51.1926, GRIFFITH Coll., NM, Dublin; L.Carb., Ire.); *Lithostrocion* D'ORBIGNY, 1850, p. 159, *nom. null.*; *Nematophyllum* MILNE-EDWARDS & HAIME, 1850, p. lxxi, *nom. van.*; *Lithostrontion* HALL, 1852b, p. 408, *nom. null.*; *Lithostrocian* THOMSON, 1881, p. 223, *nom. null.*; *Cystistrotion* SCHINDEWOLF, 1927, p. 149 (type, *Lithostrotion (Cystistrotion) paeckelmanni*, OD; †La343, ZGI, E. Berlin; L. Carb., quarry on Schälk-Letmathe road, Westphalia, Ger.); *?Cionodendron* BENSON & SMITH, 1923, which see]. Cerioid; increase lateral; corallites with columella thinly lenticular in transverse section, continuous with both counter and cardinal septa or with counter septum only; other major septa may be connected with columella by septal crests on upper surfaces of tabulae; minor septa short to long, dissepimentarium normally concentric, lonsdaleoid dissepiments rare to absent;

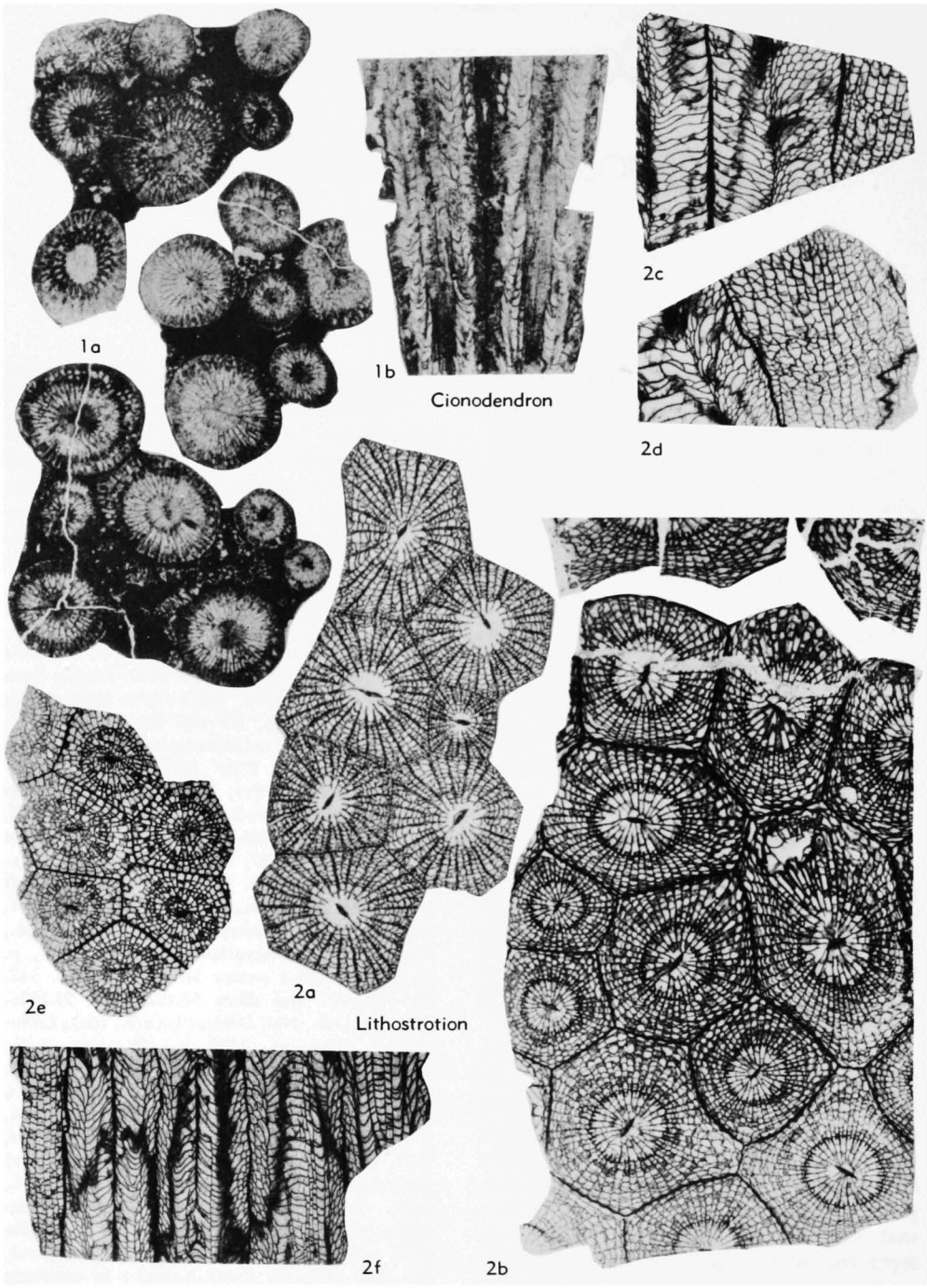


FIG. 248. Lithostrotionidae (p. *F379-F381*).

tabular floors conical, tabulae complete or incomplete when tabellae are commonly in only indistinctly bounded axial and periaxial zones; diphymorphic corallites may occur in which columella fails and tabulae become domed or flat. *L.Carb.-U.Carb.(Visean-Namur.)*, Eu.(Brit.I.-France-Belg.-

Ger.-Pol.-USSR)-N. Afr. (W. Sahara-Alg.)-Asia (Kazakh.-Taymyr-Indoch.-China-Japan-NE.USSR)-Australia(Queensl.-New S.Wales); *U.Miss.(Meramec.)*, N.Am.(?Ore.-Alaska).——Fig. 248,*2a*. **L. striatum*, lectotype, L.Carb., Brit. I.; transv. sec., ×1.9 (Thomson, 1887).——Fig. 248,*2b-d*. *L. arachnoideum* (McCoy), lectotype, Eng., Derbyshire; *b-d*, transv., long. secs., ×1.9 (Hill, n).——Fig. 248,*2e,f*. *L. flemingi* (McCoy), lectotype, Eng., Derbyshire; *e,f*, transv., long. secs., ×1.9 (Hill, n).

Akiyosiphyllum Yabe & Sugiyama, 1942, p. 574 [**A. stylophorum*; M; †65033, TohU, Sendai] [?=*Cionodendron* Benson & Smith, 1923, which see; *Akiyoshiphyllum* Yamagiwa, 1961, p. 109, *nom. van.*]. Fasciculate; corallites slender, with broad, dense columella, with traces of median lamella in counter-cardinal plane, and of tabellar structures; major septa thin in tabularium and extending to columella; minor septa dilated to form imperfect peripheral stereozone with some interseptal loculi containing wide, horizontally based dissepiments; tabular floors conical, of numerous tabellae in places penetrating columella [see Minato, 1955, p. 167]. *L.Carb.(Visean)*, Asia(Japan). [Originally considered of Permian *Yabeina* Zone, subsequently (Minato & Kato, 1957, p. 544) of *Nagatophyllum satoi* Zone of Visean age (Yanagida, 1973, p. 48).]——Fig. 249,*3a-e*. **A. stylophorum*, holotype, Yamaguchi Pref., Ohkubo, Mine-gun; *a,b*, transv., long. secs., ×3.0, *c-e*, transv. secs. columella, enl. (Minato, 1955).

Cionodendron Benson & Smith, 1923, p. 165 [**C. columen*; OD; †F51457 and slides AM1137-8, AM, Sydney with parts R21999-22001, BM(NH), London and F45551, UQ, Brisbane] [?=*Lithostrotion* Fleming, 1828, which see; *?Akiyosiphyllum* Yabe & Sugiyama, 1942, which see]. Fasciculate, corallites slender; with large dense columella consisting of short median plate and thickened axial ends of major septa; tabellae between columella and dissepimentarium trough-like; major and minor septa may be so thickened in dissepimentarium that many interseptal loculi are closed. [Only one specimen known; see Jull, 1969b, p. 122.] *L.Carb.(Visean)*, Australia(New S.Wales).——Fig. 248,*1a,b*. **C. columen*, monotype, New S. Wales, Slaughterhouse Cr., near Gravesend; *a,b*, transv., long. secs., ×2.9 (Benson & Smith, 1923).

Orionastraea Smith, 1917, p. 294 [**Sarcinula phillipsi* McCoy, 1849, p. 125; OD; †A2188, SM, Cambridge; lectotype by Smith, 1917, p. 295]. Astreoid, thamnasterioid, or aphroid; major and minor septa long, may be discontinuous toward periphery; columella formed by dilatation and upgrowth of axial end of long counter septum, may be mainly absent in diphymorph species; tabulae conical, complete or incomplete; dissepiments small, normal except peripherally in aphroid forms [see Hudson, 1929, p. 441]. *L.Carb.(Visean)*, Eu. (U. K.-Eire-Urals-N. Zemlya-Russ. Platf. - Donbas) - Asia (Japan - Hansu) - Australia (Queensl.-New S.Wales); *?L.Perm.*, N.Am.(Nev.).——Fig. 249,*4a,b*. **O. phillipsi* (McCoy), Visean, U.K., Corwen, N. Wales; *a,b*, transv., long. secs., ×4, ×2 (Hudson, 1929).

Schoenophyllum Simpson, 1900, p. 214 [**S. aggregatum*; OD; syntypes 314-315, NYSM, Albany; lectotype by Easton, 1957, p. 618] [?=*Paralithostrotion* Gorskiy, 1938, Lonsdaleiina, Petalaxidae]. Phaceloid, corallites slender, cylindrical, and anchored laterally to one another by slender, ascending processes; increase ?lateral, nonparricidal; septa few, minor septa merely ridges on wall; counter septum very long, with axial end enlarged to form lathlike columella; one longitudinal series of dissepiments; tabulae horizontal, or very low cones. [See Easton, 1957, p. 616; possibly petalaxid.] *Miss.*, N.Am.(Ky.-Ind.-Alberta-B.C.).——Fig. 249, *2a,b*. **S. aggregatum*, Meramec., St. Louis Ls., Ky., Glasgow Junction, Barren Co.; *a,b*, transv., long. secs., enl. (Simpson, 1900).

Siphonodendron McCoy, 1849, p. 127, diagnosed and figured but no species named [**S. aggregatum* McCoy, 1851b, p. 108; SD Chi, 1931, p. 26; invalid *nom. subst. pro Lithodendron pauciradialis* McCoy, 1844, p. 189; †82.1925, Griffith Coll., NM, Dublin; lectotype by Hill, 1938-1941, p. 169; L.Carb., Lower Limestone, Magheramore, Tobercurry, Co. Sligo, Eire] [=*Cystidendron* Schindewolf, 1927, p. 149 (type, *Lithostrotion (Cystidendron) kleffense*, OD; †La178, ZGI, E. Berlin; L.Carb., Kleff, Ger.; tabulae incomplete, tabellae in indistinctly bounded axial and periaxial zones); *?Stylostrotion* Chi, 1935, p. 20 (type, *S. intermedium*, OD; †5991, IGP, Nanking; M.Carb., Weining., Taloshan, Szumenshu, Kwangsi)]. Fasciculate; increase predominantly lateral; corallites with columella thinly lenticular in transverse section, continuous with both counter and cardinal septa or with counter septum only; major septa may be connected with columella by crests on upper surfaces of tabulae; minor septa short to long; tabular floors conical, tabulae complete or incomplete when tabellae are commonly in only indistinctly bounded axial and periaxial zones; dissepimentarium normally concentric; diphymorphic corallites in which columella fails and tabulae become domed or nearly flat may occur within normal coralla; cardinal fossula not distinct. *L.Carb.-U.Carb.(Visean-Namur.)*, Eu. (Brit. I.-Belg.-France-Ger.-Pol.-USSR)-N. Afr. (W. Sahara-Alg.)-Asia (Turkey-E. Urals-Kazakh.-Kuzbas - Tibet - China - Indoch. - Japan - Taymyr - NE.USSR)-Australia(Queensl.-New S.Wales); *U. Miss.(Meramec.-Chester.)*, N.Am.(E.USA-W.USA-W.Can.-Alaska); *U.Carb.*, Eu.(USSR-Czech.)-Asia (China).——Fig. 249,*1a-c*. **S. pauciradiale* (McCoy), lectotype; *a,b*, ext. views, ×1; *c*, transv. sec., ×2 (Hill, 1938-1941).——Fig. 249,*1d,e*. *S.*

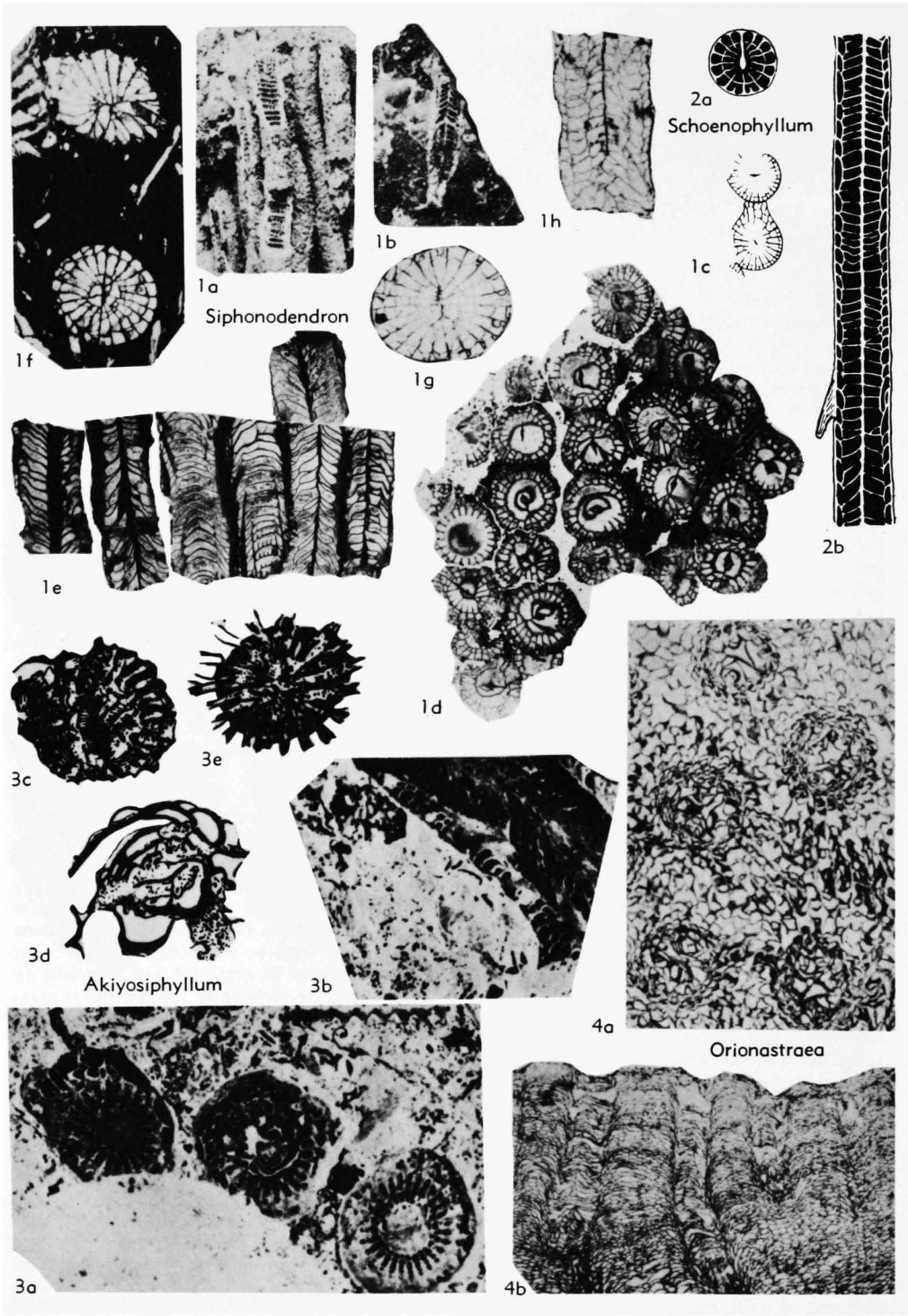


FIG. 249. Lithostrotionidae (p. *F*381-*F*383).

aggregatum, L.Carb., D_2, Merionethshire, Corwen; *d,e*, transv., long. secs., ×2 (Hill, n; A1996, SM, Cambridge).——Fig. 129,*1f-h*. *?S. intermedium* (Chi), holotype; *f-h*, transv., long. secs., ×3 (Chi, 1931).

Subfamily DIPHYPHYLLINAE Dybowski, 1873

[Diphyphyllinae Dybowski, 1873c, p. 332]

Fasciculate; weak axial structure sporadically present, either lathlike columella or few, thin, short septal lamellae; tabular floors domes upturned peripherally or mesas, and commonly formed by axial and periaxial series of tabellae; major septa longitudinally continuous to edge of axial series of tabellae, amplexoid adaxially; minor septa short, dissepimentarium regular, commonly narrow and without lonsdaleoid dissepiments; cardinal fossula inconspicuous. *L.Carb.-L. Perm.*

Diphyphyllum Lonsdale, 1845, p. 624 [**D. concinnum*; M; †neotype, 2, coll. 486, IGG, Novosibirsk; by Ivanovskiy & Shurygina, 1975, p. 17; meanwhile, figured syntype, 49470, has been rediscovered in BM(NH), London] [=*Depasophyllum* Yü, 1934, p. 85 (type, *Diphyphyllum (Depasophyllum) hochangpinense* Yü, 1934, p. 86, SD Smith & Thomas in Thomas, 1956, p. 181; †5012, Tien Coll., IGP, Nanking), *non Depasophyllum* Grabau, 1936, p. 43, Stauriina, Pycnostylidae, see Ehlers & Stumm, 1949, p. 30; *?Opiphyllum* Kozyreva, 1973, which see]. Phaceloid, increase peripheral, one to four offsets arising from the one parent calice; tabular floors mesas or domes with upturned edges, commonly in two series of tabellae, an axial series of flat or low-domed plates whose edges may rest on the next below, and a periaxial series of smaller tabellae; axial ends of major septa commonly abutting on discontinuous expanding and contracting wall formed by downturned parts of axial tabellae, and amplexoid in axial zone; occasional traces present of lathlike columella that may be thinly lenticular in transverse section; dissepimentarium with minor septa and normal concentric dissepiments, or in places in some, not developed [see Ivanovskiy & Shurygina, 1975, p. 17]. *L.Carb.-U.Carb.(Visean-Namur.)*, Eu.(Brit.I.-Belg.-Russ.Platf.-Donbas-N. Zemlya-Urals)-N. Afr. (W. Sahara)-Asia (E. Urals-Kazakh.-Kirghiz.-Asia M.-China-Japan)-Australia (New S.Wales)-N.Am.(Alberta-Alaska).——Fig. 250,*1a,b*. *D. fasciculatum* (Fleming), holotype, D_2, Merionethshire, Corwen; *a,b*, long., transv. secs., ×2.7 (Smith & Lang, 1930).——Fig. 250, *1c,d*. *D. lateseptatum* (McCoy), D_2, Corwen, Hafod-y-Calch; *c,d*, transv., long. secs., ×2.7 (Smith & Lang, 1930).——Fig. 250,*1e-j*. **D. concinnum; e-g,i,j*, neotype, base up. Visean, USSR, R. Islet near Kamensk-Uralsk, Chiriev Ravine, *e-g*, transv., *i,j*, long. secs., ×2.7 (Hill, n; IGG 486/2, photographs courtesy A. B. Ivanovskiy); *h*, figured syntype, L.Carb., E. Urals, Chirev, Kamensk, on R. Iset, long. sec., ×2.7 (Hill, n; BM(NH)49470, photograph courtesy of the British Museum (Natural History), London).

Kwangsiphyllum Grabau & Yoh in Yoh, 1931, p. 79, *nom. subst. pro Syringophyllum* Grabau & Yoh in Yoh, 1929b, p. 2, *non Syringophyllum* Milne-Edwards & Haime, 1850, a tabulatan [**Syringophyllum permicum* Grabau & Yoh in Yoh, 1929b, p. 2; OD; †not traced]. Fasciculate; corallites slender, in type species with connecting tubuli; with thin wall, short ?trabeculate major septa, rudimentary minor septa and complete tabulae; horizontal in center but with peripheral trough; sporadic dissepiments in some. [Insufficiently known; may be diphymorphic *Lithostrotion junceum, fide* Kato, 1971, p. 7.] *L.Carb.(Visean)*, Asia(Kwangsi).——Fig. 251,*4a,b*. **K. permicum*, syntype, Fengnin. (*fide* Yü, 1937, p. 47, 56), northern Kwangsi Prov., 1 li SW. of Ho-Mu-Shih, Jung Hsien; *a,b*, transv., long. secs., ×2.0 (Yoh, 1929b).

Nemistium Smith, 1928, p. 114 [**N. edmondsi*; OD; †R.25488 and 25489, BM(NH), London]. Phaceloid, with peripheral increase; with an axial structure of strongly arched axial tabulae each resting on the arch below, and, irregularly present, irregular septal lamellae; periaxial tabulae abut axial structure, somewhat declined to narrow dissepimentarium of small plates; major and minor septa present, axial ends of major septa abutting axial structure. *L.Carb.(up.Visean)*, Eu.(Eng.-Wales-USSR)-?Asia(Kazakh.).——Fig. 251,*1a,b*. **N. edmondsi*, Eng., *a*, Ward Hall East Quarry near Aspatria, W. Cumberland; transv. sec., ×2.0; *b*, Eskett Quarry, near Winder Railway Station; long. sec., ×2.5 (Smith, 1928).

Opiphyllum Kozyreva, 1973, p. 130 [**O. fomitchevi*; OD; †194, coll. 14, DPI, Donetsk] [?=*Diphyphyllum* Lonsdale, 1845, which see]. Fasciculate; tabularium wide with impersistent thin lathlike irregular columella and commonly with mesa-shaped tabulae that may sag slightly axially and may have their downturned edges resting on tabula next below or slightly upturned again to meet narrow, concentric dissepimentarium in which are short minor septa; axial ends of major septa withdrawn from axis or amplexoid above tabular platforms; cardinal fossula inconspicuous. *U.Carb.(Bashkir.)*, Eu.(USSR).——Fig. 251,*3a,b*. **O. fomitchevi*, holotype, horizon b_4, Dontsovka, borehole no. 117 at depth 369.4-369.8 m., Voronesh anteclise; *a,b*, transv., long. secs., ×2.0 (Kozyreva, 1973).

Tschussovskenia Dobrolyubova, 1936a, p. 48 [**T. captiosa*; OD; †330, coll. 4765, TsGM, Leningrad]. Fasciculate; corallites with impersistent axial structure of short, irregular septal lamellae, low-domed or mesa-shaped tabulae with peripheral edges

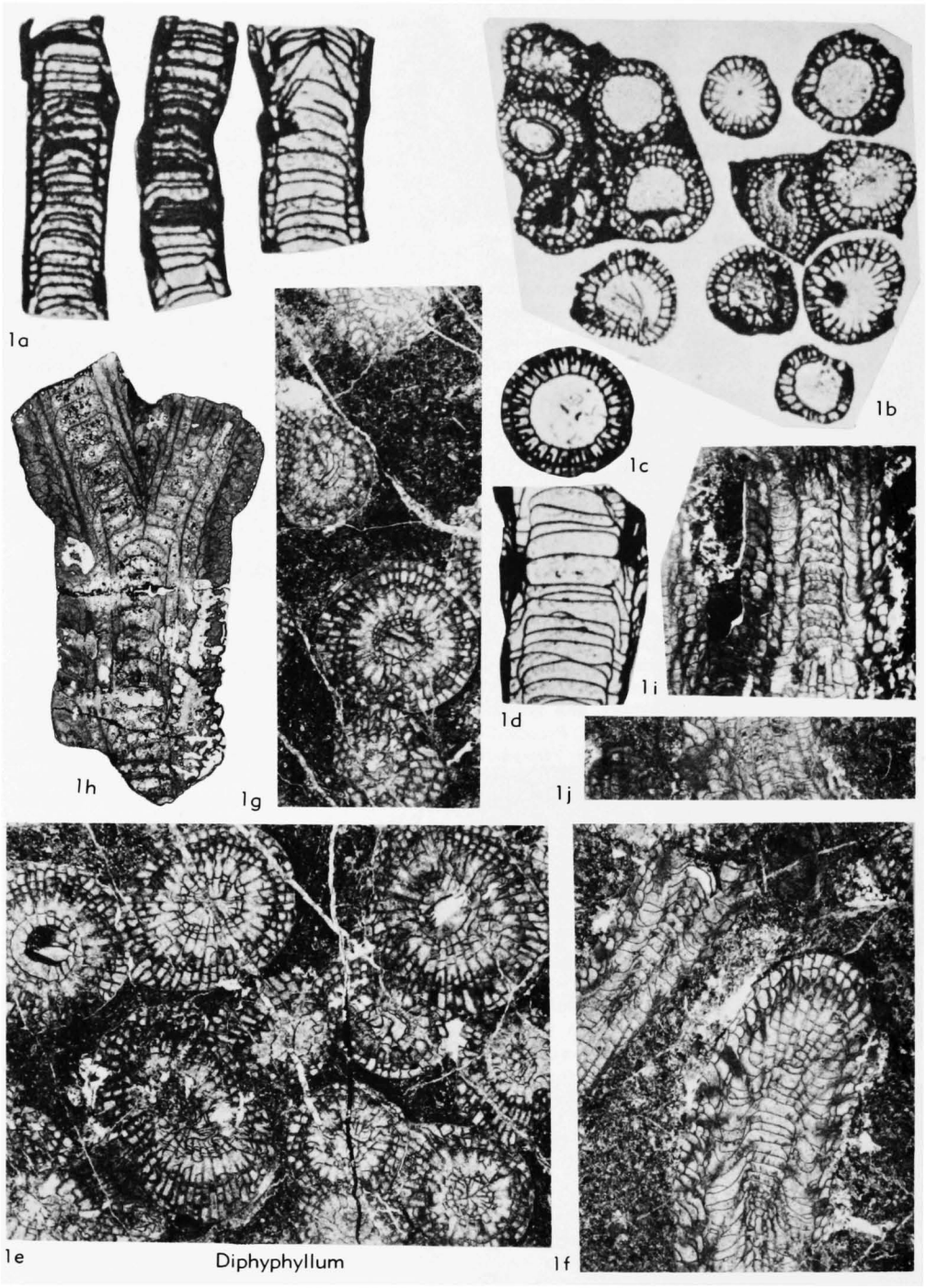


FIG. 250. Lithostrotionidae (p. *F*383).

resting on tabula next below or more commonly reaching dissepimentarium which is very narrow and commonly of one series of small plates with short minor septa; supplementary periaxial tabellae may occur; major septa withdrawn from axis, inner ends resting on tabulae at their change of

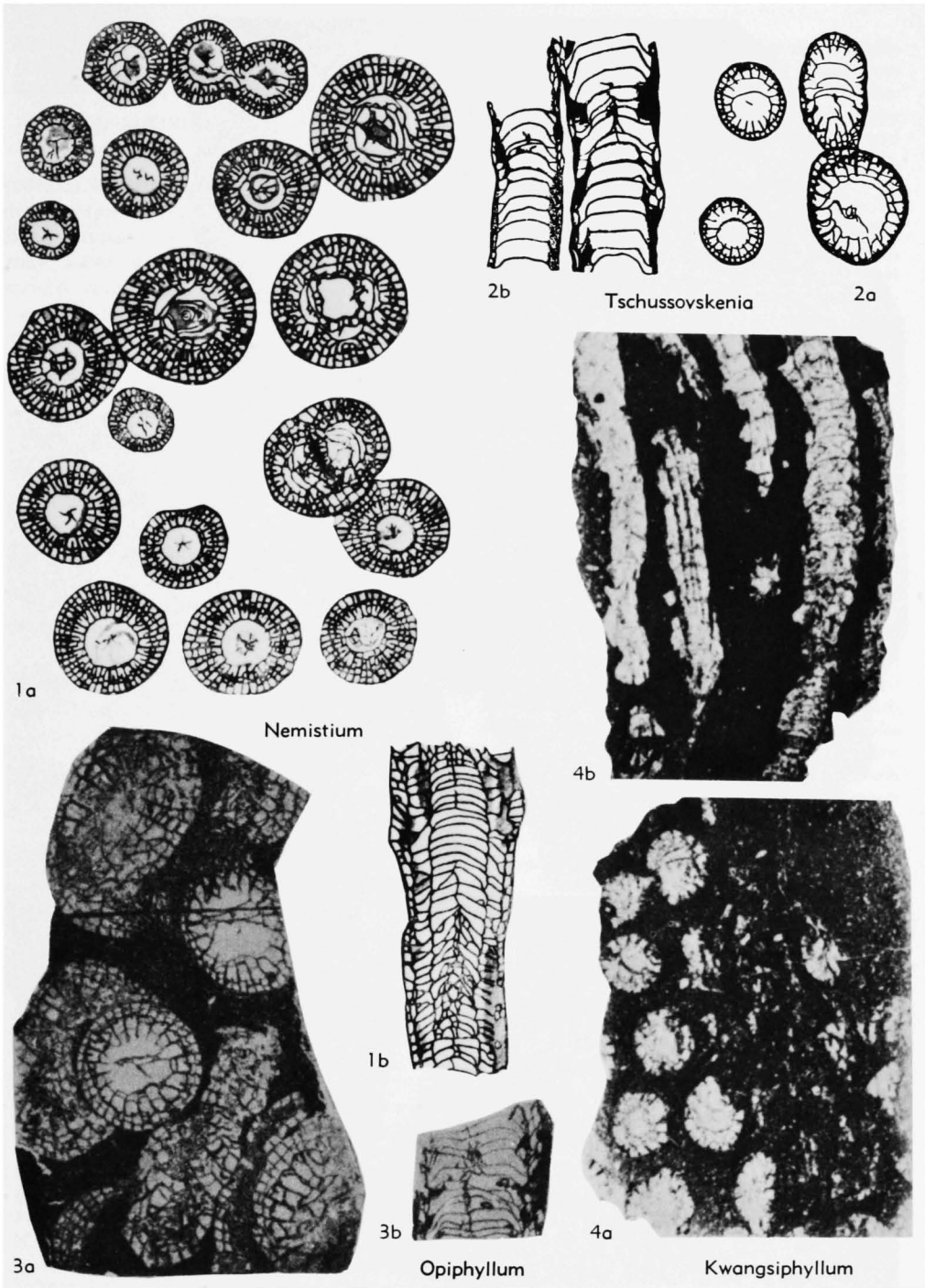


FIG. 251. Lithostrotionidae (p. *F*383-*F*387).

slope. *U. Carb.-L. Perm.,* Eu. (C. Urals-N. Urals-Spits.)-?Asia(Viet Nam-Japan).——FIG. 251,*2a,b*.

**T. captiosa,* holotype, U.Carb.(?Gshel.), W. slope C. Urals, Verkhne Chusovskie borehole no. 2 at

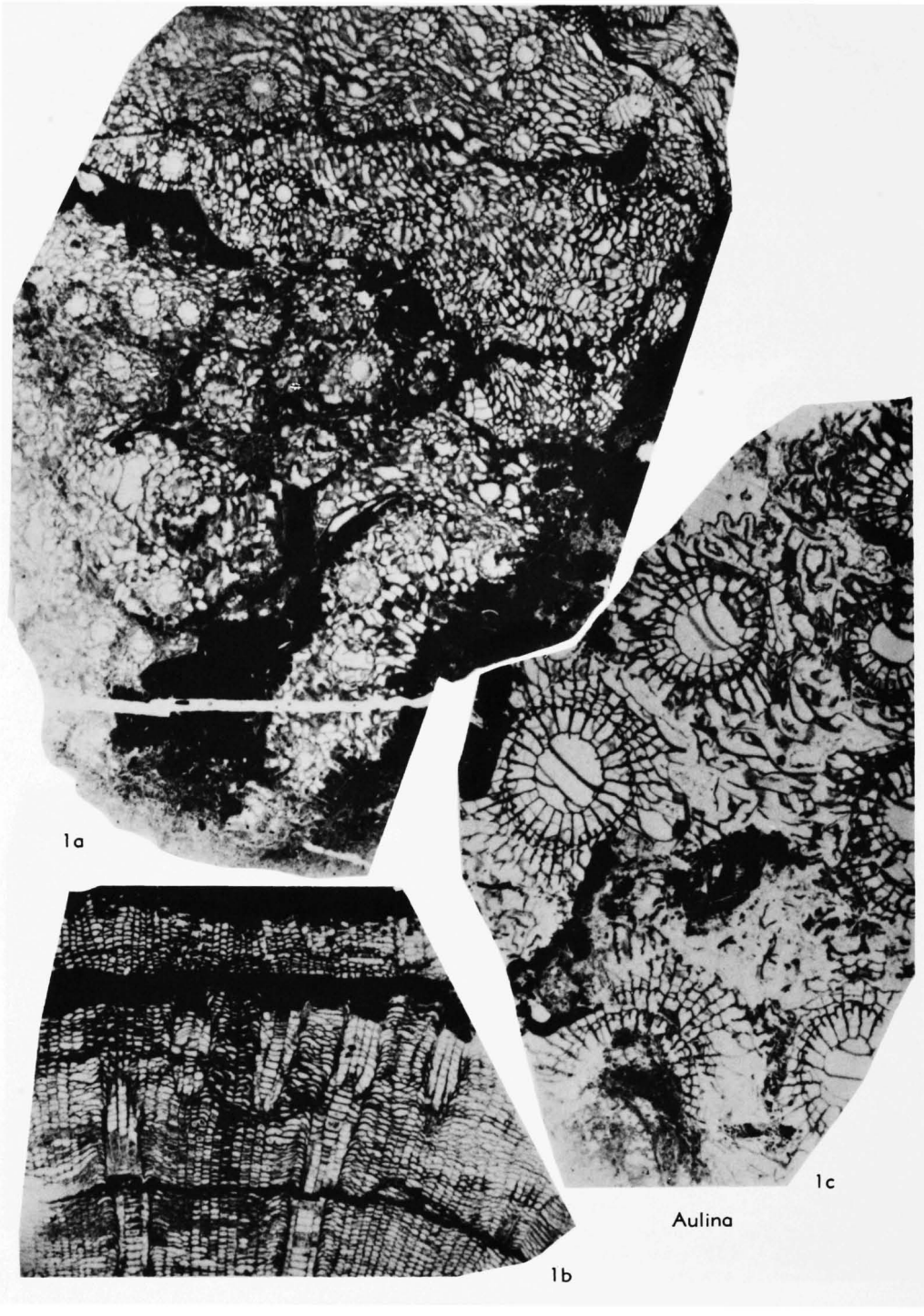


FIG. 252. Lithostrotionidae (p. *F387*).

depth 922.1 m.; *a,b,* transv., long. secs., ×1.5 (Dobrolyubova in Soshkina, Dobrolyubova, & Kabakovich, 1962).

