SYSTEMATIC DESCRIPTIONS: RUGOSA[1]

Phylum COELENTERATA Frey & Leuckart, 1847

[*nom. transl.* Haeckel, 1866, p. li, as phylon, *ex* class Coelenterata Frey & Leuckart, 1847, p. 137]

Multicellular animals with biradial or radiobilateral symmetry; body wall with cells arranged in two layers (ectoderm and endoderm) connected by a structureless mesogloea containing cells chiefly of ectodermal origin; within the body wall is a single cavity (enteron) having a single opening (mouth) for ingestion and egestion and commonly divided by radial folds and partitions; digestion partly intracellular; nervous system comprised of a network of cells; no respiratory, excretory, or circulatory systems. *Precam.-Holo.*

Subphylum CNIDARIA Hatschek, 1888

[*nom. transl.* Delage & Hérouard, 1901, p. 2, as sous-embranchment Cnidaires, Cnidaraea *(sic)*, *ex* phylum Cnidaria Hatschek, 1888, p. 40]

Mainly distinguished by possession of stinging capsules (nematocysts) and well-developed muscular action. Commonly with power of budding, by which either individuals or colonies may be formed; sexual reproduction typically producing an ovoid, uniformly ciliated larva (planula); polymorphism characteristic, chief types being fixed cylindrical polyps and free, cup-shaped medusae; some groups with endo- or exoskeleton of calcitic, aragonitic, horny, or chitinophosphatic nature. *Precam.(Algonk.)-Holo.*

Class ANTHOZA Ehrenberg, 1834

[Anthozoa Ehrenberg, 1834, p. 255 (31), less hydroids] [=Endoaria Rapp, 1829, p. 21; Actinozoa de Blainville, 1830 *(partim)*; Actinoidea Dana, 1846b, p. 16, 29; Corallaria Milne-Edwards & Haime, 1850, p. ix *(partim)*; Oecioa Huxley, 1852, p. 80; Coralliaria Milne-Edwards & Haime, 1857a, p. 2 *(partim)*; Cnidaires Milne-Edwards & Haime, 1857a, p. 95; Actinoida Gosse, 1860, p. 6; Polycyclia, Monocyclia *(partim)* Bronn, 1860, p. 42; Cnidaria Verrill, 1865, p. 145; Coralla, Corallia Haeckel, 1866, p. liii; Coralligena Huxley, 1869, p. 117; Scyphopolypi, Scyphozoa *(partim)* Goette, 1887, p. 59; Anthozoariae Delage & Hérouard, 1901, p. 370; Eoanthozoa Birenheide, 1965a, p. 33; includes subclass Sclerocorallia Ivanovskiy, 1966, p. 455]

Exclusively polypoid, solitary or colonial, mostly sedentary coelenterates. Oral end expanded as oral disc with centrally located mouth surrounded by peristome, around which are one or more rings of hollow tentacles. Stomodaeum strongly developed, leading from mouth into gastrovascular cavity biradially partitioned into compartments by complete or incomplete mesenteries, some of which bear endodermal gonads. Some groups characterized by horny or calcareous spicular endoskeleton or by calcareous exoskeleton. Exclusively marine. *Ord.-Holo.*

Representatives of this class are divided into six subclasses, only three of which have living representatives. Of the three living subclasses, one, the Zoantharia, has paired mesenteries. The other two subclasses have unpaired mesenteries; they may be distinguished by the tentacles, which are simple in the Ceriantipatharia and pinnate in the Octocorallia. Nature of the septa distinguishes two of the three extinct subclasses. The Rugosa have septa of two orders in-

[1] In the systematic descriptions, information on the status of the type (or types) of the type species and its (or their) repositories follows the citation of the type species; this information is preceded by a dagger (†) (see Editorial Preface, p. xxv). Problems of stratigraphical nomenclature are discussed in the Editorial Preface, p. xxvi.—Ed.

serted sequentially at four loci; the Tabulata have short, acanthine septa of one order, for which the plan of insertion is not yet established. The number of septal orders and their plan of insertion is unknown for the Heterocorallia.

Subclass RUGOSA Milne-Edwards & Haime, 1850

[*nom. transl.* Okulitch, 1936a, p. 59 (*ex* order Rugosa Milne-Edwards & Haime, 1850, *nom. transl.* Nicholson, 1872, p. 46, *ex* suborder Rugosa Milne-Edwards & Haime, 1850, p. lxiv)] [=suborder Stauracea Verrill, 1865, p. 146; subclass Tetracorallia Haeckel, 1866, p. liii *(partim)*, less Paranemata (=Ceriantharia); legion (of class Coralla or Anthozoa) Tetracoralla Haeckel, 1870, p. 452 *(partim)*, less Paranemata (=Ceriantharia); "Order Zoantharia, Section II Madreporaria Rugosa (Tetracoralla)" Nicholson in Nicholson & Lydekker, 1889, p. 276; order Pterocorallia Frech, 1890, p. 80; order Tetraseptata Grabau, 1913, p. 930, *non* Haacke, 1879, p. 261; ?subclass or order Palaeozoantharia Wedekind, 1927, p. 4 *(partim)*; Tetracoelia Yabe & Sugiyama, 1940, p. 85; subclass Sclerocorallia Ivanovskiy, 1966, p. 457 *(partim)*; includes suborders Proteroseptata, Deuteroseptata Grabau, 1922, p. 27; and superorders Associata, Solitaria Spasskiy, 1965a, p. 83]

Solitary or compound epithecate corals with septa typically in two orders alternating in length but in some with three or four orders; symmetry bilateral; in solitary corallites, and in many offsets, with metasepta inserted in four positions only, on the counter side of each alar septum and on each side of the cardinal septum. A marginarium, consisting of a dissepimentarium or a peripheral stereozone formed by thickening of the septa, may be developed around the tabularium in the zone of minor septa. Tabulae may be conical, domed, horizontal, sagging (in some with a median trough), or inversely conical; each tabula may be complete, consisting of one plate, or incomplete, consisting of a number of tabellae. An axial structure may develop. *M.Ord.-U.Perm.*

Order CYSTIPHYLLIDA Nicholson, 1889

[*nom. transl.* as order Cystiphyllaceae Bulvanker *et al.*, 1960, p. 231, *et correct.* Ivanovskiy, 1961c, p. 185, *ex* "Order Zoantharia, Section II Madreporaria Rugosa (Tetracoralla), section Cystiphylloidea" Nicholson in Nicholson & Lydekker, 1889, p. 298; it is assumed, from this citation, that the name is of the ordinal group] [=Lythophyllacea Wedekind, 1925, p. 22, suborder; Cystiphyllacea Wedekind, 1927, p. 9, suborder; Pholidophyllida Wedekind, 1927, p. 9, section of suborder; Cystiphyllida Wedekind, 1927, p. 11, section of suborder; Calceolacea Wedekind, 1937, p. 41; Cystiphyllina Hill, 1954, p. 29, suborder; Cystiphylalacea Wang, 1948, p. 2, *nom. null.*; Pholidophyllina Spasskiy, 1965a, p. 86, suborder; Zonastraeida Spasskiy, Kravtsov, & Tsyganko, 1971, p. 84, invalid, 1974, p. 171, order; Zonastraeina Spasskiy, Kravtsov, & Tsyganko in Tsyganko, 1972, p. 21, suborder (validation of Zonastraeina Spasskiy, Kravtsov, & Tsyganko in Tsyganko, 1972, p. 84, in which *Zonastraea* was *nom. nud.* and Zonastraeidae Spasskiy, Kravtsov, & Tsyganko, 1971, p. 85, was invalid); Rhabdacanthiina Spasskiy, Kravtsov, & Tsyganko, 1974, p. 171, suborder (replacement name for Pholidastraeina Spasskiy & Kravtsov in Spasskiy, Kravtsov, & Tsyganko, 1971, p. 84, invalid subordinal name, based on invalid generic name without assigned species, and invalid family name)]

Solitary coralla with or without opercula or epithecal scales; less commonly compound coralla, fasciculate or massive; with numerous, more or less well-formed to scarcely noticeable acanthine to (in Digonophyllida) laminar major and minor septa; septal presence may be confined to zones of skeletal thickening on more or less widely spaced old calicular floors (sclerocones, septal cones); trabeculae commonly do not form laminar septa or septal segments, but are discrete monacanths or, rarely, rhabdacanths, and may be long and extending through successive calical floors or be simple tubercles on upper surfaces of such floors; except in Palaeocyclidae and Tryplasmatidae, which lack dissepiments, and possibly in Holmophyllidae, alternation of length of septa is interrupted in counter position, where three long septa may show no intervening short septa; dissepimentarium and tabularium not sharply separated, dissepiments and tabellae together commonly forming inversely conical or bowl-shaped calicular floors; in Tryplasmatidae tabular floors commonly of complete horizontal tabulae with median notch; tabulae and tabellae absent in Palaeocyclidae. *M.Ord.-?U.Dev.*

Family PALAEOCYCLIDAE Dybowski, 1873

[Palaeocyclidae Dybowski, 1873c, p. 331] [=Palaeocyclinae Zittel, 1876, p. 226; Acanthocyclidae Hill, 1936, p. 193; Paleocyclidae Bassler, 1937, p. 189; Rhabdocyclidae Hill, 1940c, p. 404; Porpitidae Moore & Jeffords, 1945, p. 164, *non* Brandt, 1835; Primitophyllidae Ivanovskiy, 1965a, p. 56]

Corallum solitary, small, discoid to trochoid; calice extending to apex; axial structures absent; tabulae and dissepiments absent; septa pinnately inserted, of two orders, acanthine; axial ends of trabeculae discrete [see Weyer, 1973a, p. 46]. *M.Ord.-?U.Ord., L.Sil.-M.Dev.*

Palaeocyclus Milne-Edwards & Haime, 1849a, p. 71 [**Madrepora porpita* Linné, 1767a, p. 1272; M; see Wells, 1936, p. 127; †not traced (no. 232 in Hisinger Coll., RM, Stockholm, may be suitable neotype)]. Corallum discoid, cone of attachment central on base of disc; major and minor

septa laterally contiguous, each a single series of monacanthine trabeculae with axial ends projecting into calice; tabulae, dissepiments, and axial structures absent. *L.Sil.(up.Llandov.)*, Eu.(Gotl.-U. K.)-N. Am. (Ont.-Anticosti-B.C.-Mich.-Cal.-Utah); *?M.Sil.(basal Wenlock.)*, Eu.-N.Am.——Fig. 39,*3a-f*. **P. porpita* (Linné), Gotl.; *a,b*, base, side, ×1; *c*, top, ×2; *d-f*, transv., long. secs. of septa showing monacanthine trabeculae, enl. (after Hill, 1936).

Bojocyclus Prantl, 1939, p. 104 [**B. bohemicus*; †no number?, Prantl Coll., NM, Prague]. Broadly conical to turbinate, curved, apex of cone eccentric; calice with smooth outer border; septa rhabdacanthine [*fide* Weyer, 1973a, p. 46], of two orders; no tabulae, no dissepiments; no distinct fossula. *M.Dev.(Eifel.)*, Eu.(Czech.-Ger.).——Fig. 39,*4a,b*. **B. bohemicus*, holotype, Hlubočepy Ls., gγ, "White Bed" at the top, quarry at Holyňe, W. of Prague; *a,b*, calical, proximal views, ×4 (Prantl, 1939).

Primitophyllum Kaljo, 1956b, p. 35 [**P. primum*; †1023, coll 77, EGM, Tallinn] [*?=Sinkiangolasma* Yü, 1960, p. 96 (type, *S. simplex*, OD; †10382-10383, IGP, Nanking; U.Ord., Sinkiang; like *Primitophyllum* but apical parts unknown; see Weyer, 1973a, p. 46); *?Protostreptelasma* Brown, 1909, p. 88, invalid name, *nom. nud.* for hypothetical ancestral coral]. Corallum solitary, small, trochoid, weakly curved; calice reaching apex of corallum; epitheca complete, with septal furrows indicating rugosan septal insertion; septa of two orders, short, subequal, acanthine; ?monocanths [Weyer, 1973a, p. 46] forming discontinuous septal combs; tabulae absent. *M.Ord.*, Eu.(Est.)-?Asia(Salair); *?U.Ord.*, Asia(Kazakh.-Sinkiang).——Fig. 39,*2a,b*. **P. primum*, M.Ord., Est.; *a*, long. sec., ×0.7; *b*, Idavere horizon, Unikyula, Est., ext. view showing rugosan septal furrows, ×0.7 (Kaljo, 1956b).——Fig. 39,*2c,d*. *?P. simplex* (Yü), holotype, U.Ord., Sinkiang, Mt. Uryigiz-tag, Kuruk-tag; *c,d*, transv., long. secs., ×0.7 (Yü, 1960).

Rhabdocyclus Lang & Smith, 1939, p. 152, *nom. subst. pro Acanthocyclus* Dybowski, 1873c, p. 359 (103), *non Acanthocyclus* Lucas, 1844, a recent crustacean [**Palaeocyclus fletcheri* Milne-Edwards & Haime, 1851, p. 205; SD Lang & Smith, 1927, p. 450; †A6850, SM, Cambridge; lectotype by Hill, 1936, p. 201]. Solitary, small, discoid or patellate, with cone of attachment eccentric; without tabulae or dissepiments; with stereozone of rhabdacanthine or dimorphacanthine septa; major septa not confluent axially [see Weyer, 1973a, p. 46]. *L.Sil.*, Asia(Kweichow)-N.Am.(Nev.-Utah); *L.Sil.-low.U.Sil.*, Eu.(U.K.-Gotl.)-Asia(Sib.Platf.); *L.Dev.(Gedinn.)*, Eu.(Ger.).——Fig. 39,*1a,b*. **R. fletcheri* (Milne-Edwards & Haime), M.Sil.(Wenlock.); *a*, Dudley, U.K., long. sec., ×2.0 (after Lang & Smith, 1927); *b*, Wales, U.K., long. sec., ×1.3 (Hill, 1936).

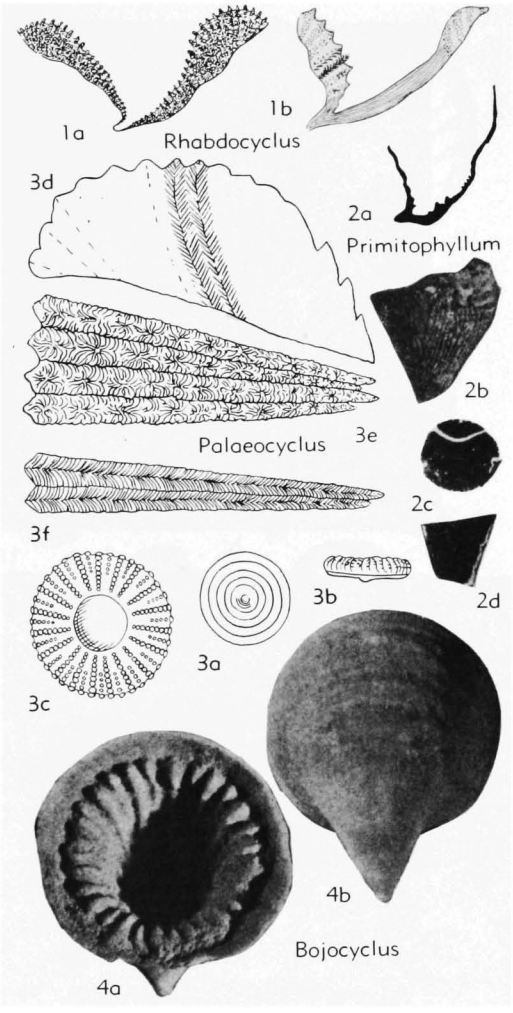
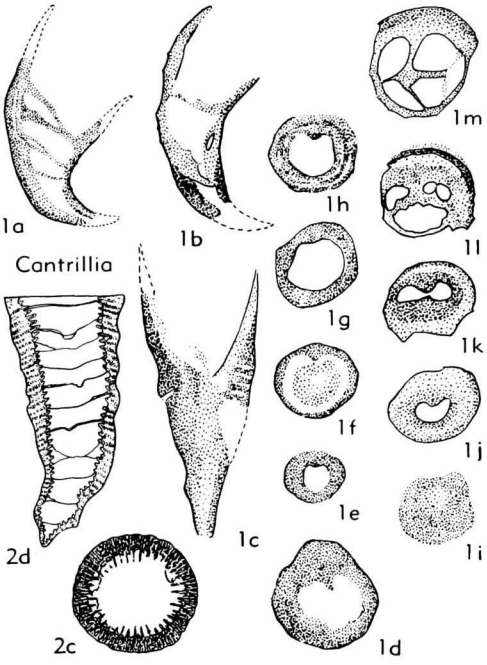


Fig. 39. Palaeocyclidae (p. *F96-F97*).

Family TRYPLASMATIDAE Etheridge, 1907

[*nom. correct.* Hill, 1954, p. 36, *pro* Tryplasmidae Etheridge, 1907, p. 59] [=Pholidophyllidae Wedekind, 1927, p. 25; Pholidophyllida Wedekind, 1927, p. 25, section of suborder; Tryplasmacea Lecompte, 1952, p. 455, superfamily; Tryplasmaticae Ivanovskiy, 1963, p. 95, superfamily; Pholodophyllina Spasskiy, 1965a, p. 86, suborder; Holacantiidae Sytova in Sytova & Ulitina, 1966, p. 208; Holacanthiidae Sytova, 1971, p. 18, *nom. van.*; Rhabdacanthiidae Spasskiy & Kravtsov in Spasskiy, Kravtsov, & Tsyganko, 1974, p. 171, ?replacement name for Pholidastraeidae Spasskiy & Kravtsov in Spasskiy, Kravtsov, & Tsyganko, 1971, p. 84, invalid name based on *nom. nud.*; ?Tchinghizophyllidae Sultanbekova, 1978, p. 41]

Solitary, fasciculate or cerioid; septa commonly short, contiguous peripherally in



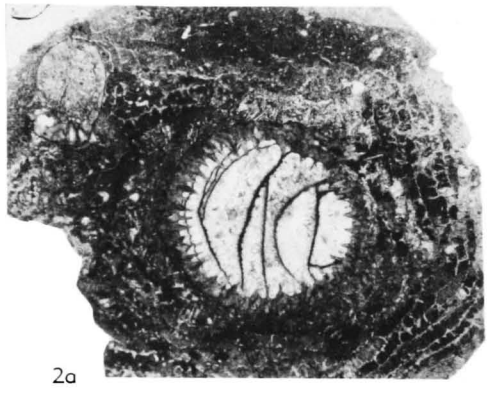


FIG. 40. Tryplasmatidae (p. *F*98, *F*100).

more or less narrow stereozone; trabeculae monacanths, or rhabdacanths and holacanths, contiguous in laminar septal bases, axial ends free; counterseptal loculi normal; cardinal fossula seldom distinct; tabulae complete and subhorizontal, in some with median notch, or with supplementary peripheral tabellae; no dissepiments. *M.Ord.-?M.Dev.*

Subfamily TRYPLASMATINAE Etheridge, 1907

[*nom. transl.* HILL, herein (*ex* Tryplasmatidae ETHERIDGE, 1907, p. 59, *nom. correct.* HILL, 1954, p. 36, *pro* Tryplasmidae ETHERIDGE, 1907, p. 59)] [=Holacanthiinae SYTOVA, 1971, p. 18, *nom. transl.* SPASSKIY, KRAVTSOV, & TSYGANKO, 1974, p. 171 (*ex* Holacanthiidae SYTOVA, 1971, p. 18, *nom. van. pro* Holacantiidae SYTOVA in SYTOVA & ULITINA, 1966, p. 208); Rhabdacanthiinae SPASSKIY & KRAVTSOV in SPASSKIY, KRAVTSOV, & TSYGANKO, 1974, p. 171]

Tryplasmatidae with septa rhabdacanthine or holacanthine; cardinal fossula not distinct, cardinal septum not noticeably short. *M.Ord.-?M.Dev.*

Tryplasma LONSDALE, 1845, p. 613 [**T. aequabile*; SD ETHERIDGE, 1907, p. 42; †neotype, 1, coll. 486, IGG, Novosibirsk; by IVANOVSKIY & SHURYGINA, 1975, p. 15] [=*Holidophyllum* LINDSTRÖM, 1871a, p. 925; 1871b, p. 125 (type, *Cyathophyllum?* [*sic*] *loveni* MILNE-EDWARDS & HAIME, 1851, p. 364, M; figured syntype MILNE-EDWARDS & HAIME, 1855, pl. 66, fig. 2; M.Sil., Wren's Nest, Dudley, U.K., presumably destroyed in BOUCHARD-CHANTEREUX Coll. at Boulogne during war; unfigured syntypes, *fide* S. Smith, written commun., 1930, in boxes 694, 712 in DE VERNEUIL Coll., EM, Paris, Sil., Gotl.); *Scarithodes* DUNCAN, 1884, p. 177, *nom. null.; Spiniferina* PENECKE, 1894, p. 592, *nom. subst. pro Acanthodes* DYBOWSKI, 1873c, p. 364 (108), *non Acanthodes* AGASSIZ, 1833, p. 19, a Permian fish (type, *A. cylindricus,* SD SHERZER, 1891, p. 278; syntypes not traced; Sil., Lauberg and Karlsö, Gotl.); *Pholadophyllum* LANG, SMITH, & THOMAS, 1940, p. 99, *nom. van.*]. Corallum solitary or with one or more parricidal offsets from calice but not forming fasciculate coralla; may have epithecal scales; with a narrow peripheral stereozone of contiguous laminar bases of commonly short rhabdacanthine, holacanthine, or dimorphacanthine septa, trabeculae being free distally; tabulae complete and commonly subhorizontal, some with median notch; dissepiments absent [see IVANOVSKIY & SHURYGINA, 1975, p. 15]. *U.Ord.(Vormsi.),* Eu.(Est.-Swed.-Urals); *Sil.-L. Dev.,* cosmop.; *?M.Dev.(Eifel.),* Asia(E.Urals). ——FIG. 40,*2a,b*. **T. aequabile,* neotype, L.Dev. (or Eifel., *fide* IVANOVSKIY, written commun.), R. Kavka, E. slope of Urals; *a,b,* trans., long. secs., ×2.7 (Hill, n; photographs courtesy A. B. Ivanovskiy).——FIG. 40,*2c,d*. *T. loveni* (MILNE-EDWARDS & HAIME), M.Sil., U.K., Knowle Quarry, Wenlock Edge; *c,d,* transv., long. secs., ×1 (after Hill, 1936).

Aphyllum SOSHKINA, 1937, p. 45 [**A. sociale*; OD; syntypes 229 and slides 324, 325, coll. 143, PIN, Moscow] [?=*Aphyllostylus* WHITEAVES, 1904, p. 113 (type, *A. gracilis,* M; †4409, Natl. Type Coll.,

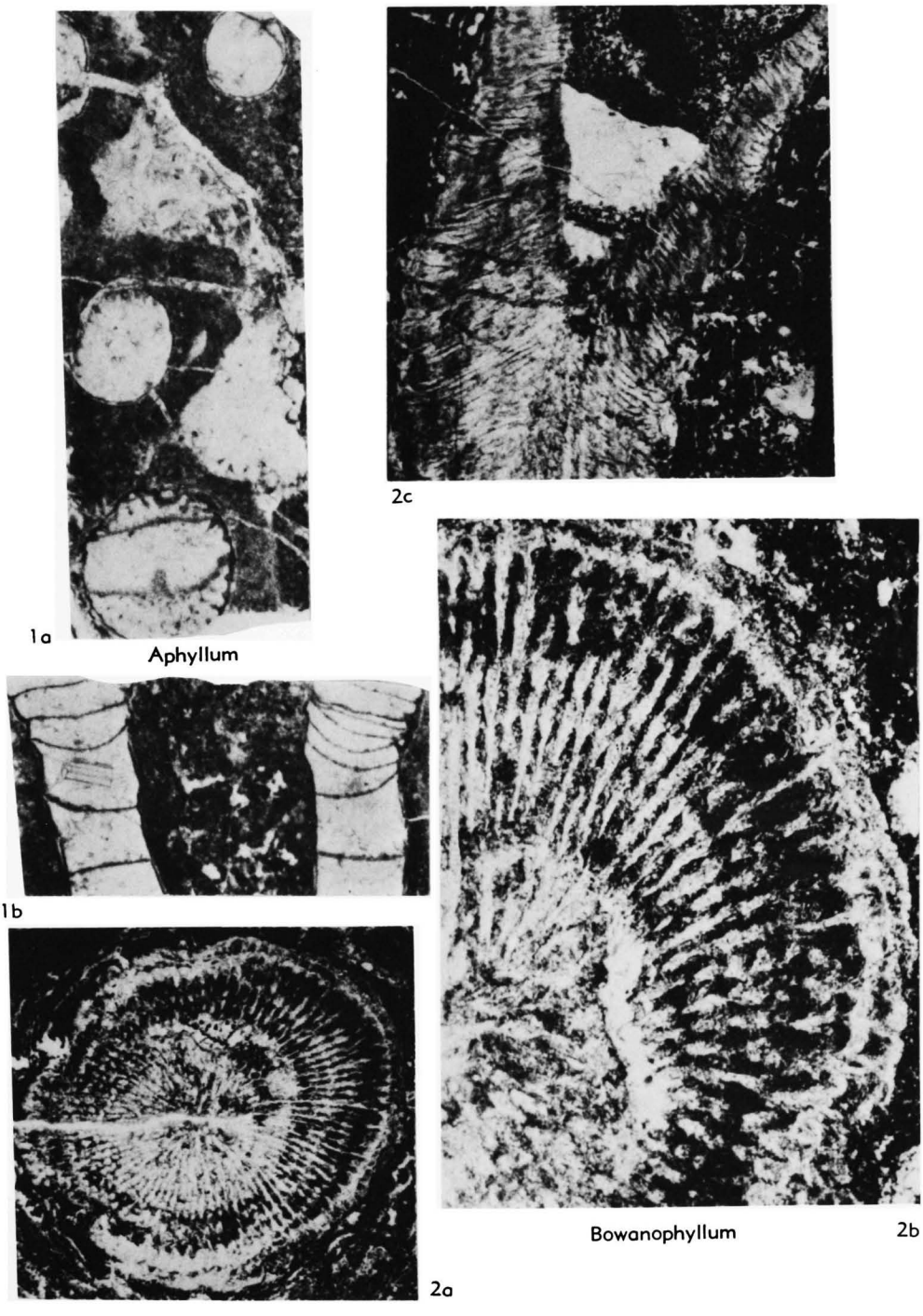


FIG. 41. Tryplasmatidae (p. *F98-F100*).

GSC, Ottawa; U.Ord., Stonewall F., Manit., *fide* Stearn, 1956, p. 8, 91); *Holacantia* SYTOVA in SYTOVA & ULITINA, 1966, p. 208 (type, "*Madrepora flexuosa* LINNÉ, 1758, Wenlock Ls., Dudley,

England," OD; but LINNÉ, 1758, p. 796, cited the fossil figured in "Corallia Baltica," 1749, I, p. 96, t. 4, fig. XIII, no. 5, which is now missing, *fide* LINDSTRÖM, 1896a, p. 617, but, *fide* LONSDALE, 1839, p. 689, was from the shores of the Baltic. Any neotype should come from there. LINDSTRÖM, 1896a, p. 632, thought *M. flexousa* LINNÉ identical with a species lying in long-stretching reefs in the shale beds along the shores on both sides of Likkersham in Gotland, i.e., in upper Llandoverian Visby marls); *Holacanthia* IVANOVSKIY, 1969, p. 31, *nom. van.; Rhabdacanthia* IVANOVSKIY, 1969, p. 45 (type, *Eridophyllum? rugosum* MILNE-EDWARDS & HAIME, 1851, p. 425, OD; †e-162, EM, Paris, lectotype by SMITH & LANG, 1927, p. 307; Sil., Gotl.; fasciculate but species has connecting talons and ?rhabdacanthine septa, whereas *H. flexuosa* (LINNÉ, 1758) has no talons and has holacanthine septa), as holacanths can develop by diagenesis of rhabdacanths, *Rhabdacanthia* is considered a subjective synonym of *Holacantia* and of *Aphyllum; Soshkinella* GORYANOV & LAVRUSEVICH, 1972, p. 91, *nom. subst. pro Aphyllum* SOSHKINA, 1937, *non Aphylum* BERGROTH, 1906, a hemipteran; see IVANOVSKIY, 1974b, p. 128]. Fasciculate, increase lateral or peripheral and pseudoaxial; may have epithecal scales; corallites with acanthine septa and narrow peripheral stereozone of contiguous laminar septal bases from which discrete rhabdacanthine or holacanthine trabeculae are directed inward and commonly upward; tabulae complete, horizontal and in some with median notch, or slightly curved. [See IVANOVSKIY & SHURYGINA, 1975, p. 27. No type species in the above synonymy has been sufficiently described or illustrated from topotypic material. I have separated as a true genus the consistently fasciculate species of *Tryplasma* AUCTT. with tryplasmatid septa and tabulae from solitary species and those species in which a few calical offsets may appear in otherwise solitary coralla. *Wenlockia* KATO, 1966a, is considered a distinct genus because of its marked cardinal fossula.] *?U.Ord.*, N.Am.(Manit.); *L. Sil.*, Eu.(Gotl.)-?Asia(Tadzhik.-Kweichow); *M. Sil.*, Eu.(U.K.-Est.-Gotl.)-Asia(E.Urals-Sib.Platf.)-N.Am.(Yukon); *U.Sil.*, Eu.(Podolia)-Asia(E.Urals-Kazakh.-?Iran)-Australia(New S.Wales-Queensl.)-S.Am.(Venez.); *?L.Dev.*, Asia(Tadzhik.); *?M.Dev. (Givet.)*, Asia(Tadzhik.).——FIG. 41,*1a,b*. **A. sociale*, syntype, up. Wenlock., W. slope Urals, right bank R. Vya, near Elkino; *a,b*, transv., long. secs., ×4 (Ivanovskiy & Shurygina, 1975).

?Bowanophyllum MCLEAN & WEBBY, 1976, p. 239 [**B. pilatum*; OD; †P75197, SU, Sydney]. Solitary; calice very deep, funnel-shaped; septa numerous, subradially arranged and long, major and minor subequal, each a single series of long trabeculae dilated to contiguity within each septum and commonly also with neighboring septa; tabulae flat or gently sagging, few; ?no dissepiments; fossula indistinct. *U.Ord.*, Australia(New S. Wales).——FIG. 41,*2a-c*. **B. pilatum*, ls. at top of Malachi's Hill beds, Malachi's Hill, central New S.Wales; *a,b*, holotype, transv. secs., ×3, ×8; *c*, paratype, long. sec., ×3 (all McLean & Webby, 1976; photographs courtesy B. D. Webby).

Cantrillia SMITH, 1930a, p. 298 [**C. prisca*; OD; †48,679, MPG coll., GSM, London] [?=*Tchinghizophyllum* SULTANBEKOVA, 1978, p. 41 (type, *T. primitivum*, OD; †1, coll. 2256, IG, Alma-Ata; up. Caradoc., R. Taldyboy, Chingiz Ra., E. Kazakh.)]. Corallum solitary, small, with numerous holacanthine septa in pseudolamellate sclerenchyme of peripheral stereozone, which may bulge adaxially from the convex (counter) side of corallum; tabular floors concave or flat, in some, sparse, highly inclined peripheral tabellae; tabulae and tabellae thickened. *L.Sil.(up.Llandov.)*, Eu.(U.K.).——FIG. 40,*1a-m*. **C. prisca*, Purple Shales, Shropshire; *a-c*, long. secs., ×3; *d-h, i-m*, transv. secs. in two ontogenetic series, ×3 (all after Smith, 1930a).

Hillophyllum WEBBY, 1971, p. 154 [**H. priscum*; OD; †P36153, SU, Sydney]. Corallum solitary to dendroid, small to medium-sized, with deep calice, common rejuvenescence and both lateral and peripheral increase; septa short, major and minor subequal, each a longitudinal row of large, monacanthine trabeculae, free at inner ends but contiguous to form peripheral stereozone; cardinal septum distinct in some; tabulae commonly complete, flat, sagging or domed; no dissepiments. *M.Ord.(Gisborn.-low.Easton.)*, Australia(New S. Wales).——FIG. 42,*2a-c*. **H. priscum*, Cliefden Caves Ls. (low. part), Boonderoo; *a*, holotype, sec. through dendroid ?colony, showing monacanthine septa, flat tabulae, and sediment-filled lat. ?offset, ×2; *b,c*, paratype, part of thin transv. secs., ×7, ×28 (Webby, 1971; photographs courtesy B. D. Webby).——FIG. 42,*2d*. *H.* cf. *priscum*, mid Bowan Park Ls.; view of inner surface of silicified corallite showing rows of septal trabeculae and mainly flat tabulae, ×5 (Webby, 1971; photograph courtesy B. D. Webby).

Maikottia LAVRUSEVICH, 1967, p. 22 [**M. turkestanica*; OD; †4713/44, coll. 791, UpG, Dushanbe]. Corallum cerioid, increase peripheral and pseudoaxial; septa short, subequal, rhabdacanthine, axial ends of rhabdacanths projecting from narrow peripheral stereozone, to which septa in places are almost completely reduced; tabulae subhorizontal, complete or incomplete. *U.Sil.(Kunzhak.)*, Asia (Tadzhik.)-N.Am.(Alaska).——FIG. 43,*4a,b*. **M. turkestanica*, holotype, Say Maykotta, S. slope Turkestan Ra.; *a,b*, transv., long. secs., ×2 (Lavrusevich, 1967).

?Neotryplasma KALJO, 1957, p. 157 [**N. longiseptatum*; OD; †Co1082, coll. 79, EGM, Tallinn] [=*Neotryplasma* KALJO, 1956a, p. 5, *nom. nud.*]. Corallum solitary, or with few offsets rising from calice; septa numerous, long, subequal so that

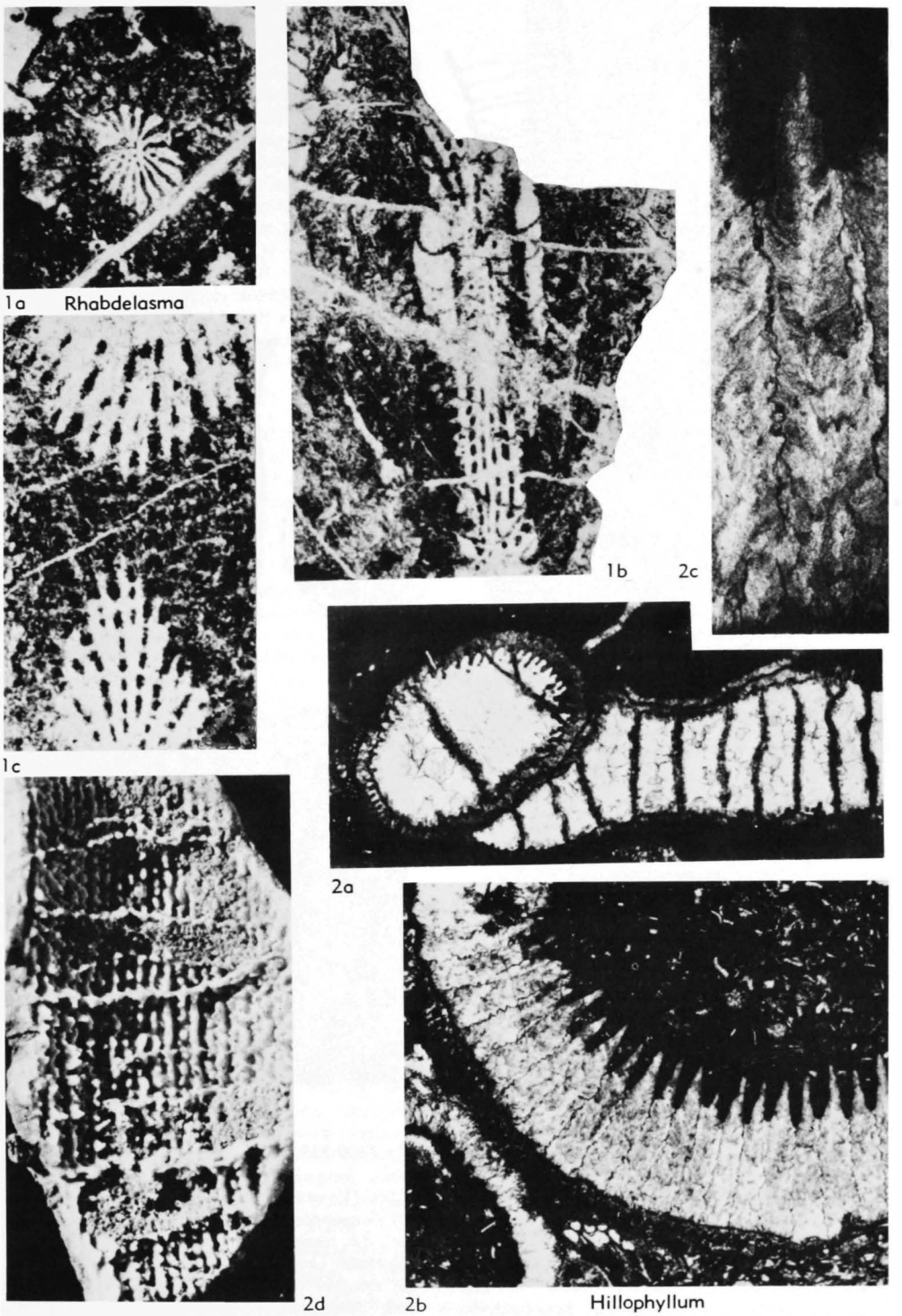


FIG. 42. Tryplasmatidae (p. *F*100, *F*103).

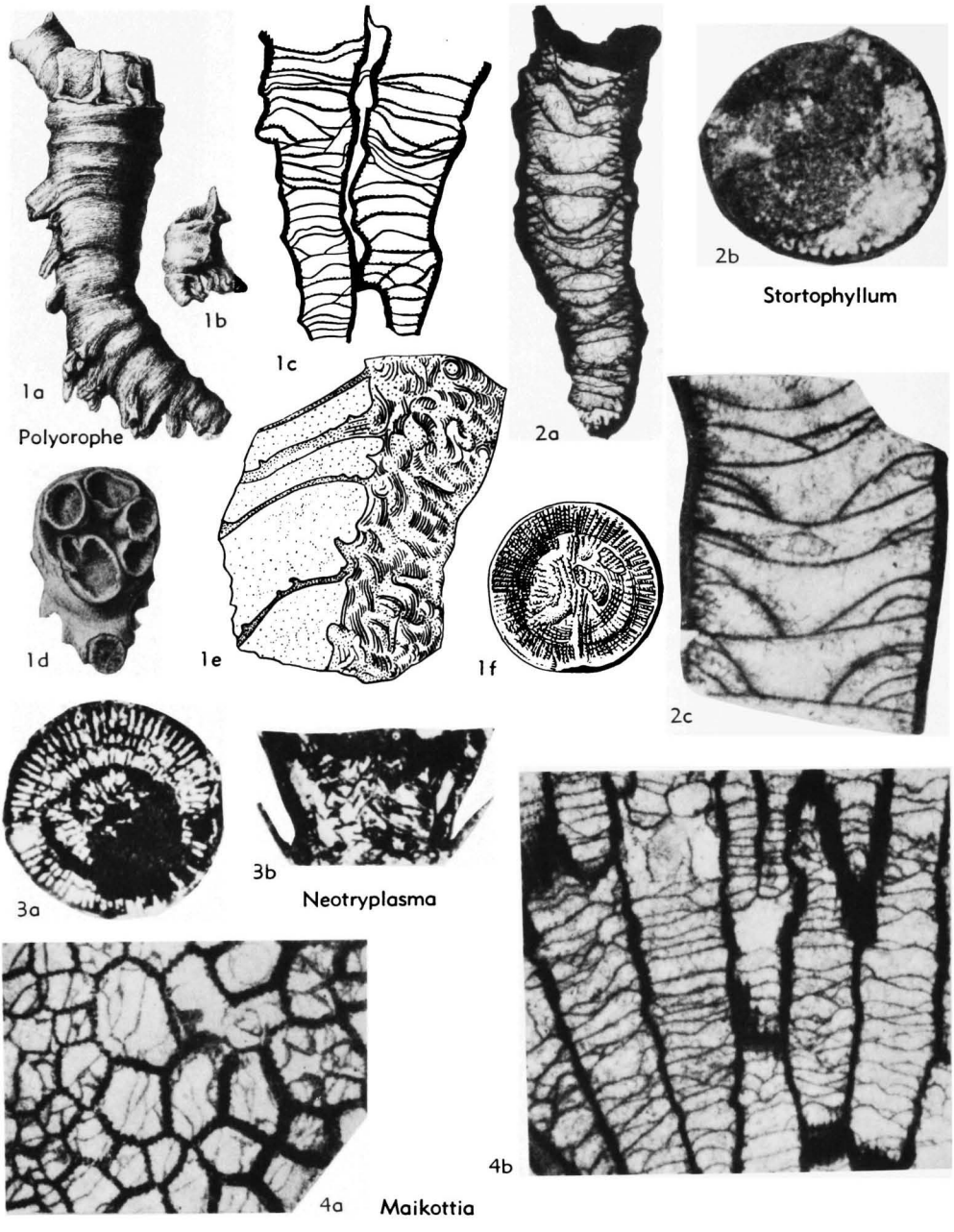


FIG. 43. Tryplasmatidae (p. *F*100-*F*103).

minor septa may be difficult to distinguish from major; septa each a longitudinal series of closely placed trabeculae contiguous only at periphery; trabeculae long, many reaching axis where they may form weak axial complex; tabulae thin, concave, in part incomplete, with long dissepimentlike plates peripherally. [Family position uncertain due to described presence of weak axial complex.]

U.Ord.(Vormsi.), Eu.(Est.-Urals).——FIG. 43,*3a,b*. **N. longiseptatum*, holotype, F_{1b}, Saksbi (north), Est.; *a,b*, transv., long. secs., ×1 (Kaljo, 1957).

Polyorophe LINDSTRÖM, 1896b, p. 43 [**P. glabra*; M; syntypes Cn21678, 21703, 21811-3, 21822-4, RM, Stockholm] [=*Polyorophe* LINDSTRÖM, 1882a, p. 16, 20, *nom. nud.*]. Corallum solitary or with a few small peripheral offsets; in type

species, epitheca draped in transverse folds extended on one side as holdfasts; peripheral stereozone with major and minor septa of holacanthine trabeculae altered during diagenesis in lamellate sclerenchyme; tabulae subhorizontal, commonly complete, their upper surfaces with subradial rows of cornlike trabeculae representing ?major septa. [See MINATO, 1961, p. 92. LINDSTRÖM's 1896b, pl. 8, fig. 99-101 suggest that, as in Cystiphyllidae, septum in each loculus neighboring counter septum is long like major septum.] *L.Sil.-M.Sil.*, Eu.(Gotl.-Karlsö)-Asia(Tadzhik.); *?U.Sil.*, Asia (Turkey).——FIG. 43,*1a-f*. **P. glabra*, Gotl.; *a,b*, ext. views, ×1.0; *c*, transv. sec., ×0.8; *d*, calice with five offsets, ×1.0; *e*, part of long. sec., ×5.0; *f*, calical view, ×1.0 (*a,b,d*, Lindström, 1896b; *c,e,f*, after Lindström, 1896b).

Rhabdelasma MCLEAN & WEBBY, 1976, p. 240 [**R. exiguum*; OD; †P75212, SU, Sydney]. Solitary, or possibly with lateral increase; septa numerous, each a single series of rhabdacanths; marginarium a stereozone in which major and minor septa are contiguous, rhabdacanths contiguous within each septum; major septa almost reaching axis; in moderately wide tabularium rhabdacanths discrete within each septum, tabulae thin, somewhat sagging and commonly complete. *U.Ord.*, Australia(New S.Wales).——FIG. 42,*1a-c*. **R. exiguum*, ls. at top of Malachi's Hill beds, Malachi's Hill, central New S.Wales; *a*, paratype, transv. sec., ×5; *b*, holotype, long. sec., ×5; *c*, paratype, tang.-long. sec. curved specimen, ×10 (McLean & Webby, 1976; photographs courtesy B. D. Webby).

Stortophyllum WEDEKIND, 1927, p. 30 [**S. simplex*; SD LANG, SMITH, & THOMAS, 1940, p. 124; †Cn54864, RM, Stockholm] [?=*Thecaspinellum* NIKOLAEVA, 1949, p. 106 (type, *T. jakowlevi*, OD; †73, coll. 5746, TsGM, Leningrad; U.Sil., Bobrovsk horizon, R. Taltiya, E. slopes Urals), has epithecal scales, U.Sil., Asia(E.Urals), U.Sil.(up.Dalyan.), Asia(Tadzhik.); *?Oborophyllum* OZAKI, 1956a, p. 170, 1956b, p. 77, with some remarks but not described, OZAKI, 1957, p. 11 (type, *O. oboroense*, ?SD FLÜGEL, 1970, p. 187; †not traced, ?in OZAKI or KATO Coll., KU, Kanazawa; Sil., Oborodani, Fukui Pref., Japan, *fide* KATO, written commun., 1975), with epithecal scales; see IVANOVSKIY & SHURYGINA, 1975, p. 37]. Solitary, rejuvenescence common, septa acanthine, bases of long ?rhabdacanths contiguous to form narrow peripheral stereozone; tabulae either horizontal and complete or inversely conical and complete, with supplementary peripheral tabellae. *U.Sil.*, Eu. (Gotl.-Podolia-Urals)-N.Am.(Tenn.); *L.Dev.*, Eu. (?N.Zemlya)-Asia(Tadzhik.-Salair).——FIG. 43,*2a*. **S. simplex*, holotype, U.Sil., Eke marls, Gotl., Lau backar; long. sec., ×1.5 (Hill, n; photograph courtesy of RM, Stockholm).——FIG. 43,*2b,c*. *?S. jakowlevi* (NIKOLAEVA), holotype, U.Sil., E. slopes Urals, R. Taltiya; *b,c*, transv., long. secs., ×4.0 (Ivanovskiy & Shurygina, 1975).

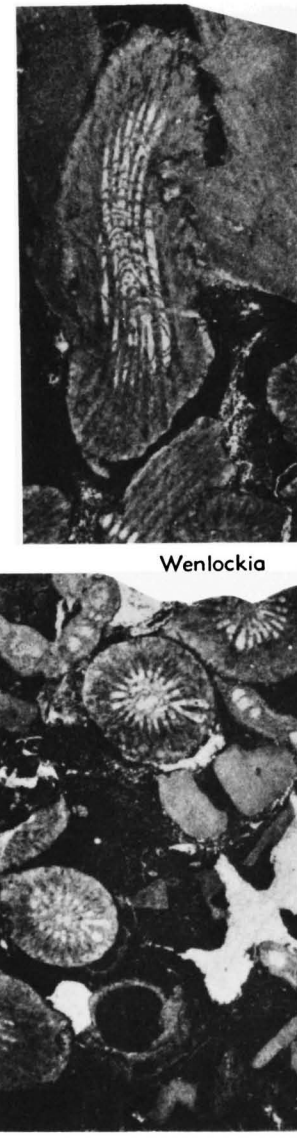


FIG. 44. Tryplasmatidae (p. *F*103-*F*104).

Subfamily WENLOCKIINAE Spasskiy & Kravtsov, 1974

[Wenlockiinae SPASSKIY & KRAVTSOV in SPASSKIY, KRAVTSOV, & TSYGANKO, 1974, p. 171]

Tryplasmatidae with monacanthine septa and short cardinal septum in notable fossula. *M.Sil.*

Wenlockia KATO, 1966a, p. 257 [**W. thomasi*; OD; †R18586, UH, Sapporo]. Corallum fasciculate, increase ?lateral; corallites slender, with rela-

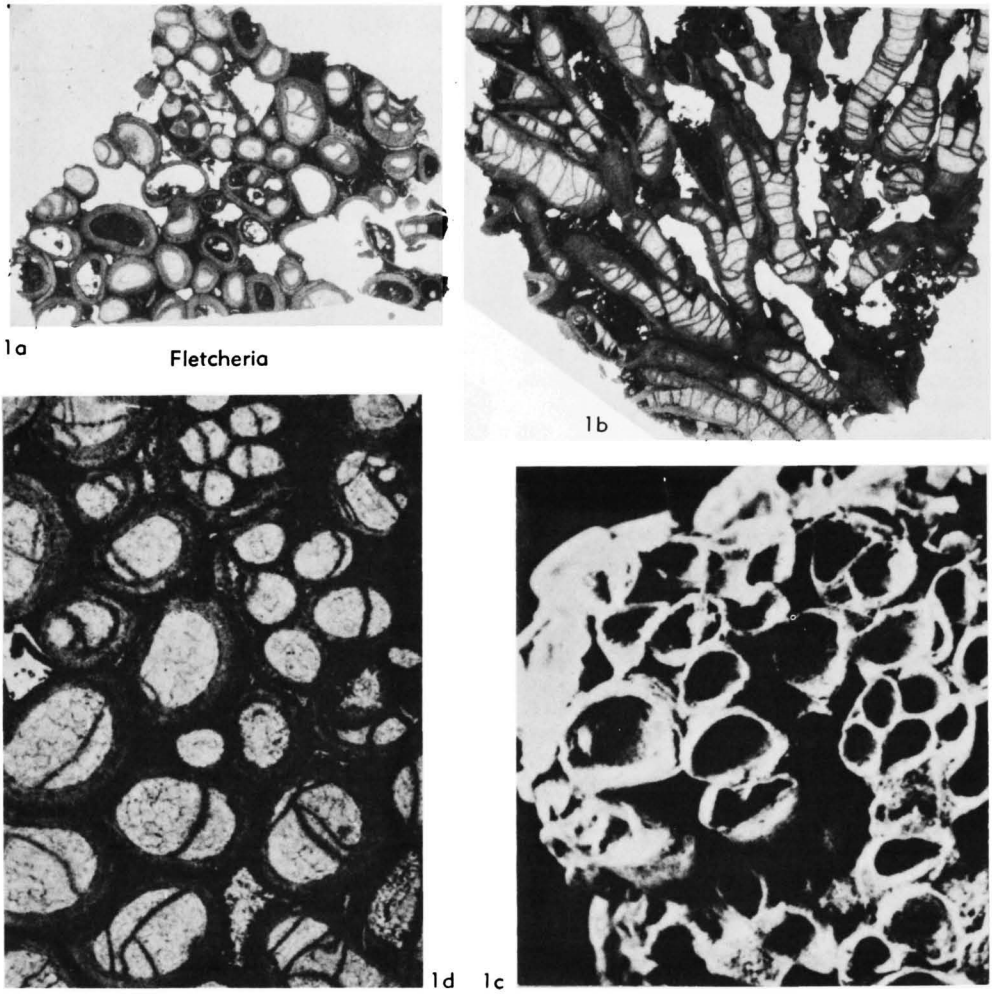


FIG. 45. Fletcheriidae (p. F104-F105).

tively wide peripheral septal stereozone; major septa not reaching axis; septa each a single series of monacanths, contiguous except at their distal ends; cardinal septum shorter, in distinct wide fossula; tabulae thin, complete, sagging, deepening in fossula. [Differs from Tryplasmatidae in presence of tabular cardinal fossula.] *M.Sil.*, Eu. (U.K.).——FIG. 44,*1a,b*. **W. thomasi*, holotype, Wenlock., Shropshire; *a,b*, long., transv. secs., ×4 (Kato, 1966a).

?Family FLETCHERIIDAE Zittel, 1876

[*nom. transl. et correct.* WEISSERMEL, 1939, p. 85, *ex* Fletcherinae ZITTEL, 1876, p. 235, tribe]

Corallum dendroid or phaceloid; corallites large, cylindrical or in places contiguous and irregularly prismatic; without connecting tubuli or mural pores; wall a thin stereozone, with very short septa, either of thin discontinuous laminae or spinose, extending but slightly beyond stereozone; tabulae horizontal, complete; increase calicular and either axial, peripheral, or lateral. [Possibly Tabulata, Auloporida.] *L.Sil.-M. Sil.*

Fletcheria MILNE-EDWARDS & HAIME, 1851, p. 300 [**F. tubifera*; OD; ††monotype, 641, DE VERNEUIL Coll., EM, Paris (only one specimen catalogued; may be figured specimen, but shows smaller group of corallites of more circular section, *fide* S. SMITH, 1930 MS)]. Corallum ramose, small; corallites cylindrical but closely attached, in places becoming prismatic; walls a thin stereozone, without mural pores or connecting processes; septa thin, sometimes discontinuous laminae; tabulae

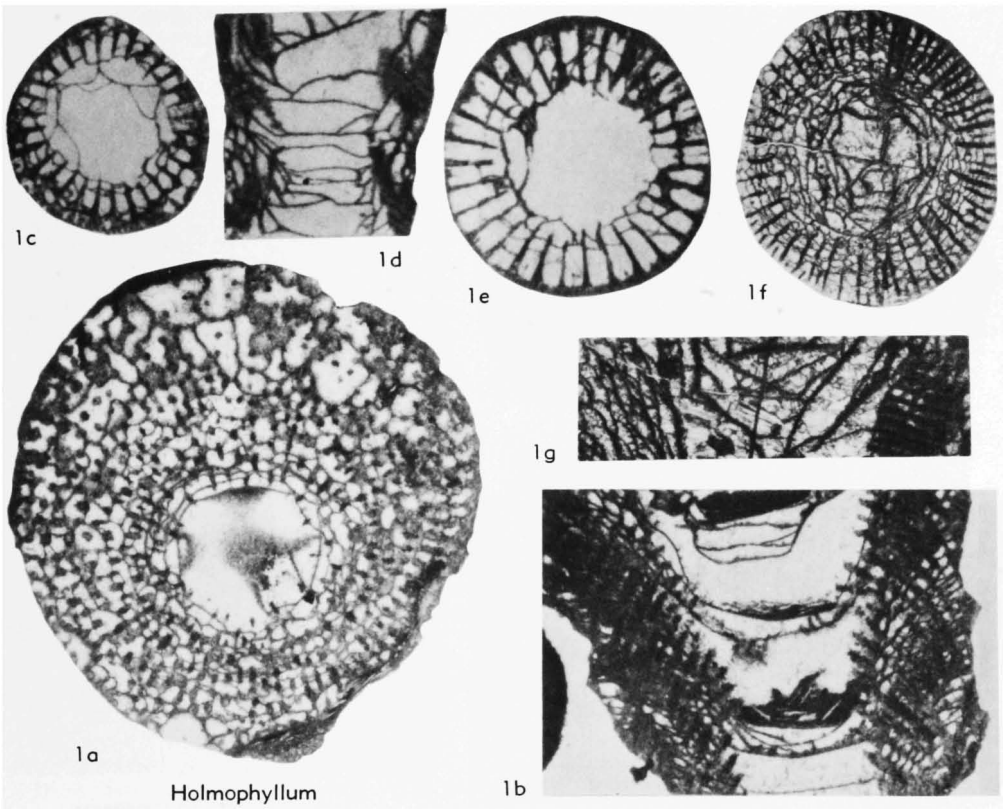


FIG. 46. Holmophyllidae (p. *F*105-*F*107).

horizontal; increase calicular, up to five offsets initially within wall of parent. [See STASINSKA, 1967, p. 101. The possibility that this genus is of the subclass Tabulata (?Auloporina), as suggested by STASINSKA (1967, p. 101), must not be overlooked; study of calice is required to establish trabecular nature of septa and whether minor septa are present; epithecal furrows should be studied to establish manner of septal insertion.] *M.Sil.(Wenlock.)*, Eu.(Gotl.).——FIG. 45,*1a-d*. **F. tubifera*, Stora Carlsö; *a,b*, ?monotype, Gotl., transv., long. secs., ×2 (Hill, n; photographs courtesy J. Lafuste); *c,d*, calical view, transv. sec., ×4, ×5 (Stasinska, 1967).

?Parafletcheria YANG, 1973, work not traced; YANG, in YANG, KIM, & CHOW, 1978, p. 223 [**P. duplicformis* YANG, 1973, named as type species and described and figured; †Gct 512-514, GB, Guiyang; L. Sil., Shiniulan F., Shimenkan, Shiqian, Guizhou (Kweichow)]. Corallum dendroid, with numerous cylindrical corallites becoming subrounded in section when contiguous, but no mural pores then observed; numerous smaller corallites arising by calical and ?lateral increase; walls thin, septal elements not observed; tabulae complete, flat. [Diagnosis tentative, from illustrations.] *L.Sil.*, Asia(Kweichow).

Family HOLMOPHYLLIDAE Wang, 1947

[*nom. transl.* IVANOVSKIY, 1968, p. 85, *ex* Holmophyllinae WANG, 1947a, p. 183] [=Dendroholmiinae SPASSKIY & KRAVTSOV in SPASSKIY, KRAVTSOV, & TSYGANKO, 1974, p. 171]

Corallum solitary, fasciculate or massive; major and minor septa numerous, subequal, somewhat withdrawn from axis and in part of discrete trabeculae and in part of laminar segments formed by contiguous trabeculae; tabulae subhorizontal or concave, complete or of tabellae; marginarium a moderately wide dissepimentarium; dissepiments may extend across more than one interseptal loculus; cardinal fossula commonly not distinct; counterseptal loculi ?normal. *Sil.-M.Dev.*

Holmophyllum WEDEKIND, 1927, p. 30 [**H. Holmi*; OD; †Cn54865, RM, Stockholm] [=*Holmophyllia* SYTOVA, 1970, p. 68 (type, *Gukoviphyllum borealis*, OD; †18, coll. 10316, TsGM, Leningrad;

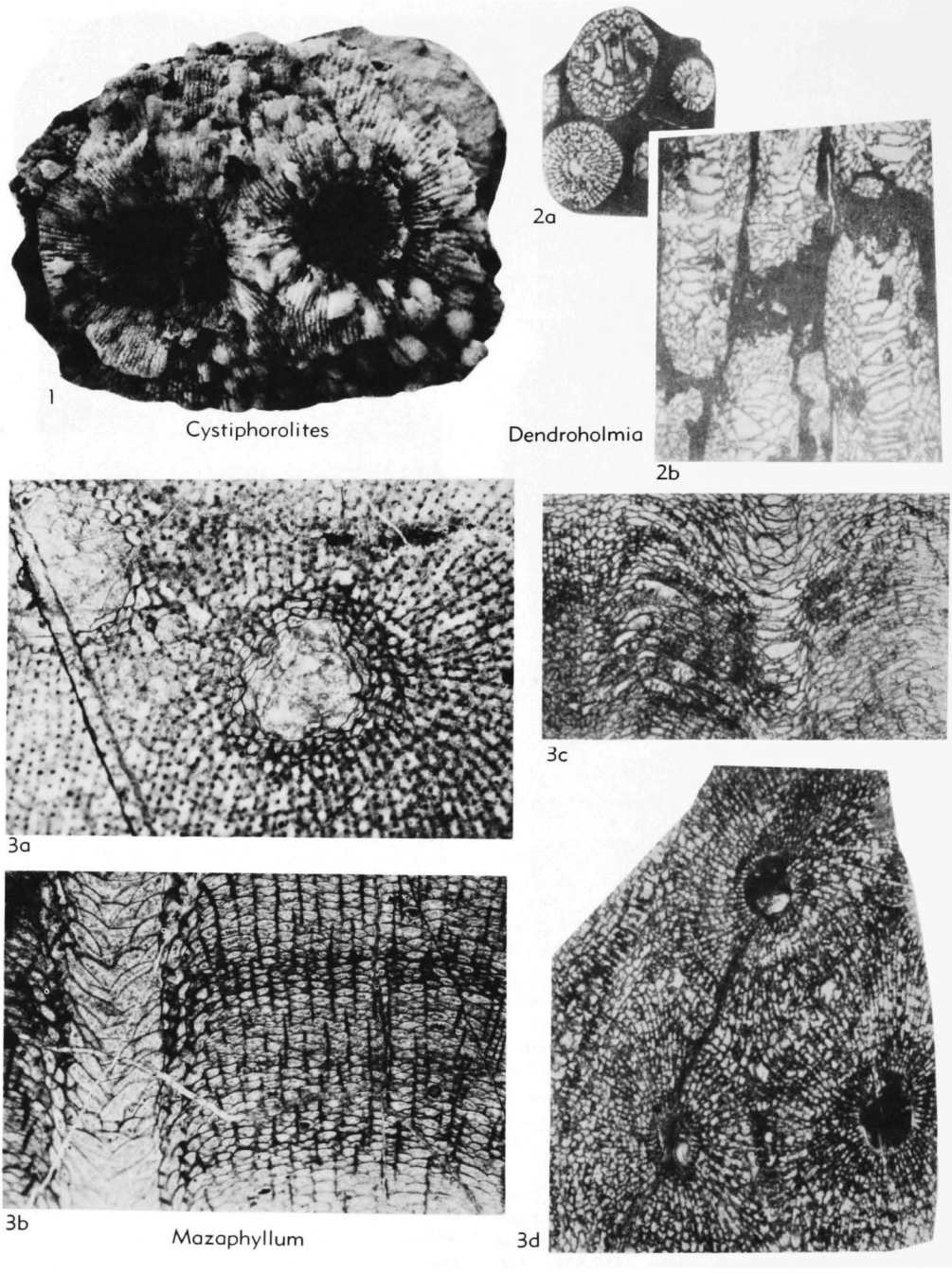


FIG. 47. Holmophyllidae (p. *F*107).

L.Dev., Vaygach I., USSR; rhabdacanths so closely spaced that septa are almost laminar), see also McLEAN, 1975a, p. 185; *?Gukoviphyllum* SYTOVA, 1968, p. 54 (type, *Holmophyllum septatum* BULVANKER, 1952b, p. 13, OD; †9, coll. 7151, TsGM, Leningrad; mid. Skalian, Gukov, Podolia, U.Sil., Podolia, L.Dev., S.Urals; trabeculae 'flabellacanthine' and closely spaced to contiguous in major septa, very widely spaced and thin in minor septa, impersistent except in narrow peripheral

stereozone in early stages); *?Aculeatophyllum* ZHAVORONKOVA in STRELNIKOV & ZHAVORONKOVA, 1972, p. 94 (type, *A. uralicum*, OD; †27-a-1, GGI, Ufa; Eifel., W. slopes S. Urals, R. Maly Ik)]. Corallum solitary or with few offsets; major and minor septa long, subequal, of discrete rhabdacanths or tufted monacanths; tabular floors horizontal or sagging, tabulae complete or incomplete; dissepimentarium moderately wide and distinct from tabularium, of numerous dissepiments [see also McLEAN, 1975a, p. 183]. *L.Sil.*, Australia(New S.Wales); *M.Sil.*, Asia(Tadzhik.-Yunnan); *U.Sil.*, Eu.(Gotl.-Podolia-Vaygach)-Australia (New S. Wales-Queensl.)-Asia (E. Urals-Kazakh.-Tadzhik.-Kuzbas-Sib.Platf.); *basal Dev.*, Asia (Tadzhik.)-Eu. (Vaygach); *M. Dev. (Eifel.)*, Eu.(USSR).——FIG. 46,*1a,b*. **H. holmi*, holotype, Ludlov., Gotl., Lau backar; *a,b*, transv., long. secs., ×5 (Hill, n; photographs courtesy RM, Stockholm).——FIG. 46,*1c-e*. *?H. septatum* BULVANKER, mid. Skalian, Gukov, Podolia; *c,e*, transv., *d*, long. secs., ×4 (all Bulvanker, 1952b). ——FIG. 46,*1f,g*. *?H. uralicum* (ZHAVORONKOVA), holotype, Eifel., W. slopes S. Urals, R. Maly Ik; *f,g*, transv., long. secs., ×2 (Strelnikov & Zhavoronkova, 1972).

Cystiphorolites MILLER, 1889, p. 183, *nom. subst. pro Vesicularia* ROMINGER, 1876, *non Vesicularia* THOMPSON, 1830, a bryozoan [**Vesicularia major* ROMINGER; OD; †8606, UMMP, Ann Arbor]. Massive, thamnasterioid or aphroid; septa represented by very numerous longitudinal series of more or less discrete, rough trabeculae developed on upper surfaces of wide, flat and somewhat everted dissepimentarial platforms and seldom continuous through more than two successive platforms; major septa continued into tabularium as fine ridges on upper surfaces of flat tabular floors, and approximately reaching axis; large, lonsdaleoid dissepiments common in wide dissepimentarium. *M.Sil.(Niag.)*, N.Am.(Mich.).——FIG. 47,*1*. **C. major* (ROMINGER), figured syntype, probably from Cordell dol., Drummond I., L. Huron; ext. view, ×0.7 (Rominger, 1876).

Dendroholmia SPASSKIY & KRAVTSOV in SPASSKIY, KRAVTSOV, & TSYGANKO, 1974, p. 171 [**Holmophyllum obscurum* SMELOVSKAYA, 1963, p. 186; OD; †slides 89/III-50-51, MGU, Moscow]. Like *Holmophyllum* but fasciculate with parricidal increase; septa with discrete rhabdacanths. *M.Sil.*, Asia(Kazakh.-?Shensi); *?up.M.Sil.* or *low.U.Sil.*, Australia(New S.Wales).——FIG. 47,*2a,b*. **D. obscurum* (SMELOVSKAYA), holotype, Wenlock., R. Ak-Chokka, S. slopes Tarbagatau Ra.; *a,b*, transv., long. secs., ×2.7 (Smelovskaya, 1963).

Mazaphyllum CROOK, 1955, p. 1052 [**M. cortisjonesi*; OD; †6136, SU, Sydney] [=*Aksarlinia* KAPLAN, 1971b, p. 17, diagnosed but not illustrated; 1975, in SYTOVA & KAPLAN, p. 67 (type, *A. concavotabulata*, OD; †5, coll. 10287, TsGM, Leningrad; L.Dev., Gedinn., Karaespa suite, Asia, Kazakh.; astreoid at least in part and with holacanthine trabeculae)]. Corallum thamnasterioid or astreoid; septa numerous, very long, major and minor equal or subequal, each septum of numerous discrete, thin rhabdacanthine or holacanthine trabeculae in several radial but adaxially convergent longitudinal series that are not connected by crosspieces; tabularium slender, tabular floors inversely conical or concave, tabulae incomplete; dissepimentarium wide, dissepiments small, subequal, somewhat elongate; some lonsdaleoid plates may occur in some. *?U.Sil.*, Australia(New S.Wales-Queensl.)-N.Am.(Somerset I.); *U.Sil.-L. Dev.(Gedinn.)*, Asia(Kazakh.).——FIG. 47,*3a,b*. **M. cortisjonesi*, holotype, near Bathurst, New S. Wales; *a,b*, transv., long. secs., ×2 (Crook, 1955). ——FIG. 47,*3c,d*. *M. concavotabulatum* (KAPLAN), holotype, Gedinn., Kazakh., near Aksarly; *c,d*, long., transv. secs., ×2 (Sytova & Kaplan, 1975).

Mesouralinia SHURYGINA, 1971, p. 106 [**M. magnifica*; OD; †453/47, coll. 1715, UGUp, Sverdlovsk]. Solitary, large, major septa long, of thick, closely spaced to contiguous trabeculae in dissepi-

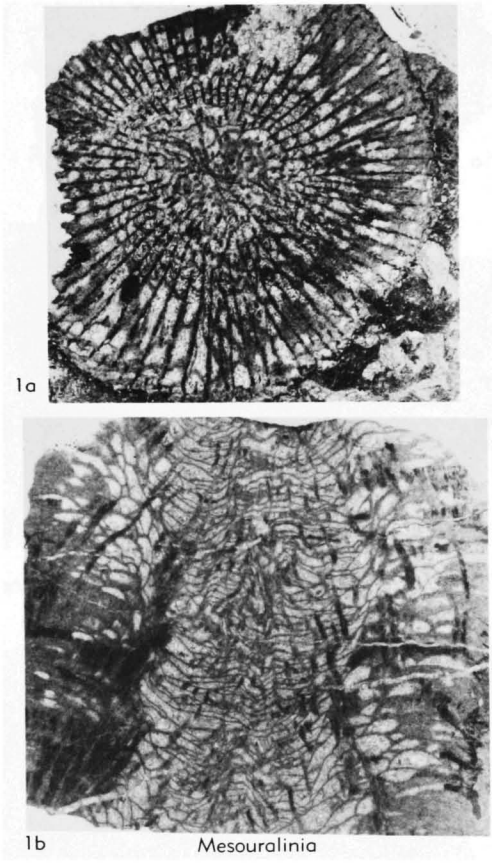


FIG. 48. Holmophyllidae (p. *F*107-*F*108).

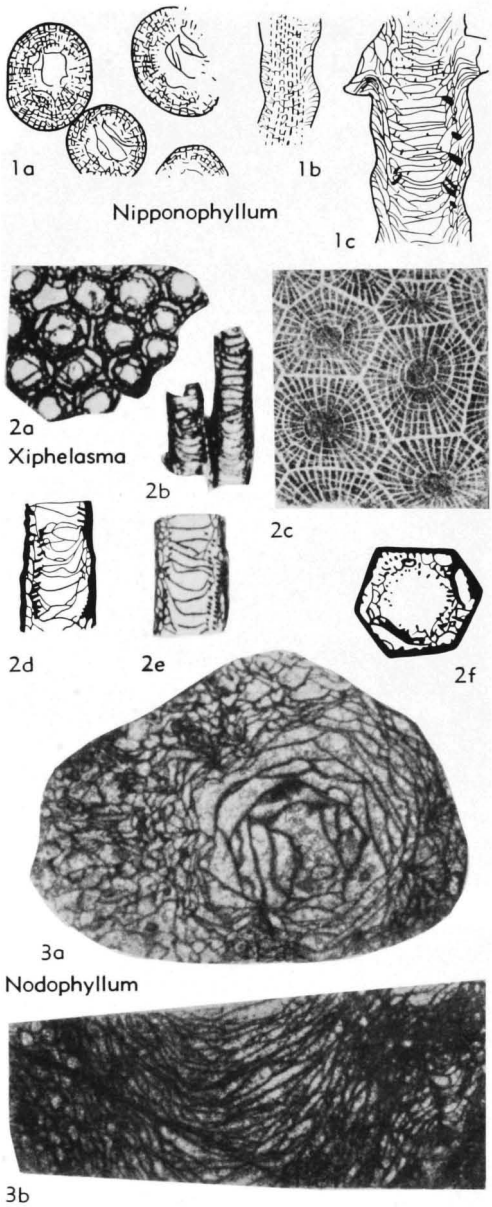


FIG. 49. Holmophyllidae (p. *F*108).

mentarium, more widely spaced in tabularium where they may reach the axis; minor septa long, thinner, commonly of disconnected trabeculae; marginarium a wide dissepimentarium of uniform dissepiments, horizontally based except near tabularium; tabularium wide, concave tabular floors formed by numerous weakly concave tabellae. [Nature of cardinal and counter septal loculi not described or figured.] *U.Sil.*, Asia(E.Urals-Tadzhik.).——FIG. 48,*1a,b*. **M. magnifica*, holotype, left bank R. Is., about 2 km. N. of Bokova; *a,b*, transv., long. secs., ×2.4 (Shurygina, 1971).

Nipponophyllum SUGIYAMA, 1940, p. 116 [**N. giganteum*; OD; †63005, TohU, Sendai] [=*Baeophyllum* HILL, 1940c, p. 403 (type, *B. colligatum*, OD; †F.9148, slide 704, AM, Sydney; Sil., Bowspring Ls., New S. Wales, Boonoo Ponds Cr., Yass R.)]. Corallum fasciculate, epithecal scales in some; major and minor septa subequal, somewhat withdrawn from axis, acanthine; trabeculae either discrete throughout or in part contiguous in laminar segments, ?monacanthine; tabulae subhorizontal or sagging, complete or incomplete, more or less sharply demarcated from plates of moderately wide dissepimentarium; dissepimentarium with shallow dissepiments that may each extend across more than one interseptal loculus and that, in many, are horizontally based so that calice has flat or everted platform [see also MCLEAN, 1975a, p. 183]. *M.Sil.*, Asia(Salair)-?Australia(New S.Wales); *U.Sil.*, Asia(Japan-Tadzhik.-E.Urals)-Australia(New S.Wales).——FIG. 49,*1a-c*. **N. giganteum*, holotype, U.Sil., *Halysites* Ls., Japan, Higuti-zawa in Kiwauti; *a-c*, transv., long., tang. secs., ×1 (Sugiyama, 1940).

?Nodophyllum KAPLAN, 1971b, p. 19, diagnosed but not illustrated; 1975, in SYTOVA & KAPLAN, p. 66 [**N. scissum*; OD; †4, coll. 10287, TsGM, Leningrad]. Solitary; septa composed of long, thin holacanths not only piercing several successive dissepimentarial floors, but also acting as nodes around which dissepiments are grouped; in some places trabeculae may be contiguous to form laminar septal segments; tabularium wide, floors concave, of wide low tabellae; dissepiments somewhat irregular, unequal [cf. *Digonoclista* YÜ, LIAO, & DENG, 1974, p. 226]. *L.Dev.(Gedinn.)*, Asia (Kazakh.).——FIG. 49,*3a,b*. **N. scissum*, holotype, Karaespa suite, SE. spur of Mt. Aksarly; *a,b*, transv., long. secs., ×3 (Sytova & Kaplan, 1975).

Xiphelasma SMITH & LANG, 1931, p. 84 [**Tubiporites tubulatus* SCHLOTHEIM, 1813, p. 37; OD; †no number, SCHLOTHEIM Coll., HU, E. Berlin] [?=*Storthygophyllum* WEISSERMEL, 1894, p. 617 (type, *S. megalocystis*, M; †original of pl. 49, fig. 6, "Ostpreuss.-provinz. Mus., Konigsberg," by LANG, SMITH, & THOMAS, 1940, p. 124; *ex* Pleistocene drift, near Königsberg)]. Cerioid or subcerioid; septa acanthine, trabeculae discrete and based on wall and on large, irregularly developed dissepiments; tabulae concave or subhorizontal, complete or incomplete. *Sil.*, Eu.(Gotl.).——FIG. 49,*2a,b,d-f*. **X. tubulatum* (SCHLOTHEIM), holotype, Sil., Gotl.; *a,f*, transv. secs., ×1.5, ×3.0; *b,d,e*, long. secs., ×1.5, ×3.0, ×3.0 (*a,b,e*, Smith & Lang, 1931; *d,f*, after Smith & Lang, 1931). ——FIG. 49,*2c*. *?X. megalocystis* (WEISSERMEL), lectotype, *ex* pebble in Pleistocene drift, E. Prussia; transv. sec., ×2.0 (Weissermel, 1894).

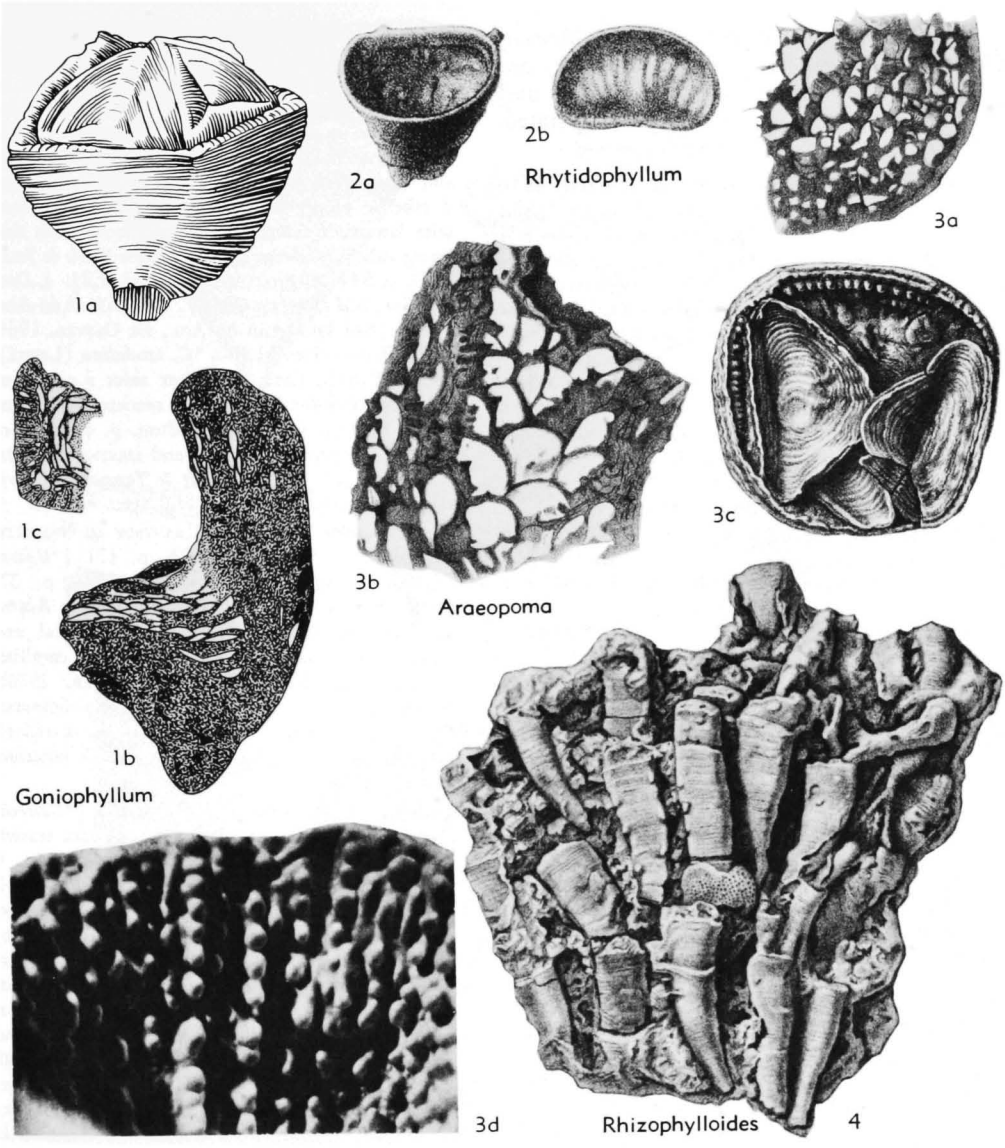


FIG. 50. Goniophyllidae (p. *F*110-*F*112).

Family GONIOPHYLLIDAE Dybowski, 1873

[Goniophyllidae DYBOWSKI, 1873c, p. 332] [=Calceolidae LINDSTRÖM, 1883c, p. 9; Heterotoechidae LINDSTRÖM, 1883c, p. 9, *nom. null.*; Araeopomatidae LINDSTRÖM, 1883c, p. 9; Homotoechidae LINDSTRÖM, 1883c, p. 9, *nom. null.*; Goniophyllinae BIRENHEIDE, 1974a, p. 460]

Corallites semicircular (calceoloid) or square in transverse section; calice with operculum of one or four plates of dense sclerenchyme; corallites either with wide dissepimentarium and inversely conical floors of tabellae, or completely or almost completely filled with skeletal thickening, or with intermittent zones of skeletal thickening (septal cones); septa either incomplete, of short, fine, isolated cornlike trabeculae developed sporadically on dissepiments and tabellae, in places coalesced in short, thin septal segments at or near periphery, or in complete but short plates so thick as to be almost contiguous laterally; minor septa difficult to distinguish from

major; septum in each loculus neighboring counter septum long like major septum [see BIRENHEIDE, 1974a]; tabularium and dissepimentarium not sharply separated. *L.Sil.(up.Llandov.)-M.Dev.(up.Givet.).*

Goniophyllum MILNE-EDWARDS & HAIME, 1850, p. lxix [**Turbinolia pyramidalis* HISINGER, 1831, p. 128; OD; †Cn54963, RM, Stockholm, Sil., Gotl.; lectotype by HILL, herein (original of HISINGER, 1831, pl. 7, fig. 5)]. Solitary, square in section, calice with operculum of four triangular plates of dense sclerenchyme; septa thick, mostly laminar and contiguous, as long as dissepimentarium is wide; septum in each loculus neighboring counter septum long like major septum [see BIRENHEIDE, 1974a, pl. 3]; dissepiments and tabellae commonly thickened, in zones with no or little thickening, numerous. *L.Sil.(up.Llandov.)*, Eu.(U.K.-Eire-Gotl.)-N.Am.(Ont.-Iowa); *M.Sil.(Wenlock.)*, Eu.(U.K.-Gotl.).——FIG. 50,*1a-c*. **G. pyramidale* (HISINGER), Sil., Gotl.; *a*, ext. view, ×1; *b,c*, part of long., transv. secs., ×1, ×2 (after Lindström, 1883c).

Aracopoma LINDSTRÖM, 1883c, p. 57 [**Cystiphyllum prismaticum* LINDSTRÖM, 1868, p. 421; M; †not identified, RM, Stockholm] [=*Protaeropoma* TING, 1937, p. 414 (type, *P. wedekindi*, OD; †not traced, ?Marburg; Sil., Visby, Gotl.; has much intermittent skeletal thickening); *Protaraeopoma* LANG, SMITH, & THOMAS, 1940, p. 106, *nom. van.*]. Solitary, square in section in adult stages and with four triangular laminate opercula in calice; with rootlets; septa long, represented each by radial longitudinal row of cornlike trabeculae based on inner surface of wall and on upper surfaces of dissepiments and tabellae, which are distinguished from one another only by size and position; trabeculae strongly developed only in intermittent zones of skeletal thickening (septal cones), seldom continuous from one dissepiment to the next above; septum in each loculus neighboring counter septum long like major septum [see BIRENHEIDE, 1974a, pl. 4]. *L.Sil.(up.Llandov.)-M.Sil.(Wenlock.)*, Eu.(Gotl.).——FIG. 50,*3a-d*. **A. prismaticum* (LINDSTRÖM), Sil., Gotl.; *a,b*, transv., long. secs., *c*, calical view showing opercula, all enl. (Lindström, 1883c); *d*, calical view, septa neighboring counter septum long like major septa, enl. (Birenheide, 1974a).

Calceola LAMARCK, 1799, p. 89 [**Anomia sandalium (sic)* GMELIN in LINNÉ, 1791, p. 3349; M; =*Anomia sandalinum* LINNÉ, 1771, p. 547, M, †not traced] [=*Calceolina* RAFINESQUE, 1815, p. 148, *nom. nud.*]. Corallum solitary, suberect or curved, without rootlets; shaped like toe of slipper, subsemicircular in transverse section. Calice with subsemicircular operculum. Counter septum in middle of flattened side, alar fossulae at angles between flat and curved sides; septum in each loculus neighboring counter septum long like major septum; near periphery counter septum swells into low columella that may engage in notch in operculum and consists of contiguous tufts of fibers radiating from its longitudinal axis; lumen completely or almost completely filled by sclerenchyme that is laminated parallel to floor of calice and that immerses septal segments of trabeculae; if tabellae occur, their upper surfaces are covered with laminated sclerenchyme continuous with that lining calical platform and sides [see HILL & JELL, 1969, p. 544; BIRENHEIDE, 1974a, pl. 1,2]. *L.Dev.(up.Ems.)-M.Dev.(up.Givet.)*, Eu.-Afr.-Asia-Australia. [Not known in N. Am., see OLIVER, 1964, p. D149.]——FIG. 51,*1a-i*. **C. sandalina* (LINNÉ), M.Dev.(Eifel.), Ger.; *a*, convex side; *b,c*, convex side and interior of another specimen, *d-f*, exterior, interior, side of operculum, *g*, diagram of septal arrangement in calice and interior of operculum; all ×1 (after Termier & Termier, 1948b); *h,i*, long., transv. secs., ×2 (Hill, n).

Rhizophylloides SPASSKIY & KRAVTSOV in SPASSKIY, KRAVTSOV, & TSYGANKO, 1974, p. 171 [**Rhizophyllum elongatum* LINDSTRÖM, 1883c, p. 32; OD; syntypes in RM, Stockholm]. Like *Rhizophyllum* but fasciculate; increase peripheral and parricidal in some, lateral in others; corallites elongate and slender [see also PEDDER, 1976b, p. 288]. *U.Sil.*, Eu.(Gotl.)-N.Am.(Ky.-Somerset I.).——FIG. 50,*4*. **R. elongatus* (LINDSTRÖM), syntype, Gotl., E. of Lau Church, ×1 (Lindström, 1883c).

Rhizophyllum LINDSTRÖM, 1866, p. 287 [**Calceola gotlandica* ROEMER, 1856, p. 798; M; †not traced; Sil., Gotl.] [=*Teratophyllum* LANG, SMITH, & THOMAS, 1940, p. 132, *nom. subst. pro Platyphyllum* LINDSTRÖM, 1883a, p. 68; 1883c, p. 40 (type, *P. sinense*, M; †in HU, E. Berlin, lectotype by HILL & JELL, 1969, p. 540; M.Sil., Szechwan, China) *non Platyphyllum* AUDINET-SERVILLE, 1831, a recent orthopteron; *Rhyzophyllum* SYTOVA, 1968, p. 69, *nom. null.*]. Solitary, or in some, with few offsets; corallites calceoloid, calice with subsemicircular operculum of dense sclerenchyme; with tubular holdfasts; septa incomplete, of isolated short, fine, cornlike trabeculae developed in radial rows sporadically on dissepiments and tabellae, in places coalesced radially into short, thin septal segments at or near periphery, or thickened and coalesced radially and laterally to form peripheral stereozone on counter (flattened) side or on both sides of corallum; part of counter septum near periphery may be expanded laterally and anteriorly as calical knob consisting of long slender trabeculae radiating obliquely upward from longitudinal axis; in some, septum in each loculus neighboring counter septum long like major septum [see BIRENHEIDE, 1974a, pl. 4]; dissepiments and tabellae numerous, seldom thickened, not readily distinguishable in size or inclination. *L.Sil.(Llandov.)-L.Dev.(Ems.)*, Eu. (U.K. - France - Swed. - Czech. - Podolia - Urals) -

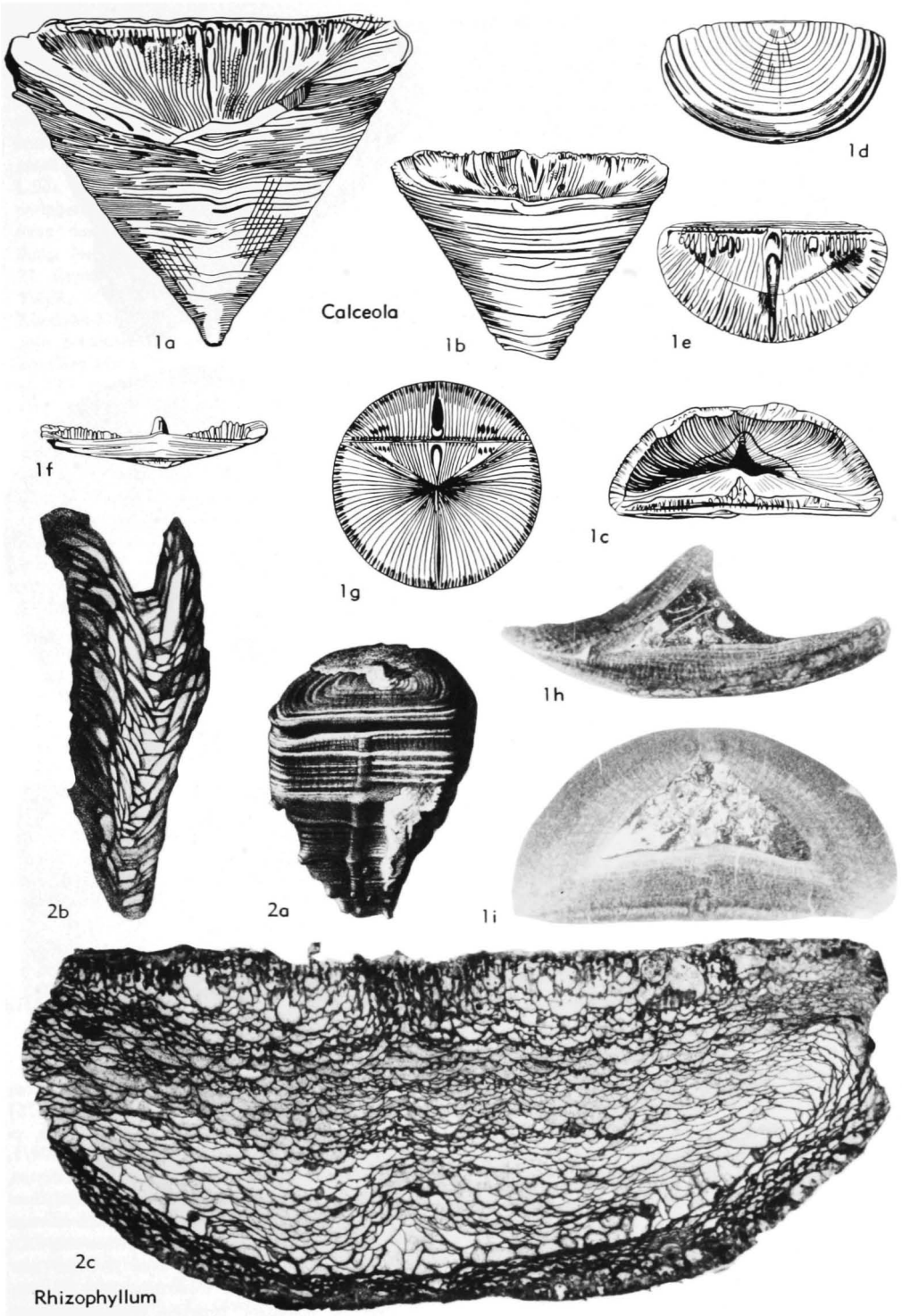


FIG. 51. Goniophyllidae (p. *F*110-*F*112).

Asia(Kazakh. - Tadzhik. - Salair - Altay - Yunnan - Hupeh - Szechwan - Japan) - N.Am.(Ky. - Cal. - Nev. - Tenn. - Okla. - Alaska - Me.) - E.Australia (New S.Wales-Queensl.-Tasm.-Vict.); possibly *low. Eifel.* in Australia-C.Asia [see HILL & JELL, 1969, p. 536].——FIG. 51,*2a,b*. **R. gotlandicum* (ROEMER), Sil., Gotl.; *a,b,* ext. view, long. sec., ×1 (Lindström, 1883c).——FIG. 51,*2c*. *R. sinense* (LINDSTRÖM), lectotype, M.Sil.(Wenlock.), Szechwan, Choatien; long. sec., ×1.7 (Hill & Jell, 1969).

Rhytidophyllum LINDSTRÖM, 1883c, p. 62 [**R. pusillum*; OD; figured syntypes Cn21848-9, 2185-3, RM, Stockholm (original of fig. 9 not identified)]. Corallum minute, calceoloid and operculate; calice deep, thin-walled; septa faint. *U.Sil.(Ludlov.),* Eu.(Gotl.).——FIG. 50,*2a,b*. **R. pusillum,* syntypes, U.Sil., Qvarnbacken, Slite; *a,b,* ext. view calice, underside of operculum, both enl. (Lindström, 1883c).

Family CYSTIPHYLLIDAE Milne-Edwards & Haime, 1850

[Cystiphyllidae MILNE-EDWARDS & HAIME, 1850, p. lxxxii] [=Cystiphyllinae McCOY, 1851b, p. 29; Zonophyllinae WEDEKIND, 1924, p. 12; Lythophyllidae WEDEKIND, 1925, p. 49; Lytophyllidae, Lytophyllinae WEDEKIND & VOLLBRECHT, 1931, p. 81, 1932, p. 99; Zonophyllidae SOSHKINA, 1936b, p. 18; Lithophyllidae, *nom. van.*, Cystiphylloidae, Cystiphylloinae STUMM, 1949, p. 38, 39; Cystiphyllacea HILL, 1953, p. 151, superfamily; Pseudozonophyllidae SOSHKINA, 1954, p. 20; Cystiphylloididae HILL, 1956b, p. *F*314; Cystiphyllicae IVANOVSKIY, 1963, p. 101; Zonastraeidae SPASSKIY, KRAVTSOV, & TSYGANKO, 1971 (*nom. inval.*, based on *Zonastraea* TSYGANKO, 1971, *nom. nud.* in SPASSKIY, KRAVTSOV, & TSYGANKO, 1971, p. 85); Zonastraeidae TSYGANKO, 1972, p. 21; Microplasmatidae, Microplasmatinae SPASSKIY & KRAVTSOV in SPASSKIY, KRAVTSOV, & TSYGANKO, 1974, p. 171; Microconoplasmatidae SPASSKIY & KRAVTSOV in SPASSKIY, KRAVTSOV, & TSYGANKO, 1974, p. 171; Cruciphyllinae LAVRUSEVICH in IVANOVSKIY, 1976, p. 49; Loboplasmatidae ZHAVORONKOVA, 1976, p. 65 (ZHAVORONKOVA gave authorship of family name as SPASSKIY & KRAVTSOV, 1971, but I have found no such publication and it appears to me that *Loboplasma* SPASSKIY, KRAVTSOV, & TSYGANKO, 1974, p. 171, is a validation of an MS generic name, and that Loboplasmatidae ZHAVORONKOVA, 1976, p. 65, is the valid name for the family.); Cruciphyllidae LAVRUSEVICH, 1977b, p. 36]

Predominantly solitary Cystiphyllida, without opercula; some with epithecal scales; with numerous, long, acanthine major and minor septa predominantly developed as discrete trabeculae, in some forming septal combs; without carinae or arched peripheral crossbars; trabeculae mainly monacanths, in some rhabdacanths, commonly affected by diagenesis resulting in holacanths buried in pseudolamellate sclerenchyme; septal presence may be confined to sclerocones more or less widely separated and thicker and more continuous in marginarium in Silurian genera, in tabularium in Devonian genera. *U.Ord.-?U.Dev.*

Cystiphyllum LONSDALE, 1839, p. 691 [**C. siluriense*; SD MILNE-EDWARDS & HAIME, 1850, p. lxxii; †GS6565 & PF4448-9, GSM, London; lectotype by LANG & SMITH, 1927, p. 476] [=*Conophyllum* HALL, 1851, p. 399, 1852a, p. 114 (type, *C. niagarense,* M; syntypes 1694/1, AMNH, New York; low. Niag. Ls., Lockport, N.Y., see STUMM, 1965, p. 51); *Cysteophyllum* MEEK, 1867, p. 80, *nom. null.*; *?Coronoruga* STRUSZ, 1961, p. 347 (type, *C. dripstonensis,* OD; †11104, SU, Sydney; M.Sil., New S.Wales near Wellington), scleroconal thickening may be continuous at boundary between dissepimentarium and tabularium, see MCLEAN, 1975a, p. 189; *?Cystilasma* ZAPRUDSKAYA & IVANOVSKIY, 1962, p.

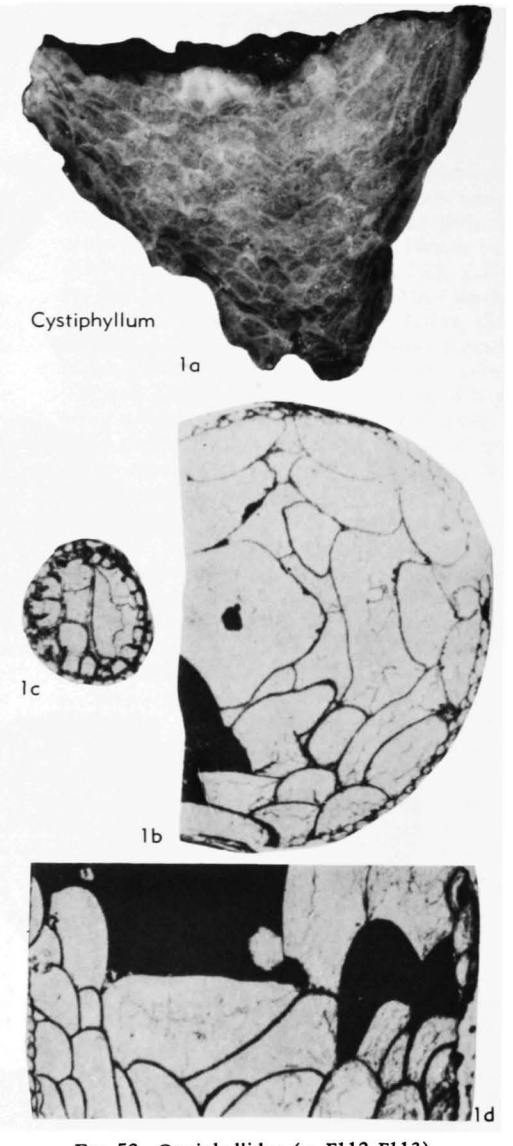


FIG. 52. Cystiphyllidae (p. *F*112-*F*113).

51 (type, *C. sibiricum,* OD; †3, coll. 654, VNIGRI, Leningrad; L.Sil., up.Llandov., Sib. Platf., R. Gorbiyachin), trabeculae apparent only in early stages, on and near wall, dissepimentarium narrow, peripheral plates very small; *?Spinolasma* Ivanovskiy, 1965a, p. 124 (type, *S. crassimarginalis,* OD; †4, coll. 236, IGG, Novosibirsk; L.Sil., up.Llandov., Sib. Platf., R. Gorbiyachin); peripheral ends of short trabeculae contiguous to form narrow stereozone, tabularium very wide, floors concave; *?Lamellophyllum* Erina, 1978, p. 73 (type, *E. bitecum,* OD; †20b, coll. 10472, TsGM, Leningrad; U.Ord., Archalyksk Beds, Khodzha-Kurgan, S. Tyan Shan), solitary with thin holocanths immersed in thick wall; *?Sinanophyllum* He & Huang in Kong & Huang, 1978, p. 113 (type, *S. sinanense,* OD; †Gcr 505-508, GB, Guiyang; L.Sil., Sinan, Kweichow)]. Solitary, turbinate to cylindrical; major and minor septa long, each represented by trabeculae typically developed only on upper surfaces of successive globose dissepiments and tabellae; sclerocones not strongly developed, thicker and more continuous peripherally than axially; calicular floors inversely conical, inclination of dissepiments and tabellae commonly being similar *U.Ord.-M.Dev.,* cosmop.

C. (Cystiphyllum). Axis of sclerocones centric, thickening weak, commonly absent on tabellae; trabeculae grainlike to moderately long and contiguous to separate. *Sil.,* cosmop.——Fig. 52,*1a.* **C. (C.) siluriense,* lectotype, M.Sil.(Wenlock Ls.), U.K., Wenlock; eccentric long. sec., ×1.5 (Hill, n; photograph courtesy Geological Survey Museum, London).——Fig. 52,*1b-d.* *?C. (C.) sibiricum* (Zaprudskaya & Ivanovskiy), holotype, L.Sil.(up. Llandov.), Sib. Platf., R. Gorbiyachin; *b,c,* transv., *d,* long. secs., all ×3.0 (Ivanovskiy, 1963).

C. (Cruciphyllum) Lavrusevich in Ivanovskiy, 1976, p. 49; Lavrusevich, 1977b, p. 36 [**Cruciphyllum cruciferum*; OD; †1101/16-17, UpG, Dushanbe]. Four longitudinal ridges of dissepimentarium project into tabularium which, therefore, has cruciform outline in transverse section; tabular floors upraised axially. *U.Sil.(Downton.).* Asia(Tadzhik.).——Fig. 53,*2a,b.* **C. (C.) cruciferum* (Lavrusevich), Isfara horizon, R. Isfara, Turkestan Ra.; *a,b,* transv., long. secs., ×2 (Ivanovskiy, 1976; photographs courtesy A. I. Lavrusevich).

C. (Cysticonophyllum) Zaprudskaya & Ivanovskiy, 1962, p. 48 [**C. khantaikaense* Zaprudskaya in Zaprudskaya & Ivanovskiy, 1962, p. 49; †1, coll. 654, VNIGRI, Leningrad]. Sclerocones one-sided and eccentric, on ?convex side of corallum; trabeculae weakly developed. *L.Sil. (up. Llandov.)-M. Sil.(low. Wenlock.),* Asia(Sib. Platf. - Hupei) - Eu.(Swed. - Nor. - U.K.) - Australia(New S.Wales).——Fig. 54,*1a-d.* **C. (C.) khantaikaense,* holotype, Llandov., Sib. Platf., R. Mogokta, right tributary of R. Khantayka; *a,c,d,*

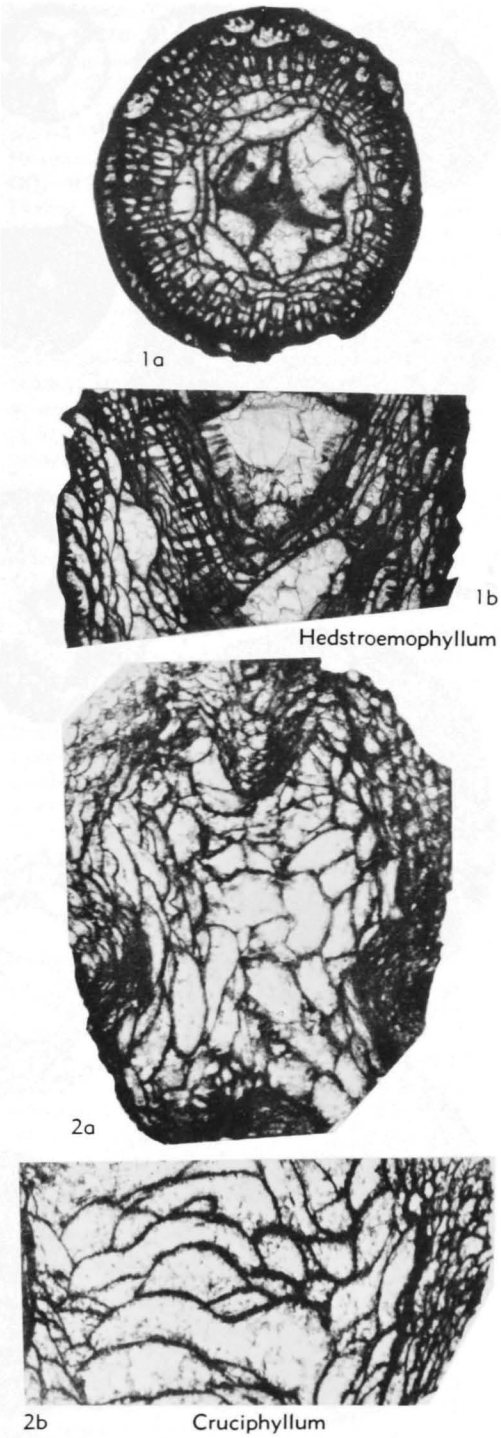


Fig. 53. Cystiphyllidae (p. F113-F115).

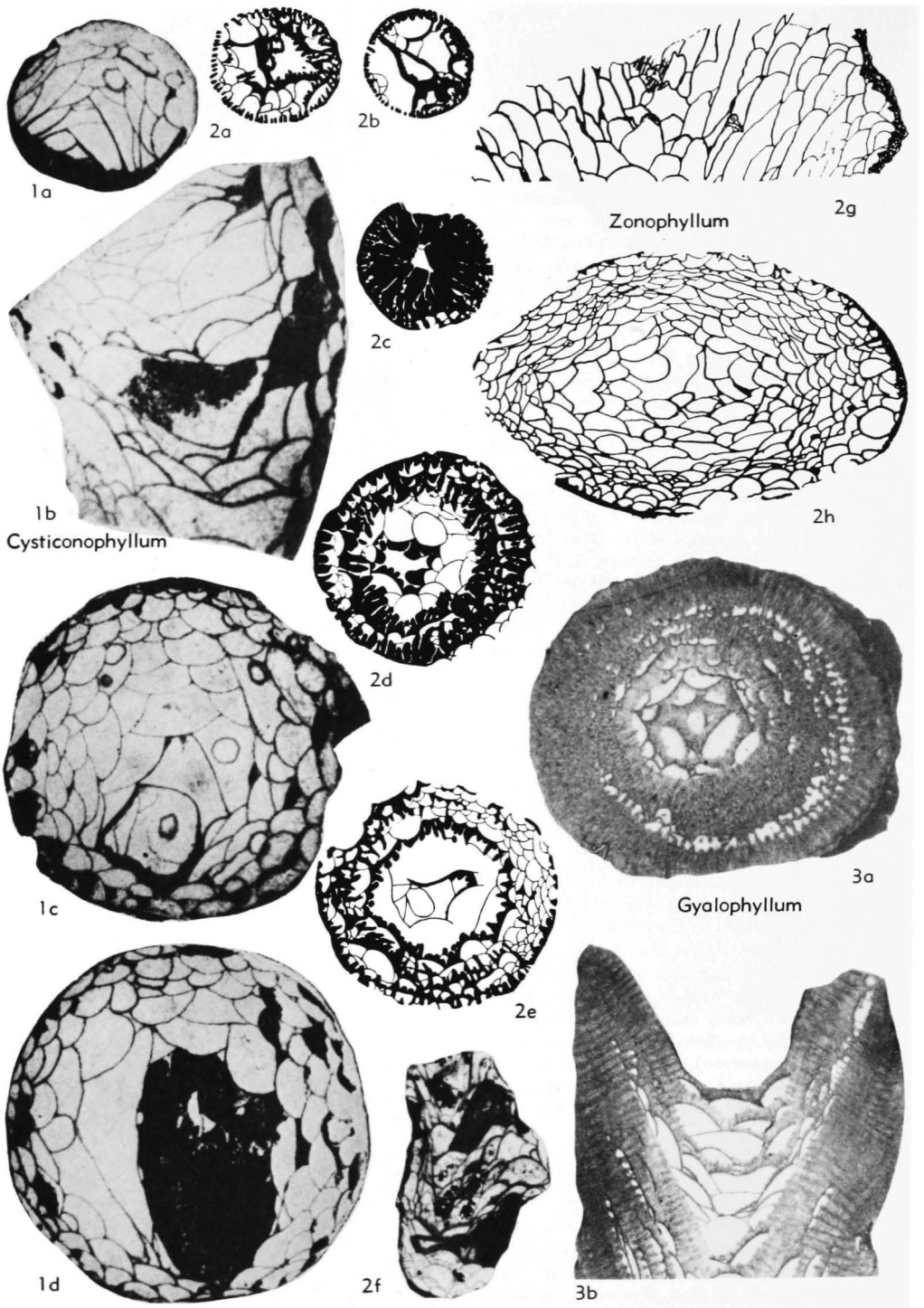


FIG. 54. Cystiphyllidae (p. *F*113-*F*115).

transv., *b*, long. secs., all ×3 (Zaprudskaya & Ivanovskiy, 1962).

C. (Gyalophyllum) WEDEKIND, 1927, p. 64 [**G. Angelini*; OD; †18026, 18027, WEDEKIND Coll., SM, Frankfurt; Ludlov., Klinteberg, Gotl.]. Sclerocones thick and commonly contiguous in dissepimentarium, thin in tabularium; major and minor septa subequal, contiguous in sclerocones, consisting of contiguous ?rhabdacanths or tufted monacanths [see JELL & HILL, 1970a, p. 10]. *U. Sil.(Ludlov.)*, Eu.(Gotl.)-Asia(?Iran-?Tadzhik.)-Australia(New S.Wales).——FIG. 54,*3a,b*. **C. (G.) angelini*, holotype, Gotl., Klinteberg bei Klintehamm; *a,b*, transv., long. secs., ×2 (Hill, n; photographs courtesy R. Birenheide).

C. (Gyaloplasma) ZHAVORONKOVA, 1976, p. 65 [**G. agglomeratum*; OD; †74/18, IG, Ufa]. Like *C. (Gyalophyllum)* but corallum phaceloid to subcerioid. *L.Dev.(Tyutyulensk beds)*, Eu.(R. Akbiik, tributary of R.Siyak, W.slopes of S.Urals).

C. (Hedstroemophyllum) WEDEKIND, 1927, p. 64 [**Hedströmophyllum articulatum*; OD; † WEDEKIND, 1927, pl. 26, fig. 6, not traced]. Trabeculae long, ?tufted monacanths, continuous through several successive calicular floors, separate except at their bases on wall or in sclerocones, sclerocones commonly thin especially in axial parts [see JELL & HILL, 1970a, p. 10]. *L.Sil.(up.Llandov.)-M. Sil.*, Eu. (Gotl.)-Asia (China); *U. Sil. (Greben.)*, Eu.(Arctic Urals)-?Asia(Kazakh.) ——FIG. 53,*1a,b*. **C. (H.) articulatum*, paratype, Gotl., Stenkyrka; *a,b*, transv., long. secs., ×3 (Hill, n; photographs courtesy V. Jaanusson).

C. (Zonophyllum) WEDEKIND, 1924, p. 12, 20 [**Z. duplicatum*; SD LANG, SMITH, & THOMAS, 1940, p. 142; †363, 7815, WEDEKIND Coll., SM, Frankfurt; 363 lectotype by BIRENHEIDE, 1968, p. 12; M.Dev., Eifel., low. Nohn Beds, Nohn; = *Cyathophyllum antilimbatum* QUENSTEDT, 1879, p. 467, †Coe3/158/40, GPI, Tübingen, M, M.Dev., Gerolstein] [=*Legnophyllum* WEDEKIND, 1924, p. 19 (type, *Zonophyllum cylindricum*, SD LANG, SMITH, & THOMAS, 1940, p. 76; †563-566, WEDEKIND Coll., SM, Frankfurt; M.Dev., Eifel., low. Nohn Beds, Nohn); *Pseudozonophyllum* WEDEKIND, 1924, p. 25 (type, *P. halli*, SD LANG, SMITH, & THOMAS, 1940, p. 110; †68-73, 7410, WEDEKIND Coll., SM, Frankfurt; M.Dev., Eifel., low. Nohn Beds, Kirbachtal bei Ahutte); *Pseudomicroplasma* SOSHKINA, 1949b, p. 53 (type, *Microplasma fractum* SCHLÜTER, 1882, p. 209, OD; †189a, SCHLÜTER Coll., IP, Bonn, lectotype by BIRENHEIDE, 1964, p. 22; M.Dev., N.Urft, Eifel), see also CHENG, 1971, p. 190; *?Cystiplasma* TAYLOR, 1951, p. 197 (type, *C. thomasi*, OD; †D/170, TAYLOR's personal coll.; up.M.Dev., U.K., Richmond Walk Quarry, Stonehouse, Plymouth), septa represented by short monacanthine trabeculae based on wall, rare to absent elsewhere, sclerocones ?absent; *Pseudomicroplasma (Choanoplasma)* YÜ & LIAO in KONG & HUANG, 1978, p. 142 (type, *P. (C.) longdongshuiense*, OD; †specimen figured KONG & HUANG, 1978, pl. 47, fig. 7, museum unknown; M.Dev., Dushan, S.Kweichow); *?Pseudomicroplasma (Phacelloplasma)* KONG in KONG & HUANG, 1978, p. 142 (type, *P. (P.) guizhouense*, OD; †Gcr 842, 843, GB, Guiyang; M.Dev., Dushan, S.Kweichow)] [See CHENG, 1971, p. 190, and BIRENHEIDE, 1974a, p. 461. BIRENHEIDE (1964, p. 21; 1968, p. 10, 12, 16; 1974a, p. 461) rates the holotypes of *Zonophyllum duplicatum, Z. cylindricum, Pseudozonophyllum halli*, and *Microplasma fractum* as conspecific with that of *Cyathophyllum antilimbatum* QUENSTEDT, 1879]. Solitary, small; traces of separate trabeculae or of septal combs or of low, thin, laminar segments of septa appearing in some specimens on upper surfaces of dissepiments and tabulae; sclerocones thin, rare to absent, in a few, thickest in tabularium; no arched crossbar plates peripherally. *L.Dev.-M.Dev.(Eifel.)*, Eu.(Ger.-France-N.Urals)-Asia (Salair-Altay-NE. USSR-Urals); *M. Dev. (Givet.)*, Eu.(U.K.-N.Urals); *M.Dev.*, Asia(Kweichow); *?U.Dev.(Famenn.)*, Eu.(Pol.)-W.Australia.——FIG. 54,*2a-f*. **C. (Zonophyllum) antilimbatum* (QUENSTEDT); *a*, holotype of *Zonophyllum duplicatum* WEDEKIND, Eifel., Nohn, transv. sec., ×1.5; *b*, holotype of *Z. (Legnophyllum) cylindricum* WEDEKIND, Eifel., Nohn, transv. sec., ×1.0; *c-e*, holotype of *Pseudozonophyllum halli* WEDEKIND, Eifel., Kirbachtal, transv. secs., ×2.0 (*a-e*, Wedekind, 1924); *f*, lectotype of *Microplasma fractum* SCHLÜTER, ?Givet., N.Urft, ×1.0 (Cheng, 1971).——FIG. 54,*2g,h*. *?C. (Z.) thomasi* (TAYLOR), holotype, Givet., U.K., Plymouth; *g,h*, long., transv. secs., ×1.5 (Taylor, 1951).

Asperophyllum SPASSKIY in DUBATOLOV & SPASSKIY, 1964, p. 132 [**A. armatum*; OD; †4-5A, coll. 248, IGG, Novosibirsk; M.Dev., Arctic Urals] [=*Kymocystis* STRELNIKOV, 1968a, p. 15 (type, *K. notabilis*, OD; †1, coll. 9485, TsGM, Leningrad; up. Wenlock., Arctic Urals]. Solitary, calice bowl-shaped with gently sloping, wide margins; septa numerous, major and minor subequal, long, each a more or less regular series of subglobose naotic plates connected more or less along the midline of their curvature by thin, short septal trabeculae; dissepiments between naotic septa normal, small, dissepimentarium not sharply separated from tabularium; tabular floors concave, of numerous small tabellae; sclerocones not notable. *L.Sil.(up.Llandov.)*, Asia(Sib.Platf.); *M.Sil.(up. Wenlock.)*, Eu.(Arctic USSR); *?U.Sil.*, N.Am. (Cornwallis I.); *M.Dev.(up.Eifel.)*, Eu.(Arctic USSR.——FIG. 55,*1a*. **A. armatum*, holotype, up. Eifel., Chernov Uplift, Arctic Urals, transv. sec., ×4 (Hill, n; photograph courtesy A. B. Ivanovskiy).——FIG. 55,*1b-d*. *A. notabilis* (STRELNIKOV), holotype, up. Wenlock., Arctic Urals,

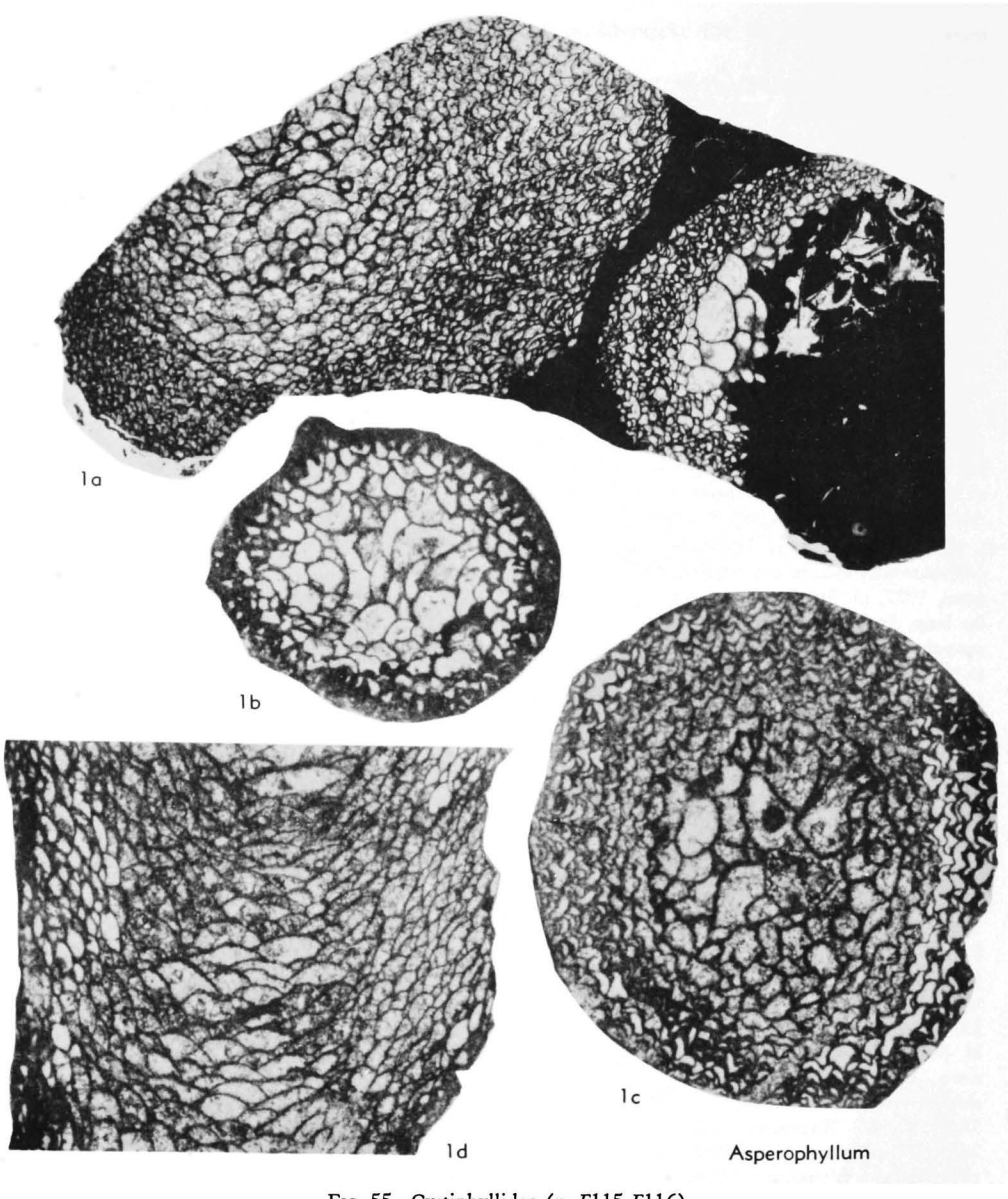


FIG. 55. Cystiphyllidae (p. *F*115-*F*116).

Chernysheva Ridge; *b,c,* transv., *d,* long. secs., all ×4 (Strelnikov, 1968a).

?**Bucanophyllum** ULRICH, 1886, p. 31 [**B. gracile*; M; syntypes 25249, AMNH, New York; =*Cystiphyllum ohioense* NICHOLSON, 1875c, p. 234, *fide* STUMM, 1961, p. 227, syntypes not located]. Small, trumpet-shaped, with slender cylindrical ?hollow stalklike basal part rapidly expanding into wide, deep funnel-shaped calice; typically with one row of dissepiments, on upper surfaces of which are fine, radiating septal crests; tabulae ?absent. *M.Dev.(Eifel.),* N.Am.(Ohio-Ind.-Ky.).

——FIG. 56,*2a,b*. **B. ohioense* (NICHOLSON); syntypes of *B. gracile* ULRICH, Jeffersonville Ls., above coral zone, Falls of the Ohio; *a,b,* ext. views, ×1 (Stumm, 1965).

Ceriocysta ZHAVORONKOVA, 1976, p. 67 [**C. aculeofera*; OD; †74/17, IG, Ufa]. Corallum cerioid, calical floors infundibuliform; septa acanthine, ?rhabdacanths amalgamated peripherally to form narrow irregular stereozone; in successive, separated, inversely conical zones of skeletal thickening, septal spines are developed in crests on upper surfaces of tabulae and dissepiments. *L.Dev.*

(Prag.), Eu.(R.Belaya, Arskiy Kamen, W. slopes of S.Urals).

Coleophyllum HALL, 1883, p. 317 [**C. romingeri*; SD MILLER, 1889-1897, p. 179; †3220/1, 238 (plastotype), type coll. NYSM, Albany, see STUMM, 1965, p. 144]. Subcylindrical to ceratoid with broad basal scar of attachment and funnel-shaped calice; successive sclerocones in contact, suppressing tabellae and dissepiments; apices of sclerocones centric; short septal trabeculae laterally contiguous in sclerocones [see STUMM, 1965, p. 52; BIRENHEIDE, 1974a, p. 457]. *M.Dev.(Eifel.)*, N.Am.(Ind.-Ky.).——FIG. 56,*1a-c*. **C. romingeri*, coral zone, Jeffersonville Ls., Ind., Falls of the Ohio, Jeffersonville; *a*, holotype, weathered ext. view, ×1.0; *b,c*, topotype, transv., long. secs., ×1.5 (Stumm, 1965).

Cystiphylloides CHAPMAN, 1893, p. 46 [**Cystiphyllum aggregatum* BILLINGS, 1859b, p. 137; †not traced, GSC, Ottawa (in absence of monotype and exact topotypes, species is interpreted on specimen figured in LAMBE, 1901, pl. 18, fig. 3, GSC6331, Ottawa, ?Bois Blanc F., Lot 6, concession 13, Walpole, Ont.)]. Predominantly solitary; a few species phaceloid or subcerioid with peripheral increase; septa represented by spinelike trabeculae, isolated or in septal combs, commonly based in sclerocones and not extending through successive dissepiments or tabellae; laminar septal segments and peripheral arched crossbar plates not developed; sclerocones more pronounced in early stages and commonly strongest in axial parts; cardinal fossula may be evident as deepening in tabularial floors; nature of ambicounter septal loculi seldom apparent. *L.Dev.-M.Dev.*, cosmop.

C. (Cystiphylloides). [=*Nardoplasma* SPASSKIY & KRAVTSOV in SPASSKIY, KRAVTSOV, & TSYGANKO, 1974, p. 171 (type, *Cystiphyllum caespitosum* SCHLÜTER, 1882, p. 209, OD; †190b, SCHLÜTER Coll., IP, Bonn, lectotype by BIRENHEIDE, 1964, p. 35; M.Dev., Eifel.); *?Loboplasma* SPASSKIY, KRAVTSOV, & TSYGANKO, 1974, p. 171 (type, *Pseudomicroplasma multilobata* SPASSKIY in BULVANKER *et al.*, 1968, p. 26, OD; †2, coll. 9347, TsGM, Leningrad; Coblenz., Tyutyulen, S.Urals), septal bases on walls thick and well developed; *?Septiphyllum* TSYGANKO, 1978, p. 10 (type, *Pseudodigonophyllum notabilis* TSYGANKO, 1970, p. 4, OD; †2, coll. 605, ?IG, Syktyvkar; L.Dev., R.Maly Shezhim, C.Urals)]. Phaceloid *Cystiphylloides*; sclerocones commonly weakly developed. *L.Dev.-M.Dev.*, Australia (New S.Wales-Queensl.)-Eu. (Ger.-Urals)-N. Am. (Ont.-N.Y.).——FIG. 57,*1a,b*. **C. (C.) aggregatus* (BILLINGS), ?Bois Blanc F., Ont.; *a,b*, transv., long. secs., ×1.6 (Hill, n; photographs courtesy Ross McLean, GSC6331).

C. (Cladionophyllum) STUMM, 1961, p. 229 [**Cystiphyllum cicatriciferum* DAVIS, 1887, pl. 125, fig. 10 only; OD; †7754, MCZ, Cambridge; by STUMM, 1961, p. 230] [BIRENHEIDE (1974a, p. 457) considers that *Cladionophyllum* may be a junior synonym of *Bucanophyllum* ULRICH, which see]. Solitary, club-shaped, broadly pyriform distally with long, narrow, cylindrical stalklike proximal part terminating in broad basal scar of attachment; calice funnel-shaped, with rounded base; septa represented on upper surfaces of dissepiments by discontinuous radial crests; sclerocones present, axes centric. Differs from other

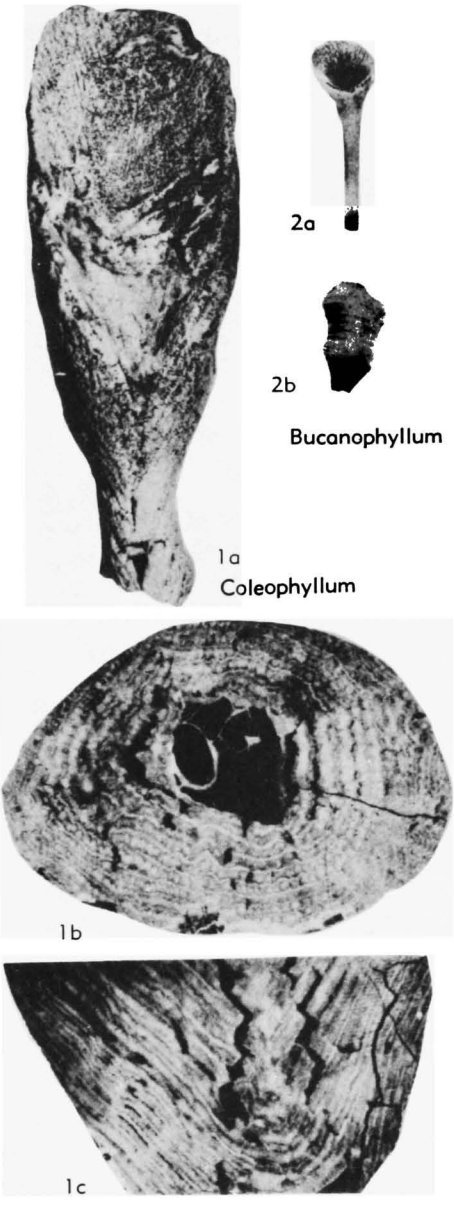


FIG. 56. Cystiphyllidae (p. *F116-F117*).

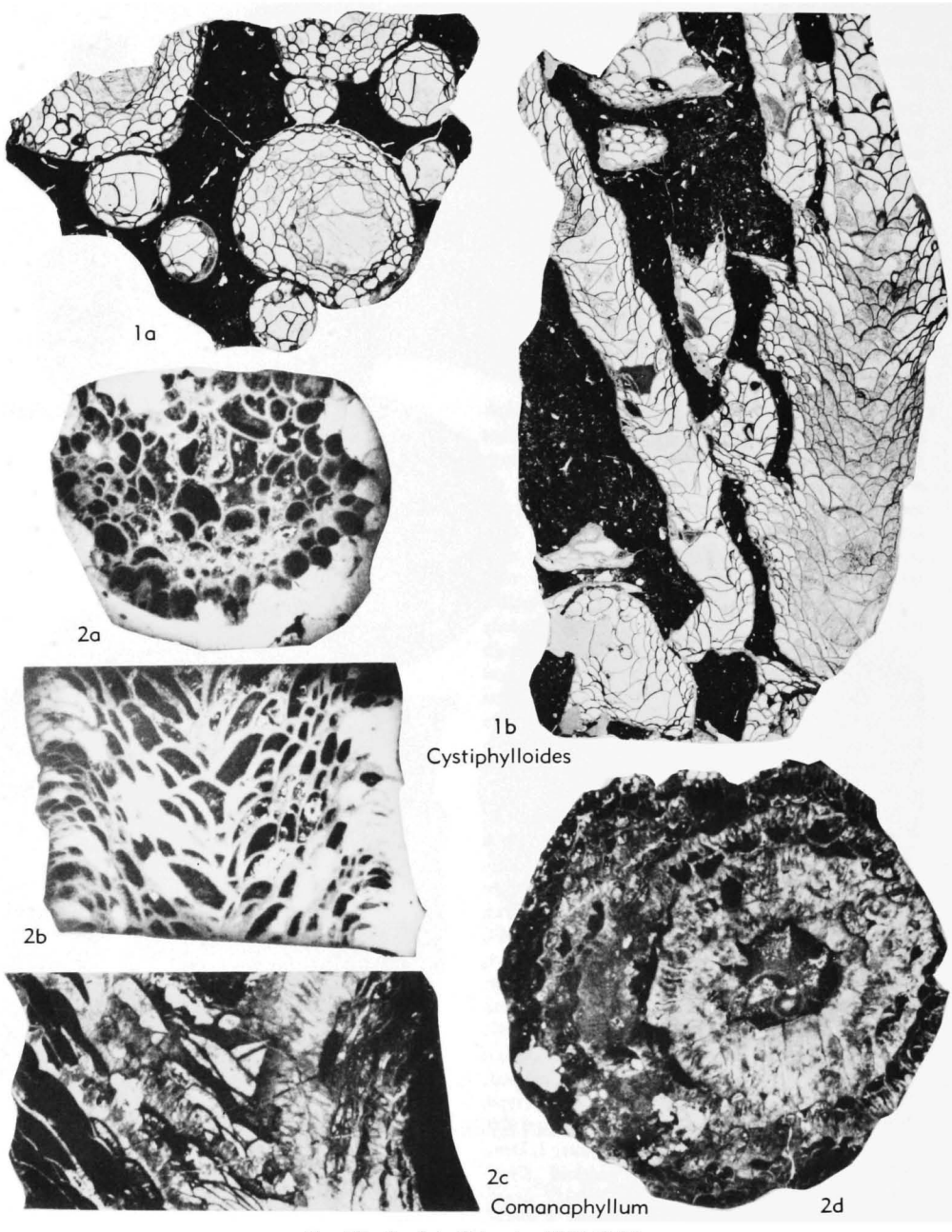


FIG. 57. Cystiphyllidae (p. *F117-F120*).

Cystiphylloides in pedicillate form. *M.Dev. (Eifel.),* N.Am.(Ind.-Ky.).——FIG. 58,*2a-d*. **C. (C.) cicatriciferus* (DAVIS); *a,* lectotype, coral zone, Jeffersonville Ls., Ind., Falls of the Ohio, Jeffersonville, ext. view, ×1.0; *b-d,* another specimen, *b,* long., *c,d,* transv. secs., all ×1.5 (Stumm, 1961).

C. (Comanaphyllum) FLÜGEL, 1961, p. 388 [**Comanaphyllum tumidum*; OD; †12340, SM, Frankfurt] [?=*Paralythophyllum* WEDEKIND, 1925, p. 35 (type, *C. tenue,* OD; †missing, SM, Frankfurt; M.Dev., Givet., Kerpen, probably Loogh Beds; type species unfigured and not strictly determinable, *fide* BIRENHEIDE, 1968, p.

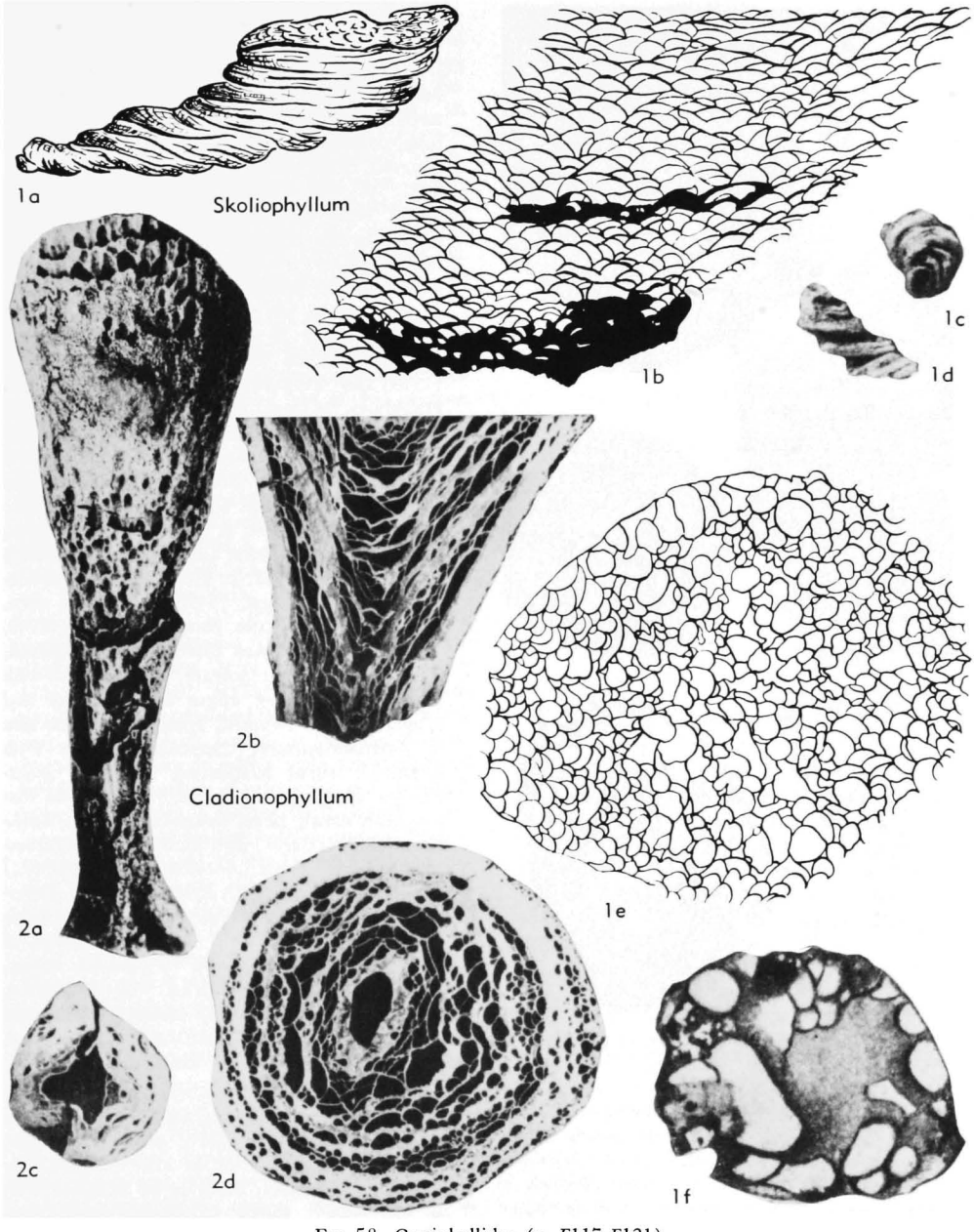


FIG. 58. Cystiphyllidae (p. *F*117-*F*121).

29); *Paralytophyllum* WEDEKIND & VOLLBRECHT, 1932, p. 114, *nom. van.; Paralithophyllum* LANG, SMITH, & THOMAS, 1940, p. 95, *nom. van.; ?Cystiphylloides* YOH, 1937, p. 53 (type, *Atelophyllum (Cystiphylloides) kwangsiensis,* SD LANG, SMITH, & THOMAS, 1940, p. 48; †not traced; low. Givet., E.Kwangsi, Tung-kan-ling; although septa may be represented by series of naotic dissepiments, no atelophylloid arched peripheral crossbar plates are seen in type material figured), junior homonym of *Cystiphylloides* CHAPMAN, 1893, which see; *Patridophyllum* ULITINA, 1963a, p. 5, 15, *nom. imperf.*; 1968, p. 86 (type, *P. paternum,* M; †552, coll. 1993, PIN, Moscow; up. Eifel., R.Arpa, Nakhichevansk ASSR; stereocones thick, of massive

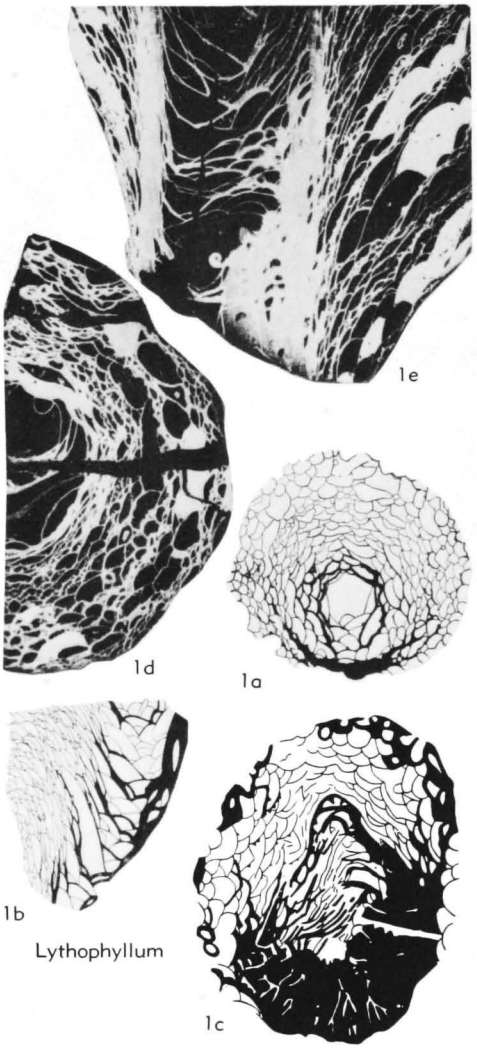


FIG. 59. Cystiphyllidae (p. F120).

monacanthine trabeculae in contiguous septal combs); *Partidophyllum* SYTOVA, 1968, p. 59, *nom. null.*]. Calices funnel-shaped, tabularial floors inversely conical; sclerocones thickest in axial regions, axes of cones centric or nearly so. *L.Dev.,* Australia(New S.Wales-Queensl.)-Asia (Nakhichev.-Kazakh.); *M.Dev.,* Eu.(Ger.-Belg.-U.K.-Pol.-Urals)-Asia (Armenia-Kuzbas-Kazakh.-Rudny Altay-Kwangsi)-Australia(Queensl.-New S. Wales)-N. Am. (N.Y.-Ont.-Mich.-Ind.-Ill.-Mo.-Nev.)-S.Am.(Venez.)-Afr.(Moroc.).——FIG. 57, *2a,b.* **C. (Comanaphyllum) tumidus* (FLÜGEL), holotype, M.Dev., Turkey, Anti-Taurus; *a,b,* transv., long. secs., ×2.0 (Flügel, 1961).——FIG. 57,*2c,d. C. (C.) paternus* (ULITINA), holotype; *c,d,* long., transv. secs., ×1.6 (Ulitina, 1968).

C. (Lythophyllum) WEDEKIND, 1925, p. 32 [**L. marginatum*; OD; †3303, 3304, and 9232, WEDEKIND Coll., SM, Frankfurt; M.Dev., Givet., Dachsberg, probably Loogh Beds] [?=*Edaphophyllum* SIMPSON, 1900, which see; *?Cayugaea* LAMBE, 1901, p. 196 (type, *C. whiteavesiana,* OD; †4690, Natl. Type Coll., GSC, Ottawa; M.Dev., Eifel., Cayuga, Ont.), see STUMM, 1961, p. 228; *Nardophyllum* WEDEKIND, 1925, p. 36, and *Plagiophyllum* WEDEKIND & VOLLBRECHT, 1931, in explanation, pl. 17, figs. 4-5, 1932, p. 115 (type of both is *Nardophyllum exzentricum* BORCHERS MS, in WEDEKIND, 1925, p. 36, OD; †1969 and 8451-8453, WEDEKIND Coll., SM, Frankfurt; M.Dev., Givet., Berndorf), BIRENHEIDE, 1964, p. 33, rated the type species of both genera as a subjective synonym of *Cystiphyllum macrocystis* SCHLÜTER, 1889, p. 346 (88), †191, SCHLÜTER Coll., IP, Bonn, lectotype by BIRENHEIDE, 1964, p. 34, M.Dev., Soetenich, Ahbach to Loogh Beds; *Lytophyllum* WEDEKIND & VOLLBRECHT, 1932, p. 113, *nom. van.; Wedekindophyllum* STUMM, 1949, p. 39, *nom. subst. pro Lithophyllum* LANG, SMITH, & THOMAS, 1940, p. 78, *nom. van., non Lithophyllum* MUELLER, 1859, a protozoan]. Solitary, subcylindrical with funnel-shaped calice; apices of sclerocones and tabularial floors eccentric, lying against one side of dissepimentarium; sclerocones in part with discernible septal boundaries; trabeculae grain-like on dissepiments but rare; tabellae and dissepiments mostly large, elongated. *M.Dev.(Eifel.-Givet.),* Eu.(Ger.-Urals-U.K.-Pol.)-Asia(Kuzbas-Asia M.)-Afr.(Moroc.).——FIG. 59,*1a-c.* **C. (L.) macrocystis* (SCHLÜTER); *a,b,* holotype of *Lythophyllum marginatum* WEDEKIND, Givet., Dachsberg, transv., long. sec., ×1.2; *c,* holotype of *Nardophyllum exzentricum* WEDEKIND, Givet., Berndorf, transv. sec., ×1.2 (all Wedekind, 1925).——FIG. 59,*1d,e. ?C. (L.) whiteavesianum* (LAMBE), monotype, Eifel., Ont., Cayuga; *d,e,* transv., long. secs., ×0.9 (Stumm, 1961).