Subfamily AULININAE Hill, new subfamily

Fasciculate or massive; axial structure a more or less regular cylindrical aulos; septa thin, major reaching aulos; aular tabulae flat; periaular tabulae declined abaxially, may have upturned edges; dissepimentarium commonly regular with concentric small dissepiments, but lonsdaleoid in places in some; cardinal fossula inconspicuous. *L.Carb.(Dinant.)-U.Carb.(Namur.).*

Aulina Smith, 1917, p. 290 [**A. rotiformis*; OD; †R17497, BM(NH), London, and parts A1801-2, A2406, SM, Cambridge] [=*A. (Pseudoaulina)* Minato & Rowett, 1967b, p. 389 (type, *A. senex* Hill, 1940 in 1938-1941, p. 193, OD; †ZNI in Neilson Coll., 1911.62-2120, RSM, Edinburgh; Namur., near Dalry, Scot.), for aphroid species]. Cerioid, astreoid, thamnasterioid, or aphroid; corallites with aulos formed at axial ends of major septa; major and minor septa may be weakly carinate or zigzag; tabulae as axial series of horizontal tabellae and periaxial series of outwardly declined tabellae; dissepiments small, except peripherally in aphroid forms [Minato & Rowett, 1967b, p. 383]. *L.Carb.-U.Carb.(Visean-Namur.),* Eu.(U.K.-Eire-France-?Ger.-Donbas-N. Zemlya)-Asia(Kuzbas-Japan-China-Viet Nam); *U. Miss.(Meramec.* or *Chester.),* N.Am.(Ariz.).——Fig. 252,*1a,b.* **A. rotiformis,* Namur., E_2, Linn Spout Ls., Scot., near Dalry; *a,b,* transv., long. secs., ×3 (Hill, 1938-1941).——Fig. 252,*1c. A. senex,* holotype, Namur., Upper Ls. Ser., E_2, superior beds, Scot., Glencart, near Dalry, transv. sec., ×3 (Hill, 1938-1941).

Aulokoninckophyllum Sando, 1976, p. 432 [**Campophyllum carinatum* Carruthers, 1909, p. 150; OD; syntypes 1954.6.8-13, RSM, Edinburgh]. Solitary, or rarely weakly fasciculate; with aulos poorly defined and formed mainly by union of deflected axial ends of major septa and partly by tabulae; septa long, carinate, carinae zigzag, tabular floors in aulos commonly flat and horizontal but abaxially declined between aulos and normal concentric dissepimentarium. [Possibly related to *Koninckophyllum* Thomson & Nicholson, 1876a (Sando, 1976, p. 432).] *L.Carb.-U.Carb.(up. Visean-low.Namur.),* Eu.(N.Zemlya-Donbas-Eng.)-N. Afr. (Alg.)-Asia (Laos)-?Australia (Queensl.).——Fig. 253,*2a,b.* **A. carinatum* (Carruthers), syntype, L.Carb., S. Novaya Zemlya, C. Cherney; *a,b,* transv., long. secs., ×3 (Carruthers, 1909).

Aulostylus Sando, 1976, p. 427 [**Lithostrotionella tubifera* Hayasaka, 1936, p. 69; OD; †120247, USNM, Washington]. Cerioid aulate corals with aulos formed by union of deflected axial ends of major septa; longitudinally discontinuous columella commonly present, axial plate formed by prolongation of one or two major septa; major and minor septa noncarinate or weakly carinate with zigzag carinae; tabular floors in aulos commonly flat and horizontal and may be upturned at columella, but abaxially declined between aulos and lonsdaleoid dissepimentarium. [Absence of tabellae from axial structure suggests relationship to Aulininae rather than to Petalaxidae.] *L.Miss.(Osag.),* N.Am.(Mont.-B.C.); *L.Carb.(up.Visean),* ?Asia (Kansu).——Fig. 253,*3a,b.* **A. tubiferus* (Hayasaka), holotype, probably from Lodgepole Ls., Mont.; *a,b,* transv., long. secs., ×4 (Sando, 1976).

?Paraaulina Kuang in Jia *et al.,* 1977, p. 185 [**P. zhongguoensis*; OD; †IV16080, GB, Nanning; L.Carb., Lingma, Guangxi (Kwangsi)]. Solitary, with everted calice; septa long, numerous, may be complexly structured; major septa ending axially at narrow aulos crossed by widely separated, flat tabellae; periaxial tabellae abaxially declined; dissepimentarium wide, dissepiments numerous, small. [Diagnosis tentative, from illustrations.] *L.Carb.,* Asia(Kwangsi).

Solenodendron Sando, 1976, p. 426 [**Aulina horsfieldi* Smith & Yü, 1943, p. 49; OD; †R34238, BM(NH), London]. Fasciculate aulate corals in which aulos is formed by union of deflected axial ends of major septa; major and minor septa carinate, carinae zigzag; tabular floors flat and horizontal in aulos; declined abaxially between aulos and regular, concentric dissepimentarium; increase marginarial in some, tabularial in others. *L.Carb. (up. Tournais.-up. Visean),* Eu. (Brit. I.-France-Urals)-Asia(China-?Laos).——Fig. 253,*1a,b.* **S. horsfieldi* (Smith & Yü), paratypes, L.Carb.(up. Tournais.), C_1, Hawbank Ls., U.K., near Bell Busk, Yorkshire; *a,b,* transv., long. secs., ×2 (Smith & Yü, 1943).

Vesiculotubus Sando, 1976, p. 431 [**Aulina vesiculata* Dobrolyubova in Dobrolyubova & Kabakovich, 1966, p. 163; OD; †411, coll. 1561, PIN, Moscow]. Fasciculate aulate corals; major and minor septa noncarinate or weakly carinate, carinae zigzag; tabular floors in aulos flat, horizontal, but between aulos and dissepimentarium complete or incomplete, flat, concave or convex and commonly abaxially declined; dissepimentarium lonsdaleoid; increase marginarial. *L.Carb.(up.Tournais.),* Asia(Kuzbas).——Fig. 253,*4a,b.* **V. vesiculatus* (Dobrolyubova), holotype, R. Malyy Bachat; *a,b,* transv., long. secs., ×4 (Dobrolyubova & Kabakovich, 1966).

Subfamily ACROCYATHINAE Hill, new subfamily

Fasciculate or massive; calices with axial boss formed by axial structure comprising median plate that may be continuous with one, or two opposed, long major septa, short septal lamellae and axial tabellae that

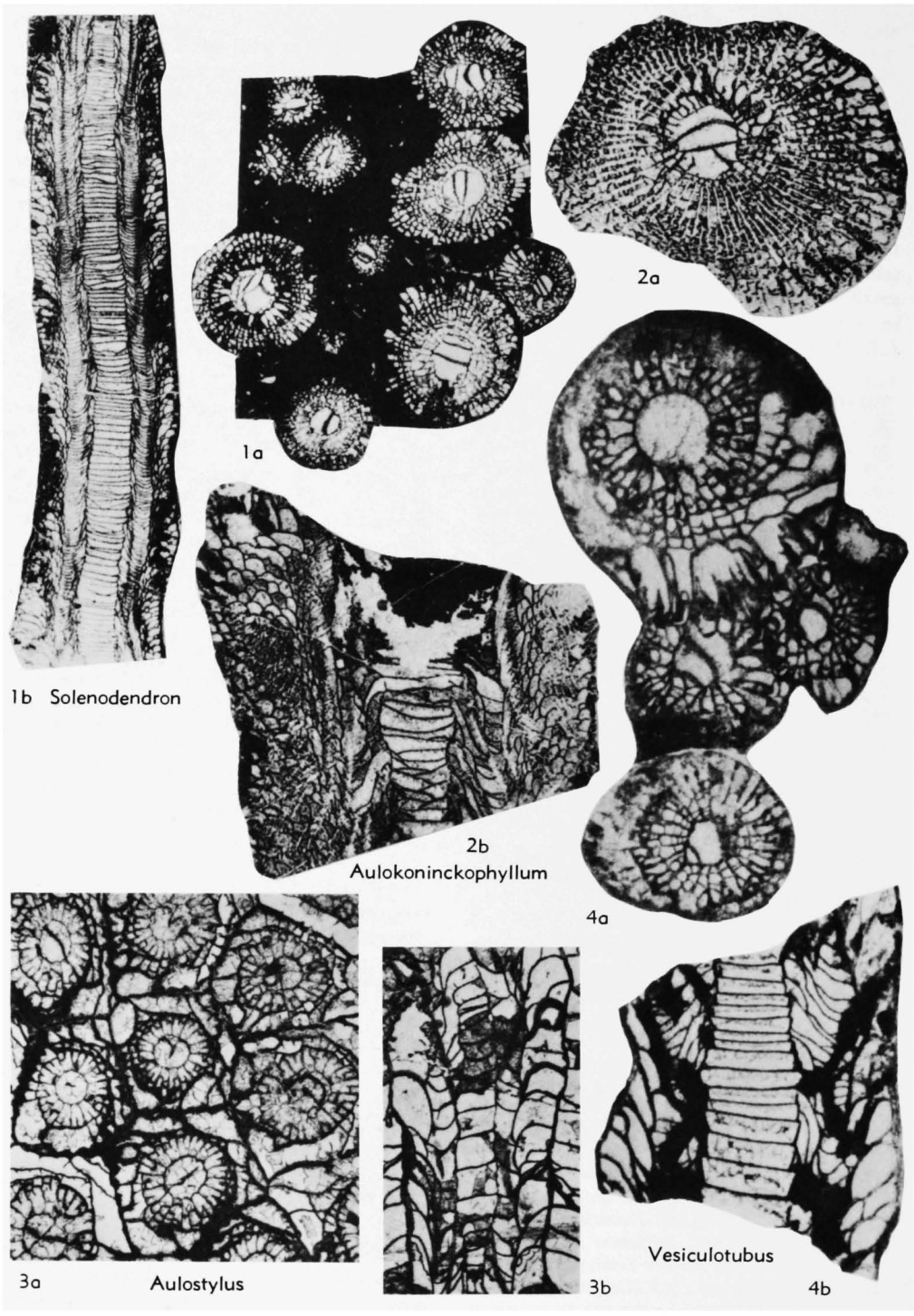


FIG. 253. Lithostrotionidae (p. *F*387).

do not form columnar wall but interdigitate with conical tabulae or with periaxial tabellae that are declined abaxially; dissepimentarium more or less lonsdaleoid; cardinal fossula inconspicuous. *L.Carb.-L.Perm.*

Acrocyathus D'ORBIGNY, 1849, p. 12 [**G.(sic) floriformis*; M; †B7078 (1140 in D'ORBIGNY Coll.), MN, Paris] [?=*Chonaxis* MILNE-EDWARDS & HAIME, 1851, which see]. Cerioid; axial structure simple, a short lathlike columella commonly not connected to major septum, few, very short amplexoid septal lamellae and commonly without axial tabellae; clinotabulae or clinotabellae ?absent; tabulae convex or conical, complete or less commonly incomplete; dissepimentarium lonsdaleoid; cardinal fossula not conspicuous [EASTON, 1973, p. 130]. *L.Carb.*, Eu.(Donbas); *Miss.*, N. Am.(Ind.-Ill.-Alberta-Ariz.-N.Mexico-Alaska); *U. Carb.*, Eu.(Spits.); *Penn.*, N.Am.(Alaska).——FIG. 254,*3a,b*. *A. floriformis*, holotype, Ind.; *a,b*, transv., long. secs., ×1.8 (Easton, 1973).

Chonaxis MILNE-EDWARDS & HAIME, 1851, p. 173, 446 [**C. verneuili*; M; figured syntype 2815, DE VERNEUIL Coll., EM, Paris] [?=*Acrocyathus* D'ORBIGNY, 1849, which see]. Phaceloceriod; axial structure boss-forming, comprising lathlike columella and broadly conical tall tabulae; tabulae supplemented by tabellae near wide dissepimentarium of small, subequal plates, lonsdaleoid in places. [Insufficiently known.] *L.Carb.*, Eu.(Tver, USSR).

Eastonoides WILSON & LANGENHEIM, 1962, p. 511 [**E. elyensis*; OD; †34654, UCMP, Berkeley]. Cerioid; with commonly lenticular columella fused with long ?counter septum and either smooth or corrugated with vestiges of septal lamellae and occasional axial tabellae; major septa thin, seldom attaining columella, minor septa short; dissepimentarium represented by sporadic lonsdaleoid dissepiments; axial tabellae few, longitudinally discontinuous; tabulae broadly conical. *U.Carb. (Myachkov.)*, Eu.(Moscow Basin); *L.Perm.(Wolfcamp.)*, N.Am.(Nev.).——FIG. 254,*1a,b*. **E. elyensis*, holotype, Ely Ls., Nev., Ely Quadrangle, White Pine Co.; *a,b*, transv., long. secs., ×1.8 (Wilson & Langenheim, 1962).

Stelechophyllum TOLMACHEV, 1933, p. 287, *nom. subst. pro Stylophyllum* TOLMACHEV, 1924, p. 316, *non Stylophyllum* REUSS, 1854, a Mesozoic coral [**Stylophyllum venukoffi* TOLMACHEV, 1924, p. 318; SD TOLMACHEV, 1933, p. 287; †in coll. 2555, VNIGRI, Leningrad; lectotype by DOBROLYUBOVA & KABAKOVICH, 1966, p. 156] [=*Eolithostrotionella* ZHIZHINA, 1956, p. 39 (type, *Lonsdaleia longisepta* LISITSYN, 1925, p. 68, OD; †? in coll. 6579, TsGM, Leningrad; Visean, Donbas; but see VASILYUK, 1960, p. 113); *?Eolithostrotionella* ZHIZHINA in FOMICHEV, 1953a, p. 593, *nom. nud.*; *?Eolithostrotionella* ZHIZHINA in FOMICHEV, 1955, p. 303-304, where only *Litho-*

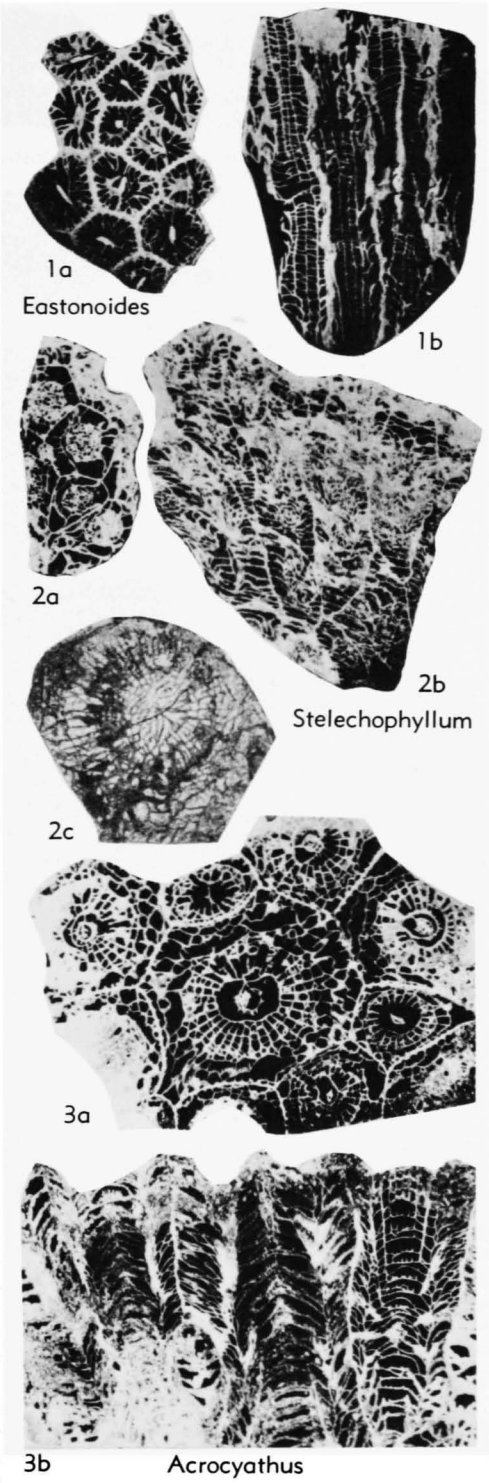


FIG. 254. Lithostrotionidae (p. F389-F391).

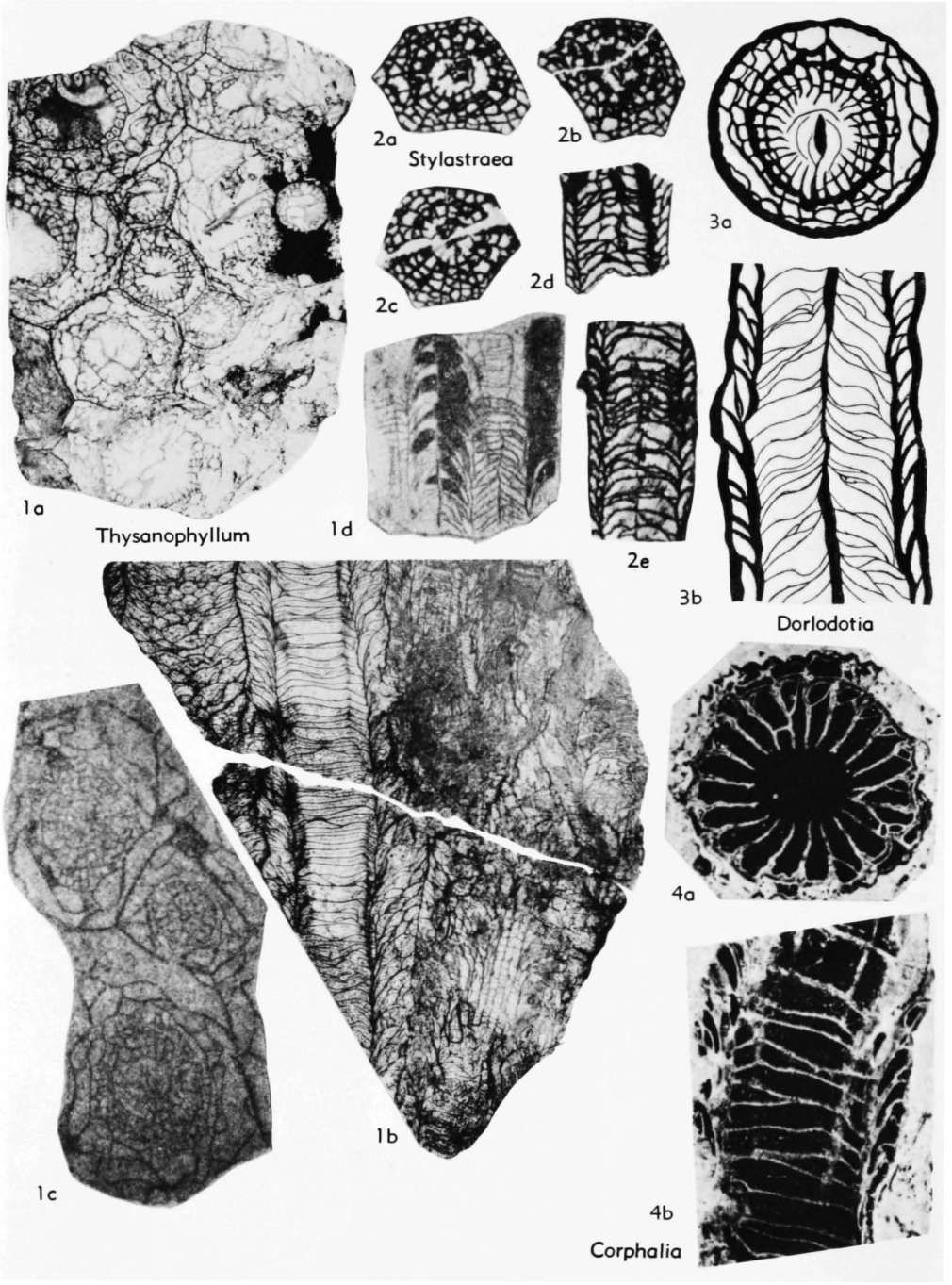


FIG. 255. Lithostrotionidae (p. *F391-F392*).

strotion (Eolithostrotionella) sibiricum (GABUNIYA, 1919, p. 39) *sensu* FOMICHEV was described and figured, no type species being named]. Cerioid, with wide lonsdaleoid dissepimentarium; counter and cardinal septa commonly conjoined and slightly thickened to form lathlike columella, remaining major septa directed toward and may reach columella; diphymorphic corallites moderately com-

mon; minor septa commonly represented by short septal crests only; tabular floors conical, tent-shaped, with edges turned out or up, tabulae complete or incomplete, may be domed in diphymorphs in longitudinally discontinuous series [Dobrolyubova & Kabakovich, 1966, p. 130]. *L.Carb.(Tournais.)*, Asia(Kuzbas); *L.Carb.(Visean)*, Eu.(Donbas-Urals); *U.Miss.*, ?N.Am.(Alaska).——Fig. 254,*2a,b*. **S. venukoffi* (Tolmachev), lectotype, L.Carb., Kuzbas, Zelenchikha; *a,b*, transv., long. secs., ×1.3 (Tolmachev, 1924).——Fig. 254,*2c*. *S. longiseptum* (Lisitsyn), figured syntype, L.Carb., Donbas; transv. sec., ×? (Lisitsyn, 1925).

Subfamily THYSANOPHYLLINAE Hill, new subfamily

Fasciculate or cerioid; weak axial structure sporadically present, either lathlike columella that in some may be continuous with one long major septum ?(cardinal), or few short thin septal lamellae; tabular floors mesa-shaped or but slightly convex to horizontal; tabulae commonly complete; major septa withdrawn from axis; and with minor septa longitudinally discontinuous in lonsdaleoid dissepimentarium; cardinal fossula inconspicuous. *L.Carb.(U.Miss.); ?U. Carb.; L.Perm.*

Thysanophyllum Nicholson & Thomson, 1876, p. 150 [**T. orientale* Thomson, 1880, p. 257; SD Gregory, 1917, p. 238; †T1095, Thomson Coll., KM, Glasgow; lectotype by Hill, 1938-1941, p. 162] [?=*Stylastraea* Lonsdale, 1845, which see; *?Sublonsdalia* Lisitsyn, 1925, p. 68 (type, *S. intermedia*, M; †? in coll. 6579, TsGM, Leningrad; low. Visean, Donbas; see also Vasilyuk, 1960, p. 107); *Sublonsdaleia* Lang, Smith, & Thomas, 1940, p. 68, *nom. van.*]. Cerioid, corallites large, with wide lonsdaleoid dissepimentarium; septa withdrawn from axis except for ?cardinal which may be very long, particularly in young stages; weakly developed axial structure may be present sporadically, tabulae complete, commonly flat-topped domes, sometimes slightly sagging [see Jull (1967, p. 623) for hystero-ontogeny]. *L. Carb.(Visean)*, Eu.(Scot.-Donbas-Urals); *U.Miss.*, N. Am. (Alaska)-?Asia (Taymyr-NE. USSR).——Fig. 255,*1a,b*. **T. orientale*, lectotype, up. Visean, Scot., Aberlady Bay; *a,b*, transv., long. secs., ×0.5 (Hill, 1938-1941).——Fig. 255,*1c,d*. *?T. intermedium* (Lisitsyn), figured syntype, low. Visean, Donbas; *c,d*, transv., long. secs., enl. (Lisitsyn, 1925).

?Corphalia Poty, 1975b, p. 111 [**C. mosae*; OD; †no holotype designated, PAU, Liège] [?=*Caninia* Michelin in Gervais, 1840, Caniniina, Cyathopsidae, but fossula indistinct and no evidence of long counter or short cardinal septum]. Solitary, subcylindrical; major septa short, subequal; fossula indistinct; minor septa as short projections from wall; dissepiments large, concentric or in places inosculating, or lonsdaleoid and disrupting major septa also; tabulae commonly complete and flat or low mesa-shaped. *L.Carb.(mid.Visean)*, Eu.(Belg.).——Fig. 255,*4a,b*. **C. mosae*, syntypes from nominated type locality, Calcaire de Neffe, Awirs Quarry, Meuse Valley; *a,b*, transv., long. secs., ×4.0 (Poty, 1975b).

Dorlodotia Salée, 1920, p. 145 [**D. briarti*; M; †1/78-Fleron, IG, Louvain; lectotype by Poty, 1975a, p. 93] [?=*Pseudodorlodotia* Minato, 1955, which see]. Fasciculate, with marginarial increase; axial structure more or less thickened, a medial plate that may be longitudinally discontinuous and may be attached to counter or, less commonly, to cardinal septum; other major septa somewhat withdrawn from axis and may be thickened in tabularium; minor septa weakly developed, commonly discontinuous longitudinally; dissepimentarium mostly lonsdaleoid, innermost series of dissepiments thickened; tabulae conical, commonly complete [see also Sando, 1965b, p. E11; Poty, 1975a, p. 93]. *L.Carb.(Visean)*, Eu. (Belg.-France)-Asia(Anatolia-?Kirgiz.-?China); *U. Miss.*, ?N.Am.(Idaho-Ariz.-Alberta).——Fig. 255, *3a,b*. **D. briarti*, lectotype, Visean, Belg., Sambre à Landélies; *a,b*, transv., long. secs., ×2.0 (Salée, 1920).

Pseudodorlodotia Minato, 1955, p. 90 [**Thysanophyllum longiseptatum* Yabe & Hayasaka, 1915, p. 138; OD; †6294 (presently misplaced), TohU, Sendai; Carb., Yang-chia-yu, Ngan-hua-hsien, Hunan, China] [?=*Dorlodotia* Salée, 1920, which see]. Fasciculate; corallites with lonsdaleoid dissepimentarium of one series of large plates, with irregular lathlike columella continuous with counter septum but not everywhere present; other major septa somewhat withdrawn from axis; tabulae subhorizontal, drawn up axially to the columella [see also Kozyreva, 1976, p. 124]. *L.Carb. (Visean)*, Asia(Japan-China); *?U.Carb.(Bashkir.)*, Eu.(USSR).——Fig. 256,*2a,b*. *P. kakimii*, syntypes, Onimaru ser., Iwate Pref., Hikoroichi-mura; *a,b*, transv., long. secs., ×1.6 (Minato, 1955).

Sciophyllum Harker & McLaren, 1950, p. 31 [**S. lambarti*; OD; †9667, GSC, Ottawa]. Cerioid; corallites with lonsdaleoid dissepimentarium of one or few series of large dissepiments with septa developed only as crests on their upper surfaces; without columella; tabulae complete, subhorizontal; increase lateral. *U.Miss.*, N.Am.(Yukon-Alaska-Idaho); *L.Carb.(Visean)*, Asia(Japan).——Fig. 256,*1a,b*. **S. lambarti*, holotype, Yukon-Alaska boundary; *a,b*, transv., long. secs., ×1.7 (Harker & McLaren, 1950).

Stylastraea Lonsdale, 1845, p. 619, *non Stylastraea* de Fromentel, 1861, p. 223, a Jurassic hexacoral [**S. inconferta*; SD Miller, 1889, p. 205; †R17562, BM(NH), London] [?=*Thysanophyl-*

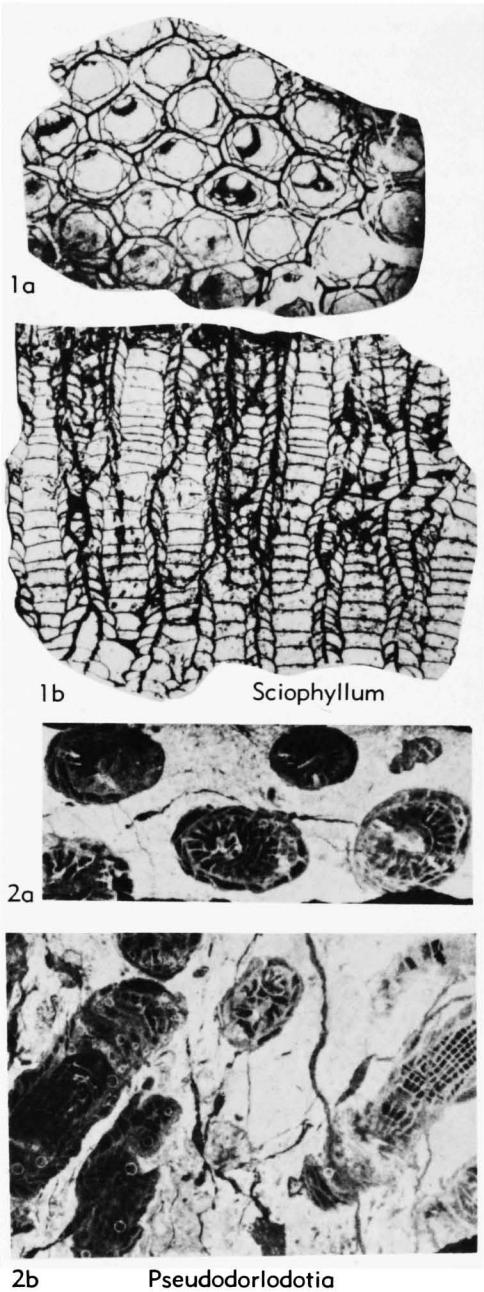


FIG. 256. Lithostrotionidae (p. *F*391).

lum NICHOLSON & THOMSON, 1876, which see; *Diphystrotion* SMITH & LANG, 1930, p. 184 (obj.), as genomorph of *Lithostrotion* FLEMING, 1828, Lithostrotioninae (type, *Stylastraea inconferta* LONSDALE, 1845, OD)]. Cerioid; corallites commonly with one long major septum ?(counter) extending beyond axis as lathlike columella, where in places it may be joined on upper surfaces of tabulae by short, irregular septal lamellae; other major septa withdrawn somewhat from axis; minor septa discontinuous, developed mostly as septal crests; tabulae conical or domed when columella present, otherwise flat, complete or incomplete; dissepimentarium lonsdaleoid in places [see SMITH & LANG, 1930, p. 185]. *?L.Carb. (Visean)*, Eu.(Eng.); *L.Carb.(Visean)*, Asia(Taymyr); *?U.Carb.(Namur.)*, Eu.(Spain); "*Carb.* limestone," Asia(E.Urals)-?S.Am.(Peru); *L.Perm.*, Eu.(Spits.).——FIG. 255,*2a-d*. **S. inconferta*, holotype, "Carb. ls.," E. Urals, Kossatchi-Datchi, S. of Miask; *a-c*, transv., *d,e*, long. secs., ×2.0 (Smith & Lang, 1930).

Subfamily YATSENGIINAE Hill, 1956

[Yatsengiinae HILL, 1956b, p. *F*291]

Fasciculate or massive; corallites slender, septa few; major septa long, thin, commonly meeting at axis, where cardinal and counter may appear continuous, or major septa may be discontinuous with their septal lamellae; axial structure wide, with numerous abaxially declined tabellae that commonly do not form column wall but intermesh with less steeply abaxially declined periaxial tabellae; dissepimentarium regular; cardinal fossula inconspicuous. *U.Carb.-L.Perm.*

Yatsengia HUANG in YOH & HUANG, 1932, p. 31 [**Waagenophyllum (Yatsengia) asiatica* HUANG, 1932, p. 56; OD; †3866, IGP, Nanking]. Fasciculate, corallites slender, septa few; major septa long, commonly reaching axis, where cardinal and counter may appear continuous; axial parts of others may become disconnected and form radial septal lamellae in wide axial structure of numerous abaxially declined tabellae that commonly do not form column wall but intermesh with less steeply abaxially declined periaxial tabellae; minor septa short, dissepimentarium narrow; fossula not notable. *L. Perm. (Chihs.)*, Asia (China-Japan-Camb.-Iran-Turkey).——FIG. 257,*3a,b*. **Y. asiatica* (HUANG), holotype, Chihsia Ls., Kweichow, 1 mi. W. of Laochialiang, Lipohsien; *a,b*, transv., long. secs., ×4.0 (Huang, 1932).