C. (Skoliophyllum) WEDEKIND, 1937, p. 52, no species named but figure given [**Cyathophyllum lamellosum* GOLDFUSS, 1826, p. 58; SD LANG, SMITH, & THOMAS, 1940, p. 118; †201b, GOLDFUSS Coll., IP, Bonn; lectotype by STUMM, 1949, p. 42; M.Dev., Eifel.] [=*Scoliophyllum* LANG, SMITH, & THOMAS, 1940, p. 118, *nom. van.; ?Praenardophyllum* SPASSKIY, 1955, p. 99 (type, *P. domrachevi,* OD; †5, coll. 507, VNIGRI, Leningrad; low.Eifel., *Calceola* Beds, R.Kosva, C.Urals; may have greater skeletal thickening than *C. (S.) lamellosum* GOLDFUSS)]. Solitary, predominantly flat, with successive flat calices developed en échelon; cardinal fossula may be indicated in calice on side toward apex of coral-lite; sclerocones predominant in early stages, in

mature stages septa may be represented by isolated grainlike trabeculae on upper surfaces of highly globose tabellae and dissepiments (giving circular transverse sections). *M.Dev.(Eifel.)*, Eu. (Ger.-?Urals)-N. Am. (Ohio-Ind.-Ky.)-?Asia M. (Nakhichev.).——Fig. 58,*1a,b,e*. **C. (S.) lamellosus* (Goldfuss), Eifel., Junkerberg Beds, Hillesheim syncline, Eifel; *a*, lat. view, ×0.5; *b,e*, long., transv. secs., ×1.5 (Birenheide, 1962c, 1964).——Fig. 58,*1c,d,f*. *?C. (S.) domrachevi* (Spasskiy), holotype, Eifel., *Calceola* Beds, C. Urals; *c,d*, calical, lat. views, *f*, transv. secs., all ×4.0 (Spasskiy, 1955).

?Diplochone Frech, 1886, p. 219 [**D. striata*; OD; †no number, HU, E. Berlin; lectotype by Cheng, 1971, p. 189]. Solitary, conical; epitheca with rugosan septal furrows, but in thin sections of syntype coralla no vestiges of septa recognized; dissepimentarium very narrow, of one or two series of elongate, highly inclined plates; tabular floors wide, inversely conical, of large tabellae; skeletal thickening ?absent [see Cheng, 1971, p. 190; Birenheide, 1974a, p. 461]. *M.Dev.(Givet.)*, Eu.(Ger.).——Fig. 60,*2a,b*. **D. striata*, lectotype, up. *Stringocephalus* Beds, Ger., Rhineland; *a,b*, long., transv. secs., ×1 (Cheng, 1971).

Edaphophyllum Simpson, 1900, p. 221 [**Cystiphyllum bipartitum* Hall, 1882, p. 55; OD?; †11142, type coll., NYSM, Albany] [?=*Cystiphylloides (Lythophyllum)* Wedekind, 1925, which see]. Solitary, with normal or oblique, shallow, bowl-shaped calice in which septa are represented by ridges on surface of sclerocone and in which bilateral symmetry is marked by thickened, raised, long counter septum and narrow cardinal fossula; sclerocones separated by dissepiments and tabellae, their apices ?eccentric [see Stumm, 1961, p. 233; 1965, p. 57]. *M.Dev.(Eifel.)*, N.Am.(Ind.-Ky.).——Fig. 60,*1*. **E. bipartitum* (Hall), holotype, coral zone, Jeffersonville Ls., Ind., Falls of the Ohio, ext. calical view, ×1 (Stumm, 1965).

Mackenziephyllum Pedder, 1971b, p. 48 [**M. insolitum*; OD; †24657, Natl. Type Coll., GSC, Ottawa] [=*Zonastraea* Tsyganko in Spasskiy, Kravtsov, & Tsyganko, 1971, p. 85, *nom. nud.*; *Zonastraea* Tsyganko, 1972, p. 21 (type, *Z. graciosa*, OD; †604/101, IG, Syktyvkar; **Givet.**, R. Belkovskaya, Pay-Khoy)]. Corallum aphroid; long major and minor septa represented only by isolated, very short, spinose trabeculae and in places by short series of globose, naotic dissepiments; normal dissepiments typically large, inflated, forming arched floors between narrow tabularia with concave floors of tabellae similar in size to normal dissepiments; sclerocones weak to absent; no arched peripheral crossbar plates. *M.Dev.*, N. Am.(NW.Terr.)-Eu.(USSR).——Fig. 61,*2a,b*. **M. insolitum*, Hume F., Can., Carnworth R., Mackenzie distr., *a*, holotype, transv. sec., ×1.9; *b*, paratype, long. sec., ×1.9 (Pedder, 1971b).

Microplasma Dybowski, 1873c, p. 340, genus diagnosed but no species named, 1874, p. 508 [**M. gotlandicum*; SD Wedekind, 1927, p. 64; syntype Co1337, coll. 11, EGM, Tallinn (original of Dybowski, 1874, pl. 5, fig. 5)] [=*Cystostylus* Whitfield, 1880, p. 63 (type, *C. typicus*, OD; †34213, MPUC, Berkeley, L.Sil., up.Llandov., coral beds, Wis., Sturgeon Bay; *Cystistylus* Lang, Smith, & Thomas, 1940, p. 48, *nom. van.*, see Stumm, 1969, p. 241; *?Microconoplasma* Ivanovskiy, 1965a, p. 122 (type, *M. crassa*, OD; †3, coll. 236, IGG, Novosibirsk; top of up.Llandov., R. Stony Tunguska), dissepiments relatively small and numerous, with intermittent sclerocones; *?Coronoplasma* Spasskiy & Kravtsov in Spasskiy, Kravtsov, & Tsyganko, 1974, p. 171 (type, *Coronotuga regia* Shurygina, 1970, p. 81, OD; †423/12, UGUp, Sverdlovsk; Wenlock., E. slopes of Urals); *?Hedstroemoplasma* Spasskiy & Kravtsov in Spasskiy, Kravtsov, & Tsyganko, 1974, p. 171 (type, *Hedstroemophyllum fasciculatum* Zheltonogova, 1961, p. 85, OD; †3484, ZSGUp, Novokuznetsk; Wenlock., left bank R. Uksunay, Salair), fasciculate]. Corallum phaceloid, with peripheral increase, offsets may lack dissepiments in early stages; in mature stages a marginarium of steeply inclined dissepiments, and tabularium of large, flat-lying, convex to globose tabellae; septa represented by small, thornlike trabeculae, projecting from narrow peripheral stereozone or

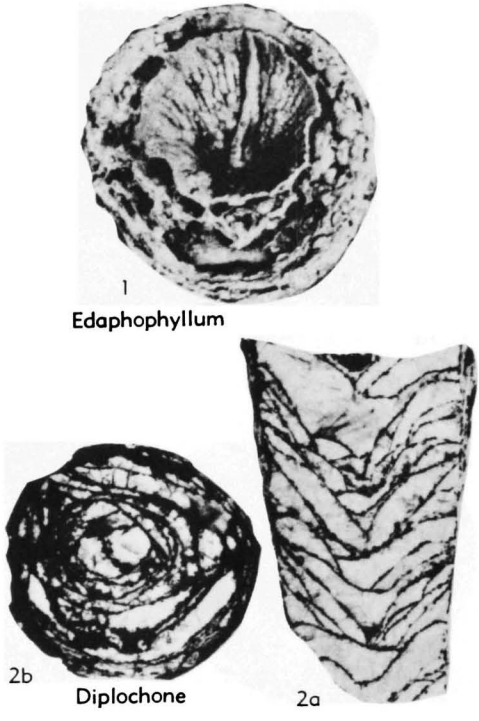
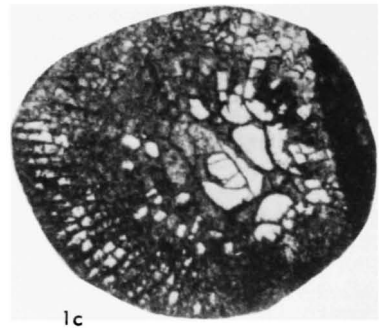


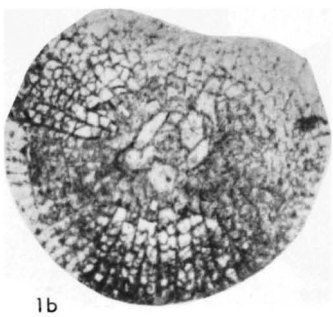
Fig. 60. Cystiphyllidae (p. *F*121).

1a

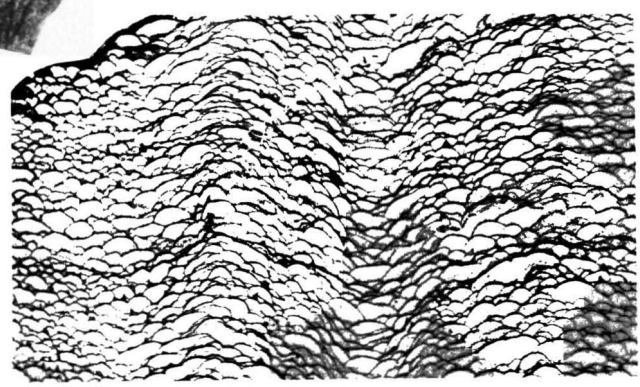
Pseudodigonophyllum



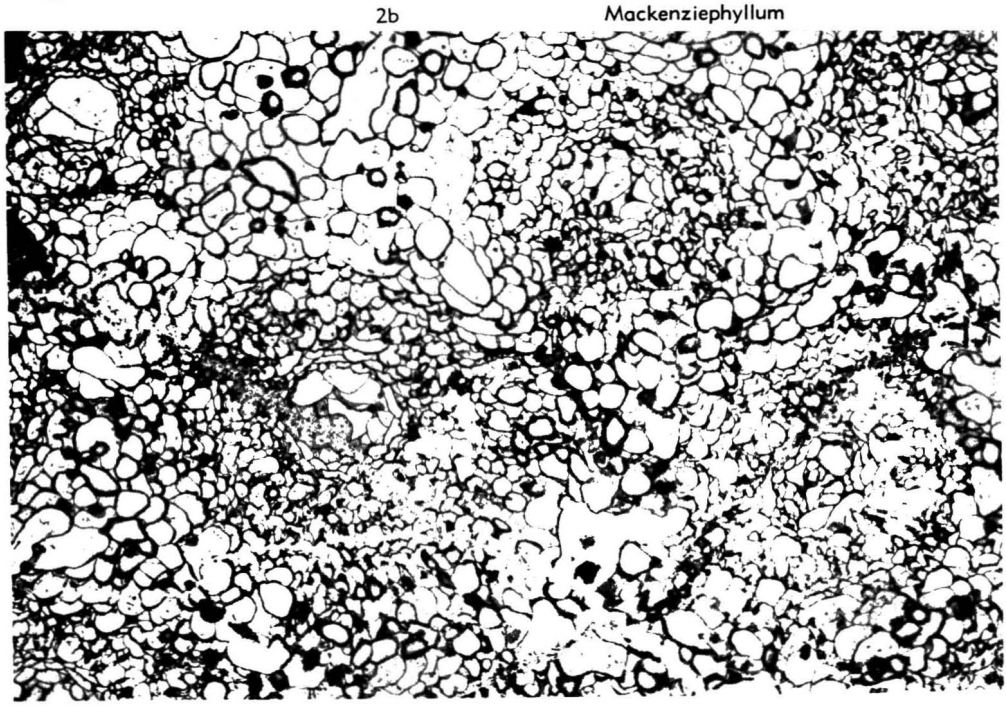
1c



1b



2b Mackenziephyllum



2a

FIG. 61. Cystiphyllidae (p. *F*121, *F*125).

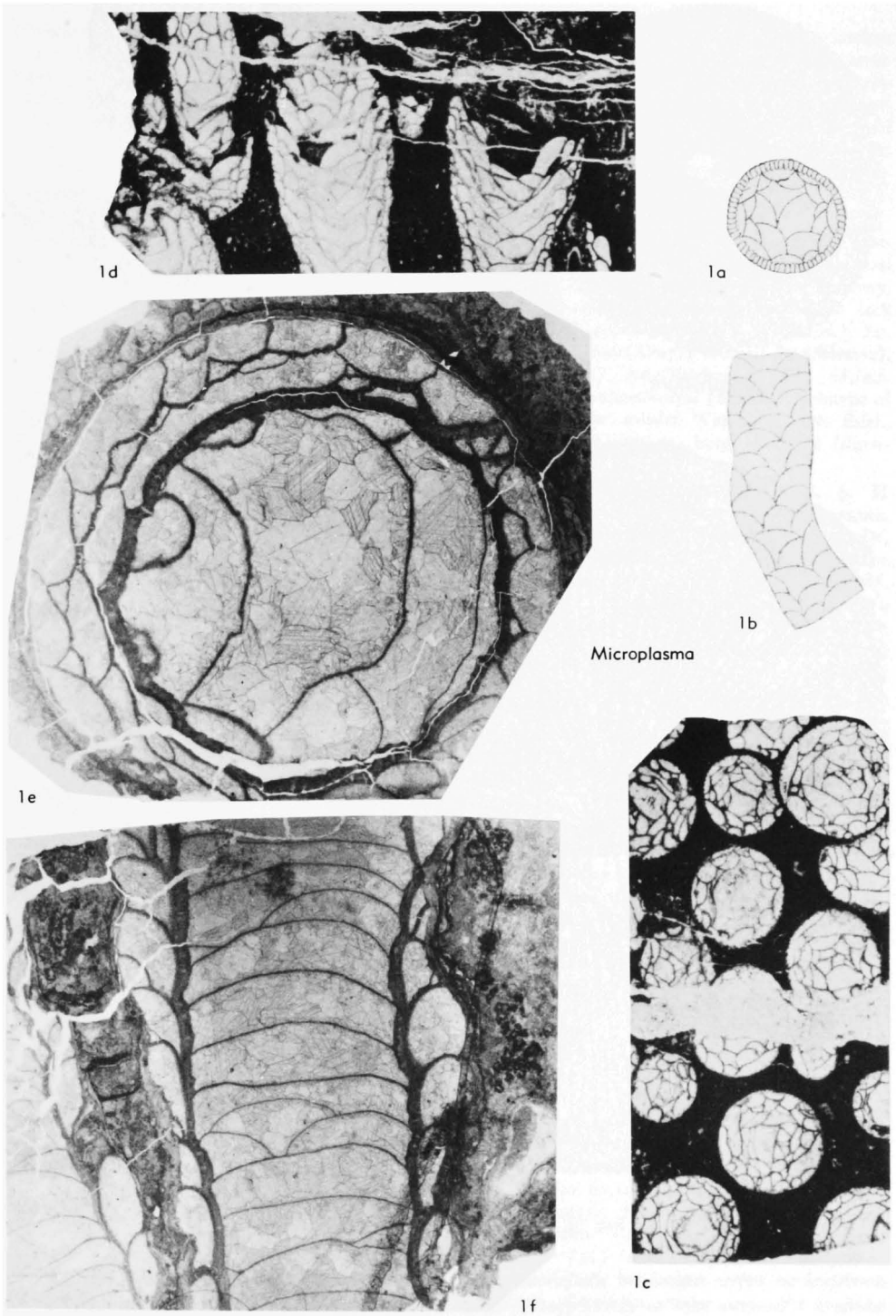


FIG. 62. Cystiphyllidae (p. *F*121-*F*125).

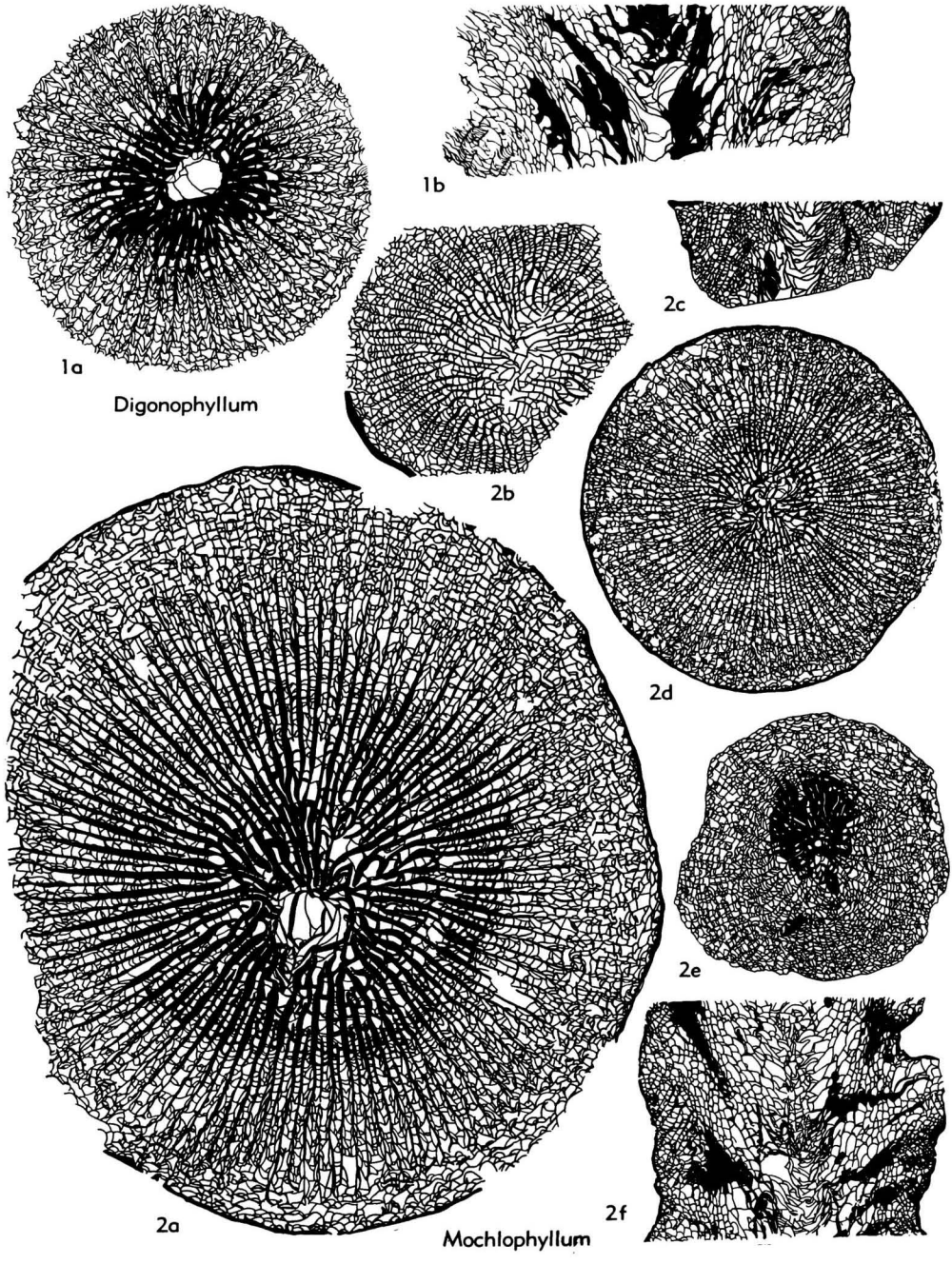


FIG. 63. Digonophyllidae (p. *F125-F127*).

developed on upper surfaces of dissepiments and tabellae; sclerocones rare to absent [see WHITE, 1966, p. 148]. *L.Sil.(up.Llandov.)*, Asia(Sib. Platf.)-N. Am. (Wis.)-Australia (New S. Wales-Queensl.); *M.Sil.-U.Sil.*, Eu.(Gotl.-Est.-Czech.-Urals-U.K.)-Asia(Altay-?Iran)-N.Am.(Okla.); *L. Dev.*, Asia(Taymyr-Tadzhik.)-Australia(New S. Wales-Queensl.); *M.Dev.(Eifel.)*, N.Am.(Can.).

——FIG. 62,*1a,b*. **M. gotlandicum*, M.Sil., Swed., Karlsö; *a,b*, transv., long. secs., ×3.6, ×1.8

(Dybowski, 1874).——FIG. 62,*1c,d*. *M. loveni-anum* DYBOWSKI, M.Sil.(Wenlock.), U.K., Usk Inlier; *c,d*, transv., long. secs., ×1.8 (White, 1966).——FIG. 62,*1e,f*. *?M. regium* (SHURYGINA), holotype, M.Sil.(Wenlock.), E. slopes of Urals; *e,f*, transv., long. secs., ×3.6 (Shurygina, 1970; photographs courtesy M. V. Shurygina).

Pseudodigonophyllum SPASSKIY, 1960c, p. 39 [**P. macroseptatum*; OD; †17/slide 186, coll. 7653, TsGM, Leningrad; Eifel., Losishinsk Beds, Rudny Altay]. Solitary; calice funnel-shaped or with platform, with wide, inversely conical axial pit without notable keyhole outline; major septa somewhat irregularly withdrawn from axis, laminar, thickest at periphery, their trabeculae may be free distally; minor septa weaker; sclerocones thin, with grainlike traces of trabeculae on tabellae, which are distinguished from dissepiments mainly by larger size; lateral dissepiments on septa very rare, and arched peripheral crossbar plates absent. *L.Dev.*, Asia(Tadzhik.); *M.Dev.(Eifel.)*, Asia (Rudny Altay).——FIG. 61,*1a-c*. **P. macroseptatum*, holotype, Losishinsk Beds (D_2^1), C.Asia, Kholozova Hill, Rudny Altay; *a*, long., *b,c*, transv. secs., all ×1.9 (Spasskiy, 1960c).

Family DIGONOPHYLLIDAE Wedekind, 1923

[*nom. transl.* WEDEKIND, 1924, p. 12, *ex* Digonophyllinae WEDEKIND, 1923, p. 33] [=Arcophyllidae MARKOV, 1926, p. 54; Cosmophyllinae WEDEKIND & VOLLBRECHT, 1932, p. 99; Cosmophyllidae RUKHIN, 1938, p. 29; Arcophyllinae STUMM, 1949, p. 43; Atelophyllinae TAYLOR, 1951, p. 202; Mochlophyllinae TAYLOR, 1951, p. 202]

Predominantly solitary, a few species phaceloid; septa long, laminae complete in a few species, but commonly represented by thin and weak to thick and strong laminar segments distally and adaxially; segments may or may not have lateral dissepiments based on their sides, and, toward their peripheral bases, arched crossbar plates and naotic dissepiments; calicular pit commonly with keyhole outline, narrow end cardinal; sclerocones present, combined dissepimentarial and tabularial floors inversely conical or with median ?trough; cardinal septum commonly short, counter septum and septum in each loculus neighboring it long. *M.Dev.*

Digonophyllum WEDEKIND, 1923, p. 27 [**D. Schulzi*; M; †359-361 and 7776-7778, WEDEKIND Coll., SM, Frankfurt; 359 lectotype by BIRENHEIDE, 1968, p. 25; Eifel., Nohn, Eifel; =*Actinocystis pseudoorthoceras* SCHULZ, 1883, p. 84, †4, SCHULZ Coll., IP, Bonn, Eifel., Nohn, see BIRENHEIDE, 1964, p. 46]. Solitary, calice with calicular pit of markedly keyhole outline, narrow end cardinal tabularial fossula; major septa numerous, very long, commonly thick and continuously laminar except peripherally, where isolated arched crossbar plates and associated series of naotic dissepiments may represent them; lateral dissepiments may occur; sclerocones may be notable in axial regions; minor septa weaker; cardinal septum commonly short; septum in each loculus neighboring long counter septum long like major septa. *M.Dev.*, Eu.-Asia-?N.Am.

D. (Digonophyllum). Calice commonly with platform; major septa thick to very thick in axial third of their length, thinning towards periphery, may have lateral dissepiments but almost lack carinae and crossbar plates. *M.Dev.(Eifel.)*, Eu. (Ger.-Urals)-Asia(Altay); *M.Dev.*, Eu.(Moravia), *M.Dev.(Givet.)*, Asia(Kuzbas).— FIG. 63,*1a,b*. **D. (D.) pseudoorthoceras* (SCHULZ), holotype of *Digonophyllum schulzi* WEDEKND, low. Eifel., Ger., Nohn; *a*, transv., long. secs., ×1 (Birenheide, 1964).

D. (Mochlophyllum) WEDEKIND, 1923, p. 31 [**Cyathophyllum maximum (sic)* WEDEKIND, 1923, p. 35; M; †2580, WEDEKIND Coll., SM, Frankfurt, formerly 207 *(partim)*, SCHLÜTER Coll., IP, Bonn; lectotype by BIRENHEIDE, 1964, p. 42; Eifel., Gerolstein; =*Actinocystis maxima* SCHLÜTER, 1882, p. 207] [=*Bothriophyllum* VOLLBRECHT, 1926, p. 220, *nom. imperf.*, figured but no species named, M.Dev., Heiligenstein near Gerolstein, ?transitional to *Dialytophyllum; Enteleiophyllum* WALTHER, 1928, p. 103 (type, *E. sundwigense*, SD LANG, SMITH, & THOMAS, 1940, p. 57; †7060-7063, WEDEKIND Coll., SM, Frankfurt; Givet., Sundwig, Sauerland; =*Actinocystis laevis* SCHULZ, 1883, p. 82, †3b, SCHULZ Coll., IP, Bonn, lectotype by BIRENHEIDE, 1964, p. 44, Givet., Berndorf); *Pseudocosmophyllum* WEDEKIND & VOLLBRECHT, 1931, explanation pl. 33-35, 1932, p. 112 (type, *P. geigeri*, SD LANG, SMITH, & THOMAS, 1940, p. 109; †1895-1904, WEDEKIND Coll., SM, Frankfurt; Givet., Niederehe; =*A. laevis* SCHULZ, see above); *Uralophyllum* SOSHKINA, 1936b, p. 44 (type, *U. unicum*, M; †slides 127-9, coll. 2869, PIN, Moscow; M.Dev., Biya Beds, W.Urals, R.Maly Patok)]. Solitary, with moderately deep bell-shaped to funnel-shaped calice; septa commonly replaced peripherally by isolated, arched, crossbar plates and associated naotic dissepiments; lateral dissepiments more or less profuse. *M.Dev.*, Eu.(Ger.-Belg.-U.K.-Czech.-Urals)-?Asia(Iran-Kuzbas)-?N. Am.——FIG. 63,*2a*. **D. (M.) maximum* (SCHLÜTER), lectotype, Eifel., Gerolstein, transv. sec., ×0.25 (after Vollbrecht, 1926).——FIG. 63, *2b,d,f*. *D. (M.) laeve* (SCHULZ); *b*, holotype of *Enteleiophyllum sundwigense* WALTHER, Givet., Sundwig, Gerolstein, transv. sec., ×1.0 (after Walther, 1928); *d,f*, monotype of *Pseudocosmophyllum geigeri*, Givet., Niederehe, transv., long. secs., ×1.0 (after Wedekind & Vollbrecht, 1931). ——FIG. 63,*2c,e*. *D. (M.) unicum* (SOSHKINA),

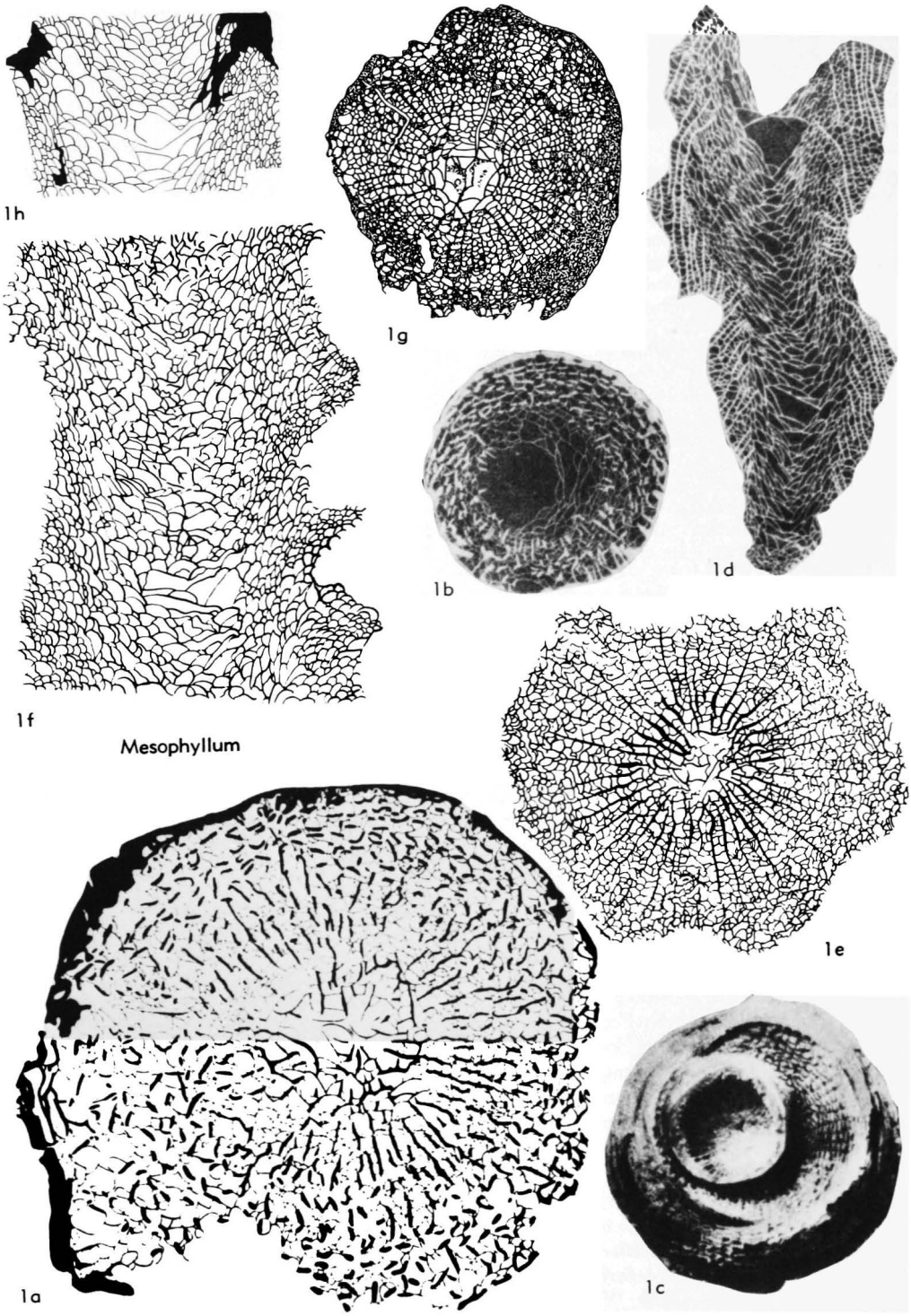


FIG. 64. Digonophyllidae (p. *F*127).

M.Dev., Urals, R.Maly Patok; *c,e,* long., transv. secs., ×1.0 (after Soshkina, 1936b).

Mesophyllum SCHLÜTER, 1889, p. 325 [**Actinocystis defecta* SCHLÜTER, 1882, p. 208; SD WEDEKIND, 1925, p. 38; †199d, GOLDFUSS Coll., IP, Bonn; lectotype by STUMM, 1949, p. 44, which is also lectotype by STUMM, 1949, p. 44, of **Cyathophyllum vesiculosum* GOLDFUSS, 1826, p. 58 (pl. 17, fig. 5e only), M.Dev., Eifel.]. Corallum solitary or phaceloid; calicular pit with weakly expressed keyhole outline, narrow end a cardinal tabularial fossula; major septa commonly thin to very thin, laminar or partly laminar except peripherally, where they are discontinuous and may be replaced by isolated arched crossbar plates associated with naotic dissepiments; sclerocones commonly weakly expressed, strongest in tabularium; septum in each loculus neighboring counter septum long like major septa; minor septa weakly expressed. *M.Dev.*

M. (Mesophyllum). [=*Atelophyllum* WEDEKIND, 1925, p. 37 (type, *Mesophyllum Emsti* WEDEKIND, 1922b, p. 57, OD; †4503-4506 and 9729-9730, WEDEKIND Coll., SM, Frankfurt; Givet., Emst near Hagen, Sauerland); *Arcophyllum* MARKOV, 1926, p. 50 (type, *A. typus,* OD; †570/635, coll. 3849, TsGM, Leningrad; M.Dev., *Calceola* Beds, W.Urals); *?Scissoplasma* SPASSKIY & KRAVTSOV in SPASSKIY, KRAVTSOV, & TSYGANKO, 1974, p. 171 (type, *Atelophyllum nebracis* MCLAREN, 1964, p. 25, OD; †16485, GSC, Ottawa; M.Dev., Horn Plateau F., near Fawn Lake, Mackenzie distr., Can.); ?possibly phaceloid; isolated arched crossbar plates very sparse]. Phaceloid or solitary with funnel-shaped calice; thin and laminar major septa withdrawn from or discontinuous in tabularium, and discontinuous peripherally where replaced by isolated arched crossbar plates and commonly by naotic dissepiments locally; sclerocones weak to absent. *M.Dev.,* Eu.(Ger.-U.K.-Czech.-Urals)-Australia (Queensl.)-Asia (Kuzbas).——FIG. 64,*1a-d.* **M. (M.) vesiculosum* (GOLDFUSS); *a,* lectotype, Givet., Eifel., transv. sec., ×3.1 (Wedekind, 1925); *b-d,* holotype of *Arcophyllum typus* MARKOV, *Calceola* Beds, W.Urals, transv. sec., calical view, long. sec., all ×1.5, ×2.0, ×1.5 (Markov, 1926).——FIG. 64,*1e-h.* *M. (M.) annulifer* (SCHLÜTER); *e,f,* lectotype, Givet., Eifel, transv., long. secs., ×1.5 (Birenheide, 1964); *g,h,* lectotype of *Mesophyllum emsti* WEDEKIND, Givet., Sauerland, Emst near Hagen, transv., long. secs., ×1 (after Wedekind, 1922b).

M. (Dialytophyllum) WEDEKIND, 1925, p. 40 [**D. complicatum*; OD; †4361, 4362, 9646-9648, WEDEKIND Coll., SM, Frankfurt; =*Actinocystis lissingenensis* SCHLÜTER, 1882, p. 206, †183, SCHLÜTER Coll., IP, Bonn, Eifel., Lissingen] [=*Dialythophyllum* WALTHER, 1928, p. 102, *nom. van.; Dialithophyllum* HILL, 1942a, p. 246, *nom. van.; Dialithophyllum (Protodialithophyllum)* KONG in KONG & HUANG, 1978, p. 158 (type, *D. (P.) quiannanense,* OD; †Gcr 928, 929, GB, Guiyang; M.Dev., Dushan, S.Kweichow)] [Although AMANSHAUSER is usually cited as author of *Dialytophyllum,* WEDEKIND (1925, p. 40) writes (transl.), "AMANSHAUSER recognized that a small group of very peculiar forms . . . differs from previously known coral groups and he gave them the name *Dialytophyllum.* Subsequently, I have obtained additional material and have formulated the genus on this basis." Apparently, WEDEKIND took the name and illustrations from AMANSHAUSER's thesis, but the description is his own. AMANSHAUSER's contribution, therefore, does not meet the requirements of Article 50 of the *Code,* and WEDEKIND is here named as author.—Ed.]. Solitary, with calicular platform; major septa very long, commonly reaching almost to axis or countercardinal plane, commonly not withdrawn from periphery, thick and laminar in inner third of length, elsewhere may have or be represented or buttressed by lateral dissepiments; peripheral arched crossbar plates rare; minor septa much weaker. *M.Dev.,* Eu. (Ger.-U.K.-Urals)-Asia (Kwangsi-Kuzbas-Kweichow)-Australia(Queensl.).——FIG. 65,*2.* **M. (D.) lissingenense* (SCHLÜTER), holotype of *Dialytophyllum complicatum* WEDEKIND, Givet., Schwelm Ls., Sauerland, Genna near Letmathe, transv. sec., ×1.5 (Wedekind, 1925).

M. (Hemicosmophyllum) WEDEKIND & VOLLBRECHT, 1931, explanation pl. 44-46, 1932, p. 111 [**H. limbatum*; OD; †4141-4149 and 8578-8580, WEDEKIND Coll., SM, Frankfurt; Givet., near Dachsberg, Eifel; =*Actinocystis cristata* SCHLÜTER, 1882, p. 206, †14300, SM, Frankfurt, neotype by BIRENHEIDE, 1964, p. 42, Givet., Hillesheim, Eifel] [=*Cosmophyllum* VOLLBRECHT, 1922, p. 17, *nom. imperf.; Cosmophyllum* VOLLBRECHT in WEDEKIND, 1923, p. 30 (type, *C. dachsbergi,* SD WEDEKIND, 1925, p. 39; †3064-3069 and 9175-9177, WEDEKIND Coll., SM, Frankfurt; Givet., Eifel, near Dachsberg), *non Cosmophyllum* BLANCHARD, 1851, a recent orthopteron]. Solitary, large, calice funnel-shaped; septa long to very long, major septa may impinge on one another in axial region and are moderately thickened and laminar except in peripheral regions, where they may be represented by isolated arched crossbar plates and rare naotic dissepiments; sclerocones thin, partial to absent. *M.Dev.(Givet.),* Eu.(Ger.-U.K.)-Australia (New S.Wales).——FIG. 65,*1a-e.* **M. (H.) cristatum* (SCHLÜTER); *a,* neotype, Givet., Hillesheim syncline, transv. sec., ×1.0 (Birenheide, 1964); *b,c,* holotype of *Hemicosmophyllum limbatum* WEDEKIND, Givet., Dachsberg, transv. secs., ×1.0 (after Wedekind & Vollbrecht, 1931); *d,e,* holotype of *Cosmophyllum dachsbergi* VOLLBRECHT,

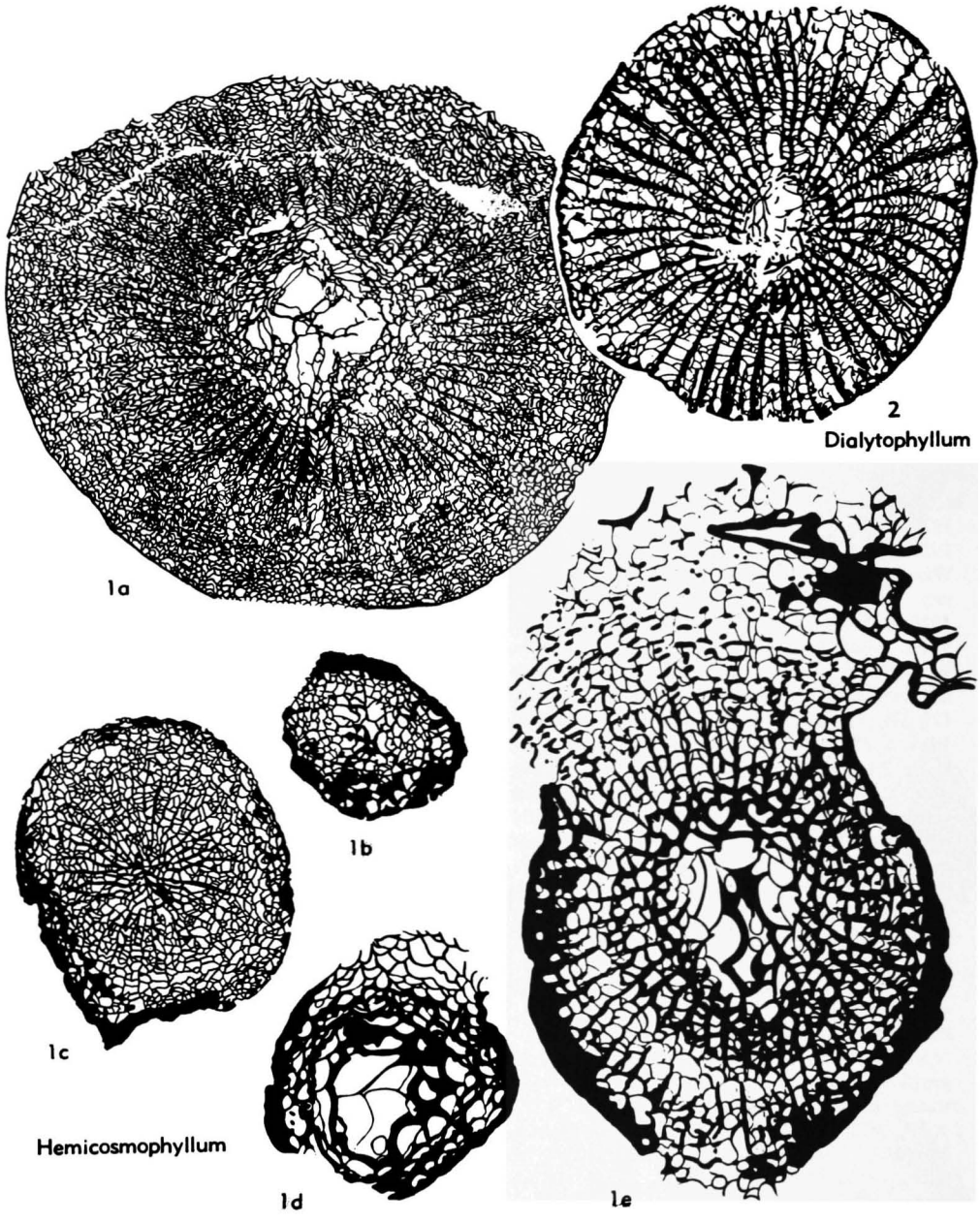


FIG. 65. Digonophyllidae (p. *F*127-*F*128).

Givet., Dachsberg, transv. secs., ×2.5 (Wedekind and Vollbrecht, 1931).

M. (Lekanophyllum) WEDEKIND, 1923, p. 29, *nom. imperf.*, no species named; WEDEKIND, 1924, p. 29 [**L. punctatum*; SD LANG, SMITH, & THOMAS, 1940, p. 75; †2716-2720 and 8960-8965, WEDEKIND Coll., SM, Frankfurt; Eifel., Auberg] [=*Lecanophyllum* LANG, SMITH, & THOMAS, 1940, p. 75, *nom. van.*; *?Neozonophyllum* ULITINA, 1963a, p. 5, *nom. imperf.*; *?Neozonophyllum* ULITINA, 1968, p. 52 (type, *Zonophyllum longispinosum* ULITINA, 1963b, p. 32, OD; †1191, coll. 1993, PIN, Moscow; Givet., R. Arpa, Nakhichev.)]. Solitary or phaceloid, with shallow, funnel-shaped calice; septa partly laminar except toward periphery, where trabeculae

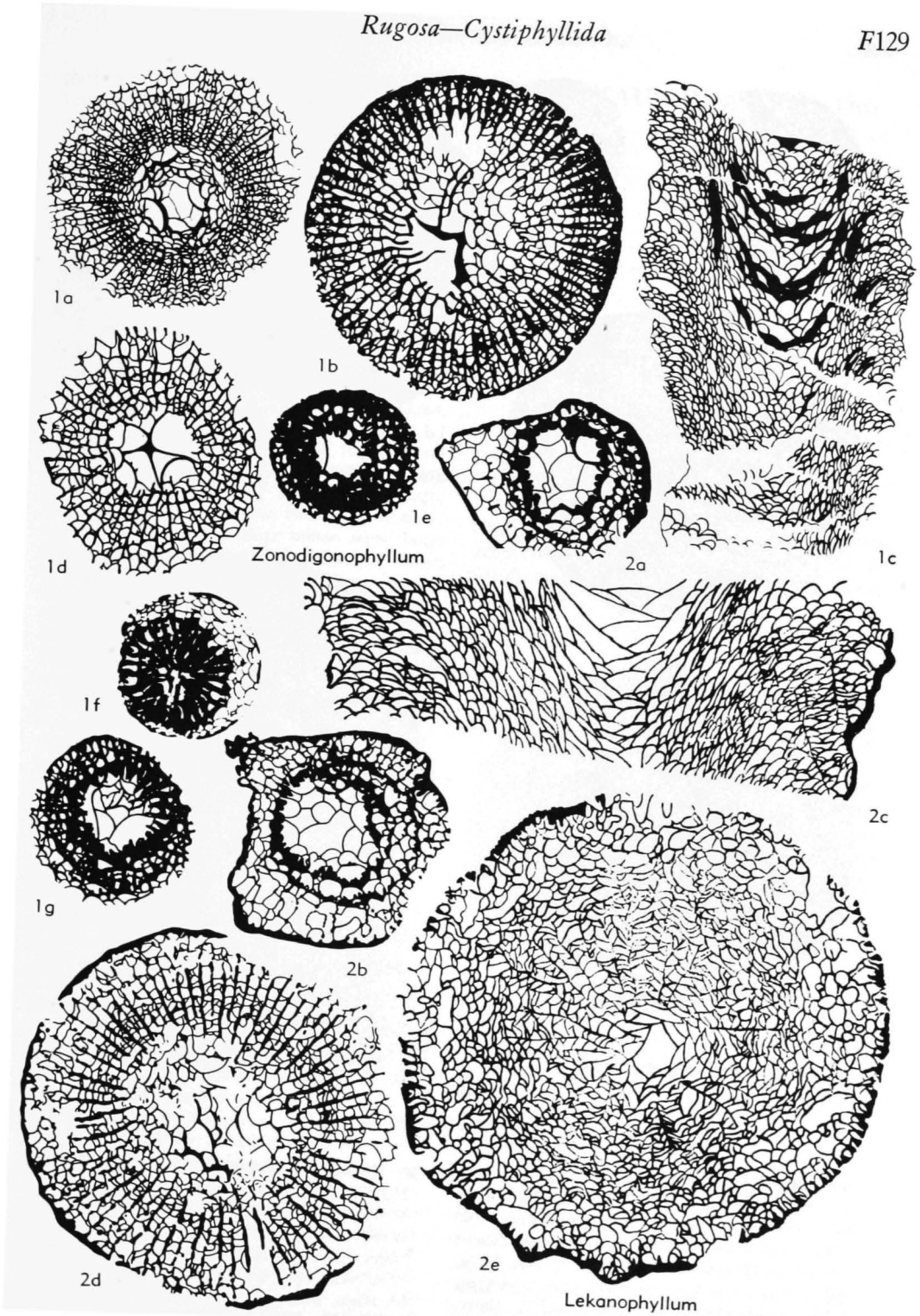


FIG. 66. Digonophyllidae (p. *F*128-*F*131).

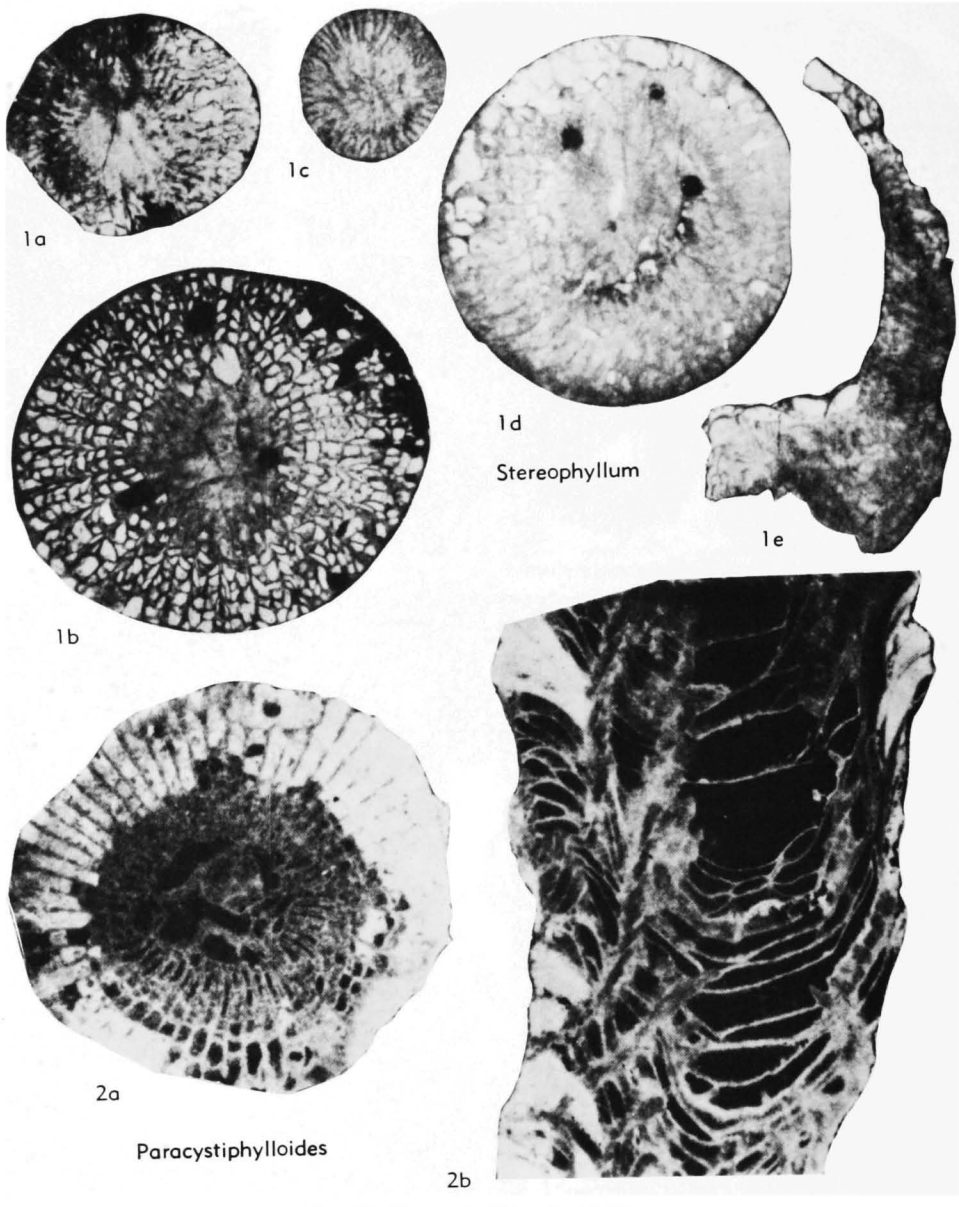


FIG. 67. Digonophyllidae (p. *F*131).

are isolated but arched crossbar plates are rare to absent; sclerocones rare in mature stages, may be marked in young stages. *M.Dev.(Eifel.)*, Eu. (Ger.)-Asia (Asia M.-Kuzbas)-N. Am. (Can.-?Nev.); *M.Dev.(Givet.)*, Asia M.——FIG. 66,*2a,b,d*. **M. (L.) punctatum* WEDEKIND, monotype, Eifel., Junkerberg Beds, Auburg; *a,b,d*, transv. secs., ×2.0 (after Wedekind, 1924).——FIG. 66, *2c,e*. *?M. (L.) longispinosum* (ULITINA), holotype, Givet., Nakhichev., R.Arpa; *c,e*, long., transv. secs., ×1.5 (Ulitina, 1963b).

M. (Zonodigonophyllum) VOLLBRECHT, 1926, p. 240 [**Zonodigonophyllum primum*; SD LANG, SMITH, & THOMAS, 1940, p. 142; †708-718, WEDEKIND Coll., SM, Frankfurt; Eifel., lower Nohn Beds, Nohn; =*Actinocystis cylindrica* SCHLÜTER, 1882, p. 206, †184, SCHLÜTER Coll., IP, Bonn, lectotype by BIRENHEIDE, 1964, p. 48, Eifel., near Lissingen] [?=*Hemicystiphyllum* WEDEKIND, 1925, p. 66 (type, *H. frechi*, M; †1394-1400, WEDEKIND Coll., SM, Frankfurt; Givet., Loogh)]. Solitary, calice with peripheral

platform, keyhole outline of pit weak; major septa somewhat withdrawn from axis, longitudinally and radially nearly continuous or interrupted between sclerocones, which are prominently developed in early stages; minor septa weak; peripheral arched crossbar plates ?absent. *M.Dev.(Eifel.)*, Eu.(Ger.-Urals)-?N.Am.(Nev.); *M. Dev.(Givet.)*, Asia(Kuzbas).——FIG. 66,*1a, c-e,g*. **M. (Z.) cylindricum* (SCHLÜTER); *a,c*, lectotype, Eifel., Ger., Lissingen; transv., long. secs., ×1.5 (Birenheide, 1964); *d,e,g*, holotype of *Zonodigonophyllum primum* VOLLBRECHT, Eifel., Ger., Nohn; transv. secs., ×1.0, ×1.5, ×1.0 (after Vollbrecht, 1926).——FIG. 66,*1b,f*. *?M. (Z.) frechi* (WEDEKIND), holotype, Givet., Ger., Loogh; transv. secs., ×2.0 (after Wedekind, 1925).

?**Paracystiphylloides** TSIEN, 1969, p. 107 [**P. inconditum*; OD; †68001, IG, Louvain; Co2a, Eau Noire, Couvin]. Solitary, subcylindrical; septa thick ?(of mainly contiguous monacanths), major septa withdrawn from axis; minor septa long; dissepimentarium narrow, dissepiments ?large, horizontally based in peripheral series; tabulae wide, tabular floors shallowly concave. *M.Dev. (up.Couvin.)*, Eu.(Belg.).——FIG. 67,*2a,b*. **P. inconditus*, holotype; *a,b*, transv., long. secs., ×3 (Tsien, 1969).

Parazonophyllum KONG in KONG & HUANG, 1978, p. 149 [**Pseudozonophyllum intermedium* YÜ & LIAO in YÜ, LIAO, & DENG, 1974, p. 228; OD; †18787-18790, IGP, Nanking; M.Dev., Dushan]. Solitary; septa thick, laminae in early stages, of laminar segments and discrete trabeculae in late stages, not thinning in peripheral regions, and ?without crossbar carinae; fossula of keyhole section. [Diagnosis tentative; from illustrations.] *M.Dev.*, Asia(S.Kweichow).

Stereophyllum SCHLÜTER, 1889, p. 81 [**Cyathophyllum goldfussi* MILNE-EDWARDS & HAIME, 1851, p. 363, *non* CASTELNAU, 1843, p. 47; M; †figured specimen not found in MN, Paris, *fide* BIRENHEIDE, 1964, p. 20; =*Cyathophyllum limbatum* QUENSTEDT, 1879, p. 465, †Coe3/158/37, GPI, Tübingen, lectotype by BIRENHEIDE, 1964, p. 19, Gerolstein, Eifel]. Solitary, small, curved-conical; calice with platform from which commonly rise distal edges of laminar septa or locally isolated grainlike trabeculae; cardinal fossula weakly expressed or indistinguishable; in early stages sclerocones predominant, with thick, partly laminar septa discernible, each composed of a series of short, thick trabeculae; zones of coarse tabellae may appear in some, and between the septa, smaller dissepiments; peripheral arched crossbar plates absent. *M.Dev.*, Eu.(Ger.-Belg.-Urals)-Asia(Altay-Kuzbas).——FIG. 67,*1a-e*. **S. limbatum* (QUENSTEDT), Eifel., Prüm syncline; *a,b*, transv. secs.; *c,d*, second specimen, transv. secs.; *e*, third specimen, long. sec., all ×2 (Birenhe ide, 1964).

Order STAURIIDA Verrill, 1865

[*nom. transl. et correct.* HILL, herein (*ex* Stauriacea VERRILL, 1865, p. 146, *nom. emend.* MOORE, 1952, p. 133, *pro* Stauracea VERRILL, 1865, p. 146, suborder; *partim*)] [=Streptelasmatida WEDEKIND, 1927, p. 15 (*nom. correct.* CHEREPNINA, 1960, p. 387, *pro* Streptelasmacea WEDEKIND, 1927, p. 15, *nom. transl.* BULVANKER *et al.*, 1960, p. 220, *ex* Streptelasmacea WEDEKIND, 1927, p. 15, suborder); Columnariida SOSHKINA, 1941, p. 30, *nom. transl.* CHEREPNINA, 1960, p. 391 (*ex* Columnariina SOSHKINA, 1941, p. 30, *nom. correct.* HILL, 1954, p. 37, *pro* Columnariacea SOSHKINA, 1941, p. 30, suborder); Kodonophyllida SOSHKINA, 1949b, p. 35 (*nom. correct.* ZHELTONOGOVA, 1961, p. 82, *pro, et transl.* BULVANKER *et al.*, 1960, p. 237, *ex* Kodonophyllacea SOSHKINA, 1949b, p. 35, suborder); Codonophyllacea KALJO, 1957, p. 153, *nom. van.*; Plerophyllida SOKOLOV, 1960, p. 53; Evenkiellida ZHELTONOGOVA, 1961, p. 86; Chonophyllida SPASSKIY, 1969, p. 31]

Solitary or compound Rugosa; marginarium a stereozone or a dissepimentarium; septa laminar, of contiguous trabeculae; each lamina may be longitudinally contiguous throughout, or may be either amplexoid in tabularium or lonsdaleoid in dissepimentarium, or both; tabular floors horizontal or uparched or sagging; tabulae complete or incomplete. *M.Ord.-U.Perm.*

Suborder STAURIINA Verrill, 1865

[*nom. correct.* HILL, herein (*pro* suborder Stauriacea VERRILL, 1865, *nom. correct.* MOORE, 1952, p. 133, *pro* Stauracea VERRILL, 1865, p. 146)]

Fasciculate or cerioid Stauriida with marginarium a narrow stereozone and in some with sporadic elongate dissepiments; septa laminar, not lobed or acanthine axially; tabulae commonly complete. Increase tabularial or less commonly marginarial (lateral). *M.Ord.-U.Miss.*

Family STAURIIDAE Milne-Edwards & Haime, 1850

[*nom. correct.* HILL, 1951, p. 13 (*ex* Stauridae MILNE-EDWARDS & HAIME, 1850, p. lxiv; =Stauriens DE FROMENTEL, 1861, p. 74; Stauriinae, Stauriicae IVANOVSKIY, 1965a, p. 79, 81)] [=Cyathophylloididae DYBOWSKI, 1873c, p. 331 (*nom. correct.* IVANOVSKIY, 1968, p. 75, *ex* Cyathophylloidae DYBOWSKI, 1873c, p. 331); Cyathophylloinae DYBOWSKI, 1873c. p. 331; ?Favistellidae CHAPMAN, 1893, p. 43 (based on *Favistella* DANA, 1846b, which is herein considered indeterminate); Cyathophylloidinae IVANOVSKIY, 1973a, p. 79]

Phaceloid or cerioid; corallites commonly with narrow peripheral septal stereozone; septa thin elsewhere; major septa commonly long and subequal and may reach axis; minor septa rudimentary to moderately long; tabulae commonly complete, may be somewhat arched and with broad median depression; narrow and, in some, impersistent dissepimentarium of longitudinally elongate interseptal plates may develop; in-

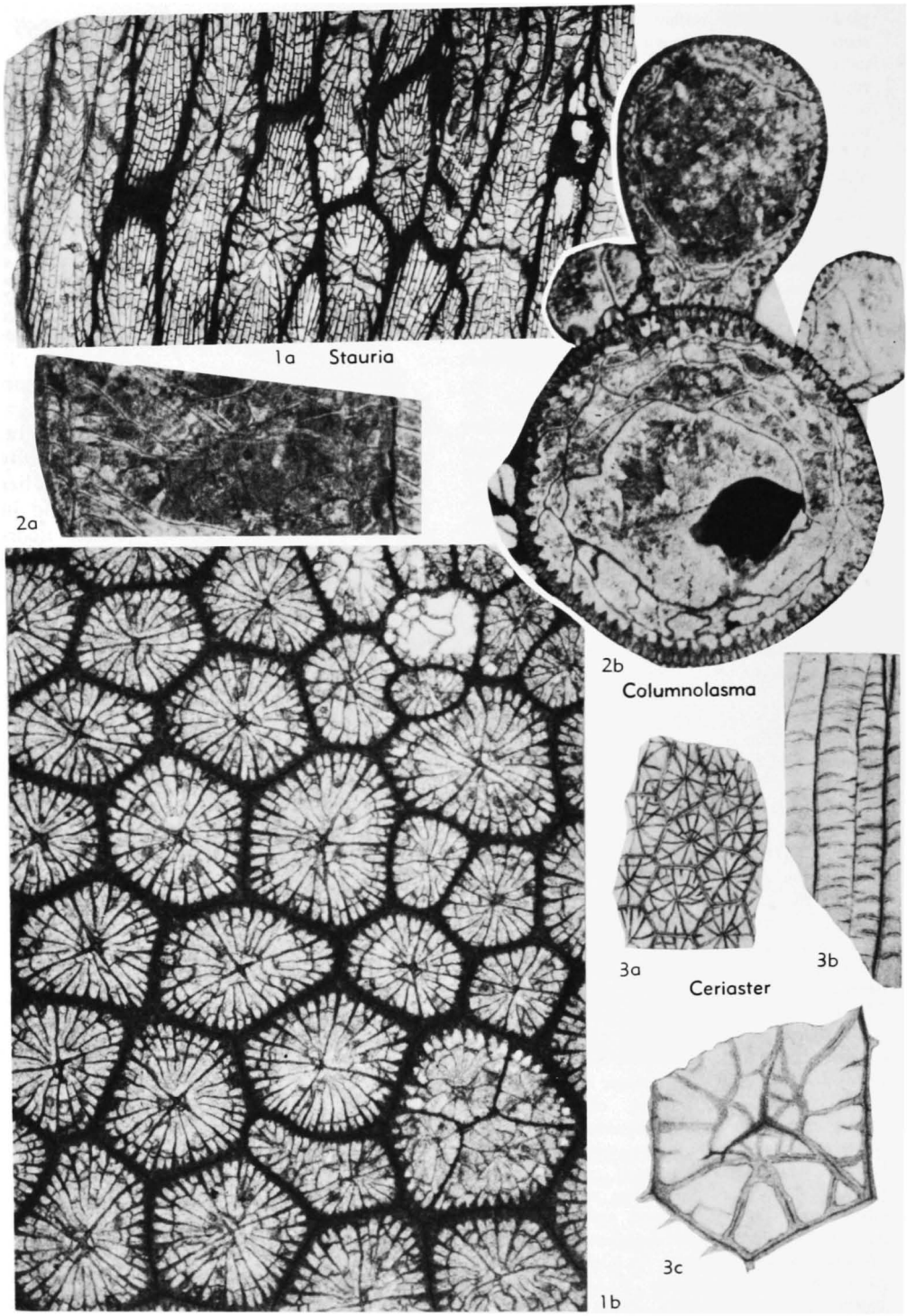


FIG. 68. Stauriidae (p. *F*133-*F*134).

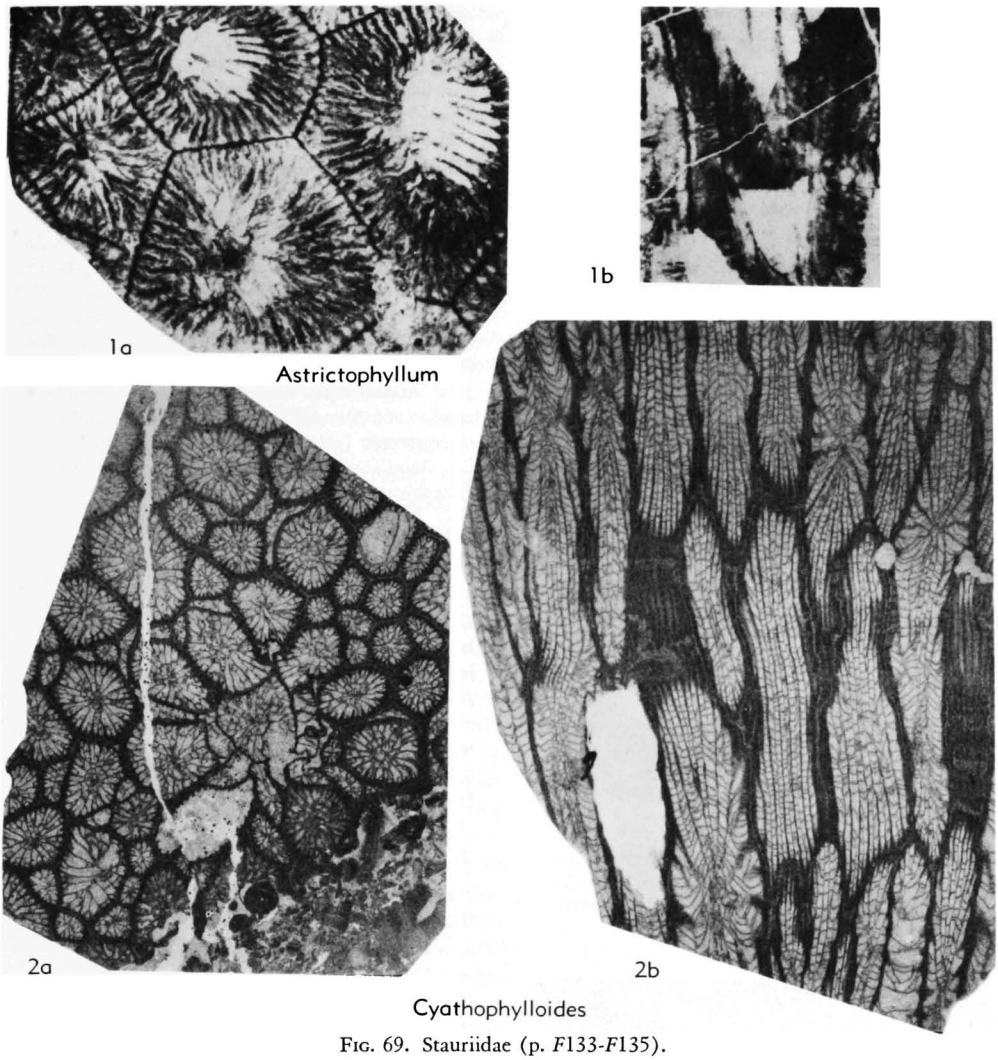
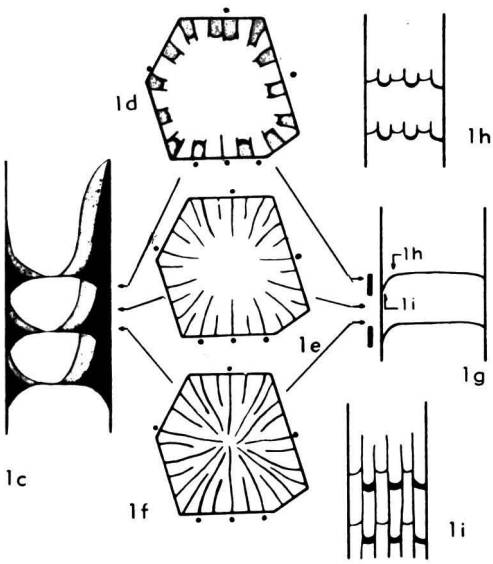


FIG. 69. Stauriidae (p. *F*133-*F*135).

crease in some quadripartite and parricidal, in others nonparricidal. *M.Ord-M.Dev.*

Stauria MILNE-EDWARDS & HAIME, 1850, p. lxiv [**S. astreiformis*; species not described or figured until MILNE-EDWARDS & HAIME, 1851, p. 316; †?unfigured ?syntype, Z115a, in MILNE-EDWARDS & HAIME Coll., MN, Paris; †lectotype by LANG, SMITH, & THOMAS, 1940, p. 122, not traced; =*Madrepora favosa* LINNÉ, 1758, p. 796, †not traced]. Cerioid, or partly phaceloid; commonly four, in some three peripheral and parricidal offsets arise simultaneously, their dividing walls arranged in cross at axis, two opposite walls commonly growing above counter and cardinal septa; major septa reaching almost to axis, minor septa short, dissepiments in up to two series, or sparse and isolated, in some disrupting minor septa; tabulae subhorizontal or slightly convex, complete or with some tabellae [see SMITH & RYDER, 1927, p. 337]. *L.Sil.,?M.Sil.*, Asia(Kweichow); *M.Sil.*, Eu.(Gotl.). ——FIG. 68,*1a,b*. **S. favosa* (LINNÉ), M.Sil., Slite Gr., Gotl., Bögeklint; *a,b*, oblique, transv. secs., ×2, ×4 (Hill, n; UQF34301).

Astrictophyllum SPASSKIY, 1971b, p. 24, *nom. subst. pro Stereophyllum* SOSHKINA, 1937, p. 19, *non Stereophyllum* SCHLÜTER, 1889, p. 339, a Devonian Cystiphyllina, *nec Stereophyllum* GRABAU, 1917a, p. 199, *nom. nud.* [**Stereophyllum massivum* SOSHKINA, 1937, p. 19; OD; †thin sections 411-2, coll. 143, PIN, Moscow]. Cerioid; septa thick, in early stages almost wedge-shaped, peripheral ends contiguous and forming wide peripheral stereozone, major septa almost reaching axis, one



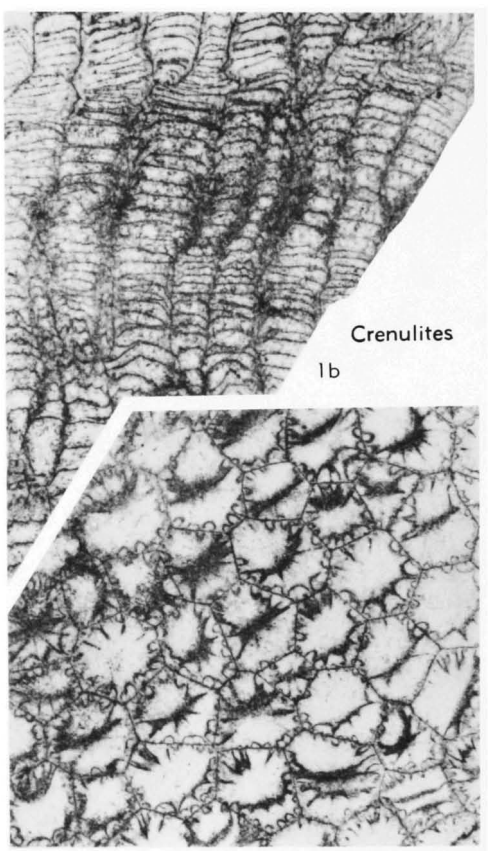


FIG. 70. Stauriidae (p. F134-F135).

may be longer than others, their inner ends may be rhopaloid and curved; minor septa confined to stereozone; tabulae complete, horizontal [see IVANOVSKIY & SHURYGINA, 1975, p. 21]. *M.Dev. (Eifel.),* Eu.(Urals).——FIG. 69,*1a,b*. **A. massivum* (SOSHKINA), holotype, zone of *Favosites regularissimus,* C.Urals, mouth of R. Bardym, W. slopes; *a,b,* transv., long. secs., ×2.7 (Ivanovskiy & Shurygina, 1975).

Ceriaster LINDSTRÖM, 1883a, p. 61 [**C. calamites*; M; syntypes in RICHTHOFEN Coll., HU, E. Berlin] [?=*Stauria* MILNE-EDWARDS & HAIME, 1850, which see]. Cerioid or fasciculate; increase axial, tripartite or quadripartite; corallites small; septa few; major septa long, axial ends joining at axis; minor septa very short or not developed; tabulae complete, slightly convex or horizontal; no dissepiments [see LAVRUSEVICH, 1965, p. 27]. *L. Sil.,* Asia(Tadzhik.-Shensi-Kweichow); *M.Sil.,* Asia (Szechwan).——FIG. 68,*3a-c*. **C. calamites,* M. Sil., bed 1, China, Chaotien, Szechwan; *a,b,* transv., long. secs., ×1; *c,* transv. sec. showing tripartite axial increase, greatly enl. (Lindström, 1883a).