Arachnastraea YABE & HAYASAKA, 1916, p. 67 [**A. manchurica*; OD; ?syntype 8291, TohU, Sendai, metatype, R23722, BM(NH), London] [=*Cystophorastraea* DOBROLYUBOVA, 1935, p. 32 (type, *Phillipsastrea molli* SHTUKENBERG, 1888, p. 25, 45, OD; †91, coll. 321, TsGM, Leningrad); *Cystiphorastraea* LANG, SMITH, & THOMAS, 1940, p. 47, *nom. van.*]. Astreoid, in part thamnasterioid or aphroid; septa thin, rarely slightly thickened, meeting conjoined counter and cardinal septa, which are only faintly thickened axially to suggest

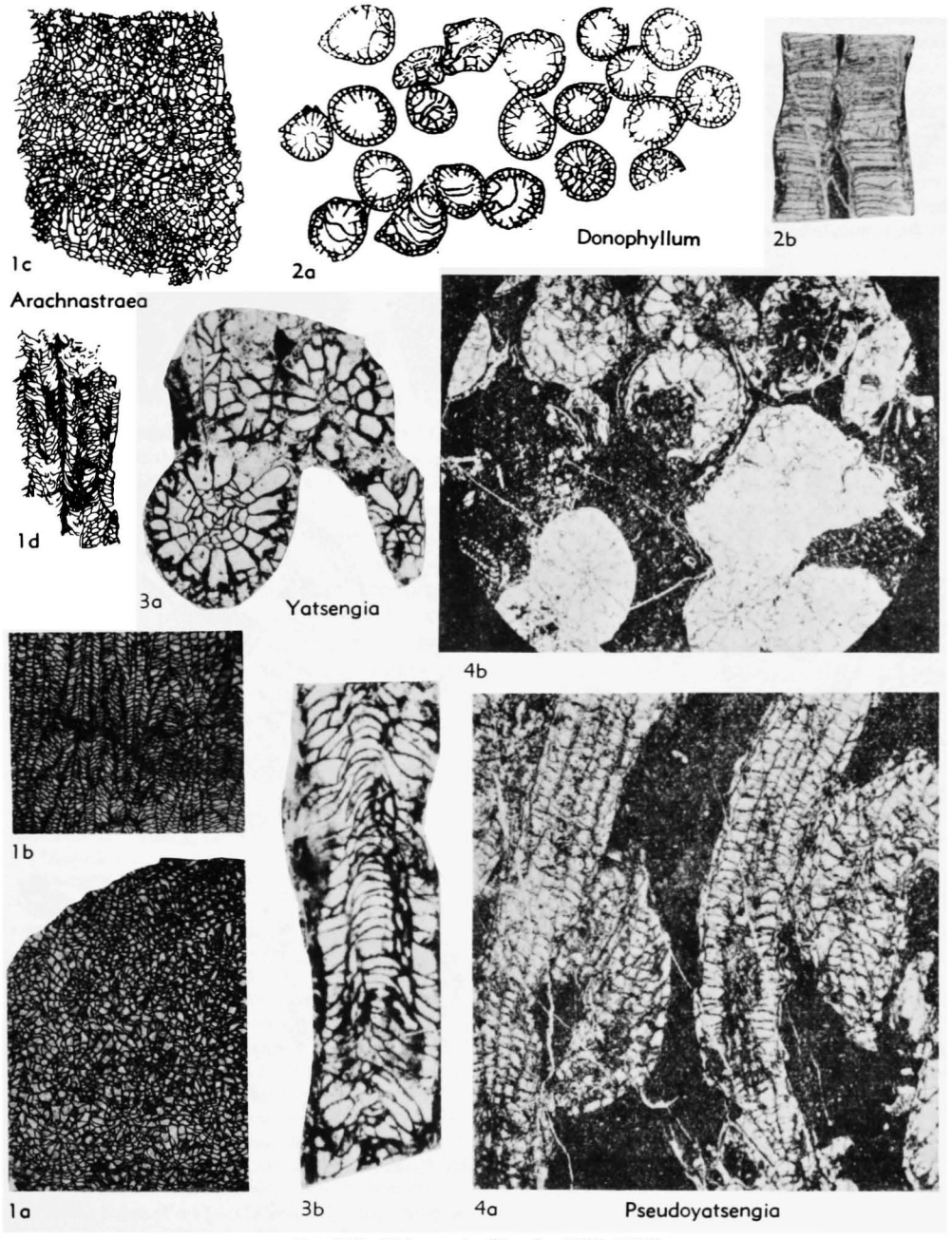


FIG. 257. Lithostrotionidae (p. *F*392-*F*395).

median plate; tabulae conical, complete or commonly with auxiliary axial tabellae; dissepimentarium regular; cardinal fossula indistinct [YABE & EGUCHI, 1944, p. 733]. *U.Carb.*, Eu.(Moscow Basin-Donbas-?Spain)-Asia(Manchuria-Korea-Kiangsu-Shantung).——FIG. 257,*1a,b*. **A. manchurica,* metatype, Penchi Ser., S. Manchuria, Hon-kei-ko coalfield; *a,b,* transv., long. secs., ×2.0 (photographs courtesy British Museum (Natural History), London).——FIG. 257,*1c,d*. *A. molli* (SHTUKENBERG), Myachkovo horizon, right bank of R. Moskva, quarry opposite Sonino; *c,d,* transv.,

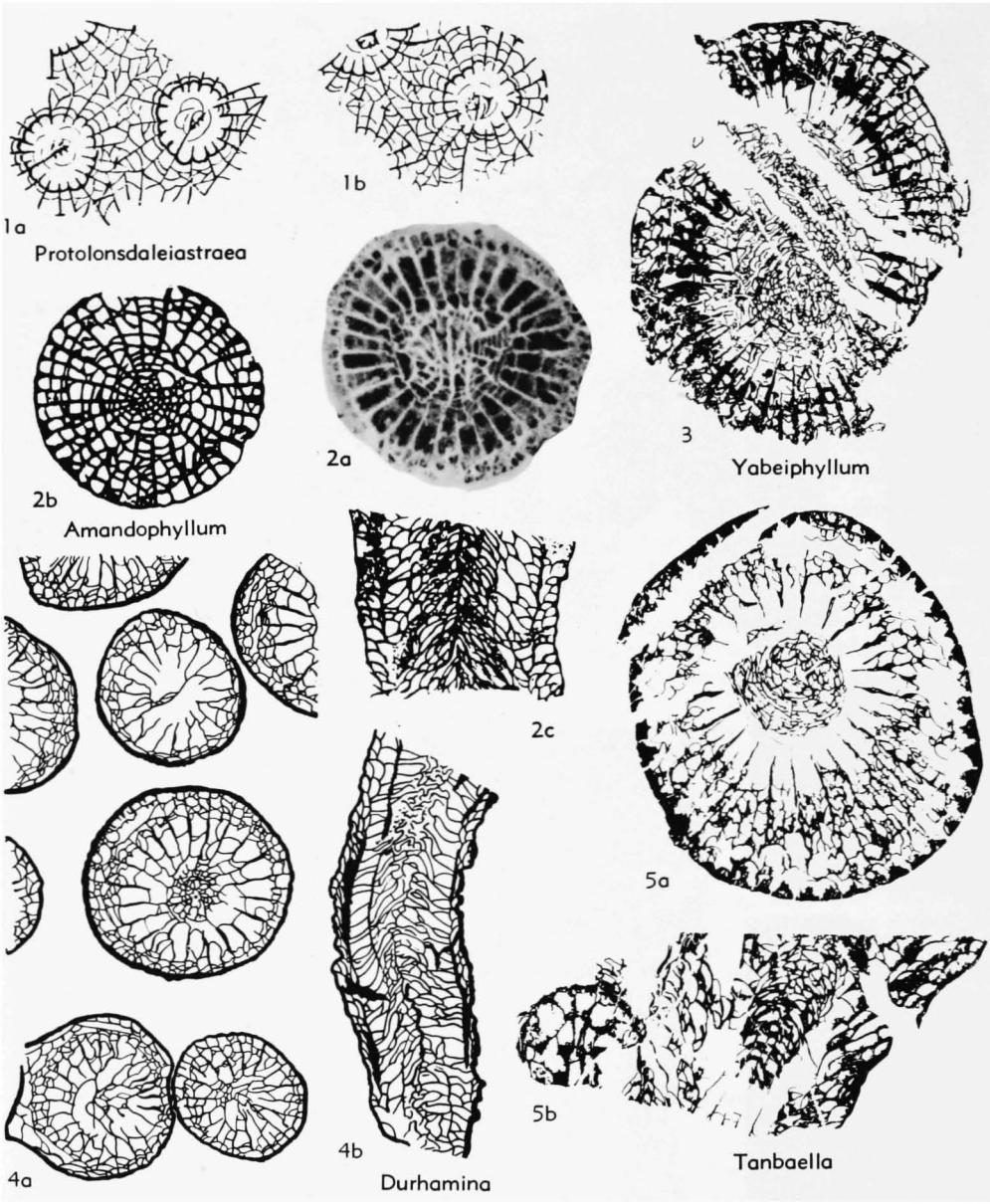


FIG. 258. Durhaminidae (p. *F*395-*F*398).

long. secs., ×2.0 (Dobrolyubova, 1935).

Donophyllum FOMICHEV, 1939, p. 59 [**Diphyphyllum (Donophyllum) diphyphylloideum*; SD LANG, SMITH, & THOMAS, 1940, p. 54; †99, coll. 5030, TsGM]. Fasciculate, corallites slender; major septa commonly withdrawn from axis, but in some corallites many may run loosely together to axis; without distinct columella; minor septa short, dissepimentarium narrow, of one series of small plates which may be impersistent, or of two or three series of small plates; tabulae may be subhorizontal with downturned edges where major septa are short, or low cones or domes and complete or incomplete where major septa run together at axis. *U.Carb.*, Eu.(Donbas).——FIG. 257,*2a,b*. **D. diphyphylloideum*, holotype, ls. K$_8$, Donetz Basin, Belyansk mine; *a,b*, transv., long. secs., ×2.0 (Fomichev, 1939).

?**Pseudoyatsengia** YABE, 1951, p. 201 [**P. kuzuensis*; OD; syntype 66343, TohU, Sendai, and pieces in IGEd., Tokyo and Science Museum, Tokyo]. Fasciculate, corallites slender, with axial structure consisting of few radial lamellae and conical tabellae, but without median plate; septa discontinuous in narrow dissepimentarium; periaxial tabellae horizontal or convex and overlapping [see MINATO, 1955, p. 121]. *L.Perm.(Parafusulina Z.)*, Asia(Japan).——FIG. 257,*4a,b*. **P. kuzuensis*, monotype, Tochigi Pref., Aisawa, 3 km. N. of Kuzu-machi; *a,b*, long., transv. secs., ×2.5 (Yabe, 1951).

Family DURHAMINIDAE Minato & Kato, 1965

[Durhaminidae MINATO & KATO, 1965b, p. 28]

Solitary, fasciculate, cerioid, astreoid, thamnasterioid or aphroid; axial structure of median lamella that may become indistinct, irregular septal lamellae, and axial tabellae, some of which may have proximal edges based on the commonly abaxially declined periaxial tabellae; some peripheral supplementary tabellae or clinotabellae may develop; major and minor septa commonly thick in tabularium, thin in commonly herringbone dissepimentarium; third and higher orders of septa absent. *L.Carb.-Perm.*

Systematic classification adopted herein is that of MINATO & KATO (1965b), with few modifications.

Durhamina WILSON & LANGENHEIM, 1962, p. 504 [**Lonsdaleia cordillerensis* EASTON, 1960, p. 580; OD; †5127, USC, Los Angeles]. Fasciculate; with axial structure in early states a medial plate, which may be irregular and discontinuous in later stages; in late stages axial structure is composed of irregularly and loosely disposed and few lamellae and axial tabellae whose proximal edges do not rest on those below to form a column, but interdigitate with abaxially inclined periaxial tabellae; some adaxially inclined peripheral tabellae or clinotabellae may develop; septa somewhat thickened in tabularium, and withdrawn unequally from axial structure; minor septa weakly developed, dissepimentarium narrow, herringbone to lonsdaleoid. *Penn.-L.Perm.*, N.Am.(Nev.-Texas-Alaska)-S.Am.(Peru); *U.Carb.-L.Perm.*, Asia(Japan).——FIG. 258,*4a,b*. **D. cordillerensis* (EASTON), holotype, L.Perm., basal ls., Arcturus F., Nev., 2 mi. S. of Ruth; *a,b*, transv., long. secs., ×3.0 (Easton, 1960).

Amandophyllum HERITSCH, 1941, p. 136 [**Clisiophyllum carnicum* HERITSCH, 1936, p. 122; SD HILL, 1956b, p. F290; †P2076, UG, Graz] [?=*Dibunophylloides* FOMICHEV, 1953a, p. 393 (type, *?Cyathoclisia simmetrica* DOBROLYUBOVA, 1937, p. 58, OD; †611, coll. 141, PIN, Moscow; Moscov., Podolsk horizon, R. Volga, downstream from Molokovo)]. Solitary, conical or conicocylindrical; axial structure forming boss in calice and arachnoid, consisting of commonly indistinct median plate, of irregularly radiating septal lamellae, some of which may run parallel to median plate, and some may be continuous with septa, and of axial tabellae; major septa slightly thickened in tabularium, thinning toward periphery, minor septa thin to discontinuous leaving concentric or pseudoherringbone dissepiments; lateral dissepiments may occur on major septa; dissepimentarium commonly narrow, indistinct fossula invading it only slightly; periaxial tabellae ?(declined abaxially) [see MINATO & KATO, 1965b, p. 30]. *?U.Carb.*, Eu.(Moscow Basin); *U.Carb.-L.Perm.*, Eu.(Carnic Alps-?Donbas)-Asia(Japan); *L.Perm.*, N.Am.(Texas).——FIG. 258,*2a*. **A. carnicum* (HERITSCH), holotype, U.Carb., Carnic Alps, N. of Garnitzen, transv. sec., ×3.5 (Heritsch, 1936).——FIG. 258,*2b,c*. *?A. simmetricum* (DOBROLYUBOVA), holotype, M.Carb., Podolsk horizon, Volga R., downstream from Molokovo; *b,c*, transv., long. secs., ×4.0 (Dobrolyubova, 1937).

Heritschioides YABE, 1950, p. 75 [**Waagenophyllum columbicum* SMITH, 1935, p. 38; OD; †9059, GSC, Ottawa, part =A6805, SM, Cambridge] [?=*Yabeiphyllum* MINATO & KATO, 1965b, which see]. Fasciculate; closely packed tabellae of large axial structure incompletely differentiated from abaxially declined tabulae; also in axial structure, a short medial plate and imperfectly radiated septal lamellae as numerous as major septa; dissepimentarium irregularly concentric to angulocentric, major septa thicker in tabularium, thinning toward periphery; septa not carinate [see MINATO & KATO, 1965b, p. 51]. *L.Perm.*

H. (Heritschioides). Tabellae of compact axial structure numerous and steeply declined from medial plate. *L.Perm.(Pseudoschwagerina-Parafusulina Z.)*, N.Am.(B.C.-Ore.-Nev.)-Eu.(Urals)-Asia(Japan).——FIG. 259,*4a,b*. **H. columbicus* (SMITH), holotype, B.C., ridge between Blind and Barslow Crs., 4 mi. E. of Keremeos; *a,b*, transv., long. secs., ×2.4 (Smith, 1935).

H. (Eoheritschioides) STEVENS, 1967, p. 429 [**H. (E.) moormanensis*; OD; †27311, Univ. Colo., Boulder]. Axial tabellae gently declined from obscure medial plate in loose axial structure. *L.Perm.(Leonard.)*, N.Am.(Nev.).——FIG. 259, *1a,b*. **H. moormanensis*, holotype, Pequop F., Nev., White Pine Co.; *a,b*, transv. secs., ×1.2 (Stevens, 1967).

Kleopatrina MCCUTCHEON & WILSON, 1963, p. 299, *nom. subst. pro Ptolemaia* MCCUTCHEON & WILSON, 1961, p. 1023, *non Ptolemaia* OSBORN, 1908, a mammal [**Ptolemaia ftatateeta*; OD; †30267, MPUC, Berkeley]. Cerioid with moderately thick walls, with small axial structure consisting of median plate, few septal lamellae, and axial tabel-

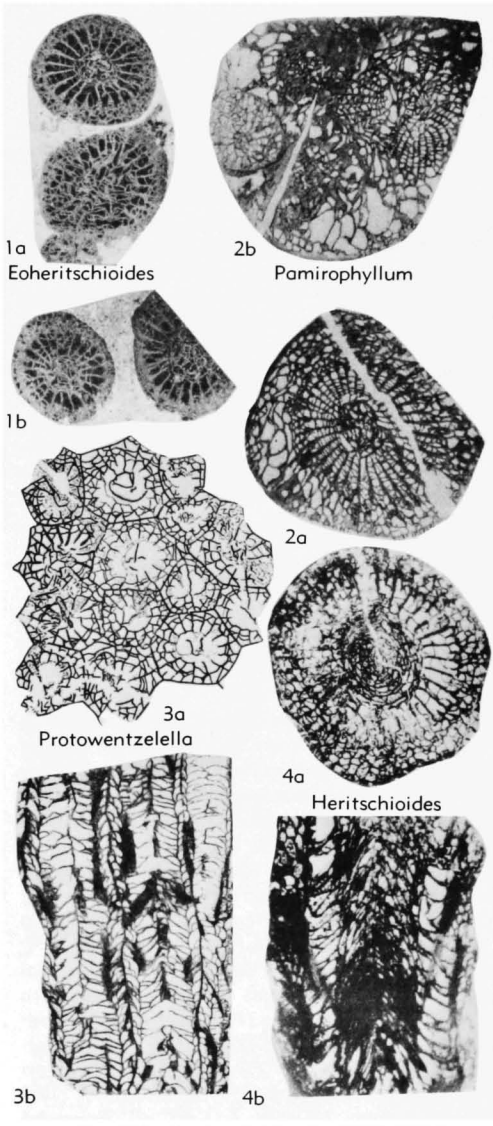


FIG. 259. Durhaminidae (p. *F395-F397*).

lae, some of which are based on those next below, others on abaxially declined periaxial tabellae; septa thickened in tabularium and somewhat withdrawn from axial structure (except one long septum that may be continuous with median plate), commonly thin in narrow dissepimentarium of concentric or anguloconcentric plates. *L.Perm. (Sakmar.-Artinsk.).*

K. (Kleopatrina). Minor septa continuous, few lonsdaleoid dissepiments. *L.Perm.(Wolfcamp.-Artinsk.),* N.Am.(Nev.)-Eu.(Urals-Spits.).——FIG. 260,*3a,b.* **K. ftatateeta* (MCCUTCHEON & WILSON), holotype, Wolfcamp., grey ls. beds forming uppermost 60 ft. of Ely Ls., Nev., in NE.¼ sec. 9, T.13N., R.63E., Ely #3 Quadrangle, Ward Mt., White Pine Co.; *a,b,* transv., long. secs., ×3.4 (McCutcheon & Wilson, 1961).

K. (Porfirievella) MINATO & KATO, 1965b, p. 71 [**Wentzelella grandis* DOBROLYUBOVA in SOSHKINA, DOBROLYUBOVA, & PORFIREV, 1941, p. 197; OD; †1196, coll. 146, PIN, Moscow] [=*Porfirievella* KULASINGAM & BARTLETT, 1967, p. 26, *nom. null.; Uralnevadaphyllum* MINATO & KATO, 1968, p. 363 (obj.); *Porfiriviella* FLÜGEL, 1970, p. 215, *nom. null.*]. Minor septa weak, crestal; lonsdaleoid dissepiments well developed. *L.Perm. (Pseudoschwagerina-Pseudofusilina Z.),* N.Am. (Nev.)-Eu.(Urals-Spits.).——FIG. 260,*1a,b.* **K. (P.) grandis* (DOBROLYUBOVA), holotype, Sakmar., USSR, left bank R. Ural, near R. Psi, Aktiubinsk reg.; *a,b,* transv., long. secs., ×1.5 (Soshkina, Dobrolyubova, & Porfirev, 1941).

Minatoa FLÜGEL, 1974, p. 97 [**M. bulla*; OD; †P2680, UG, Graz]. Cerioid; with narrow dibunophylloid axial structure not defined by tabellar wall; tabular floors conical, tabulae incomplete; dissepimentarium wide, major and minor septa discontinuous longitudinally in places due to irregular development of lonsdaleoid dissepiments; septa may be somewhat thickened in places, thickening not emphasized in tabularium. *?U. Carb.(?low.Bashkir.),* Asia(Iran).——FIG. 260, *2a,b.* **M. bulla,* holotype, Sadar F. II, Kuh-e-Cheshmesh-Baghal, Ozbak-Kuh Ra.; *a,b,* transv., long. secs., ×1.5, ×1.6 (Flügel, 1974).

?Pamirophyllum PYZHYANOV, 1971, p. 166 [**Darwasia (sic) instabilis* (=*P. instabilis*); OD; †sample 2281-24-6, coll. 705, UpG, Dushanbe] [=*Pamiriphyllum* PYZHYANOV, 1971, p. 165, *nom. null.; Darwasia* PYZHYANOV, 1971, p. 166, *nom. nud.,* earlier MS name published inadvertently in binomial above]. Compound, with stocky corallum, offsets arising from dissepimentarium of large protocorallite so that first an astreoid region develops, then subastreoid to subphaceloid levels; axial structure commonly comprises median plate that may be connected with long cardinal septum, tabulae [or tabellae—the longitudinal section figured by PYZHYANOV, 1971, is not central], and sparse septal lamellae in places continuous with major septa; major septa long, connected or not with axial structure; minor septa thin and commonly discontinuous in wide dissepimentarium in which unequal lonsdaleoid dissepiments may be few or many; attitude of tabular floors uncertain, probably domed or conical. *L.Perm.,* Asia(Tadzhik.).——FIG. 259,*2a,b.* **P. instabile,* holotype, Karachatyr., low. part Sebisurkh suite, SW. Darvaz, R. Kalay-Kukhna; *a,b,* transv. secs., ×1.2 (Pyzhyanov, 1971).

Protodurhamina KOZYREVA, 1978, p. 21 [**P. strelzovkensis*; OD; †52, coll. 14, DPI, Donetsk]. Fasciculate, septa short, axial structure variable, from thin columella to median plate with few

septal lamellae and axial tabellae; tabellae numerous, commonly complete but in places incomplete, tabular floors broadly conical, drawn steeply upward at axis; dissepimentarium narrow. *L.Carb. (Serpukhov.)-U.Carb.(Bashkir.)*, Eu.(USSR).

Protolonsdaleiastraea Gorskiy, 1932, p. 44 [**P. atbassarica*; OD; †in coll. 2612, TsGM, Leningrad] [*?=Dobrolyubovia* Fomichev, 1953a, p. 593, *nom. nud.*; *?Gorskyia* Fomichev, 1953a, p. 593, *nom. nud.*; *Protolonsdaleiastrea* Flügel, 1970, p. 221, *nom. null.*]. Partly cerioid, partly astreoid or aphroid, with weak axial structure of irregular median lamella, few impersistent short irregular septal lamellae, and in places some axial tabellae steeply declined from median lamella with their proximal edges based on median lamella or on tabula next below; tabulae conical, complete or incomplete; septa commonly thickened especially in tabularium, where major septa somewhat withdrawn from axial structure; minor septa weak, crestal; dissepimentarium wide, herringbone to irregular, in places lonsdaleoid. [?Lower Carboniferous type specimens of type species imperfectly known. The diagnosis given herein follows Soshkina, Dobrolyubova, & Porfirev, 1941, p. 200, and Minato & Kato, 1965b, p. 60, based mainly on Upper Carboniferous and Lower Permian species.] *?L.Carb.(?Tournais.)*, Asia(W. Kazakh.); *U. Carb. (Triticites Z.)-L. Perm. (Artinsk.)*, Asia(W.Kazakh.)-Eu.(Urals-Spits.).——Fig. 258,*1a,b*. **P. atbassarica*, holotype, ?Tournais., Kirghiz Steppe, Dzhezky R., Atbassarsky reg.; *a,b*, transv. secs., ×3.0 (Gorskiy, 1932).

?Protowentzelella Porfirev in Soshkina, Dobrolyubova, & Porfirev, 1941, p. 179 [**P. simplex*; OD; †107, NNII, Ufa] [*?=Protowentzelella* Porfirev, 1937, pl. 2, *nom. nud.*]. Cerioid; with weak axial structure of thin median lamella, sparse radial lamellae, and in places, axial tabellae; major septa moderately long, cardinal and counter in places may join median lamella; minor septa discontinuous so that dissepiments inosculate in loculi between major septa; tabulae conical, complete or incomplete [see Ivanovskiy, 1976, p. 138]. *L.Perm.*, Eu.(Urals-Spits.).——Fig. 259,*3a,b*. **P. simplex*, holotype, L.Perm., Mt. Jurak-tau near Sterlitamak; *a,b*, transv., long. secs., ×1.8 (Soshkina, Dobrolyubova, & Porfirev, 1941).

Tanbaella Minato & Kato, 1965b, p. 55 [**Waagenophyllum izuruhense* Sakaguchi & Yamagiwa, 1958, p. 176; OD; †59026-59028, IAGG, Osaka]. Fasciculate; large axial structure a column bounded by axial tabellae whose proximal edges are based on those below, and with a median plate that may be indistinct, and septal lamellae; periaxial tabellae small, variously inclined, mostly abaxially; dissepimentarium lonsdaleoid in part, septa with thick bases modified naotically. [Only two specimens known.] *U.Perm.(Neoschwagerina Z.)*, Asia(Japan).——Fig. 258,*5a,b*. **T. izuruhensis* (Saka-

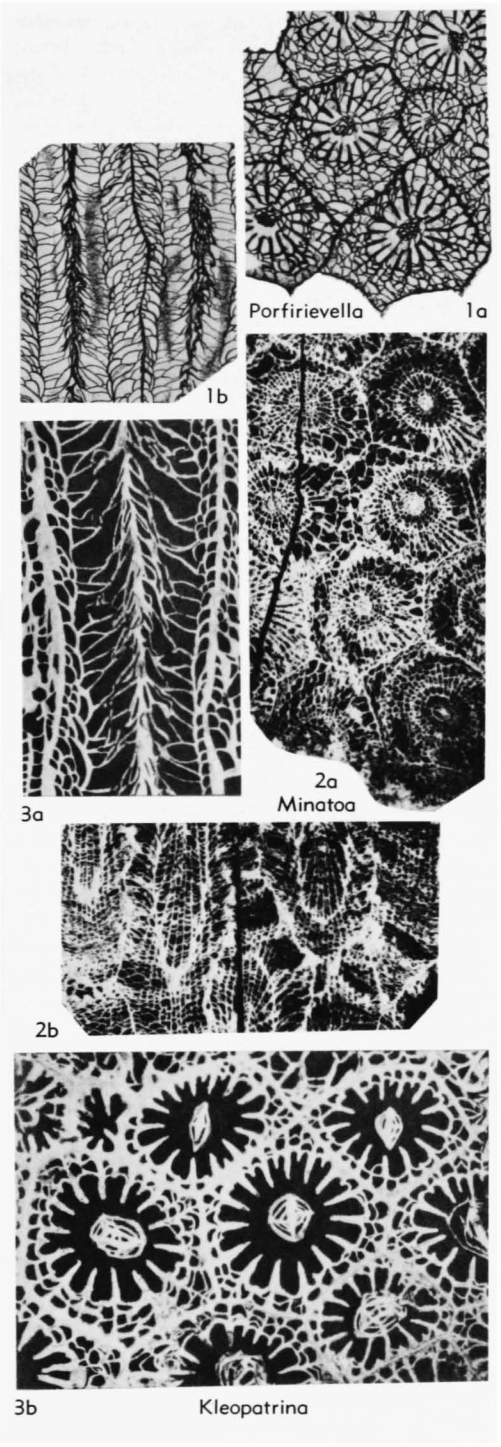


Fig. 260. Durhaminidae (p. *F396*).

GUCHI & YAMAGIWA), holotype, Japan, Izuruha-Shimojo, Takatsuki city, Osaka Pref., Japan; *a,b,* transv., long. secs., ×4.0 (Minato & Kato, 1965b).

Yabeiphyllum MINATO & KATO, 1965b, p. 45 [*Y. *hayasakai*; OD; †R18470, UH, Sapporo] [?=*Heritchioides* YABE, 1950, which see]. ?Fasciculate; major and minor septa carinate in dissepimentarium; axial structure almost a column, with proximal edges of most of numerous axial tabellae resting on those next below; thin, irregular medial lamella present, and numerous somewhat irregular septal lamellae; periaxial tabellae declined abaxially; septa carinate in dissepimentarium, thickened in tabularium and in inner parts of dissepimentarium. [Type species not well known.] *U. Carb.-L.Perm.(Pseudoschwagerina Z.),* Asia(Japan); *Penn.-L.Perm.,* N.Am.(Texas).——FIG. 258, *3.* **Y. hayasakai,* holotype, L.Perm., *Triticites simplex* subzone of *Pseudoschwagerina* Z., Japan, point N65, SW. of Oniana, Akiyoshi-dai, Yamaguchi Pref., transv. sec., ×5.0 (Minato & Kato, 1965b).

Suborder LONSDALEIINA Spasskiy, 1974

[*nom. correct.* HILL, herein, *ex* Lonsdaleeina SPASSKIY, 1974, p. 133]

Solitary or compound Stauriida; dissepimentarium commonly lonsdaleoid, but in some herringbone to normal concentric; axial structure of septal lamellae including axial or medial lamella and abaxially declined tabellae; tabularial floors between axial structure and dissepimentarium flat, sagging, or adaxially with supplementary clinotabulae or clinotabellae; third or higher orders of septa in some. *L.Carb.-U.Perm.*

Family AXOPHYLLIDAE Milne-Edwards & Haime, 1851

[*nom. correct.* DYBOWSKI, 1873, p. 332, *pro* Axophylliens DE FROMENTEL, 1861, p. 283, *nom. transl. ex* Axophyllinae MILNE-EDWARDS & HAIME, 1851, p. 452] [=Lonsdaleiidae DE FROMENTEL, 1861, p. 73, 306, *nom. correct.* GRABAU in CHI, 1931, p. 33, *pro* Lonsdaliens DE FROMENTEL, 1861, p. 73; Carcinophyllidae HUDSON, 1942b, p. 374, *nom. transl.* FOMICHEV, 1953a, p. 408 *ex* Carcinophyllinae HUDSON, 1942b, p. 374; Lonsdaleiinae WANG, 1950, p. 212; Lonsdaleiicae IVANOVSKIY, 1965a, p. 53]

Solitary, fasciculate or massive; with wide axial column consisting of median plate commonly continuous with cardinal septum, radial lamellae and axial tabellae; pericolumnar tabulae concave or subhorizontal, commonly complete; dissepimentarium lonsdaleoid with minor septa or both major and minor septa discontinuous and commonly developed as septal crests. *L.Carb.(Dinant.)-U.Carb.(Namur.).*

Axophyllum MILNE-EDWARDS & HAIME, 1850, p. lxxii [**A. expansum*; OD; †Z83a-1, MN, Paris; lectotype by SEMENOFF-TIAN-CHANSKY, 1974, p. 211] [=*Carcinophyllum* THOMSON & NICHOLSON, 1876b, p. 70, *nom. nud.,* name and text figure of axial column only; *Carcinophyllum* THOMSON, 1880, p. 241 (type, *C. kirsopianum,* OD; †C4638, HM, Glasgow, and part T2119, KM, Glasgow, lectotype by HILL, 1940, p. 159; Visean, Arbigland Bay, Scot.); *?Agassizia* THOMSON, 1883, p. 497 (type, *A. vesiculara,* M; †K153, DI, Kilmarnock and part T1004, KM, Glasgow, lectotype by HILL, 1940, p. 160; L.Carb., up. Visean, Charlestown, Scot.), *non Agassissia* VALENCIENNES in DUPETIT-THOUARS, 1846, emended to *Agassizia, nom. van.,* by AGASSIZ & DESOR, 1870, an echinoid, *nec Agassizia* BEHR, 1870, a lepidopteran; *?Proagassizia* COTTON, 1973, p. 160, *nom. subst. pro Agassizia* THOMSON, 1883]. Solitary; axial column of irregular, curving, anastomosing septal lamellae, with a median plate and irregular conical tabellae; in marginarium peripheral parts of septa may be thickened and lonsdaleoid dissepiments may develop; pericolumnar tabulae flat or sagging [HILL, 1940, p. 157; SEMENOFF-TIAN-CHANSKY, 1974, p. 210]. *L.Carb.,* Eu.(Brit.I.-Belg.-France-USSR)-N. Afr. (W. Sahara)-Asia (Kazakh.-Kweichow-?Japan)-Australia(Queensl.).——FIG. 261,*3a,d,e.* **A. expansum,* lectotype, Visean, Belg.; *a,* calical view, ×1.7 (Salée, 1913); *d,e,* transv., long. secs., ×3.3 (Hill, n; photographs courtesy P. Semenoff). ——FIG. 261,*3b,c. A. kirsopianum* (THOMSON); *b,* lectotype, transv. sec., ×2.5; *c,* topotype, long. sec., ×2.5 (Semenoff-Tian-Chansky, 1974).