?Columnolasma PAVLOVA, 1973, p. 39 [**C. ramosum*; OD; †84, coll. 347, UpG, Frunze]. Fasciculate or in part cerioid; increase peripheral, not parricidal; septa short, laminar, laterally contiguous peripherally to form narrow stereozone, beyond which ?amplexoid major septa may extend, thinning very rapidly; minor septa rudimentary; tabular floors shallowly concave, tabulae complete or incomplete, one inconstant series of peripheral dissepiments developed. *U.Sil.(Ludlov.),* Asia (Kirg.).——FIG. 68,*2a,b*. **C. ramosum,* holotype, Dalyan horizon, *Tabulasma oblongum* Zone, Tashbulak, Turkestan Ra.; *a,b,* long., transv. secs., ×3 (Pavlova, 1973).

Crenulites FLOWER, 1961, p. 84 [**C. duncanae*; OD; †671, NMBM, Socorro]. Corallum cerioid; common walls thin; septa thin, of two orders, 10 to 12 of each, major amplexoid, minor short; tabulae thin, complete, tabularium biform; of each pair of interseptal loculi on either side of minor septa, that on cardinal side with tabular margins much more strongly downturned than that on counter side; no dissepiments [see WEYER, 1972c, p. 444]. *U.Ord.,* N.Am.(Texas-Iowa-Minn.-Que.-Akpatok I.)-Asia (W. Sib. Platf.)-Australia (New S.Wales).——FIG. 70,*1a,b*. **C. duncanae,* holotype, Second Value F., Texas, El Paso; *a,* transv. sec., ×3.0; *b,* long. sec., ×2.4 (Flower, 1961).——FIG. 70,*1c-i*. Biform tabularium of *Crenulites,* diagram.; *c,* idealized long. sec. with margins of four different amplexoid megasepta (calical stage uppermost); *d-f,* several transv. secs. of corallites; *g,* nearly median long. sec., two bars on left indicate maximal intervals in which accurately oriented cross sections could show more or

less clearly indicated biform tabularium; *h,i,* tangential long. secs. with typical arrangements of tabulae (Weyer, 1972c).

Cyathophylloides Dybowski, 1873c, p. 379 [**C. kassariensis*; SD Sherzer, 1891, p. 278; syntype, Co1335, coll. 11, EGM, Tallinn]. Cerioid; increase peripheral, nonparricidal, corallites with long major septa running together in groups axially, and with long minor septa; septa thin, peripheral stereozone narrow; tabulae domed, in some interseptal loculi with strongly upturned margins ?(=biform tabularium), and complete or incomplete. *?U.Ord.,* Asia(Kazakh.); *L.Sil.* (G_{2-3}), Eu.(Est.)-?N.Am.(Nev.).——Fig. 69,*2a,b.* **C. kassariensis,* L.Sil., Est., Tamsalu; *a,b,* transv., long. secs., ×2.7 (Hill, n; UQF26866).

Dendrostella Glinski, 1957, p. 87 [**Cyathophylloides rhenanum* Frech, 1886, p. 207; OD; †neotype, SMF xxv 625a,b, SM, Frankfurt, figured syntype, 1, Frech Coll., IP, Bonn (Glinski, 1957, p. 88); (?=*Cyathophyllum caespitosum trigemme* Quenstedt, 1881, pl. 162, fig. 5-8; lectotype, pl. 182, fig. 5, *fide* Flügel, 1959, p. 114, in GPI, Tübingen, ?M.Dev., Bensberg, Ger.; Frech did not include fig. 5-8 in his syntypes of *C. rhenanum*)] [=*Soshkinella* Ivaniya, 1960, p. 41 (type, *Columnaria vulgaris* Soshkina, 1936b, p. 22, OD; †slides 149, 460-1, coll. 2869, PIN, Moscow; Givet., R.Shchugor, N. Urals); *Iteophyllum* Crickmay, 1962, p. 1 (type, *I. virgatum,* OD; syntypes 27073, PRI, Ithaca; M.Dev., Norman Wells F., W.Can.); *Steophyllum* Ivanovskiy, 1973b, p. 283, *nom. null.; Dendrostelloides* Jia in Jia *et al.,* 1977, p. 115 (type, *D. zhongguoensis,* OD; †IV 37005, HPRIGS, Yichang; M.Dev., Guilin [Kuilin], Guangxi [Kwangsi])]. Dendroid or phaceloid with nonparricidal peripheral increase; corallites with moderately thick peripheral stereozone; septa thin inside stereozone, one or two ?(cardinal and counter), and sometimes also two other major septa more or less normal to these, may be longer than others; minor septa short; tabulae commonly slightly arched, complete; no dissepiments. *L.Dev.-M.Dev.,* Asia(Kwangsi); *M. Dev.,* Eu. (Ger.-France-Belg.-U.K.-Carnic Alps-Urals)-Asia(Urals-Altay-Sayan-Kuzbas-Viet Nam-S.China)-N.Am.(Can.)-Australia(Queensl.-New S. Wales).——Fig. 71,*1a,b.* **D. rhenana* (Frech), Givet., Büchel Beds, Ger., Schladetal, near Bergisch-Gladbach; *a,b,* long., transv. secs., ×2 (Glinski, 1957).

Favistina Flower, 1961, p. 77 [**Favistella undulata* Bassler, 1950, p. 273; OD; †46294, USNM, Washington] [?=*Favistella* Dana, 1846b, p. 538, 635 (type, "*Columnaria alveolaris* Van Cleve," M; figured, *fide* Dana, in Van Cleve's unpublished "Western Fossils")[1]; *Favistella* Hall, 1847, p. 275 (type, *F. stellata,* M; †1168/A, AMNH, New York, SD Browne, 1965, p. 1186, *quo vide*; Richmondian Saluda beds, Madison, Ind.), invalid junior homonym of *Favistella* Dana, 1846b]. Cerioid; increase lateral, from peripheral region of calice and nonparricidal; septa thin except in wall; major septa almost attaining axis, commonly 12 to 15, minor septa as short ridges projecting inward from wall; tabulae complete, flat, commonly with slightly down-turned edges and median depression. *M.Ord.,* N.Am.(Wis.); *low.U.Ord.*(4cβ), Eu.(Nor.-Urals); *U.Ord.(Richmond.),* N. Am. (Ind.-?Ohio-Ky.-Ont.-N. Mex.)-Asia(Altay Mts.-W.Sib.Platf.-China)-Australia(New S.Wales-Tasm.).——Fig. 72,*1a-c,e.* **F. undulata* (Bassler), holotype, M. Ord. (Blackriv.), Platteville Ls., Wis., Beloit; *a,* calical view, ×4; *b,e,* transv. secs., ×4, ×2; *c,* long. sec., ×2 (Bassler, 1950).——Fig. 72,*1d,f-h.* *F. stellata* (Hall), U. Ord., Saluda Ls., Ind., Madison; *d,* lectotype, transv. sec., ×3 (Browne, 1965); *f-h,* syntype, transv., long. secs., ×3 (Flower, 1961).

Loyolophyllum Chapman, 1914, p. 306 [**Columnaria (Loyolophyllum) cresswelli*; M; †12904, NM, Melbourne]. Cerioid; corallites small with very narrow peripheral stereozone; septa few, thin, without carinae, major septa unequal, some extending almost to axis; minor septa short; tabulae complete, commonly sagging, or horizontal; a few scattered lonsdaleoid dissepiments adhering to wall by both upper and lower edges, or partial longitudinal series may be developed [see Hill, 1939a, p. 239]. *L.Dev.(Siegen.),* Australia(Vict.), *?M.Dev.,* Australia(Queensl.)-Asia (Salair-Kuzbas)-Eu.(Urals).——Fig. 71,*4a,b.* **L. cresswelli,* L.Dev., Vict., Griffith's Quarry, Loyola, near Mansfield; *a,b,* long., transv. secs., ×2.7 (Hill, 1939a).

Modesta Cherepnina, 1962, p. 140 [**M. prima*; OD; †445-577, coll. 405, SNIIGGIMS, Novosibirsk]. Corallum small, fasciculate; corallites with deep, sharp-edged calice and two orders of septa laterally contiguous in wide peripheral stereozone;

---

[1] Van Cleve's specimen is lost (*fide* Lang, Smith, & Thomas, 1940, p. 60). The name *Columnaria alveolaris* does not appear in the only list published by Van Cleve (1849), but two species with similar names do: "*Columnaria alveolata* Goldf., Dayton; quarries, Madison, Ind." (p. 22) and "*Favosites alveolaris* Goldf., yellow limestone, Dayton" (p. 23). It likewise does not occur in Hall's (1883, p. 239) discussion of Van Cleve's fossil corals, nor in White's (1882, pl. 44) illustration of the "first plate" of Van Cleve's fossil corals. "*F. alveolaris* Goldf." Van Cleve was illustrated (*fide* Stumm, 1948b, p. 3) by Hall (1883, pl. 5) with Hall's designation of "*Favosites hemisphericus* Yandell & Shumard," and was accepted as a Devonian tabulate. It was reasonably presumed by Stumm (1948b, p. 3) that Dana, 1846b, p. 635, was citing a specimen referred by Van Cleve to *Columnaria alveolata* Goldfuss, but this does not justify interpreting *Favistella* Dana on Goldfuss' type specimen (240 in Goldfuss Coll., GPI, Bonn; M) from glacial drift, which was described by Stumm (1964, p. 984). This *Treatise* follows Lang, Smith, & Thomas (1940, p. 61) and Flower (1961, p. 77) in regarding *Favistella* Dana, 1846 as indeterminate.

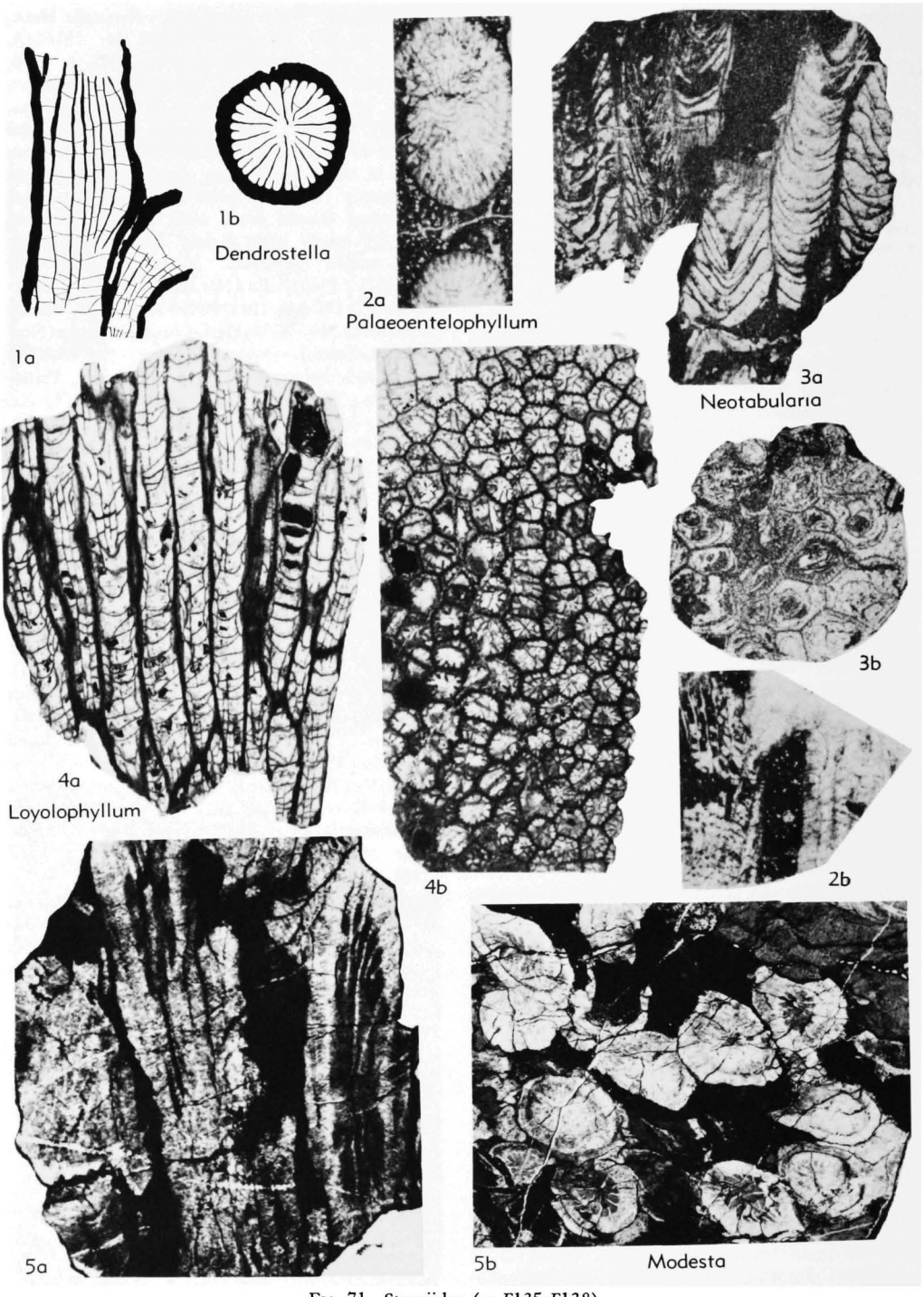
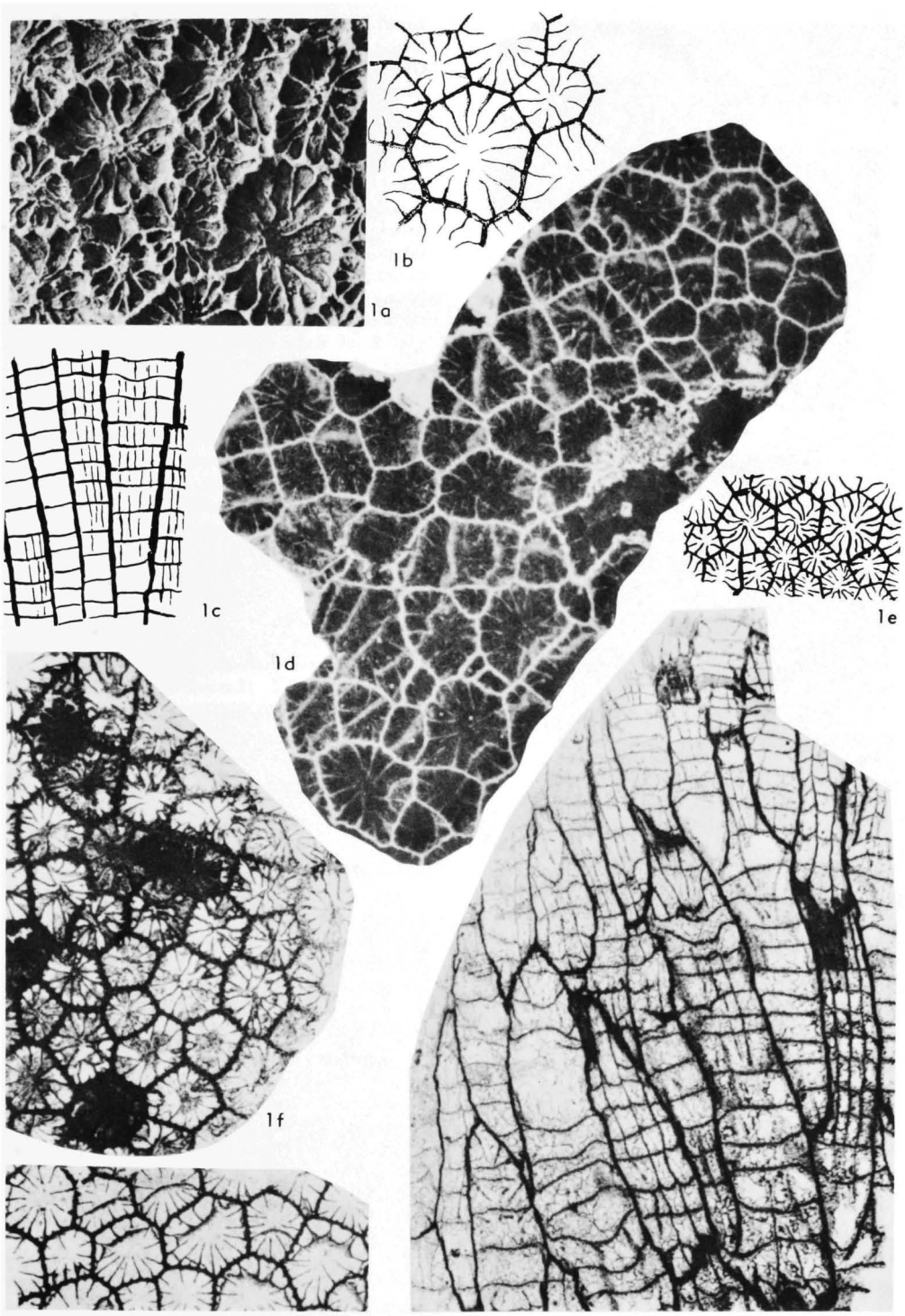


FIG. 71. Stauriidae (p. *F*135-*F*138).

each septum composed of a single longitudinal series of contiguous trabeculae directed upward and inward; ?cardinal septum long, other major septa moderately long, directed toward it but not



Favistina

FIG. 72. Stauriidae (p. *F*135).

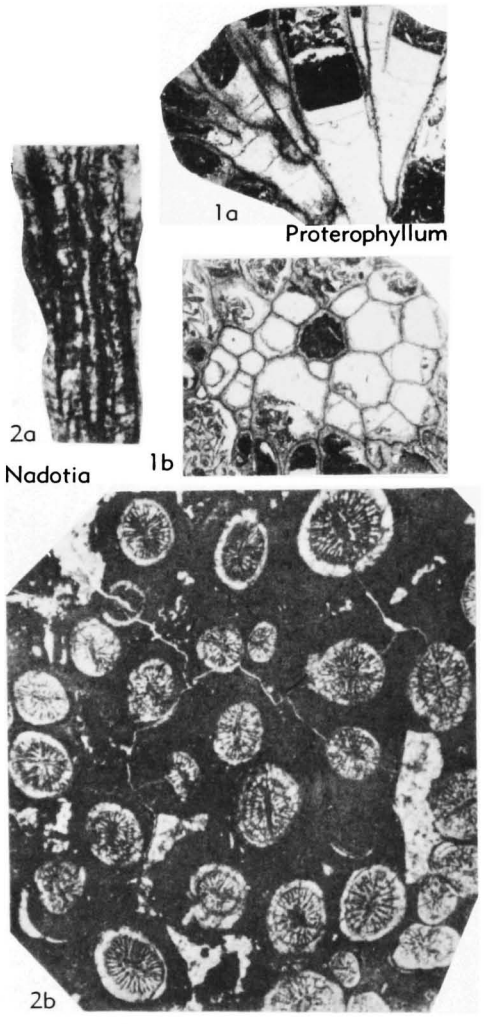


FIG. 73. Stauriidae (p. F138, F140).

reaching it; no tabulae [none observed]. *U.Ord.*, Asia(Altay Mts.).——FIG. 71,*5a,b*. **M. prima*, holotype, Altay Mts., USSR, right bank of Muta Cr., 2 km. SE. of Bolshaya Muta; *a,b*, long., transv. secs., ×2.7 (Cherepnina, 1962; photographs courtesy of S. K. Cherepnina).

?Nadotia TSYGANKO, 1974, p. 87 [**N. stylifera*; OD; †607/216, IG, Syktyvkar]. Phaceloid; wall slightly thickened; major septa moderately thick, with rhopaloid axial ends, not reaching axis except for counter septum, counter septum extending beyond axis and thickened to form laminar, solid columella that may have longitudinally ribbed sides; minor septa shorter, thinner; dissepimentarium narrow, inconstant, of one or two series of longitudinally elongate plates; tabulae complete or incomplete, sparse, tabular floors horizontal or strongly curved. *M.Dev.(Givet.)*, Eu.(N. Urals).——FIG. 73,*2a,b*. **N. stylifera*, holotype, Givet., Polar Urals, R. B. Hadota; *a,b*, long., transv. secs., ×3.5, ×2.1 (Tsyganko, 1974).

?Neotabularia IVANIYA in IVANIYA, KOSAREVA, & FEDOROVICH, 1968, p. 98 [**N. simplex*; OD; †19-1-8, TGU, Tomsk]. Cerioid; septa short, triangular in transverse section, thickened and contiguous, forming ridged, narrow peripheral stereozone; tabulae commonly concave and saclike or infundibuliform, complete or less commonly incomplete; dissepiments absent. *L.Dev.*, Asia (Altay).——FIG. 71,*3a,b*. **N. simplex*, holotype, Ganinskaya subsuite, N.Altay, triangulation beacon, S. of Kamyshensk; *a,b*, long., transv. secs., ×1.3 (Ivaniya, Kosareva, & Fedorovich, 1968).

Palaeoentelophyllum LAVRUSEVICH, 1971c, p. 6 [**P. sangtariense*; OD; †133/60, coll. 1030, UpG, Dushanbe]. Fasciculate, increase lateral; narrow peripheral stereozone formed by thickened ends of septa; major septa long, almost attaining axis, minor septa seldom extending beyond stereozone; axial tabellae wide, convex, with axial depression; periaxial tabellae narrow, weakly concave; one impersistent series of unequal dissepiments may develop. *U.Ord.*, Asia(Tadzhik.).——FIG. 71,*2a,b*. **P. sangtariense*, holotype, low. Archaly Beds, Zeravshan-Gissar Ra., right side of R. Karasu, 2 km. W. of meridian of Sangtar Pass; *a,b*, transv., long. secs., ×2.7 (Lavrusevich, 1971c).

Palaeolithostrotion LAVRUSEVICH, 1975a, p. 31 [**P. zachonense*; OD; †14-17, coll. 1101, UpG, Dushanbe]. Phaceloid to subcerioid, with peripheral, nonparricidal increase; corallites slender, with cylindrical or somewhat compressed columella, columella rarely isolated or connected with all or most major septa, more commonly connected with only one of them; minor septa short, projecting slightly from narrow peripheral septal stereozone; tabulae complete, low cones. *U.Ord.* or *L.Sil.*, Asia(Tadzhik.).——FIG. 74,*2a,b*. **P. zachonense*, holotype, Zeravshan-Gissar Ra., upper reaches Saya Zakhona; *a*, transv. sec., ×6; *b*, long. sec., ×3 (Lavrusevich, 1975a; photographs courtesy A. I. Lavrusevich).

Palaeophyllum BILLINGS, 1858, p. 168 [**P. rugosum*; M; †1379, GSC, Ottawa; lectotype by LAMBE, 1899, p. 218] [=*Paleophyllum* AUCTT., *nom. van.*; *?Synamplexoides* STEARN, 1956, p. 80 (type, *S. varioseptatus*, OD; †11047, GSC, Ottawa; M.Sil., Chemahawin Mbr., Cedar Lake F., Lundar Quarry, Manit.), see under *Pycnostylus* WHITEAVES, 1884]. Corallum phaceloceroid or phaceloid, commonly with marginal (lateral) increase; corallites with narrow peripheral stereozone formed by thickening of peripheral ends of septa; short minor septa alternate with long and somewhat wavy major septa that thin rapidly just inside stereozone, then attenuate more slowly as they approach axis, which they reach or almost reach,

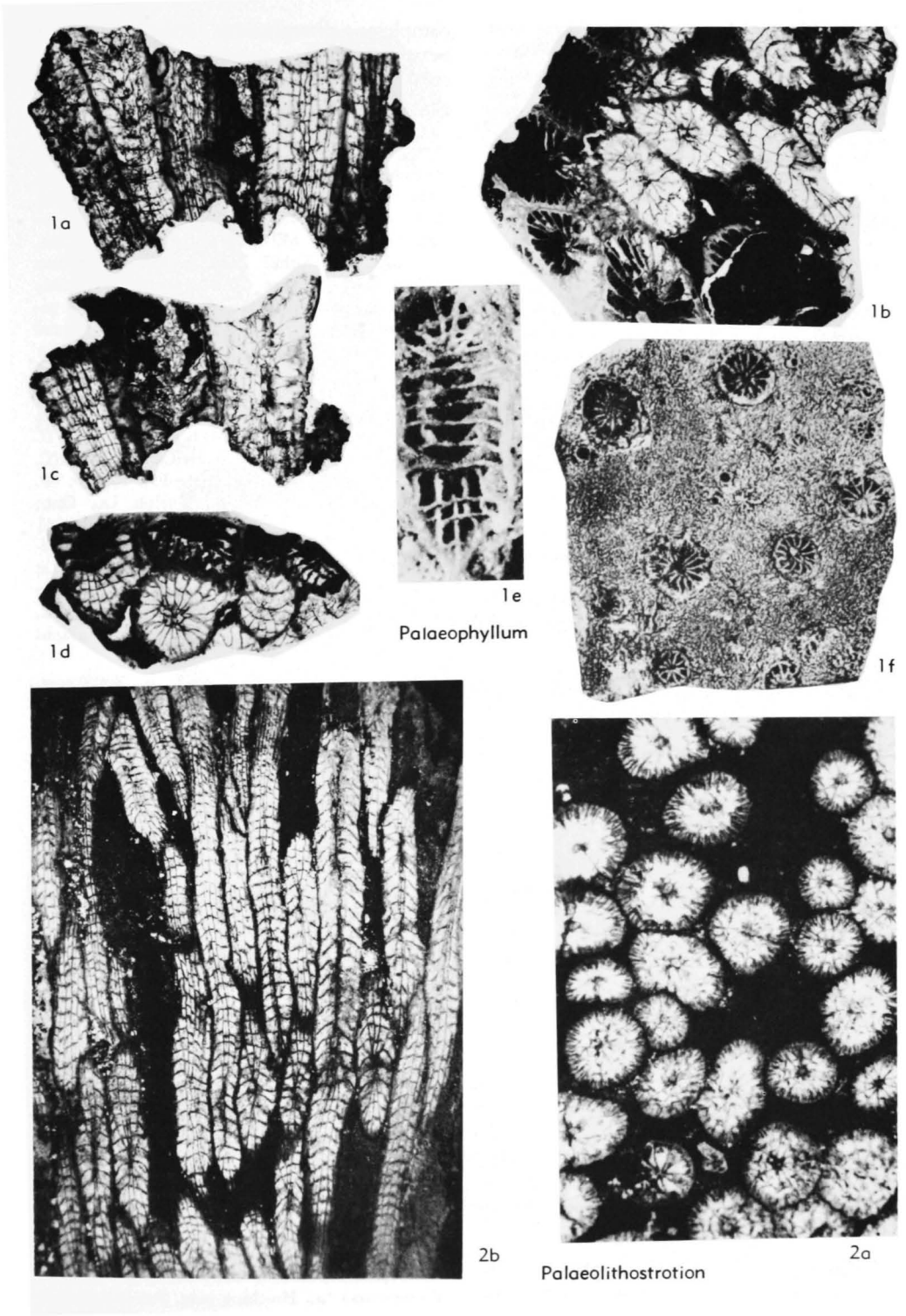


FIG. 74. Stauriidae (p. *F*138-*F*140).

their axial edges being without paliform lobes; tabulae complete, commonly with axial depression and slightly downturned edges; dissepiments absent; cardinal fossula not distinct. *Up.M.Ord.-U. Ord.*, N. Am. (Que.-Manit.-Ont.-Texas-N. Mex.-Cal.)-Eu.(Nor.-Est.-Urals)-Asia (Sib.Platf.-?Shoria Mts.-Sinkiang)-Australia(New S.Wales); *L.Sil.*, N. Am. (Greenl.)-Eu. (Nor.-Est.)-Asia (Hupei-Sib. Platf.-Altay-Sayan); *M.Sil.*, Australia(New S. Wales)-N.Am. (Cal.-Yukon-Manit.-N.Y.).——Fig. 74,*1a-d*. **P. rugosum*, lectotype, Blackriv. or lowermost Trenton., Can., L.St. John, Little Discharge, *a,c,* long. secs., *b,d,* oblique, transv. secs., all ×2 (Hill, 1961).——Fig. 74,*1e,f*. *?P. varioseptatum* (Stearn), M.Sil., Cedar Lake F., Manit.; *e,* holotype, long. natural sec., ×4; *f,* paratype, from type locality, transv. sec., ×2 (Stearn, 1956).

Parastauria He & Lee, 1974, publication not traced, quoted without bibliographic reference or page number in Kong & Huang, 1978, p. 65 [**P. polygonalis*; OD; †not traced]. Cerioid, corallites small; walls and septa thin; major septa long, straight, minor septa reduced to wall; tabulae subhorizontal, dissepiments large, globose in single series. [Diagnosis tentative, from illustrations.] *L.Sil.*, Asia(Kweichow).

?Prisciturben Kunth, 1870, p. 25 [**P. densitextum*; M; † HU, E. Berlin, lost, *fide* Lindström, 1889, p. 10; ?Ord., ?Öland]. Lindström showed that similar specimens from the Silurian of Gotland are an intergrowth of a stromatoporoid with a coral. Lang, Smith, & Thomas (1940, p. 104) restricted the name, which they considered should lapse, to the coral. Lindström's figures suggest that his coral may be a fasciculate stauriid lacking dissepiments; he believed a spongy columella described by Kunth might be either adventitious debris or stromatoporoid infilling.

Proterophyllum Sokolov in Ivanovskiy, 1969, p. 63 [**Favistella simplex* Sokolov, 1955, p. 462; OD; †113, coll. 599, VNIGRI, Leningrad]. Corallum cerioid, small, increase peripheral and lateral, nonparricidal; corallites with complete horizontal tabulae and short, uneven, septal combs; [neither presence of minor septa nor order of septal insertion established in type species]; possibly tryplasmatid. *M. Ord.-U. Ord.*, Asia (Sib.Platf.-Altay-Sayan).——Fig. 73,*1a,b*. *P. simplex* (Sokolov), holotype, M.Ord., USSR, R. Moyero, Sib. Platf.; *a,b,* long., transv. sec., ×3.5 (Ivanovskiy, 1969).

Family PYCNOSTYLIDAE Stumm, 1953

[Pycnostylidae Stumm in Shrock & Twenhofel, 1953, p. 158] [=Zelophyllidae Ivanovskiy, 1965a, p. 72; Coelophyllidae Roemer, 1883, p. 409, invalid name based on junior homonym *Coelophyllum* Roemer, 1883, p. 409]

Solitary or fasciculate; corallites with moderate peripheral stereozone, major septa elsewhere thin and amplexoid, minor septa very short; tabulae subhorizontal, commonly complete; dissepiments absent; increase peripheral, either quadripartite and parricidal or lateral. *Sil.-Dev.*

Pycnostylus Whiteaves, 1884, p. 2 [**P. guelphensis*; SD Miller, 1889, p. 202; syntypes 2789a,b, 2793, 2932a, GSC, Ottawa] [?=*Synamplexoides* Stearn, 1956, p. 80, see under *Palaeophyllum* Billings, 1858; *?Neofletcherina* Yang in Yang, Kim, & Chow, 1978, p. 225 (type, *N. guizhouensis*, OD; †Gct 647-649, GB, Guiyang; L.Sil., Shiniulan F., Xishui Xian [county], Guizhou [Kweichow]), nature of septa unclear; possibly Tabulata, Auloporida]. Fasciculate, increase peripheral, commonly four offsets simulating axial quadripartite increase; corallites with very narrow peripheral stereozone; septa amplexoid, peripheral continuous part very short; no dissepiments; tabulae complete, horizontal. *L.Sil.*, Asia(Kweichow); *M.Sil.*, N.Am.(Ont.-B.C.-Mich.)-Eu.(Urals); *U. Sil.*, Australia(New S.Wales-Queensl.)-Asia(C. Kazakh.); *Sil.*, N.Am.(Cal.).——Fig. 75,*3a,b*. **P. guelphensis*, syntype, M.Sil., Guelph Ls., Ont.; *a,* transv. fracture, ×1; *b,* isolated corallite, ×1 (Whiteaves, 1884).——Fig. 75,*3c,d*. *P. acanthinus* (Kesling *et al.*), Hendriks dol., Fiborn Ls. Mbr., Mich., quarry of Inland Lime & Stone Company, Mackinac Co.; *c,d,* transv., long. secs., ×10, ×1 (Kesling *et al.*, 1973; photographs courtesy G. Ehlers).

Cyathopaedium Schlüter, 1889, p. 263, *nom. subst. pro Coelophyllum* Roemer, 1883, p. 409, *non* Scudder, 1875, an insect, *nec* Schrammen, 1924 [**Calophyllum paucitabulatum* Schlüter, 1880a, p. 52; M; †157a,b, Schlüter Coll., IP, Bonn]. Fasciculate, with connecting processes, increase peripheral, parricidal, calical edges not flared; corallites with widely spaced subhorizontal tabulae, septa short, developed only as low ?nonspinose ridges at periphery and on upper surfaces of tabulae [see also Pedder, 1976b, p. 289]. *M.Dev.(Givet.)*, Eu.(Ger.).——Fig. 75,*2a-c*. **C. paucitabulatum* (Schlüter); holotype, *Stringocephalus* Ls., Ger., Hebborn, Bergisch-Gladbach; *a,* side view, ×0.5; *b,* calice showing peripheral increase, ×1.0; *c,* long. sec., ×1.0 (Schlüter, 1881).

Depasophyllum Grabau, 1936, p. 43 [**D. adnetum* Grabau, 1936, p. 44; OD; syntypes 25651a-i, UMMP, Ann Arbor] [=*Depasophyllum* Grabau, 1922, p. 21, *nom. nud.*; not *Depasophyllum* Yü, 1934, p. 85, which, *fide* McLaren, 1959, p. 17, is not valid, since it was published after 1930 without nomination of type species, although two new species were described and illustrated (type, *Diphyphyllum (Depasophyllum) hochangpingense* Yü, 1934, p. 86, SD Smith & Thomas in Thomas, 1956, p. 181; †5012, IGP, Nanking; L.Carb., Tzemenchiao Ls., Ho-chang-ping, Pao-ching-hsien, Hunan); *?Synaptophyllum* Simpson, 1900, which see; *Prodepasophyllum* Cotton, 1973, p. 161,

FIG. 75. Pycnostylidae (p. F140-F142).

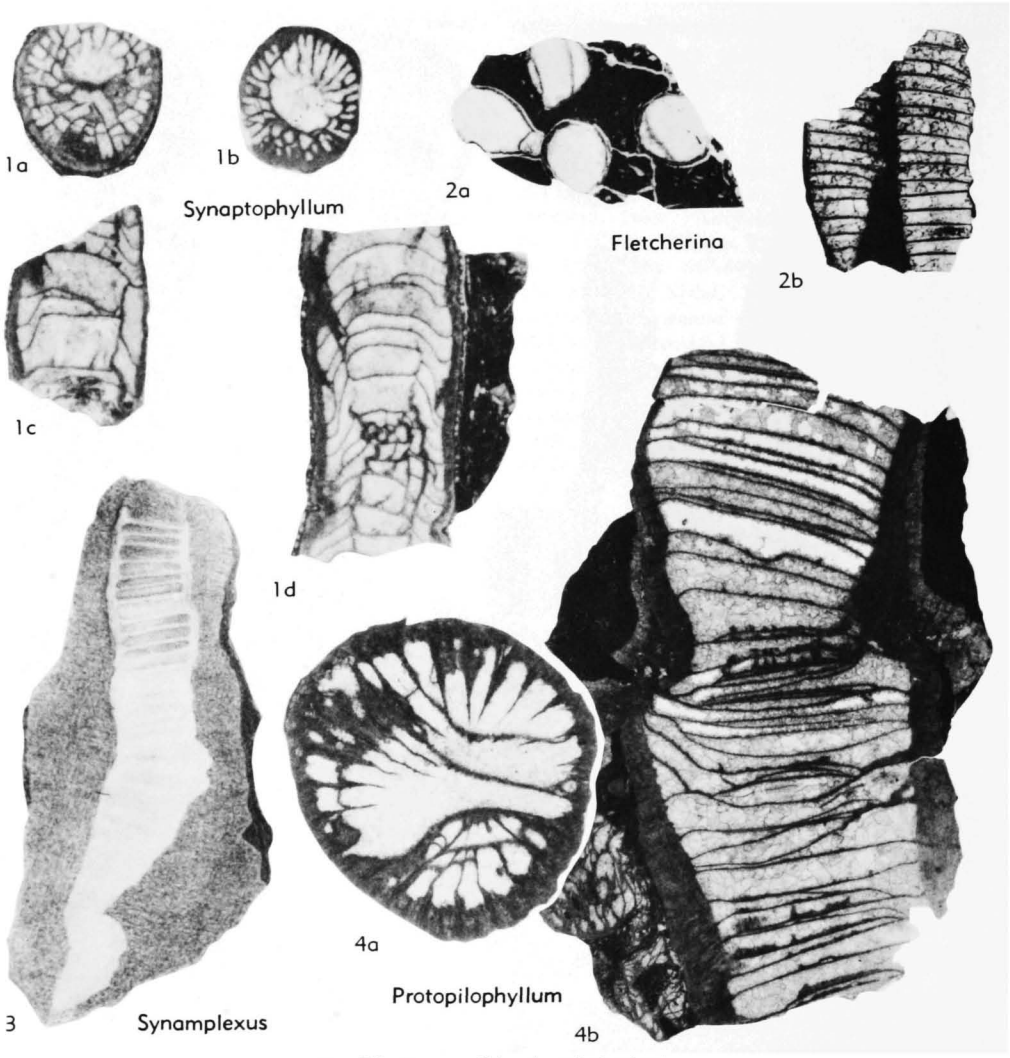


FIG. 76. Pycnostylidae (p. *F*142-*F*143).

nom. subst. pro Depasophyllum GRABAU, 1936]. Fasciculate, increase lateral, some corallites with connecting processes; septa thin, short, major extending to change of slope in low domed or mesa-shaped tabulae, downturned edges of some of which may form sporadic and imperfect aulos; minor septa commonly rudimentary; cardinal fossula indistinct; no dissepiments [see EHLERS & STUMM, 1949, p. 31]. *M.Dev.(Givet.)*, N.Am. (Mich.).——FIG. 75,*1a-d*. **D. adnetum*, syntypes, Traverse Gr. (bioherm in Four Mile Dam F.), Mich., Four Mile Dam, Thunder Bar R., Alpena Co.; *a,d*, long., *b,c*, transv. secs. of two specimens, all ×2 (Ehlers & Stumm, 1949).

?**Fletcherina** LANG, SMITH, & THOMAS, 1955, p. 261, *nom. subst. pro Yabeia* LANG, SMITH, & THOMAS, 1940, p. 140, *non Yabeia* RESSER & ENDO, 1935, a trilobite, *nom. subst. pro Cylindrophyllum* YABE & HAYASAKA, 1915, p. 90, *non Cylindrophyllum* SIMPSON, 1900, a Devonian rugosan [**Cylindrophyllum simplex* YABE & HAYASAKA, 1915, p. 90; OD; †not traced]. Corallum phaceloid; walls of corallites thin; septa or septal spines ?absent; tabulae complete, horizontal; increase lateral; no connecting tubuli or mural pores. *Dev.*, Asia(Yunnan); *M.Dev.(Givet.)*, Australia(Queensl.).—— FIG. 76,*2a,b*. **F. simplex* (YABE & HAYASAKA), ?holotype, Dev., Yunnan, Hung-kuo-chi, Ta-kien-hsieng; *a,b*, transv., long. secs., ×2 (Yabe & Hayasaka, 1920).

Protopilophyllum IVANOVSKIY, 1963, p. 62 [**P. cylindricum*; OD; †31, coll. 305, IGG, Novosibirsk] [?=*Amplexoides* WANG, 1947a, p. 174, Stauriina, Amplexidae]. Solitary coralla; septa

thickened wedgewise forming narrow peripheral stereozone; major septa amplexoid and attenuated toward axis in tabularium; minor septa short; tabulae thin, subhorizontal, commonly somewhat incomplete; dissepiments absent. *L.Sil.(up.Llandov.)-M.Sil.,* Asia (Sib. Platf.).——Fig. 76,*4a,b*. **P. cylindricum,* holotype, up. Wenlock., R. Moyero; *a,b,* transv., long. secs., ×4 (Ivanovskiy, 1963; photographs courtesy A. B. Ivanovskiy).

?Synamplexus Grabau, 1922, p. 62 [**Amplexus viduus* Lindström, 1883a, p. 62; M; †K96 in Richthofen Coll., HU, E. Berlin] [?=*Pycnostylus* Whiteaves, 1884, which see; *?Zelophyllum* Wedekind, 1927, which see; or *?Aphyllum* Soshkina, 1937, which see]. Fasciculate; septa short and confined to narrow peripheral stereozone; tabulae horizontal, complete. [Data lacking on increase and septal structure.] *?M.Sil.,* Asia (Szechwan).——Fig. 76,*3*. **S. viduus* (Lindström), monotype, China, Chaotien, Szechwan, long. ?fracture, ?×1 (Lindström, 1883a).

Synaptophyllum Simpson, 1900, p. 212 [**Diphyphyllum arundinaceum* Billings, 1859b, p. 134; OD; †3602, GSC, Ottawa; lectotype by McLaren, 1959, p. 19] [?=*Placophyllum* Simpson, 1900, p. 216 (type, *P. tabulatum,* OD; syntypes 300, NYSM, Albany; Onondaga Ls., Walpole, Ont.), insufficiently known, see McLaren, 1959, p. 17; *?Depasophyllum* Grabau, 1936, which see]. Phaceloid, increase peripheral or axial; corallites long, slender, cylindrical, rarely connected by lateral projections from corallite walls; septa noncarinate, thin except in narrow peripheral stereozone; major septa short or extending nearly to axis, minor septa short; no dissepiments; tabulae complete, horizontal to distally arched and strongly deflected proximally near periphery [see McLaren, 1959, p. 16; Oliver, 1976a, p. 46]. *M.Dev.(Couvin.),* N.Am.(Ont.-N.Y.-Wash.).——Fig. 76, *1a-d*. **S. arundinaceum* (Billings), lectotype, Bois Blanc F., Ont., 3 mi. W. of Cayuga; *a,b,* transv., *c,d,* long. secs., all ×3 (McLaren, 1959).

?Thecacristatus Strelnikov, 1973, p. 50 [**T. horridus*; OD; †4, coll. 9520, TsGM, Leningrad]. Fasciculate; epitheca with short, sharp crests girdling corallites; wall thin, commonly with thin short septa projecting from it; tabulae complete, thin, sparse, flat or concave. [Tangential section required to prove transverse nature of epithecal ridges and laminar nature of septa not available.] *U.Sil.(Ludlov.),* Eu.(Polar Urals).——Fig. 77, *2a,b*. **T. horridus,* holotype, Yengani-Ye Ra., Nuja-Yu R.; *a,b,* transv., long. secs., ×4 (Strelnikov, 1973).

Zelophyllum Wedekind, 1927, p. 34 [**Z. intermedium*; OD; †10207, 10208, 10209 (thin sections), SM, Frankfurt] [?=*Synamplexus* Grabau, 1922, which see]. Fasciculate; increase lateral; major and minor septa short, subequal, thick and

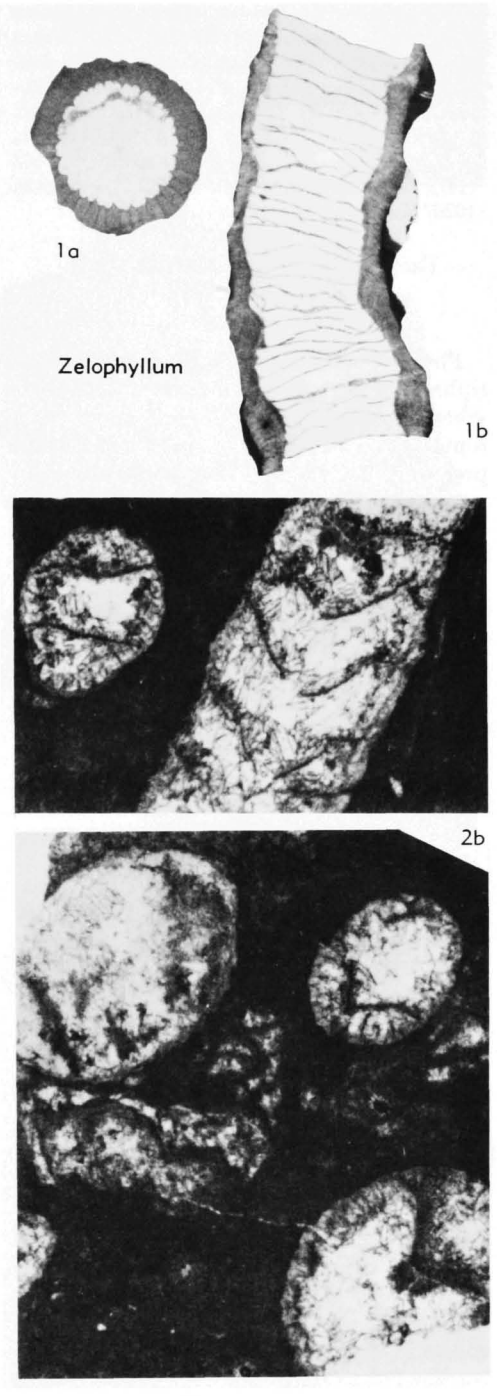


Fig. 77. Pycnostylidae (p. *F*143-*F*144).

contiguous, forming narrow peripheral stereozone from which their nondentate axial edges project but slightly; without dissepiments; tabulae complete, thin, subhorizontal. *M.Sil.-U.Sil.*, Eu.(Gotl.-Podolia)-Asia (Urals-Altay-?Szechwan).——Fig. 77,*1a,b*. **Z. intermedium*, holotype, Reef Ls., Gotl., Högklint; *a,b*, transv., long. secs., ×2 (Hill, n; photographs courtesy R. Birenheide, 10207, 10209, SM, Frankfurt).

Family NEOCOLUMNARIIDAE Soshkina, 1949

[Neocolumnariidae Soshkina, 1949b, p. 145]

Phaceloid; corallites with moderate peripheral septal stereozone; septa thin elsewhere, moderately long to long, major septa somewhat amplexoid; dissepimentarium present in late stages, of longitudinally elongate and unequal plates that become angulate when minor septa are longitudinally discontinuous; tabularium wide, floors commonly slightly arched but may have broad median depression, tabulae commonly complete. *M.Dev.*

?**Neocolumnaria** Soshkina, 1949b, p. 145 [**N. vagranensis*; OD; syntypes, sample 19, slides 1091-8, PIN, Moscow]. Fasciculate; corallites with moderate peripheral septal stereozone; septa thin elsewhere; major septa long, two opposed ones may be longer than others; minor septa commonly discontinuous longitudinally in mature stages, leaving an angulate dissepimentarium of unequal, longitudinally somewhat elongate plates adaxial to stereozone; tabulae with downturned edges, may be depressed axially and may have irregular supplementary tabellae in zone of downturning. *M.Dev.(Eifel.)*, Asia(N.Urals); *?M.Dev. (Givet.)*, N.Am.(NW.Terr.).——Fig. 78,*2a,b*. **N. vagranensis*, syntype, Krasnaya shapochka no. 19; *a,b*, transv., long. secs., ×3 (Soshkina, 1949b).

Family CENTRISTELIDAE Tsyganko, 1971

[Centristelidae Tsyganko, 1971, p. 43]

Fasciculate or cerioid, increase lateral; corallites with narrow peripheral stereozone and irregular axial structure of few radial major septal lamellae and conical tabellae separated from normal concentric dissepimentarium by small concave tabellae; major and minor septa subequal; lonsdaleoid dissepiments sparse. *M.Dev.(Givet.)*.

Centristela Tsyganko, 1967, p. 124 [**C. fasciculata*; OD; †53/5-1, IG, Syktyvkar] [=*Arcotabulophyllum* Goryanov in Bulvanker *et al.*, 1968, p. 43 (type, *A. anavarense*, OD; †16, coll. 271, LGU, Leningrad; Givet., C.Asia); *Acrotabulophyllum* Flügel, 1970, p. 6, *nom. null.*]. Fasciculate or cerioid, increase lateral, nonparricidal; major and minor septa subequal, peripheral ends dilated to form narrow peripheral stereozone; tabularium an axial structure of four to eight subradial major septal lamellae and conical tabulae separated from dissepimentarium by very narrow concave tabulae; a few lonsdaleoid plates may develop in otherwise normal dissepimentarium [see also Tsyganko, 1971, p. 44]. *M.Dev.(Givet.)*, Eu.(Pay-Khoy–Polar & near Polar Urals)-Asia(S.Fergana).——Fig. 78,*1a,b*. *C. anavarensis* (Goryanov), holotype, Givet., S.Fergana, Katran Ra.; *a,b*, transv., long. secs., ×4 (Bulvanker *et al.*, 1968).——Fig. 78,*1c,d*. **C. fasciculata*, holotype, Givet., USSR, Pay-Khoy, Belovskaya R., *c,d*, transv., long. secs., ×4, ×3 (Tsyganko, 1967).

Family AMPLEXIDAE Chapman, 1893

[Amplexidae Chapman, 1893, p. 44; Amplexinae Wang, 1947a, p. 173; Amplexicae Rozkowska, 1967, p. 750] [?=Heterophrentinae Kullman, 1965, p. 140; ?Siphonophrentinae Birenheide, 1974c, p. 253] [Heterophrentinae (=?Siphonophrentinae) possibly referable to Streptelasmatidae; type specimens of type species of nominate genera insufficiently known; L. Dev.-M. Dev.]

Solitary; septa amplexoid (i.e., longitudinally continuous only in peripheral ends, but extending and thinning toward axis as short low ridges developed on upper surfaces only of tabulae and without axial lobes or swelling; cardinal septum may be shorter, in slight fossula, and counter septum longer than others; tabulae subhorizontal with downturned edges. *L.Sil.-M.Sil.; L.Dev.-M.Dev.; Miss.*

Amplexus Sowerby, 1814, p. 165 [**A. coralloides*; M; †44115, BM(NH), London; lectotype by Smith & Thomas, 1963, p. 163] [?=*Bordenia* Greene, 1901, which see; *?Gorskyella* Kachanov, 1973, p. 83 (type, *Amplexus? tschigariensis* Fomichev, 1953a, p. 87, OD; †871, coll. 5030, TsGM, Leningrad; M.Carb., $C_2$3, Donbas, ls. $N_6$1, right bank of Zheleznaya ravine), new name for provisional new subgenus of *Amplexus, Amplexoides* Fomichev, 1953a, p. 88, *non* Wang, 1947a)]. Solitary, cylindrical and scolecoid; wall very thin, interseptal ridges indistinguishable; tabulae flat, with downturned edges and with cardinal fossular depression; major septa thin, subequal, continuous vertically only at peripheral edges, but may extend about halfway toward axis as low, short ridges developed only on upper surfaces of tabulae; minor septa commonly not distinguishable; dissepiments absent [see Hill, 1938-1941, p. 147; Smith & Thomas, 1963, p.

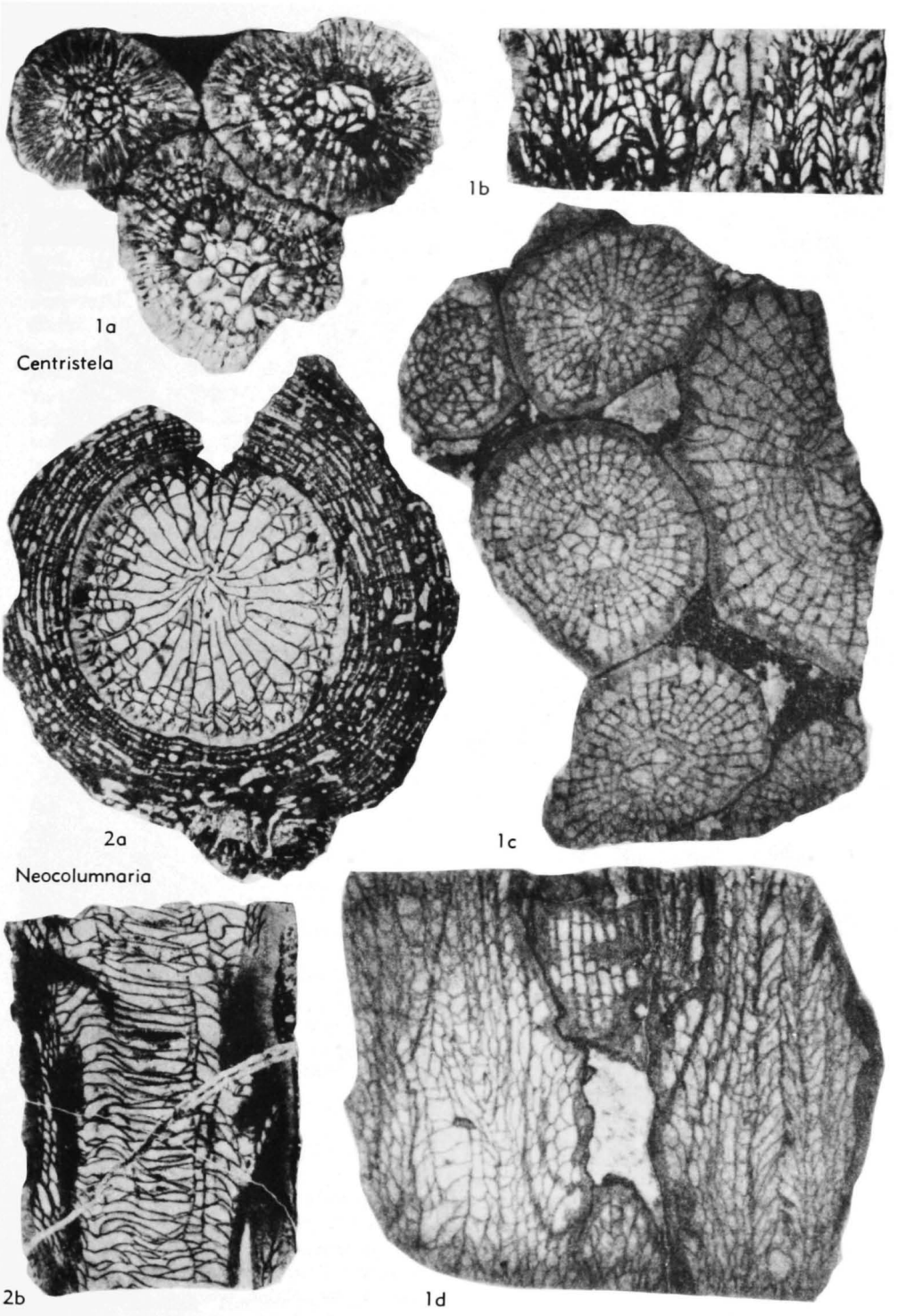


FIG. 78. Neocolumnariidae (2); Centristelidae (1) (p. *F*144).

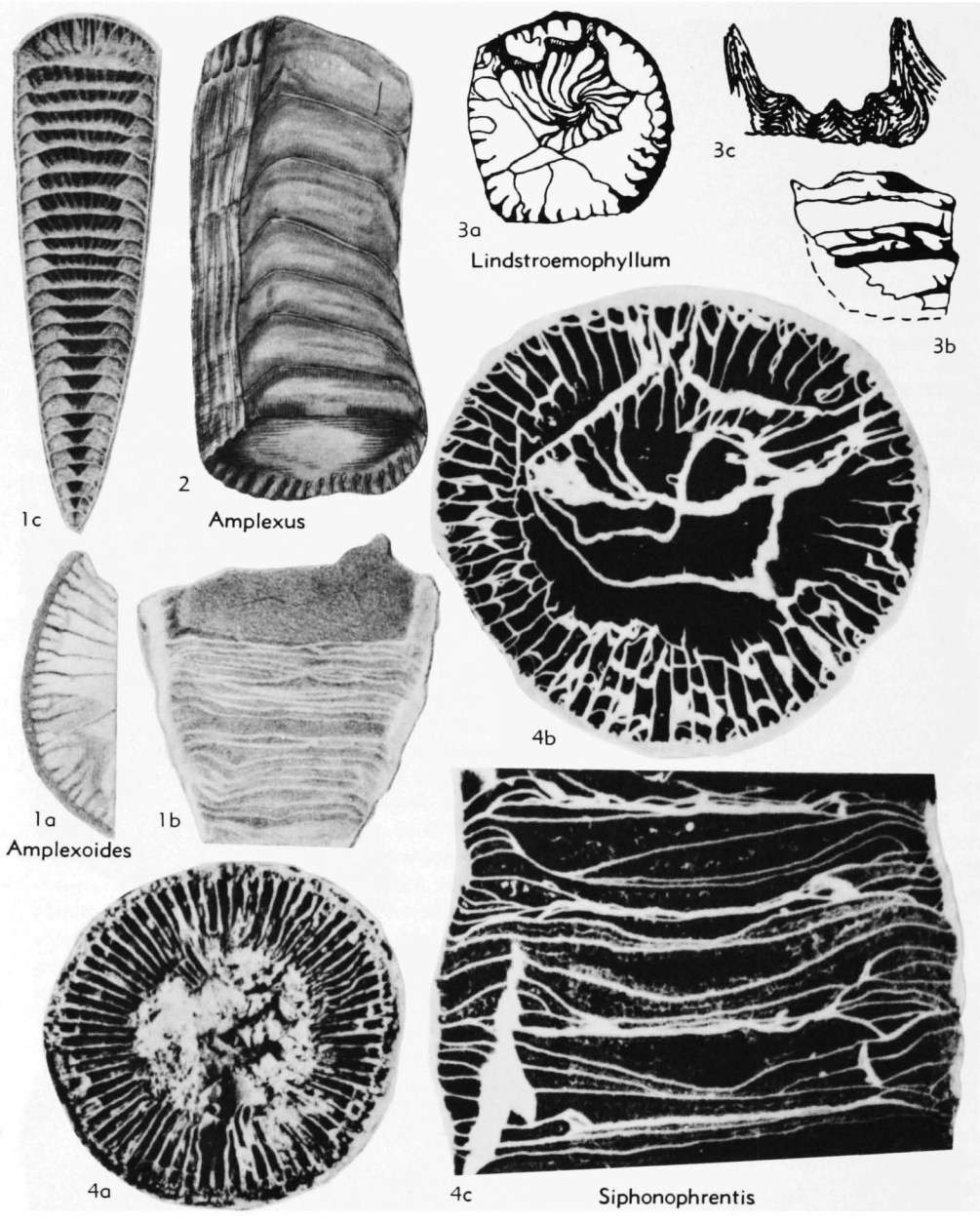


FIG. 79. Amplexidae (p. *F*144-*F*148).

162]. *L.Carb.*, Eu.(Eire-U.K.-Belg.)-Asia(Kazakh.-Japan); *Miss.*, N.Am.(Mont.-Ida.-Wyo.-Utah-?Ind.-?Ill.).——FIG. 79,*2*. **A. coralloides*, lectotype, C zone, Eire, Limerick; side view, ×0.5 (Sowerby, 1814).

Amplexoides WANG, 1947a, p. 174 [**Amplexus appendiculatus* LINDSTRÖM, 1883a, p. 63; OD; syntypes in RICHTHOFEN Coll., HU, E. Berlin] [?=*Protopilophyllum* IVANOVSKIY, 1963, p. 63, Stauriina, Pycnostylidae; *Protyrrellia* COTTON, 1973, p. 166, *nom. subst. pro Tyrrellia* PARKS, 1913, p. 193 (type, *T. severnensis*, M; †22548[300S], ROM, Toronto; Sil., N.Ont., limestone rapids, Severn R., renamed *Amplexus severnensis* by PARKS, 1915, p. 36), see STEARN, 1956, p. 79, *non Tyrrellia* KOENIKE, 1895, a recent arachnid]. Corallum

solitary, trochoid to subcylindrical, septa amplexoid, longitudinally continuous only in narrow peripheral stereozone, major septa extending adaxially only as long, low ridges developed on upper surfaces of complete, horizontal tabulae that may have downturned edges; minor septa short, no dissepiments. *?L.Sil.*, N.Am.(Ont.); *L.Sil.-M. Sil.*, Asia(Szechwan).——Fig. 79,*1a,b*. **A. appendiculatus* (Lindström), syntype, M.Sil., Szechwan, Chaotien; *a,b*, transv., long. secs., ×1 approx. (Lindström, 1883a).——Fig. 79,*1c*. *A. severnensis* (Parks), holotype, ?L.Sil., Ont., limestone rapids, Severn R., long. sec., restored, ×3 (Parks, 1915).

Bordenia Greene, 1901, p. 57 [**B. zaphrentiformis*; OD; syntypes 23593-23600, AMNH, New York] [?=*Amplexus* Sowerby, 1814, which see]. Solitary, irregularly ceratoid or trochoid with talon, or weakly colonial, with peripheral offsets; major septa long but amplexoid; minor septa short; tabulae complete, horizontal, with downturned edges; no dissepiments. [See Stumm, 1948d, p. 71. Thin sections of early stages are lacking.] *Miss.*, N.Am.(Ind.-Ky.).

?Heterophrentis Billings, 1875, p. 235 [**H. spatiosa*; SD Miller, 1889, p. 193 (=*Zaphrentis spatiosa* Billings, 1858, p. 178, syntype, 3451a, GSC, Ottawa, not sectioned or illustrated and calice filled with matrix, M.Dev., Rama's Farm, Pt. Colborne, Ont.; assumed to =*Zaphrentis prolifica* Billings, 1858, p. 176, †3449h, GSC, Ottawa, same loc., by O'Connell, 1914, p. 183)]. Solitary, large, ceratoid to trochoid; cardinal fossula prominent on convex side of corallum, alar fossulae may be prominent also; major septa thick, amplexoid, thinning toward axis; axial lobes present; cardinal septum very short; minor septa short; tabular floors horizontal in wide axial region, distally arched in periaxial region and bending abruptly downward peripherally; no dissepiments. [Diagnosis based on *H. prolifica* (Billings), *sensu* Stumm, 1949, pl. 5, fig. 10. Billings' type material must be restudied before generic name can be safely used.] *M.Dev.(Couvin.)*, N.Am.(Ind.-Ky.-Ont.-?Ohio)-?S.Am.(Venez.)-Eu.(Spain).

?Lindstroemophyllum Wang, 1947a, p. 175 [**L. involutum*; OD; †45053-4, GSGI, Peking]. Corallum solitary, trochoid; major septa amplexoid, long ridges on upper surfaces of tabulae, discontinuous between tabulae, convolute in axial region; minor septa very short, tertiary septa possibly present; narrow peripheral stereozone formed of dilated peripheral ends of septa; tabulae flat, complete, widely spaced; no dissepiments. *M.Sil.*, Asia(Yunnan).——Fig. 79,*3a-c*. **L. involutum*, holotype, Choukeng, Hueitse; *a,b*, transv., long. secs., ×1.5; *c*, part of transv. sec. showing part of peripheral stereozone between two major septa, altered during diagenesis, ×15.0 (Wang, 1947a).

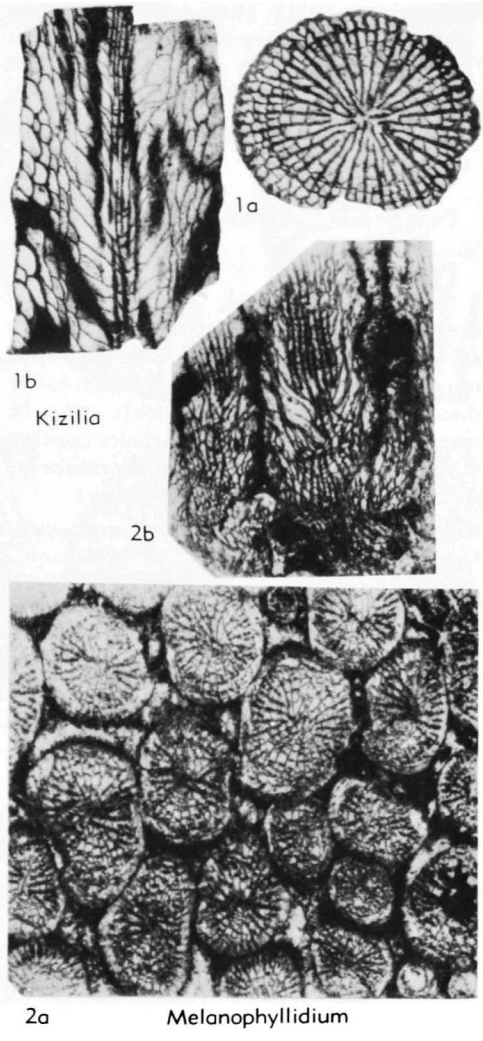


Fig. 80. Kiziliidae (p. *F*148).

?Siphonophrentis O'Connell, 1914, p. 187 [**Caryophyllia gigantea* Lesueur, 1820-1821, p. 296; OD; †not traced; M.Dev., Waren near Utica, N.Y.; =*Turbinolia buceros* var. *elongata* Rafinesque & Clifford, 1820, p. 233, *fide* Stumm, 1965, p. 23, †8616, UMMP, Ann Arbor, neotype by Stumm, 1965, p. 23]. Solitary, large, ceratoid to cylindrical; major septa long, numerous, amplexoid, minor septa short longitudinal ridges, their peripheral edges thickened and contiguous with those of major septa to form narrow stereozone; tabulae slightly convex, flat or depressed axially, depressed at fossula with short cardinal septum; no axial structure, no dissepiments. [*Sensu* Stumm, 1965, p. 23; neotype requires study by thin section before generic and subfamily names may be safely used.]

L.Dev., N.Am.(N.Y.); *M.Dev.*, N.Am.(N.Y.-Ind.-Ky.-Ohio-Ont.)-Eu. (Eng.-Spain)-N. Afr. (Moroc.-Spanish Sahara).——FIG. 79,*4a-c.* **S. elongata* (RAFINESQUE & CLIFFORD); *a*, neotype, M.Dev., Jeffersonville Ls., Falls of the Ohio, calical view, ×1; *b,c*, topotype, long., transv. secs., ×1.5 (Stumm, 1965).

Family KIZILIIDAE Degtyarev, 1965

[Kiziliidae DEGTYAREV, 1965, p. 48] [?=Adamanophyllidae VASILYUK, 1959, p. 85]

Solitary or phaceloid; major septa long, unequal, arranged subradially or pinnately about shorter ?cardinal and ?counter septa, minor septa moderately long, thinner, rarely discontinuous peripherally; septa may be sinuous peripherally; tabular floors concave with ?median or axial notch; dissepiments steeply inclined. *L.Carb.(up.Visean).*

Kizilia DEGTYAREV, 1965, p. 48 [**K. concavitabulata*; OD; †3, coll. 70909, UGUp, Sverdlovsk]. Solitary Kiziliidae, with very sparse lonsdaleoid dissepiments. *L.Carb.(up.Visean)*, Eu.(S.Urals-Polar Urals)-Asia(S.Fergana-?Kweichow).——FIG. 80,*1a,b.* **K. concavitabulata*, holotype, up. Visean, Kizilian suite, S.Urals, Kizil; *a,b*, transv., long. secs., ×2.4 (Degtyarev, 1965).

Melanophyllidium KROPACHEVA, 1966, p. 44 [**Melanophyllum (Melanophyllidium) lativesiculosum*; OD; †4, coll. 8945, TsGM, Leningrad] [=*Melanophyllum (Melanophyllidum)* BARTLETT & ARMITAGE, 1968, p. 29, *nom. null.*]. Phaceloid Kiziliidae with irregular peripheral zone of large, lonsdaleoid dissepiments. *L.Carb.(up.Visean)*, Asia (S.Fergana).——FIG. 80,*2a,b.* **M. lativesiculosum* (KROPACHEVA), holotype, S.Fergana, low. part of Puma suite of southern slopes of Katran Ra.; *a,b*, transv., long. secs., ×2.4 (Kropacheva, 1966).