Actinocyathus D'ORBIGNY, 1849, p. 12 [**Cyathophyllum crenulare* PHILLIPS, 1836, p. 202; M; †R87 in GILBERTSON Coll., BM(NH), London; lectotype by SMITH, 1916, p. 257; =*Lonsdaleia floriformis* (MARTIN) 1809, pl. 43, validated by ICZN Op. 419, †neotype by SMITH, 1916, p. 269, A2359, SM, Cambridge, which is holotype of *Strombodes conaxis* MCCOY, 1849, p. 10] [=*Stylidophyllum* DE FROMENTEL, 1861, p. 316 (type, *Erismatolithus Madreporites (floriformis)* MARTIN, 1809, pl. 43, SD CHI, 1931, p. 44); *?Protolonsdalia* LISITSYN, 1925, p. 62 (type, *P. carcinnophyllosa,* M; †not traced; low. Visean, Donbas.; axial structure with irregular septal lamellae not forming spider web, but see VASILYUK, 1960, p. 106); *Protolonsdaleia* LANG, SMITH, & THOMAS, 1940, p. 106, *nom. van.; ?Cystolonsdaleia* FOMICHEV, 1953a, Petalaxidae]. Cerioid; with axial column consisting of more or less regular medial plate that may in late stages remain continuous with cardinal septum, radial septal lamellae and axial tabulae commonly forming wall to column; pericolumnar tabulae flat or concave, commonly complete; dissepimentarium commonly wide, lonsdaleoid, dissepiments commonly very large; in-

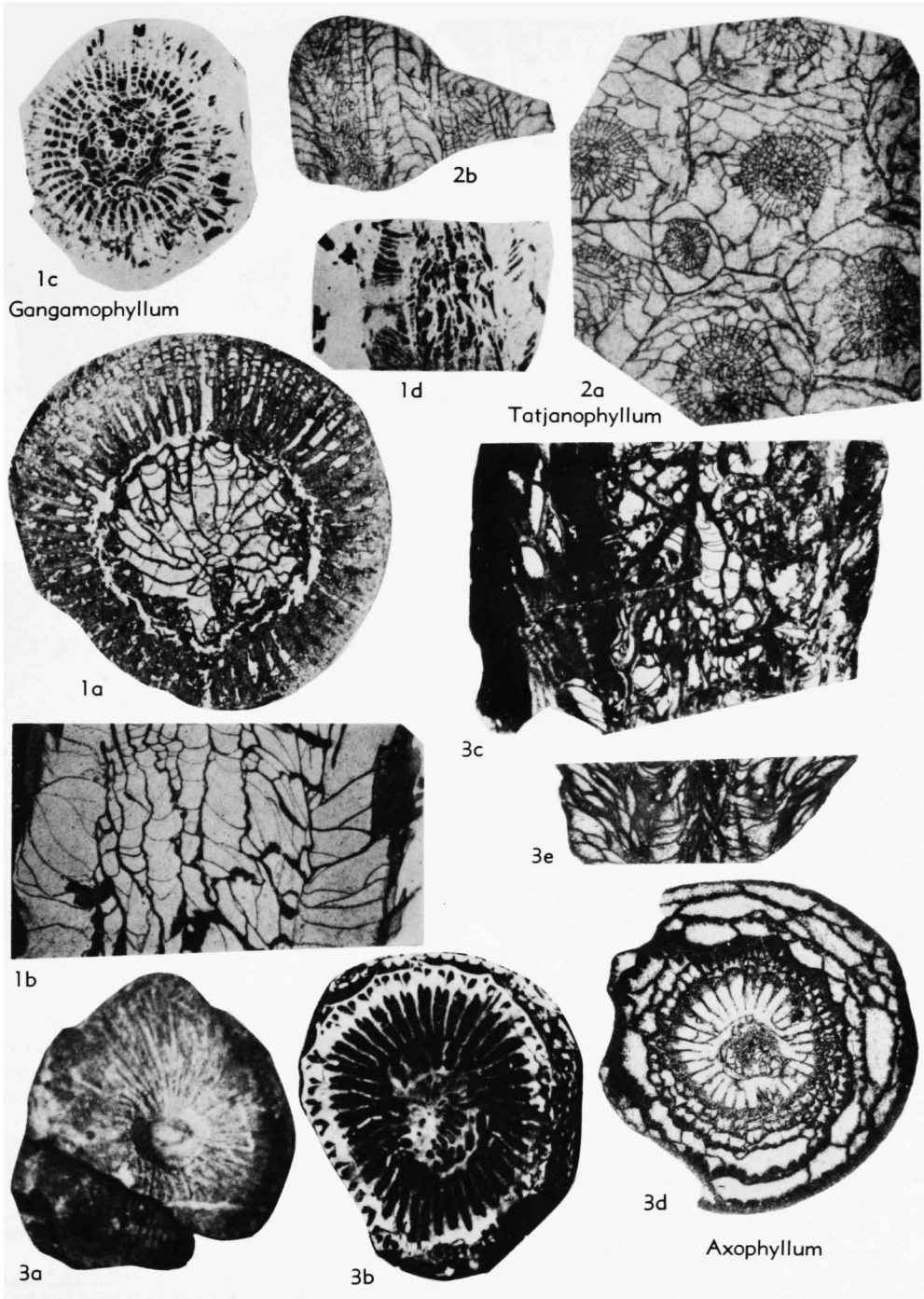


FIG. 261. Axophyllidae (p. *F*398-*F*401).

crease lateral, cardinal-counter plane in offsets commonly radial to axis of parent [see KATO, 1966b, p. 100; JULL, 1967, p. 618]. *L.Carb.*, Eu. (U. K.-Belg.-France-Ger.-USSR)-Asia (Kwangsi-Manchuria-Japan).——FIG. 262,*3a-d*. **A. floriformis* (MARTIN); *a*, lectotype of *Cyathophyllum*

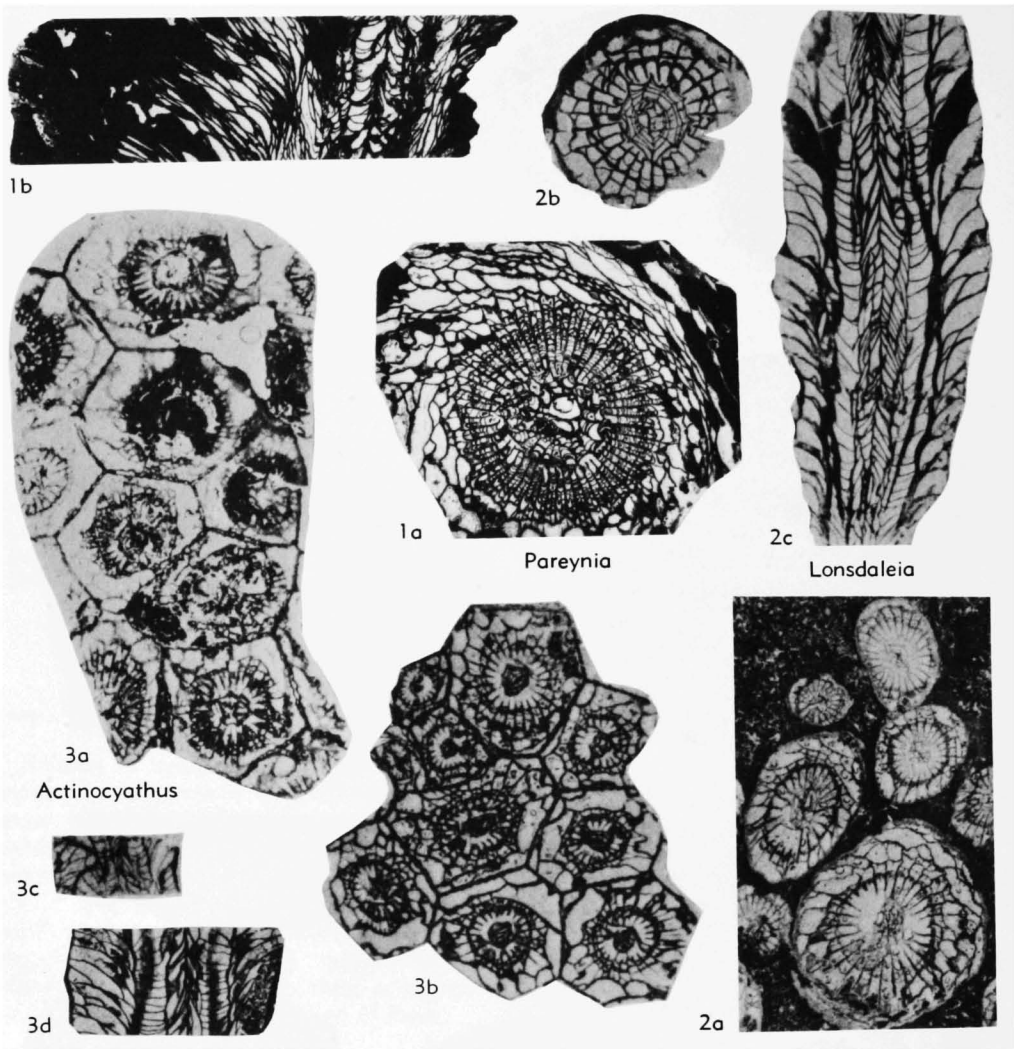


FIG. 262. Axophyllidae (p. *F*398-*F*401).

crenulare PHILLIPS, Visean, ?Clitheroe, transv. sec., ×1.5 (Kato, 1966b); *b,c,* neotype of *A. floriformis* (MARTIN), Visean, Derbyshire, transv., long. secs., ×1.5; *d,* another specimen, Visean, Derbyshire, long. sec., ×2.0 (Smith, 1916).

Gangamophyllum GORSKIY, 1938, p. 101 [**G. boreale*; OD; †not traced, *fide* DOBROLYUBOVA, 1952a, p. 53] [=*Chienchangia* LIN & FAN, 1959, p. 113 (type, *C. retiformis,* OD; †Ch1161, GC, Changchun; Visean, Chinghai]. Large, solitary, cylindrical, in late stages with lonsdaleoid dissepimentarium; with wide axial column of irregularly radial septal lamellae and domed tabellae and without median lamella or columella; axial ends of major septa not attaining column; pericolumnar tabulae concave to declined or inclined; no marked fossula [DOBROLYUBOVA, 1952a, p. 53]. *L.Carb. (Visean),* Eu.(N.Zemlya-Urals-Yugo.-Donbas-Moscow Basin)-Asia(Kazakh.-N.Pamir-China-Japan). ——FIG. 261,*1a,b*. **G. boreale; a,* holotype, up. Visean or Namur., N. Zemlya, S. Coast Bogaty I., transv. sec., ×1.7 (Gorskiy, 1938); *b,* another specimen, R. Oka, Moscow Basin, long. sec., ×1.7 (Dobrolyubova, 1952a).——FIG. 261,*1c,d*. *G. retiforme* (LIN & FAN); *c,* holotype, transv. sec., ×1.7; *d,* another specimen, long. sec., ×1.7 (Yü *et al.,* 1963).

Lonsdaleia MCCOY, 1849, p. 11 [**Erismatolithus madreporites (duplicatus)* MARTIN, 1809, p. 20; validated by ICZN Op. 419; †neotype, A2149, SM, Cambridge; by SMITH, 1916, p. 268]. Phaceloid, increase peripheral or lateral, nonparricidal; axial column well-defined, with medial plate derived from cardinal septum, radial lamellae, and

axial tabellae, or less commonly with irregularly curved and thickened lamellae and axial tabellae, or sporadically absent; pericolumnar tabulae slightly concave or slightly declined outward or inward; minor septa commonly weakly developed, dissepimentarium lonsdaleoid; fossula not distinct [SMITH, 1916, p. 238]. *L.Carb.(Visean)-U.Carb.(Namur.),* Eu. (U. K.-France-Belg.-Ger.-Moscow Basin-Urals-Donbas-N. Zemlya)-Asia (Japan-?China)-?N.Am.(Nova Scotia).——FIG. 262,*2a-c.* **L. duplicata* (MARTIN); *a,* neotype, Visean, Derbyshire, top of Crick Hill, SE. of Matlock, transv. sec., ×1.5; *b,c,* another specimen, Visean, Merionethshire, Hafod-y-calch, Corwen, transv., long. secs., ×2.0 (Smith, 1916).

Pareynia SEMENOFF-TIAN-CHANSKY, 1974, p. 240 [**P. splendens*; OD; †93, sample 382, PAREYN Coll., LG, Caen, ?now in MN, Paris]. Solitary, very large; with wide axial column of irregular median and septal lamellae and conical tabellae, very numerous long septa and with dissepimentarium peripherally with elongate, unequal, and closely spaced lonsdaleoid dissepiments commonly with septal crests; cardinal and counter septa may have attenuate connections with median plate; pericolumnar tabellae steeply declined adaxially, numerous. *L.Carb.(up.Visean),* N.Afr.(W.Sahara).——FIG. 262,*1a,b.* **P. splendens,* holotype, up. Visean, piton to E. of Meharez el Kebir; *a,b,* transv., long. secs., ×1.0 (Semenoff-Tian-Chansky, 1974).

Tatjanophyllum KOZYREVA, 1974a, p. 94 [**T. dobrolyubovae*; OD; †14/69, DPI, Donetsk] [?=*Protolonsdalia* LISITSYN, 1925, see *Actinocyathus* D'ORBIGNY, 1849]. Cerioid; corallites with wide axial ?column of thin irregular septal lamellae and irregular tabellae and commonly lacking median plate and definite column wall; periaxial tabulae flat or concave, incomplete; dissepimentarium wide, lonsdaleoid, of large plates with sparse septal crests, thin major and minor septa longitudinally continuous only in tabularium; fossula not distinguished. *L.Carb.(Visean),* Eu. (USSR).——FIG. 261,*2a,b.* **T. dobrolyubovae,* holotype, from horizon V_6, at depth 178.5 m. in borehole 120, Kulikovka, S. Slope Voronezh anteclise; *a,b,* transv., long. secs., ×1.7 (Kozyreva, 1974a).

Family PETALAXIDAE Fomichev, 1953

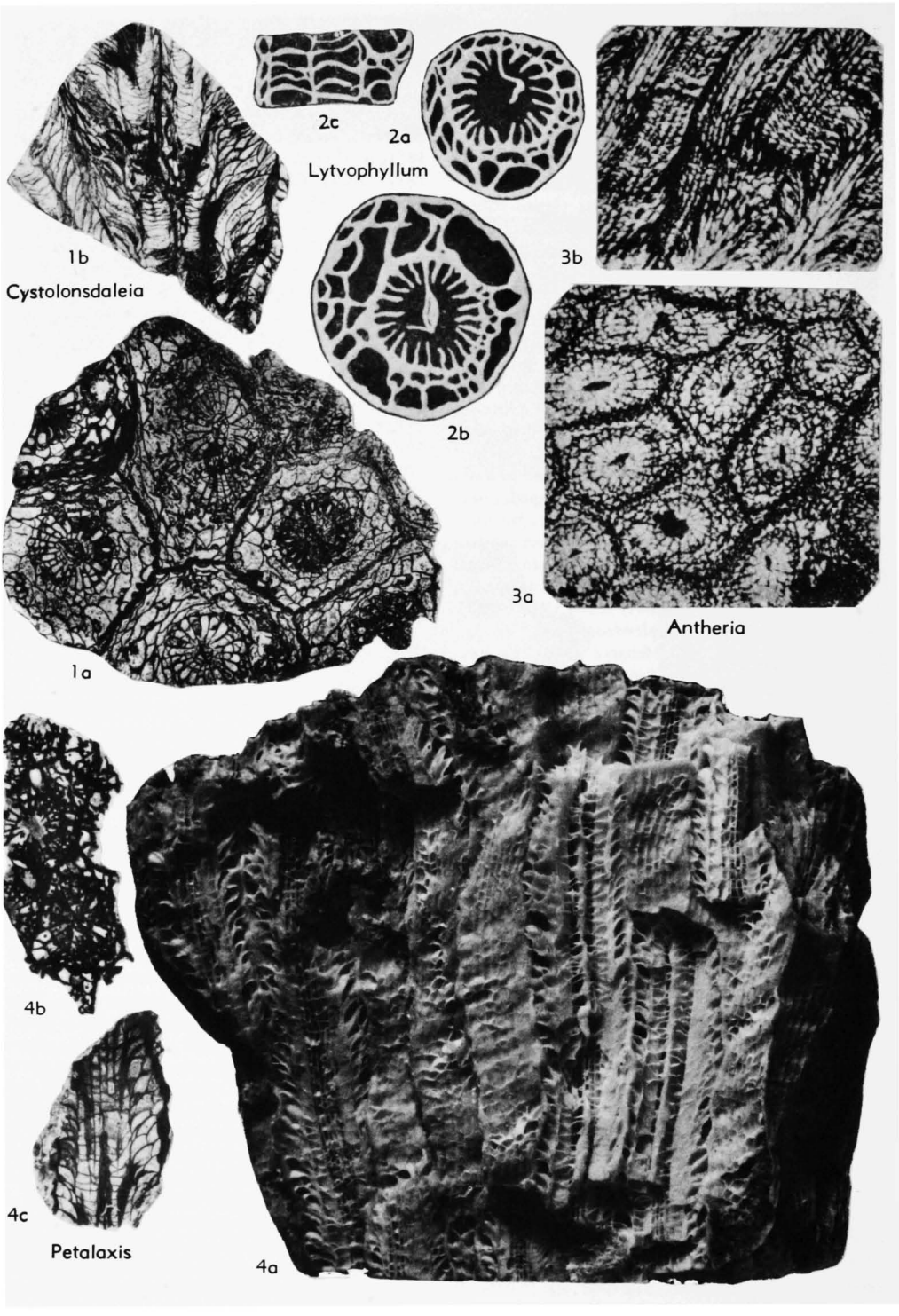
[Petalaxidae FOMICHEV, 1953a, p. 449] [=Cystophoridae FOMICHEV, 1953a, p. 469; Lithostrotionellidae SHROCK & TWENHOFEL, 1953, p. 161]

Fasciculate, cerioid, astreoid or aphroid; axial structure lathlike columella, commonly continuous with long cardinal septum, becoming narrow axial column by addition of few, short septal lamellae and axial tabellae that form discontinuous column wall; periaxial tabulae subhorizontal or concave or declined adaxially; dissepimentarium commonly lonsdaleoid [see also KOZYREVA, 1974b, p. 24]. *L.Carb.-L.Perm.*

Petalaxis MILNE-EDWARDS & HAIME, 1852, p. 204 [**Stylaxis m'coyana* MILNE-EDWARDS & HAIME, 1851, p. 453; SD ROEMER, 1883, p. 388; syntypes 2817, 2821, EM, Paris; see also SUTHERLAND, 1977, p. 185] [=*Lithostrotionella (Hillia)* DE GROOT, 1963, p. 86 (type, *L. (H.) wagneri,* OD; †112734, RGM, Leiden; M.Carb., Namur. or Bashkir.-low. Verey, Perapertú F., Palencia, Spain; ?=*Stylaxis maccoyana* MILNE-EDWARDS & HAIME, 1851), *non Hillia* GROTE, 1883, a lepidopteran; *Huananophyllum* XU in JIA *et al.,* 1977, p. 207 (type, *H. lithostrotionelloidea,* OD; †IV38568, HPRIGS, Yichang; U.Carb., C_3, Yi Shan Xian [co.], Guangzi [Kwangsi]), axial tabellae rare to absent]. Cerioid; with simple, narrow axial structure of lathlike columella continuous with one long protoseptum, commonly the cardinal, commonly reinforced by one or two very short septal lamellae and sparse, steep axial tabellae based on columella or on axial tabella next below; other major septa somewhat withdrawn from axis; minor septa moderately long in lonsdaleoid dissepimentarium; tabulae subhorizontal, supplemented peripherally by adaxially declined tabellae [KOZYREVA, 1974b, p. 23]. *U.Carb.(Bashkir.-Moscov.),* Eu.(Moscow Basin-Urals-Voronezh-Donbas-Spain)-Asia(China); *L.Penn.(Morrow.),* N. Am.(Okla.).——FIG. 263,*4a-c.* **P. maccoyanus* (MILNE-EDWARDS & HAIME), syntypes, USSR, Colonna on R. Oka; *a,* lat. view, *b,c,* transv., long. secs., ×2.0 (Hill, n; *b,c,* EM2821).——FIG. 266, *2a-c.* *P. wagneri* (DE GROOT), holotype; *a-c,* transv., long. secs., ×3.0 (de Groot, 1963).

Antheria WU & ZHAO, 1974, p. 273 [**A. polygonalis*; OD; †21891-21892, IGP, Nanking]. Cerioid, in places astreoid; with axial structure a somewhat thickened lathlike columella continuous with one or two opposing long major septa and in places buttressed by sparse short septal lamellae; tabular floors declined toward columella, ?some clinotabellae present; major septa long, attenuate adaxially, their bases thickened to form, with those of minor septa, very narrow stereozone; minor septa discontinuous, and in places ?(where offsets arise) major septa also, so that dissepimentarium becomes lonsdaleoid. *U.Carb.(Maping.),* Asia(S.China).——FIG. 263,*3a,b.* **A. polygonalis,* holotype, Maping F., W. Kweichow, Toupo, Weining; *a,b,* transv., long. secs., ×2.0 (Wu, Chang, & Ching, 1974).

Cystolonsdaleia FOMICHEV, 1953a, p. 464 [**Petalaxis (Cystolonsdaleia) lutugini*; OD; †399, coll. 5030, TsGM, Leningrad] [?=*Actinocyathus* D'ORBIGNY, 1849, Axophyllidae]. Cerioid; with wide lonsdaleoid dissepimentarium, narrow axial column comprising thickened medial plate, in places short thickened radial lamellae, and axial tabellae



widely spaced and steeply inclined; major septa continuous only in tabularium, extending to axial column, minor septa present only as crests on wall and dissepiments; periaxial tabulae gently inclined, somewhat elevated toward both column and dissepimentarium, with supplementary clinotabellae. *U.Carb.*, Eu.(Donbas-Moscow Basin)-Asia(S.China).——Fig. 263,*1a,b*. **C. lutugini*, holotype, M.Carb.(Moscov.), ls. L_5, Donbas, Fashchevka; *a,b*, transv., long. secs., ×2.0 (Fomichev, 1953a).

?**Huanglongophyllum** Yü, 1976, p. 228 [**H. simplex*; OD; †KCH090-091, GB, Nanjing]. Fasciculate; with wide lonsdaleoid dissepimentarium in which major septa are markedly less discontinuous longitudinally than minor; major septal ends thickened in tabularium and separated from axial structure in wide axial space; axial structure variable, with more or less constant median plate that may be continuous with one major ?(cardinal) septum, and with few short irregular septal lamellae; tabular floors flat or somewhat concave but with broad peripheral clinotabellae, and with conical axial tabellae doubtfully present in places. *U. Carb. (Moscov.)*, Asia (China-Japan).——Fig. 264,*2a,b*. **H. simplex* (Yü), holotype, Huanglong F., Jiangsu, Wuxian, Wenhuashan; *a,b*, transv., long. secs., ×1.8 (Yü, 1976).

Ivanovia Dobrolyubova, 1935, p. 35, 45 [**I. podolskiensis*; OD; †106, coll. 140, PIN, Moscow] [?=*Cystophora* Yabe & Hayasaka, 1916, p. 70 (type, *C. manchurica*, OD; ?syntype, 8262, TohU, Sendai, metatype, R23724, BM(NH), London), *non Cystophora* Nilsson, 1820, a mammal; *Cystiphora* Lang, Smith, & Thomas, 1940, p. 47, *nom. van., non Cystiphora* Kieffer, 1892, a dipteran; *?Langia* Flügel, 1970, v. 2, p. 82, *nom. subst. pro Cystophora* Yabe & Hayasaka, 1916, *non Langia* Moore, 1872, a lepidopteran; *?Protoivanovia* Yü, 1977, p. 84 (type, *P. regularis*, OD; †KCH004-007, GB, Nanjing; U.Carb., Chuanshan F., Jiangsu; medial plate without septal lamellae), Yü, 1976, p. 227, first used the name in the combination *P. intermedia* Yü (†KCH082-084, GB, Nanjing; M.Carb., Moscov., Jiangsu, China), but without diagnosis or designation of type species]. Aphroid, with some traces of walls; major septa long, but few reaching columella, dilated in tabularium; minor septa present but not tertiary septa; septa discontinuous in dissepimentarium; axial structures compact, comprising thickened median plate and few short lamellae with few axial tabellae arranged in cones; periaxial tabulae sagging, some peripheral clinotabellae [see Yabe & Eguchi, 1944, p. 470]. *U.Carb.(Moscov.)*, Eu.(Russ.Platf.-Donbas)-Asia (Manchuria-Korea).——Fig. 265,*1a,b*. **I. podolskiensis*, syntype, Podolsk horizon, Moscow Basin, Schurovo; transv., long. secs., ×2 (Dobrolyubova, 1935).——Fig. 265,*1c,d*. *?I. manchurica* (Yabe & Hayasaka), metatype, Manchuria; *c,d*, transv., long. secs., ×2 (Hill, 1956b).——Fig. 265, *1e-g*. *?I. intermedia* (Yü), holotype, Moscov., Jiangsu, Yixing; *e,f*, transv., *g*, long. secs., ×3 (Yü, 1976).

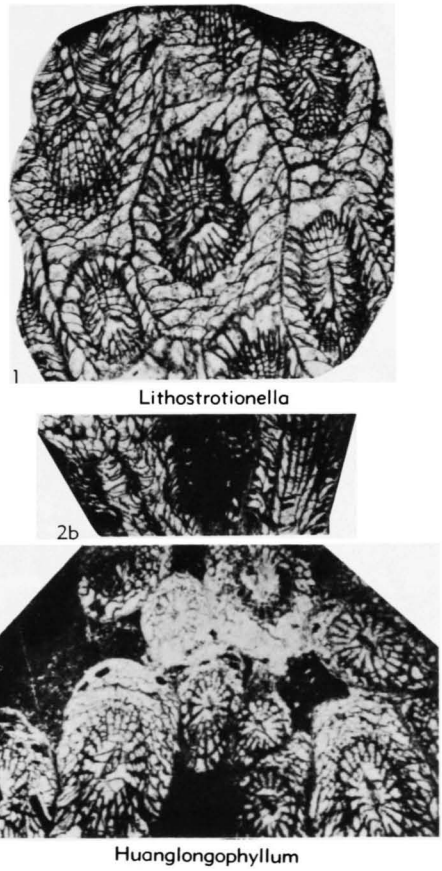


Fig. 264. Petalaxidae (p. *F*403).

Lithostrotionella Yabe & Hayasaka, 1915, p. 93 [**Lithostrotion (Lithostrotionella) unicum*; M; †6282, TohU, Sendai; lectotype by Minato & Kato, 1974, p. 72]. Cerioid, with lonsdaleoid dissepimentarium; with lathlike columella continuous with one, or two opposite, major septa; no wall-forming axial tabellae noted in figured type specimen, nor any radial septal lamellae; tabular floors subhorizontal, more commonly slightly convex or in places updrawn at columella, a few slightly concave; fossula not distinct. [Diagnosis based only on lectotype. Older names *Petalaxis* Milne-Edwards & Haime, 1852, which see, and *Acrocyathus* d'Orbigny, 1849, Lithostrotionina, Lithostrotionidae, Acrocyathinae, are available for species with different morphologies commonly attributed to *Lithostrotionella*; because knowledge of the range of variation in *L. unica* is lacking, it is recommended that the name

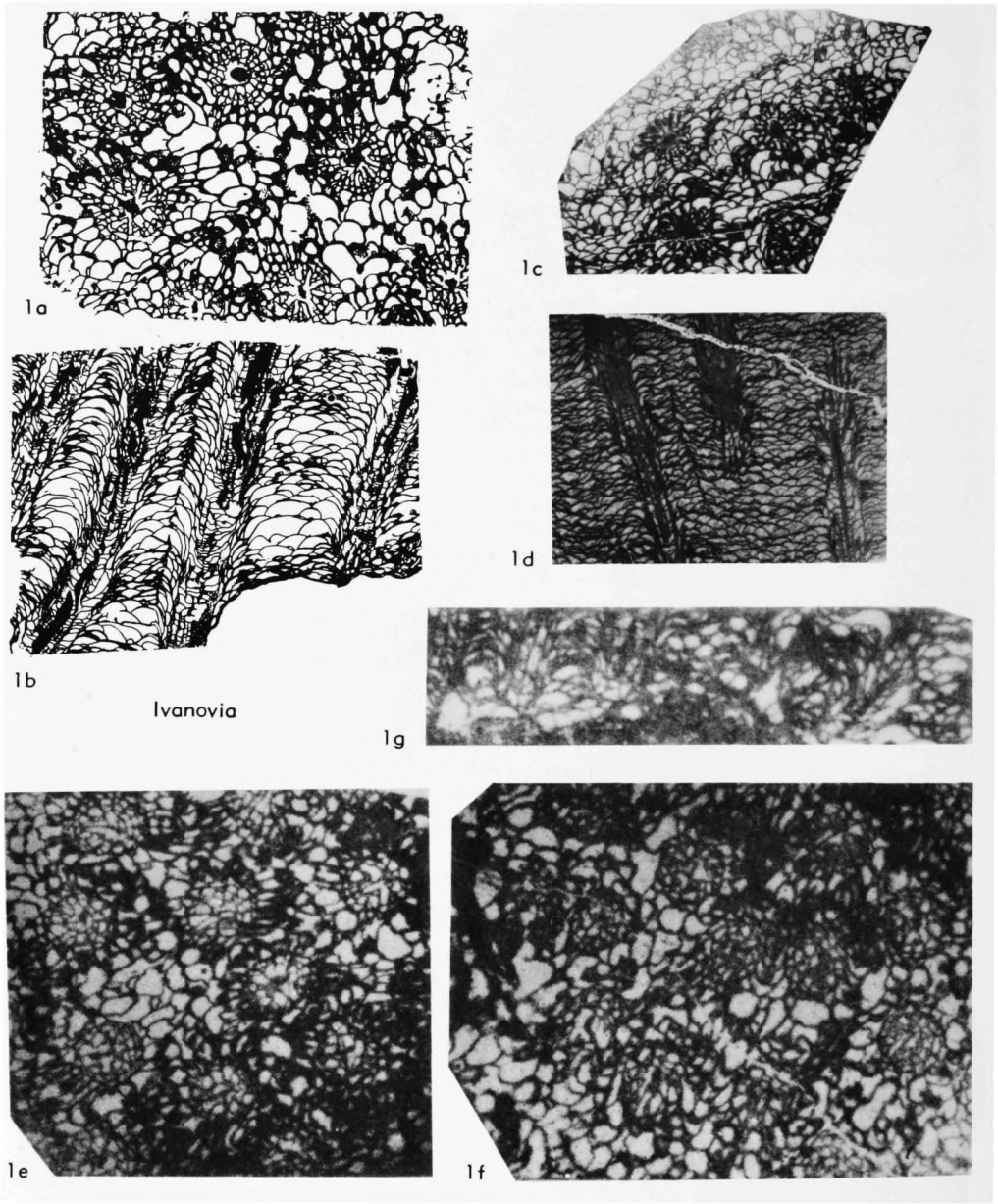


FIG. 265. Petalaxidae (p. *F*403).

Lithostrotionella not be used. See also EASTON, 1973, p. 128.] *L.Perm.(Chihs.)*, Asia(Yunnan). ——FIG. 264,*1*. **L. unica*, lectotype, Kung-shan, Hui-tso-hsien [Mandarin; =Hon-shan, Ton-chuan-hsien, local pronunciation, *fide* I. HAYASAKA, written commun., May 4, 1964, to R. K. JULL, wherein also HAYASAKA considered that the original collection from this locality was Chihsian, though it was first tentatively regarded as Carboniferous]; oblique sec., ×2.4 (Minato & Kato, 1974).

Lytvophyllum DOBROLYUBOVA in SOSHKINA, DOBROLYUBOVA, & PORFIREV, 1941, p. 146 [**Thysanophyllum tschernowi* SOSHKINA, 1925, p. 98; OD; †921, coll. 146, PIN, Moscow, SD DOBROLYUBOVA in SOSHKINA, DOBROLYUBOVA, & PORFIREV, 1941,

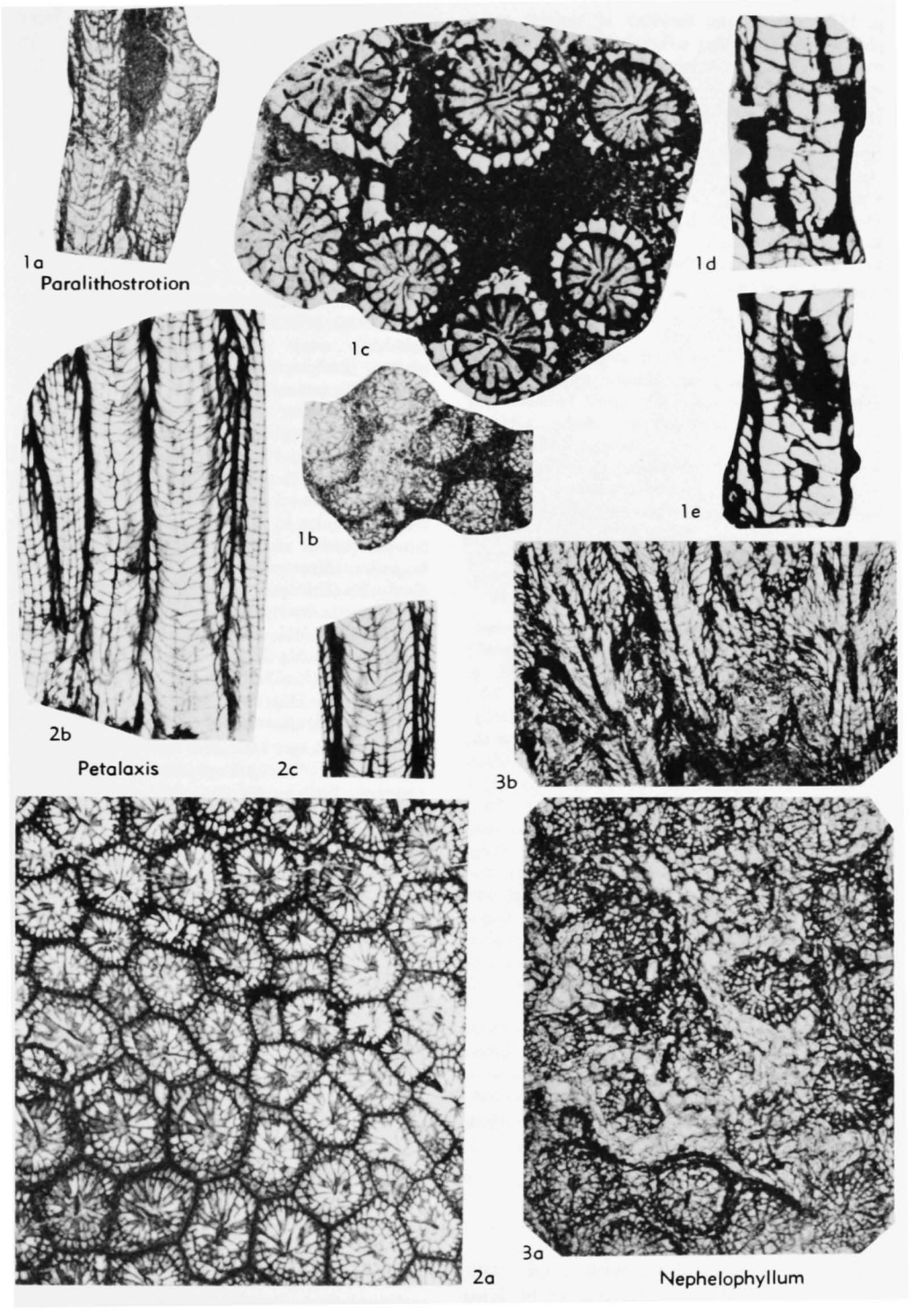


FIG. 266. Petalaxidae (p. F401, F406).

p. 147]. Fasciculate; corallites of variable morphology; thick laminar columella attached to long major septum commonly present; often major septa somewhat withdrawn from axis; dissepimentarium commonly lonsdaleoid with minor septa or both major and minor septa discontinuous; tabulae subhorizontal, complete or incomplete. *U.Carb.(Namur.-Bashkir.)*, Eu.(Donbas); *L.Perm.*, Eu.(Urals).——Fig. 263,*2a-c*. **L. tschernowi* (Soshkina), holotype, L.Perm.(Artinsk.), S. Urals, R. Lytva; *a,b*, transv., *c*, long. secs., ×3.5 (Soshkina, Dobrolyubova, & Porfirev, 1941).