Suborder STREPTELASMATINA Wedekind, 1927

[*nom. correct.* HILL, 1954, p. 8, *pro* Streptalasmacae WEDEKIND, 1927, p. 15]

Predominantly solitary Stauriida; commonly with peripheral stereozone and, except in a few somewhat doubtfully referred herein (Paliphyllidae, Acrophyllidae, Breviphyllinae), lacking dissepiments; septa laminar, commonly with coarse contiguous trabeculae, axial edges commonly with vermiform lobes that may or may not form axial structure; minor septa commonly short, in a few, longer and contratingent or contraclined; fossula inconspicuous, predominantly on longer, convex side of corallum; tabular floors domed, tabulae complete or, less commonly, incomplete. *M. Ord.-U.Dev.*

Family STREPTELASMATIDAE Nicholson, 1889

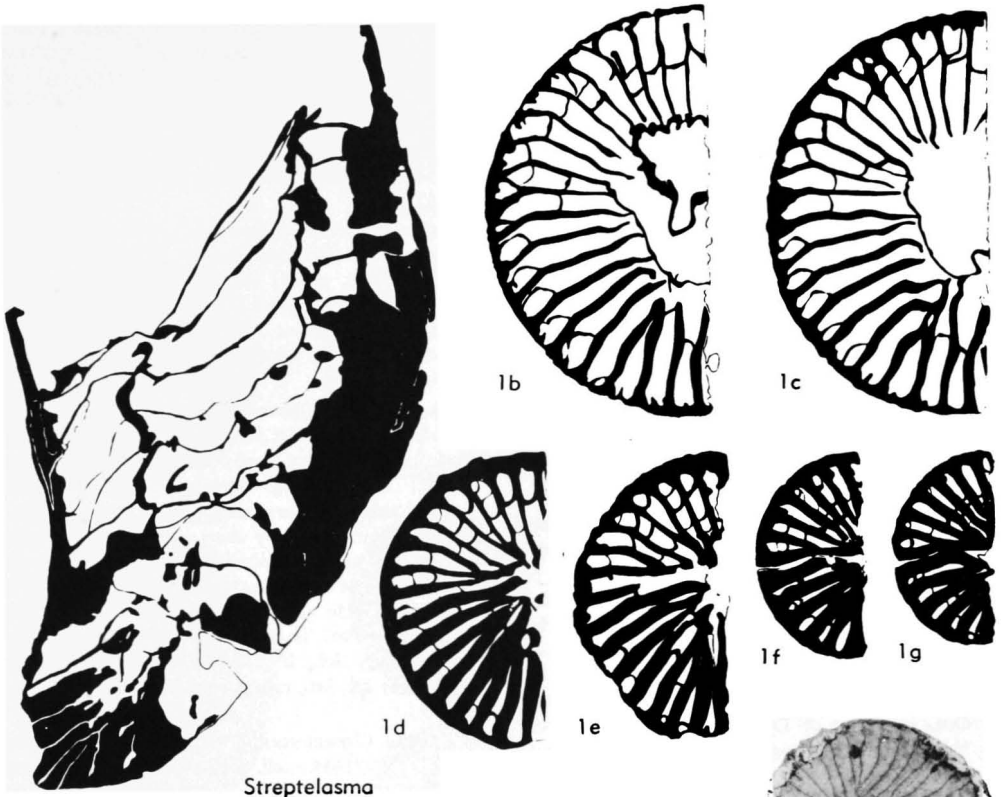
[*nom. correct.* WEDEKIND, 1927, p. 7, *pro* Streptelasmidae NICHOLSON in NICHOLSON & LYDEKKER, 1889, p. 297] [=Densiphyllinae DYBOWSKI, 1873c, p. 331; Streptelasmaidae GRABAU, 1922, p. 28; Dinophyllidae WANG, 1947a, p. 174; Streptelasminae LECOMPTE, 1952, p. 461; Streptelasmacea LECOMPTE, 1952, p. 461, superfamily; Dinophyllinae LECOMPTE, 1952, p. 462; Stereolasmidae FOMICHEV, 1953a, p. 96; Streptelasmaticae HILL, 1954, p. 13, superfamily; Tungussophyllidae IVANOVSKIY, 1963, p. 48; Tungussophyllinae IVANOVSKIY, 1965a, p. 63; Densiphyllidae IVANOVSKIY, 1965a, p. 60; Homalophyllidae WEYER, 1971c, p. 1027; Densiphyllicae IVANOVSKIY, 1973a, p. 77]

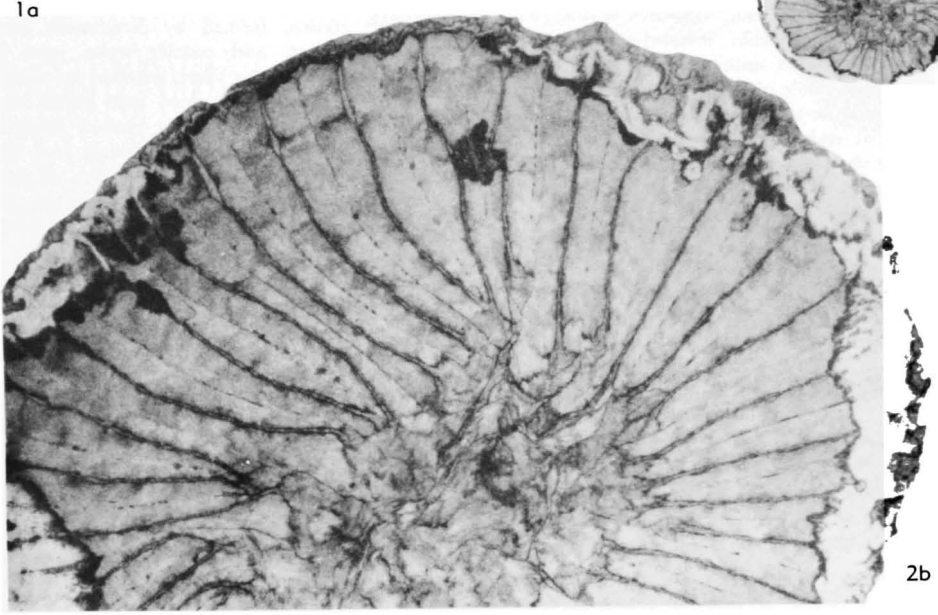
Solitary, in some with a few offsets, or rarely, compound; septa imperforate; septal trabeculae coarse monacanths; major septa long but in some somewhat withdrawn from axis; axial edges of major septa ragged, with vermiform lobes or meandrine septal lamellae sparse to common and in many forming axial structure that may project as calical boss and in which septal elements may be connected by ?synapticulae; minor septa short, commonly buried in or scarcely projecting from somewhat irregular peripheral stereozone, in a few longer and contratingent or contraclined; fossula inconspicuous and commonly on convex side of curved coralla, in early forms more or less parallel-sided, in later forms may merge with axial space within axial structure; tabulae tall domes, complete or incomplete; dissepimentlike tabellae may develop between a minor septum and the major septum against which it is contratingent. *M.Ord.-M.Dev.*

Subfamily STREPTELASMATINAE Nicholson, 1889

[*nom. transl.* LECOMPTE, 1952, p. 461 (as Streptelasminae), *ex* Streptelasmatidae NICHOLSON in NICHOLSON & LYDEKKER, 1889, p. 297] [=Tungussophyllinae IVANOVSKIY, 1963, p. 48, *nom. transl.* IVANOVSKIY, 1965a, p. 63, *ex* Tungussophyllidae IVANOVSKIY, 1963, p. 48; Densiphyllinae DYBOWSKI, 1873c, p. 331]

Solitary or with few offsets, or, rarely, compound; axial edges of major septa ragged with vermiform lobes or meandroid septal lamellae in many forming axial structure; minor septa short, commonly buried in or scarcely projecting from irregular peripheral stereozone; tabular floors tall domes, tabulae complete or incomplete; no dissepiments. *M.Ord.-M.Dev.*





Aknisophyllum

Streptelasma HALL, 1847, explanation to pl. 25, fig. 1 [**S. corniculum*; SD ROEMER, 1861, p. 19; †645/1(a), AMNH, New York; lectotype by NEUMAN, 1969, p. 10] [=*Streptoplasma* HALL, 1847, p. 17, *nom. nud.; Brachyelasma* LANG, SMITH, & THOMAS, 1940, p. 28, *nom. subst. pro Dybowskia* WEDEKIND, 1927, p. 18, *non* DALL, 1876, *nec* others (type, *Dybowskia prima* WEDEKIND, 1927, p. 18, OD; †11384, 11385 (slides), WEDEKIND Coll., SM, Frankfurt; U.Ord., Tyrifjord, Nor.)]. Corallum solitary; trochoid, ceratoid, or cylindrical, with convex cardinal side, cardinal fossula open; major septa in early stages long, thin or moderately thick, normally fused into weak axial structure, in late stages thin, somewhat withdrawn from axis, and not forming axial structure, axial edges of major septa transversely corrugated and with sparse vermiform lobes; minor septa rudimentary or short; peripheral stereozone present in all stages; tabulae complete, convex, with wide axial depression and mostly with lateral tabellae; no dissepiments. [See NEUMAN, 1969, p. 8. NEUMAN's revision requires reassessment of previous cosmopolitan records from Middle Ordovician to Lower Silurian.] *M.Ord.*, N.Am.(N.Y.-Mich.); *U.Ord.*, Eu.(U.K.-Nor.-Swed.-Est.-Urals); *L.Sil.*, Asia (SW. China)-S. Am. (Venez.).——FIG. 81,*1a-g*. **S. corniculum* HALL, lectotype, up.M. Ord., low. part of Trenton Ls., USA, Middleville, N.Y.; *a*, central long. sec., *b-g*, parts of transv. secs., all ×3 (Neuman, 1969).

?**Aknisophyllum** OLIVER, 1960a, p. 97 [**A. consuitum*; OD; †137185, USNM, Washington]. Solitary, trochoid; calice inverted-conical, fossula visible in base with unthickened cardinal septum and on concave side of corallum; major septa long, dilated, and laterally contiguous so that lumen is filled; axial ends somewhat curved; minor septa extremely short; tabulae commonly suppressed due to thickening of septa except just below calice in a few corallites; no dissepiments. *L.Dev.*, N.Am. (N.Y.).——FIG. 81,*2a,b*. **A. consuitum*, holotype, reef facies, Coeymans Ls., N.Y.; *a,b*, transv. secs., ×1.5, ×6.7 (Oliver, 1960a; photographs courtesy W. A. Oliver).

Altaiophyllum IVANIYA, 1955, p. 85 [**A. belgebaschicum*; OD; †1948-22, TGU, Tomsk] [?=*Zmeinogorskia* SPASSKIY, 1960c, p. 31 (type, *Z. bublichenkoi*, OD; †75, coll. 7653, TsGM, Leningrad; Strizhkovsk beds, Givet., Rudny Altay), see IVANIYA, 1965, p. 10; *Zmeinogroskia* FLÜGEL, 1970, p. 309, *nom. null.*]. Solitary, cylindroconical; calice shallow, with gently sloping walls and sharp edges; major septa amplexoid and somewhat withdrawn from axis, thicker and pinnately arranged in cardinal quadrants, where their axial ends curve around inner edge of fossular depression in tabulae; cardinal septum short in mature stages; tabulae flat or somewhat sagging and with downturned edges, and with accessory tabellae grouped in zone of downturning; minor septa short, very steeply inclined, ?dissepiments present in some interseptal loculi. *M.Dev.*, Asia (Altay Mongolia-Altay Kazakh.).——FIG. 82,*3a-c*. **A. belgebaschicum*, holotype, up. Givet., Altay, R. Belgebash, right tributary of R. Chi; *a,c*, transv. secs., ×2.5, ×2.0; *b*, long. sec., ×2.0 (Ivaniya, 1965).

?**Archaeozaphrentis** IVANOVSKIY, 1959, p. 897 [**A. primigenius* (figured only); OD]. IVANOVSKIY states (1963, p. 49) that this genus was founded on very scanty material and that (1965a, p. 97) the type specimens are fragments probably not from the one corallum. *L.Sil.(mid.Llandov.)*, Asia(Sib.Platf.).

Asthenophyllum GRUBBS, 1939, p. 546 [**A. orthoseptatum*; OD; †UC46014, FM, Chicago]. Very small, calice very deep; major septa subequal, radial but twisting slightly together to form slight axial structure with central calical depression; minor septa very short, commonly projecting from wall as longitudinal rows of spines; presence or absence of streptelasmoid septal lobes not established; tabulae rare to absent. *M.Sil.*, N.Am.(Ill.-Wis.).——FIG. 82,*1a,b*. **A. orthoseptatum*, holotype, Niag. dol., Ill., Federal Stone Quarry, near Chicago; *a,b*, lat., calical views, ×3, ×4 (Grubbs, 1939).

Axiphoria CHEREPNINA, 1960, p. 389 [**A. kanica*; OD; †790/1416, coll. 210, SNIIGGIMS, Novosibirsk]. Solitary, rather small, conical, with rejuvenescence; well-marked isolated columella, lenticular in section, formed by detachment from conjoined cardinal and counter septa; septa of two orders, minor very short, confined to narrow peripheral stereozone; separated axial septal lobes interlace in axial region; tabulae domed, rising to columella or freely curved. [Fossula not described.] *U.Ord.*, Asia(Mt.Altay).——FIG. 83,*3a,b*. **A. kanica*, holotype, USSR, near Yakonur, Mt. Altay; *a,b*, transv., long. secs., ×3 (Cherepnina, 1960).

Axolasma IVANOVSKIY, 1963, p. 33 [**A. flexuosum*; OD; †8, coll. 305, IGG, Novosibirsk] [=*Protosyringaxon* IVANOVSKIY, 1963, p. 37 (type, *P. primitivum*, OD; †12, coll. 305, IGG, Novosibirsk; up. Llandov., R.Moyero), see WEYER, 1973f, p. 702]. Solitary; septa thickened, to contiguity in narrow peripheral stereozone with short, not contratingent minor septa; weak axial structure formed of conjoined and lobed axial ends of major septa, curved in same sense around small calical axial depression, but free laterally in outer part of tabularium in adult stages; fossula somewhat expanded toward, but not into, axis and with long, rather thin cardinal septum; tabulae sparse; dissepiments absent. *L.Sil.(Llandov.)*, Asia(Sib.Platf.).——FIG. 83,*2a,c*. *A. primitivum* (IVANOVSKIY), holotype, up. Llandov., R.Moyero; *a,c*, long., transv. secs., ×4 (Ivanovskiy, 1963;

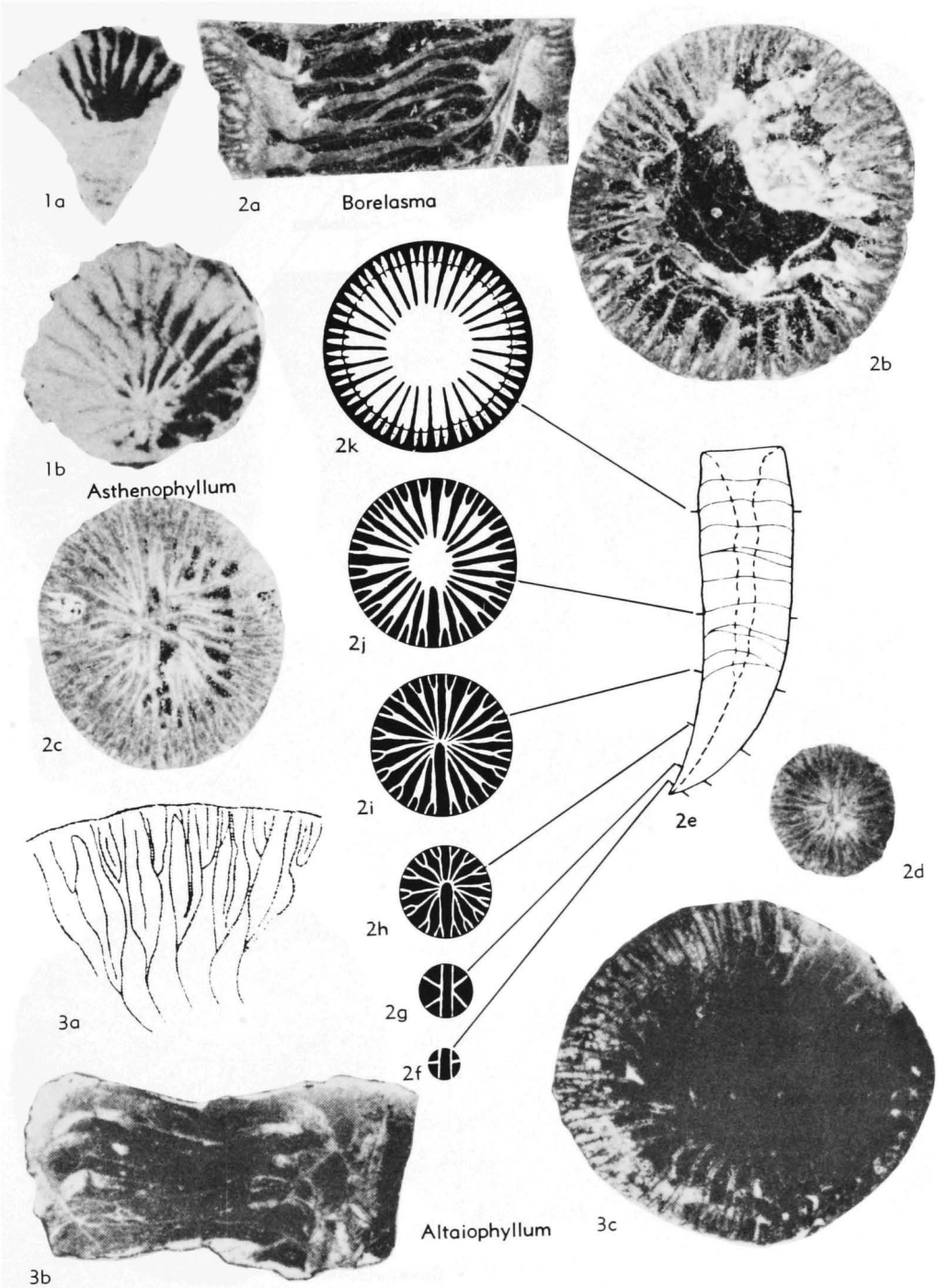


FIG. 82. Streptelasmatidae (p. *F*150, *F*154).

photographs courtesy A. B. Ivanovskiy).——FIG. 83,*2b*. **A. flexuosum*, holotype, up. Llandov., R.Moyero; transv. sec., ×4 (Ivanovskiy, 1963; photographs courtesy A. B. Ivanovskiy).

Bighornia DUNCAN, 1957, p. 608 [**B. parva*; OD; †127574, USNM, Washington]. Corallum solitary;

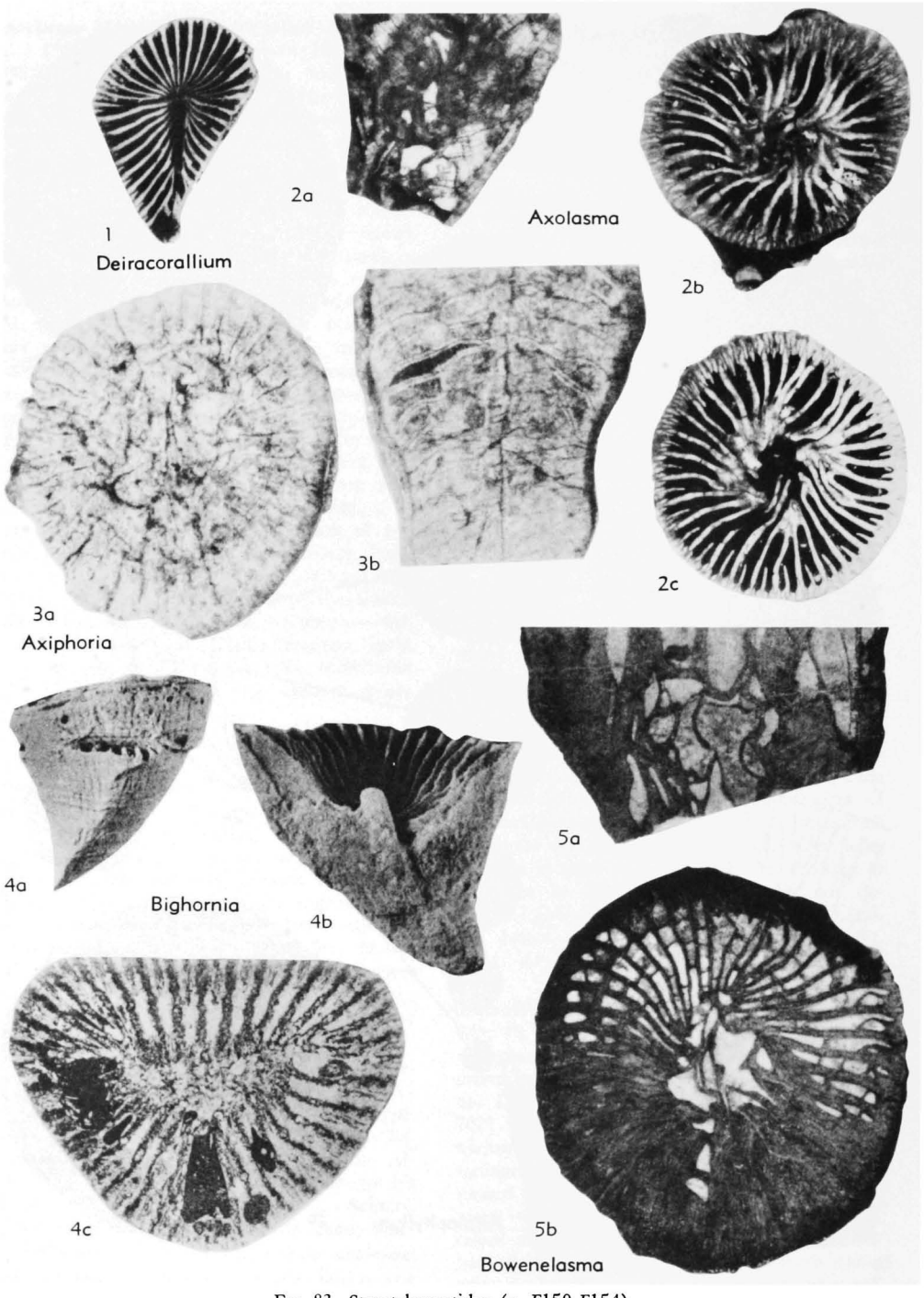


FIG. 83. Streptelasmatidae (p. *F*150-*F*154).

counter side convex, flattened in apical region with angulations at edges of flattened area coinciding with edges of alar septa; minor septa very short; cardinal septum short, in well-defined fossula; counter septum thickened at axial end and produced into lathlike, terminally rounded columella

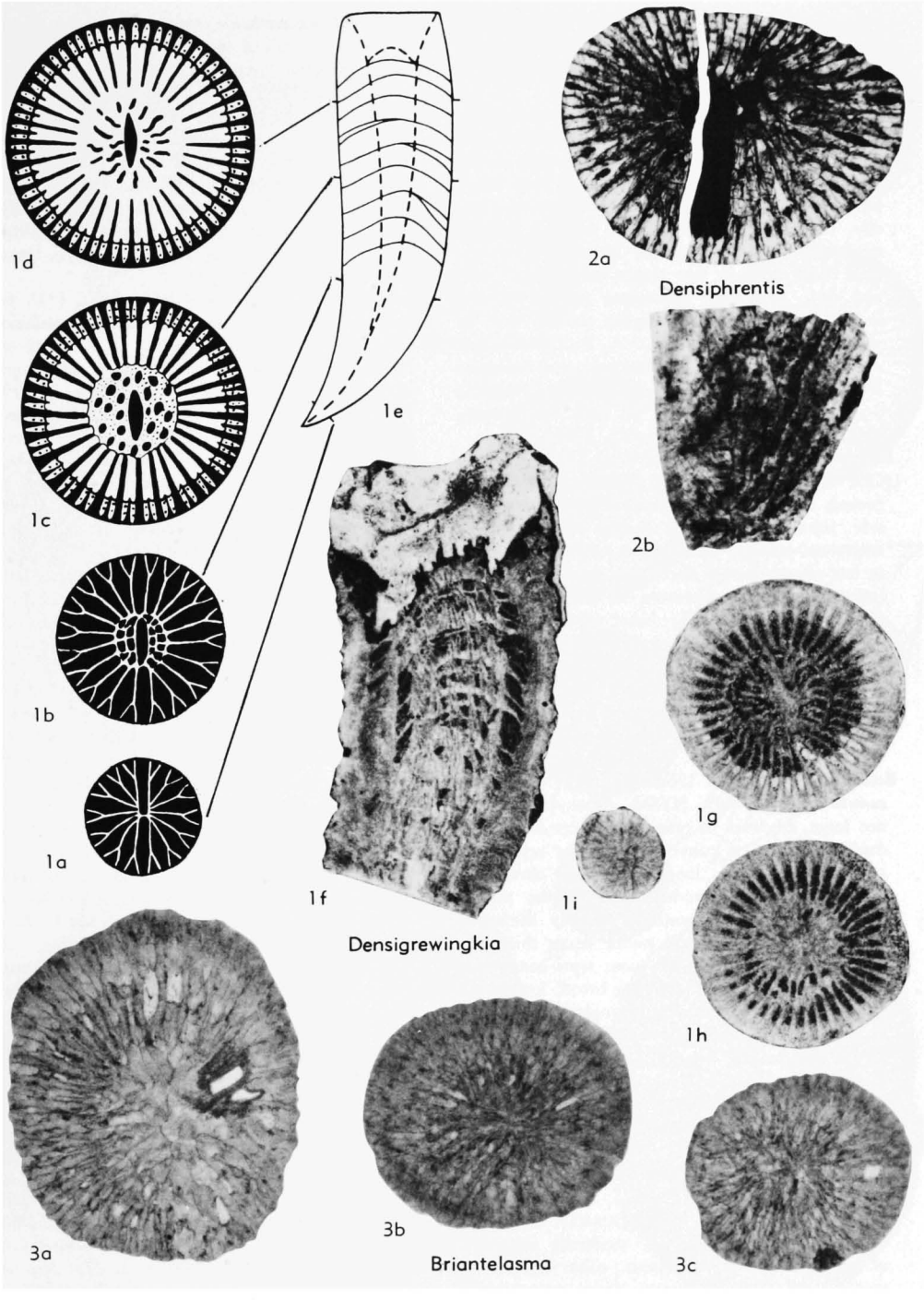


FIG. 84. Streptelasmatidae (p. *F*154).

that rises from *Grewingkia*-like axial structure; tabulae present in late stages of reduced septal thickening, domed, complete or incomplete; no dissepiments. *U.Ord.*, N.Am.(Wyo.-Colo.-Ida.-Utah-Nev.-Cal.-Texas-Iowa-Minn.-Arctic Arch.-B. C.-Manit.-Greenl.)-Eu.(Est.).——FIG. 83,*4a-c*. **B.*

parva, Bighorn dol., Wyo., Bighorn Mts.; *a,* paratype, alar view, ×2; *b,* holotype, long. sec., ×3; *c,* paratype, transv. sec., ×5 (Duncan, 1957; *a,* USNM124801, *c,* USNM127576).

Borelasma NEUMAN, 1969, p. 65 [**B. crassitangens*; OD; †Cn2055, RM, Stockholm]. Corallum solitary, trochoid, ceratoid or cylindrical, with convex cardinal side; cardinal fossula open; in early stages septa strongly dilated, normally contiguous laterally, major septa reaching axis without forming axial structure and cardinal septum prominent; axial lobes few; in late stages major septa short and thin; peripheral stereozone present; tabulae numerous, complete, not highly curved, with or without lateral tabellae. *U.Ord.,* Eu.(Swed.-Est.).——FIG. 82,*2a-k.* **B. crassitangens; a-d,* holotype, *Dalmanitina* Beds, Swed., Borenshult Östergötl.; *a,* long., *b-d,* transv. secs., all ×3; *e-k,* transv., long. secs., diagram. (Neuman, 1969).

Bowenelasma SCRUTTON, 1973, p. 242 [**B. typa*; OD; †R45094, BM(NH), London]. Corallum curved, ceratoid with cardinal septum on convex side; septa thickened and closing lumen in early stages and strongly thickened in cardinal quadrants in late stages; fossula narrow or poorly developed; intertwined septal elements in axial area may form low boss in calice; minor septa well developed but no dissepiments; tabulae downturned peripherally, undulating or highly domed in axial area. *M.Dev.(up.Onesquethaw.),* S.Am.(Venez.).——FIG. 83,*5a,b.* **B. typus,* holotype, Cano Grande F., Cano Grande; *a,b,* long., transv. secs., ×2 (Scrutton, 1973).

Briantelasma OLIVER, 1960a, p. 89 [**B. americanum*; OD; †11069, NYSM, Albany]. Solitary, not large, trochoid to cylindrical, erect or curved, cardinal fossula on convex side; major septa subpinnately arranged, long, extending almost to axis; minor septa one-half this length; marginarium a wide stereozone formed by thickened and contiguous major and minor septa; thickened axial ends (?and lobes) of major septa contiguous in dense axial structure forming broad, low mesa-like boss in calice; tabulae strongly domed with axial depression and cardinal fossular depression [see SCRUTTON, 1973, p. 247]. *Sil.,* N.Am.(Que.); *L.Dev.,* N.Am.(N.Y.-Me.); *low.M.Dev.,* S.Am.(Venez.).——FIG. 84,*3a-c.* **B. americanum,* holotype, reef facies, L.Dev., Coeymans Ls., N.Y.; *a-c,* transv. secs., ×3.0, ×1.5, ×1.5 (Oliver, 1960a; photographs courtesy W. A. Oliver).

Deiracorallium NELSON, 1963, p. 37 [**D. manitobense*; OD; †10844, GSC, Ottawa]. Corallum solitary, curved, convex side markedly angulated at outer end of cardinal septum; calice fairly deep; cardinal fossula long, narrow, deep; septa numerous, straight, in cardinal quadrants arranged pinnately to fossula, in counter quadrants successively decreasing in length toward alar septa, [presence or absence of axial lobes not determined]; minor septa very short. *U.Ord.,* N.Am.(Manit.).——FIG. 83,*1.* **D. manitobense,* holotype, Chasm Ck. F., Churchill R.; calical view, ×2 (Nelson, 1963).

Densigrewingkia NEUMAN, 1969, p. 50 [**D. pyrgoidea*; OD; †72919, PM, Oslo]. Like *Grewingkia* but cardinal fossula on concave side, and axial structure with septal lobes and lamellae connected by stereoplasmatic deposits in early stages. *U.Ord. (5a),* Eu.(Nor.).——FIG. 84,*1a-i.* **D. pyrgoidea,* Stavnaestangen, Ringerike area; *a-e,* diagram. illus. of ontogeny; stippled areas indicate stereoplasmatic deposits; *f,* long. sec., ×1.5; *g-i,* holotype, transv. secs., ×2.0 (Neuman, 1969).

?Densiphrentis IVANOVSKIY, 1963, p. 56 [**D. fossulatum*; OD; †27, coll. 305, IGG, Novosibirsk] [?=*Rhegmaphyllum* WEDEKIND, 1927, which see; *?Tungussophyllum* IVANOVSKIY, 1959, see IVANOVSKIY, 1970, p. 121, WEYER, 1974a, p. 157; *?Pterophrentis* IVANOVSKIY, 1963, which see]. Solitary, small; major septa thickened and contiguous; in late stages cardinal septum very short, in long, wide pear-shaped fossula extending beyond axis; tabulae not distinguishable in few interseptal spaces noted; presence of axial septal lobes not proved. *L.Sil.(up.Llandov.),* Asia(Sib. Platf.).——FIG. 84,*2a,b.* **D. fossulatum,* holotype, up. horizon of up. Llandov., R. Gremyachiy; *a,b,* transv., long. secs., ×4 (Ivanovskiy, 1963; photographs courtesy A. B. Ivanovskiy).

?Densiphyllum DYBOWSKI, 1873c, p. 335 [**D. thomsoni*; SD SHERZER, 1891, p. 284; Co1336, syntype, coll. 11, EGM, Tallinn] [=*Pycnophyllum* LINDSTRÖM, 1873b, p. 32, *nom. van. pro Densiphyllum*]. Solitary, small, ceratoid; major septa straight, radially arranged, axial ends contiguous and interfingered; minor septa long, not contratingent, buried in peripheral stereozone; fossula not distinct; septal trabeculae impart scalloped edges and sides to septa; tabulae complete, low domes. [Imperfectly known; presence or absence of septal lobes not established.] *L.Sil. (low.Llandov.),* Eu.(Est.).——FIG. 85,*2a-c.* **D. thomsoni,* syntype, Herküll; *a-c,* long., tang., transv. secs., ×8, ×20, ×5 (Dybowski, 1873c).

Grewingkia DYBOWSKI, 1873c, p. 384 [**Clisiophyllum buceros* EICHWALD, 1856, p. 108; SD SHERZER, 1891, p. 284; †1/241, EICHWALD Coll., LGU, Leningrad] [=*Kiaerophyllum* WEDEKIND, 1927, p. 17 (type, *K. kiaeri* WEDEKIND, 1927, p. 17, OD; †F11469, 11470, 11486, WEDEKIND Coll., SM, Frankfurt; U.Ord., Stavnaestangen, Nor.; =*Clisiophyllum buceros* EICHWALD, 1856, see NEUMAN, 1969, p. 36); *?Cyatholasma* IVANOVSKIY, 1961a, p. 120 (type, *C. perforata,* OD; †4/1, IVANOVSKIY Coll., SNIIGGIMS Novosibirsk; U. Ord., Salair; see WEYER, 1973a, p. 27); also see *Rectigrewingkia* KALJO, 1961]. Corallum solitary, trochoid, ceratoid or cylindrical, with convex cardinal side; in early stages septa moderately or strongly dilated, major septa being long and feebly fused into narrow axial structure; in later stages major septa thin and short; axial structure broad,

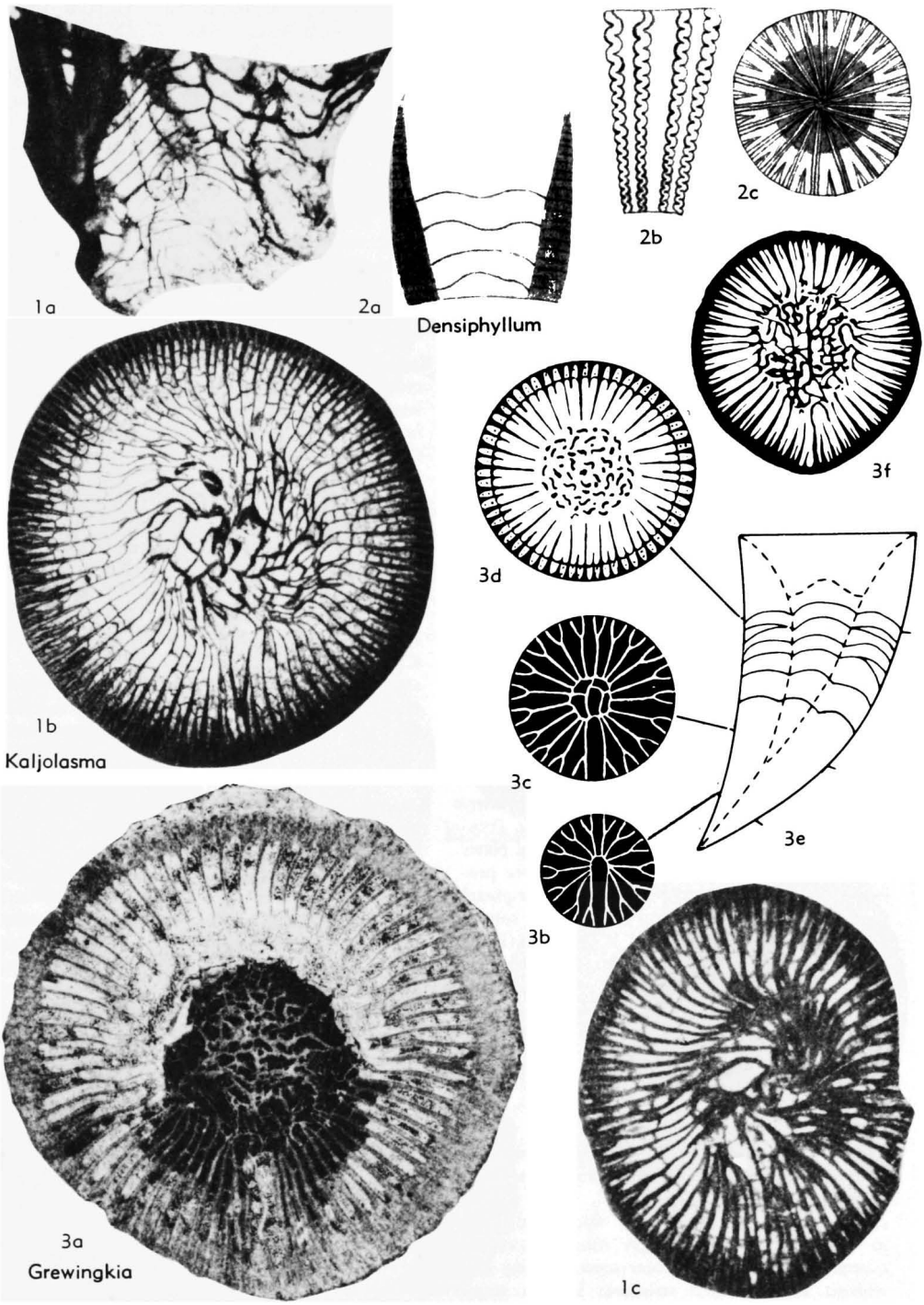


FIG. 85. Streptelasmatidae (p. *F154-F156*).

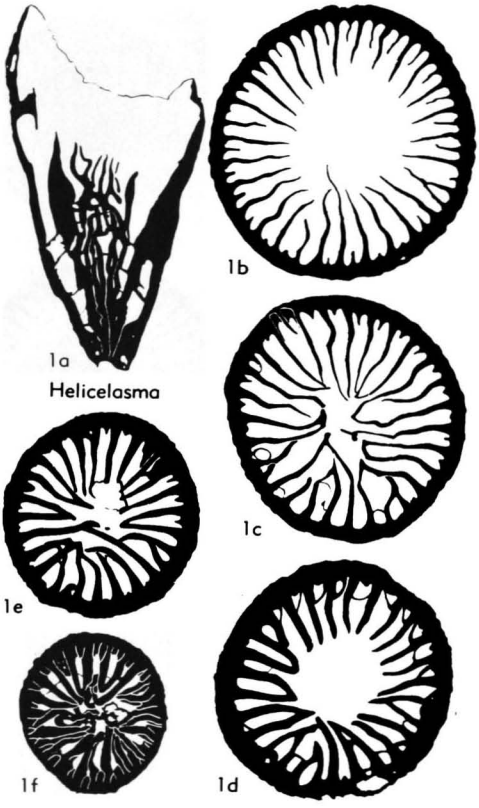


FIG. 86. Streptelasmatidae (p. *F*156).

spongy, of numerous mostly irregularly intertwined vermiform septal lobes and lamellae [possibly with synapticulae], may include medial plate; calicular boss present or absent; minor septa projecting variably from moderately wide peripheral stereozone; tabulae complete or incomplete, convex [see NEUMAN, 1969, p. 33]. *U.Ord.*, Eu.(Eng.-Nor.-Swed.-Est.)-N. Am. (USA-Can.-Akpatok I.)-?Asia(Salair).——FIG. 85,*3a-e.* **G. buceros* (EICHWALD), U.Ord.(5a), Nor., Stavnaestangen; *a,* transv. sec., ×2.0; *b-d,* diagram. transv. secs.; *e,* diagram. long. sec. (Neuman, 1969).——FIG. 85,*3f.* *G. bilateralis* NEUMAN, Boda Ls., Swed., Osmundsberg, NE. Siljan distr.; transv. sec., ×1.5 (Neuman, 1969).

Helicelasma NEUMAN, 1969, p. 28 [**H. simplex*; OD; †Og.117, PM, Uppsala]. Corallum solitary; trochoid, ceratoid or cylindrical, with convex cardinal side; cardinal fossula open, indistinct; in early stages septa strongly dilated, normally contiguous laterally and major septa reaching axis without forming axial structure; in late stages major septa long and thin, their axial edges normally variably joined into loosely built axial structure; axial septal lobes few; peripheral stereozone present; tabulae complete, convex, with lateral tabellae. *M.Ord.-U.Ord.*, Eu.(U.K.-Swed.-Est.)-N.Am.(USA-Can.-Akpatok I.); *?L.Sil.*, Eu. (U.K.).——FIG. 86,*1a-f.* **H. simplex*, U.Ord., *Dalmanitina* Beds, Swed., Borenshult, Östergötl.; *a,* holotype, long. sec., ×2.4; *b-f,* serial transv. secs., ×3.0 (Neuman, 1969).

Kaljolasma WEYER, 1972c, p. 450 [**Streptelasma giganteum* KALJO, 1958a, p. 21; OD; †Co1220, EGM, Tallinn]. Like *Helicelasma* but large and with long and commonly contratingent minor septa; small dissepimentlike plates present within contratingencies. *U.Ord.(Porkun.)*, Eu.(Est.-?Nor.).——FIG. 85,*1a-c.* **K. giganteum* (KALJO), holotype, F_2, Est., Porkuni; *a,* long. sec., ×2.0; *b,c,* transv. secs., ×1.3, ×2.0 (Kaljo, 1958a).

Kenophyllum DYBOWSKI, 1873c, p. 358 [**K. subcylindricum*; M; †Co1113, coll. 11, EGM, Tallinn; lectotype by KALJO, 1958a, p. 23] [=*Cenophyllum* RYE, 1875, in Zool. Rec., p. 534, *nom. van.*]. Corallum solitary, ceratoid or subcylindrical, cardinal side commonly concave; calice deep with deep fossula; all septa strongly dilated and contiguous laterally except in last phases, and coarsely trabeculate; major septa long, cardinal septum dominant in early stages, shortened in later stages; in early stages axial ends of septa feebly interlaced but not forming axial structure; tabulae ?occasional to absent. [See NEUMAN, 1969, p. 70; KALJO, 1958a, p. 22; 1961, p. 59. Presence or absence of axial septal lobes not established.] *U.Ord.*, Eu.(Est.).——FIG. 87,*3a-d.* **K. subcylindricum*, F_1b, Est., Kyrgessaare; *a,* lectotype, transv. sec., ×2.0 (Kaljo, 1958a); *b,c,* transv. secs., ×1.5, ×1.3; *d,* long. sec., ×2.0 (Kaljo, 1961).

Kionelasma SIMPSON, 1900, p. 207 [**Streptelasma mammiferum* HALL, 1882, p. 21; OD; †11057, NYSM, Albany; lectotype by OLIVER, 1958, p. 825] [=*Cionelasma* LANG, SMITH, & THOMAS, 1940, p. 36, *nom. van.*]. Solitary, moderately large, curved, conical or somewhat compressed parallel to counter-cardinal plane, with curvature perpendicular to plane of compression; septa numerous, dilated peripherally to form moderately wide stereozone, beyond which axial ends of minor septa project but slightly; long axial ends (?and lobes) of major septa dilated, twirled and connected so that large axial structure with few irregular spaces is formed and projects as boss in calice; fossula wide and deep near but not invading axial structure, with shortened cardinal septum; tabulae ?rising to axial structure; no dissepiments. *Up.L.Dev.-?low.M.Dev.*, N.Am.(Ind.-Ky.).——FIG. 87,*4a,b.* **K. mammiferum* (HALL), lectotype, Jeffersonville Ls., Falls of the Ohio; *a,* polished sec., ×1; *b,* calical view, ×1 (Oliver, 1958).

Leolasma KALJO, 1956b, p. 36 [**L. reimani*; OD; †Co1040, coll. 77, EGM, Tallinn]. Small to medium-sized, solitary; conical, cardinal side convex; septa thickened and long in early stages, in

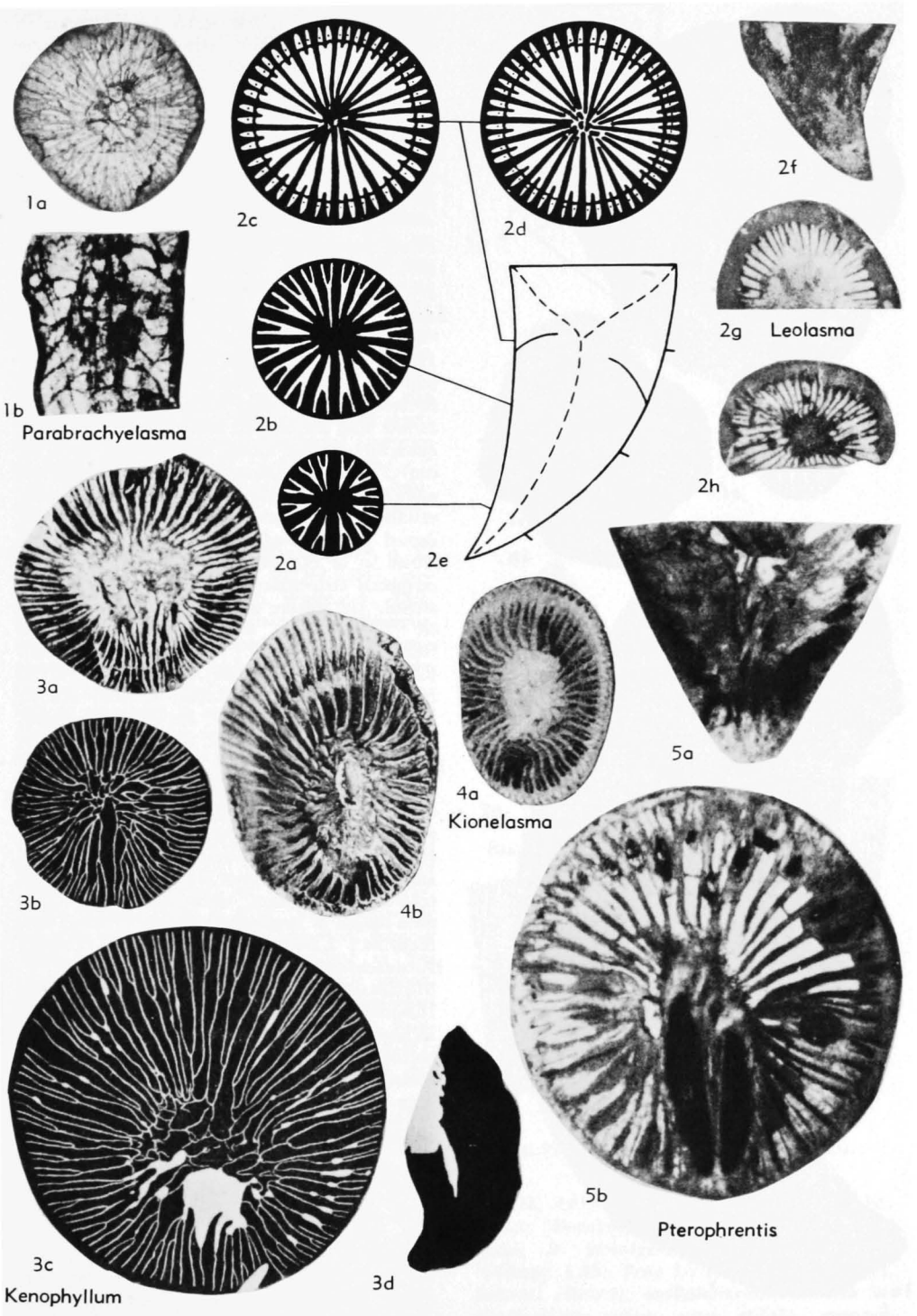


FIG. 87. Streptelasmatidae (p. *F156-F159*).

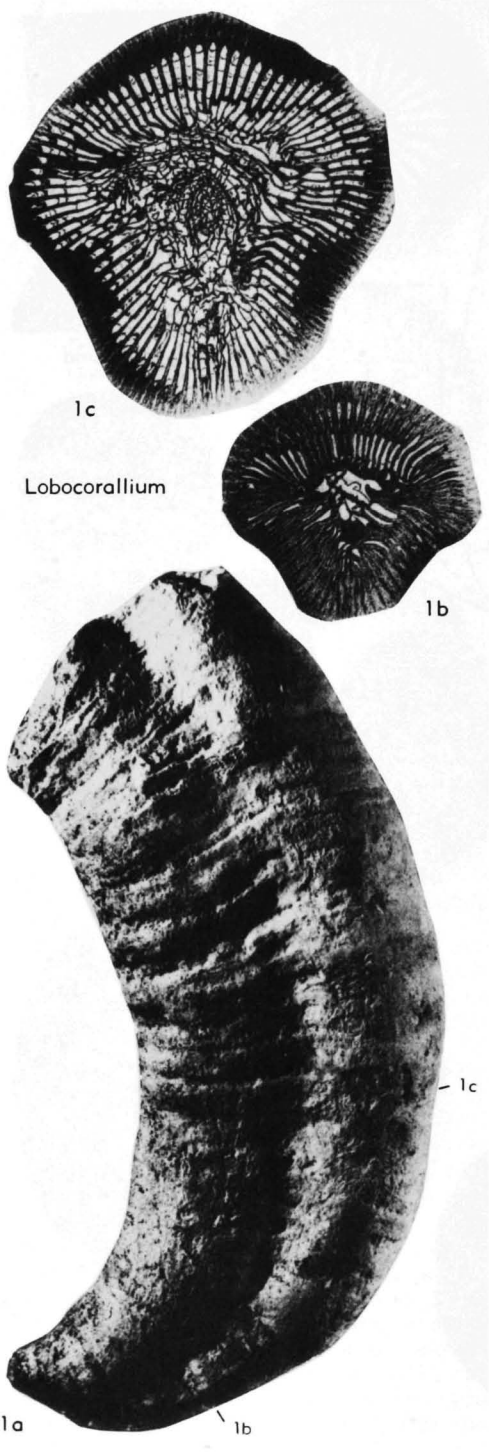


FIG. 88. Streptelasmatidae (p. *F*158).

late stages thin; a few septal lobes present; in axial parts of corallum some major septa form more or less solid axial structure that does not form calicular boss; in peripheral parts thick major and minor septa form peripheral stereozone; fossula commonly indistinct; tabulae sparse, mostly incomplete [see WEYER, 1973a, p. 41; NEUMAN, 1975, p. 337]. *M.Ord.-L.Sil.(low.Llandov.)*, Eu.(Est.-Nor.-Swed.)-Asia(China)-S.Am.(Venez.). ——FIG. 87,*2a-h*. **L. reimani*, holotype, M.Ord. (Vasalemm.), Est., Rakvere; *a-d*, transv., *e*, long. secs., all diagram. (Neuman, 1975); *f*, long., *g,h*, transv. secs., ×1 (Kaljo, 1956b).

Lobocorallium NELSON, 1963, p. 34 [**Streptelasma rusticum* var. *trilobatum* WHITEAVES, 1895, p. 113; syntypes not traced, never figured]. Corallum solitary, curved, with two broad longitudinal furrows, giving corallum trilobate appearance, each furrow with deepest part midwall in each cardinal quadrant; cardinal fossula long, narrow, open, on convex side of corallum; septa variably thickened, numerous, major long, their axial edges with vermiform lobes and lamellae that form with domed tabulae loose axial structure; minor septa buried in or extending but little from moderate peripheral stereozone; tabulae numerous, strongly arched. [In absence of syntypes, diagnosis framed on "*Lobocorallium trilobatum* var. *major*" of NELSON, 1963, p. 35.] *U.Ord.*, N.Am.(Manit.-Baffin I.-Greenl.-?Anticosti).——FIG. 88,*1a-c*. *L. trilobatum* var. major NELSON; *a*, Stony Mt. F., Manit., Stony Mt., ×0.75; *b,c*, holotype, transv. secs. at places indicated in *a*, ×1.0 (Nelson, 1963).

?**Ogilvilasma** PEDDER, 1978, p. 44 [**O. discors*; OD; †46098, GSC, Ottawa]. Corallum solitary, cardinal side convex; marginarium a septal stereozone; cardinal and counter septa long in early stages, short in late stages, major septa sinuous, amplexoid, flanged; minor septa short, locally with acanthine axial edges; tabularium wide, tabulae mesa-shaped in longitudinal section. [Possibly mucophyllid.] *L.Dev.(low.Zlichov.)*, N.Am.(Yukon).

?**Parabrachyelasma** CHEREPNINA, 1960, p. 388 [**P. lebediense*; OD; †17/5, coll. 210, SNIIGGIMS, Novosibirsk]. Corallum dendroid to fasciculate, increase lateral; corallites cylindrical, each with narrow peripheral stereozone; septa laminar, each composed of contiguous parallel trabeculae, thinning adaxially; in adult stages major septa do not reach axis but their interlaced axial ends form loose axial structure; minor septa short; tabulae convex. [WEBBY, 1972, p. 152, considers this genus a synonym of *Palaeophyllum* BILLINGS, 1858, but transverse section of the holotype appears to show streptelasmatid septal lobes and lamellae in axial zone.] *U.Ord.*, Asia(Mt.Altay). ——FIG. 87,*1a,b*. **P. lebediense*, holotype, R. Lebed; *a*, transv. sec., ×3 (Ivanovskiy, 1969); *b*, long. sec. of single corallite, ×2 (Cherepnina, 1960).

?**Paramplexoides** HE in KONG & HUANG, 1978, p. 44

[**P. cylindricus*; OD; †KO96-KO99, museum not traced; U.Ord., up. Wufeng F., Chandi Xian (county), Guizhou (Kweichow)]. Solitary; septa thin, major moderately long, somewhat waved, minor very short; tabulae adaxially declined, commonly complete. [Diagnosis tentative, from illustrations.] *U.Ord.*, Asia(Kweichow).

?**Pterophrentis** Ivanovskiy, 1963, p. 53 [**P. allae*; OD; †24, coll. 305, IGG, Novosibirsk] [?=*Tungussophyllum* Ivanovskiy, 1959, p. 897, see *?Densiphrentis, Rhegmaphyllum* Ivanovskiy, 1970, p. 121; Weyer, 1974a, p. 157]. Corallum solitary, with narrow peripheral stereozone and long cardinal fossula lenticular in section, bisected by long cardinal septum and lined by thickening on neighboring septa; septa thickened, especially in cardinal quadrants; axial ends of metasepta pinnately curved with regard to cardinal and alar septa, and may not attain axis; minor septa short; tabulae rare, complete; no dissepiments; [presence of axial lobes unproved]. *L.Sil.(low.Llandov.)*, Asia(Sib.Platf.).——Fig. 87,*5a,b*. **P. allae*, holotype, R. Stony Tunguska; *a,b*, long., transv. secs., ×4 (Ivanovskiy, 1965a).

?**Pycnactoides** He in Kong & Huang, 1978, p. 52 [**P. marginotabulatus*; OD; †KO43-KO45, museum not traced; U.Ord., up. Wufeng F., Bijie, Guizhou (Kweichow)]. Solitary; septa numerous, thickened, with axial ?lobes, and possibly amplexoid; tabular floors concave, tabulae ?complete; no dissepiments. [Diagnosis tentative, from illustrations suggesting in places that septa may be of discrete to contiguous monacanths as in *Hillophyllum* Webby, 1971, Cystiphyllida, Tryplasmatidae.] *U.Ord.*, Asia(Kweichow).

Rectigrewingkia Kaljo, 1961, p. 62 [**Grewingkia anthelion* Dybowski, 1873c, p. 388; OD; †probably lost, orig. fig. Dybowski, 1873c, pl. 2, fig. 6; lectotype by Kaljo, 1961, p. 62] [?=*Grewingkia* Dybowski, 1873c, which see; see Neuman, 1969, p. 35; Weyer, 1972c, p. 450]. Like *Grewingkia* but with septal lobes uniform and erect, forming wide, open axial structure protruding as low calicular boss and granular in transverse section. *U.Ord.*, Eu.(Est.).——Fig. 89,*3a,b*. **R. anthelion* (Dybowski); *a*, lectotype, Wormsi horizon, Palukyula, Est., lateral view, ×1 (Dybowski, 1873c); *b*, another specimen, F_1b, Paopä, Est., transv. sec., ×2 (Kaljo, 1961).

Rhegmaphyllum Wedekind, 1927, p. 14 [**"Regmaphyllum turbinatum* (Hisinger)," questionably =*Zaphrentis? conulus* Lindström, 1868, p. 428; SD Soshkina, 1937, p. 85, see Lang, Smith, & Thomas, 1940, p. 114, also Weyer, 1974a, p. 159; †selection of type should be made only after detailed study of Hisinger's and Wedekind's material] [=*Regmaphyllum* Wedekind, 1927, p. 74, *nom. null.*; *Rhegmatophyllum* Lang, Smith, & Thomas, 1940, p. 114, *nom. van.*; *?Tungussophyllum* Ivanovskiy, 1959, p. 897 (type, *Zaphrentis? conulus* Lindström, 1868, p. 428, OD; †Cn5942, RM, Stockholm; Sil., Gotl.); *?Densiphylloides* Ge & Yü, 1974, p. 166 (type, *D. yichangensis*, M; †22064-6, IGP, Nanking; L.Sil., Peng Jai F., Hupei, Yichang)]. Solitary, relatively small, erect-conical, with infundibuliform calice; septa radially arranged, thick in early stages, thinning distally; axial ends of major septa connected in groups that

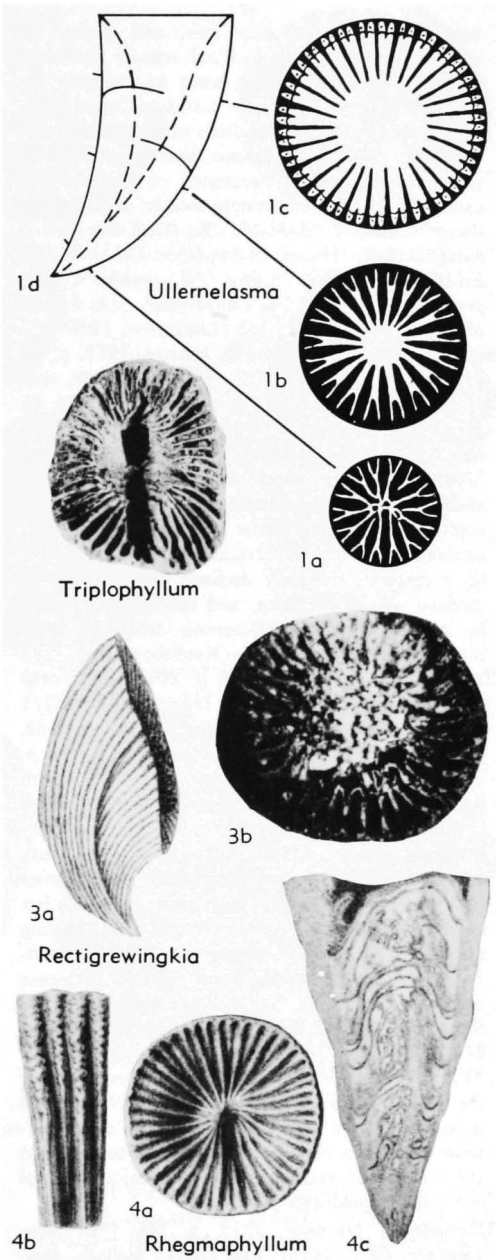


Fig. 89. Streptelasmatidae (p. *F*159-*F*160).

vary distally, at or near axis, and giving off vermiform axial lobes; cardinal septum shortened in fossula in calice and in some immediately below calice; septal trabeculae associated with sculpturing of distal edge and faces of peripheral parts of septa; fossula may open into axial tabulate space; tabulae axially horizontal or slightly concave, peripherally moderately steeply declined; no dissepiments. *L.Sil.-M.Sil.*, Eu.(Gotl.-Est.-U.K.)-Asia(Sib.Platf.-?Hupei)-N.Am.(Que.-Cal.); *?U.Sil.*, Eu.(Gotl.).——Fig. 89,*4a-c*. **R. conulus* (Lindström), M.Sil., Gotl.; *a*, calical view, ×2; *b*, part of *a*, ×4; *c*, long. sec., ×2 (Lindström, 1896b).

Siphonolasma He in Kong & Huang, 1978, p. 43 [**S. obliquitabulatum*; OD; †YO143-YO148, museum not traced, chosen by He, 1978, p. 42; U. Ord., up. Wufeng F., Bijie, Guizhou (Kweichow)]. Solitary; cardinal side concave, cardinal fossula very deep; septa thick, major septa long and somewhat ?amplexoid, axial edges ?lobed, confluent in groups; minor septa moderately long, confined to peripheral stereozone; tabulae complete or incomplete, obliquely declined from counter to cardinal side of corallum, and markedly deepened in cardinal fossula. [Diagnosis tentative, from illustrations.] *U.Ord.*, Asia(Kweichow).

Triplophyllum Simpson, 1900, p. 209 [**Zaphrentis terebrata* Hall, 1883, p. 316; OD; †3841/1 (=341), NYSM, Albany (original Hall, 1883, pl. 23, fig. 5); lectotype by Simpson, 1900, p. 209]. Solitary, curved-conical; calice deep, with deep narrow fossula on concave? side, bounded by unfused adjacent metasepta and occupied by cardinal septum with distal edge lower than others; septal insertion accelerated in counter quadrants; major septa long, but in very late stages withdrawn somewhat from axis, leaving axial space floored by tabula; minor septa short, ?no dissepiments; tabular floors domed. [Presence or absence of axial septal lobes unknown. See Stumm, 1965, p. 22; Easton, 1944b, p. 38.] *M.Dev.(Eifel.)*, N.Am.(Ind.-Ky.).——Fig. 89,*2*. **T. terebratum* (Hall), holotype, M.Dev., Falls of the Ohio; calical view, ×1 (Easton, 1944b). [It is assumed from this photograph that the uppermost tabula has been broken between the axis and the withdrawn axial edges of the major septa of the counter quadrants.]

Ullernelasma Neuman, 1975, p. 346 [**U. svartoeyense*; OD; †16761, PM, Oslo]. Solitary, conical to cylindrical, cardinal side convex; in early stages septa strongly dilated, almost filling lumen, major septa long, may be fused in weak axial structure with few septal lobes; in late stages major septa short and thin, axial structure absent and peripheral stereozone moderately wide, minor septa extending but little beyond it; tabulae few, incomplete. *U.Ord.(5b)*, Eu.(Nor.).——Fig. 89, *1a-d*. **U. svartoeyense*, holotype, Vestre Svartøy, Ringerike; *a-c*, transv., *d*, long. secs., all diagram., approx. ×1.5 (Neuman, 1975).

Subfamily NEVADAPHYLLINAE Hill, new subfamily

Solitary, large; marginarium wide, peripherally an irregular septal stereozone and adaxially a variably wide dissepimentarium with distinctive long, irregular, adaxially declined dissepiments; fossula large, deep, expanding adaxially where it penetrates axial structure of convolute and lobed major septal ends and domed tabularial floors. *L.Dev.(Ems.)*

Nevadaphyllum Stumm, 1937, p. 429 [**N. masoni*; OD; †94447, USNM, Washington]. Solitary; septa numerous, long; cardinal fossula long, expanding adaxially, with short cardinal septum and with deeply depressed floor; septa dilated in marginarium to form wide, somewhat irregular peripheral stereozone in which few interseptal loculi remain, with elongate dissepiments; major septa thinner in tabularium, attaining axial region and somewhat convolute; tabular floors axially depressed domes, their peripheral edges curved so that periaxial trough is formed; tabulae incomplete, of numerous tabellae. *L.Dev.(Ems.)* [see also Merriam, 1974, p. 44], N.Am.(Nev.).——Fig. 90,*3a,b*. **N. masoni*, paratype, basal 500 ft. of Nevada Ls., Nev., Lone Mt., 18 mi. NW. of Eureka; *a,b*, transv., long. secs., ×1.3 (Hill, n; photographs courtesy W. A. Oliver, USNM94447a).

Subfamily DINOPHYLLINAE Wang, 1947

[*nom. transl.* Lecompte, 1952, p. 462, *ex* Dinophyllidae Wang, 1947a, p. 174]

Solitary, moderately large; major septa long, in late stages thin, forming with septal lamellae and conical or domed tabulae an axial structure that projects as calical boss; cardinal fossula shallow, broad, open, on convex side; minor septa short, no dissepiments. *L.Sil.-?M.Sil.-U.Sil.-?base of Dev.*

Dinophyllum Lindström, 1882b, p. 21 [**D. involutum*; M; figured syntypes Cn44a, 20687-20693, 55155-55157, RM, Stockholm] [=*Streptophyllum* Grabau in Chi, 1931, p. 24 (type, *Clisiophyllum hisingeri* Milne-Edwards & Haime, 1851, p. 410, SD Lang, Smith, & Thomas, 1940, p. 125; †Z99ter.b, MN, Paris, lectotype by Lang, Smith, & Thomas, 1940, p. 125; =*Dinophyllum involutum* Lindström, 1882b, p. 21; *?Neobrachyelasma* Nikolaeva, 1960, which see; *?Porfirieviella* Ivanovskiy, 1963, which see; *?Tenuilasma* Ivanovskiy, 1965a, which see]. Solitary, curved, conical or conicocylindrical coralla, cardinal fossula moderately deep and wide, on convex side; major septa long, thin in late stages, reaching to axis where, with or without convolution of their axial ends, they form an axial struc-

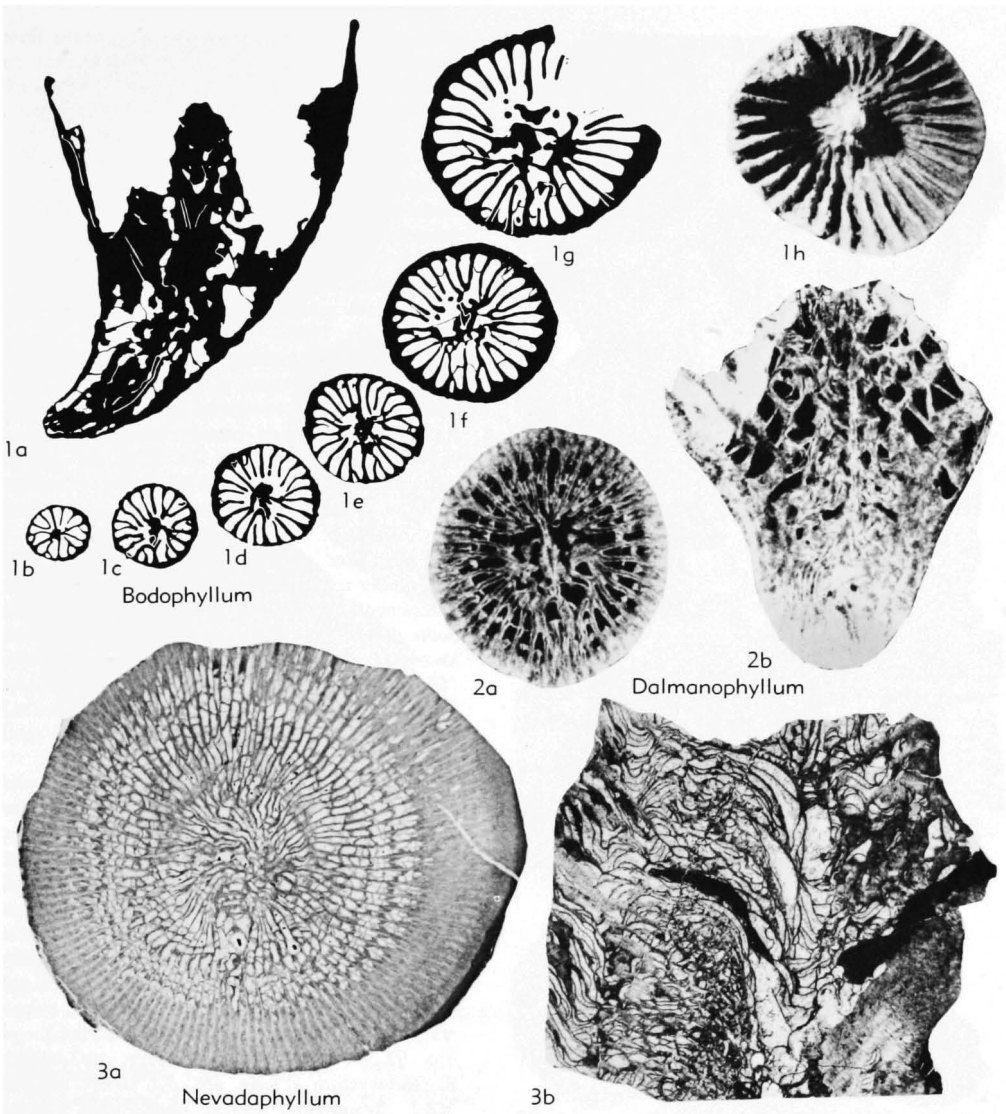


FIG. 90. Streptelasmatidae (p. *F*160, *F*163-*F*164).

ture (and calical boss) with steeply conical tabulae, septal lamellae, ?and vermiform lobes; minor septa extremely short; no dissepiments. *L.Sil.*, Eu. (Gotl.-Nor.-Vaygach I.)-Asia (Sib.Platf.)-Australia(Queensl.); *?M.Sil.*, Eu.-Asia(Sib.Platf.)-Australia(Queensl.).——FIG. 91,*2a-c*. **D. hisingeri* (MILNE-EDWARDS & HAIME), L.Sil., Gotl.; *a,c,* calical views, ×1; *b,* long. sec., ×2 (Lindström, 1896b).

?Crassilasma IVANOVSKIY, 1962, p. 126 [**C. simplex*; OD; †68b, coll. 2, SNIIGGIMS, Novosibirsk, holotype lost; neotype, 71, coll. 305, IGG, Novosibirsk, by IVANOVSKIY, 1976, p. 47]. Corallum solitary, major septa long, thick, and radially arranged peripherally, but thinning somewhat and twirling adaxially in groups; minor septa rudimentary; [presence or absence of axial septal lobes unclear]; fossula indistinct; tabulae sparse, flat or slightly concave or convex; dissepiments absent. *L.Sil.*, Asia(Sib.Platf.-Szechwan)-?Eu.(U.K.-Vaygach I.).——FIG. 91,*3a-d*. **C. simplex*, up. Llandov., Asia, R. Moyero; *a,* long., *b-d,* transv. secs., ×2 (Ivanovskiy, 1962).

Neobrachyelasma NIKOLAEVA in MARKOVSKIY, 1960, p. 220 [**N. balchaschica*; OD; †1, coll. 5747, TsGM, Leningrad] [?=*Dinophyllum* LINDSTRÖM, 1882b, which see, IVANOVSKIY, 1970, p. 121]. Large, solitary, conical or conicocylindrical; calice

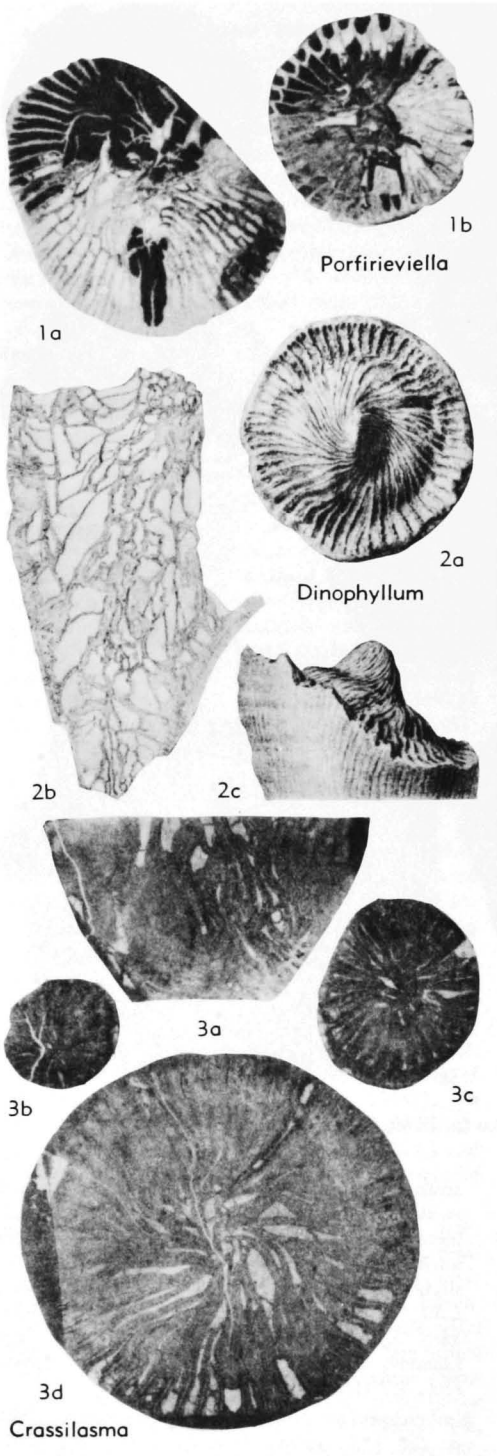


FIG. 91. Streptelasmatidae (p. *F*160-*F*162).

deep, with steep walls and convex-concave floor, fossula not strongly marked; an insignificant peripheral stereozone; major septa thin, long, spirally curved, ends or ?lobes or ?lamellae coiled in wide axial structure; minor septa short; tabulae complete or incomplete, convex in marginal zone and concave at axis and connected to one another in batteries of omphymoid character; dissepiments ?absent. *U.Sil.* or *?L.Dev.*, Asia (N.L.Balkash area-Altay).——FIG. 92,*1a,b*. **N. balchaschicum*, holotype, Aynasu horizon, Tokrau-Kenterlau Interfluve, L. Balkhash area; *a,b*, transv., long. secs., ×1.3 (Markovskiy, 1960).