Nephelophyllum Wu & Zhao, 1974, p. 272 [**N. simplex*; OD; †21889-21890, IGP, Nanking]. Cerioid or in part aphroid, common wall when present a narrow peripheral stereozone of contiguous septal bases; axial column narrow, simple median plate with few short radial lamellae and conical tabellae; pericolumnar tabulae subhorizontal or sagging, with clinotabulae peripherally; marginarium mainly lonsdaleoid dissepimentarium except in early stages of offsets, where septa longitudinally contiguous and thickened. *U.Carb.*, Asia (Kweichow).——Fig. 266,*3a,b*. **N. simplex*, holotype, Maping F., W. Kweichow, Toupo, Weining; *a,b*, transv., long. secs., ×2 (Wu, Chang, & Ching, 1974).

Paralithostrotion Gorskiy, 1938, p. 66 [**P. jermolaevi*; OD; †83, coll. 5769, TsGM, Leningrad] [=*Tschernowiphyllum* Dobrolyubova, 1958, p. 210 (type, *T. podboriense*, OD; †583, coll. 705, PIN, Moscow; L.Carb., Visean, NW. Russ. Platf.); *?Schoenophyllum* Simpson, 1900, Lithostrotionina, Lithostrotionidae, Lithostrotioninae]. Fasciculate, corallites with connecting processes; major septa long, unequal, one prolonged into axis to form thin, impersistent, lathlike columella which may become discrete, or may overlap second long, opposite, major septum; minor septa may be discontinuous when dissepiments are lonsdaleoid, and each crosses one major interseptal loculus; tabular floors concave, tabulae complete or incomplete [see Rakshin, 1965, p. 56]. *L.Carb.-U.Carb.(up. Visean-Namur.)*, Eu.(N.Zemlya-Moscow Basin-C. Urals)-Asia(Kazakh.).——Fig. 266,*1a,b*. **P. jermolaevi*, holotype, exposure 19, Novaya Zemlya, Russian Harbor N. of C. Shueretsky; *a,b*, long., transv. secs., ×2 (Gorskiy, 1938).——Fig. 266, *1c-e*. *P. podboriense* (Dobrolyubova), holotype, Podbore, Lyobytin distr.; *c*, transv., *d,e*, long. secs., ×4 (Dobrolyubova, 1958).

Family GEYEROPHYLLIDAE Minato, 1955

[Geyerophyllidae Minato, 1955, p. 155]

Solitary or fasciculate; with axial structure a solid rod in early stages, in later stages with radial septal lamellae, median plate, and axial tabellae; septa bilaterally arranged in early stages, radial in later stages, in some peripherally thickened to form stereozone; septal microstructure diffusotrabeculate; cardinal septum united to columellar rod at least in early stages, cardinal fossula indistinct; periaxial tabulae subhorizontal, with clinotabellae peripherally; dissepimentarium normal, with lonsdaleoid dissepiments in some in later stages; rejuvenescence common [Minato & Kato, 1975a, p. 5]. *U.Carb.-L.Perm.*

Geyerophyllum Heritsch, 1936, p. 131 [**G. carnicum*; OD; †P2077, UG, Graz]. Solitary, with commonly dense axial structure consisting of median plate continuous with longest, probably cardinal, septum, septal lamellae whose outer edges may project but are commonly discontinuous from major septa, and in places tabellae; dissepimentarium wide, commonly lonsdaleoid peripherally, otherwise of normal small concentric plates; minor septa more weakly developed than major; form of tabulae in type material unknown, clinotabulae present in species subsequently assigned to genus [Minato & Kato, 1975a, p. 3]. *?U. Carb.*, Eu.(Croatia); *U.Carb.*, Eu.(Carnic Alps)-Asia(Japan); *Penn.(Missour.)*, N.Am.(Kans.).——Fig. 267,*1a*. **G. carnicum*, holotype, Auernig Beds, Carnic Alps, Ahornach area; transv. sec., ×1.6 (Heritsch, 1936).——Fig. 267,*1b,c*. *G.* sp. cf. *G. broilii* Heritsch, Missouri., USA, Kans.; *b,c*, transv., long. secs., ×1.8 (Cocke, 1970).

Amygdalophylloides Dobrolyubova & Kabakovich, 1948, p. 23 [**Amygdalophyllum ivanovi* Dobrolyubova, 1937, p. 60; OD; †181, coll. 141, PIN, Moscow] [?=*Koninckocarinia* Dobrolyubova, 1937, Koninckocariniidae]. Solitary, small, almost straight; major septa long, reaching or almost reaching thick columella, columella oval in section and in contact with, or formed from axial end of, long cardinal septum; in some, columella may be part of axial structure that includes thick septal lamellae and poorly developed axial tabellae; minor septa may be moderately long and dissepimentarium may be wide, septa thickened peripherally to form narrow stereozone; clinotabulae wide, may merge with narrow horizontal pericolumnar tabulae; dissepiments normal or somewhat irregular, lonsdaleoid dissepiments sporadic and steeply inclined. *U.Carb.(Namur.-Stephan.)*, Asia(Japan)-Eu.(Moscow Basin-Spain)-Asia(Viet Nam-China); *L.Perm.*, Eu.(Aus.).——Fig. 268,*1a,b*. **A. ivanovi* (Dobrolyubova), holotype, U.Carb.(Moscov.), Myachkovo horizon, Shchurovo; *a,b*, transv., long. secs., ×3.2 (Dobrolyubova, 1937).

Axolithophyllum Fomichev, 1953a, p. 413 [**A. mefferti*; OD; †375, coll. 5030, TsGM, Leningrad]. Solitary, widely conical, with solid columella of

simple, cylindrical form in young stages, but more complex in mature stages with thickened medial plate connected with cardinal septum and to which may be attached irregular, short, thick septal lamellae and thin axial tabellae; cardinal septum may shorten in latest stages; tabulae subhorizontal, with clinotabulae peripherally; dissepimentarium wide, irregularly lonsdaleoid peripherally, dissepimentarial floors may be somewhat everted; innermost series of dissepiments may be thickened; lateral dissepiments developed in places; major septa long, nearly reaching columella, thickened wedgewise toward periphery, where in late stages both orders may become naotic; minor septa thinner. *U.Carb.*, Eu.(Moscow Basin-Donbas-Spain)-Asia (S. China-?Japan); *Penn.*, N. Am. (Kans.).——Fig. 268,*3a,b*. **A. mefferti*, U.Carb. (Moscov.), ls. in group N_2, Donbas, Kholodnyy spring; *a*, holotype, transv. sec., ×2.0; *b*, topotype, long. sec., ×2.0 (Fomichev, 1953a).

Carinthiaphyllum Heritsch, 1936, p. 134 [**C. kahleri*; OD; †P2082, UG, Graz]. Solitary ?(or fasciculate) with a columella of variable pattern; a median plate is commonly present, connected with long cardinal septum from which one or more short septal lamellae may radiate irregularly; uncommonly, tabellae may form briefly a somewhat more complex axial structure; septa thin, long, but mostly not reaching columella, dissepimentarium wide, of small normal concentric plates, lonsdaleoid plates developing peripherally in places; tabulae of type species imperfectly known [commonly declined adaxially and including clinotabulae, *fide* Minato & Kato, 1967, p. 314; see Minato & Kato, 1975a, p. 15]. *U.Carb.-L.Perm.*, Eu.(Aus.-Yugo.-Greece-Donbas)-Asia(Tadzhik.-Japan-S.China).——Fig. 268,*5*. **C. kahleri*, holotype, L.Perm., low. *Pseudoschwagerina* ls., Carnic Alps; transv. sec., ×2.2 (Heritsch, 1936).

Carniaphyllum Heritsch, 1936, p. 131 [**C. gortanii*; OD; †P2071, UG, Graz]. ?Solitary; with an axial structure attached by its short, thick median plate to probable cardinal septum, and composed of septal lamellae and numerous tabellae; dissepimentarium wide, with minor septa long, thinner than major and in places discontinuous; dissepiments small, normal concentric, but somewhat irregular, a few larger lonsdaleoid plates in places; form of tabulae unknown. [See Minato & Kato, 1975a, p. 4, 8; insufficiently known.] *U.Carb.(Coral fauna II)*, Eu.(Carnic Alps).——Fig. 267,*2*. **C. gortanii*, holotype, Auernig Beds; transv. sec., ×2.9 (Heritsch, 1936).

Darwasophyllum Pyzhyanov, 1964, p. 170 [**D. irregulare*; OD; sample 19-2-5, coll. 705, UG, Dushanbe]. Fasciculate; corallites with peripheral stereozone disrupted in mature stages by lonsdaleoid dissepiments, and with one long major septum ?(cardinal, *fide* Rowett & Kato, 1968, p. 37) connected with axial structure consisting of thickened medial plate, thickened irregular septal lamellae, and axial tabellae also somewhat thickened; other major septa unequal, commonly somewhat withdrawn from axial structure; tabulae declined toward axial structure, complete or incomplete. *U.Carb.(Namur.)*, Asia(Japan); *U. Carb.(Bashkir.-Moscov.)*, Asia(Tadzhik).——Fig. 268,*2a-c*. **D. irregulare*, Tadzhik, SW. Darvaz; *a,b*, holotype, transv., long. secs., ×2.4; *c*, paratype, transv. sec., ×2.4 (Pyzhyanov, 1964).

?Jintingophyllum Yü, 1977, p. 85 [**J. jintingense*; OD; †KCH201-202, GB, Nanjing]. Aphroid but with septa of two orders continuous through wide dissepimentarium except at periphery; axial ends of major septa somewhat rhopaloid and curved; wide axial structure with few, irregular lamellae; tabular floors concave, with some clinotabellae peripherally. [Possibly petalaxid.] *U.Carb.*, Asia (S.Kiangsu).

Kionophyllum Chi, 1931, p. 39 [**K. dibunum*;

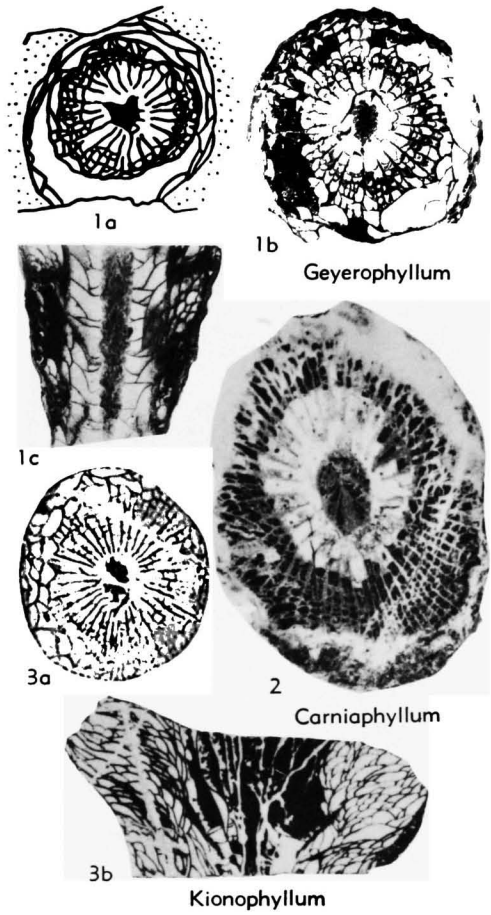


Fig. 267. Geyerophyllidae (p. *F406-F408*).

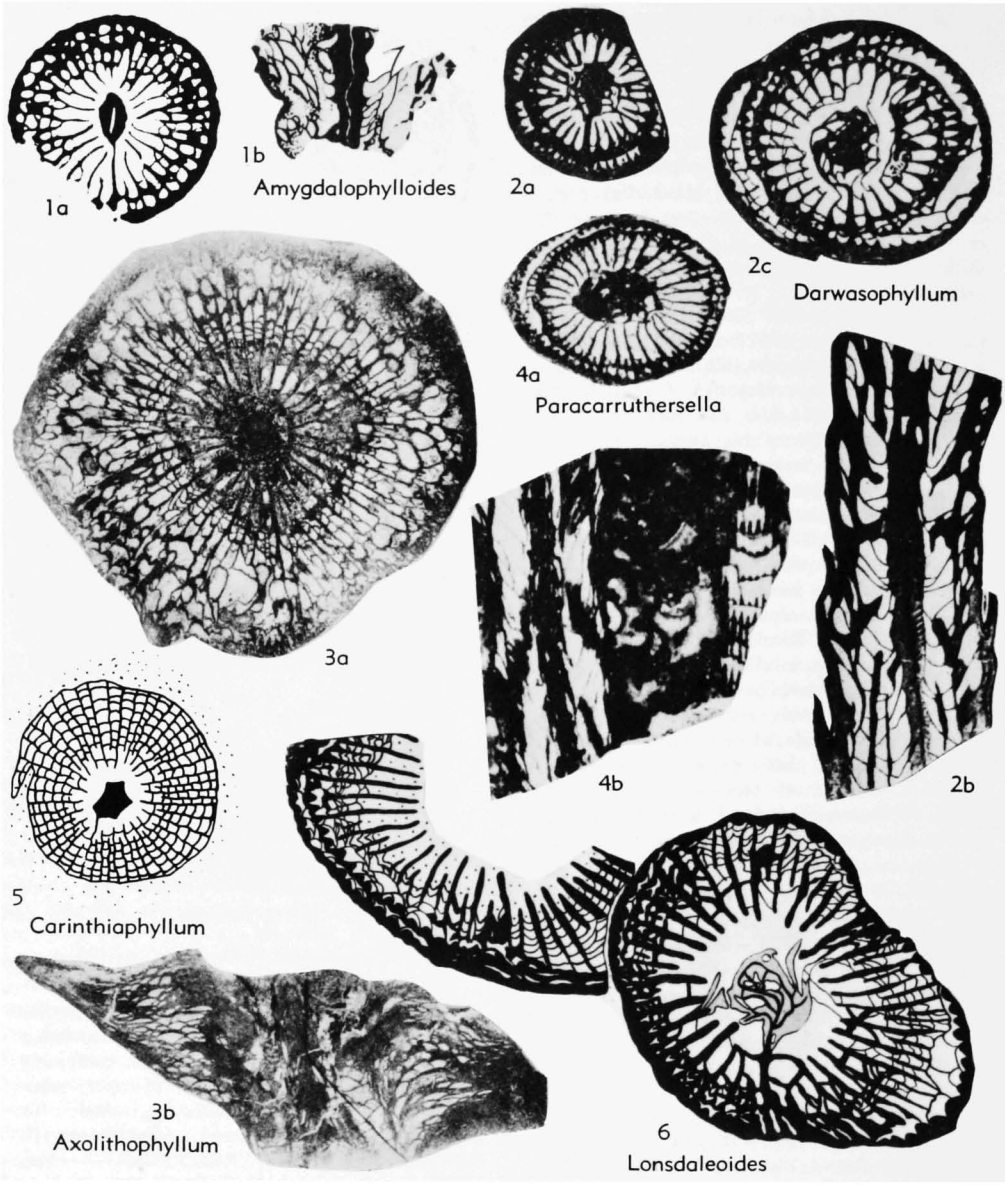


FIG. 268. Geyerophyllidae (p. *F*406-*F*409).

OD; †3995, IGP, Nanking] [=*Cionophyllum* LANG, SMITH, & THOMAS, 1940, p. 37, *nom. van.*]. Solitary, conical to cylindrical; with solid axial structure consisting of a median plate continuous with cardinal and in places with counter septum also, and a few septal lamellae, some of which may be continuous with the longer major septa; slightly inclined tabulae are supplemented peripherally by some clinotabellae; dissepimentarium more or less lonsdaleoid, minor septa more weakly developed than major [see MINATO & KATO, 1975a, p. 9]. *U.Carb.(Weining.)*, Asia(S.China)-Eu.(Donbas); *Penn.*, N.Am.(Kans.-Iowa).——FIG. 267,*3a,b*. **K. dibunum*, holotype, Laokanchai Ls., Kweichow, Kuanyintung Pass, Lipohsien; *a,b*, transv., long. secs., ×1.0 (Chi, 1931).

Lonsdaleoides HERITSCH, 1936, p. 128 [**L. boswelli*; OD; †P2703, UG, Graz; lectotype by HOMANN, 1971, p. 129]. Fasciculate, with variable axial structure of septal lamellae and tabellae, one lamella being continuous with long protoseptum [counter, *fide* HERITSCH, 1936, p. 129, and

HOMANN, 1971, p. 130, but cardinal, *fide* DE GROOT, 1963, p. 101, and HAYASAKA & MINATO, 1966, p. 273], but commonly not bisecting opposite half of structure; septa long, thickened, may become naotic peripherally, minor septa weaker; dissepimentarium wide, may develop peripheral lonsdaleoid zone; tabularium of three zones, in axial structure tabellae declined from median lamella; in median zone tabulae concave or flat; in peripheral zone, clinotabellae. *U.Carb.(Westphal. D)*, Eu.(Spain); *L.Perm.*, Eu.(Carnic Alps).——FIG. 268,*6*. **L. boswelli,* holotype, L.Perm., low. *Schwagerina* Ls., Zöllner See, Carnic Alps; transv. sec., ×2.4 (Heritsch, 1936).

?Paracarruthersella YOH, 1961, p. 13 [**P. bryocolumellata*; OD; †not traced]. Fasciculate ?(or solitary, *fide* MINATO & KATO, 1975a, p. 14); with axial structure a loose aggregate of axial tabellae and irregular lamellae with short median plate; septa slightly thickened, ?(with zigzag carinae); in late stages major septa almost attaining axial structure, ?(cardinal rather shorter); minor septa short; tabulae mostly complete, tented [COTTON, 1973, p. 147, ?clinotabulae, *fide* ROWETT & KATO, 1968, p. 39]; wall thick; with wide lonsdaleoid dissepimentarium of steep, elongate plates, innermost series may be thickened to form inner wall [see MINATO & KATO, 1975a, p. 14]. *?U.Carb.*, Asia(S.China).——FIG. 268,*4a,b*. **P. bryocolumellata,* Maping Ls., S. China, loc. unknown; *a*, paratype, transv. sec., ×1.6; *b*, holotype, long. sec., ×1.6 (Yoh, 1961).

Family KONINCKOCARINIIDAE Dobrolyubova, 1962

[Koninckocariniidae DOBROLYUBOVA in SOSHKINA, DOBROLYUBOVA, & KABAKOVICH, 1962, p. 332]

Like Geyerophyllidae, but with simple, thin, lathlike columella formed by expansion of ?(or union with) axial end of long cardinal septum [see MINATO & KATO, 1975b, p. 23]. *U.Carb.*

Koninckocarinia DOBROLYUBOVA, 1937, p. 51 [**Koninckophyllum (Koninckocarinia) flexuosa*; OD; †279, coll. 141, PIN, Moscow] [*?=Amygdalophylloides* DOBROLYUBOVA & KABAKOVICH, 1948, Geyerophyllidae]. Solitary, small, conicocylindrical; cardinal septum very long, axial end slightly expanded to form ?(or unite with) lathlike columella; other major septa withdrawn unequally from axial region; minor septa long, both major and minor septa discontinuous in irregularly lonsdaleoid dissepimentarium, of steep dissepiments; tabulae slightly concave, with some peripheral clinotabellae [see MINATO & KATO, 1975b, p. 23]. *U.Carb.*, Eu.(Moscow Basin-Spain)-Asia(S.China); *Penn.*, N.Am.(Iowa).——FIG. 269,*1a,b*. **K. flexuosa,* monotype, U.Carb.(Moscov.), Podolsk horizon, Moscow Basin, Shchurovo; *a,b*, transv., long. secs., ×3.2 (Soshkina, Dobrolyubova, & Kabakovich, 1962).

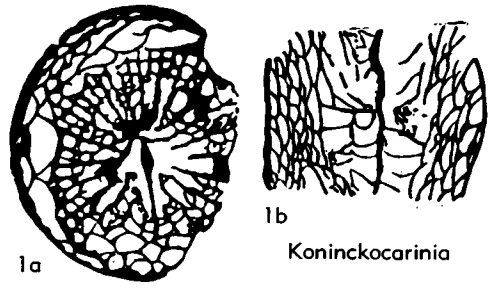


FIG. 269. Geyerophyllidae (p. *F*407-*F*408).

Family WAAGENOPHYLLIDAE Wang, 1950

[*nom. transl.* HUDSON, 1958, p. 177, *ex* Waagenophyllinae WANG, 1950, p. 212] [=Lonsdaleiastraeidae DOBROLYUBOVA in SOSHKINA, DOBROLYUBOVA, & KABAKOVICH, 1962, p. 344; Iranophyllidae FLÜGEL, 1965, p. 9]

Solitary or colonial; with an axial column commonly cylindrical, and consisting of median lamella and a few septal lamellae that may be regularly or irregularly disposed and of steeply inclined axial tabellae, their proximal edges commonly resting on the next below; major and minor septa present, and (in Wentzelellinae only) tertiary or higher orders of septa; tabulae annular in narrow adaxial parts between column and axial ends of major septa, segmented and the segments drawn upward very steeply abaxially as clinotabellae in the major interseptal loculi; supplementary, dissepiment-like clinotabellae may occur peripherally; supplementary ring tabellae may also occur; dissepimentarium wide or narrow; either of normal small concentric globose plates or lonsdaleoid or partly lonsdaleoid; narrow peripheral stereozone may develop where septal bases are thickened to contiguity. *U.Carb.-U.Perm.*

The classification adopted in this family follows that of MINATO & KATO, 1965a, with few modifications. Known material is scanty for several of the taxa.

Subfamily WAAGENOPHYLLINAE Wang, 1950

[Waagenophyllinae WANG, 1950, p. 212]

Waagenophyllidae without tertiary or higher orders of septa. *U.Carb.-U.Perm.*

Waagenophyllum HAYASAKA, 1924, p. 23, *nom. subst. pro Waagenella* YABE & HAYASAKA, 1915, p. 96, *non Waagenella* DE KONINCK, 1883, a Car-

boniferous gastropod [**Lonsdaleia indica* WAAGEN & WENTZEL, 1886, p. 897; SD GRABAU, 1931, p. 42; †3909-3911, GSI, Calcutta; lectotype by HUDSON, 1958, p. 179] [=*Warganella* YABE & HAYASAKA, 1915, p. 96, *nom. null.*]. Fasciculate, corallites slender, with lateral increase; axial column irregularly cylindrical, consisting of median lamella and a few septal lamellae biradially or irregularly disposed, and of steeply inclined axial tabellae whose proximal edges rest on the next below; major and minor septa not or rarely disrupted by lonsdaleoid dissepiments; no tertiary or fourth order septa; dissepimentarium normal, concentric, of small globose and elongate interseptal plates; a narrow peripheral stereozone may be present; tabulae annular in narrow adaxial part, segmented into steep clinotabellae in wider peripheral parts. *L.Perm.(Pseudofusulina Z.)-U.Perm.(Yabeina Z.)*, Asia (Pak.-Iran-Nakhichev.-Iraq-India-Burma-Camb.-Laos-Viet Nam-Inner Mongolia-China-Japan)-Eu.(Yugo.)-N.Z.

W. (Waagenophyllum). Zone of clinotabellae wide, dissepimentarium and annular part of tabulae narrow. *L.Perm.(Pseudofusulina Z.)-U.Perm.(Yabeina Z.)*, Asia(Pak.-Iran-Iraq-India-Burma-Camb.-Laos-Viet Nam-Inner Mongolia-China-Japan)-Asia M.-Eu.(Yugo.)-N.Z.——FIG. 270,*2a,b*. **W. (W.) indicum* (WAAGEN & WENTZEL), U.Perm., Wargal Ls., Pak., road from Chidru to Musakhel, Salt Ra.; *a,b*, transv., long. secs., ×10, ×20 (Waagen & Wentzel, 1886).

W. (Chaoiphyllum) MINATO & KATO, 1965a, p. 124 [**W. (C.) chaoi*; OD; †3948, IGP, Nanking] [=*Chaiophyllum* KULASINGAM & BARTLETT, 1967, p. 23, *nom. null.*]. Axial structure weak, loosely constructed of few axial tabellae and few irregularly disposed septal lamellae; septa thin; dissepimentarium wide, minor septa long, contratingent. [Insufficiently known, from two thin sections only.] *L.Perm.(Chihs.)*, Asia (China).——FIG. 270,*4a,b*. **W. (C.) chaoi*, holotype, Szechuan, Gnomeishan; *a,b*, transv., long. secs., ×6 (Huang, 1932).

W. (Huayunophyllum) TSENG, 1959, p. 500 [**W. (H.) aequitabulatum*; OD; syntype, FS42-15a, Research Inst. Petrol. Sci., ?Peking]. Corallites small; axial structure very simple, narrow; annular parts of tabulae wide. [Insufficiently known.] *U.Perm.(Yabeina Z.)*, Asia(Szechuan-Japan).——FIG. 270,*5a,b*. **W. (H.) aequitabulatum*, syntype, mid. Chuang-chang-wan F., Szechuan, Huayunshan; *a,b*, transv., long. secs., ×4 (Tseng, 1959).

W. (Liangshanophyllum) TSENG, 1949, p. 100 [**W. (L.) lui*; OD; †6948, ?Peking]. Axial column with medial plate, biradial lamella, and cone-in-cone tabellae; axial ends of septa variably withdrawn from column so that relative widths of commonly wide annular tabulae and of clinotabellae vary; dissepimentarium narrow, minor septa short. *U.Perm.*, Asia(Shensi).——FIG. 270, *6a,b*. **W. (L.) lui*, holotype, Wuchiaping Ls. (in *Palaeofusulina-Reichelina* Z., *fide* MINATO & KATO, 1965a, p. 128), Liangshan; *a,b*, transv., long. secs., ×2 (Tseng, 1949).

Akagophyllum MINATO & KATO, 1965a, p. 73 [**Lonsdaleia (Waagenophyllum) indica* var. *akagoensis* OZAWA, 1925, p. 76; OD; †type material, thin sections 77-81, 83, 84, OZAWA Coll., UT, Tokyo]. Fasciculate; axial column normal, separated from axial ends of major septa by relatively wide space, so that horizontal parts of tabulae are broad and somewhat irregular, as are clinotabellae; dissepimentarium wide, in part lonsdaleoid, minor septa long. *L.Perm.(Pseudofusulina-Parafusulina Z.)*, Asia(Japan-China-Iran-Tibet).——FIG. 271,*3a,b*. **A. akagoense* (OZAWA), *Pseudofusulina* Z., Japan, Kaerimizu, Akiyoshi-dai, Yamaguchi Pref.; *a,b*, transv., long. secs., ×2.3, ×2.4 (Minato & Kato, 1965a).

Chielasma MINATO & KATO, 1965b, p. 73 [**Dibunophyllum yüi* CHI, 1931, p. 39; OD; †3994, IGP, Nanking]. Solitary; axial column with median plate, septal lamellae (some corresponding to minor septa), and somewhat unequal axial tabellae, the proximal edges of some overlapping several more proximal tabellae; tabulae widely transverse, few peripheral clinotabellae; dissepimentarium lonsdaleoid in part, minor septa commonly crestal, major septa crestal in parts in some; no third or fourth order septa. *U.Carb. (Weining.)*, Asia(S.China).——FIG. 270,*1a,b*. **C. yui* (CHI), holotype, Weining., Laokanchai Ls., Kweichow, N. of Piaochai, Lipohsien; *a,b*, transv., long. secs., ×2 (Chi, 1931).

Chihsiaphyllum MINATO & KATO, 1965a, p. 87 [**Corwenia chihsiaensis* YOH in YOH & HUANG, 1932, p. 27; OD; †1175, IGP, Nanking]. Fasciculate; axial column in places may lack both medial plate and septal lamellae, so that superposed axial tabellae resemble an aulos; periaxial tabellae wide, slightly concave, in places with clinotabellae peripherally; dissepimentarium narrow, minor septa discontinuous, confined mainly to bases, dissepiments large, concentric, extending across major interseptal loculi. [Insufficiently known.] *L.Perm. (Chihs.)*, Asia(S.China).——FIG. 272,*3a,b*. **C. chihsiaense* (YOH), holotype, Chihsia Ls., Chihsiashan; *a,b*, transv., long. secs., ×1.3, ×4.0 (Yoh & Huang, 1932).

Heritschiella MOORE & JEFFORDS in HILL, 1956b, p. *F*310, *nom. subst. pro Heritschia* MOORE & JEFFORDS, 1941, p. 94, *non Heritschia* TEPPNER, 1922, a mollusk [**Heritschia girtyi*; OD; †3419-1, KUMIP, Lawrence]. Fasciculate, with compact, narrow axial column and wide dissepimentarium; axial column with median plate joined to counter septum, a few radial lamellae, and close, numerous, arched tabellae sloping nearly vertically; periaxial tabellae concave with peripheral clinotabellae; septa long, numerous, thin in normal dissepi-

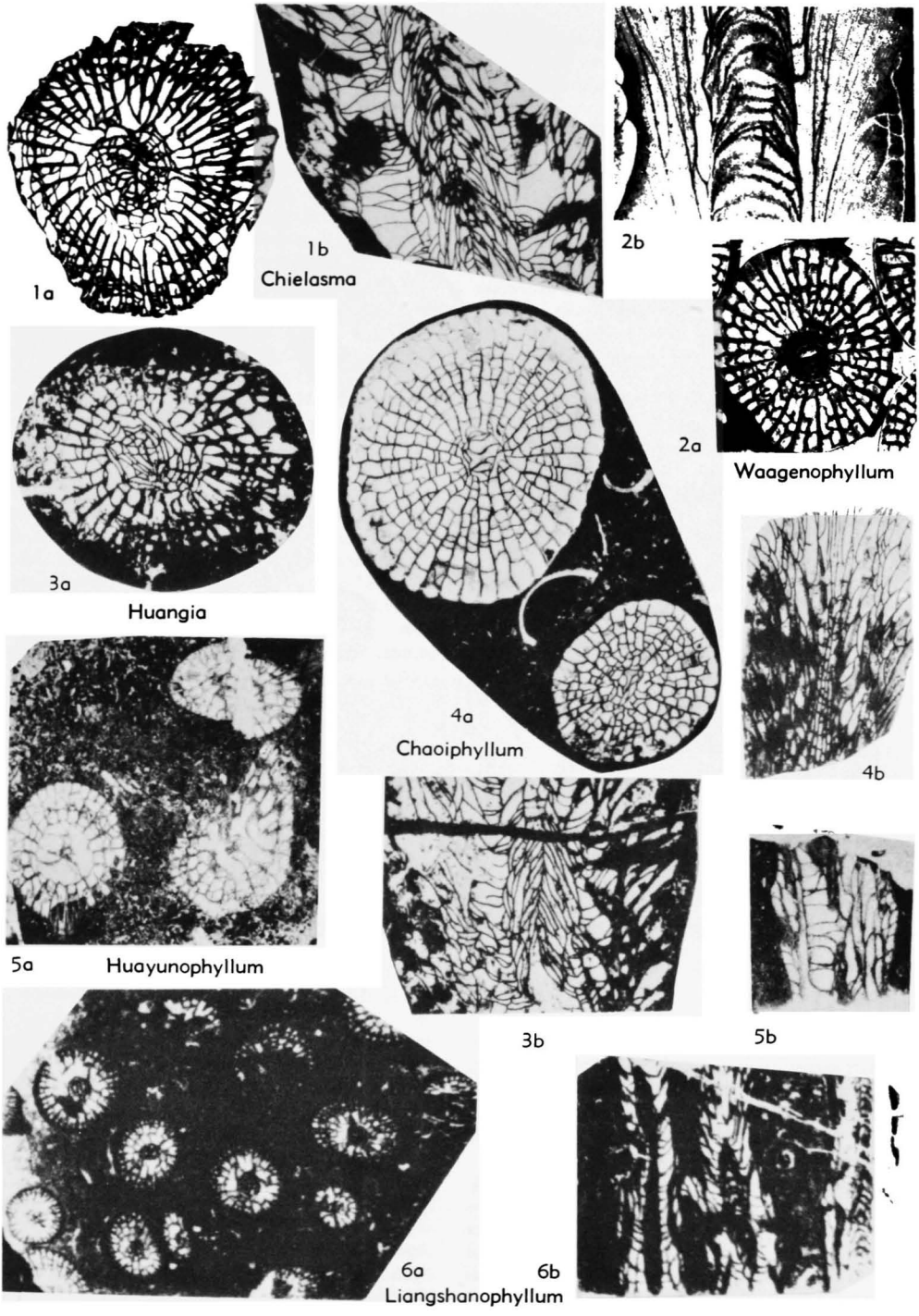


FIG. 270. Waagenophyllidae (p. *F*409-*F*410, *F*412).