?**Porfirieviella** IVANOVSKIY, 1963, p. 39 [**Zaphrentis stokesi* MILNE-EDWARDS & HAIME, 1851, p. 330, *sensu* SHROCK & TWENHOFEL, 1939, p. 250, pl. 27, fig. 7-10; OD; †not traced; MILNE-EDWARDS & HAIME figured specimen is Z14a in MILNE-EDWARDS & HAIME Coll., MN, Paris] [?=*Dinophyllum* LINDSTRÖM, 1882b, which see, IVANOVSKIY, 1970, p. 121]. Solitary, conical, erect to curved; major septa reach or nearly reach axis where they may coil somewhat; minor septa short; dissepiments may occur in late stages; tabular floors domed to conical, of tabellae. [Insufficiently known.] *L.Sil.*, N.Am.(Newf.)-?Eu.(Est.)-Asia (Sib.Platf.).——FIG. 91,*1a,b*. **P. stokesi* (MILNE-EDWARDS & HAIME *sensu* SHROCK & TWENHOFEL), Pike Arm F., Newf.; *a,b*, transv. secs. of 2 specimens, ×1 (Shrock & Twenhofel, 1939).

Tenuilasma IVANOVSKIY, 1965a, p. 103 [**T. tenue*; OD; †in coll. 236, IGG, Novosibirsk] [?=*Dinophyllum* LINDSTRÖM, 1882b, which see, IVANOVSKIY, 1970, p. 121]. Solitary, with thin metasepta arranged pinnately in relation to short, thin cardinal and counter septa; minor septa thin, very close to major septa on their counter sides; tabulae domed, commonly with supplementary tabellae, especially peripherally; dissepimentlike plates possibly present in narrow minor septal loculi, normal tabulae in wider ones. *L.Sil.*, Asia (Sib.Platf.).——FIG. 92,*2a-c*. **T. tenue*, holotype, up.Llandov., R. Gorbiyachin; *a*, long. sec., *b,c*, transv. secs., all ×2.7 (Ivanovskiy, 1965a; photographs courtesy A. B. Ivanovskiy).

Subfamily DALMANOPHYLLINAE Lecompte, 1952

[Dalmanophyllinae LECOMPTE, 1952, p. 464]

Solitary, not large, curved, cardinal side convex; with axial structure dominated by median plate continuous in early stages with cardinal and counter septa, but disconnected from one or both in late stages, when cardinal septum may shorten; major septa with axial vermiform lobes or septal lamellae that may conjoin in axial structure; minor septa short; tabulae complete or incomplete, somewhat declined abaxially; no dissepiments. *U.Ord.-M.Sil.*

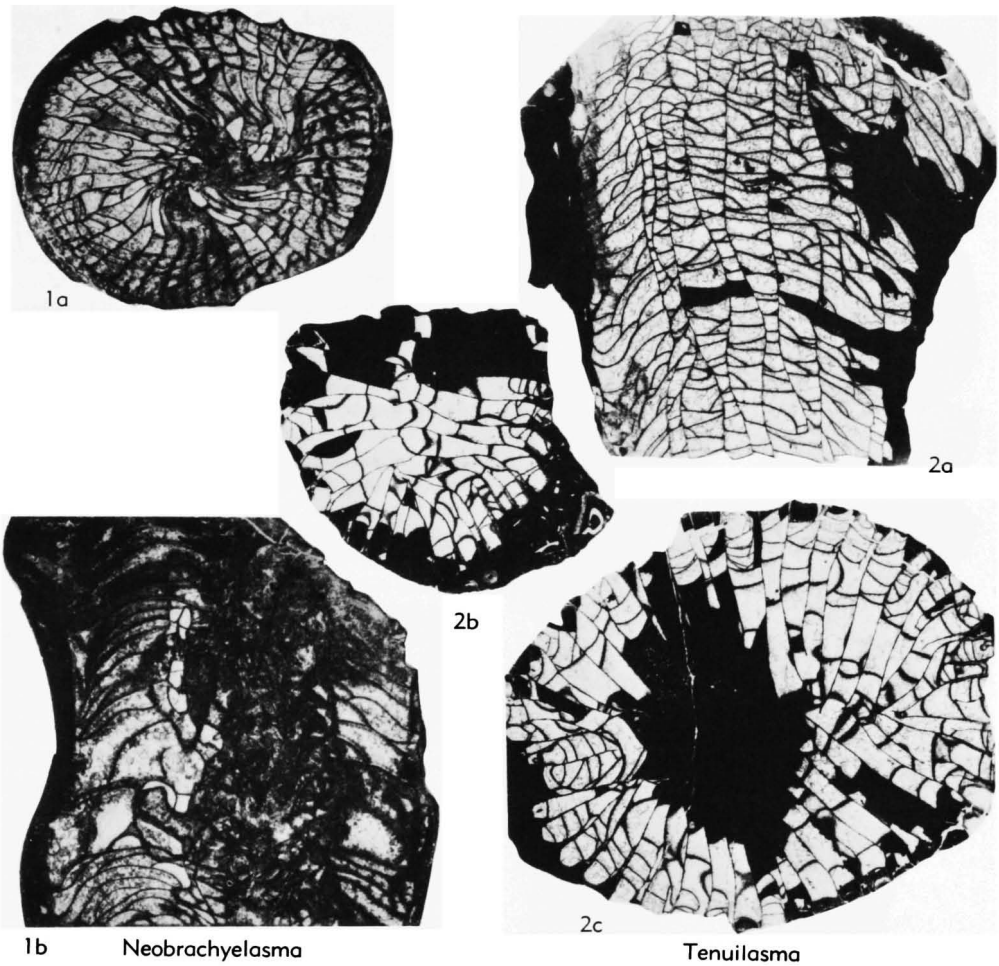


FIG. 92. Streptelasmatidae (p. *F*161-*F*162).

Dalmanophyllum LANG & SMITH, 1939, p. 153 [**Cyathaxonia dalmani* MILNE-EDWARDS & HAIME, 1851, p. 322; OD; figured syntype, 704, DE VERNEUIL Coll., EM, Paris (S. SMITH, 1930, *in litt.*)] [=*Centrotus* LINDSTRÖM in THOMSON & NICHOLSON, 1876a, p. 128 (type, *Cyathaxonia dalmani* MILNE-EDWARDS & HAIME, 1851, M), *non Centrotus* FABRICIUS, 1803, a hemipteron; *?Protyria* COTTON, 1973, p. 166, *nom. subst. pro Tyria* SCHEFFEN, 1933, p. 33 (type, *T. inserta*, OD; †74640, PM, Oslo, lectotype by LANG, SMITH, & THOMAS, 1940, p. 136; Zone 5b, Lilla Svartø, Tyrifjord), *non Tyria* HUEBNER, 1819, a lepidopteron]. Solitary or (in *Protyria*) ?compound, calice deep with large, bladelike columellar boss, elliptical in section; major septa long and thick with axial lobes joining columella, which is upwardly produced part of conjoined cardinal and counter septa; cardinal septum in fossula on convex side of corallum, and shortened in late stages; minor septa very short, peripheral stereozone narrow; tabulae thin, steeply declined abaxially [see MINATO, 1961, p. 85]. *L.Sil.-M.Sil. (low.Wenlock.)*, Eu.(Gotl.-U.K.); *L.Sil.*, N.Am. (Cal.); *M.Sil.*, ?N.Am.(Ind.-Ky.-Wis.).——FIG. 90,*2a,b*. **D. dalmani* (MILNE-EDWARDS & HAIME), Gotl.; *a,b*, transv., long. secs., ×2.7 (Minato, 1961).

Bodophyllum NEUMAN, 1969, p. 54 [**B. osmundense*; OD; †D1292, PM, Uppsala]. Solitary, small to medium-sized; ceratoid, trochoid, or subcalceoloid; cardinal side convex; calice deep with prominent calicular boss rounded or elliptical in transverse section; axial structure solid, fairly narrow, of septal lobes, ?synapticulae, and few lamellae originating from long major septa; minor septa short, peripheral stereozone narrow; tabulae few, domed, incomplete or complete [see WEYER, 1974a, p. 158]. *U.Ord.*, Eu.(Nor.-Swed.-?Scot.-?Eire-?Wales).——FIG. 90,*1a-h*. **B. osmundense*,

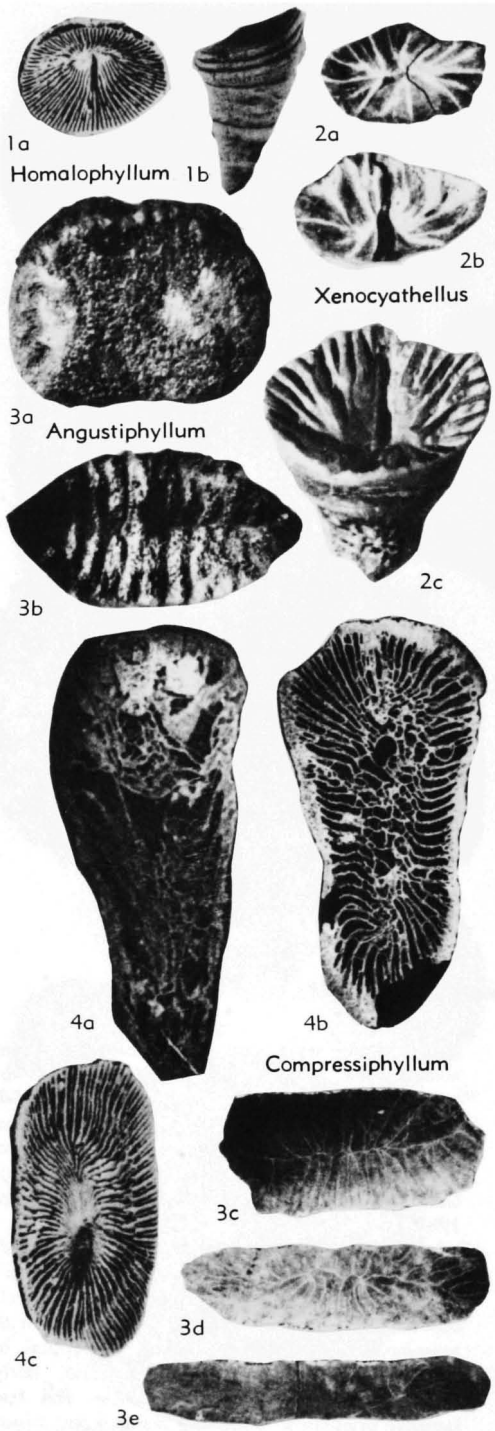


FIG. 93. Streptelasmatidae (p. *F*164-*F*165).

Boda Ls., Swed., Osmundsberg, NE. Quarry, Siljan distr.; *a*, topotype, long. sec., ×2.7; *b-g*, topotype, serial transv. secs., ×2.7; *h*, holotype, calicular view, ×2.0 (Neuman, 1969).

Subfamily HOMALOPHYLLINAE Altevogt, 1965

[Homalophyllinae ALTEVOGT, 1965, p. 87] [=Homalophyllidae WEYER, 1971c, p. 1027]

Small, compressed or calceoloid streptelasmatids ?without axial septal lobes. *L. Dev.-M.Dev.* Grouping very tentative.

Homalophyllum SIMPSON, 1900, p. 221 [**Zaphrentis ungula* ROMINGER, 1876, p. 151; OD; †8619, UMMP, Ann Arbor; see STUMM, 1965, p. 23]. Solitary, at least in early stages calceoloid, with flattened side cardinal, or somewhat compressed in alar septal plane; septa numerous, long, thickened to contiguity in wide marginarium and in axial region, but in calice may leave narrow trenchlike space in alar septal plane; counter septum taller or thicker, cardinal septum less tall, than others; cardinal septum in deep fossula extending to axis into axial zone of septal thickening that forms nonspongy axial structure; no dissepiments, minor septa not contratingent [see OLIVER, 1958, p. 819; SCHINDEWOLF, 1938, p. 451]. *L.Dev.*, N.Am.(Ind.-Ky.).——FIG. 93,*1a,b*. **H. ungula* (ROMINGER), holotype, L.Dev., Jeffersonville Ls., coral zone, Ind., Falls of the Ohio; *a,b*, calical side views, ×1 (Stumm, 1965).

Angustiphyllum ALTEVOGT, 1965, p. 88 [**A. cuneiforme*; OD; †B.28, type coll., GPI, Münster/Westfalen]. Corallum small, solitary, sphenoid; no epitheca preserved; calical edges of septa sloping down toward wall, calice without axial deepening; major septa thick, almost completely contiguous, directed toward and meeting at long axial plane of wedge; cardinal septum in middle of broad side of wedge; minor septa stunted to ?absent; no coarse septal trabeculae observed; tabellae rare. *M.Dev.(Eifel.)*, Eu.(Spain).——FIG. 93,*3a-e*. **A. cuneiforme, Gosseletia* Ss., Spain, Playa de Candas, Prov. Oviedo; *a,b*, holotype, lat., calicular views, ×2; *c-e*, paratype, transv. secs., ×2 (Altevogt, 1965).

Compressiphyllum STUMM, 1949, p. 13 [**Zaphrentis compressa* ROMINGER, 1876, p. 151; OD; †8620, UMMP, Ann Arbor, see STUMM, 1965, p. 22; =*Zaphrentis davisana* MILLER, 1889, p. 209, *nom. subst.; non Z. compressa* MILNE-EDWARDS, 1860, p. 342]. Solitary, compressed parallel to countercardinal plane; cardinal fossula deep, long; septa dilated peripherally to form narrow peripheral stereozone, elsewhere attenuate; major septa extending almost to axis, minor septa reaching but little beyond stereozone; cardinal septum long, but distally shortened in calice; axial edges of septa ?with lobes; tabulae arched periaxially; no dissepiments [see also OLIVER, 1958, p. 826]. *L.Dev.*, N.Am.(Ind.-Ky.).——FIG. 93,*4a-c*. **C.*

davisanum (MILLER), L.Dev., Jeffersonville Ls., coral zone, Ind., Falls of the Ohio; *a,b,* topotypes, long., transv. secs., ×1.5 (Oliver, 1958); *c,* holotype, calical view, ×1.0 (Stumm, 1965).

Xenocyathellus BASSLER, 1937, p. 196 [**Homalophyllum thedfordense* STEWART, 1936, p. 879; OD; †17996, OSU, Columbus]. Very small, calceoloid, flattened and attached on cardinal side; cardinal fossula large, contracted near periphery, with cardinal septum short in mature calice; septa thickened and contiguous in early stages, filling lumen; minor septa short; axial edges of major septa grouped, joining in quadrants, counter quadrants with fewer septa; septal trabeculae not recognized; ?no tabulae. *M.Dev.(Givet.),* N.Am.(Ont.).——FIG. 93,*2a-c.* **X. thedfordensis* (STEWART), Hamilton-Arkona beds, Ont., Dam, Aus Sables R., mouth of Rock Glen, Arkona; *a,b,* paratype, transv. secs., ×2; *c,* holotype, calicular view, ×2 (Altevogt, 1965).

Subfamily ENTEROLASMATINAE Hill, new subfamily

Solitary, with spongy axial structure of corrugated and variably fused axial ends of major septa, of vermiform axial lobes or lamellae, and of ?synapticulae; major septa carinate or waved parallel to distal edges; minor septa short; fossula may be indistinct; tabulae domed; no dissepiments. *U. Sil.-L.Dev.*

Enterolasma SIMPSON, 1900, p. 203 [**Streptelasma strictum* HALL, 1874, p. 114; OD; syntypes, 258-259, 11051-11053, NYSM, Albany, and 2283, AMNH, New York] [?=*Palaeocyathus* FOERSTE, 1888, which see, but in U.Sil. species *E. waynense* (SAFFORD), thin tabular films appear parallel to distal edges of septa; *Enterelasma* LANG, SMITH, & THOMAS, 1940, p. 58, *nom. van.*]. Small, cylindroconical, commonly erect; narrow peripheral stereozone formed by thickening of peripheral ends of major and short minor septa; major septa ridged, furrowed or waved parallel to distal edges, their axial edges lobed and variably coalescent; axial edges of minor septa free; cardinal and counter septa long; tabulae domed, or, in some, tabular films parallel to distal edges of septa [see SUTHERLAND, 1965, p. 22; WEYER, 1974a, p. 161]. *U.Sil.-L.Dev.,* N.Am.(N.Y.-Okla.-Tenn.); *L.Dev.(Ems.),* Eu.(Spain).——FIG. 94, *3a,b.* **E. strictum* (HALL), L.Dev.(Helderberg.), N.Y., Clarksville; *a,* natural long. sec., enl.; *b,* axial ends of major septa in natural transv. sec., enl. (Simpson, 1900).

Palaeocyathus FOERSTE, 1888, p. 129 [**Cyathophyllum australe,* p. 128; SD LANG, SMITH, & THOMAS, 1940, p. 94; †R26519, BM(NH), London; lectotype by HILL, 1940c, p. 410] [?=*Enterolasma* SIMPSON, 1900, which see; *Orthopaterophyllum*

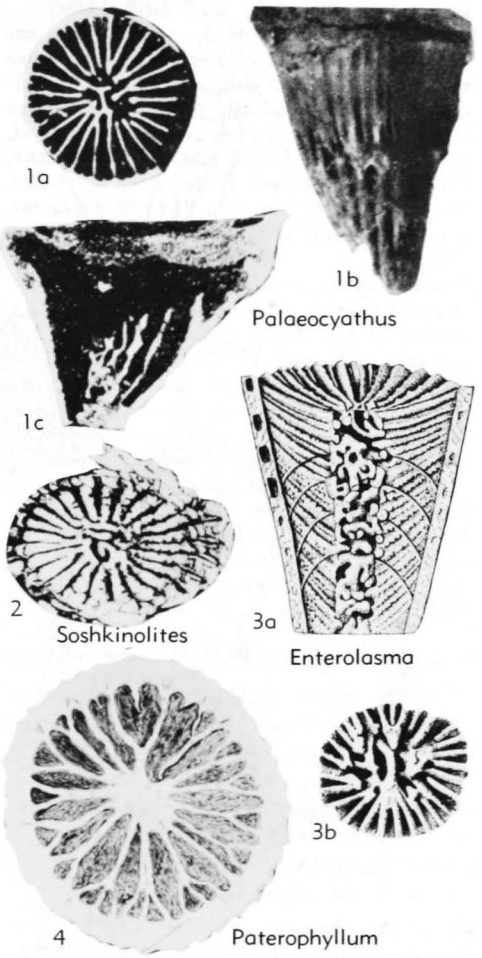


FIG. 94. Streptelasmatidae (p. *F165-F166*).

NIKOLAEVA in BULVANKER, 1952b, p. 7 (type, *O. kazakhstanicum,* not described or figured until NIKOLAEVA in MARKOVSKIY, 1960, p. 221, OD; †4, coll. 5747, TsGM, Leningrad; U.Sil. or basal Dev., Aynasu horizon, C. Kazakh.)]. Solitary, small, conical, slightly curved; major and minor septa straight, moderately thick, contiguous in narrow peripheral stereozone; without dissepiments; major septa unequal, may be carinate parallel to their distal edges, almost reaching axis, their axial ends lobate and somewhat swollen, those of neighbors variably joined to form loose axial structure; tabular cardinal fossula present; tabulae widely spaced, domed, complete or incomplete. *U.Sil.(Ludlov.),* Australia(New S.Wales); *U.Sil.* or *L.Dev.(Aynasu.),* Asia(C.Kazakh.).——FIG. 94,*1a-c.* **P. australis* (FOERSTE), New S. Wales, from trilobite bed of Rainbow Hill and Bellevale, near Yass; *a,b,* calical transv., long. secs. of two topotypes, ×2.7; *c,* lectotype, calical cast,

part skeleton, ext. view, ×2.7 (Hill, 1940c).

?Paterophyllum PŏCTA, 1902, p. 209 [**P. explanans*; SD GRABAU, 1928, p. 18; syntypes, unnumbered, BARRANDE Coll., NM, Prague]. Solitary, small, erect, conical; major septa meeting in axial structure; ?minor septa contratingent, short; tabulae not known [see OLIVER & GALLE, 1971b, p. 95; WEYER, 1974a, p. 158]. *L.Dev. (G 1)*, Eu.(Czech.).——FIG. 94,*4*. **P. explanans*, syntype, Lochkov, G 1; transv. sec., enl. (Pŏcta, 1902).

?Soshkinolites ZHELTONOGOVA, 1965, p. 43 [**S. microcorallita*; M; †364, coll. 1508, ZSGUp, Novokuznetsk]. Small, conical, solitary; marginarium a stereozone that in late stages may be partly replaced by lonsdaleoid dissepiments; minor septa ?short; sides of major septa tuberculate or in places carinate; major septa not attaining axis, fringing an isolated axial structure composed of one or several curved lamellae, one ?derived from cardinal septum. [Incompletely known.] *U.Sil.(Ludlov.)*, Asia(Altay).——FIG. 94,*2*. **S. microcorallitus*, holotype, Chagyr Suite, NW. Altaya, Dragunskiy Spring; transv. sec., ×5.4 (Zheltonogova, 1965).

Subfamily BREVIPHYLLINAE Hill, new subfamily

Solitary; septa numerous, major septa withdrawn more or less from axis and amplexoid; minor septa long, projecting far into tabularium; long, steeply declined dissepiments may develop peripherally; fossula more or less distinct, cardinal septum short; tabular floors low domes with wide, flat or depressed axial parts. *L.Dev.*

Breviphyllum STUMM, 1949, p. 25 [**Amplexus lonensis* STUMM, 1937, p. 428; OD; †94445, USNM, Washington] [?=*Breviphrentis* STUMM, 1949, which see]. Solitary; septa numerous, major septa withdrawn about halfway from axis, minor septa half as long, cardinal fossula indistinct; inner plates between minor and major septa mostly concave outward and thus periaxial tabellae; true dissepiments sparse, in one incomplete to three series of steeply inclined plates; tabular floors wide, horizontal or with broad central depression, supplemented by periaxial tabellae. *L.Dev.(Ems.)*, N.Am.(Nev.).——FIG. 95,*3a,b*. **B. lonense* (STUMM), holotype, basal 500 ft. of Nevada Ls., Nev., Lone Mt.; *a,b*, long., transv. secs., ×2 (Stumm, 1937; photographs courtesy W. A. Oliver).

Breviphrentis STUMM, 1949, p. 13 [**Amplexus invaginatus* STUMM, 1937, p. 427; OD; †94443, USNM, Washington] [?=*Breviphyllum* STUMM, 1949, which see]. Solitary, ceratoid to subcylindrical; major septa moderately long, amplexoid, cardinal fossula distinct, with short cardinal septum; minor septa long, connected to major septa by periaxial tabellae only, dissepiments ?absent; tabular floors mesa-shaped, edges declined abaxially to wall or bent downward to join tabula next below [see MERRIAM, 1974, p. 42]. *L.Dev.(Ems.)*, N.Am.(Nev.).——FIG. 95,*1a,b*. **B. invaginata* (STUMM), holotype, low. beds Nevada F., Nev., Atrypa Peak, Eureka mining distr.; *a,b*, transv., long. secs., ×2 (Hill, n; photographs courtesy of W. A. Oliver).

Family DITOECHOLASMATIDAE Sutherland, 1965

[Ditoecholasmatidae SUTHERLAND, 1965, p. 35] [=Ditoecholasmatinae WEYER, 1972c, p. 452]

Solitary, small, with slender peripheral stereozone; septa long, somewhat thickened, may be waved or carinate parallel to distal edges; axial edges of major septa lobed and variably coalescent, forming loose axial structure; alternate (?minor) septa less long, contratingent; in contratingently enclosed interseptal loculi, horizontal skeletal elements commonly subparallel to distal edges of septa, i.e., declined somewhat adaxially; in alternate interseptal loculi, tabulae declined abaxially to wall; in all except four contratingencies [interpreted by SUTHERLAND as due to splitting of cardinal, counter and the two *Km* septa], two very short ridges ?(tertiary septa) projecting adaxially from wall; correspondence between median septal planes and longitudinal furrows on epithecate wall imperfect. *U.Sil.*

Ditoecholasma SIMPSON, 1900, p. 200 [**Petraia fanningana* SAFFORD, 1869, p. 320; OD; †missing, *fide* SUTHERLAND, 1965, p. 36] [=*Ditoechelasma* LANG, SMITH, & THOMAS, 1940, p. 53, *nom. van.*]. Characters as for family. *U.Sil.(Ludlov.)*, N.Am. (Tenn.-Okla.).——FIG. 95,*2a,b*. **D. fanninganum* (SAFFORD), Brownsport F., Tenn.; *a,b*, long., transv. secs., ×3 (Amsden, 1949).——FIG. 95, *2c,d*. *D. lawrencense* SUTHERLAND, Henryhouse F., Okla.; *c,d*, diagram., transv. secs., showing septal pattern, ×15, ×9; 1, major septa; 2, minor septa; 3, ?third order septa added in position I (contratingently closed interseptal loculus) only; position II, in alternate interseptal loculi (Sutherland, 1965).

Family PALIPHYLLIDAE Soshkina, 1955

[Paliphyllidae SOSHKINA, 1955, p. 121] [=Paliphyllinae IVANOVSKIY, 1965a, p. 75]

Solitary, moderately large; septa numerous, long, trabecular axes distant; axial septal lobes or lamellae forming, with tabulae and tabellae, axial structure that may also contain medial plate or columella;

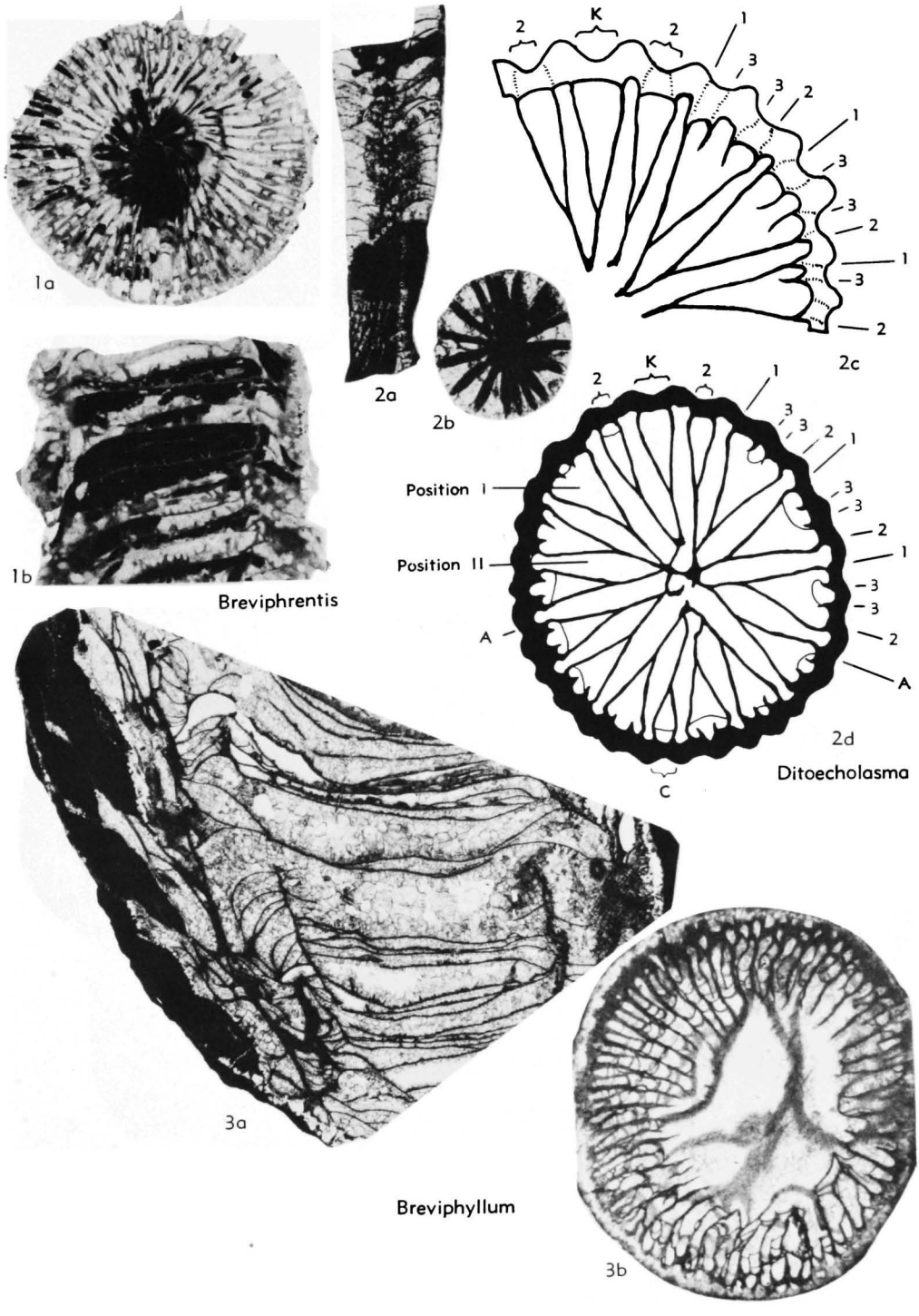


FIG. 95. Streptelasmatidae (1, 3); Ditoccholasmatidae (2) (p. *F166*).

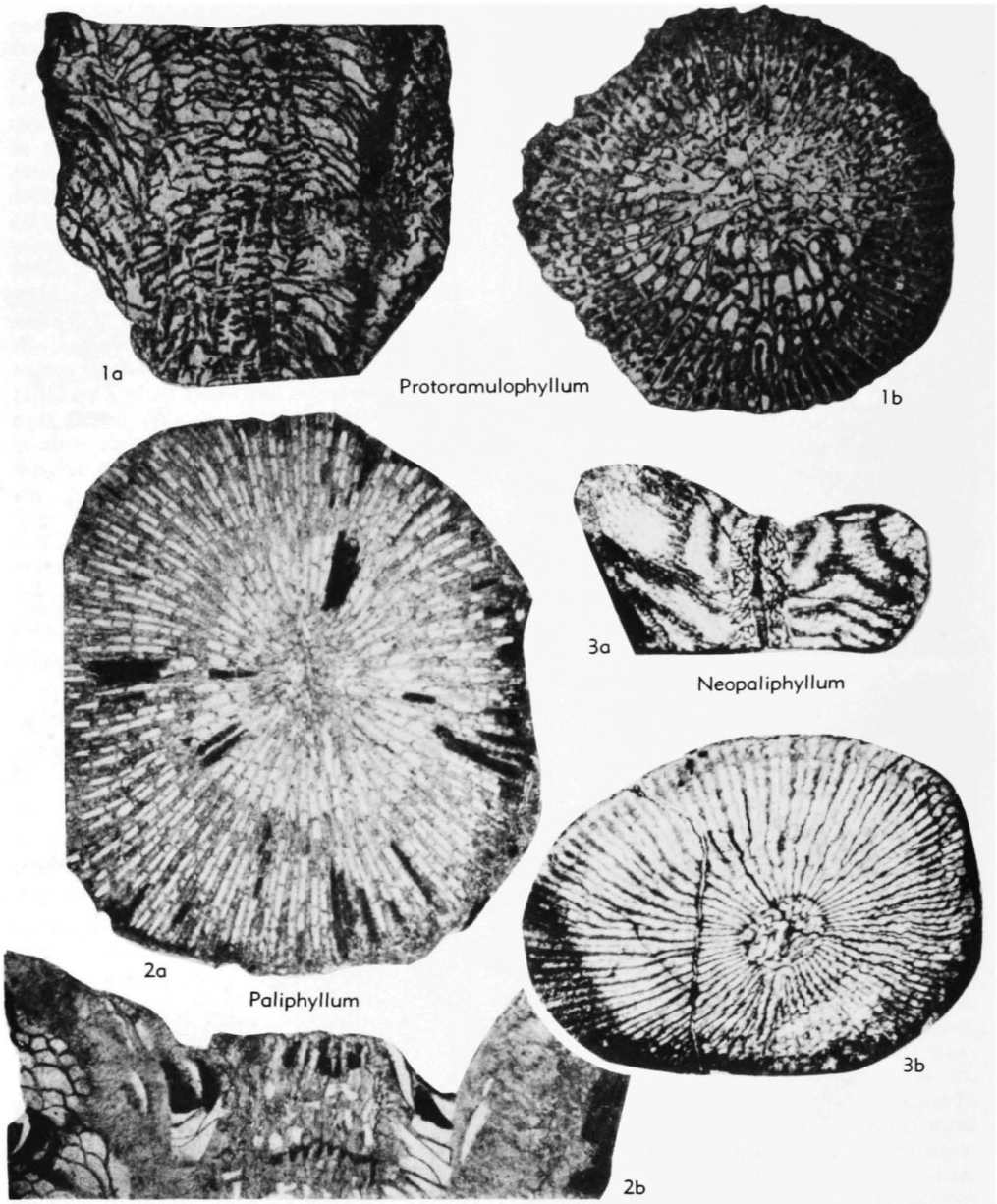


FIG. 96. Paliphyllidae (p. *F168-F171*).

minor septa may be contratingent, contraclined, or normal; tabular floors domed; marginarium a more or less wide dissepimentarium. *U.Ord.-M.Sil.*

Paliphyllum SOSHKINA in IVANOVA *et al.*, 1955, p. 121 [**P. primarium*; OD; †3057, coll. 587, PIN, Moscow] [?=*Sclerophyllum* REYMAN, 1956, which see, NEUMAN, 1968, p. 231; ?*Protocyathactis* IVANOVSKIY, 1961b, which see, IVANOVSKIY, 1970, p. 121]. Corallum solitary, conical, slightly curved, cardinal fossula on convex side, calice with broad axial boss; major and minor septa long, numerous, thickening slightly toward periphery, thinned adaxially; peripheral stereozone absent; cardinal septum in long, narrow fossula; cardinal and counter septum may be continuous and form, with interlaced axial ends and lamellae

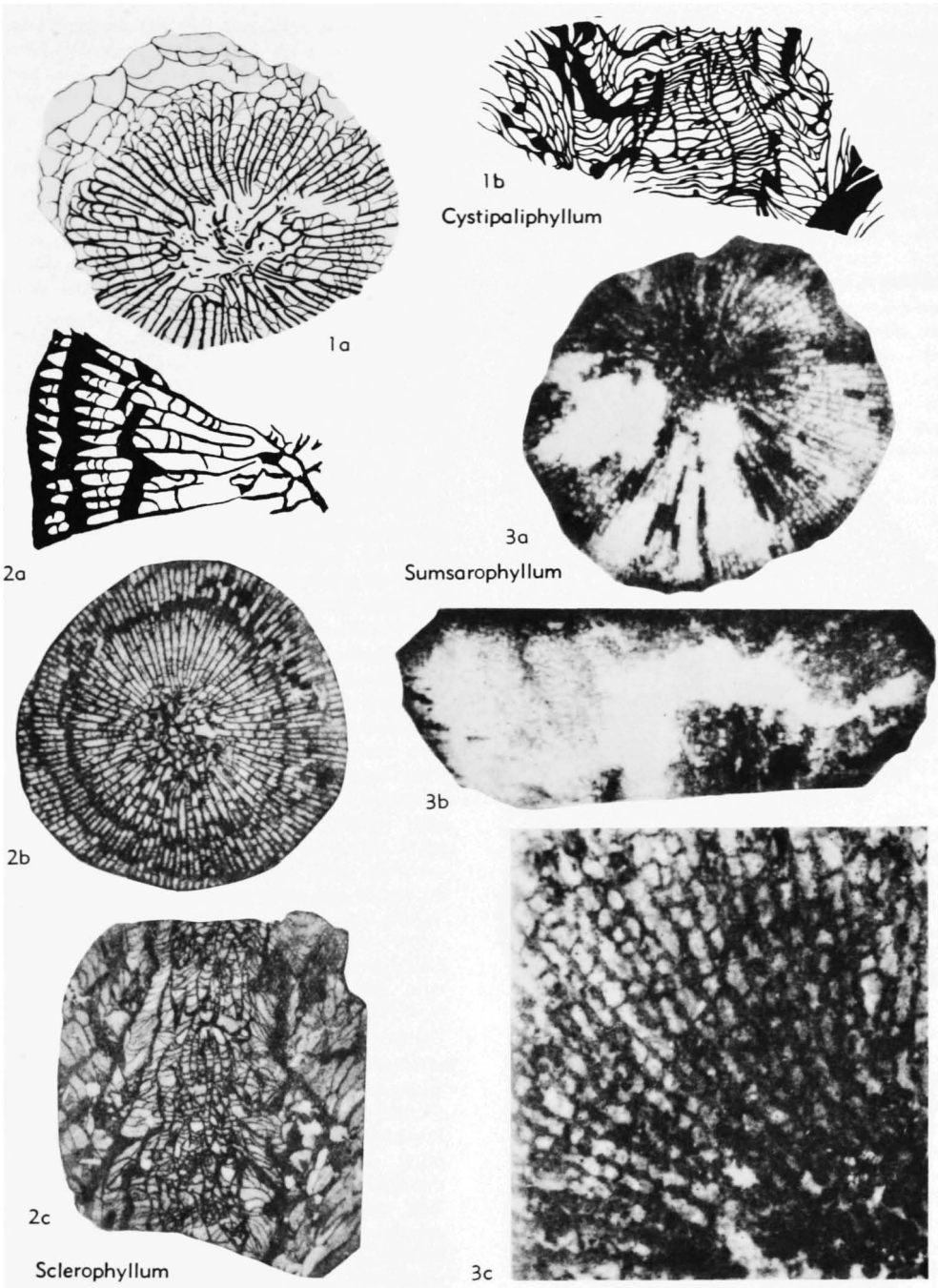


FIG. 97. Paliphyllidae (p. *F*170-*F*171).

from other major septa, an axial boss; tabular floors domed; dissepimentarium wide, of variably sized, somewhat globose dissepiments, moderately steeply inclined [see NEUMAN, 1968, p. 230]. *U.Ord.*, Asia(Sib.Platf.-Altay).——FIG. 96,*2a,b*.

**P. primarium*, holotype, up. Stolbor suite, Sib., R. Stony Tunguska; *a,b*, transv., long. secs., ×3 (Ivanova *et al.*, 1955).

?**Cystipaliphyllum** LAVRUSEVICH, 1964, p. 22 [**C. kimi*; OD; †6/58, ?UpG, Dushanbe]. Solitary,

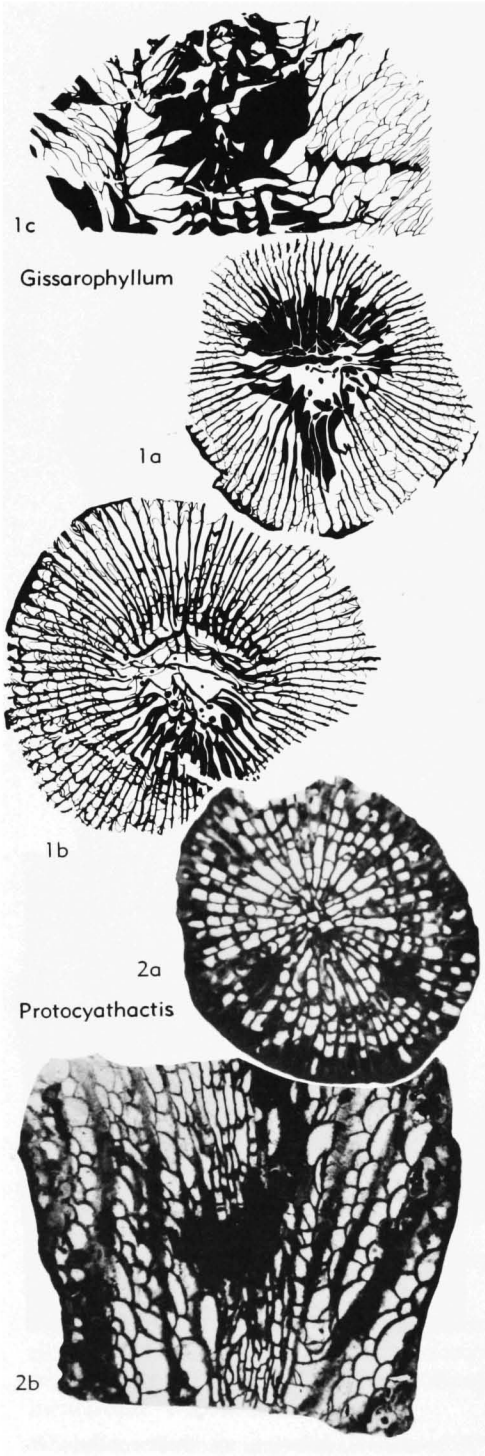


FIG. 98. Paliphyllidae (p. F170-F171).

cornute; major septa long but not reaching axis, though septal lobes or discrete trabeculae form very open structure axially; minor septa long and contraclined; cardinal fossula with shortened cardinal septum; dissepimentarium wide, lonsdaleoid peripherally, normal in inner parts; tabular floors subhorizontal in narrow peripheral zone and broadly domed in wide axial region; tabellae close, elongate. *L.Sil.(low.Llandov.),* Asia(Tadzhik.).——FIG. 97,*1a,b*. **C. kimi,* holotype, low. Llandov., Zeravshan-Gissar Ra., right bank R. Karasu at Shakhriomon crossing; *a,b,* transv., long. secs., ×2 (Lavrusevich, 1964).

Gissarophyllum LAVRUSEVICH, 1964, p. 23 [**G. paligerum*; OD; †8806, UpG, Dushanbe]. Solitary, large, septa long, major septa extending unequally almost to axis, and may have lobed axial edges, minor septa contraclined or contratingent; in early stages septa thickened especially in tabularium, thickening retained longest in tabularium during ontogeny; dissepimentarium wide, normal; tabulae domed, incomplete. *L.Sil.(low-Llandov.),* Asia(Tadzhik.).——FIG. 98,*1a-c*. **G. paligerum,* holotype, mouth of Arba-shir gully, Zeravshan-Gissar Ra.; *a,b,* transv. secs., ×1; *c,* long. sec., ×1 (Lavrusevich, 1964).

Neopaliphyllum ZHELTONOGOVA, 1961, p. 76 [**N. soshkinae*; OD; †1301, coll. 1508, ZSGUp, Novokuznetsk]. Solitary, calice shallow with ?everted margins and low axial boss; major and minor septa numerous, long, thickened and carinate in wide dissepimentarium, minor septa contratingent, contraclined or normal; a narrow, well-defined axial structure formed of isolated, curved, major septal lamellae, of tabellae, and of small solid columella, oval in transverse section, formed by thickening and isolation of axial end of cardinal septum that lies in narrow, open fossula; dissepiments numerous. *M.Sil.,* Asia(Salair Mts.-Altay-E.Urals).——FIG. 96,*3a,b*. **N. soshkinae,* holotype, Baskuskan suite, Salair, left bank R. Baskuskan; *a,b,* long., transv. secs., ×3 (Zheltonogova, 1961).

Protocyathactis IVANOVSKIY, 1961b, p. 205 [**P. cybaeus*; OD; †11, coll. 304, IGG, Novosibirsk] [?=*Paliphyllum* SOSHKINA, 1955, which see, IVANOVSKIY, 1970, p. 121]. Corallum subcylindrical or ceratoid; septa somewhat thickened throughout, of two orders; minor septa moderately long, contratingent, contraclined or normal; axial complex very weak, of few lobes or lamellae; tabulae domed, incomplete; dissepimentarium moderately wide with numerous small inflated dissepiments. *U.Ord.,* Asia(Sib.Platf.).——FIG. 98,*2a,b*. **P. cybaea,* holotype, up. Dolbor., USSR, R. Lower Chunku, basin of R. Stony Tunguska; *a,b,* transv., long. secs., ×4 (Ivanovskiy, 1961b).

?**Protoramulophyllum** NIKOLAEVA, 1964, p. 50 [**P. kazakhstanicum*; OD; †R-1/5747, TsGM, Leningrad]. Solitary; septa moderately thick, major

septa long, their axial ends somewhat curved, ?lobed, running irregularly together; minor septa not long; tabularium wide, tabulae incomplete, tabular floors broad domes somewhat flattened axially, their edges turned neither out nor up; dissepimentarium narrow, dissepiments declined adaxially, interseptal, somewhat elongate, commonly obscured by septal thickening; cardinal fossula evident in early stages. *L.Sil.*, Asia(C. Kazakh.).——Fig. 96,*1a,b*. **P. kazakhstanicum*, holotype, S. foothills, Chingiz Ra., near Karanay; *a,b*, long., transv. secs., ×3 (Nikolaeva, 1964).

Sclerophyllum Reyman, 1956, p. 37 [**S. sokolovi*; OD; †in sample 89, coll. B. S. Sokolov, 1949, Geol. Muzey Karelo-Finskogo Gosudarst. Univ. Petrozavodsk] [?=*Paliphyllum* Soshkina, 1955, which see, Neuman, 1968, p. 231]. Large, cylindrical, solitary coralla; major and minor septa numerous, somewhat thickened; in axial zone major septa penetrating loose axial complex of somewhat irregular septal lamellae and tabulae; minor septa long, commonly contratingent; marginarium a wide dissepimentarium of elongate dissepiments steeply adaxially inclined within ?(and between) contratingent pairs of septa; tabulae numerous, broadly convex, incomplete. *U.Ord.*, Eu.(Est.-Swed.); *L.Sil.*, Eu.(Est.).——Fig. 97, *2a-c*. **S. sokolovi*, U.Ord.(Porkun.), Est., Porkuni; *a*, part of transv. sec. showing interrupted thickening, ×3.0; *b,c*, transv., long. secs., ×1.4 (Reyman, 1956).

Sumsarophyllum Lavrusevich, 1971c, p. 5 [**S. patella*; OD; †133, coll. 1030, UpG, Dushanbe]. Solitary, large; patellate; with very wide dissepimentarium; dissepiments very small and numerous, some horizontally based; septa very long, of fine trabeculae; alternation of major and minor septa unclear [suggesting septal structural modification, *cf. Arachnophyllum*]; tabularium narrow, with axial structure of axial lobes granular in section and convex tabellae. [Insufficiently known; possibly arachnophyllinan.] *U.Ord.*, Asia(Tadzhik.).——Fig. 97,*3a-c*. **S. patella*, holotype, low. Archalyk Beds; Zeravshan-Gissar Ra., right side R. Karasu, 2 km. W. of meridian of Sanglar crossing; *a,c*, transv., *b*, long. secs., all ×1.5 (Lavrusevich, 1971c).

Family KODONOPHYLLIDAE Wedekind, 1927

[*nom. transl.* Lecompte, 1952, p. 463, *ex* Kodonophyllinae Wedekind, 1927, p. 32] [=Codonophyllidae Kaljo, 1956a, p. 6; Kodonophyllicae Ivanovskiy, 1963, p. 60; Bulvankeriphyllinae Goryanov, 1966, p. 55]

Solitary, fasciculate or cerioid; marginarium a wide stereozone of contiguous thickened major and minor septa, axial ends of major septa more or less curved and ragged (?lobed); septal trabeculae uniserial, compound, or multiserial; tabular floors domed, tabulae complete or incomplete; no dissepiments. *?U.Ord.; Sil.-M.Dev.*

Kodonophyllum Wedekind, 1927, p. 34 [**Streptelasma Milne-Edwardsi* Dybowski, 1873c, p. 409; OD; †not traced; =*Madrepora truncata* Linné, 1758, p. 795, see Smith & Tremberth, 1929, p. 368, †not traced] [=*Patrophontes* Lang & Smith, 1927, p. 456 (type, *Madrepora truncata* Linné, 1758, p. 795, OD; †not traced; Sil., Gotl.); *Codonophyllum* Lang, Smith, & Thomas, 1940, p. 39, *nom. van.*]. Solitary or weakly fasciculate, with peripheral increase; marginarium a wide septal stereozone without dissepiments; fossula indistinct; major septa extending almost to axis, but relatively thin in tabularium where axial edges may be lobed or waved and turned aside; septal trabeculae uniserial monacanths, wider in tangential than in radial direction; tabulae incomplete, floors arched [see Oliver, 1962, p. 23; Oliver & Galle, 1971b, p. 68]. *?U.Ord.-L.Sil.*, Eu.(Est.); *L.Sil.*, Asia(SW.China); *M.Sil.-U.Sil. (Ludlov.)*, Eu.(U.K.-Nor.-Swed.-Est.-?Urals)-Asia (Kazakh.)-N.Am.(Quebec-Ky.); *?L.Dev.*, Asia (Zeravshan Ra.).——Fig. 99,*2a,b*. **K. truncatum* (Linné); up.Wenlock-low.Ludlov., Klinteberg Ls., Gotl., Klinteberg; *a,b*, transv., long. secs., ×2 (Hill, n; UQF34169).

Bulvankeriphyllum Goryanov, 1966, p. 56 [**B. mirandum*; OD; †107, coll. 271, LGU, Leningrad]. Solitary coralla with wide marginarium formed by dilation to contiguity of minor septa and peripheral parts of major septa; major septa withdrawn from axis, except that two ?(cardinal and counter) may unite and have lenticular dilation at axis forming laminar columella; septal lamellae ?(or lobes) sparse; fossula indistinct; tabulae domed, complete or of wide tabellae; no dissepiments. *L.Dev.*, Asia(Zeravshan Ra., C.Asia).——Fig. 99,*1a,b*. **B. mirandum*, holotype, left bank of Shishkat ravine; *a,b*, long., transv. secs., ×5 (Goryanov., 1966).

Chlamydophyllum Počta, 1902, p. 134 [**C. obscurum*; M; †L7329, NM, Prague; lectotype by Oliver & Galle, 1971b, p. 78] [?=*Zelophyllia* Soshkina, 1952, which see]. Solitary; marginarium a wide peripheral stereozone formed from contiguous major and minor septa; in tabularium major septa notably less thickened and may be weakly convolute, their axial edges irregularly thickened and tortuous; tabulae complete or incomplete, floors flat or arched; near periphery septal trabeculae multiserially arranged and subparallel, in tangential planes diverging somewhat, but toward tabularium septal trabeculae ?rhabdacanths. *L. Dev.(Siegen.-Ems.)*, Eu.(Czech.-?France)-Australia (New S.Wales-Queensl.).——Fig. 99,*4a,b*. **C. obscurum*, up. Koněprusy Ls., Czech., Zlatý Kůň near Koněprusy; *a*, lectotype, transv. sec., ×2; *b*, paralectotype, long. sec., ×2 (Oliver & Galle, 1971b).

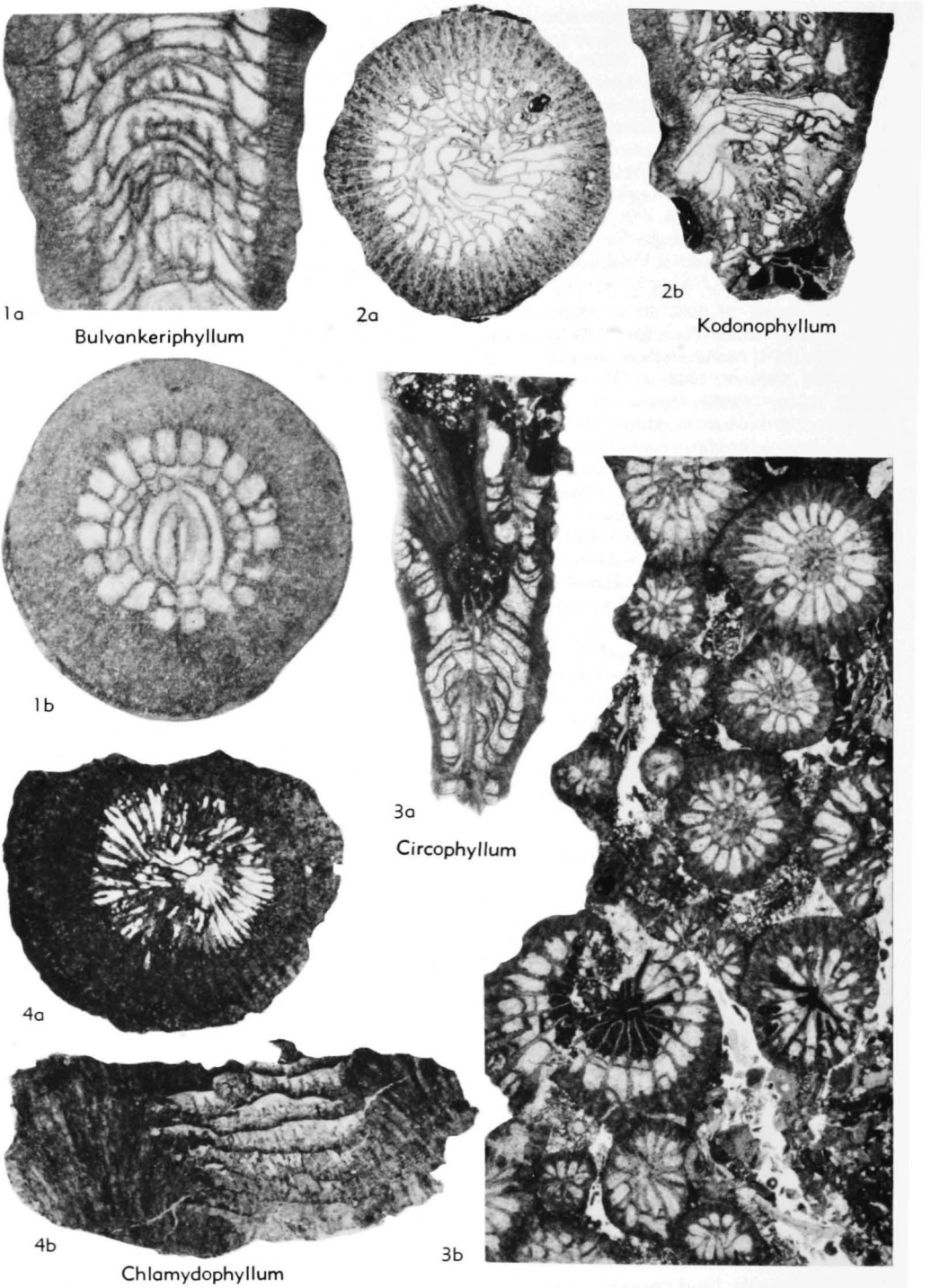


FIG. 99. Kodonophyllidae (p. *F*171-*F*173).

Circophyllum LANG & SMITH, 1939, p. 153, *nom. subst. pro Rhysodes* SMITH & TREMBERTH, 1927, p. 311, *non Rhysodes* ILLIGER in KALMAN, 1823, a coleopteron [**Rhysodes samsugnensis* SMITH & TREMBERTH, 1927, p. 311; OD; †R24355, BM (NH), London] [=*Rhyzodes* IVANOVSKIY, 1973b, p. 282, *nom. van.*]. Fasciculate, increase peripheral, parricidal; corallites slender with narrow peripheral septal stereozone; major septa long, straight, united axially in variable groups, axial ends somewhat thickened and may be deflected; tabular floors conical with upturned edges; dissepiments absent. *U.Sil.(Ludlov.)*, Eu.(Gotl.)-?Asia(Altay-Kazakh.); *?Sil.*, N.Am.(Utah); *?L. Dev.*, Asia(Tadzhik.-E.Urals).——FIG. 99,*3a,b*. **C. samsugnense* (SMITH & TREMBERTH), U.Sil., Slite Gr., Swed., Fårö, Gotl.; *a,b*, long., transv. secs., ×5 (Hill, n; UQF34671).

?Cronyphyllum ULITINA, 1975, p. 273 [**C. grossaxiale*; OD; †39, coll. 3294, PIN, Moscow]. Cerioid; septa long, major septa coiling somewhat in axial region; marginarium a wide stereozone breached here and there by poorly developed, small, steeply sloping dissepiments; tabular floors domes with upturned edges, tabulae incomplete. [Possibly an entelophyllid.] *M.Sil.-U.Sil.(Wenlock.-Ludlov.)*, Asia(E.Mongolia).

Niajuphyllum STRELNIKOV, 1973, p. 48 [**N. obsoletum*; OD; †2, coll. 9520, TsGM, Leningrad]. Cerioid, increase peripheral, nonparricidal; marginarium wide, a stereozone formed by contiguous peripheral ends of thick septa each of ?contiguous trabeculae; fossula indistinct; major septa reaching axis, presence or absence of streptelasmatid lobes or lamellae unproved; minor septa long; tabular floors domed; dissepiments ?absent [see also PEDDER, 1976a, p. 286]. *U.Sil.(Ludlov.)*, Eu. (Polar Urals)-N.Am.(Yukon).——FIG. 100,*2a,b*. **N. obsoletum*, holotype, Yengane-Pe Ra., Niya-Yu R.; *a,b*, transv., long. secs., ×2.9 (Strelnikov, 1973).

Pilophyllia GE & YÜ, 1974, p. 170 [**P. involuta*; OD; †22131-2, IGP, Nanking]. Solitary, large; marginarium a narrow peripheral stereozone composed of thick minor septa and thickened peripheral ends of major septa; major septa thinning in tabularium towards axis, slowly at first, then rapidly becoming attenuate, and either involute or straight; cardinal septum may be short in indistinct fossula; tabularium wide, tabular floors close, shallow domes or subhorizontal, tabulae commonly complete; no dissepiments. [Possibly amplexid; nature of discontinuity in axial parts of septa unclear.] *L.Sil.-M.Sil.*, Asia(SW.China).——FIG. 101,*1a,b*. **P. involuta*, holotype, M.Sil., Ning Qiang F., Shensi, Ning Qiang; *a,b*, transv., long. secs., ×1.5 (Ge & Yü, 1974).

Pseudoblothrophyllum OLIVER, 1960a, p. 91 [**P. helderbergium*; OD; †11081, NYSM, Albany]. Solitary, large, cylindrical; marginarium in adult stages a wide stereozone in which major and

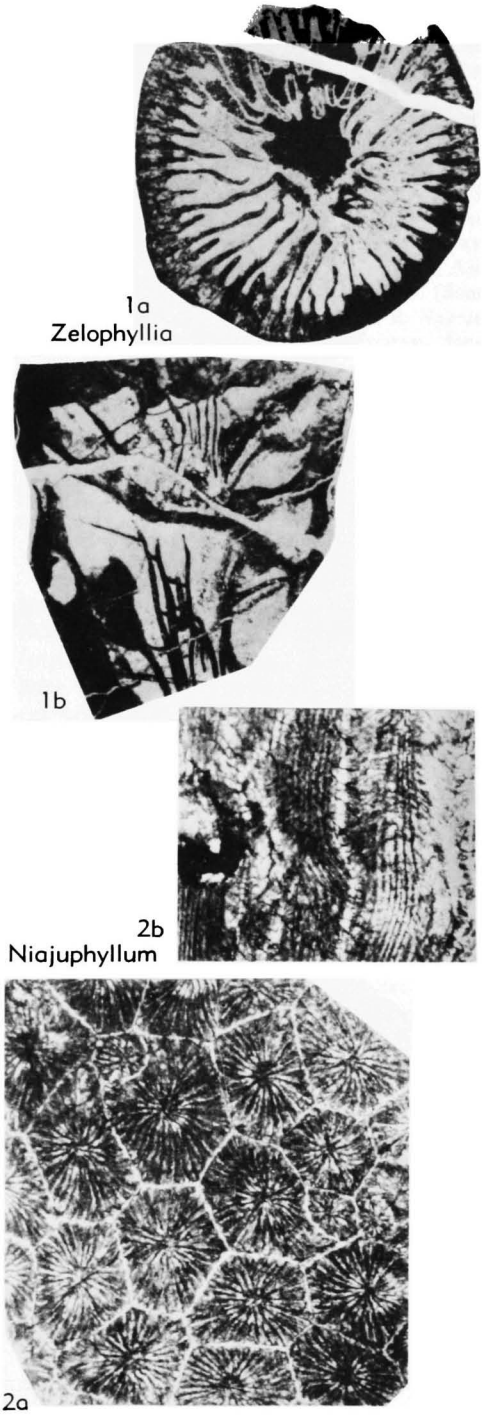
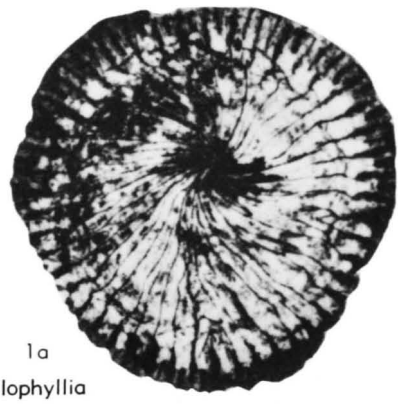
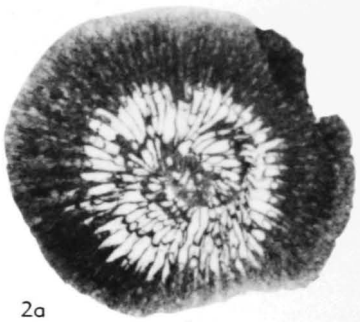


FIG. 100. Kodonophyllidae (p. *F173*, *F175*).

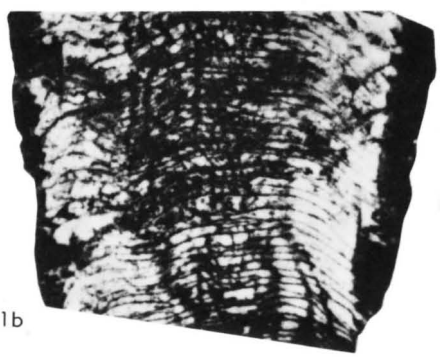


1a

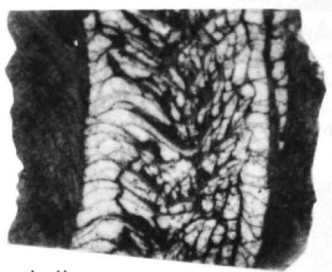
Pilophyllia



2a



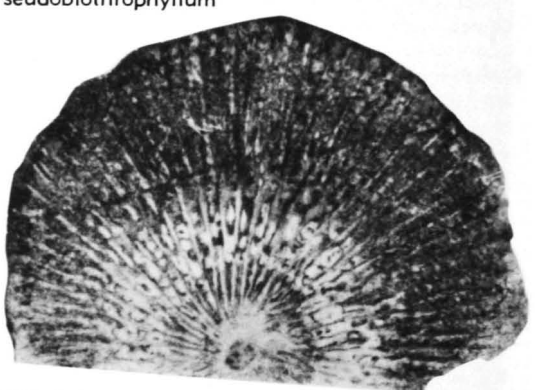
1b



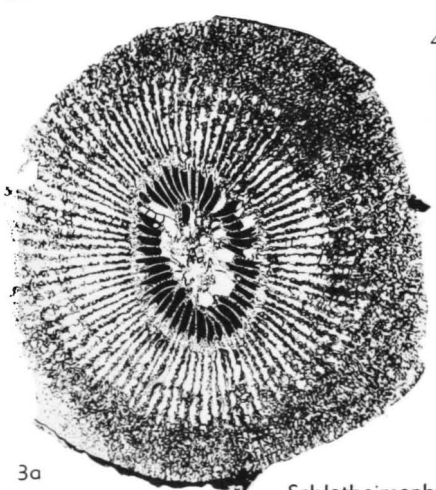
2b

Pseudoblothrophyllum

3b

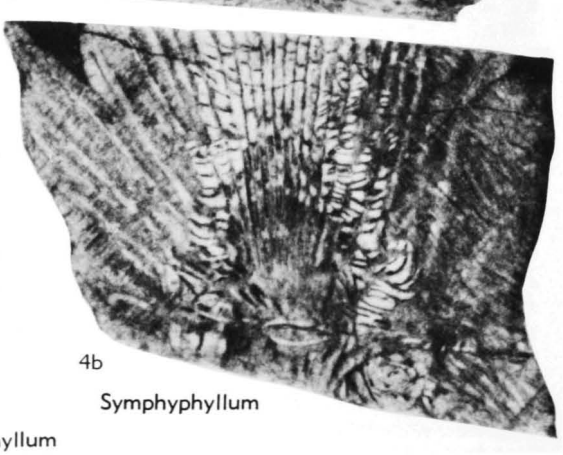


4a



3a

Schlotheimophyllum



4b

Symphyphyllum

minor septa are almost everywhere dilated to contiguity, a very few interseptal loculi or dissepiments ?present; major septa long, extending nearly to axis, relatively thin in tabularium, axial ends somewhat convolute, peripheral ends may have lonsdaleoid discontinuities; cardinal fossula limited to tabularium, marked by short cardinal septum; tabulae complete, axially concave, periaxially arched, strongly bent downward toward marginarium. *L.Dev.(Coeymans)*, N.Am.(N.Y.).——FIG. 101,*2a,b*. **P. helderbergium*, holotype, reef facies, Coeymans Ls., N.Y.; *a,b*, transv., long. secs., ×1 (Oliver, 1960a; photographs courtesy W. A. Oliver).

Schlotheimophyllum SMITH, 1945, p. 18 [**Fungites patellatus* SCHLOTHEIM, 1820, p. 347; OD; †unnumbered, in SCHLOTHEIM Coll., HU, E. Berlin; lectotype by SMITH, 1945, p. 19]. Solitary, large, discoid or patellate, commonly with reflexed calicular platform as wide as very wide marginarium, which is stereozone without dissepiments; major septa long, thinner in tabularium where their axial edges twirl in vacuolar axial structure forming low boss in calice; axial ?lobes few; septal trabeculae in marginarium multiserially arranged without strict relationship to median plane of septum, subparallel, in tangential planes diverging slightly; tabulae incomplete, floors arched. *L.Sil.(up.Llandov.)-U.Sil.(Ludlov.)*, Eu.(U.K.-Swed.-Nor.)-Asia(C.Kazakh.)-N.Am.(Can.-Ind.-Ky.).——FIG. 101,*3a,b*. **S. patellatum* (SCHLOTHEIM); *a*, ?M.Sil., N.Gotl., Häftings Klint, transv. sec., ×1.25; *b*, M.Sil., Gotl., long. sec., ×1.25 (Lang, 1926).

Sinochlamydophyllum GUO, 1976, p. 79 [**S. crassiseptatum*; OD; †Ru4053, IGMR, Shenyang (Mukden); low.M.Dev., Inner Mongolia]. Solitary, large, marginarium a wide stereozone of contiguous thickened major and minor septa; axial ends of major septa moderately thick, extending to axis and somewhat twirled; cardinal fossula not prominent; tabular floors uparched, but may sag in wide axial zone [as in *Pseudoblothrophyllum* OLIVER, 1960a. Diagnosis tentative, from illustrations.] *M.Dev.(Eifel.)*, Asia(Inner Mongolia).

Symphyphyllum SPASSKIY in BULVANKER *et al.*, 1968, p. 14 [**S. styliferum*; OD; †6, coll. 9347, TsGM, Leningrad]. Solitary; major septa confluent axially to form compact axial column, minor septa long, extending but little beyond wide peripheral stereozone formed by dilated and contiguous septa; tabulae incomplete, somewhat elevated at the column; no dissepiments. *L.Dev. ("Coblenz.")*, Asia(Altay).——FIG. 101,*4a,b*. **S. styliferum*, holotype, Baragashskaya suite, *"Rensellaria"* horizon, Gornyy Altay, Ganin Log; *a,b*, transv., long. secs., ×4 (Bulvanker *et al.*, 1968).

Zelophyllia SOSHKINA, 1952, p. 74 [**Regmaphyllum tabulatum* SOSHKINA, 1937, p. 85; OD; †thin sections 306, 307, sample 595, in coll. 143, PIN, Moscow; lectotype by SPASSKIY, 1959, p. 29] [?=*Chlamydophyllum* POČTA, 1902, which see, SOSHKINA in SOSHKINA, DOBROLYUBOVA, & KABAKOVICH, 1962, p. 309, but see OLIVER & GALLE, 1971b, p. 77]. Large, solitary, but may form parricidal offsets; epitheca smooth; peripheral ends of thick septa fused to form moderately wide stereozone; major septa long, not reaching axis, unequal, slightly thickened and irregularly curved; minor septa short; tabulae thin, distant, subhorizontal; no dissepiments [see IVANOVSKIY & SHURYGINA, 1975, p. 35]. *L.Dev.-M.Dev.(Eifel.)*, Asia (Urals).——FIG. 100,*1a,b*. **Z. tabulata* (SOSHKINA), holotype, D_2^1, Urals, left bank R. Vagran, *fide* SPASSKIY, 1960a, p. 84; *a,b*, transv., long. secs., ×2.9 (Ivanovskiy & Shurygina, 1975).

Family MUCOPHYLLIDAE Soshkina, 1947

[Mucophyllidae SOSHKINA, 1947, p. 761] [=Mycophyllidae HILL, 1940a, p. 156, based on invalid jr. syn.; Pseudamplexinae STUMM, 1949, p. 48; Mycophyllinae MERRIAM, 1972, p. 32]

Solitary, rarely compound; corallites trumpet-shaped with peripheral stereozone that extends outward to form calical platform that may be flaring or everted; stereozone of contiguous rhabdacanthine septa extending but slightly onto tabulae, tabulae complete and horizontal, commonly with fossular depression peripherally; dissepiments absent or present only as lonsdaleoid discontinuities in stereozone. *L.Sil.-L.Dev.*

Mucophyllum ETHERIDGE, 1894, p. 12 [**M. crateroides*; OD; †F3048, AM, Sydney; lectotype by HILL, 1940c, p. 400] [=*Mycophyllum* LANG, SMITH, & THOMAS, 1940, p. 87, *nom. van.*]. Solitary, broadly trumpet-shaped, with tabularium surrounded by peripheral stereozone as wide as minor septa are long, and formed by contiguous thick septa of rhabdacanthine trabeculae; stereozone extending at calice into very wide rim that may be everted; major septa but little longer than minor; tabulae horizontal, complete, may be greatly thickened; no dissepiments. *U.Sil.*, Australia(New S.Wales-Queensl.)-?Eu.(Gotl.)-Asia (Manchuria-?Szechuan); *L.Dev.*, N.Am.(Nev.).——FIG. 102,*1a-c*. **M. crateroides*, U.Sil., New S. Wales, Yass; *a*, long. sec., *b*, part of tang. sec. of septa, *c*, part of transv. sec. of septa, all ×1 (after Etheridge, 1894, and Lang, 1926).