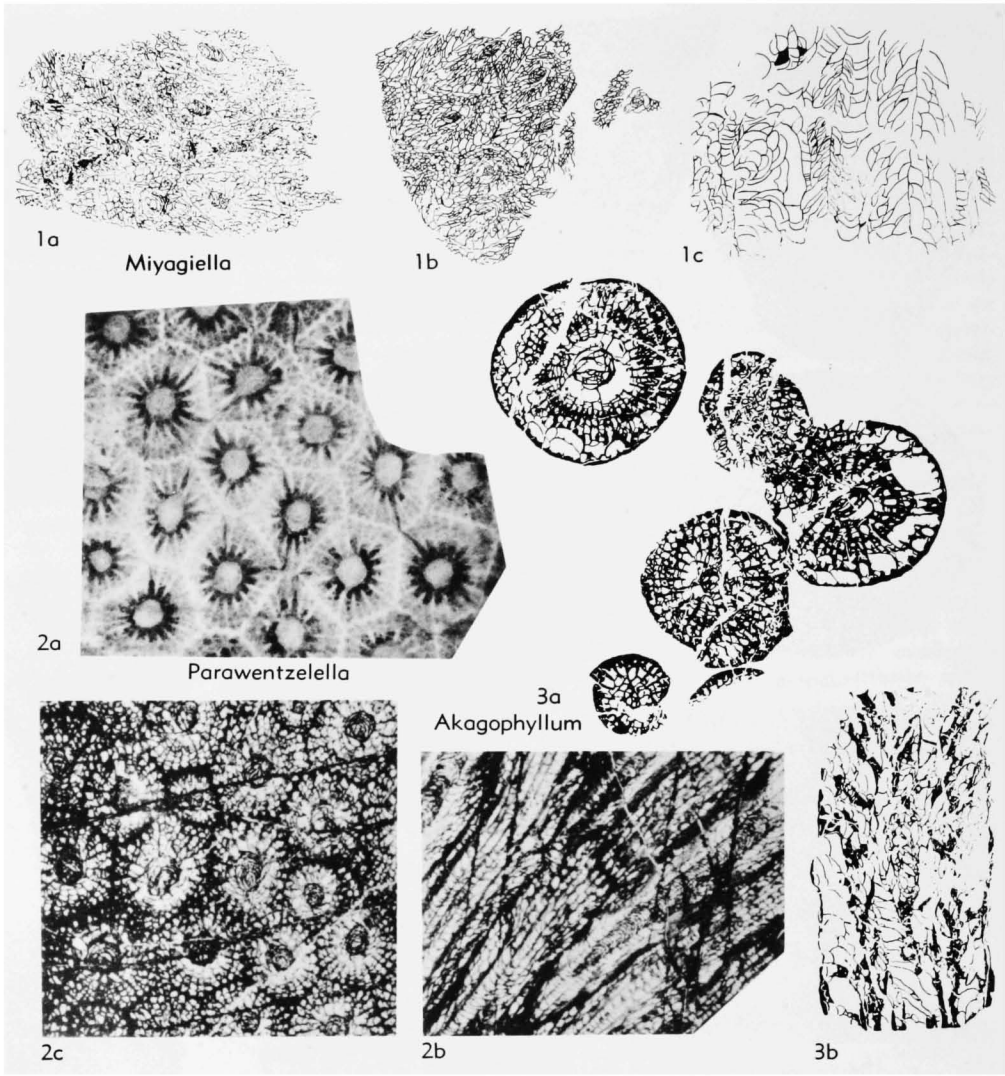


FIG. 271. Waagenophyllidae (p. F410, F413).

mentarium, minor septa weaker; no tertiary septa; dissepiments concentric to oblique and overlapping. *L.Perm.(Wolfcamp.)*, N.Am.(Kans.).——FIG. 272, *2a,b*. **H. girtyi*, holotype, up. Florence Ls., Kans., 2 mi. SW. of Leon; *a,b*, transv., long. secs., ×2.0 (Moore & Jeffords, 1941).

Huangia YABE, 1950, p. 76 [**Corwenia chütsingensis* CHI, 1931, p. 45; OD; †3998, IGP, Nanking]. Fasciculate; axial column of median lamella, somewhat irregular septal lamellae, and axial tabellae, but variable in diameter; axial ends of major septa unequally distanced from column, some may be continuous with septal lamellae; annular parts of tabulae of irregular width, and peripheral clinotabellae also variably developed; dissepimentarium includes large lonsdaleoid dissepiments, minor septa commonly discontinuous, major septa may also be disrupted. [Monotype species requires further study.] *U.Carb.(Weining.)*, Asia(S.China).——FIG. 270,*3a,b*. **H. chutsingensis* (CHI), holotype, White Ls., Yunnan, Tungshan, Chütsinghsien; *a,b*, transv., long. secs., ×3 (Chi, 1931).

Ipciphyllum HUDSON, 1958, p. 179 [**I. ipci*; OD; †R42028, BM(NH), London; =*Lonsdaleia indica* var. *laosensis* PATTE, 1926, p. 108, †7B, MANSUY Coll., EM, Paris, *fide* FONTAINE, 1961, p. 174, Permian, Pong-Oua, Laos] [?=*Aridophyllum* ZHAO, 1976, p. 220 (type, *A. anshunense*, OD; †31636-31637, IGP, Nanking; U.Perm., Anshun, Kweichow]. Cerioid; axial column with thin, irregular, persistent medial plate, radial lamellae,

and prominent conical axial tabellae; septa thin, or somewhat thickened particularly in tabularium, may become discontinuous and crestal in lonsdaleoid parts of wide dissepimentarium with normal concentric or anguloconcentric dissepiments; tabularium occupies greater part of corallite, formed of wide outer zone of elongate almost vertical cystose clinotabellae and of narrow periaxial zone of horizontal tabulae. *Perm.(Parafusulina-Yabeina Z.),* Asia(Turkey-Iraq-Iran-Laos-Viet Nam-S.China-Timor-Japan).——Fig. 272,*1a,b.* *?I. anshunense* (Zhao), holotype, U.Perm., low. Wuchiaping F., Anshum; *a,b,* transv., long. secs., ×2.0 (Zhao, 1976).——Fig. 272,*1c,d.* *I. laosense* (Patte), holotype, Laos, Pong-Oua; *c,d,* transv., long. secs., ×2.3 (Fontaine, 1961).——Fig. 272, *1e,f.* **I. ipci,* Perm., Zinnar Ls., N. Iraq, Chalki; *e,* holotype, transv. sec., ×3.0, *f,* paratype, long. sec., ×3.0 (Hudson, 1958).

Paraipciphyllum Wu, 1963, p. 501 [**P. elegantum*; OD; †14032-14034, IGP, Nanking] [=*Paraipiciphyllum* Wu, 1963, p. 504, *nom. null.*]. Like *Ipciphyllum* but in places astreoid or thamnasterioid, and zone of clinotabellae very narrow and impersistent. *U.Perm.(Neoschwagerina Z., fide* Minato & Kato, 1965a, p. 161), Asia(Anhui-?Iraq).——Fig. 272,*4a,b.* **P. elegantum,* holotype, Maokou Suite, China, Tongling distr., Anhui; *a,b,* transv., long. secs., ×2.7, ×2.0 (Wu, 1963).

Parawentzelella Fontaine, 1961, p. 185 [**Lonsdaleia canalifera* Mansuy, 1913, p. 109; OD; †780, Mansuy Coll., MSG, Saigon]. Cerioid; corallites with thick walls, pierced by canals or gaps that may be associated with discontinuities in dissepimentaria so that tabularia of adjoining corallites are placed in contact; axial column wide; zone of annular horizontal tabulae wide, some being continued as clinotabulae; lonsdaleoid dissepiments may occur in wide dissepimentarium. *Perm. (Parafusulina-Yabeina Z.),* Asia(Indoch.-China-Japan).

P. (Parawentzelella). Without or almost without lonsdaleoid dissepiments. *Perm.,* Asia(Laos-Camb.-Japan).——Fig. 271,*2a-c.* **P. (P.) canalifera; a,* holotype, Camb., Pnom Banteay Neang, transv. sec., ×2.0; *b,c,* another specimen, Camb., Pnom Kraupeu, long., transv. secs., ×2.3 (Fontaine, 1961).

P. (Miyagiella) Minato & Kato, 1965a, p. 168 [**P. (M.) miyagiensis*; OD; †18272-4, UH, Sapporo]. With walls thick or thin and with lonsdaleoid dissepiments well developed. *U.Perm. (Neoschwagerina Z.),* Asia(Japan).——Fig. 271, *1a-c.* **P. (M.) miyagiensis,* holotype, Japan, Iwaizaki, Kesen-numa city, Miyagi Pref.; *a,b,* transv. secs., ×1.5; *c,* long. sec., ×4.4 (Minato & Kato, 1965a).

Parawentzellophyllum Yü, 1977, p. 87 [**P. jiangsuense*; OD; †KCH027-029, GB, Nanjing]. Massive; in part cerioid with strong walls, in part aphroid; septa of two orders; axial column with somewhat irregular medial plate and short lamellae, tabellae in moderately steep cones; dissepimentarium commonly lonsdaleoid. *U.Carb.,* Asia(S. Jiangsu).

Pavastehphyllum Minato & Kato, 1965a, p. 64 [**Iranophyllum simplex* Douglas, 1936, p. 19; OD; †SPR1514, coll. Anglo-Iranian Oil Co. Ltd., not traced]. Solitary, cylindrical, not large; axial column with medial plate, biradial but irregular septal lamellae, and axial tabellae close and steeply declined from medial plate, their proximal edges based on more proximal axial tabellae; periaxial tabellae declined adaxially, incomplete, supplemented against the column by smaller, more transverse tabellae; major septa somewhat unequal and somewhat withdrawn from column; minor septa long, may be discontinuous in part; no third or fourth order septa; dissepiments irregularly concentric and small, but sporadic lonsdaleoid plates may occur. *L.Perm.-U.Perm.(Pseudoschwagerina-Pseudofusulina Z.),* Asia(SW.Iran-Tibet-Burma-Viet Nam-China-Japan)-N.Afr.(Tunisia).

P. (Pavastehphyllum). Corallites small and skeletal plates thin; lonsdaleoid dissepiments sporadic. *L. Perm. (Chihs.)-U. Perm. (Polydiexodina-Neoschwagerina Z.),* Asia(Iran-China).——Fig. 273, *5a,b.* **P. (P.) simplex* (Douglas), holotype, *Polydiexodina-Neoschwagerina* Z., Iran, Pavasteh, Bakhtiari Co.; *a,b,* transv., long. secs., ×3.2, ×2.4 (Douglas, 1936).

P. (Pseudocarniaphyllum) Wu, 1962, p. 335 [**P. orientale*; OD; †13760-13762, IGP, Nanking] [?=*P. (Chuanshanophyllum)* Yü, 1977, p. 86, as genus (type, *C. typicus,* OD; †KCH001-002, GB, Nanjing; U.Carb., low. Chuanchan F., S. Jiangsu, China)]. Dissepimentarium lonsdaleoid, of thin plates; zone of clinotabellae narrow and impersistent, of adaxially declined tabellae wide. *L.Perm.(Pseudoschwagerina Z.),* Asia(Kwangsi).——Fig. 273,*1a,b.* **P. (P.) orientale,* holotype, Maping Ls., N. Kwangsi, 5-6 km. S. of Desheng, Yishan distr.; *a,b,* transv., long. secs., ×1.6 (Wu, 1962).

P. (Sakamotosawanella) Minato & Kato, 1965a, p. 66 [**Iranophyllum carcinophylloides* Douglas, 1936, p. 19; OD; †SPR863, coll. Anglo-Iranian Oil Co. Ltd., not traced] [=*Sakamotosawanella* Minato, 1944, p. 84, *nom. nud.*]. Axial structure large, with short medial plate and numerous biradially arranged septal lamellae and axial tabellae; septa thickened in tabularium, thin in anguloconcentric dissepimentarium; adaxially declined parts of tabulae wide, transverse parts very narrow. *L.Perm.,* Asia(SW.Iran-?Japan-?Yunnan)-N.Afr.(Tunisia).——Fig. 273,*4.* **P. (S.) carcinophylloides* (Douglas), holotype, Iran, Tapileh Valley; transv. sec., ×2.4 (Douglas, 1936).

P. (Thomasiphyllum) Minato & Kato, 1965a, p. 67 [**Iranophyllum spongifolium* Smith, 1941, p. 6; OD; †17249, GSI, Calcutta]. In wide dis-

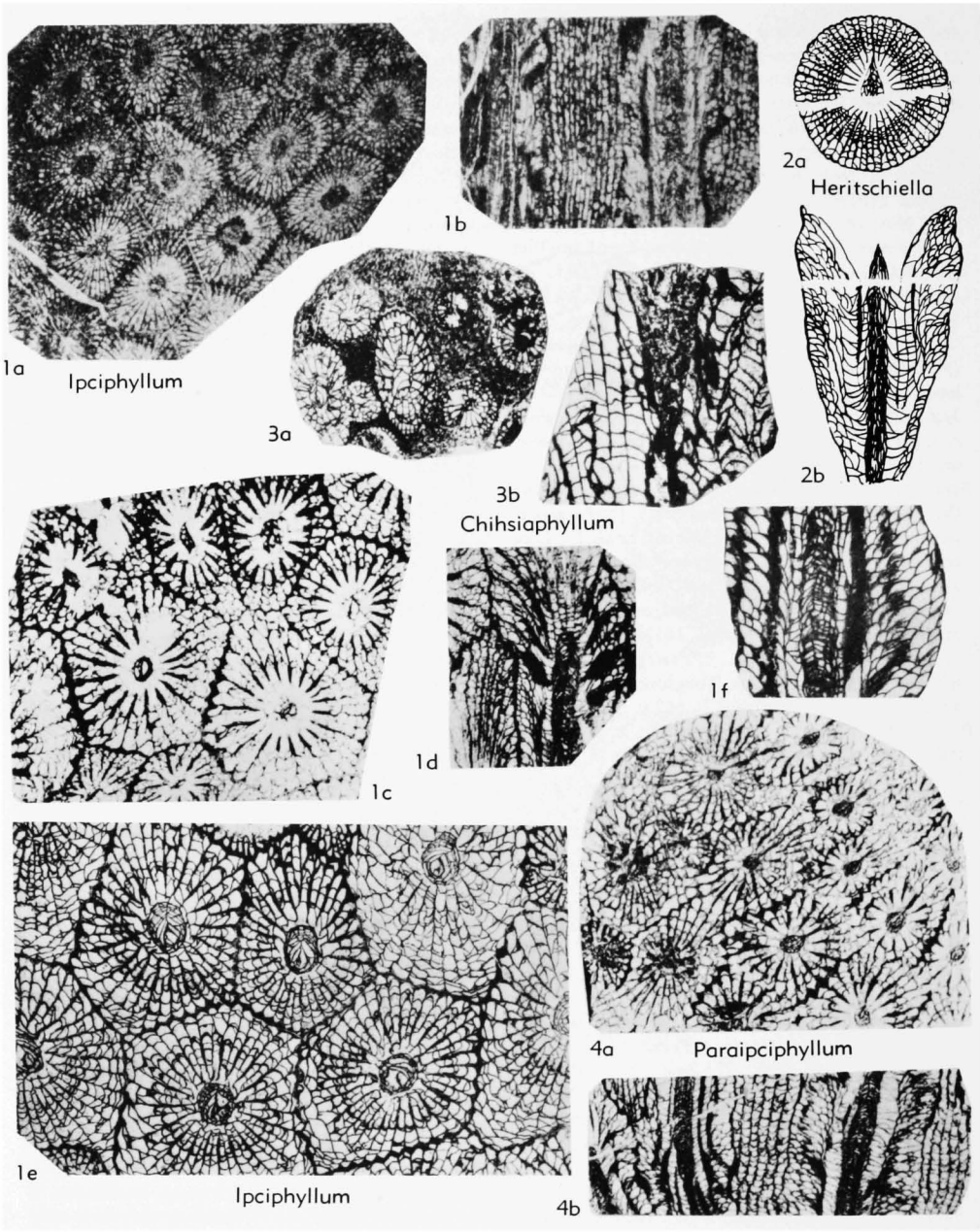


FIG. 272. Waagenophyllidae (p. F410-F413).

sepimentarium major and long minor septa are each modified to form columns of naotic plates connected by granules arranged in either two or three rows to form two peripheral or two peripheral and one median radial laminae, the peripheral laminae of minor septa simulating third order septa whose axial ends merge with the median lamina. *L.Perm.*, Asia(Burma-Iran-Kwangsi)-N.Afr.(Tunisia).——FIG. 274,*2a-c.* **P. (T.) spongifolium* (SMITH), holotype, Burma, Pon, S. Shan States; *a,b,* transv., long. secs., ×1.7, ×1.4, *c,* tang. sec. dissepimentarium, ×2.8 (Smith, 1941).

Pseudohuangia MINATO & KATO, 1965a, p. 89 [**Waagenophyllum chitralicum* SMITH, 1935, p. 37; OD; †12856-12859, GSI, Calcutta, and

R.27870-1, BM(NH), London]. Fasciculate; axial column relatively wide, not sharply bounded, variable in width; some septal lamellae may be in places continuous with major septa; tabulae somewhat declined adaxially, peripheral clinotabellae sparse; dissepimentarium wide, normal, without lonsdaleoid dissepiments, and minor septa long. *L.Perm.(Pseudoschwagerina Z.)-U.Perm.(Yabeina Z.),* Asia(Pak.-Iran-Turkey-Viet Nam-China).——Fig. 273,*2a,b.* **P. chitralica* (Smith), holotype, Pak., right bank Yarkhun R., about 2 mi. N. of Baroghil Ailak, Chitral; *a,b,* transv., long. secs., ×1.6 (Smith, 1935).

Yokoyamaella Minato & Kato, 1965a, p. 135 [**Lonsdaleia (?Waagenophyllum) yokoyamai* Ozawa, 1925, p. 72; OD; †III,64, Ozawa Coll., UT, Tokyo; lectotype by Minato & Kato, 1965a, p. 136]. Cerioid or in part thamnasterioid; septal bases dilated to form peripheral stereozone; axial column with medial plate, few radial lamellae, and numerous conical axial tabellae; tabulae with narrow transverse annuli against the columnella, and wide peripheral clintabellae; dissepimentarium normal and moderately wide, septa rather thin except at peripheral stereozone; lonsdaleoid dissepiments may develop in angles of corallites prior to appearance of peripheral, nonparricidal offsets. *Perm.(Pseudoschwagerina-Yabeina Z.),* Asia(Japan)-N.Z.-Eu.(Yugo.-Carnic Alps).

Y. (Yokoyamaella). Cerioid. *Perm.,* Asia(Japan)-Eu.(Yugo-Aus.).——Fig. 273,*3a,b.* **Y. (Y.) yokoyamai* (Ozawa), holotype, L.Perm., *Pseudofusulina* Z., Japan, Kaerimizu, Akiyoshi-dai, Yamaguchi Pref.; *a,b,* transv., long. secs., ×2.0 (Ozawa, 1925).

Y. (Maoriphyllum) Minato & Kato, 1965a, p. 143 [**Wentzelella maoria* Leed, 1956, p. 19; OD; †Co1264 and slides C1013, 1014, 1017, 1037, NZGS, Auckland, and slides R39602, 39603, BM(NH), London]. Cerioid and in part thamnasterioid; commonly skeletal elements of column also thickened; zone of transverse tabulae very narrow. *U.Perm.(uppermost Neoschwagerina Z.–Yabeina Z.),* N.Z.-Asia(Japan).——Fig. 274,*1a,b.* **Y. (M.) maoria* (Leed), holotype, *Yabeina* Z., N.Z., Marble Basin, E. of Tauranga Bay, Whangaroa, Northland; *a,b,* transv., long. secs., ×6.2, ×10.4 (Leed, 1956).

Subfamily WENTZELELLINAE Hudson, 1958

[Wentzelellinae Hudson, 1958, p. 184]

Solitary or compound waagenophyllids, with septa of three or more orders; axial column compact, variously of medial plate, conical tabellae, and septal lamellae that may be represented only as crests on tabellae; tabulae horizontal in inner tabularium, replaced outward by clinotabulae that may be nearly vertical and supplemented by elongate clinotabellae; septa may be discontinuous due to lonsdaleoid dissepiments or naotic; peripheral dissepiments may bear septal crests. *Perm.*

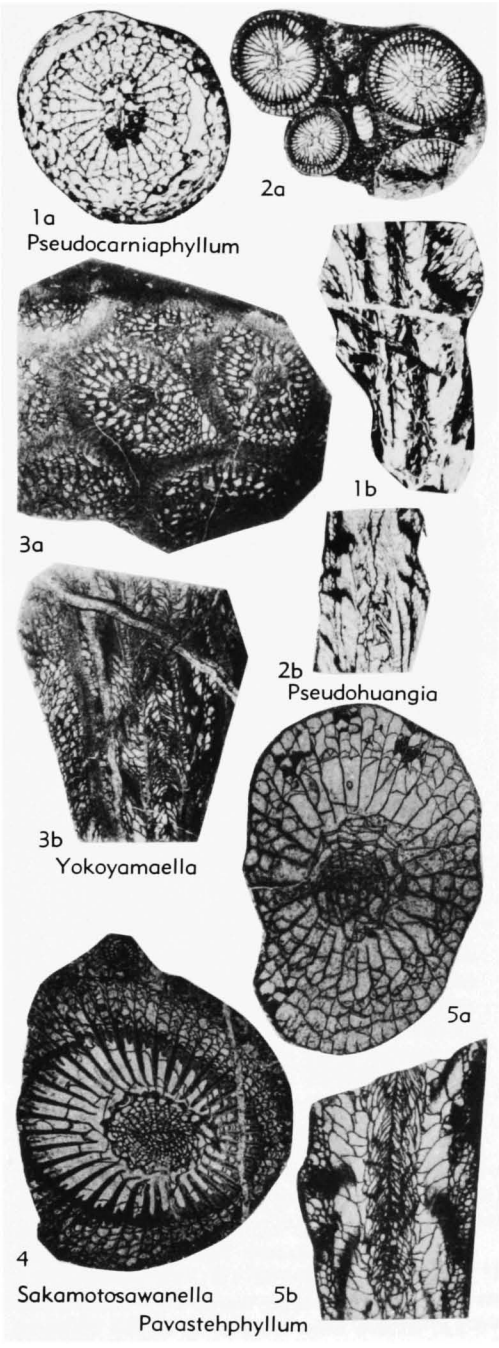


Fig. 273. Waagenophyllidae (p. *F*413-*F*415).

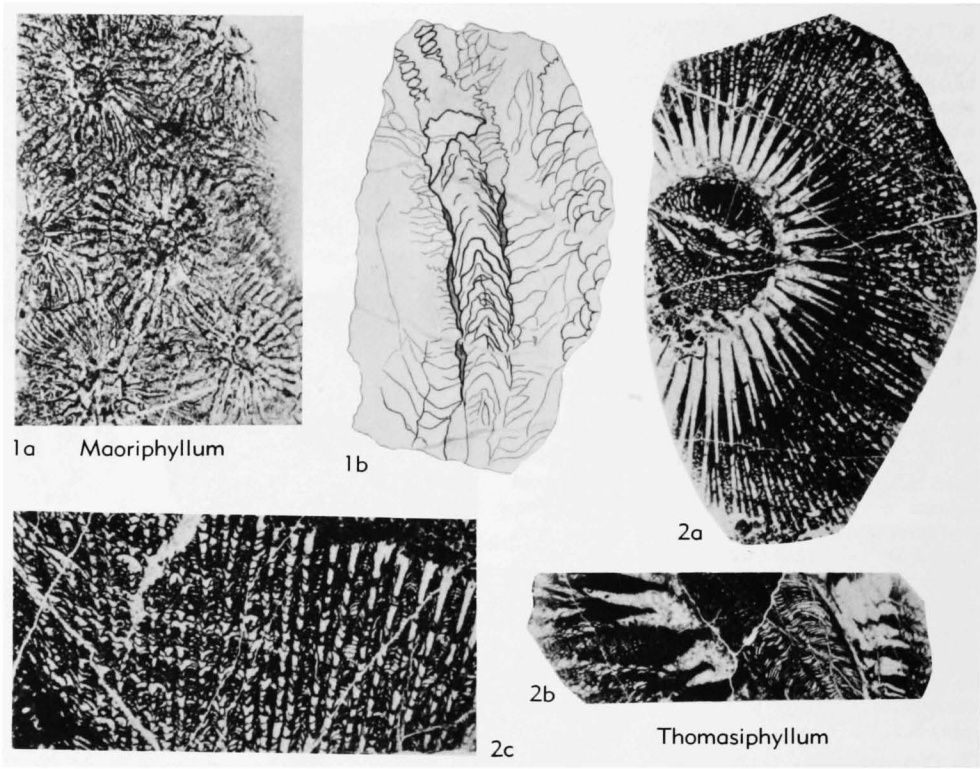


FIG. 274. Waagenophyllidae (p. F413-F415).

Wentzelella GRABAU in HUANG, 1932, p. 46 [**Lonsdaleia salinaria* WAAGEN & WENTZEL, 1886, p. 895; OD; figured syntype, 3902, 3904-3906, GSI, Calcutta] [=*Wentzelella* GRABAU in CHI, 1931, p. 34, *nom. nud.*]. Cerioid, with tertiary, and rarely with quaternary septa; septal bases may be thickened to contiguity; axial column of median plate, septal lamellae and axial tabellae drawn up to median plate; width of transversely tabulate and clinotabulate zones varying with length of minor septa and distance of ends of major septa from column; lonsdaleoid dissepiments absent or present. *Perm.*, Asia(Pak.-Iran-Nakhichev.-Karakorum-Camb.-China-Japan-NE.USSR).

W. (Wentzelella). Without lonsdaleoid dissepiments; quaternary septa absent or poorly developed. *U.Perm.(Pseudoschwagerina-Yabeina Z.)*, Asia (Iran-Pak.-Indoch.-Tibet-N. China-Japan). ——FIG. 275,*2a,b*. **W. (W.) salinaria* (WAAGEN & WENTZEL), syntype, Wargal Ls., Pak., Salt Ra.; *a,b*, transv., long. secs., ×4.1, ×16.6 (Waagen & Wentzel, 1886).

W. (Szechuanophyllum) WANG, 1957 (*fide* WU, 1963, p. 500) [**Wentzelella szechuanensis* HUANG, 1932, p. 62; OD; †3869, IGP, Nanking]. With quaternary septa and with lonsdaleoid dissepiments. *Perm.(Pseudofusulina-?Yabeina Z.)*, Asia (S. China-Karakorum-Manchuria-Japan-NE. USSR).——FIG. 276,*1a,b*. **W. (S.) szechuanense* (HUANG), holotype, L.Perm., Chihsia Ls., Szechuan, Gnomeishan, Omeishan; *a,b*, transv., long. secs., ×2.0 (Huang, 1932).

Iranophyllum DOUGLAS, 1936, p. 17 [**I. splendens*; OD; †15915, GSI, Calcutta (*fide* LA TOUCHE, SASTRY, & SINHA, 1969, p. 61), slide SPR829, coll. Anglo-Iranian Oil Co. Ltd., not traced]. Solitary, with third or higher orders of septa; axial column of median plate, septal lamellae and numerous axial tabellae declined from medial plate; major septa commonly thicker than others, may be withdrawn somewhat from column; wide dissepimentarium, plates in all interseptal loculi small, concentric; lonsdaleoid dissepiments in some; tabulae between axial ends of minor and major septa clinotabulae; those between axial ends of major septa and column narrow and horizontal. *Perm.(Pseudoschwagerina-Yabeina Z.)*, Asia(Iran-Pak.-Viet Nam-S.China-Japan).

I. (Iranophyllum). Without or with very rare lonsdaleoid dissepiments. *Perm.*, Asia(Iran-Pak.-Viet Nam-Laos-S.China-Japan).——FIG. 277, *1a,b*. **I. (I.) splendens*, holotype, Iran, Darreh Duzdun; *a,b*, transv., long. secs., ×2.3 (Douglas, 1936).

I. (Laophyllum) FONTAINE, 1961, p. 195 [**Chonaxis pongouaensis* MANSUY, 1912b, p. 8; OD;

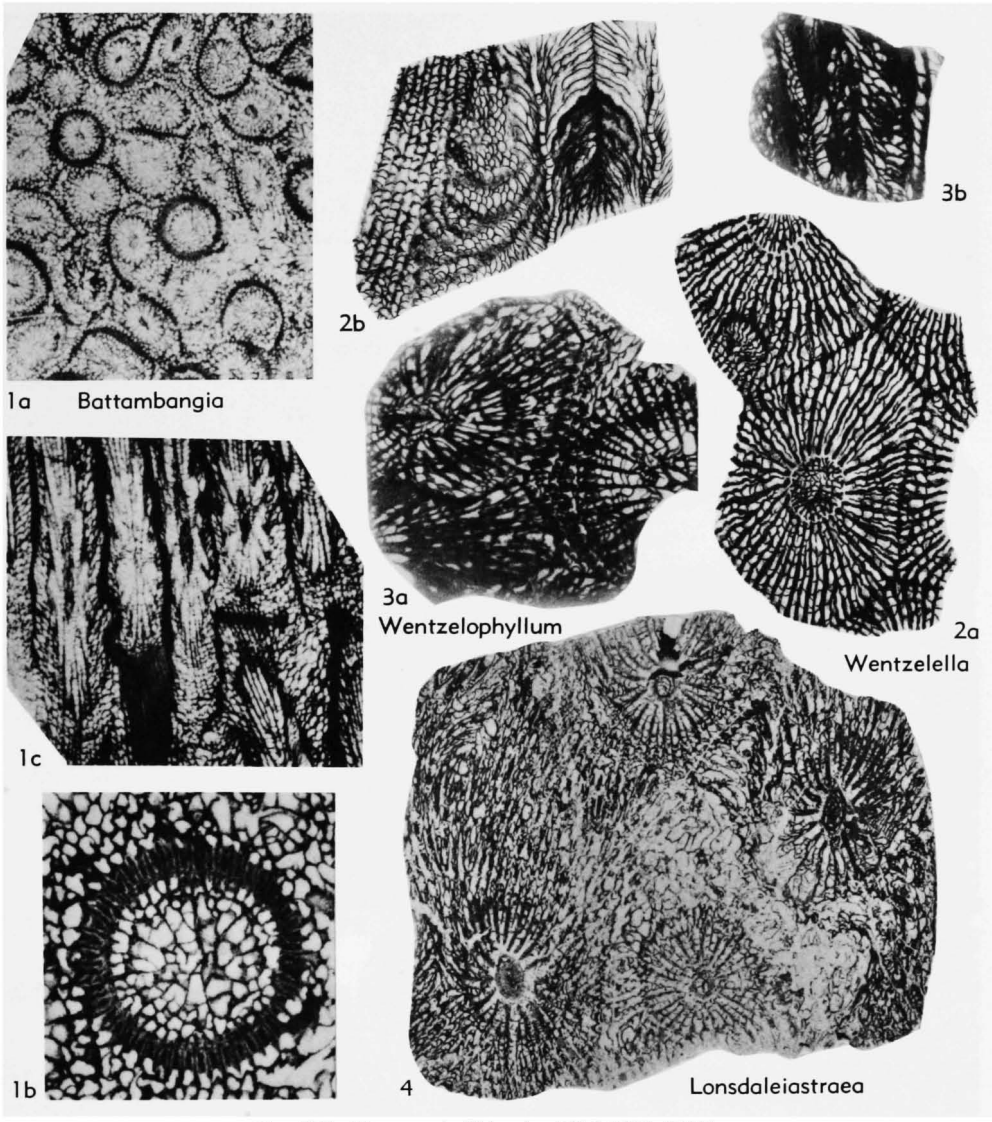


FIG. 275. Waagenophyllidae (p. F416-F417, F420).

† in MANSUY Coll., EM, Paris]. *Iranophyllum* with lonsdaleoid dissepiments well developed. *Perm. (Pseudoschwagerina-Neoschwagerina Z.),* Asia(Laos-Japan).——FIG. 277,*2a,b*. **I. (L.) pongouaense* (MANSUY), holotype, Laos, Pong-Oua, near Luang-Prabang; *a,b,* transv., long. secs., ×2.3, ×2.0 (Fontaine, 1961).

Lonsdaleiastraea GERTH, 1921, p. 77 [**L. vinassai*; M; †11792, TH, Delft]. Thamnasterioid or partly aphroid; with tertiary septa; axial column of median plate, septal lamellae, and axial tabellae variously thickened; tabularium with clinotabulae peripherally and horizontal tabulae next to the column, width of both varying with length of major and minor septa. *Perm.(?Parafusulina-Neoschwagerina Z.),* Asia(Timor-Japan-?Karakorum).——FIG. 275,*4*. **L. vinassai,* holotype, Poetain, Timor; transv. sec., ×2.1 (Gerth, 1921).