Briantia BARROIS, 1889, p. 44 [**B. repleta*; M; †not traced]. Solitary; marginarium a wide septal stereozone; major septa almost reaching axis, subequal; free axial ends of minor septa projecting slightly into tabularium, whose tabular floors are domed and tabulae are complete or incomplete; fossula not distinct. [Type requires restudy.] *L.Dev.(Ems.)*, Eu.(France).——FIG. 103,*3a,b*. **B. repleta*, holotype, Calcaire d'Erbray, Chateau-

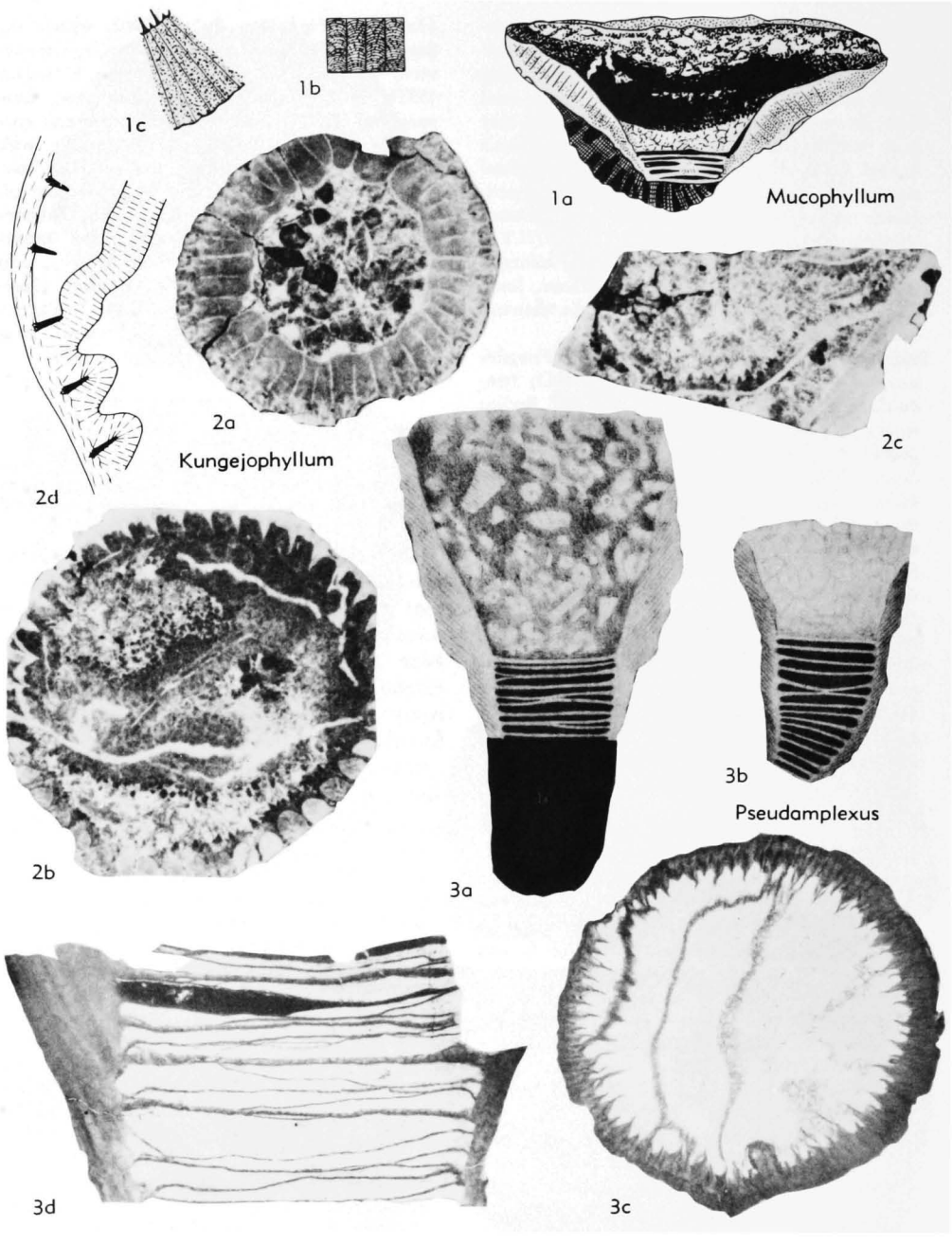


FIG. 102. Mucophyllidae (p. *F175-F178*).

Briant; *a,b,* transv., long. secs., ×2 (Barrois, 1889).

Kungejophyllum SULTANBEKOVA, 1971, p. 28 [**K. ajagusense*; OD; †1/20, IG, Alma-Ata]. Solitary, large, cylindrical or conical; major and minor septa short, dilated peripherally to form stereozone; growth of sclerenchymal layers may thicken axial ends of major septa also, may then continue as thickening on upper surfaces of tabulae; nature of septal trabeculae not known; tabulae complete, depressed medianly, a little everted peripherally; no dissepiments. *L.Sil.(up.Llandov.),* Asia

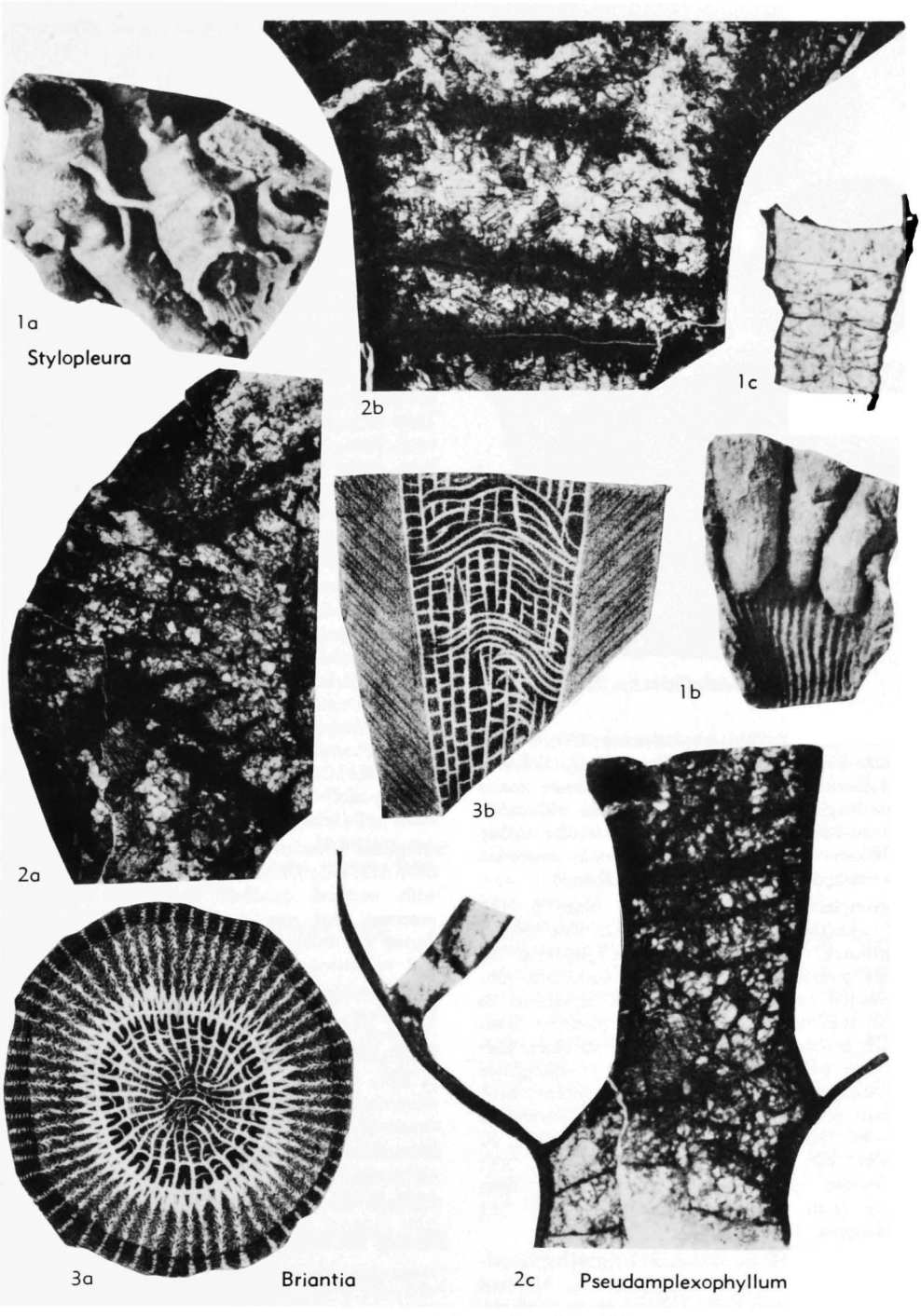


FIG. 103. Mucophyllidae (p. *F*175-*F*178).

(Kazakh.).——FIG. 102,*2a-d*. **K. ajagusense*, holotype, R. Ayaguz, Chingiz Ra.; *a,b*, transv. secs., *c*, long. sec., all ×2; *d*, diagram., part of transv. sec., ×9 (Sultanbekova, 1971).

"?Ningqiangophyllum" CAO in LI *et al.*, 1975, p. 184, invalid jr. homonym of *Ningqiangophyllum*

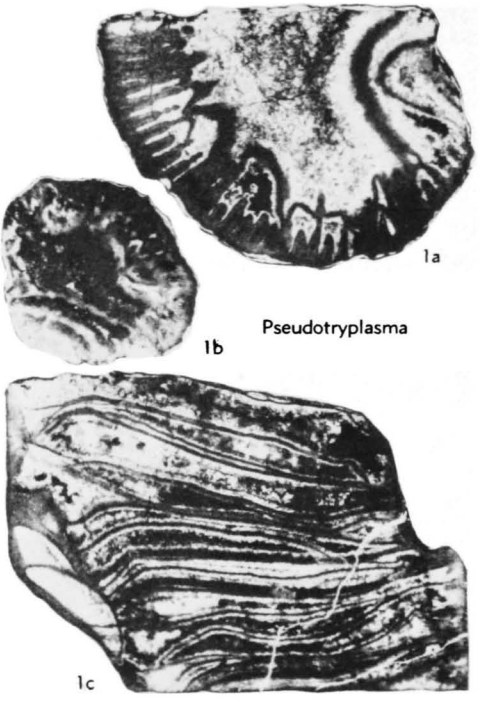


FIG. 104. Mucophyllidae (p. *F178*).

GE & YÜ, 1974 [**N. tenuiseptatum*; OD; †G360, IGMR, Sian; M.Sil., Ningqiang, Shensi]. Solitary; marginarium a narrow septal stereozone; major septa long, amplexoid and attenuate in wide tabularium, but cardinal septum short; tabulae mostly complete, closely spaced, thin, with somewhat downturned edges. *M.Sil.*, Asia(Shensi).

Pseudamplexophyllum SHURYGINA, 1968, p. 132 [**P. insolitum*; OD; †506/68a, coll. 930, UGUp, Sverdlovsk]. Compound; corallites cylindrical; increase periodic, following sudden wide, thin, subhorizontal extension of peripheral stereozone to form thin marginarial calicular platform from which nonparricidal offsets arise; septa short, confined to peripheral stereozone and of contiguous rhabdacanthine trabeculae; tabulae complete, horizontal; no dissepiments. *Low.L.Dev.*, Asia(Urals). ——FIG. 103,*2a-c*. **P. insolitum*, Ivdel distr., R. Sauma; *a,b*, holotype, transv., long. secs., ×4; *c*, another specimen, long. sec. showing offset rising from calical marginarial platform, ×4 (Shurygina, 1968).

Pseudamplexus WEISSERMEL, 1897, p. 878 [**Zaphrentis ligeriensis* BARROIS, 1889, p. 52; M; †not traced, ?in BARROIS Coll., Laboratoire de Géologie, Université des Sciences et Techniques, Lille] [=*Pselophyllum* POČTA, 1902, p. 82 (type, *P. bohemicum*, SD HILL, 1940a, p. 158; †lectotype L7332, NM, Prague, by OLIVER & GALLE, 1971b, p. 63; L.Dev., up. Koněprusy Ls., Zlatý Kůň near Koněprusy, Czech.); *?Pseudomphyma* WEDEKIND, 1927, p. 34 (type, *P. profunda*, OD; †SMF10870, 10871, 4960, WEDEKIND Coll., SM, Frankfurt; M.Sil., Gotl.); *Pseliophyllum* LANG, SMITH, & THOMAS, 1940, p. 107, *nom. van.*; *?Pseudotryplasma* IVANIYA, 1958, which see; *?Gyalophylloides* CAO in LI *et al.*, 1975, p. 193 (type, *G. elegantus*, OD; †G401, IGMR, Sian; M.Sil., Ningqiang, Shensi)]. Solitary, large, subcylindrical; marginarium a wide septal stereozone; major septa but slightly longer than minor; septa each a single series of coarse ?rhabdacanthine trabeculae, free at their axial ends; tabulae complete. *?L.Sil.*, Asia(Altay-Sayan); *?M.Sil.*, Eu.(Gotl.)-Asia(Shensi); *L.Dev.*, Eu.(France-Czech.-Urals)-Asia (Kuzbas-Tadzhik.-Altay-Sayan-Taymyr-NE. USSR)-Australia (Queensl.-New S. Wales-Vict.-Tasm.).——FIG. 102,*3a,b*. **P. ligeriensis* (BARROIS), Ems., France, Calcaire d'Erbray; *a,b*, transv., long. secs., ×0.5 (Barrois, 1889).——FIG. 102, *3c,d*. *?P. profundus* (WEDEKIND), holotype, M. Sil., N. Gotl., Storugus near Kappelshamn; *c,d*, transv., long. secs., ×2.0 (Hill, n; photographs courtesy R. Birenheide).

Pseudotryplasma IVANIYA, 1958, p. 121 [**P. tryplasmaeformis*; OD; †220/1-12a, TGU, Tomsk] [?=*Pseudamplexus* WEISSERMEL, 1897, which see]. Like *Pseudamplexus* but with occasional large lonsdaleoid dissepiments. [Type species may be only a variant within *P. altaicus* (DYBOWSKI).] *L.Dev.(Krekov Beds)*, Asia(Salair).——FIG. 104, *1a-c*. **P. tryplasmaeforme*, holotype, Salair, left bank R. Chernevoy Bachat, Staro-Gurievskiy quarry; *a,c*, transv., long. secs., ×1; *b*, calical view, ×1 (Ivaniya, 1965).

Stylopleura MERRIAM, 1973a, p. 34 [**S. berthiaumi*; OD; †159382; USNM, Washington]. Fasciculate, with unequal corallites joined by connecting processes that may be hollow; mature calices flaring and trumpet-shaped; wall a narrow peripheral stereozone from which short laminar septa project adaxially as low ridges with little or no distinction between major and minor; tabulae complete, horizontal; no dissepiments; increase marginarial, unequal [see also PEDDER, 1976b, p. 289]. *U.Sil.*, N.Am.(Arctic Arch.-Yukon); *L. Dev.(Gedinn.)*, N.Am.(Yukon-Nev.).——FIG. 103, *1a-c*. **S. berthiaumi*, holotype, Roberts Mt. F., Nev., Roberts Cr. Mt.; *a*, ext. view, ×1.5; *b*, calical view showing 3 offsets and short laminar septa, ×2.0; *c*, long. sec., ×2.0 (Merriam, 1973a).

Family ACROPHYLLIDAE Stumm, 1949

[Acrophyllidae STUMM, 1949, p. 14] [=Acrophyllinae HILL, 1956b, p. *F272*]

Solitary, large, with numerous long septa, wide tabularium in which conical tabulae form, with the convolute axial ends of major septa and with septal lamellae, a tent-shaped axial structure rising in wide

calical boss; cardinal fossula deep, with shortened cardinal septum; minor septa short to very short, scarcely visible on inner surface of wall; dissepiments sparse, vertically based. *Up.L.Dev.*

Acrophyllum THOMSON & NICHOLSON, 1876a, p. 455 [**Clisiophyllum oneidaense* BILLINGS, 1859b, p. 128; OD; syntypes 3416a-c, GSC, Ottawa]. Solitary, large, with numerous, long, thin, major septa and excessively short minor septa, a wide tabularium in which conical tabulae form with thin convolute axial ends of major septa a tent-shaped axial structure; a narrow dissepimentarium of vertically based dissepiments; those parts of major septa in peripheral zone of tabularium may be somewhat thickened, cardinal septum short, in fossula deepened at edge of tabularium [see OLIVER, 1958, p. 826; STUMM, 1965, p. 27]. *Up. L.Dev.*, N.Am.(Ont.-N.Y.).——FIG. 105,*1*. **A. oneidaense* (BILLINGS), Onondaga Ls., Ont.; transv. sec., ×0.7 (Lambe, 1901).

Scenophyllum SIMPSON, 1900, p. 210 [**Zaphrentis conigera* ROMINGER, 1876, p. 149; OD; †8585, UMMP, Ann Arbor; lectotype by STUMM, 1965, p. 26]. Solitary, ceratoid, large; calice elliptical, deep, with thin, erect walls and large, conical axial boss; septa numerous, axial ends thin and somewhat convolute in loose, wide axial boss; cardinal fossula deep, wide near boss, with shortened cardinal septum; minor septa short, ?dissepiments few; tabular floors conical, close, of elongate tabellae [see STUMM, 1965, p. 26]. *Up.L. Dev.*, N.Am.(Ind.-Ky.).——FIG. 105,*2a-c*. **S. conigerum* (ROMINGER), Jeffersonville Ls., coral zone, Ind., Falls of the Ohio; *a*, lectotype, ext. view, ×0.7; *b,c*, another specimen, transv., long. secs., ×1.4 (Stumm, 1965).

Family AMSDENOIDIDAE Hill, new family

Solitary, with periodic rejuvenescence; major septa long, thin, axial ends intermeshing at or somewhat withdrawn from axis, axial septal lobes ?present; minor septa long or short; septa commonly richly vepreculate; horizontal skeletal elements commonly calcareous films of inconstant curvature, drawn up adaxially but, when minor septa are long, may form shallow marginal troughs peripherally. *U.Sil., ?M. Dev.*

Amsdenoides SUTHERLAND, 1965, p. 18 [**Ditoecholasma acutiannulatum* AMSDEN, 1949, p. 102; OD; †17665, YPM, New Haven]. Solitary, with irregularly spaced, acutely projecting rejuvenescence rims; minor septa very short, no dissepiments; major septa commonly coarsely vepreculate and reaching or nearly reaching axis with or without slight convolution, their axial edges may be variably coalescent or ?lobed; tabulae as films declined abaxially, sparse. *U.Sil.(Ludlov.)*, N.Am. (Tenn.-Ky.-Ind.).——FIG. 106,*1a-f*. **A. acutiannulatus* (AMSDEN), Brownsport F., Tenn.; *a-c*, holotype, *a*, ext. view, ×1, *b,c*, transv., long. secs., ×4; *d-f*, another specimen, *d,e*, transv., *f*, long. secs., all ×4 (Sutherland, 1965).

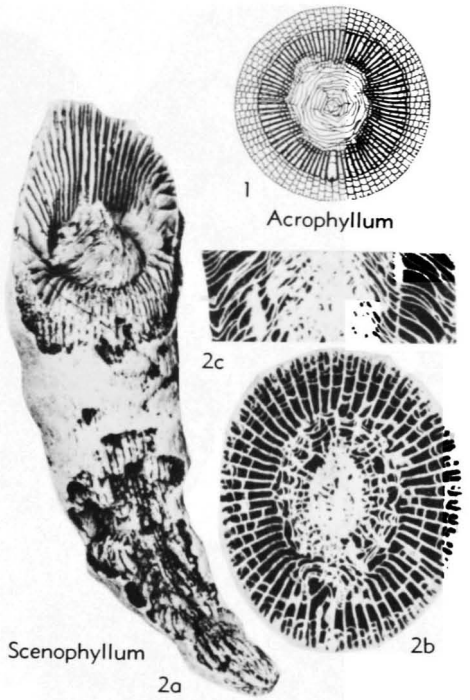


FIG. 105. Acrophyllidae (p. *F*179).

?**Multicarinophyllum** SPASSKIY, 1965b, p. 24 [**M. multicarinatum*; OD; †5, coll. 9349, TsGM, Leningrad]. Moderately large, solitary, cornute, with rejuvenescence; calice shallow, with sharp edges; major septa long, thin, convolute in axial zone, in places with conjunct axial ends; minor septa long; both orders vepreculate; in axial zone tabular films numerous, low domes, in peripheral zone, shallow troughs. *?M.Dev.(Eifel.)*, Asia (Dzhungarian Alatau).——FIG. 106,*2a,b*. **M. multicarinatum*, holotype, Eifel., Dzhungarian Alatau, R. Kyzylagach; *a,b*, transv., long. secs., ×2 (Markovskiy, 1968).

Suborder CALOSTYLINA Prantl, 1957

[*nom. correct.* WEYER, 1973a, p. 23, *pro* Calostylacea PRANTL, 1957, p. 491, as suborder]

Rugosa with perforate septa that may be laterally connected by synapticulae. *M.Ord.-U.Sil.* or *L.Dev.(Aynasu.)*.

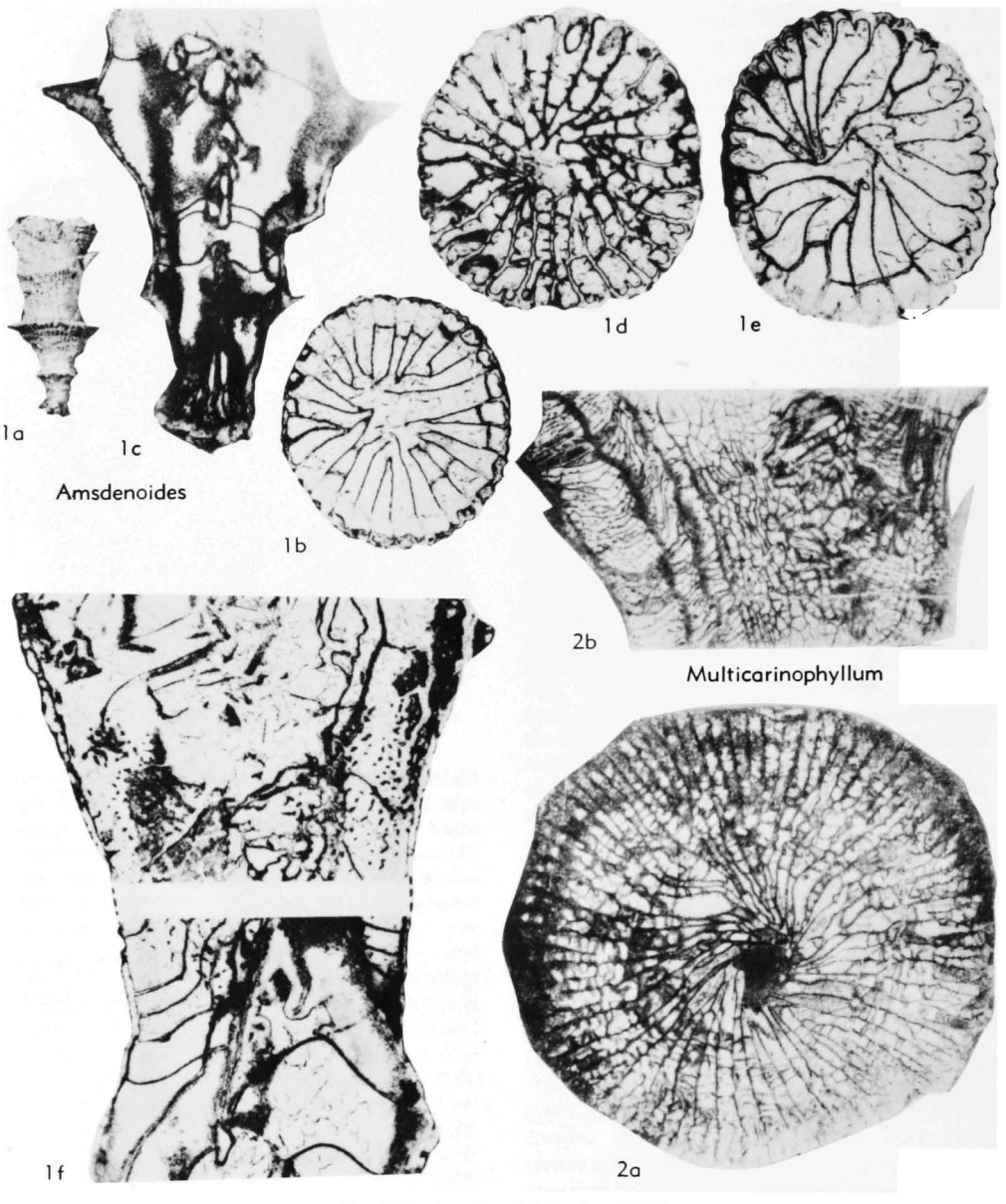


FIG. 106. Amsdenoididae (p. *F*179).

Superfamily CALOSTYLICAE Zittel, 1879

[*nom. correct.* IVANOVSKIY, 1963, p. 92, *pro* Calostylacea IVANOVSKIY, 1961a, p. 120, *nom. transl. ex* Calostylinae ZITTEL, 1879, p. 241] [=Calostylacea PRANTL, 1957, p. 491, suborder; Calostylaceae WEYER, 1973a, p. 33, superfamily]

Rugosa with perforate septa. Solitary or compound (fasciculate, astreoid), epitheca commonly incomplete, when present may show longitudinal septal furrows in normal rugosan arrangement of septal insertion, calice everted in some, in many with axial boss; septa of two orders, perforate, may be laterally connected by synapticulae, minor septa contraclined to contratingent; trabeculae monacanthine, in single series, connected radially by outgrowths that may or may not be arranged in regular series parallel to distal edges of septa; axial struc-

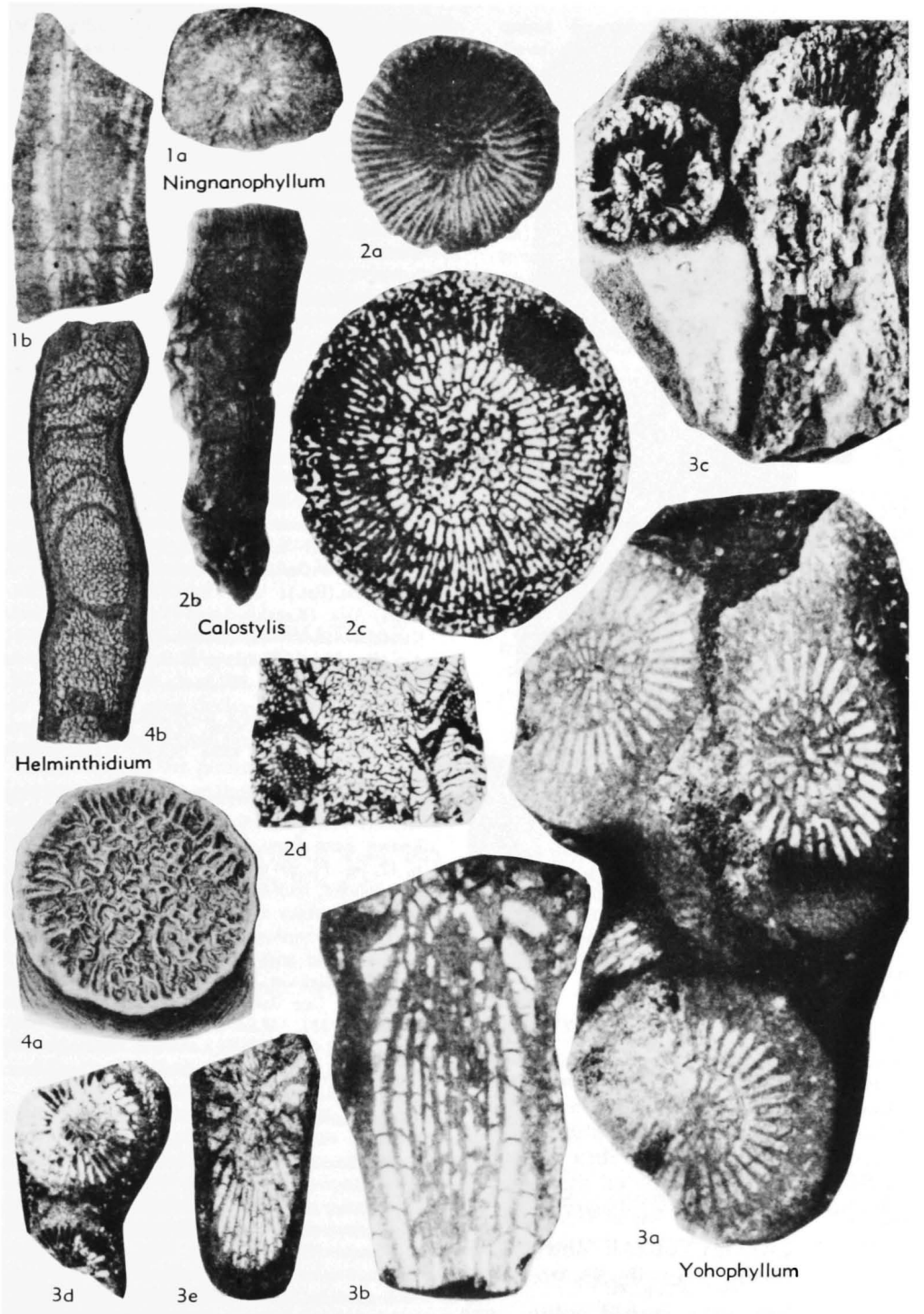


FIG. 107. Calostylidae (p. *F*182-*F*183).

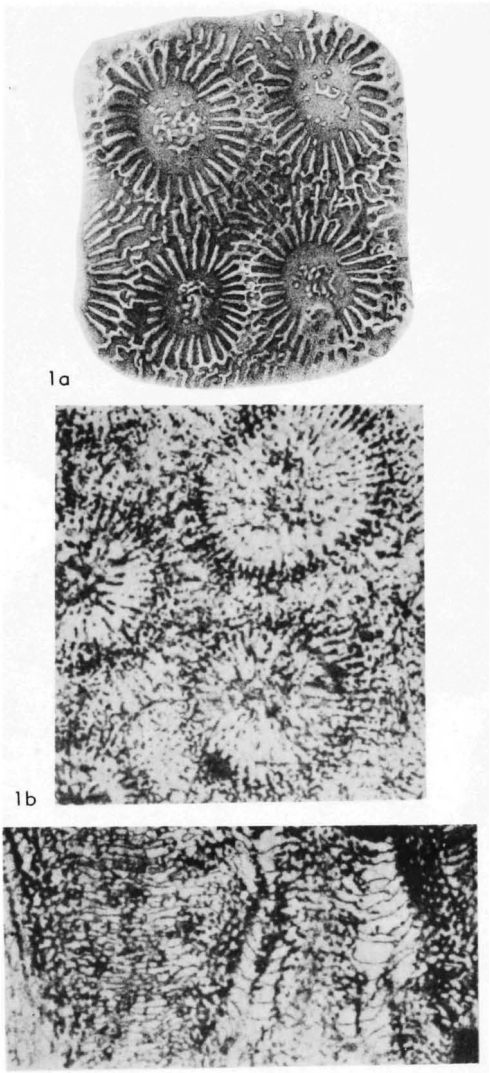


FIG. 108. Calostylidae (p. *F*182-*F*183).

ture spongy, of septal lobes; tabulae filmy, low convex or slightly concave, may be continuous with similarly thin plates crossing cavities in marginarium, their curvature parallel to distal edges of major septa. *M.Ord.-U.Sil.* or *L.Dev.(Aynasu.)*.

Family CALOSTYLIDAE Zittel, 1879

[*nom. transl.* ROEMER, 1883, p. 334, 393, *ex* Calostylinae ZITTEL, 1879, p. 241]

Calostylicae with everted calice, with synapticulae and with synapticular irregular stereozone. *M.Ord.-U.Sil.* or *L.Dev. (Aynasu.)*.

Calostylis LINDSTRÖM, 1868, p. 421 [**C. cribraria*; M; †Cn15679, RM, Stockholm; lectotype by WEYER, 1973a, p. 29; ?=*Clisiophyllum denticulatum* KJERULF, 1865, p. 25, Sil., Gotl., †not traced, see SMITH, 1930b, p. 267, WEYER, 1973a, p. 29] [=*Hemiphyllum* TOMES, 1887, p. 98 (type, *Calostylis tomesi* SMITH, 1930b, p. 269, M, *nom. nov. pro "Hemiphyllum siluriensis* McCOY sp.?" TOMES, 1887, p. 99; †R18446, BM(NH), London; M.Sil., (Wenlock.), U.K., Wenlock); *?Stanleysmithia* WEYER, 1973a, p. 30 (type, *Calostylis roemeri* SMITH, 1930b, p. 262, OD; †48598, GSM, London; up.Llandov., U.K., *Pentamerus* beds near Buildwas)]. Solitary, not epithecate in distal region, calice being steeply everted near peripheral margin; major and minor septa slightly perforate, connected by irregular synapticulae; trabeculae ?monacanthine, connected radially in single series by synapticular extensions; axial ends of large major septa lobed and reticulate, forming spongy axial structure that may form calical boss; tabulae domed, filmy, complete and widely separated, continuous in marginarium with filmy plates parallel to distal edges of major septa. *Up.M.Ord.-U.Ord.*, Asia(Szechwan-Kweichow); *U. Ord.*, Eu.(Est.); *Sil.*, Eu.(U.K.-Gotl.-Nor.-Est.-Urals)-Asia (Kazakh.-Sayan-Himalaya-Sib. Platf.-Kweichow-Szechwan)-Australia(New S.Wales)-N. Am.(Ky.-Ohio); *U.Sil.* or *L.Dev.(Aynasu.)*, Asia (Kazakh.).——FIG. 107,*2a-d*. **C. cribraria*, Sil., Gotl.; *a*, lectotype, calical view, ×15.0; *b*, another specimen, side view, ×1.0; *c,d*, third specimen, transv., long. secs., ×2.8, ×1.8 (Smith, 1930b).

Helminthidium LINDSTRÖM, 1882a, p. 16 [**H. mirum*; M; †original specimen figured as "unknown coral from Djupvik," LINDSTRÖM, 1870, p. 12, fig. 14, not traced, RM, Stockholm]. Corallum solitary, scolecoid, epitheca complete and septal furrows faint to absent; calice slightly convex or concave, without axial boss; septa perforate and reticulate with but faint trace of radial pattern, of division in orders, or of component trabeculae [see SMITH, 1930b, p. 272; WEYER, 1973a, p. 30]. *M.Sil.-U.Sil.(Ludlov.)*, Eu.(Gotl.-U.K.-Czech.)-Asia(Japan).——FIG. 107,*4a,b*. **H. mirum*, Sil., Gotl.; *a,b*, calical view, long. sec., ×4, ×2 (Lindström, 1896b).

?Ningnanophyllum LIN, 1965, p. 69 [**N. ningnanense*; OD; †1002A'63$_8$, ?AGS, ?Peking]. Small, fasciculate, calices keg-shaped; septa thick, ?perforate, axial edges of major septa united about axial tabular space; marginarium a spongy stereozone; tabulae complete, sparse; without dissepiments. [WEYER, 1973a, p. 28, considers septal structure inconsistent with that of Calostylidae.] *M.Ord.*, Asia(Szechwan-Kweichow).——FIG. 107, *1a,b*. **N. ningnanense*, holotype, Ningnan distr., Szechwan; *a,b*, transv., long. secs., ×4 (Lin, 1965).

Palaearaea LINDSTRÖM, 1882b, p. 11 [**P. lopatini*;

M; †not traced, RM, Stockholm]. Like *Calostylis* but astreoid. *L.Sil.(Llandov.),* Asia(Sib.Platf.-Tuva).——FIG. 108,*1a-c.* **P. lopatini; a,* L.Sil., Sib. Platf., R. Stony Tunguska, calical view, ×4 (Lindström, 1882b); *b,c,* L.Sil.(up.Llandov.), Sib. Platf., R. Gorbyachin, transv., long. secs., ×4 (Ivanovskiy, 1965a).

?Yohophyllum LIN, 1965, p. 68 [**Streptelasma kueiyangense* YOH, 1959, p. 404; OD; †not traced; M.Ord., Kueiyang, Kweichow] [=*Yokophyllum* COTTON, 1973, p. 223, *nom. null.*]. Fasciculate; corallites with deep infundibuliform calices; septa thick, ?perforate, major septa irregularly contiguous with minor septa in perforate peripheral stereozone; major septa with septal lobes forming loose axial structure; thin tabulae declined from axis in axial structure, of irregular inclination periaxially; ?without dissepiments. [WEYER, 1973a, p. 28, considers septal structure inconsistent with that of Calostylidae.] *M.Ord.,* Asia (Kweichow-Szechwan).——FIG. 107,*3a-e.* **Y. kueiyangense* (YOH); *a,b,* M.Ord., Kueidon distr., Szechwan, transv., long. secs., ×4 (Lin, 1965); *c-e,* ?type material, M.Ord., Kueiyang, *c,* lat. and calical ext. views, *d,e,* transv., oblique secs., ×2 (Yü et al., 1963).

Family LAMBELASMATIDAE Weyer, 1973

[Lambelasmatidae WEYER, 1973a, p. 33]

Calostylicae with calices not everted and without connecting rods or bars (synapticulae) between the perforate major and minor septa; with or without axial septal boss. *M.Ord.(low.Caradoc.-mid.Caradoc.)-L.Sil.*

Subfamily LAMBELASMATINAE Weyer, 1973

[Lambelasmatinae WEYER, 1973a, p. 34]

Lambelasmatidae with zaphrentoidid pinnate septal arrangement and with cardinal septum dominantly on concave side of corallum. *M.Ord.(low. Caradoc.-mid. Caradoc.)-U.Ord.*

Lambelasma WEYER, 1973a, p. 34 [**L. lambei*; OD; †K61, coll. D. WEYER, 1968, HU, E. Berlin] [?=*Lambeophyllum* OKULITCH, 1938, which see, presence of pores in septa uncertain]. Corallum solitary, small; cardinal fossula on concave side of apically curved corallum; septa of two orders, arranged pinnately in cardinal quadrants and somewhat more radially in counterquadrants, minor septa short, barely projecting beyond peripheral stereozone; septa coarsely monacanthine, monacanths radially incompletely fused whereby septal pores are formed; spinose edges of septa attaining axial region but not forming axial calical boss; intermajor septal loculi small and sparse due to skeletal thickening and crossed by sparse tabulae. [Photographs of median longitudinal sections required for proof of pores.] *Up.M.Ord.(mid. Caradoc.),* Eu.(Ger., Pleist. drift derived from Baltoscandia)-N.Am.(Mich.-Wis.).——FIG. 109, *2a,b.* **L. lambei,* holotype, M.Ord., *Macrurus* Ls. drift, Ger., Warnemünde; *a,* transv. sec. above highest tabula, ×3.0; *b,* transv. sec. through proximal part, ×7.5 (Weyer, 1973a).

Dybowskinia WEYER, 1973a, p. 37 [**D. dybowskii*; OD; †X4115, coll. BEHM, *ca.* 1880, ZGI, E. Berlin]. Like *Lambelasma* but with spongy axial structure, low calical boss, and less markedly pinnate arrangement of septa. [Photographs of longitudinal sections required to confirm presence of septal pores.] *Up.M.Ord.(mid.Caradoc.),* Eu. (Pleist. erratics from Baltoscandia).——FIG. 109, *1a-c.* **D. dybowskii,* monotype, *Macrurus* Ls.; *a,* transv. sec. through lower part of calice, ×3; *b,c,* transv. secs., ×6, ×15 (Weyer, 1973a).

?Lambeophyllum OKULITCH, 1938, p. 100 [**Cyathophyllum profundum* CONRAD, 1843, p. 335; OD; †neotype, 45346 (?=20703), UMMP, Ann Arbor; by STUMM, 1963a, p. 25, WEYER, 1973a, p. 35, considers this nomination invalid] [?=*Lambelasma* WEYER, 1973a, which see]. Corallum solitary, conical, small; major septa extending to axis in early stages, may shorten in mature stages, denticulate, of contiguous trabeculae; minor septa each a longitudinal row of short spines; tabulae not known; cardinal septum prominent in long, narrow fossula; alar and counter septa also long and prominent [see WEBBY, 1971, p. 165]. *M.Ord.(Blackriv.),* N. Am.(Wis.-Mich.-Ont.-N.Y.).——FIG. 109,*3a-c.* **L. profundum* (CONRAD), Black River Gr., Platteville Ls., Wis., Mineral Point; *a,b,* neotype, lat., calical views, ×1; *c,* topotype, showing denticulate axial edges of septa, ×1 (Stumm, 1963a).

?Sogdianophyllum LAVRUSEVICH, 1971c, p. 3 [**S. karasuense*; OD; †133/4, coll. 1030, UpG, Dushanbe]. Corallum fasciculate; increase lateral; septa monacanthine, thick and contiguous in narrow peripheral stereozone, thinning adaxially; within wide tabularium septa not completely laminar [unclear whether perforate as in Calostylicae or of discrete axial ends of trabeculae as in Tryplasmatidae]; axial structure present [unclear whether of axial ends of monacanths as in *Coelostylis* or of curved axial lobes as in *Calostylis*]; tabulae convex; dissepiments ?absent. *U.Ord. (Ashgill.),* Asia(Tadzhik.).——FIG. 109,*4a,b.* **S. karasuense,* holotype, L. Archaly beds, Zeravshan-Gissar Mts., Kashkadarya R. basin, 2 km. W. of meridian of Sangtor Pass; *a,b,* transv., long. secs., ×4 (Lavrusevich, 1971c).

Subfamily COELOSTYLINAE Weyer, 1973

[Coelostylinae WEYER, 1973a, p. 38]

Solitary; septa coarsely monacanthine, with monacanths incompletely fused so that septal pores are left; septa radially arranged

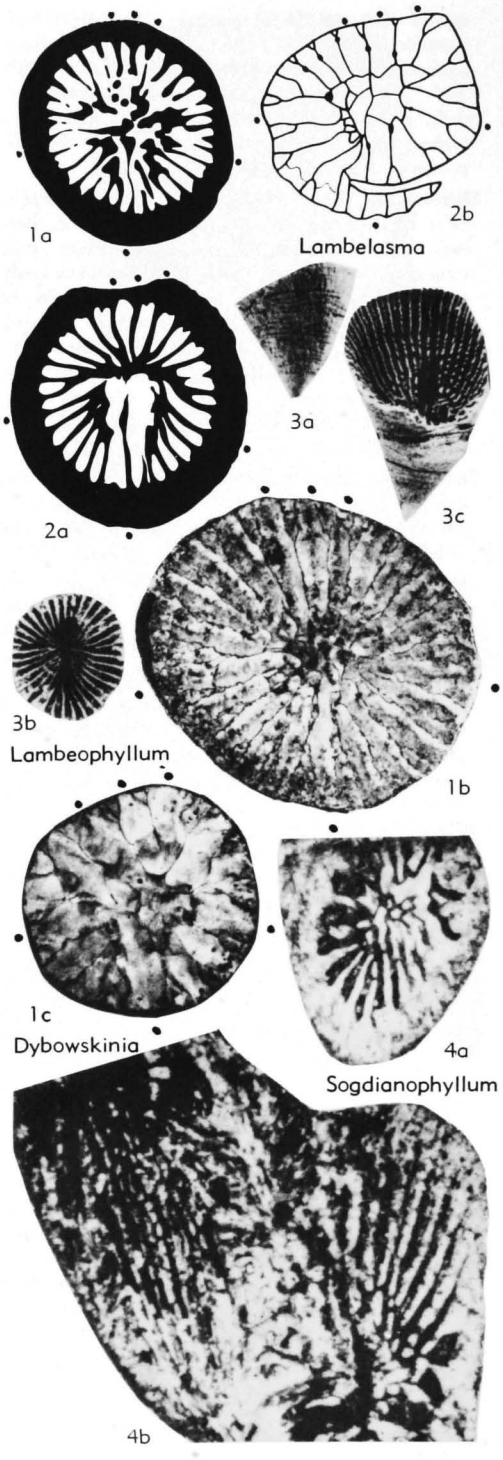


FIG. 109. Lambelasmatidae (p. *F*183).

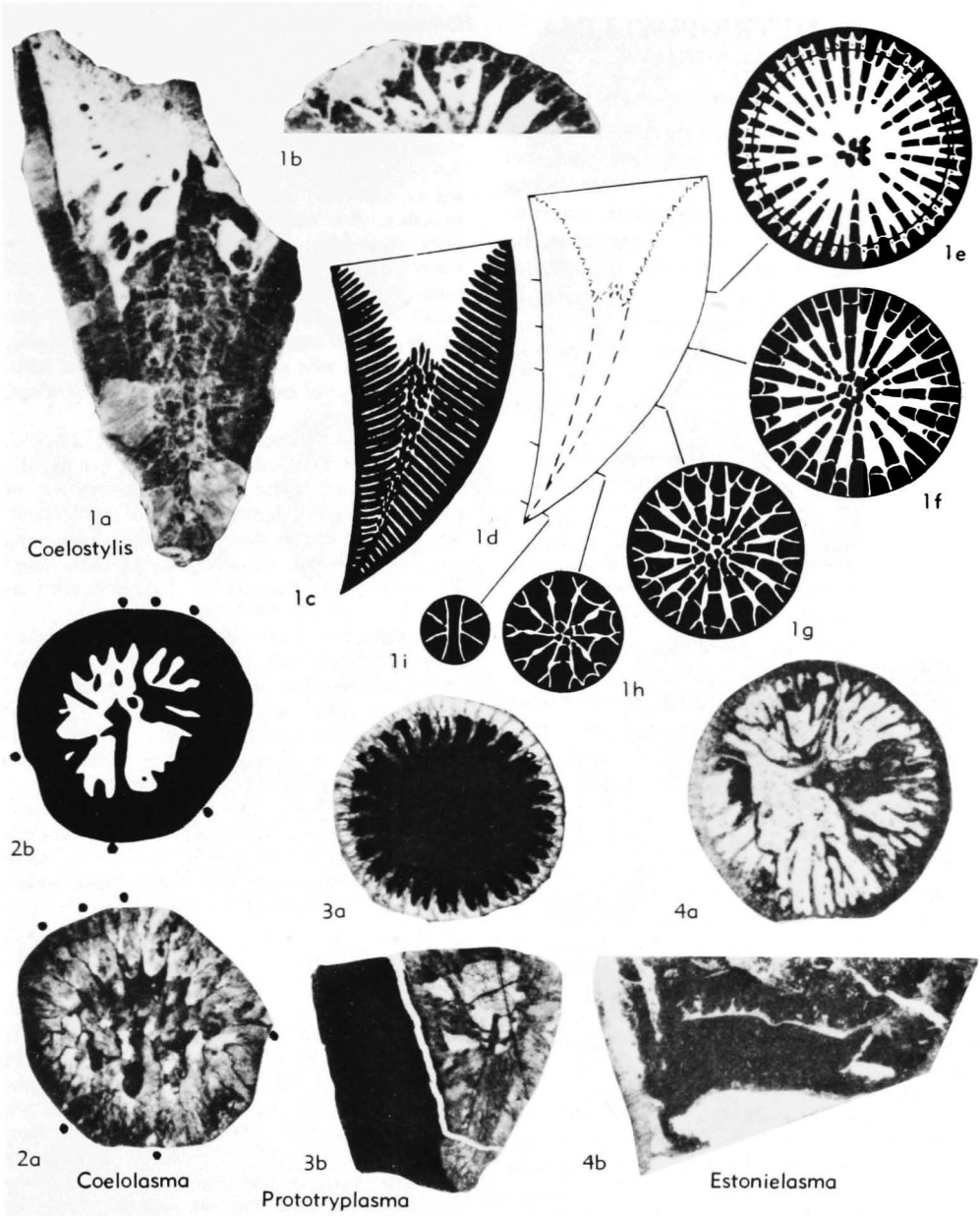
with cardinal septum on convex side; major septal monacanths attaining axial region; major septa thick, so that only narrow and sparse loculi occur between major septa, crossed by sparse tabellae. *Mid.M.Ord.-L.Sil.*

Coelostylis LINDSTRÖM in ANGELIN & LINDSTRÖM, 1880, p. 34 [**Cyathaxonia? Törnquisti* LINDSTRÖM, 1873b, p. 25; M; †Cn54653, RM, Stockholm]. Solitary, small to medium-sized; when curved, cardinal side convex; calice deep; septa of large, periodically contiguous, monacanthine trabeculae very dilated in early stages; axial structure and calicular boss loosely constructed of inner ends of trabeculae; minor septa short; dissepiments absent and tabulae absent to rare [see NEUMAN, 1967, p. 454; WEYER, 1973a, p. 40]. *Mid.M.Ord. (Viru.)*, Eu.(Swed.-Nor.-Ger. in Pleist. drift). ——FIG. 110,*1a,b*. **C. toernquisti*, holotype, *Macrurus* Ls., Swed., Fjäcka, Siljan distr.; *a,b*, long. sec., part of transv. sec., ×4 (Neuman, 1967). ——FIG. 110,*1c-i*. *Coelostylis* sp.; diagram., dotted area in *e* indicates width of peripheral stereozone (Neuman, 1967).

Coelolasma WEYER, 1973a, p. 38 [**C. neumani*; OD; †K64, coll. D. WEYER, 1968, HU, E. Berlin]. Corallum with cardinal septum lateral to convex side of short, curved, apical portion; no calical boss; septa coarsely monacanthine, radially arranged; monacanths incompletely fused so that septal pores occur; axial ends of major septal monacanths variably connected in axial region or reduced; minor septa very short; skeletal thickening great, leaving so few interseptal spaces that tabulae may be absent. [Photographs of longitudinal sections required.] *Up.M.Ord.(mid.Caradoc.)*, Eu.(Ger., erratics in Pleist. drift).——FIG. 110,*2a,b*. **C. neumani*, holotype, drift at Warnemünde; *a,b*, calical, transv. secs., ×6, ×5 (Weyer, 1973a).

Estonielasma WEYER, 1973a, p. 43 [**Tryplasma hemicymatelasma* REYMAN in KALJO, 1957, p. 156; OD; †Co1274, EGM, Tallinn; lectotype by REYMAN, 1958, p. 39]. Solitary, septa monacanthine, radially arranged, amplexoid in mature stage but reaching axis in early stages, monacanths incompletely fused in laminar parts of septa so that septal pores result [confirmatory photographs of longitudinal sections required]; minor septa short; tabulae numerous, thin, horizontal. *?Up.M.Ord.-U.Ord.(Vormsi.)*, Eu.(Est.).——FIG. 110,*4a,b*. **E. hemicymatelasma* (REYMAN), holotype, U.Ord. (Vormsi.), F_1ba horizon, Est., Kohila; *a,b*, transv., long. secs., ×2.4, ×2.3 (Reyman, 1958).

?Prototryplasma IVANOVSKIY, 1963, p. 96 [**P. oroniana*; OD; †57, coll. 305, IGG, Novosibirsk]. Small, solitary, epitheca ribbed, calice deep with sharp edges; septa short, acanthine, strongly thickening toward periphery so that narrow peripheral stereozone is formed; tabellae sparse, strongly inflated, steep, resembling dissepiments. [IVANOV-



Suborder METRIOPHYLLINA Spasskiy, 1965

[Metriophyllina Spasskiy, 1965a, p. 88]

Predominantly small, solitary Stauriida with narrow peripheral stereozone and, except in a few, lacking dissepiments; septa laminar, longitudinally continuous, trabeculae commonly fine; minor septa may be long and contratingent; fossula inconspicuous; columella or axial structure present in some, an aulos in others; tabulae abaxially declined, commonly complete. *M.Ord.; L. Sil.-U.Perm.*

Family CYATHAXONIIDAE Milne-Edwards & Haime, 1850

[*nom. correct.* Chapman, 1925, p. 105, *ex* Cyathaxonidae Milne-Edwards & Haime, 1850, p. lxv] [=Cyathaxoninae Dybowski, 1873c, p. 333; Cyathaxoniicae Hill, 1956b, p. *F*257; Cyathaxoniinae Rozkowska, 1969, p. 51; Cyathaxoniaceae Weyer, 1971c, p. 1026; Lophotichiinae Weyer, 1972c, p. 456; Epiphanophyllinae Weyer, 1972c, p. 462]

Solitary, small, ceratoid; calice deep with steep sides and axial boss; major septa long, equal, may meet dense columella rising independently from apex of corallum; minor septa long, commonly contratingent; tabulae declined from columella in noncontratingent loculi. *U.Sil.; U.Dev.-L.Penn.; L. Perm.-U.Perm.*

Cyathaxonia Michelin, 1847, p. 257 [**C. cornu*; SD Milne-Edwards & Haime, 1850, p. lxv; †not traced] [?=*Cyathocarinia* Soshkina, 1928, p. 376 (type, *C. tuberculata,* SD Lang, Smith, & Thomas, 1940, p. 43; †546, coll. 146, PIN, Moscow; L. Perm., R. Ilych, N. Urals); *Cyathacarinia* Dobrolyubova, 1936b, p. 92, *nom. null.*]. Small, ceratoid, with cylindrical columella projecting as calicular boss and developed independently of, but in contact with, major septa, and with long and commonly contratingent minor septa clearly inserted alternately with major septa; with complete tabulae declined abaxially ?(in open, i.e., noncontratingent, interseptal loculi) and without dissepiments; sides of septa may be vepreculate. *U.Dev.(Famenn.),* Eu.(Pol.); *L.Carb.,* Eu.(U.K.-Eire-Belg.-Urals)-N.Afr.(Sahara)-Asia (Laos)-Australia(New S.Wales); *Miss.,* N.Am.(Mo.); *L. Perm.,* Eu. (Urals); *U. Perm. (Kazan.),* Asia (Camb.).——Fig. 111,*2a-e.* **C. cornu; a,b,* L. Carb.(Visean), Scot., Southfold Quarry, Dunfermline, central part of transv. sec., long. sec. through septa and columella, ×8; *c,d,* L.Carb. (Tournais.), Belg., Cornet Quarry, Tournai, transv., long. secs., ×4; *e,* L.Carb.(Visean), Eng., Stock, near Bracewell, long. sec. showing vepreculae on sides of septa, ×5 (Carruthers, 1913).

?Columnaxon Scrutton, 1971, p. 199 [**C. angelae*; OD; †R46748 (A2579), BM(NH), London]. Very small, solitary, conicocylindrical; aulos formed from axial ends of major septa present in early stage; in later stages, axial end of counter septum where projecting into aulos greatly expanded, almost closing the axial space and in calice projecting as axial boss; minor septa contratingent except in calice, *Km* longest; tabellae within aulos in early stage flat; periaular tabellae imperfectly known, those of larger alternate interseptal loculi concave distally and thus probably declined abaxially. *U.Sil.(Ludlov.),* S.Am.(Venez.).——Fig. 111,*4a-g.* **C. angelae,* holotype, Merida Andes, Río Aricagua sec.; *a-g,* serial transv. secs. of holotype from edge of calice downward, ×4 (Scrutton, 1971).

?Cyathaxonella Shtukenberg, 1895, p. 25 [**C. gracilis*; OD; †?in coll. 305, TsGM, Leningrad]. Small, solitary; calice deep; calical surface of columella showing slightly convolute septal lamellae; cardinal septum short in fossula, major septa reaching columella, minor septa moderately long; no dissepiments; ?no tabulae. [Types require restudy.] *L.Carb.,* Eu.(W.Urals).

Epiphanophyllum Ilina, 1970, p. 149 [**E. sinuosum*; OD; †363, coll. 2376, PIN, Moscow]. Solitary, small, cardinal side convex, with peripheral stereozone; septa long, waved ?(parallel to distal edge), major septa thick, coarsely trabeculate, almost joining or joining columella formed from axial edge of cardinal septum; minor septa long, thin, contratingent; loculi within contratingent septa very narrow, containing horizontal skeletal elements that in transverse section are ?concave toward axis, alternate interseptal loculi wider, with tabulae convex toward axis [see Weyer, 1972c, p. 462]. *U.Perm.(Murgab.),* Asia(Pamir). ——Fig. 111,*3a,b.* **E. sinuosum,* holotype, SE. Pamirs; *a,b,* transv. secs., ×4 (Ilina, 1970).

Lophotichium Moore & Jeffords, 1945, p. 111 [**L. vescum*; OD; †7385-24s, KUMIP, Lawrence]. Moderately small, curved, conical; with narrow peripheral stereozone; major septa long, thin, not rhopaloid, in early stages joined in groups of two or three or singly to thickened axial end of long counter septum, which is produced in calice as columellar boss, in late stages major septa withdrawing from axis, cardinal septum shortening most; minor septa either long or short, thinner, contratingent *Km* longer than others; horizontal skeletal elements in interseptal loculi closed by contratingency declined slightly adaxially, in alternate loculi tabulae declined steeply abaxially [see Weyer, 1972c, p. 456]. *L.Penn.,* N.Am. (Okla.); *L.Perm.(Wolfcamp.),* N.Am.(Texas). ——Fig. 111,*1a-c.* **L. vescum,* topotype, Hale F., Okla., Greenleaf Lake, Braggs; *a,b,* transv. secs., arrows mark positions of septa *C, K, A,* and *KL,* ×4; *c,* another specimen, long. sec., ×4 (Moore & Jeffords, 1945).

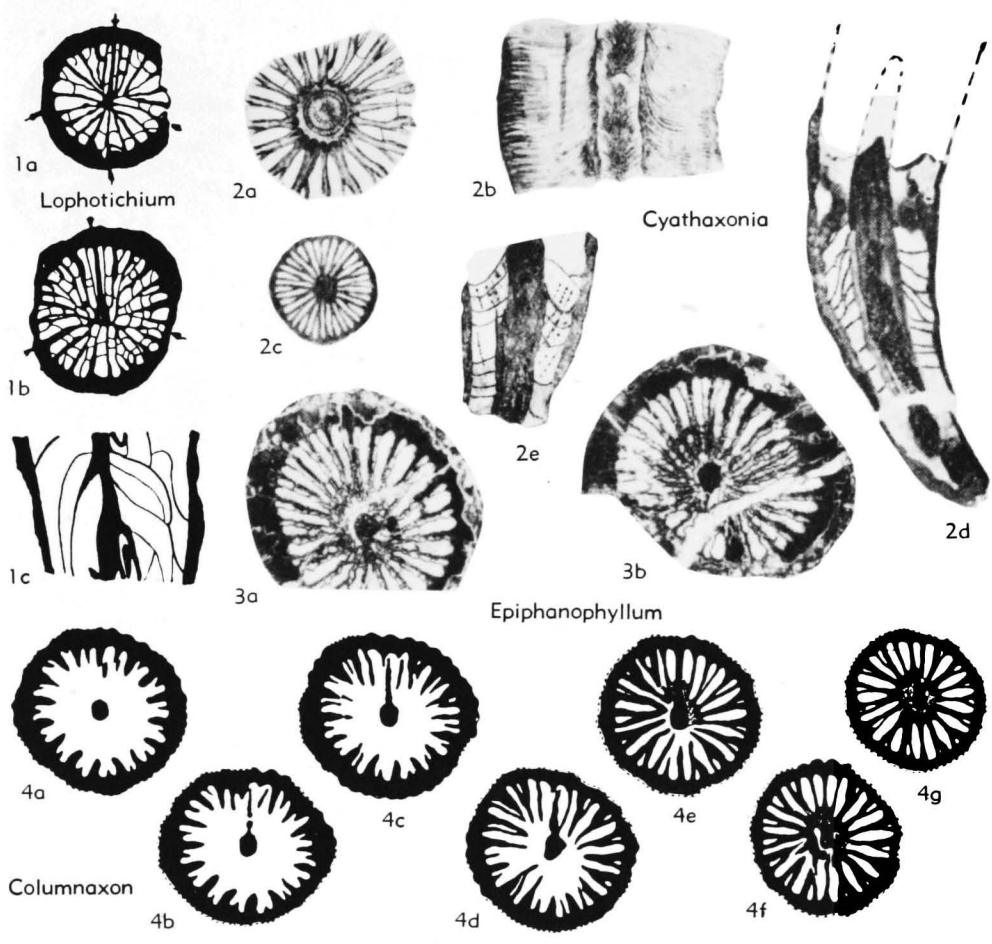


FIG. 111. Cyathaxoniidae (p. *F*186).

Family PETRAIIDAE de Koninck, 1872

[*nom. correct.* GRABAU, 1922, p. 27, *pro* Petraiadae DE KONINCK, 1872, p. 113] [=Petrainae DYBOWSKI, 1873c, p. 331; Petraiinae WANG, 1950, p. 205; Protozaphrentidae IVANOVSKIY, 1959, p. 895; Petraiicae IVANOVSKIY, 1968, p. 86]

Small, solitary, conical; calice deep, not columellate; major septa or groups of major septa joining axially and, in some, withdrawing from axis in late stages; minor septa long and contratingent; tabulae absent or declined abaxially; small plates within contratingencies absent or declined adaxially. *M.Ord.; U.Sil.; L.Dev.; U.Dev.*

Petraia MÜNSTER, 1839a, p. 42 [**P. decussata*; SD MILLER, 1889-1897, p. 199; †not traced; =*P. radiata, fide* SCHINDEWOLF, 1931, p. 634, †neotype K90.1 in MÜNSTER Coll., HU, E. Berlin, by SCHINDEWOLF, 1931, p. 634]. Small, solitary, calice deep, not columellate; with narrow peripheral stereozone; septa equal, finely trabeculate, thin, laterally smooth; major septa meeting axially, minor septa long, contratingent and clearly inserted alternately with major; tabulae sparse; small plates within contratingencies also sparse [see SCHINDEWOLF, 1931, p. 633; WEYER, 1973f, p. 703]. *U.Sil.(eβ),* Eu.(Ger.)-N.Am.(Okla.).—— FIG. 112,*4a-d*. *P. semistriata* MÜNSTER, Ludlov., *Orthoceratites* Ls., Bavaria, Elbersreuth; *a-d,* serial transv. secs., ×15 (Schindewolf, 1931).

Haptophyllum PEDDER, 1967b, p. 110 [**Metriophyllum erisma* HILL, 1950, p. 142; OD; †48901, GSV, Melbourne] [=*Haplophyllum* HATCH & ARMITAGE, 1970, p. 23, *nom. null.*]. Solitary, small, with peripheral stereozone; septa thin, waved and ?flanged parallel to calical edges; axial edges of major septa confluent at or near axis; minor septa long and contratingent; tabellae in open interseptal loculi steeply declined abaxially, those within contratingencies sloping down ad-

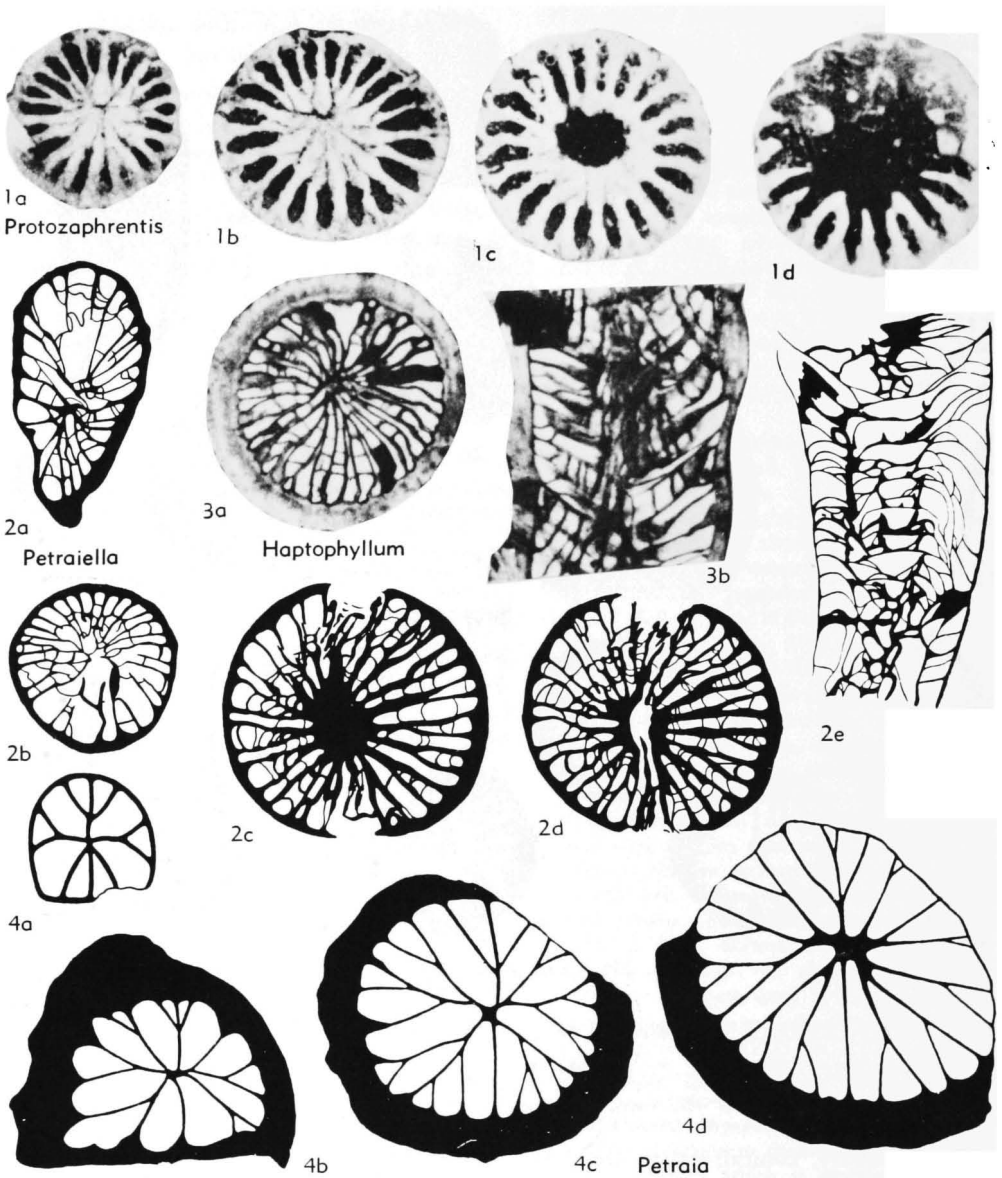


FIG. 112. Petraiidae (p. *F*187-*F*189).

axially; counter septum greatly shortened and appearing forked peripherally [*fide* WEYER, 1972c, p. 452]. *L.Dev.(Ems.),* Australia(Vict.).——FIG. 112,*3a,b*. **H. erisma* (HILL), topotypes, Vict., Taravale mudstone near Buchan; *a,b,* transv., long. secs., ×5 (Pedder, 1967b).

Petraiella ROZKOWSKA, 1969, p. 43 [**P. kielcensis*; OD; †Tc 3/961, PZI, Poznan]. Small, solitary; calice shallow, not columellate; distal edges of septa smooth; in early stages axial ends of thin major septa at axis, but in later stages may withdraw; in some, in late stage, peripheral ends of counter and cardinal septa may appear to be split; minor septa long, contratingent, septal insertion accelerated in counter quadrants; copious adaxially declined plates within contratingencies, and abaxially declined tabellae in alternate interseptal loculi [see WEYER, 1972c, p. 456; 1973f, p. 704]. *U.Dev.(Famenn.),* Eu.(Pol.-Czech.).——FIG. 112,*2a-e*. **P. kielcensis,* low. Famenn., Pol., Kielce; *a-d,* holotype, transv. secs., ×3.5; *e,* paratype, long. sec., ×3.5 (Rozkowska, 1969).

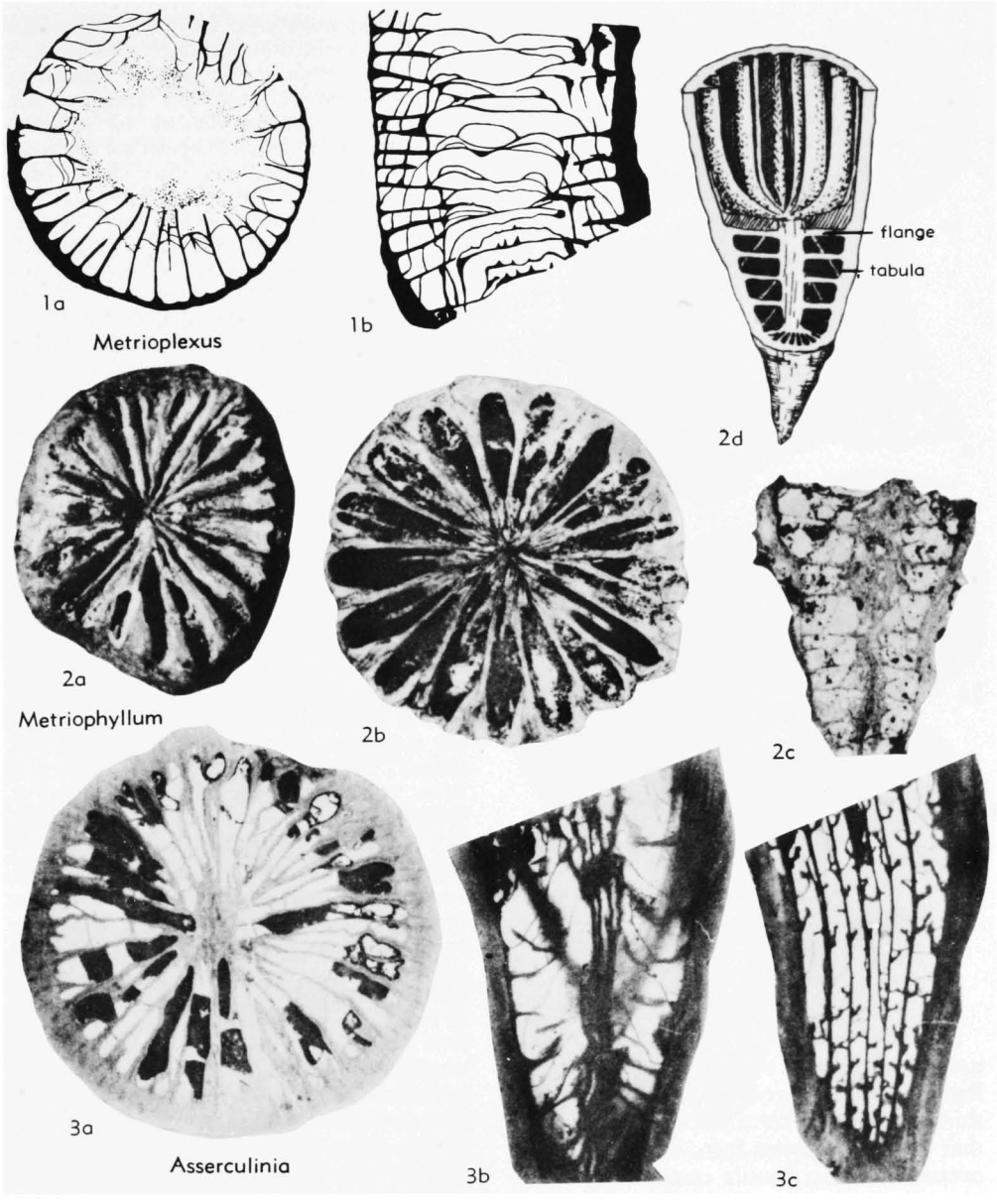


FIG. 113. Metriophyllidae (p. *F*190-*F*191).