Polythecalis YABE & HAYASAKA, 1916, p. 63 [**P. confluens*; OD; †not traced]. Partly aphroid and partly cerioid, with tertiary and quaternary septa; major septa few; dissepimentarium commonly lonsdaleoid, its plates with or without septal crests; isolated segments of common walls consist of contiguous septal bases; axial column with more or less distinct medial plate, septal lamellae, and axial tabellae; tabularium with clinotabulae peripherally and in places narrow periaxial hori-

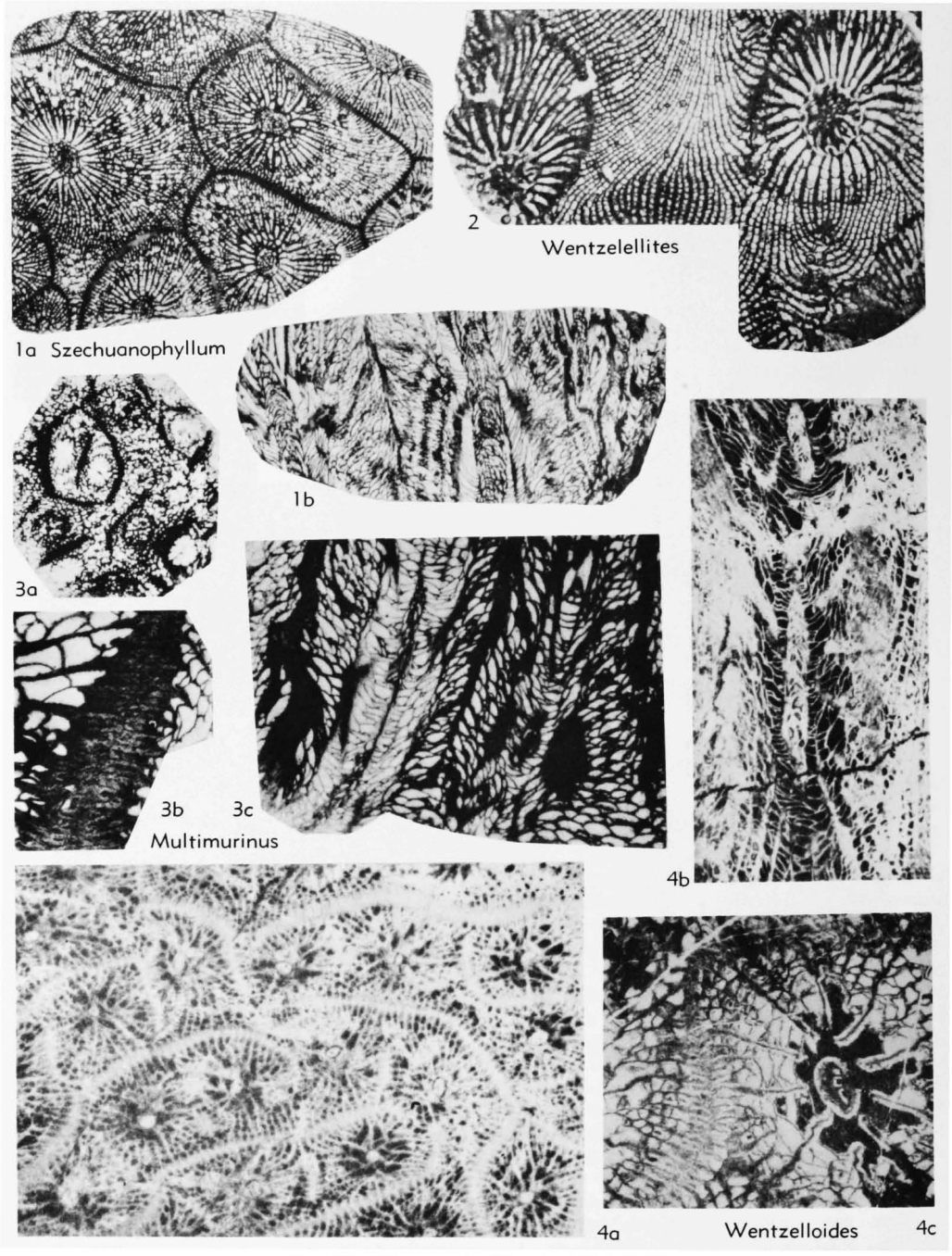


FIG. 276. Waagenophyllidae (p. *F*416, *F*420).

zontal tabulae. *Perm.(Pseudoschwagerina-Yabeina Z.),* Asia(China-Indoch.-Sumatra-Iran-Iraq-Turkey)-Eu.(Carnic Alps).

P. (Polythecalis) [=*Polythecalia* WANG, 1950, p. 212, *nom. null.*]. Partly cerioid and partly aphroid. Range as for genus.——FIG. 277,*4a,b*. *P. yangtzeensis* HUANG, holotype, Chihsia Ls., Kweichow, between Chiutsaitung and Singchang, Hsishui-hsien; *a,b,* transv., long. secs., ×2.3 (Huang, 1932).

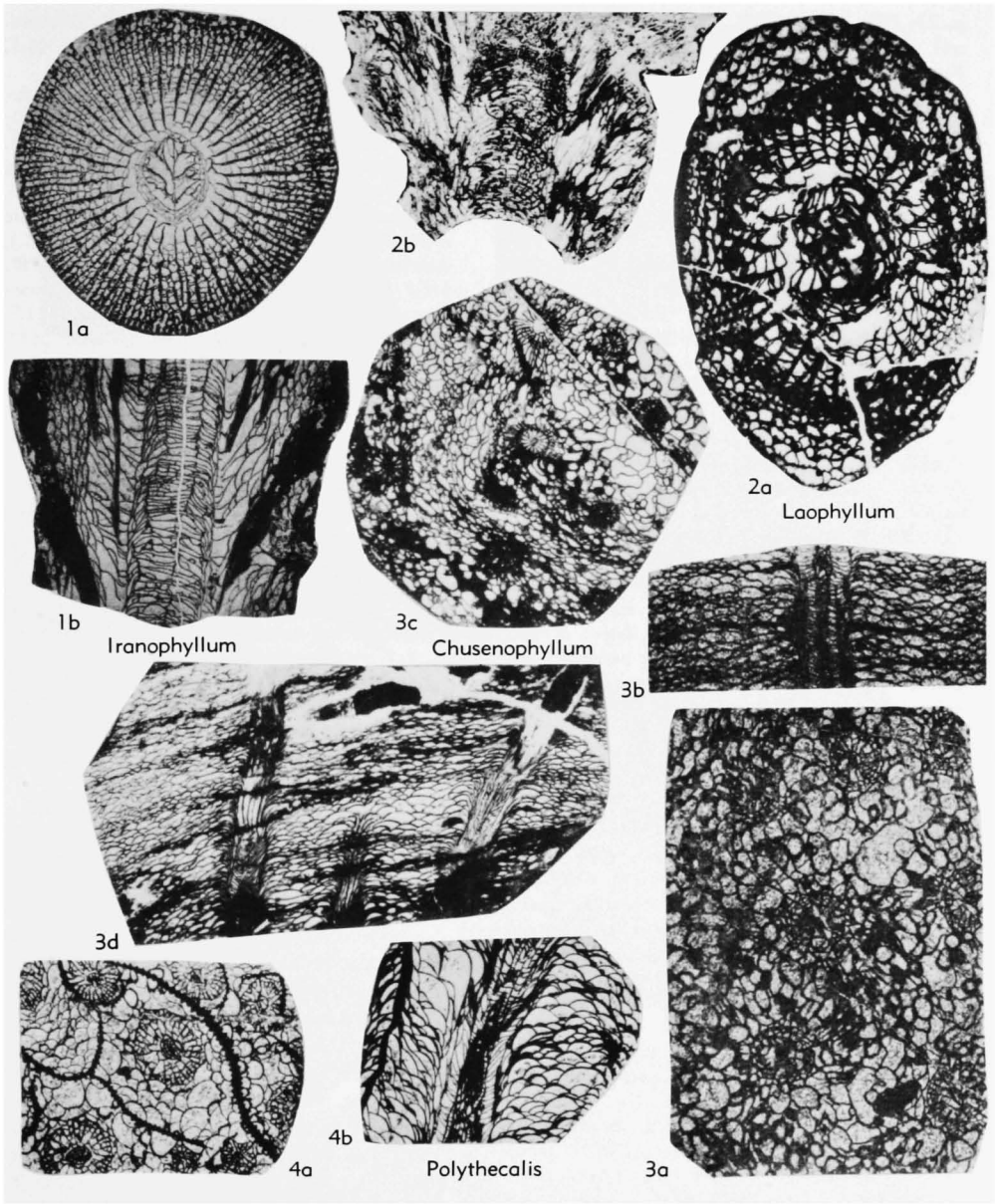


FIG. 277. Waagenophyllidae (p. *F*416-*F*419).

P. (Chusenophyllum) TSENG, 1948, p. 1 [**C. paeonoidea*; OD; †6944, not traced, ?Peking] [=*Vesotabularia* Yü in Yü & SHU, 1929, p. 50, *nom. nud.* in binomen *V. tungliangensis* of which Yü's intended holotype, 3889, ?IGP, ?Nanking, was validly described and figured as *Polythecalis multicystosis* var. *tungliangensis* HUANG, 1932, p. 91, from the Chihsia Ls. of Tunliangchai, Hupeh]. Aphroid *Polythecalis,* without corallite walls and with lonsdaleoid dissepiments commonly bare of septal crests. *L.Perm.,* Asia(China). ——FIG. 277,*3a,b*. **P. (C.) paeonoidea,* ?holotype, uppermost bed of Chihsia Ls., China, Kungshan, Nanking; *a,b,* transv., long. secs., ×2.3 (Tseng, 1948).——FIG. 277,*3c,d*. *P. (C.) tunliangensis* (HUANG), holotype, L.Perm., Chihsia Ls., Hupeh, Tunliangchai; *c,d,* transv., long. secs., ×3.1, ×1.6 (Huang, 1932).

Praewentzelella MINATO & KATO, 1965a, p. 179 [**Waagenophyllum magnificum* DOUGLAS, 1936,

p. 23; OD; †15904, GSI, Calcutta; slide SPR318, coll. Anglo-Iranian Oil Co., Ltd., not traced]. Fasciculate; axial column with irregular septal lamellae, indistinct medial plate, and axial tabellae; minor septa very long and dissepimentarium very wide; third and fourth order septa present; tabularium narrow, predominantly with clinotabulae of moderate inclination. *Perm.(Pseudofusulina-Neoschwagerina Z.)*, Asia(Iran-Turkey-Japan).

Pseudopolythecalis Xu in Jia *et al.*, 1977, p. 229 [**P. intermedis*; OD; †IV38589, HPRIGS, Yichang; L.Perm., Maokou F., Jiangya, Hunan]. Like *Polythecalis* but axial structure weakly developed to absent. *L.Perm.*, Asia(Hunan).

Wentzelellites Wu, 1963, p. 501 [**Wentzelella salinaria* var. *sicula* Montanaro-Gallitelli, 1954, p. 50; OD; †18831, Gallitelli Coll., PIU, Modena]. Thamnasterioid or partly cerioid; with tertiary septa; axial column of thickened lamellae, median plate not always distinct, and axial tabellae; major septa thick in tabularium and in young offsets in dissepimentarium also; major septa as thin as minor and long tertiary septa in fine-textured peripheral parts of large, mature corallites; lonsdaleoid dissepiments absent or very rare; steep clinotabulae and narrow periaxial horizontal tabulae. *Perm.(?Parafusulina-?Neoschwagerina Z.)*, Eu.(Sicily)-Asia(SW.Iran-Pak.).——Fig. 276,*2*. **W. sicula* (Montanaro-Gallitelli), syntype, Sosio Ls., Sicily; transv. sec., ×4.0 (Montanaro-Gallitelli, 1954).

Wentzelloides Yabe & Minato, 1944b, p. 141 [**W. maiyaensis*; M; syntypes R15232-4, R15242, R15682, UH, Sapporo]. Corallum massive but wall between parent and offset may be imperfectly developed giving pseudomeandroid coralla or parts of coralla; tertiary and quaternary septa short and subequal; septal bases thickened but may be locally suppressed; waagenophylloid axial column densely structured, small; dissepimentarium may include lonsdaleoid dissepiments; width of zones of clinotabulae and horizontal tabulae variable. *U.Perm.(Yabeina Z.)*, Asia(Japan-Viet Nam-Camb.).

W. (Wentzelloides). Corallum in places pseudomeandroid; lonsdaleoid dissepiments absent; axial column waagenophylloid or may be almost a simple rod. *U.Perm.(Yabeina Z.)*, Asia(Japan).——Fig. 276,*4a-c*. **W. maiyaensis*, syntype, Usuginu congl., Japan, near Maiya, Miyagi Pref., N. Honshu; *a,b*, transv., long. secs., ×3.4, ×4.7 (Yabe & Minato, 1944b); *c*, transv. sec., ×10.0 (Minato & Kato, 1965a).

W. (Battambangia) Fontaine, 1967, p. 56 [**Polythecalis khmerianus* var. *biformis* Fontaine, 1961, p. 183; OD; †6159, MSG, Saigon, =705, Fontaine Coll.]. Some corallites have cylindrical outline in transverse section; otherwise like *W. (Multimurinus)*. *U.Perm.(Yabeina Z.)*, Asia (Camb.).——Fig. 275,*1a-c*. **W. (B.) biformis* (Fontaine), holotype, W.Camb., Pnom Takream, near Battambang; *a,b*, transv. secs., ×2.1, ×8.3, *c*, long. sec., ×2.1 (Fontaine, 1961).

W. (Multimurinus) Fontaine, 1967, p. 52 [**Polythecalis khmerianus* Fontaine, 1961, p. 182; OD; †6155, MSG, Saigon, =369, Fontaine Coll.]. Corallites dominantly prismatic; small lonsdaleoid dissepiments present; column waagenophylloid, disappearing locally or reduced to thin or more commonly thick plate. *U.Perm.(Yabeina Z.)*, Asia(Camb.-Viet Nam).——Fig. 276,*3a-c*. **W. (M.) khmerianus*, holotype, W. Camb., Pnom Sway near Sisophon; *a,b*, transv. secs., ×1.7, ×10.0 (Fontaine, 1961); *c*, long. sec., ×4.0 (Fontaine, 1967).

Wentzelophyllum Hudson, 1958, p. 186 [**Lonsdaleia volzi* Yabe & Hayasaka, 1915, p. 108; OD; †not traced; SD Minato & Kato, 1965a, p. 200]. Cerioid, septa thickened, may be disrupted by lonsdaleoid dissepiments or separated from their rounded bases by lonsdaleoid dissepiments; and may be modified into columns of naotic plates connected by granules; tertiary septa rare and very short; axial column with strong medial plate; tabularium with wide peripheral clinotabulae and narrow periaxial horizontal tabulae. *L.Perm.(Pseudoschwagerina-Parafusulina Z.)*, Asia (China-Japan-Karakorum-Iran-Iraq-Turkey)-Eu.(Carnic Alps).——Fig. 275,*3a,b*. **W. volzi* (Yabe & Hayasaka), ?holotype, Kweichow, Houchang, Wei-ning-hsien; *a,b*, transv., long. secs., ×2.5 (Yabe & Hayasaka, 1920).

Family PSEUDOPAVONIDAE Yabe, Sugiyama, & Eguchi, 1943

[*nom. correct.* Kanmera, 1961, p. 221, *pro* Pseudopavoniidae Yabe, Sugiyama, & Eguchi, 1943, p. 245]

Solitary or compound; corallites small to medium-sized; axial structure either solid columella or short axial column originating from solid columella; septa in two or more orders; septa distinctly trabeculate, commonly thickened, may be naotic peripherally; tabulae horizontal near axial structure, declined adaxially peripherally; dissepimentarium may be wide, interseptal loculi commonly narrow; lonsdaleoid dissepiments may develop [Kato & Minato, 1975, p. 97]. *U.Carb.(Millerella Z.-Fusulina Z.)-?L.Perm.*

Subfamily PSEUDOPAVONINAE Yabe, Sugiyama, & Eguchi, 1943

[*nom. transl. et correct.* Kato & Minato, 1974, p. 189, *ex* Pseudopavoniidae Yabe, Sugiyama, & Eguchi, 1943, p. 245]

Pseudopavonidae without tertiary septa. *U.Carb.(Millerella Z.-Fusulina Z.)-?L.Perm.*

Pseudopavona Yabe, Sugiyama, & Eguchi, 1943, p. 245 [**P. taisyakuana*; M; †90872-3, IGP, TohU, Sendai] [=*Pseudopavonia* Rowett &

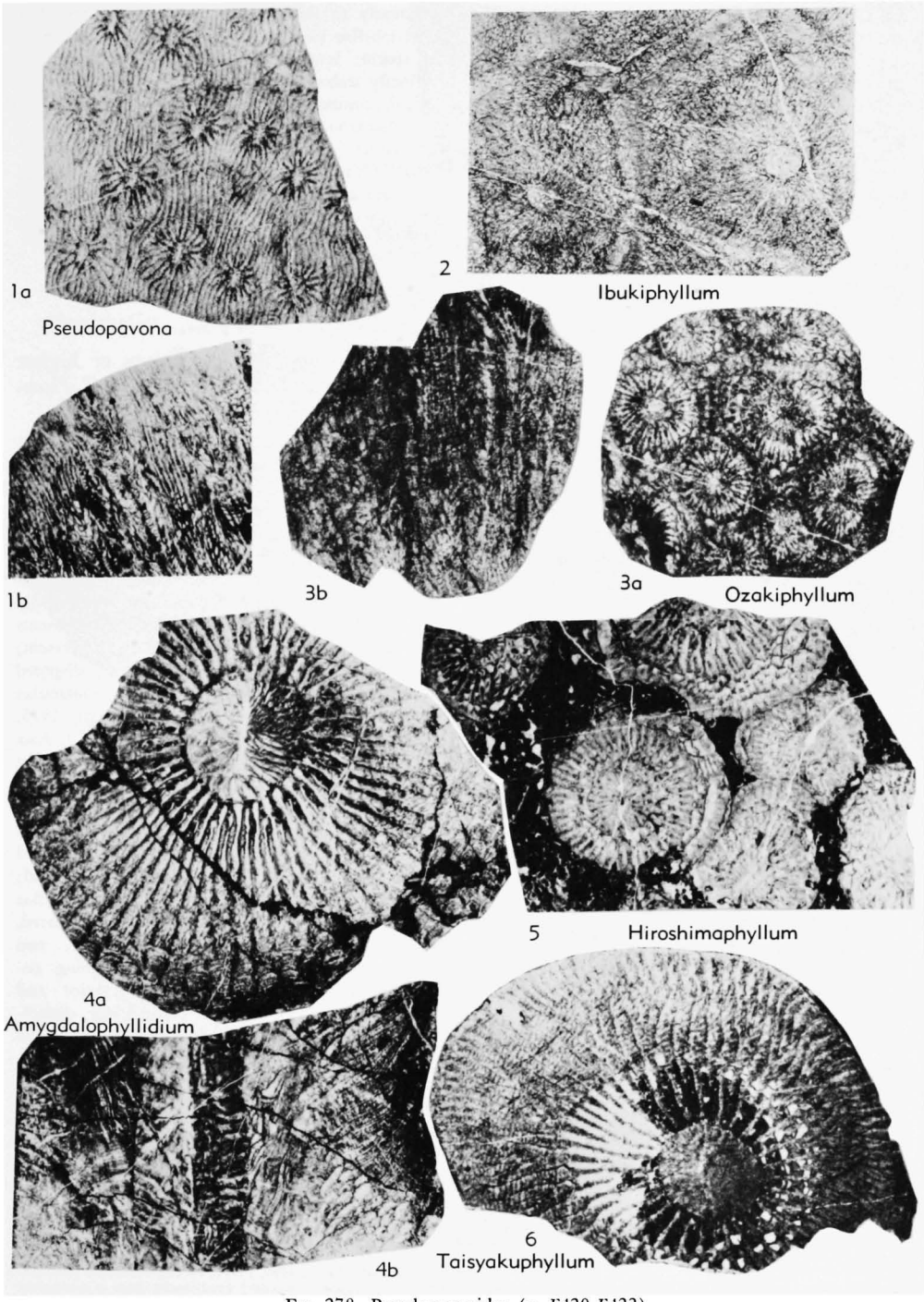


FIG. 278. Pseudopavonidae (p. F420-F422).

MINATO, 1968, p. 8, *nom. null.*]. Thamnasterioid, in places partly aphroid or, where walls are retained, pseudomeandroid; with solid columella originating from cardinal septum; major and minor

septa normally thickened; tabulae subhorizontal near columella, adaxially declined near dissepimentarium; dissepiments small, lonsdaleoid plates may occur in places [KATO & MINATO, 1975, p. 104]. *U.Carb.(Millerella Z.-Fusulina Z.)-?L.Perm.*, Asia (Japan).——FIG. 278,*1a,b*. **P. taisyakuana*, U. Carb.; *a*, Hiroshima Pref., Karamon, Taisyaku, transv. sec., ×2.7, *b*, Yamaguchi Pref., Shiraiwa, long. sec., ×2.7 (Kato & Minato, 1975).

Amygdalophyllidium KATO & MINATO, 1974, p. 189 [**Amygdalophyllum naosoidea* MINATO, 1951, p. 3; OD; †IV$_{1,2}$, OZAWA Coll., UT, Tokyo] [=*Amygdalophyllidium, nom. nud.* in HASEGAWA, 1963, p. 34, *fide* KATO & MINATO, 1975, p. 98]. Solitary; axial column large, of long median plate and numerous, normally contiguous septal lamellae that are not continuous with septa; thick major and very long, contratingent minor septa with rhopaloid axial edges, cavernous in mid-length and naotic in wide peripheral zone; dissepiments in narrow interseptal loculi subglobose; tabulae declined steeply adaxially [see KATO & MINATO, 1975, p. 98]. *U.Carb.(Namur.)*, Asia(Japan).——FIG. 278,*4a,b*. **A. naosoideum* (MINATO), holotype, pre-*Fusulinella* Z., low. part of Akiyoshi Ls. Gr., Yamaguchi Pref., Ohkubo; *a,b*, transv., long. secs., ×2.7 (Kato & Minato, 1975).

Hiroshimaphyllum KATO & MINATO, 1974, p. 189 [**Lonsdaleoides toriyamai* MINATO, 1955, p. 165; OD; †R17809-17810, UH, Sapporo]. Fasciculate; axial structure an axial column of numerous septal lamellae, normally not contiguous, a more or less distinct median plate and axial tabellae; major and minor septa thick, long, distinctly trabeculate, rarely naotic peripherally, pinnately arranged in early stages, radial in late stages; lonsdaleoid dissepiments developing irregularly in peripheral zone; clinotabulae present; offsets arise from periphery of calical platforms [see KATO & MINATO, 1975, p. 99]. *U.Carb.(Namur.)*, Asia(Japan).——FIG. 278,*5*. **H. toriyamai* (MINATO), holotype, Yamaguchi Pref., Ohkubo; transv. sec., ×2.7 (Kato & Minato, 1975).

Omiphyllum KATO, 1967, p. 103 [**O. confertum*; OD; †R13528, UH, Sapporo]. Astreoid; major and minor septa naotic throughout wide dissepimentarium in which lonsdaleoid dissepiments may occur sparsely; major septa laminar in narrow tabularium and not quite reaching columella which is amygdaloidal in transverse section and formed of ?fibers biradially arranged with respect to median seam in plane of counter and cardinal septa, with one of which, a long ?counter septum, columella is connected; tabulae ?(declined toward columella). [Only one specimen known.] *U.Carb.(Namur.)*, Asia(Japan).

Ozakiphyllum KATO & MINATO, 1975, p. 101 [**O. hayasakai*; OD; III$_{96-98}$, OZAWA Coll., UT, Tokyo] [=*Ozakiphyllum* KATO & MINATO, 1974, p. 189, *nom. inval.*]. Cerioid; with axial structure an axial column of medial lamella and septal lamellae commonly so thickened as to be contiguous, but axial tabellae may appear in occasional interlamellar spaces; long, thick, major and minor septa distinctly trabeculate, radially arranged, their axial ends discontinuous with axial column; dissepiments and clinotabulae present; lonsdaleoid dissepiments may occur [see KATO & MINATO, 1975, p. 101]. *U.Carb.(Namur.)*, Asia(Japan).——FIG. 278,*3a,b*. **O. hayasakai*, holotype, Yamaguchi Pref., Edo; *a,b*, transv., long. secs., ×2.7 (Kato & Minato, 1975).

Subfamily TAISYAKUPHYLLINAE Kato & Minato, 1974

[Taisyakuphyllinae KATO & MINATO, 1974, p. 189]

Pseudopavonidae with tertiary or higher orders of septa. *U.Carb.(Millerella Z.-Fusulinella Z.)*.

Taisyakuphyllum MINATO, 1955, p. 143 [**T. rostfer*; OD; †IV$_{4,5,6}$, OZAWA Coll., UT, Tokyo, now in UH, Sapporo]. ?Solitary or fasciculate with marginal increase; axial column large, of thick, closely spaced septal lamellae and more or less distinct median plate, may be continuous with ?counter septum; septa thick, distinctly and complexly trabeculate, long, contiguous or leaving only narrow interseptal loculi with small dissepiments in wide marginarium; third order septa present; tabularium narrow, tabulae nearly flat, disposed subhorizontally near axial column, clinotabulae present peripherally [see KATO & MINATO, 1975, p. 106]. *U.Carb.(Millerella Z.-Fusulina Z.)*, Asia (Japan).——FIG. 278,*6*. **T. rostfer*, low. part Omi Ls., Honshu, Fukugakuchi, Omi distr.; transv. sec., ×6.7 (Rowett & Minato, 1968).

Ibukiphyllum KATO & MINATO, 1974, p. 190 [**Wentzelella sekii* MINATO, 1955, p. 108; figured syntype 108 in SEKI Coll., TohU, Sendai]. Cerioid; corallites with axial structure of septal lamellae and axial tabellae more or less closely spaced, ?(without medial plate); major, minor, and tertiary septa with thickened bases, forming peripheral trabeculate stereozone, but major and minor septa commonly thinner in inner dissepimented marginarium and tabularium; clinotabulae present [see KATO & MINATO, 1975, p. 108]. *U.Carb.*, Asia(Japan-?Sinkiang).——FIG. 278,*2*. *I. densum* KATO & MINATO, holotype, *Fusulinella* Z., Niigata Pref., Omi; transv. sec., ×2.7 (Kato & Minato, 1975).

?Order HETEROCORALLIA Schindewolf, 1941

[*nom. transl.* MOORE, 1956, p. *F4*, *ex* Heterocorallia SCHINDEWOLF, 1941, p. 276, suborder] [=Dicoelia YABE & SUGIYAMA, 1940, p. 85, as Dycoelia, subdivision of Tetracoralla]

Elongate coralla lacking epitheca, earliest stages with four septa conjoined axially and with new septa formed in adaxial attach-

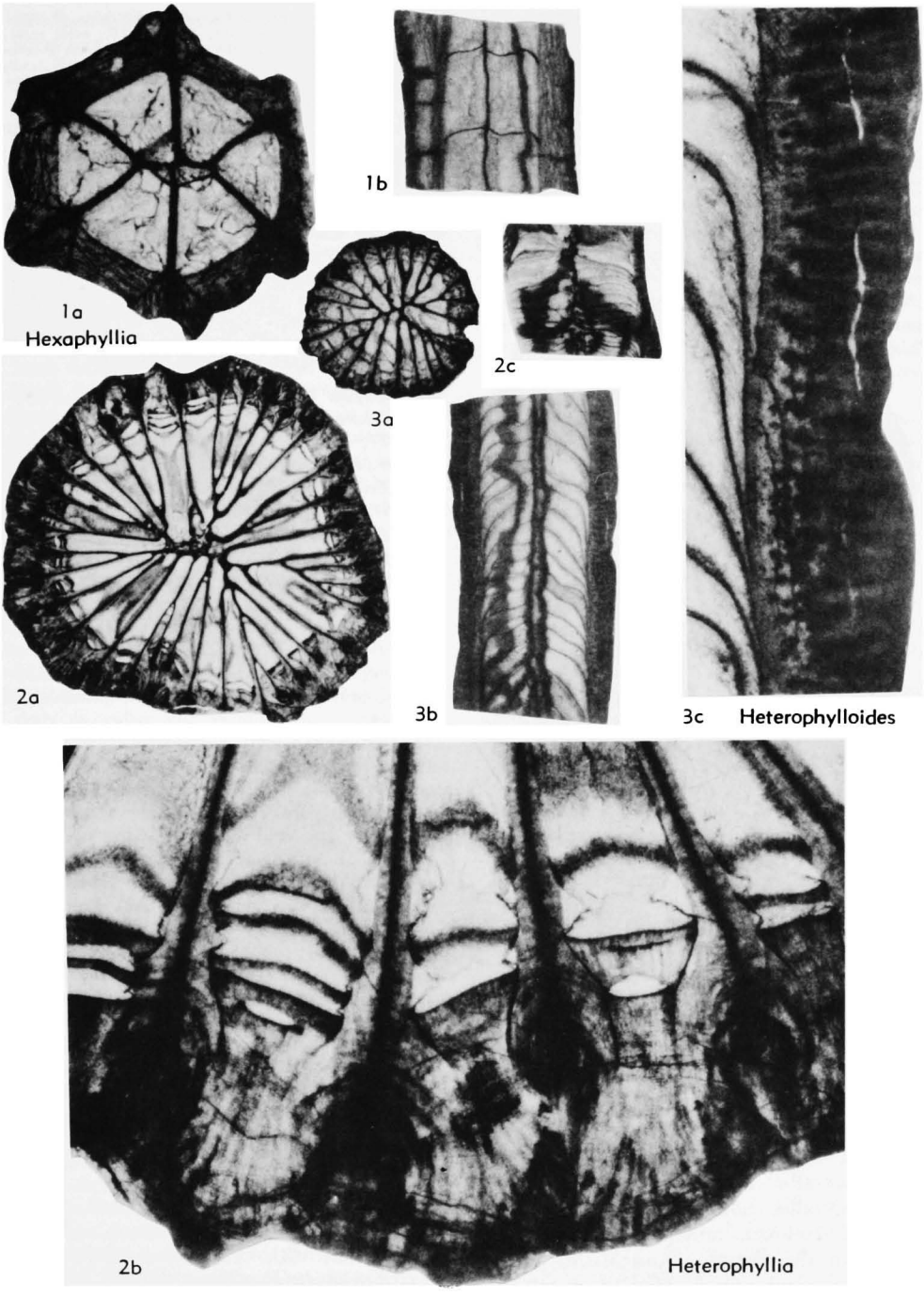


FIG. 279. Heterophylliidae (p. *F424*).

ment to these so that the four original interseptal loculi remain undivided; tabulae complete domes with steeply sloping to confluent edges that form narrow layered wall.

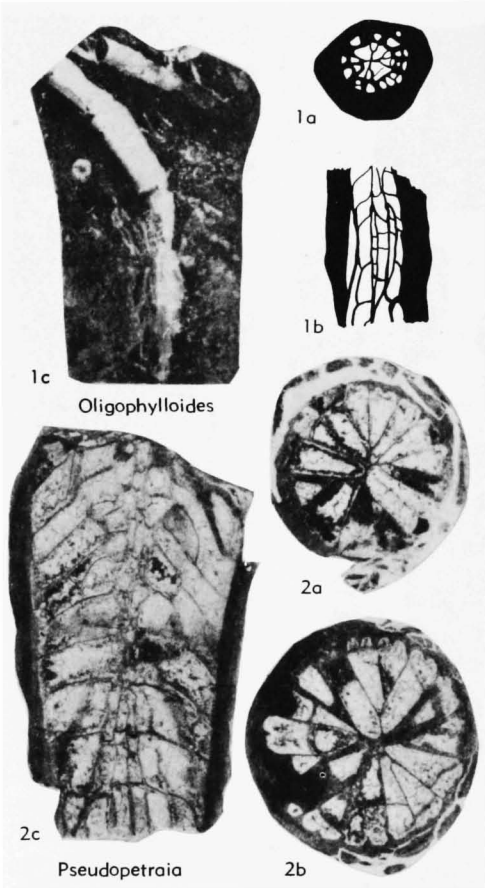


FIG. 280. Heterophylliidae (p. *F424-F425*).

The possibility that the Heterocorallia developed from the Rugosa during the Famennian is suggested by the morphology of such genera as *Oligophylloides* ROZKOWSKA, 1969, p. 161, and *Pseudopetraia* SOSHKINA, 1951, p. 23, which, however, may be incorrectly referred to the Heterophylliidae. BIRENHEIDE, 1965a, p. 33, thought it expedient to consider a new class Eoanthozoa BIRENHEIDE, 1965a, to include the orders Rugosa MILNE-EDWARDS & HAIME and Heterocorallia SCHINDEWOLF. Possibly the Heterocorallia should be regarded as a subclass of Anthozoa rather than as a doubtful order of the Rugosa. *Low.M.Dev.; up.U. Dev.; L. Carb. (up. U. Miss.)-U. Carb. (Namur.).*

Family HETEROPHYLLIIDAE Dybowski, 1873

[*nom. correct. et transl.* YABE & SUGIYAMA, 1940, p. 85, *ex* Heterophyllinae DYBOWSKI, 1873c, p. 331] [Dicoelia YABE & SUGIYAMA, 1940, p. 85, as Dycoelia, subdivision of Tetracoralla; Palaeastraeidae ROEMER, 1883, p. 412, *nom. inval.*, not derived from generic name, *transl. ex* division Palaeastraceae DUNCAN, 1868, p. 651, of a scleractinian family Astreidae, the division comprising *Heterophyllia* MCCOY, 1849 and *Battersbyia* MILNE-EDWARDS & HAIME, 1851]

Elongate coralla lacking epitheca and in earliest stages with four septa conjoined axially and with new septa formed in attachment to these so that the four original interseptal loculi remain undivided; marginarium a narrow trabeculate stereozone; tabulae complete, domes with steeply sloping to vertical and confluent edges forming layered wall. *Low.M.Dev.; up.U.Dev.; L. Carb.(up.U.Miss.)-U.Carb.(Namur.).*

Heterophyllia MCCOY, 1849, p. 126 [**H. grandis*; SD MILNE-EDWARDS & HAIME, 1850, p. lxxiii; †E1987, SM, Cambridge. With numerous septa. *U.Dev.(Famenn.)*, Eu.(Pol.); *L.Carb.(up.Visean)*, Eu. (Brit. I.-Belg.-L. Silesia)-N. Afr. (Moroc.)-Asia (S. Fergana-Japan)-Australia (Queensl.); *U. Miss.*, N.Am.(Alaska).

H. (Heterophyllia). With all four original interseptal loculi separated by new septa. *U.Dev. (Famenn.)*, Eu.(Pol.); *L.Carb.(up.Visean)*, Eu. (Brit. I.-Belg.-L. Silesia)-N. Afr. (Moroc.)-Asia (S.Fergana).——FIG. 279,*2a-c*. **H. (H.) grandis*, up. Visean, Silesia, Altwasser; *a,b*, transv. secs., ×4, ×20, *c*, long. sec., ×2 (Schindewolf, 1941).

H. (Heterophylloides) SCHINDEWOLF, 1941, p. 295 [**H. (H.) reducta*; OD; †in SCHINDEWOLF Coll., ZGI, E. Berlin]. With two of the original interseptal loculi not separated by new septa or separated by one new septum. *L.Carb.(up.Visean)*, Eu.(Brit.I.-Ger.-L.Silesia)-Asia(Japan); *U.Miss.*, N.Am.(Alaska).——FIG. 279,*3a-c*. **H. (H.) reducta*, paratype, up. Visean, Ger., Rothwaltersdorf; *a*, transv. sec., ×4; *b,c*, long. secs., ×4, ×20 (Schindewolf, 1941).

Hexaphyllia SHTUKENBERG, 1904, p. 5 [**H. prismatica*; OD; †?LGI, Leningrad]. Slender, with only six septa; peripheral stereozone thick. [Possibly early stages of excessively long *Heterophyllia*.] *L.Carb.-?U.Carb.(up.Visean-?Namur.)*, Eu. (Brit. I.-Silesia-Ger.-Hung.-USSR)-Asia (Japan-Laos-China-N.Pamir); *U.Miss.-L.Penn.*, N.Am. (Wash.).——FIG. 279,*1a,b*. *H. mirabilis* (DUNCAN); *a*, up. Visean, D_2, Ger., Rothwaltersdorf, transv. sec., ×20; *b*, up. Visean, D_2, up. Silesia, Altwasser, long. sec., ×8 (Schindewolf, 1941).

Oligophylloides ROZKOWSKA, 1969, p. 161 [**O. pachythecus*; OD; †Tc3/2064, PZI, Poznan] [=*Oliphylloides* ROZKOWSKA, 1969, p. 161, *nom. null.*]. Long, slender corallites with talon and smooth thick wall without epitheca; with not more than 12 septa in tabularium; peripheral ends of septa embedded in wall, axial ends of four protosepta fused axially forming a cross; axial ends of other septa shorter and grouped about and fused

with protosepta; tabulae domed, their fused outer edges forming wall. *U.Dev.(Famenn.),* Eu.(Pol.). ——Fig. 280,*1a-c.* **O. pachytheca; a,b,* Holy Cross Mts., Galezice, transv., long. secs., ×4.8; *c,* another specimen, Holy Cross Mts., Lagow-Dule, ext. view, ×1.3 (Rozkowska, 1969).

?**Pseudopetraia** Soshkina, 1951, p. 23, *non Pseudopetraia* Schindewolf, 1924, p. 108, *nom. nud.,* see Lang, Smith, & Thomas, 1940, p. 109 and Kullman, 1965, p. 69 [**P. devonica*; OD; †slide 6662, Soshkina Coll., PIN, Moscow]. Solitary, small, cylindrical or conical; epithecate; calice deep; wall a narrow peripheral septal stereozone, axial edges of minor septa free, extending but little from it; major septa thin except in stereozone, axial ends variably confluent in groups, not lobed as in *Palaeocyathus* Foerste, 1888, the longest in ?six groups confluent at axis somewhat as in *Heterophyllia* McCoy, 1849; tabulae domed or conical, complete or with additional tabellae. *M.Dev.(Eifel.),* Eu.(Urals).——Fig. 280,*2a-c.* **P. devonica,* holotype, eastern slopes C. Urals, near Pokrovsk Egorshin; *a,b,* transv., *c,* long. secs., all ×3.6 (Soshkina, 1951).

Order and Family Uncertain

Astraeophyllum Nicholson & Hinde, 1874, p. 152 [**A. gracile*; M; ?syntype 518(4), AU, Aberdeen, *fide* Benton, 1979]. Corallum alternately slenderly fasciculate and thamnasterioid; septa long, meeting columella at axis. [Insufficiently studied.] *M.Sil.(Niagar.),* N.Am.(Ont.).——Fig. 281,*2a,b.* **A. gracile,* Owen Sound; *a,* side view, enl.; *b,* calical view, greatly enl. (Nicholson & Hinde, 1874).

Axinura Castelnau, 1843, p. 49 [**A. canadensis*; M; †not traced in Castelnau Coll., in EM or in MN, Paris; M; Dev., L. St. Clair, USA]. See Easton, 1973, p. 130.

Belgradeophyllum Cotton, 1973, p. 32, *pro* Gen. I Kostić-Podgorska, 1957, p. 77 [**belgrade, pro* sp. I; OD; †not traced]. Solitary, with axial structure of medial plate and irregular septal lamellae, without dissepimentarium. [Insufficiently known.] *L.Carb.,* Eu.(Bosnia).

Beogradophyllum Cotton, 1973, p. 33, *pro* Gen. II Kostić-Podgorska, 1957, p. 78 [**beograd, pro* sp. I; OD; †not traced]. Solitary, with axial structure of medial plate and numerous irregular radial septal lamellae, without dissepimentarium. [Insufficiently known.] *L.Carb.,* Eu.(Bosnia).

Campsactis Rafinesque & Clifford, 1820, p. 234 [**C. canaliculata*; SD Lang, Smith, & Thomas, 1940, p. 31; †not traced]. *?Dev.,* USA(Ky.).

Cylicopora Steininger, 1849, p. 17 [**C. fasciculata*; M; †not traced]. *Dev.,* Eu.(Ger.). Not illustrated, description inadequate.

Digonoclisia Yu, Liao, & Deng, 1974, p. 226 [**D. sinensis*; OD; †18777-9, IGP, Nanking]. Solitary; bilateral symmetry barely distinguishable; with dissepimentarium dominantly of steeply inclined lonsdaleoid dissepiments, with a few long, thick segments of septa developed discontinuously, other septa being represented in places by shorter septal crests; tabular floors deeply concave. [See also Yu & Liao, 1978, p. 174; possibly digonophyllid.] *M.Dev.,* Asia(Kweichow).——Fig. 281,*3a-c.* **D. sinensis,* holotype, Hon-yi Shan F., Kweichow, Hon-yi Shan, Dushan; *a,b,* transv., *c,* long. secs., ×2 (Yu, Liao, & Deng, 1974).

Duncania de Koninck, 1872, p. 107 [**D. simplex*; OD; †a585, IRSN, Brussels] [=*Duncania* de Koninck, 1871, p. 322, *nom. nud.*]. Small, solitary, with long, equal major septa whose axial ends stop equally at edge of cylindrical axial space; cardinal septum shorter; minor septa very short. *L.Carb.,* Eu.(Belg., Dos, near Engis).

Elasmophyllum Hall, 1882, p. 38 [**E. attenuatum*; M; †not traced; no figs. published]. Solitary, ceratoid with concentrically banded epitheca and longitudinal grooves on exterior; septa radially arranged, major septa extending to axis and forming an axial whorl; dissepiments present. [Insufficiently characterized; see Stumm, 1949, p. 26.] *Dev.(Onondag.),* N.Am.(N.Y.-Can.).

Ellipsocyathus d'Orbigny, 1849, p. 12 [**Anthophyllum bicostatum* Goldfuss, 1826, p. 46; †164, Goldfuss Coll., IP, Bonn; *Dev.,* Heisterstein, Eifel, Ger.]. Study of holotype required.

Exostega Rafinesque & Clifford, 1820, p. 235 [**Turbinolia (Exostega) tecta*; SD Lang, Smith, & Thomas, 1940, p. 59; †not traced in MN, Paris]. *?Dev.,* USA(Ky.).

Gazimuria Spasskiy, 1960b, p. 106 [**G. ildicanica*; OD; †31, coll. 8774, TsGM, Leningrad]. Small, solitary, calice deep; with wide peripheral stereozone of thickened contiguous septa between which a few dissepiments may appear in late stages; major septa may attain axis; tabulae almost horizontal or weakly convex, may be incomplete. [Insufficiently illustrated.] *L.Dev.-low.M.Dev.,* Asia(Transbaikal).

Insoliphyllum Ermakova, 1957, p. 170 [**I. soshkinae*; OD; †222, coll. 11, VNIGNI, Moscow]. Dendroid, increase lateral; corallites very slender, major septa discontinuous, ?amplexoid, a few may reach axis; discontinuous columella may be formed from axial ends of one or more septa; minor septa not observed; tabulae complete, sparse, subhorizontal or rising slightly to columella; no dissepiments. [Possibly a heterocoral.] *U.Dev.(Frasn.),* Eu.(USSR).——Fig. 281,*1a-d.* **I. soshkinae,* holotype, Kirovsk Distr., Sovetsk borehole, depth 1,590-1,596 m.; *a,b,* transv., *c,d,* long. secs., ×4 (Ermakova, 1957).

Orthophyllum Počta, 1902, p. 196 [**O. praecox*; SD Smith, 1930a, p. 303; †not traced, ?NM, Prague]. Solitary, small, erect, conical; major septa thin, somewhat withdrawn from axis; minor septa contratingent; tabulae present. [Type material, *L.Dev.-M.Dev.,* from "E_2 Lochkov" Czech.,

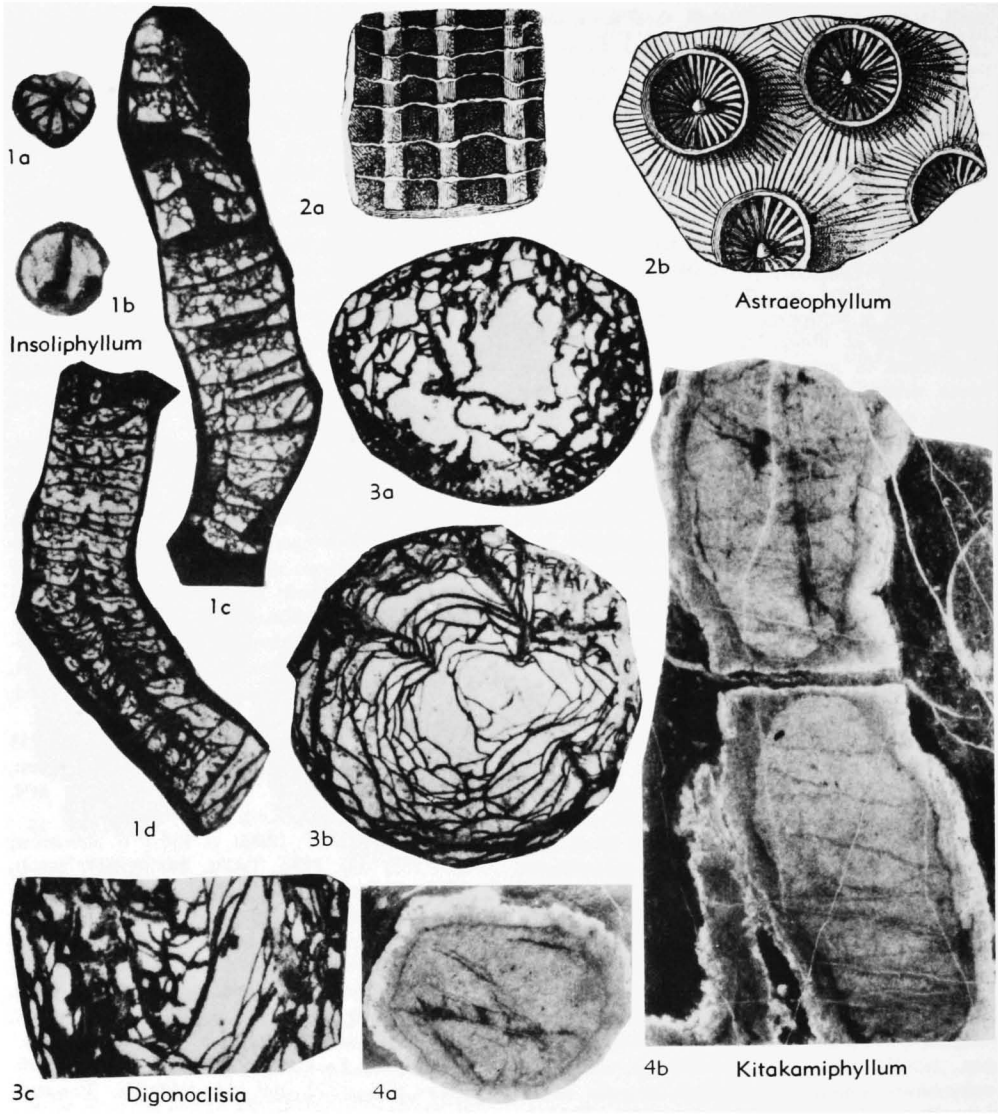


FIG. 281. Order and Family Uncertain (1-3); Subclass Uncertain (4) (p. F425-F427).

insufficiently known; see OLIVER & GALLE, 1971b, p. 94; GALLE & WEYER, 1973, p. 708.]

Phineus KOLOSVÁRY, 1951, p. 172, 185, *non Phineus* STÅL, 1862, a hemipteran [**P. confluentiseptatus*; OD; †not traced]. Solitary, with moderately wide, normal dissepimentarium, major septa extending to axial region. [Insufficiently described.] *?U.Carb.*, Eu.(Hung.).

Polydilasma HALL, 1851, p. 399; 1852a, p. 112 [**P. turbinatum*; M; †not traced] [=*Polydiselasma* LANG, SMITH, & THOMAS, 1940, p. 102, *nom. van.*]. *Sil. (Niagar.)*, N.Am.(N.Y.).

Protocyathophyllum THOMSON, 1883, p. 336, *nom. subst. pro Protocyathus* THOMSON, 1880, p. 244, *non Protocyathus* FORD, 1878, an archaeocyathan [**P. quadraphyllum*; OD; †destroyed by fire]. Indeterminable. *L.Carb.(Visean)*, Eu.(Scot.).

Pseudoamplexus SMYSHLYAEVA, 1948, p. 132 [**P. intermedius*; †not traced]. Solitary, conical, small; septa of two orders, thin, slightly thickened peripherally, not reaching axis; no dissepiments, tabulae commonly complete, flat axially, then declined abaxially [*fide* COTTON, 1974, p. 19]. *L.Perm.*, Eu.(Urals, R.Kosva, *fide* IVANOVSKIY, 1973b, p. 107).

Schreteria KOLOSVÁRY, 1951, p. 45, 183 [**Schréteria*

megastoma; M; †not traced]. Solitary, large; septa long, minor septa more than half as long as major; counter septum very long, thicker; dissepimentarium wide; tabularium with numerous tabellae. [Insufficiently known.] *U.Carb.*, Eu.(Hung.).

Vischeria IVANOV in IVANOV & MYAGKOVA, 1955, p. 34 [**V. vischerensis*; OD; †39, coll. 2, SGI, Sverdlovsk] [?=*Xystriphyllum* HILL, 1939b, *fide* YANET, written commun., July 26, 1974]. Cerioid; corallites thin-walled with numerous long thin major and minor septa; tabulae sagging; dissepiments normal. [Types poorly preserved (IVANOVSKIY, 1965a, p. 97); restudy required.] *M.Ord.*, Eu.(Urals); *?Dev.* [*fide* YANET, 1974, written commun.].

Subclass Uncertain

Decaphyllum FRECH, 1885, p. 69 [**D. koeneni*; M; †thin section in HU, E. Berlin, remainder not traced, *fide* SCHINDEWOLF, 1942, p. 285; ?Göttingen]. Massive, marginarium of each corallite a wide septal stereozone merging with those of neighbors; in small tabularia, six long septa meet or almost meet at axis ?(at small columella), with six shorter septa alternating; in larger tabularia eight still shorter septa are present, two in each of the four sextants adjacent to plane of biradial symmetry; septa laterally ridged subhorizontally; tabulae flat. [Insufficiently known. SCHINDEWOLF (1942, p. 286) considered it a Mesozoic scleractinian.] *?U.Dev.(Frasn.)*, Eu.(Ger.).——FIG. 282, *1a-d*. **D. koeneni*, holotype, ?Grund; *a,b*, calical views, ×3, ×6 (Frech, 1885); *c,d*, SCHINDEWOLF's diagram. interpretation of septal arrangement in tabularia as scleractinian (Schindewolf, 1942).

Kitakamiphyllum HILL, 1956b, p. *F*312, *nom. subst. pro Maia* SUGIYAMA, 1940, p. 122, *non Maia* LAMARCK, 1801, a crustacean, *nec Maia* REICHENBACH, 1850, *ex* BRISSON, 1760, a bird, *nec Maia* FRÉDÉRIKS, 1924, a brachiopod [**M. cylindrica*; OD; †61523, TohU, Sendai]. Solitary, wall thickened, scabrous; no septa or septal spines observed; tabulae subhorizontal, commonly complete; no dissepiments. *?U.Sil.*, Asia(Japan).——FIG. 281,*4a,b*. **K. cylindricum* (SUGIYAMA), holotype, Kitakami mountainland, Kusayami-zawa at S. foot of Takainari-yama, Hikoroiti-mura; *a,b*, transv., long. secs., ×3 (Sugiyama, 1940).

Numidiaphyllum FLÜGEL, 1976b, p. 57 [**N. gillianum*; OD; †Ex.19, AMNH, New York]. ?Solitary to fasciculate; wall indented at junctions with septa; four to seven long septa thickened so as to be sphenoid or lanceolate in transverse section, one to three or more amplexoid shorter septa of differing length and thickness developed without obvious regularity in interseptal loculi; tabulae complete, sagging; septal and tabular surfaces may be finely granulate; neither dissepiments, columella, nor fossula observed. [Specimens embedded in rock, calical and epithecal features not seen; number of septa unchanged over considerable number of serial transverse sections, plan of septal insertion unknown.] *U.Perm.*, N.Afr.(Tunisia).—— FIG. 283,*1a-e*. **N. gillianum*, paratype, Djebel Tebaga; *a*, transv. sec., ×2.0, *b-e*, transv. secs., ×1.3 (Flügel, 1976b).

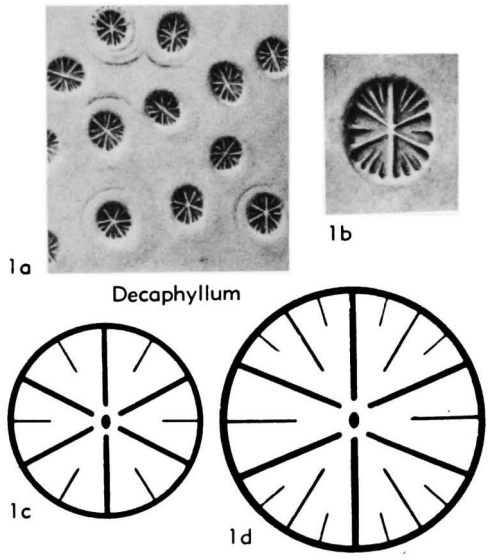


FIG. 282. Subclass Uncertain (p. *F*427).

For this genus, FLÜGEL (1976b, p. 55) established the family Numidiaphyllidae, with the following diagnosis (transl.): Rugosa with irregularly arranged septa of up to four orders of length and thickness, with four to seven septa predominant and with sagging tabulae; neither dissepiments, columella, nor fossula present.

Doubtful Genera

Siphonaxis DYBOWSKI, 1873c, p. 335, 390 [**S. tubiferus*; M; †not traced]. Drift, Eu., Ostrominsk, near Burtneksh Lake, Latvia. LINDSTRÖM, 1883b, p. 13, writes, "Founded on silicified and altered fragments of an undeterminable coral."

Stegophyllum SCHEFFEN, 1933, p. 34 [**S. densum*; OD; †not traced]. *U.Ord.*, Eu.(Nor.). Indeterminable.

Strobilasma SCHEFFEN, 1933, p. 32 [**S. dentatum*; OD; †not traced] [=*Strobilelasma* LANG, SMITH, & THOMAS, 1940, p. 126, *nom. van.*]. *L.Sil.*, Eu.(Nor.). Indeterminable.

Nomina Nuda

Agonophyllum SIMPSON, 1900, p. 203. No species named.

Amplexi-Caninia VAUGHAN, 1906, p. 296 [=*Amplexicaninia* COTTON, 1973, p. 17]. In faunal lists. *L.Carb.*, Eu.(Ire.). No species mentioned.

Astroplasmatidae SPASSKIY & KRAVTSOV in SPASSKIY, KRAVTSOV, & TSYGANKO, 1971, p. 85, *nom. nud.*;

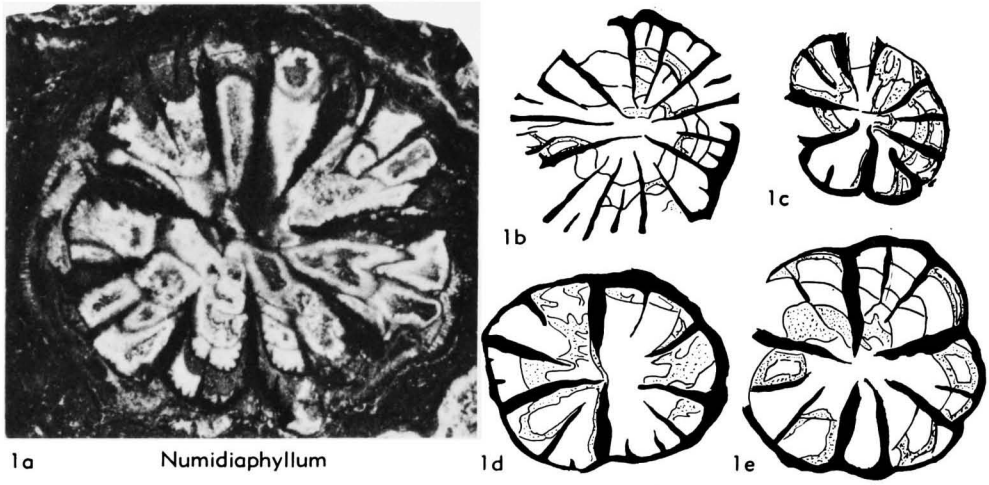


FIG. 283. Subclass Uncertain (p. *F427*).

applied to Cystiphyllida.

Asymmetrilamellum THOMSON, 1901, p. 483. No descriptions or illustrations, but two lower Carboniferous species are mentioned, of which *A. lintoni* was designated "type species" by GREGORY, 1917, p. 223. Material not traced.

Aulinella BYKOVA, 1966, p. 17. In faunal list in binomen *"Aulinella elegans* GORSKY *gen. et sp. nov."* *L.Carb.(Namur.)*, USSR(E.Kazakh.). Possibly intended for aulinoids.

Axophylloides YABE & HAYASAKA, 1915, p. 61. In binomen *"Axophylloides rikuzenicus* YABE & HAYASAKA," *Parafusulina* limestone, Yatsuse near Kesen-numa, Iwate Pref. *Perm.*, Asia(Japan). No descriptions or figures.

Blothromissum GRABAU, 1917a, p. 199. In list of new genera in abstract; no species, descriptions, or figures.

Brochiphyllum WEDEKIND, 1923, p. 35. No species, briefly compared with *Keriophyllum* WEDEKIND, 1923; not illustrated.

Calvinastraea GRABAU, 1917a, p. 199. In list of new genera in abstract, no species, descriptions, or illustration.

Cantharophyllum ETHERIDGE, 1900, p. 18. *L.Carb.*, Australia(Queensl.). Conditional name for three lithostrotionid species.

Chonophylloides KIAER, 1897, p. 17, 26, 75. In binomen *"Chonophylloides rarotabulatus gen. et sp. nov."*

Coenophyllum BYKOVA, 1966, p. 12. In faunal list as *"Coenophyllum* ? sp."

Crassophyllum WANG, 1945, p. 28. One species named, *C. typicum*. *M.Dev.*, Asia(E.Yunnan). No description or figures; entry in table only.

Cyathacyis SOSHKINA, 1955, Byull. Mosk. Obshch Ispyt. Prirody Sec. Geol., v. 30, p. 57, *fide* COTTON, 1973, p. 57 (not seen by HILL), Probably *nom. null.* for *Cyathactis* SOSHKINA, 1955.

Cystocantrillia LIN & CHOW, no date, two species listed in YI, 1974, p. 10. No diagnoses, descriptions, or figures; no type species named. Tryplasmatid. *U.Ord.*, China.

Dansikophyllum ULITINA, 1963a, p. 15, no type species named. "This widely known genus was described originally under the name *Lythophyllum* WEDEKIND and later under *Cystiphylloides* YOH." ULITINA considered both names preoccupied and proposed *Dansikophyllum* as a replacement name. Later, 1968, p. 59, she considered *Cystiphylloides* YOH, 1937, a synonym of *Cystiphylloides* CHAPMAN, 1893; *Lythophyllum* WEDEKIND, 1925, she placed in synonymy with *Nardophyllum* WEDEKIND, 1925. The name Dansikophyllidae ULITINA, 1963a, p. 14, is invalid; it was intended for forms herein placed in Cystiphyllidae MILNE-EDWARDS & HAIME, 1850.

Dobrolyubovia FOMICHEV, 1953a, p. 593 [=*Dobrolyuboviae* COTTON, 1973, p. 71, *nom. null. et nud.*]. Conditional name. *U.Carb.-L.Perm.*, Eu.(W.Urals). No type species cited.

Eokoninckophyllum FOMICHEV, 1953a, p. 353. Conditional name with provisional type species *Koninckophyllum proprium* SIBLY, 1908, p. 70. *L.Carb.(D_2)*, Eu.(U.K., near Wensley, Derbyshire).

Gorskyia FOMICHEV, 1953a, p. 593 [=*Gorskya* FLÜGEL, 1970, II, p. 118, *nom. null. et nud.*]. Conditional name. *U.Carb.-L.Perm.*, Eu.(W. Urals). No type species.

Lophodibunophyllum LISITSYN, 1925, p. 68. In combination *Lophodibunophyllum novum*, n. sp.; treated by LANG, SMITH, & THOMAS, 1940, p. 80, as *err. pro Lophophyllum* MILNE-EDWARDS & HAIME, and by SOSHKINA, DOBROLYUBOVA, & KABAKOVICH, 1962, p. 345, as Tetracoralla *incertae sedis*.

Merophyllum GRABAU, 1917a, p. 199. In list of new genera in abstract; no species named, no description, no illustration.

Neocantrillia LIN & CHOW, no date, in combination *N. cystotabulata* LIN & CHOW, listed in YI, 1974, p. 10. No diagnosis, description, or figure; no type species named. Tryplasmatid. *U.Ord.*, China.

Onychophylloides ULITINA, 1968, p. 7. In binomen "*Onchophylloides armenicus* SYT." *M.Dev.(up. Givet.)*, Transcauc. In faunal list only.

Pelladophyllum SANDBERGER, 1889, p. 102. *Nom. nud., fide* COTTON, 1973, p. 151. [SANDBERGER reference not seen by HILL.]

Pholidastraea SPASSKIY & KRAVTSOV in SPASSKIY, KRAVTSOV, & TSYGANKO, 1971, p. 84, *nom. nud.*; no species named, no descriptions or illustrations.

Pholidastraeidae SPASSKIY & KRAVTSOV in SPASSKIY, KRAVTSOV, & TSYGANKO, 1971, p. 84; applied to Cystiphyllida.

Pristiphyllum GRABAU, 1917a, p. 199. In list of new genera in abstract; no species named, no description, no illustrations.

Pseudopetraia SCHINDEWOLF, 1924, p. 108. See LANG, SMITH, & THOMAS, 1940, p. 109 and KULLMAN, 1965, p. 69.

Siphodon RAFINESQUE, 1815, p. 136, *nom. nud.*; RAFINESQUE & CLIFFORD, 1820, p. 234, conditional name for *Turbinolia tubulosa*; M; †not traced. N.Am.(Allegheny Mts.).

Soshkinia FOMICHEV, 1953a, p. 593 [=*Soshkiniae* COTTON, 1973, p. 192, *nom. null.*]. Conditional name. *U.Carb.-L.Perm.*, Eu.(W.Urals). No type species cited.

Sphaerophyllum WEDEKIND, 1923, p. 29, 35. *Dev. (Eifel.)*, Eu.(Ger.). No species named.

Stereophyllum GRABAU, 1917a, p. 199. In list of new genera in abstract; no species named, no description, no illustration.

Tabulasma SHURYGINA, 1971, p. 102. In binomen "*Tabulasma oblonga* ZHELT.," and cited as such again in PAVLOVA, 1973, p. 35.

Texanophyllum HERITSCH, 1937, p. 315. Used in combination as *Texanophyllum skinneri* HERITSCH, from Delaware F. *Perm.*, N.Am.(Texas). No description, figure, or diagnosis.

Tienophyllum WANG, 1945, p. 29. Four species named. *M.Dev.*, Asia(Yunnan). No species designated as type, no descriptions or figures; diagnoses inadequate.

Tillophyllum VOLLBRECHT in WEDEKIND, 1923, p. 31, 35. *M.Dev.*, Eu.(Ger.). No species named.

Uralastraea FOMICHEV, 1953a, p. 593. Conditional name. *U.Carb.-L.Perm.*, Eu.(W.Urals). No type species cited.

Unavailable Genus-Group Names

The following generic names have ceased to be available by Opinion 946 of the International Commission on Zoological Nomenclature (Bull. Zool. Nomencl., v. 27, p. 226, March, 1971), which suppressed for the purposes of the Law of Priority but not for those of the Law of Homonymy the paper by R. LUDWIG, 1865-1866, "Corallen aus paläolithischen Formationen" (Palaeontographica 14). The case was submitted by COLIN T. SCRUTTON (Bull. Zool. Nomencl., v. 25, p. 156-161, January, 1969).

Acanthochonium: p. 139, 142, 145; **Anorygmaphyllum:** 139, 143, 156; **Astroblastocyclus:** 229; **Astroblastodiscus:** 189, 227; **Astroblastothylacus:** 230; **Astrocalamocyathus:** 188, 222; **Astrochartodiscus:** 189, 234; **Astrocyathus:** 139, 184, 187, 203; **Astrocyclus:** 184; **Astrodendrocyathus:** 188, 220; **Astrodiscus:** 184, 187, 212; **Astrolopas:** 184, 187, 211; **Astrophloeocyathus:** 237; **Astrophloeocyclus:** 189, 237; **Astrophloeothylacus:** 190, 239; **Astroplacocyathus:** 191, 243; **Astrothrombocyathus:** 190; **Astrothylacus:** 184, 187, 209; **Cyathothaelaea:** 139, 142, 152; **Cyathodactylia:** 139, 143, 160; **Hexorygmaphyllum:** 139, 144, 174; **Lioblastocyathus:** 188, 223; **Lioblastolopas:** 224; **Liocalamocyathus:** 214; **Liochartocyathus:** 189, 231; **Liocyathus:** 139, 184, 187, 191; **Liodendrocyathus:** 188, 213; **Liodendrolopas:** 214; **Liophloeocyathus:** 189, 235; **Lioplacocyathus:** 190, 242; **Liothrombocyathus:** 190; **Ptychoblastocyathus:** 188, 224; **Ptychocalamocyathus:** 216; **Ptychochartocyathus:** 189, 231; **Ptychochartocyclus:** 232; **Ptychochonium:** 139, 141, 144; **Ptychocyathus:** 139, 184, 187, 194; **Ptychodendrocyathus:** 188, 215; **Ptycholopas:** 198; **Ptychophloeocyathus:** 189; **Ptychophloeolopas:** 236; **Ptychoplacocyathus:** 190, 243; **Ptychothrombocyathus:** 190, 240; **Taenioblastocyathus:** 188; **Taeniocalamocyathus:** 219; **Taeniocalamolopas:** 218; **Taeniochartocyclus:** 189, 233; **Taeniocyathus:** 139, 184, 187, 199; **Taeniodendrocyathus:** 218; **Taeniodendrocyclus:** 188, 220; **Taeniodendrolopas:** 188, 216; **Taeniolopas:** 187, 201; **Taeniophloeolopas:** 189, 237; **Taenioplacocyathus:** 190, 243; **Taeniothrombocyathus:** 190, 241; **Tetraphyllum:** 143, 154.

Family, tribe, and species-group names that have become unavailable in the same way are listed by SCRUTTON (1969, Bull. Zool. Nomencl., v. 25, p. 159-160).

The following generic name was placed on the official list of rejected and invalid names by Opinion 813 of the International Commission on Zoological Nomenclature (Bull. Zool. Nomencl., v. 24, p. 143, June, 1967) and suppressed for the purposes of the Law of Priority but not for those of the Law of Homonymy: **Faviphyllum** HALL, 1852b, p. 407, together with the specific name **rugosum** HALL, 1852b, p. 407, as published in the binomial *Faviphyllum? rugosum*.