Protozaphrentis Yü, 1957, p. 317 [**P. minor*; M; †8925-8932, IGP, Nanking]. Corallum solitary, small, conical, not columellate, cardinal side convex; calice deep; fossula faint; septa coarsely trabeculate, long, thick, with sculptured sides; major septa forming axial structure by conjunction of swollen axial ends that are lower in axial calical depression; minor septa long, contratingent, *Km* (those of ambicounter septal loculi) longest; tabulae absent, no plates observed within contratingencies [see WEYER, 1973f, p. 696]. *M.Ord.*, Asia (Sinkiang).——FIG. 112,*1a-d*. **P. minor*, holotype, China, Liu-Wang-shan, Kuluk-Tag Ra.; *a-d*, transv. secs., ×10 (Yü, 1957).

Family METRIOPHYLLIDAE Hill, 1939

[Metriophyllidae HILL, 1939c, p. 143] [=Metriophyllacea HUDSON, 1945b, p. 287, superfamily; Metriophyllinae WANG, 1950, p. 204; Metriophyllicae HILL, 1954, p. 8; Petronellidae BIRENHEIDE, 1965b, p. 1; Petrophyllinae BIRENHEIDE, 1965b, *nom. transl.* BIRENHEIDE & SOTO, 1977, p. 6]

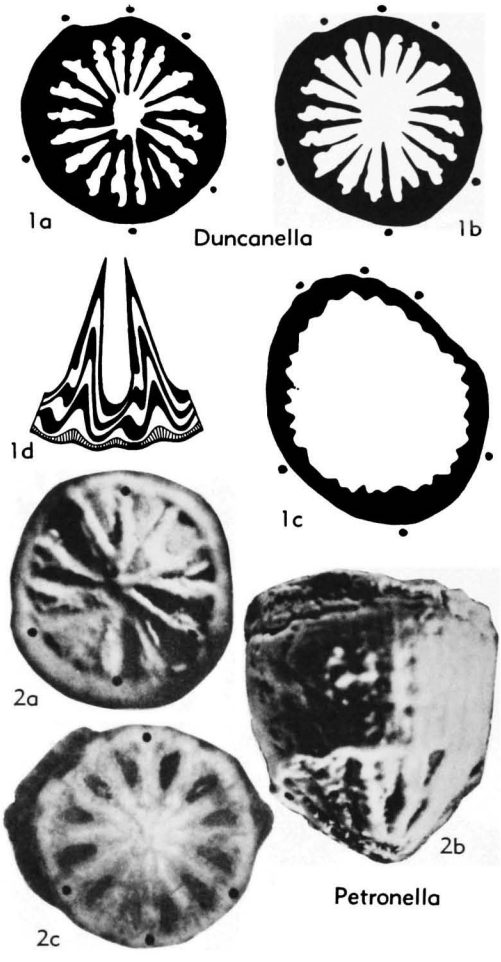


FIG. 114. Metriophyllidae (p. *F*190-*F*191).

Solitary, small, ceratoid, suberect, with narrow peripheral stereozone; major septa flanged or not flanged, subradially arranged, thick, meeting to form thick axial structure that does not project into, but may be excavate in, calice; fossula commonly not obvious; minor septa insignificant, contratingent or not; tabulae absent or present, declined abaxially. *L.Sil.-?Miss.; ?L.Perm.-U.Perm.*

Metriophyllum MILNE-EDWARDS & HAIME, 1850, p. lxix [**M. bouchardi*; OD; †specimen figured MILNE-EDWARDS & HAIME, 1851, p. 318, pl. 7, fig. 1, 1a; lectotype by LANG, SMITH, & THOMAS, 1940, p. 84, specimen lost *fide* HOLWILL, 1964, p. 112]. Small, solitary, turbinate to ceratoid, erect or slightly curved with cardinal side convex; with narrow peripheral stereozone and without dissepiments; major septa with horizontal flanges (parallel to epithecal growth rings) with upturned lateral edges alternating in level in neighboring septa; axial ends of major septa uniting at axis, but axial structure thus formed not projecting from base of calice; cardinal septum not shortened; minor septa including *Km* short, below calice reduced to wall, not contratingent; tabulae thin and sloping downward from axis [see HOLWILL, 1964, p. 109]. *L.Dev.*, Australia(Vict.); *M.Dev.-U.Dev.*, Eu.(France-Ger.-U.K.)-N.Am.(N.Y.)-Australia(W.Australia)-Asia(China-Indoch.); *?Miss.*, N.Am.(Mo.); *?L.Perm.*, Eu.(Urals).——FIG. 113, *2a-d*. **M. bouchardi*; U.Dev.(Frasn.), France, Ferques, near Boulogne; *a*, calical view, ×5.4; *b*, transv. sec., ×8.0; *c*, long. sec., ×4.0; *d*, diagram. (Holwill, 1964).

?**Asserculinia** SCHOUPPÉ & STACUL, 1959, p. 284 [**A. prima*; OD; †Se 230, SCHOUPPÉ Coll., GPI, Münster] [=*Asserculina* NAKAZAWA *et al.*, 1975, p. 41, *nom. null.*]. Solitary, small, ceratoid; major septa long, meeting at axis, or in groups before reaching axis, ?without forming projecting columella, with metriophylloid flanges opposite or subopposite on either side of each septum; minor septa including *Km* short, axial edges free; tabulae declined from axis; no dissepiments; in young stages septa of cardinal quadrants pinnate about cardinal ?fossula, which is possibly on concave side of corallum [see also WEYER, 1970a, p. 58]. *U.Perm.*, Eu.(Greece)-Asia(Timor).——FIG. 113, *3a-c*. **A. prima*, holotype, Basleo, Timor; *a*, transv. sec., ×4; *b*, long. sec., ×3; *c*, tang. sec., ×3 (Schouppé & Stacul, 1959).

?**Duncanella** NICHOLSON, 1874b, p. 333 [**D. borealis*; M; syntypes 01554-01558, NICHOLSON Coll., AU, Aberdeen, and 1968.15.40, RSM, Edinburgh, *fide* BENTON, 1979]. Very small, solitary, suberect, ceratoid to cylindrical; in short conical apical region without wall so that peripheral bases of septa are exposed; major septa thick, ?sculptured laterally, confluent axially although small round pit may develop in calice on the dense axial structure so formed; *Km* long, other minor septa very short, amalgamate with major septa to their counter side; tabulae absent. [Type material never revised; diagnosis based in part on WEYER, 1972c, p. 446, fig. 9,11b.] *Sil.(Niag.)*, N.Am.(Ind.).——FIG. 114,*1a-d*. **D. borealis*, Ind., Waldron; *a-c*, transv., calical secs., ×8.3; *d*, growth layers in two major septa and their amalgamate minor septa, diagram. (Weyer, 1972c).

?**Metrioplexus** GLINSKI, 1963, p. 328 [**M. richteri*; OD; †F17084, SM, Frankfurt]. Solitary, not large; early stages metriophylloid, i.e., major septa meeting at axis in axial structure that disappears in later stages when septa are withdrawn from axis and amplexoid; major septa with metriophylloid flanges; tabulae commonly complete, in early

stages declined from axis, in later stages horizontal or distally convex axially, peripherally declined to wall, but no aulos noted; cardinal septum commonly short and fossula weakly expressed on concave side of corallum in type species; *Km* moderately long, contratingent in early stages, remaining minor septa reduced to wall; no dissepiments. *M.Dev.(up.Eifel.),* Eu.(Ger.).——Fig. 113,*1a,b*. **M. richteri,* holotype, Ahback Beds, Lahr horizon, Hillesheim Mulde; *a,b,* transv., long. secs., ×5 (Glinski, 1963).

Petronella Birenheide, 1965b, p. 2 [**Duncanella pygmaea* Schlüter, 1885a, p. 6; OD; †160, Schlüter Coll., IP, Bonn; lectotype by Birenheide, 1965b, p. 2]. Very small, solitary; peripheral edges of thick septa in small, inversely conical tip bare of epitheca and not connected by wall; upper part of corallum subcylindrical, with slender, epithecate peripheral stereozone and showing longitudinal septal grooves; insertion of septa accelerated in counter quadrants; major septa axially united or free, may form platy axial structure that does not project into calice; minor septa insignificant, contratingent; no septal flanges; tabulae ?absent. *M.Dev.,* Eu.(Ger.-Spain).——Fig. 114,*2a-c*. **P. pygmaea* (Schlüter); *a,b,* lectotype, Eifel., apical, side views, ×11; *c,* another specimen, Eifel., probably Freiling Beds, Eifel, transv. sec., ×11 (Birenheide, 1965b).

Family LACCOPHYLLIDAE Grabau, 1928

[Laccophyllidae Grabau, 1928, p. 82] [=Syringaxonidae Hill, 1939c, p. 141; Amplexocariniidae Soshkina in Soshkina, Dobrolyubova, & Porfirev, 1941, p. 92, *nom. transl. et correct.* Rozkowska, 1969, p. 81, *ex* Amplexocarininae Soshkina in Soshkina, Dobrolyubova, & Porfirev, 1941, p. 92)]

Solitary, not large; major septa in early stages meeting at axis on metriophylloid plan, in later stages withdrawing from axis and aulos formed by thickening and conjunction or by deflection of their axial ends or by conjunction of downturned edges of axial tabellae or by some combination of these modes; in latest stages aulos may be breached or disappear; minor septa may be long and contratingent with *Km* longest, or may be reduced to wall; tabularium biform when minor septa are contratingent, periaxial tabellae within contratingencies being declined adaxially, those in alternate loculi declined abaxially; aular tabellae horizontal or concave; dissepiments present in some. *Sil.-Perm.*

Subfamily LACCOPHYLLINAE Grabau, 1928

[*nom. transl.* Rozkowska, 1969, p. 57, *ex* Laccophyllidae Grabau, 1928, p. 82] [=Syringaxoninae Hill, 1939c, p. 141, *nom. transl.* Rozkowska, 1969, p. 40, *ex* Syringaxonidae Hill, 1939c, p. 141; Sub-Glandiniinae Weyer, 1972c, p. 452]

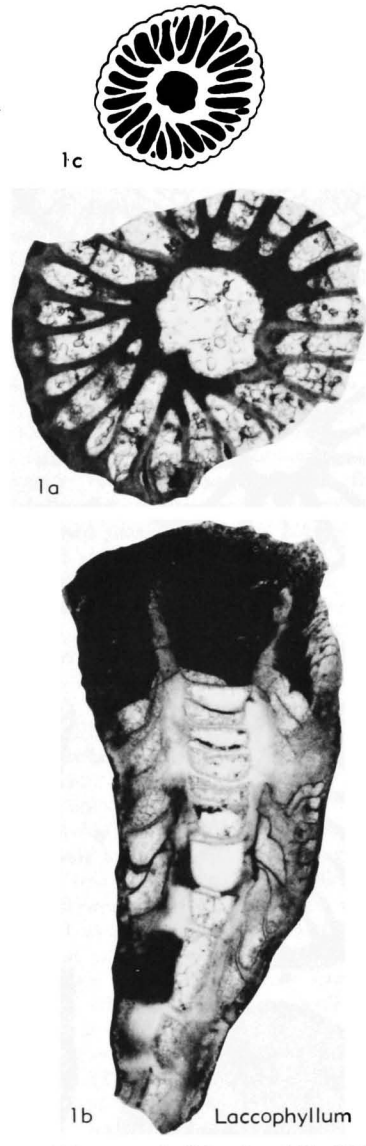


Fig. 115. Laccophyllidae (p. *F*191-*F*193).

Laccophyllidae with aulos in late stages dominantly of septal origin; with long, contratingent minor septa, *Km* longest, and biform tabularium; dissepiments present in some; in some laccophyllids, some or all of the septa *K, KL, C,* and *Km* may have 'split' peripheral ends. *L.Sil.-U.Dev.; ?L. Perm.-U.Perm.*

Laccophyllum Simpson, 1900, p. 201 [**L. acuminatum*; OD; syntypes, 288, 289, type coll., NYSM, Albany] [?=*Syringaxon* Lindström, 1882b,

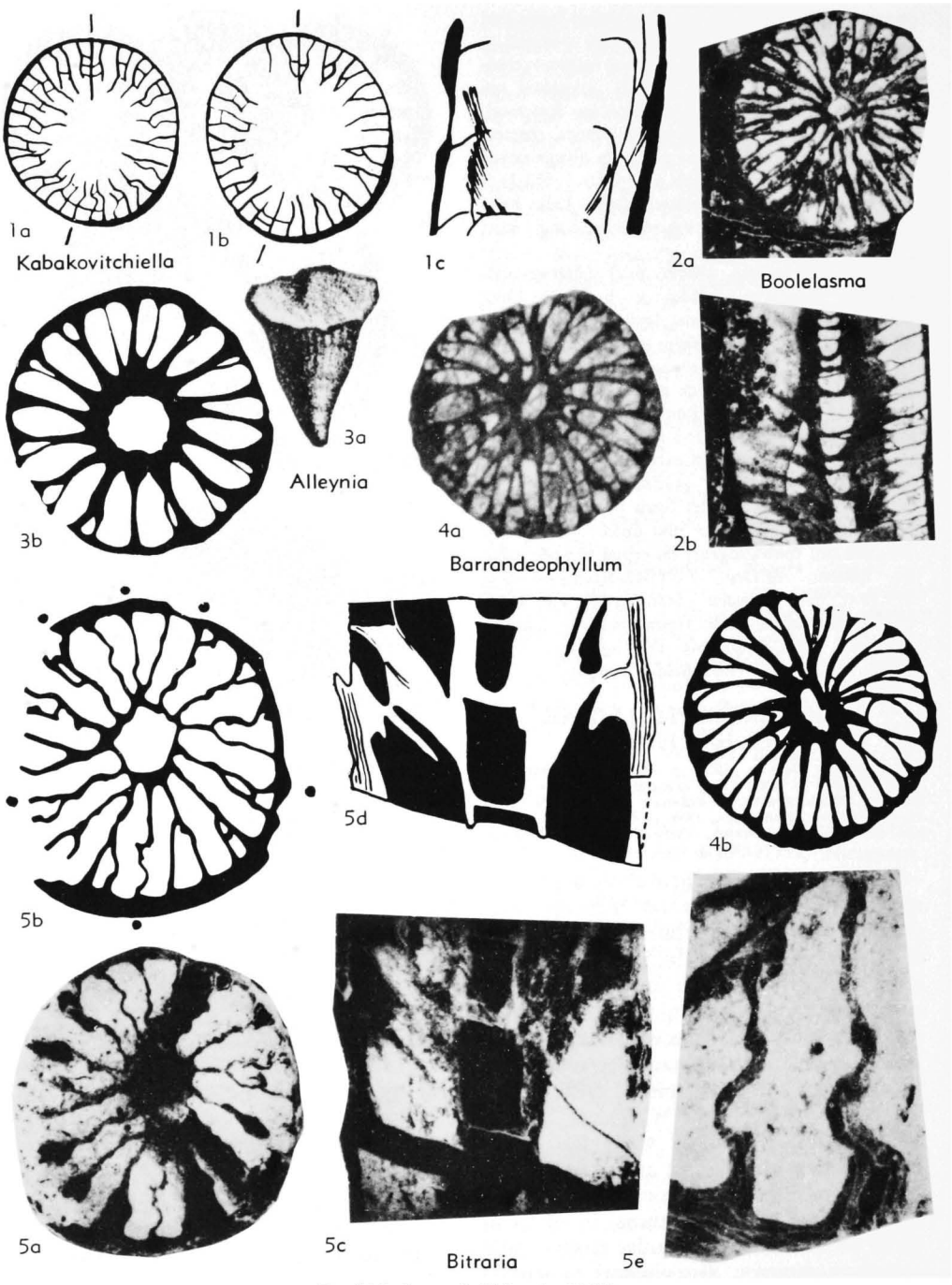


FIG. 116. Laccophyllidae (p. *F193*).

which see]. Small, solitary, with aulos of septal origin, in part at least from deflection of axial ends of major septa; [identification of protosepta cannot be made unambiguously from SIMPSON's figured transverse thin section, which was subsequently damaged]; minor septa long and contratingent; tabellae in aulos horizontal or slightly concave, those within contratingencies dissepiment-

like and declined adaxially, those in alternate interseptal loculi mostly complete and declined abaxially. [Presence or absence of peripheral septal 'splitting' not established.] *M.Sil.(Niag.)*, N. Am.(Tenn.).——Fig. 115,*1a-c*. **L. acuminatum*, syntypes, M.Sil.(Niag.), Tenn., Perry Co.; *a,b*, transv., long. secs., ×10, ×5 (Hill, n; photographs courtesy W. A. Oliver); *c*, Simpson's drawing of transv. sec. in *a*, enl. (Simpson, 1900).

Alleynia Počta, 1902, p. iv, *nom. subst. pro Nicholsonia* Počta, 1902, p. 184, *non Nicholsonia* Schlüter, 1885c, p. 53 [**Nicholsonia bohemica* Barrande in Počta, 1902, p. 186; SD Grabau, 1928, p. 84; †CF1325, NM, Prague; lectotype by Prantl, 1938, p. 24; =*Petraia bohemica* Barrande, 1865, p. 51, *nom. nud.* Lectotype ?unsectioned, definition based on Prantl, 1938, p. 24, text-fig. 1, transverse section of topotype, and his descriptions of paratypes.] [?=*Syringaxon* Lindström, 1882b, which see]. Solitary, small, conical; major septa moderately thick, their axial ends contiguous in thickened aulos that is crossed by flat or slightly concave tabellae; minor septa contratingent, thin, moderately long, *Km* very long; periaular tabellae declined abaxially [presence or absence of tabellae within contratingencies not stated; no evidence of peripheral splitting of protosepta]. *M.Dev.(low.Eifel.)*, Eu.(Czech.).——Fig. 116,*3a,b*. **A. bohemica* (Barrande), Daleje Sh., g*β*, Hlubočepy; *a*, holotype, ext. view, ×2 (Počta, 1902); *b*, topotype, transv. sec., enl. (Prantl, 1938).

Barrandeophyllum Počta, 1902, p. 190 [**B. perplexum*; M; †L10077, NM, Prague; lectotype by Prantl, 1938, p. 35. The lectotype has never been sectioned and Oliver & Galle (1971b, p. 89) point out that Prantl's concept of the species is based on Počta's syntypes, which may or may not be conspecific with the lectotype. The diagnosis given below is based on Prantl, 1938, p. 35.] [?=*Syringaxon* Lindström, 1882b, which see]. Solitary, small; major septa moderately thick, reaching axis in early stages; in later stages their axial edges withdrawing from axis but remaining conjoined, forming narrow aulos crossed by slightly concave tabellae; minor septa thinner, moderately long, contratingent, *Km* longest; cardinal septum may be longer than others; periaular tabularium biform, tabellae within contratingencies dissepimentlike, those in alternate interseptal loculi declined abaxially. Presence or absence of 'splitting' at peripheral edges of septa not noted. *L.Dev.* or *M.Dev.*, Eu.(Czech.).——Fig. 116,*4a,b*. **B. perplexum*, syntype, Branik Ls., g*α*, Hlubočepy Valley; *a*, transv. sec., ×7 (Počta, 1902); *b*, Prantl's drawing of same transv. sec., ×7 (Prantl, 1938).

Bitraria Galle & Weyer, 1973, p. 708 [**B. bohemica*; OD; †AG327, UUG, Prague]. Solitary, small; calice very deep, wall relatively thick; aulos crossed by flat tabellae; septa waved and with flangelike swellings parallel to calical edges; cardinal septum not shortened; minor septa commonly long and contratingent, may be free at axial ends, *Km* longest; tabellae within contratingencies declined adaxially parallel to calical edges of septa, those of alternate loculi between minor septa declined abaxially. *M.Dev.(up.Eifel.)*, Eu.(Czech.).——Fig. 116,*5a-e*. **B. bohemica*, holotype, *Acanthopyge* Ls., Zlatý Kůň near Koněprusy; *a,b*, transv. sec., photograph and drawing, ×8.0; *c,d*, long. sec., photograph and drawing, ×9.0; *e*, transv. sec., ×23.5 (Galle & Weyer, 1973).

Boolelasma Pedder, 1967b, p. 122 [**B. pycnotheca*; OD; †F8985, UNE, Armidale] [=*Bodelasma* Flügel, 1970, p. 35, *nom. null.*]. Solitary, small, slender, with narrow peripheral stereozone; major septa united axially to form narrow, regular aulos; minor septa long, contratingent; both orders with ?waves or metriophylloid flanges; aular tabellae flat; tabellae within contratingencies gently declined adaxially, those of alternate interseptal loculi steeply declined abaxially. [Weyer, 1972c, p. 455, states that the cardinal, counter, counter-lateral, and *Km* septa appear forked peripherally.] *L.Dev.(Siegen.)*, Australia(Vict.); *L. Dev.(up.Ems.)*, Eu.(Spain).——Fig. 116,*2a,b*. **B. pycnotheca*, holotype, Siegen., Cooper's Cr. F., Vict., Tyer's R.; *a,b*, transv., long. secs., ×5 (Pedder, 1967b).

?**Kabakovitchiella** Weyer, 1972c, p. 451 [**Amplexocarinia duplex* Schouppé & Stacul, 1959, p. 322; OD; †Se262, GPI, Münster]. Solitary, small, with thread-thin septa; major septa short, minor septa relatively long and either contratingent, contrajunct, or free at axial ends; thin-walled irregular ?aulos formed by downturned edges of broad, mesa-shaped axial tabellae [evidenced by longitudinal section of holotype]; periaxial tabularium possibly biform [based on different levels of intersection of tabellae in alternate loculi between minor septa as seen in transverse section]; ?without tabular fossula. *?L.Perm.*, Eu.(Carnic Alps); *U.Perm.*, Asia(Timor).——Fig. 116,*1a-c*. **K. duplex* (Schouppé & Stacul), holotype, Basleo Beds, Timor; *a,b*, transv. secs., *c*, long. sec., all ×3 (Schouppé & Stacul, 1959).

?**Metrionaxon** Glinski, 1963, p. 324 [**M. schlueteri*; OD; †FXXV549, SM, Frankfurt]. Solitary, small, cardinal side concave; major septa with subhorizontal metriophylloid flanges and uniting axially to form narrow aulos crossed by more or less horizontal tabellae; *Km* long and contratingent, remaining minor septa very short; periaular tabellae sparse or absent [see also Plusquellec, 1966, p. 834]. *L.Dev.(Ems.)*, Eu.(Spain); *M.Dev.*, Eu.(Ger.-France-Pol.).——Fig. 117,*6a,b*. **M. schlueteri*, Prümer Mulde, Ger.; *a*, holotype, Junkerberg beds, median long. sec., ×5; *b*, another specimen, Freiling beds, transv. sec., ×5 (Glinski, 1963).

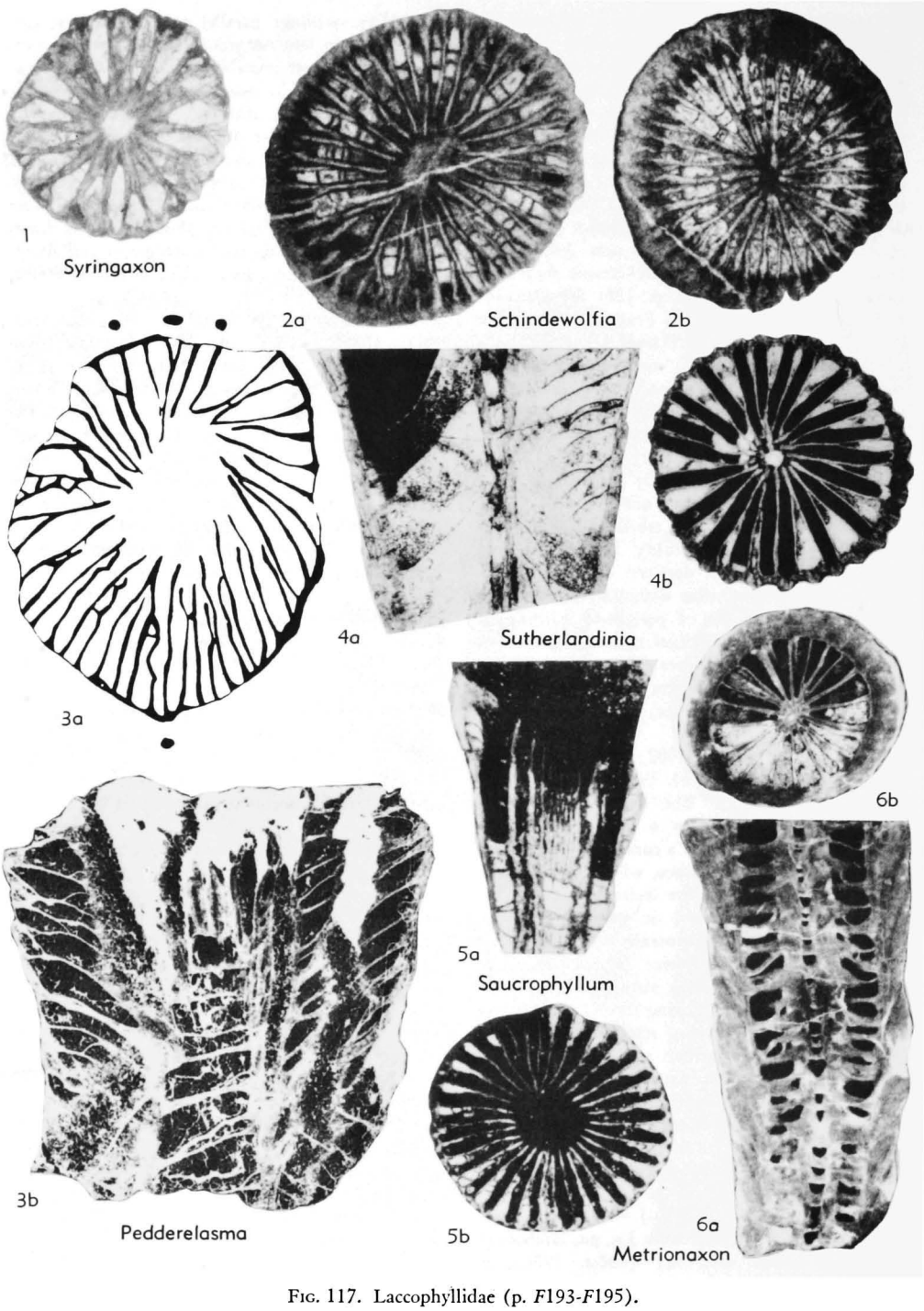


FIG. 117. Laccophyllidae (p. *F*193-*F*195).

Pedderelasma WEYER, 1972c, p. 455 [**Syringaxon? furcaseptatus* FLÜGEL & FREE, 1962, p. 240; OD; †P1117, UG, Graz]. Solitary, small; with imperfect aulos developed only in middle stages of growth; septa long, thin, irregularly waved, major septa withdrawing toward periphery in late stages,

counter septum may be 'split' at peripheral end; minor septa contratingent or with axial ends free; tabularium biform, within contratingencies tabellae declined adaxially, in alternate loculi between minor septa declined steeply abaxially; aular tabellae flat. *M.Dev.(Eifel.),* Eu.(Ger.).——FIG. 117, *3a,b.* **P. furcaseptatum* (FLÜGEL & FREE), Greifenstein Ls., Rhenish Schiefergebirge; *a,* holotype, transv. sec., ×6 (Weyer, 1972c); *b,* topotype, long. sec., ×6 (Flügel & Free, 1962).

Saucrophyllum PHILIP, 1962, p. 172 [**S. pocillum*; OD; †M3021, MU, Melbourne] [?=*Syringaxon* LINDSTRÖM, 1882b, which see]. Solitary, small; major septa long, axial ends thickened and conjunct in aulos that is crossed by subhorizontal tabellae; cardinal and counter septa may be longer than others; minor septa long, contratingent, *Km* longest; periaular tabularium biform, with dissepimentlike plates within contratingencies and subhorizontal tabellae in alternate loculi between minor septa. [WEYER, 1972c, p. 453, states that there are no septa with peripheral ends 'split,' but this is not apparent from the illustrations and descriptions of the type material.] *L.Dev.,* Australia(Vict.).——FIG. 117,*5a,b.* **S. pocillum,* Gedinn., Vict., Boola Beds, Tyer's area; *a,* holotype, long. sec.; *b,* topotype, transv. sec., both ×2 (Philip, 1962).

Schindewolfia WEISSERMEL, 1943b, p. 24 [**Lindströmia (Schindewolfia) lauterbergensis*; M; †not traced, ?in ZGI, E. Berlin] [?=*Syringaxon* LINDSTRÖM, 1882b, which see]. Solitary; calice with area of axial structure appearing excavate, axial structure constructed of the dilated and somewhat withdrawn axial ends of major septa, which form an aulos, and of sclerenchyme infilling the aular space; counter septum and in some stages cardinal also longer and slightly more rhopaloid than others; *Km* very long, axially free or contratingent; other minor septa moderately long and contratingent; peripheral ends of septa forming stereozone; [in transverse section, adaxially convex intersections of periaular tabellae cross loculi between major septa, and sparse intersections of ambiguous curvature are seen within some contratingencies; see also KULLMAN, 1965, p. 71]. *U.Sil.* or *L.Dev.,* Eu.(Ger.).——FIG. 117,*2a,b.* **S. lauterbergensis*; syntype, Oberharz, Heilbeck near Lauterberg; *a,b,* transv. secs., ×5.5 (Weissermel, 1943b).

Sutherlandinia WEYER, 1972c, p. 453 [**Saucrophyllum arbucklense* SUTHERLAND, 1965, p. 39; OD; †5510, OU, Norman] [?=*Syringaxon* LINDSTRÖM, 1882b, which see]. Solitary, small, with slender aulos formed by conjunction of slightly rhopaloid axial ends of long major septa of which counter and in some stages cardinal also may be slightly longer than others; aulos with sparse subhorizontal tabellae; minor septa long and contratingent, *Km* longest; tabellae within contratingencies declined adaxially, those of alternate interseptal loculi subhorizontal or declined abaxially; peripheral ends of cardinal, counter, and *Km* septa may appear split. *U.Sil.,* N.Am.(Okla.); *U.Sil.-L.Dev.,* Eu.(Ger.).——FIG. 117,*4a,b.* **S. arbucklensis* (SUTHERLAND), U.Sil., Henryhouse Ls., Okla.; *a,* holotype, long. sec., cardinal side to left, *b,* paratype, transv. sec., ×6 (Sutherland, 1965).

Syringaxon LINDSTRÖM, 1882b, p. 20 [**Cyathaxonia siluriensis* MCCOY, 1850, p. 281; M; †A5468, SM, Cambridge] [?=*Laccophyllum* SIMPSON, 1900, which see; *?Alleynia* POČTA, 1902, which see; *?Barrandeophyllum* POČTA, 1902, which see; *?Schindewolfia* WEISSERMEL, 1943b, which see; *?Saucrophyllum* PHILIP, 1962, which see; *?Sutherlandinia* WEYER, 1972c, which see; *?Neosyringaxon* JIA in JIA *et al.,* 1977, p. 118 (type, *N. elegantulum,* OD; †IV37013, HPRIGS, Yichang; M. Dev., Xiangzhou Co., Guangxi [Kwangsi]; no evidence available of presence of horizontal skeletal elements in contratingencies). Of the genera included tentatively in this synonymy of *Syringaxon,* only *Sutherlandinia* has its type species adequately described and illustrated. The diagnosis given below is based on the holotype of the type species of *Syringaxon.* Diagnoses of the subjective synonyms given under the several generic names are based as strictly as possible on their type species.]. Small, solitary, ceratoid, with aulos formed dominantly by thickening to contiguity of somewhat rhopaloid and withdrawn axial ends of major septa; minor septa contratingent, and tabularium biform, periaular tabellae except within contratingencies convex adaxially, indicating declination from axis to wall [within contratingencies only one section of tabella noted, concave adaxially, indicating declination abaxially; WEYER, 1972c, p. 461, suggests that peripheral ends of counter and *Km* septa may be 'split']. [See HILL & JELL, 1970b, p. 17; SUTHERLAND, 1970, p. 1126. SUTHERLAND showed that the holotype of *S. siluriensis* had been twice buried, eroded, and transported before final fossilization, so that unambiguous morphological reconstruction is hardly possible.] *U.Sil.,* Eu.(Eng.), *sensu lato Sil.-Dev.,* Eu.-Asia-N. Am.-S. Am.-Australia.——FIG. 117,*1.* **S. siluriensis* (MCCOY), holotype, Ludlov., Westmoreland; transv. sec., ×8 (Sutherland, 1970).

Subfamily GUERICHIPHYLLINAE Rozkowska, 1969

[Guerichiphyllinae ROZKOWSKA, 1969, p. 70]

Solitary, small; in early stages major septa joining at axis, later withdrawing, forming aulos by deflection or thickening to contiguity of neighboring axial ends; in late stages aulos fails to continue; cardinal septum may be shorter, in shallow tabular fossula; minor septa short, not contra-

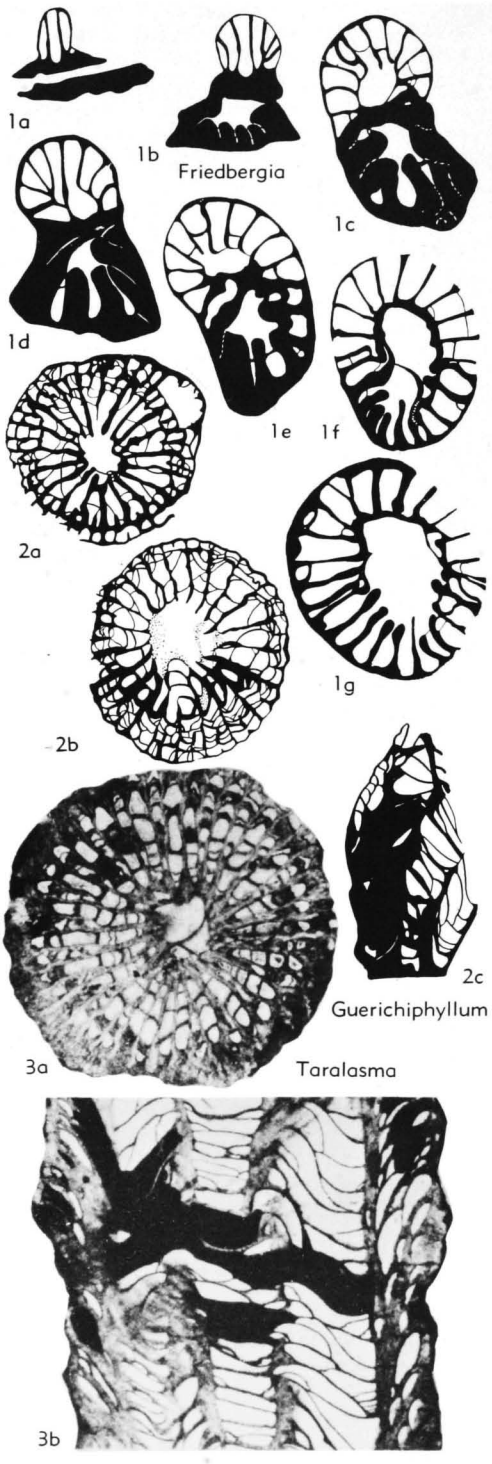


FIG. 118. Laccophyllidae (p. F196-F198).

tingent; dissepiments present, and, where minor septa are withdrawn, crossing loculi between major septa; tabulae horizontal in and above aular region, abaxially declined peripherally. *M.Dev.-U.Dev.*

Guerichiphyllum ROZKOWSKA, 1969, p. 71 [**Blothrophyllum skalense* GÜRICH, 1896, p. 173; OD; †neotype, here chosen on request of FEDOROWSKI (written commun., May 28, 1974), P128, PZI, Poznan, figured FEDOROWSKI, 1965b, pl. 5, fig. 1]. Small, solitary, ?convex side cardinal; major septa united at axis in earliest stages, then withdrawing but forming aulos by turning aside to contiguity or by thickening of neighboring axial ends; aulos fails to continue into latest stages; minor septa short or reduced to wall or surfaces of dissepiments, not contratingent; septa of cardinal quadrant, or in places of all quadrants may be thickened; cardinal septum shortens in shallow fossula; lonsdaleoid dissepiments may occur. *M.Dev.-U.Dev.*, Eu.(Pol.)-W.Australia.——FIG. 118,*2a-c*. **G. skalense* (GÜRICH), M.Dev., Pol., Skaly; *a*, neotype, transv. sec., ×2.3; *b,c*, other specimens, transv., long. secs., ×2.3 (Fedorowski, 1965b).

?Subfamily FRIEDBERGIINAE Rozkowska, 1969

[Friedbergiinae ROZKOWSKA, 1969, p. 78]

Characters as for genus. *U.Dev.*

Friedbergia ROZKOWSKA, 1969, p. 78 [**F. bipartita*; M; †163i, II, 62, IG, Warsaw]. Solitary, small, in early stages major septa of cardinal quadrants thick, those of counter quadrants thin and bent around axial space to form half aulos in counter quadrants, which are separated from cardinal by partition formed by thick alar septa; cardinal septum short, thick, in open shallow fossula, counter septum long, thin, and in open fossula; septal insertion accelerated in counter quadrants; in later stages cardinal septum lengthens and thins, and counter septum equals other septa of counter quadrants, and with them forms half aulos; bilateral symmetry persists throughout; minor septa reduced in wall; no dissepiments. [ROZKOWSKA (in WEYER, 1973e, p. 685) states that an explanation of the juvenile stages as a talon anomaly is quite unlikely and that additional *Friedbergia* material has been found in Famennian of the Urals.] *U.Dev.(up.Famenn.)*, Eu.(Pol.).——FIG. 118,*1a-g*. **F. bipartita*, holotype, Kowala, Holy Cross Mts.; *a-g*, serial transv. secs., ×2.6 (Rozkowska, 1969).

Subfamily NEAXONINAE Hill, new subfamily

Small, solitary, erect or curved, commonly with cardinal side convex; major septa meeting near axis to form aulos and not flanged, but of coarse trabeculae; minor septa including *Km* short, not contratingent,

commonly buried in more or less thick wall; aular tabellae complete or incomplete, periaular tabellae declined from aulos. *L. Dev.-L.Carb.*

Neaxon KULLMAN, 1965, p. 81 [**N. regularis*; OD; †Coe1281/1505, KULLMAN Coll., GPI, Tübingen]. Small, solitary, erect or curved with cardinal side convex; septa without flanges, may be coarsely monacanthate; cardinal and counter septa may be longest; minor septa very short, not contratingent; in early stages major septa joining at axis, in later stages their axial ends withdrawn but united to form aulos, in which are horizontal tabellae; periaxial tabellae declined from aulos; no dissepiments [see WEYER, 1971b, p. 295]. *L.Dev. (up.Ems.),* Eu.(Spain); *M.Dev.(Eifel.),* Eu. (Ger.); *U.Dev.(Famenn.),* Eu.(Ger.-Pol.)-W.Australia; *L.Carb.,* Eu.(Eng.)-Asia(Kansu).——FIG. 119,*3a,b.* **N. regularis,* holotype, L.Dev.(up. Ems.), N.Spain, E. of Muda; *a,b,* transv. secs., ×6, ×4 (Kullman, 1965).

Catactotoechus HILL, 1954, p. 10 [**C. irregularis*; OD; †33535, UWA, Perth]. Solitary, subcylindrical, in early stages with an aulos formed mainly by flexing to contiguity of axial ends of major septa, or from continuation of septal thickening over tabulae in regions of downturning, or both, and in some partly also by direct contiguity of thickened axial ends of septa; in later stages aulos is breached and disappears; cardinal septum in shallow fossula; minor septa reduced to thin wall; dissepiments commonly in single incomplete series, each dissepiment connecting two neighboring major septa [see HILL & JELL, 1970b, p. 11]. *U.Dev.(Famenn.),* W.Australia.——FIG. 119,*1a,b.* **C. irregularis,* holotype, Famenn., zone of *Spinulicosta proteus,* Fairfield F., Oscar Hill, Canning Basin; *a,b,* long., transv. secs., ×3, ×2 (Hill & Jell, 1970b).

?Czarnockia ROZKOWSKA, 1969, p. 67 [**C. obliqua*; OD; †163d, II, 62, IG, Warsaw]. Corallum curved, cornute, with very oblique, wide calice; major septa long, here and there with axial edges flexed to form discontinuous aulos or terminating on tabulae; minor septa short, not contratingent; septa finely trabeculate; axial tabellae wide, periaxial tabellae developed ?only on convex side of corallum and curved and nearly at right angles to axial tabellae; no septal flanges; no dissepiments. *U.Dev.(up.Famenn.),* Eu.(Pol.).——FIG. 119,*5a,b.* **C. obliqua,* holotype, Kowala, Holy Cross Mts.; *a,b,* transv., long. secs., ×2 (Rozkowska, 1969).

?Hillaxon ROZKOWSKA, 1969, p. 65 [**H. vesiculosus*; M; †Tc3/2566, PZI, Poznan]. Solitary, turbinate, with wide, horizontal calice; aulos discontinuous, formed by deflected axial ends of major septa, or here and there by downturning to continuity of edges of axial tabellae; septa finely trabeculate, minor septa not contratingent, peripheral parts of both major and minor septa may be discontinuous; aular tabellae flat, periaular tabellae declined toward thick outer wall; normal and lonsdaleoid dissepiments well developed in sides of calice. *U.Dev.(up.Famenn.),* Eu.(Pol.).——FIG.

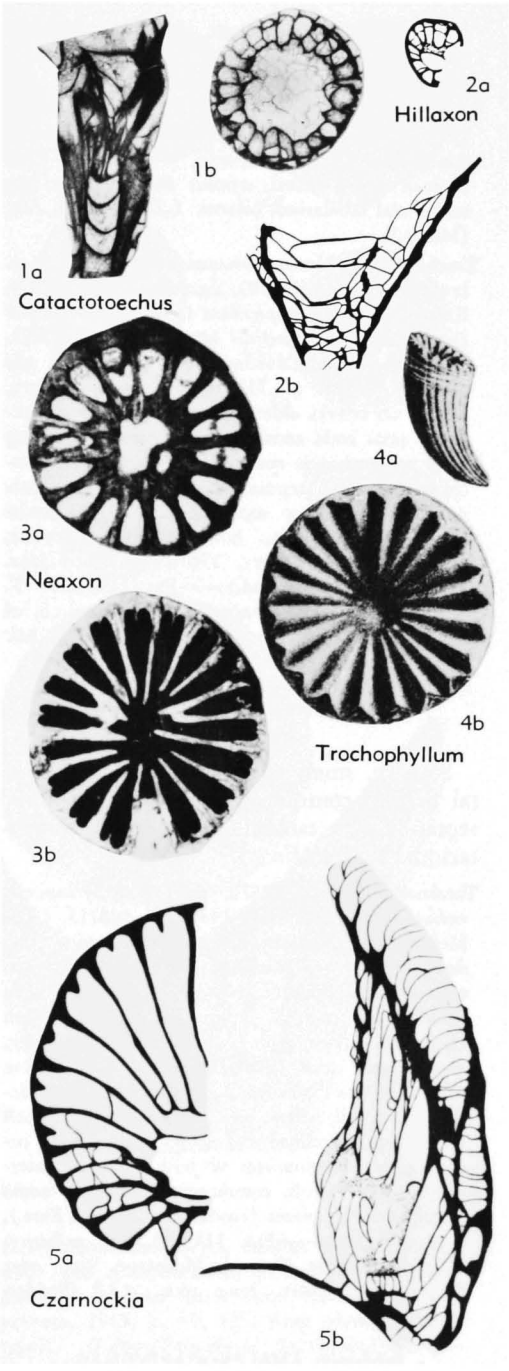


FIG. 119. Laccophyllidae (p. *F197-F198*).

119,*2a,b*. **H. vesiculosus*, holotype, Galezice [=Besówka]; *a,b*, transv., long. secs., ×1.5 (Rozkowska, 1969).

Neaxonella Weyer, 1978, p. 292 [**N. albertii*; OD; †K66.1, HU, East Berlin; older up.Ems., Ain Targa, SW. of Foucauld, W. Moroc.]. Like *Neaxon* but cardinal septum shortened in late stages and tabularium biform. *L.Dev.(Ems.)*, Afr. (Moroc.).

Trochophyllum Milne-Edwards & Haime, 1850, p. lxvii [**T. verneuili*; OD; figured syntype e-1159, EM, Paris] [=*Crassiphyllum* Grove, 1935, p. 368 (type, *Zaphrentis declinis* Miller, 1892, p. 621, OD; syntypes UC6615a-c, FM, Chicago), see Stumm, 1948d, p. 71]. Very small, solitary, fossula on convex side; major septa radiate, thickened, axial ends contiguous ?(in aulos), leaving axial space that is commonly filled with sclerenchyme; cardinal septum slightly shorter, fossula not obvious; minor septa insignificant; periaxial tabellae sparse, thin, horizontal [see Stumm, 1948d, p. 71; Pickett, 1967a, p. 7]. *L.Miss. (Osag.)*, N.Am.(Ky.-Ind.).——Fig. 119,*4a,b*. **T. verneuili*, New Providence Sh., Ky., 7 mi. S. of Louisville; *a*, ext. view, ×1; *b*, calical view, enl. (Milne-Edwards & Haime, 1851).

Subfamily TARALASMATINAE Hill, new subfamily

Solitary, small; with aulos of major septal origin, commonly contratingent minor septa, biform tabularium and dissepimentarium. *L.Dev.(Ems.)*.

Taralasma Pedder, 1967b, p. 112 [**Syringaxon radiatum* Hill, 1950, p. 144; OD; †48113, GSV, Melbourne]. Corallum solitary, small, with wide dissepimented marginarium and with long, unequal major septa conjoined in axial region to form aulos; cardinal septum longest and most rhopaloid; minor septa contratingent, very long, *Km* longest; aular tabellae subhorizontal, tabellae within contratingencies dissepimentlike and declined adaxially, those of alternate loculi between minor septa declined abaxially; dissepiments occurring in marginarium of both types of interminor septal loculi, commonly normal but some angulate or in places lonsdaleoid. *L.Dev.(Ems.)*, Australia(Vict.).——Fig. 118,*3a,b*. **T. radiatum* (Hill), topotype, Taravale Mudstone, Vict., near Buchan; *a,b*, transv., long. secs., ×3.8 (Pedder, 1967b).

Subfamily AMPLEXOCARINIINAE Soshkina, 1941

[*nom. correct.* Rozkowska, 1969, p. 81, *pro* Amplexocarininae Soshkina in Soshkina, Dobrolyubova, & Porfirev, 1941, p. 92]

Corallum solitary, subcylindrical, not large; with discontinuous aulos commonly formed by downturned edges of mesa-shaped tabulae resting on tabula next below; major septa attaining axis in earliest stages, but withdrawing and their axial ends joining aulos; cardinal septum may be shorter than others; minor septa very short; commonly reduced to wall; tabulae distant; sporadic dissepiments in some. [The validity of this subfamily rests on the current view that its aulos is basically tabular in origin and not formed by thickening or deflection of axial ends of septa as is assumed in Laccophyllinae. Flügel (1972, p. 79), following Schouppé & Stacul (1959, p. 293), considers also that a fossular depression in the tabulae present in Amplexidae is absent in Amplexocariniinae. Allocation of genera between the two subfamilies is somewhat arbitrary, more research being required.] *U.Dev.-Perm.*

Amplexocarinia Soshkina, 1928, p. 379, as subgenus of *Amplexus* [**A. muralis*; M; †562, coll. 146, PIN, Moscow] [=*Amplexicarinia* Lang, Smith, & Thomas, 1940, p. 16, *nom. van.*]. Solitary, small, cylindrical; in young stages major septa attaining axis; in mature stages septa withdrawing from axis, their axial ends joining somewhat discontinuous aulos; cardinal septum may be shorter than others in more or less distinct fossula; minor septa very short, confined to wall; tabulae distant, flat in broad axial parts, with edge downturned and commonly resting on plate next below, thus forming aulos; periaxial tabellae declined abaxially; sporadic dissepiments in some. *U.Dev.*, Eu.(Pol.); *Miss.*, N.Am.(Mont.); *U.Carb.*, Eu.(Spain-Carnic Alps-Chios-Spits.); *Penn.*, N.Am. (Okla.-Texas); *L.Perm.*, Eu.(Carnic Alps-N. Urals)-Asia(Iran); *U.Perm.*, Asia(Asia M.-Salt Ra.-Timor).——Fig. 120,*3a-d*. **A. muralis*, L. Perm.(Artinsk.), N. Urals, R. Shchugor; *a-c*, holotype, transv. secs., ×5; *d*, paratype, long. sec., ×5 (Soshkina, Dobrolyubova, & Porfirev, 1941).

Gorizdronia Rozkowska, 1969, p. 89 [**Nalivkinella profunda* Soshkina, 1951, p. 33, *non* Soshkina, 1939, p. 44, renamed *Gorizdronia soshkinae* Rozkowska, 1974, p. 531; †?in PIN, Moscow; lectotype by Rozkowska, 1974, p. 531]. Solitary, moderately large, with rejuvenescence; in early stages with short-lasting axial tube ?(formed by tabellae); major septa amplexoid, without carinae or flanges, but in some with lateral tabellae; minor septa reduced to wall; tabulae mostly complete low domes with downturned edges and some with axial depression, with accessory, conical tabellae near periphery. *U.Dev.(Famenn.)*, Eu.(Pol.-Urals)-Asia(E.slopes Urals).——Fig. 120,*1a-e*. **G. soshkinae* Rozkowska, Pol., Kadzielnia, Holy Cross

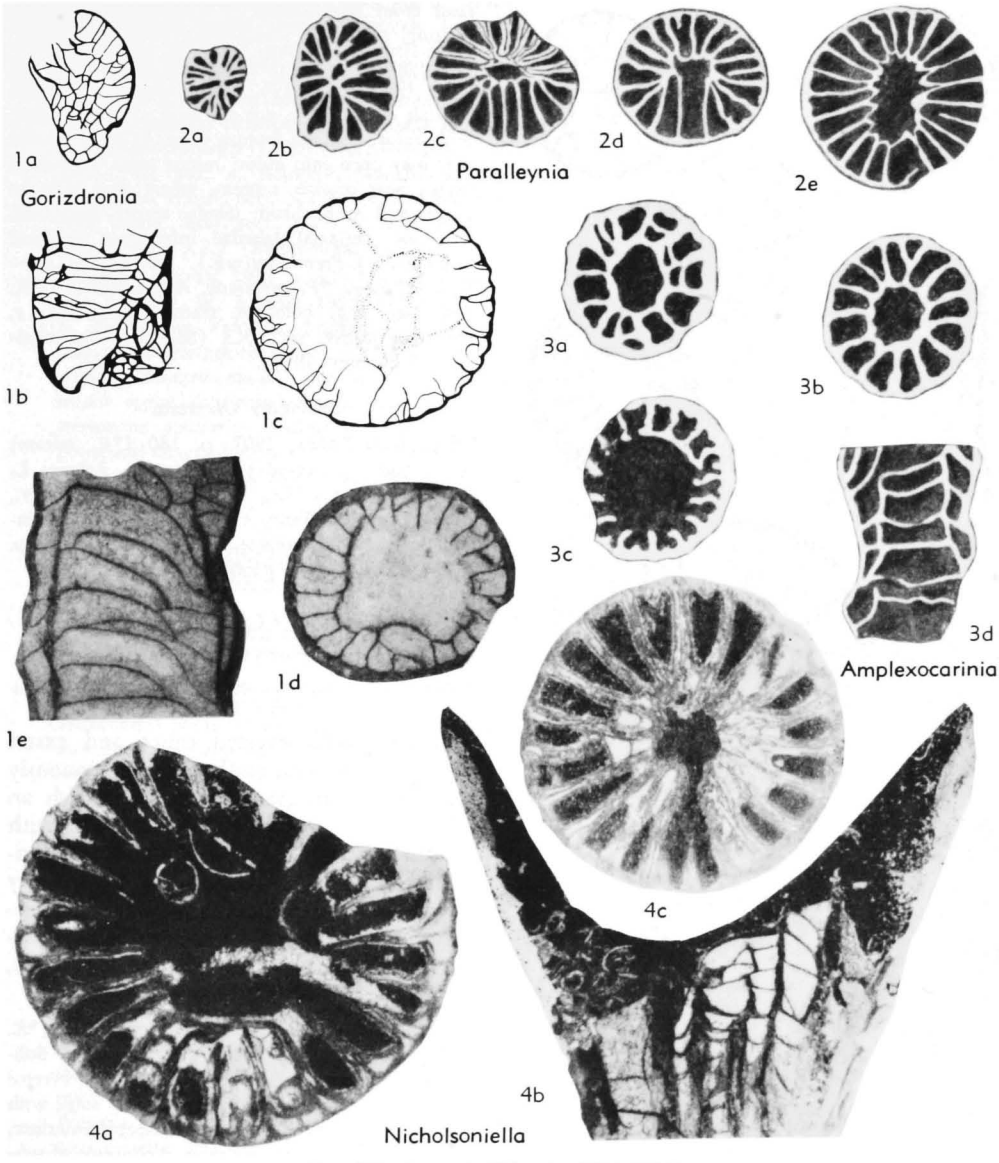


FIG. 120. Laccophyllidae (p. *F*198-*F*200).

Mts.; *a,* oblique sec., early stage, ×1.5; *b,* another specimen, long. sec., ×2.0; *c,* another specimen, transv. sec., ×1.5 (Rozkowska, 1969); *d,e,* holotype, railway cutting, Rezh-Orsy, C. Urals, transv., long. secs., ×4.0 (Soshkina, 1951).

Nalivkinella SOSHKINA, 1939, p. 44 [**N. profunda*; OD; syntypes sample 1-6, coll. 144, PIN, Moscow]. Small, solitary; with discontinuous aulos present in all stages, but breached in cardinal quadrants in late stages; major septa withdrawn from axis but not amplexoid, ?(without carinae or flanges, but may carry lateral tabellae); minor septa very short; tabulae incomplete, tabellae in concave axial series and dissepimentlike periaxial series whose downturned axial parts form aulos [see ROZKOWSKA, 1969, p. 89, 101, from photographs of types]. *U.Dev.(Famenn.),* Eu.(Urals-Pol.).—— FIG. 121,*1a-g.* **N. profunda; a-d,* Pol., Kadzielnia I, bed 2, *a-c,* transv., *d,* long. secs., ×6 (Rozkowska, 1969); *e-g,* holotype, E. slope of Urals, Verkhneuralsk reg., *e,f,* transv., *g,* long. secs., ×4 (Soshkina, 1939).

Nicholsoniella SOSHKINA, 1952, p. 66 [**N. bashkirica*; OD; syntypes in PIN, Moscow]. Solitary,

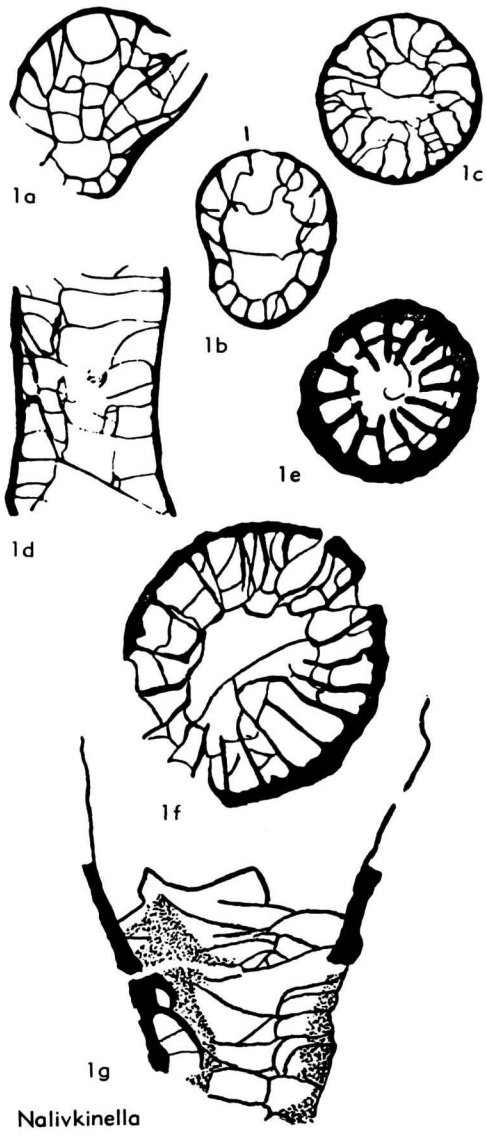


FIG. 121. Laccophyllidae (p. *F*199).

small, erect, conical; with tabular and tabulate axial space formed by confluence in an aulos of thickened and somewhat withdrawn axial ends of major septa that are contiguous or connected by extensions of thickening over downturnings of the tabulae; cardinal fossula, with shortened cardinal septum, opens into aulos in adult stages; minor septa short, not contratingent; and with imperfect dissepimentarium in calice in late stages [see SOSHKINA, 1960, p. 306 and ROZKOWSKA, 1969, p. 24]. *U.Dev.(Frasn.)*, Eu.(S.Urals).—— FIG. 120,*4a-c*. **N. bashkirica*, syntypes, R. Belaya, road from Kuk-Kulyor to Akavaz; *a,c*, transv., *b*, long. secs., ×4 (Soshkina, 1952).

Paralleynia SOSHKINA, 1936a, p. 30 [**P. permiana*; OD; †968, coll. 146, PIN, Moscow]. Small, conical; major septa not reaching axis but fusing with aulos; cardinal septum short, in wide fossula that may open into aulos; minor septa very short except near counter septum, where they may be longer and contraclined; tabulae scanty, horizontal in aulos, periaxial tabellae infrequent, declined abaxially. *L.Perm.(Artinsk.)*, Eu.(S.Urals).—— FIG. 120,*2a-e*. **P. permiana*, Aktiubinsk reg., R. Sogur-say; *a-d*, holotype, transv. secs., ×3; *e*, paratype, transv. sec., ×3 (Soshkina, Dobrolyubova, & Porfirev, 1941).

Subfamily Uncertain

Retiophyllum POČTA, 1902, p. 180 [**R. mirum*; M; 2 badly preserved syntypes, NM, Prague; L. Dev., Koněprusy Ls., f2, Koněprusy, M.Dev., Branik Ls., g*α*, Tetin, Czech.; type material inadequate for redescription, *fide* PRANTL (1938, p. 20)]. Possibly *Laccophyllum* SIMPSON.

Family KIELCEPHYLLIDAE Rozkowska, 1969

[Kielcephyllidae ROZKOWSKA, 1969, p. 105] [?=Thecaxonidae WEYER, 1978, p. 299]

Solitary, with everted calice and exsert septa, in some with epitheca discontinuously developed in rings; in early stage with an aulos; inner part of dissepimentarium with irregular, broad pipe of dissepiments horizontally based but drawn up laterally against septa; peripheral dissepiments declined abaxially; tabular floors flat, of numerous tabellae. *U.Dev.(low.Famenn.)*, Eu.(Pol.).

Kielcephyllum ROZKOWSKA, 1969, p. 106 [**K. cupulum*; OD; †Tc3/1605, PZI, Poznan]. Solitary, moderately large, cylindrical; with everted calice and continuous epitheca; in early stage with indistinct aulos in inner part of dissepimentarium, in later stages with an irregular, broad pipe of subglobose, horizontally based dissepiments drawn up laterally against major septa; peripheral dissepiments declined abaxially; axial tabellae flat, close; major septa may be discontinuous; minor septa withdrawn. *U.Dev.(low.Famenn.)*, Eu.(Pol.).—— FIG. 122,*1a-c*. **K. cupulum*, holotype, Kadzielnia, Holy Cross Mts.; *a*, diagram., distal end of corallum, showing archate distal edges of septa, ×1; *b,c*, transv., long. secs., ×1 (Rozkowska, 1969).

Kozlowskinia ROZKOWSKA, 1969, p. 114 [**K. flos*; OD; †Tc3/1898, PZI, Poznan]. Solitary, slender, cylindrical with everted calice and discontinuous epithecal rings; internally like *Kielcephyllum* but

aulos may continue to calice; septa not or seldom discontinuous, minor septa moderately long; at inner edge of minor septal marginarium, pipe of subhorizontally based dissepiments that may be drawn up against the sides of the septa may develop; peripheral ?dissepiments abaxially declined. *U.Dev.(low.Famenn.),* Eu.(Pol.).——FIG. 122, *2a-d.* **K. flos; a,* holotype, Kadzielnia, Holy Cross Mts., transv. sec., ×2.0; *b,d,* another specimen, transv., long. secs., ×2.0; *c,* third specimen, transv. sec., ×2.5 (Rozkowska, 1969).

?Thecaxon WEYER, 1978, p. 303 [**T. rozkowskae*; OD; †X4537, W. REUTER 1955-1965 Coll., ZGI, E. Berlin; low. Famenn., Saalfeld-Obernitz, Thuringian Schiefergebirge]. Like *Kozlowskinia* but without dissepimentarial pipe at inner edge of minor septal dissepimentarium, and with septal stereozone somewhat withdrawn adaxially from peripheral edges of septa in the distal exsert region of the corallum. *U.Dev.(low. Famenn.),* Eu. (Ger.).

?Family LINDSTROEMIIDAE Počta, 1902

[*nom. correct. et transl.* CHAPMAN, 1925, p. 105, as Lindstroemiinae POČTA, 1902, *ex* Lindströmidae POČTA, 1902, p. 181] [=Lindstroemiicae ROZKOWSKA, 1969, p. 32]

Characters as for genus. *Dev.*

Lindstroemia NICHOLSON & THOMSON, 1876, p. 150, *nom. correct.* CHAPMAN, 1925, p. 105, *ex Lindströmia* NICHOLSON & THOMSON, 1876, p. 150 [**Lindströmia columnaris*; M, figured NICHOLSON & ETHERIDGE, 1878b, p. 84, fig. 4b, b′; syntypes 1968.15.41-43, RMS, Edinburgh, *fide* BENTON, 1979]. Solitary, small, conical; calice deep; septa joining axially to form "strong twisted pseudocolumella which projects into floor of calice"; with remote "dissepiments," and tabulae. [In the only illustrations of what is probably type material, by NICHOLSON & ETHERIDGE (1878b), the transverse section resembles that of *Stereolasma rectum* (HALL) except that the cardinal fossula does not invade the columellar mass; in this respect it resembles *Syringaxon* LINDSTRÖM, 1882b. Presence of an aulos is unproven; the longitudinal section, with its slightly oblique calical floor sloping downward toward the concave side of corallum, and absence of calical projection of columellar mass, differs from that used by SIMPSON (1900, p. 207) as *S. rectum,* in which an oblique calical floor, without calicular projection, slopes down toward convex side. SIMPSON's longitudinal section seems, however, somewhat inconsistent morphologically with his transverse section. Until the type material is restudied, *Lindstroemia* NICHOLSON & THOMSON will remain unsuitable as the name genus for a family.] *Dev.,* N.Am.——FIG. 122,*3a,b.* **L. columnaris,* type material, M.Dev., N.Am.; *a,b,* transv., long. secs., ×3 (Nicholson & Etheridge, 1878b).

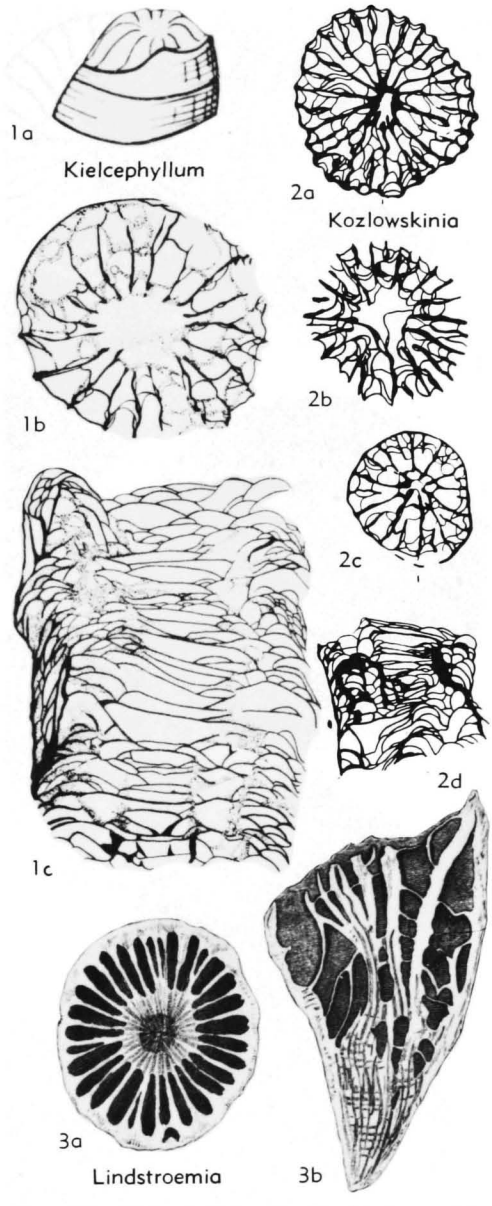


FIG. 122. Kielcephyllidae (1, 2); Lindstroemiidae (3) (p. *F*200-*F*201).

Family HADROPHYLLIDAE Nicholson, 1889

[Hadrophyllidae NICHOLSON in NICHOLSON & LYDEKKER, 1889, p. 296]

Small, solitary, top-shaped, turbinate, patellate, or discoid, probably epithecate; septa arranged pinnately about fossula in cardinal quadrants and at angles toward alar fossu-

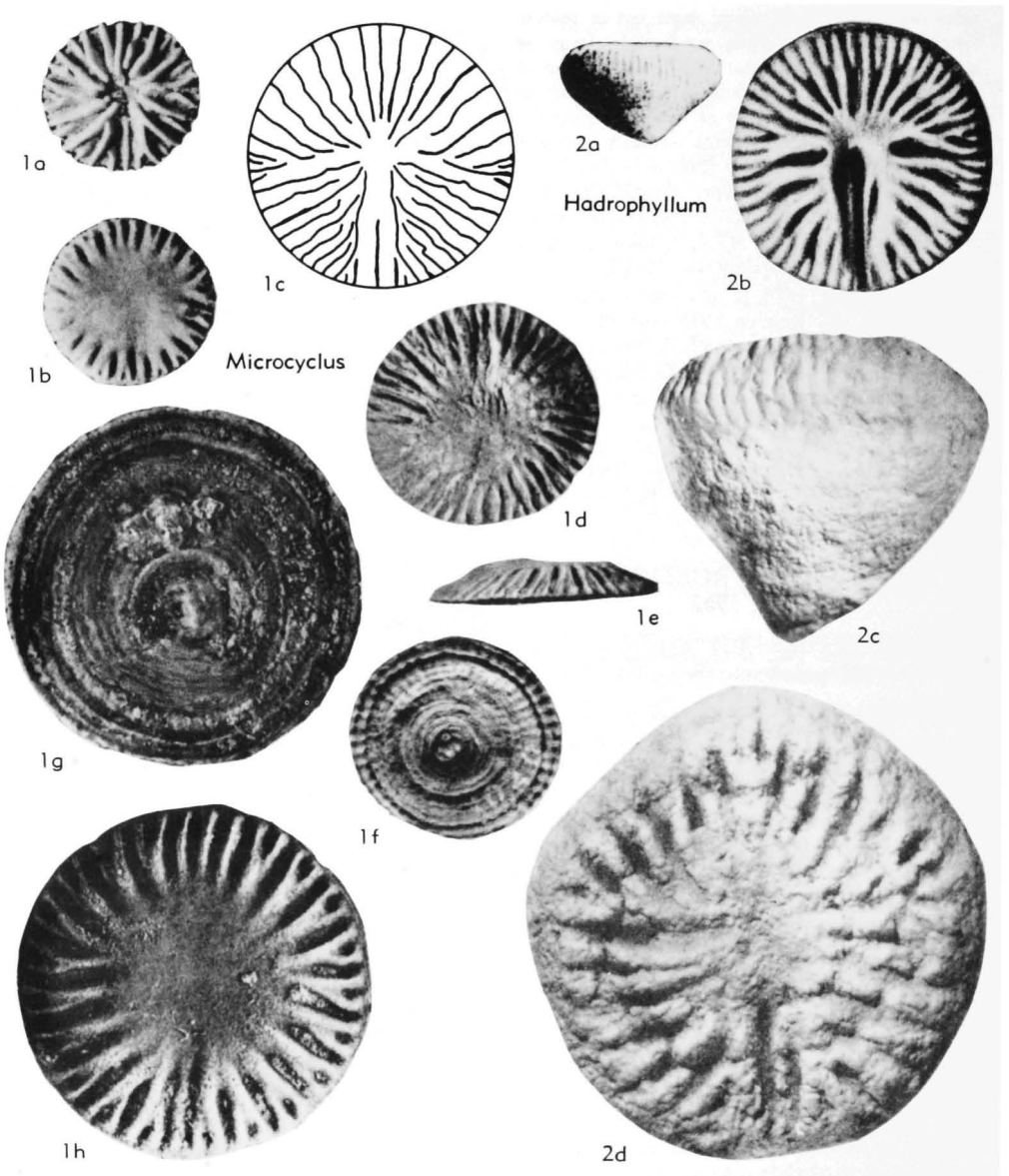


FIG. 123. Hadrophyllidae (p. *F202-F204*).

lae in counter quadrants; cardinal septum may be shorter or thinner or less tall than others; minor septa may be contratingent. [Topotypes of the type species of *Hadrophyllum* are worn and not thin-sectioned. Pending examination of internal structure, definition of the family can only be tentative.] *?L.Dev.-M.Dev.*

Hadrophyllum MILNE-EDWARDS & HAIME, 1850, p. lxvii [**H. orbignyi*; OD; syntypes e-139a-c, DE VERNEUIL Coll., EM, Paris]. Small, solitary; patellate, turbinate or top-shaped, probably epithecate; calice ?flat or slightly depressed axially; tip slightly eccentric, toward counter side; cardinal septum thin, may shorten, rising but little above floor of deep adaxially expanding fossula that is bounded by fused axial edges of metasepta of cardinal quadrants; alar septa long, with narrow alar fossulae bounded on counter sides by fused axial ends of metasepta of counter quadrants; minor septa may be contratingent. [Thin sections

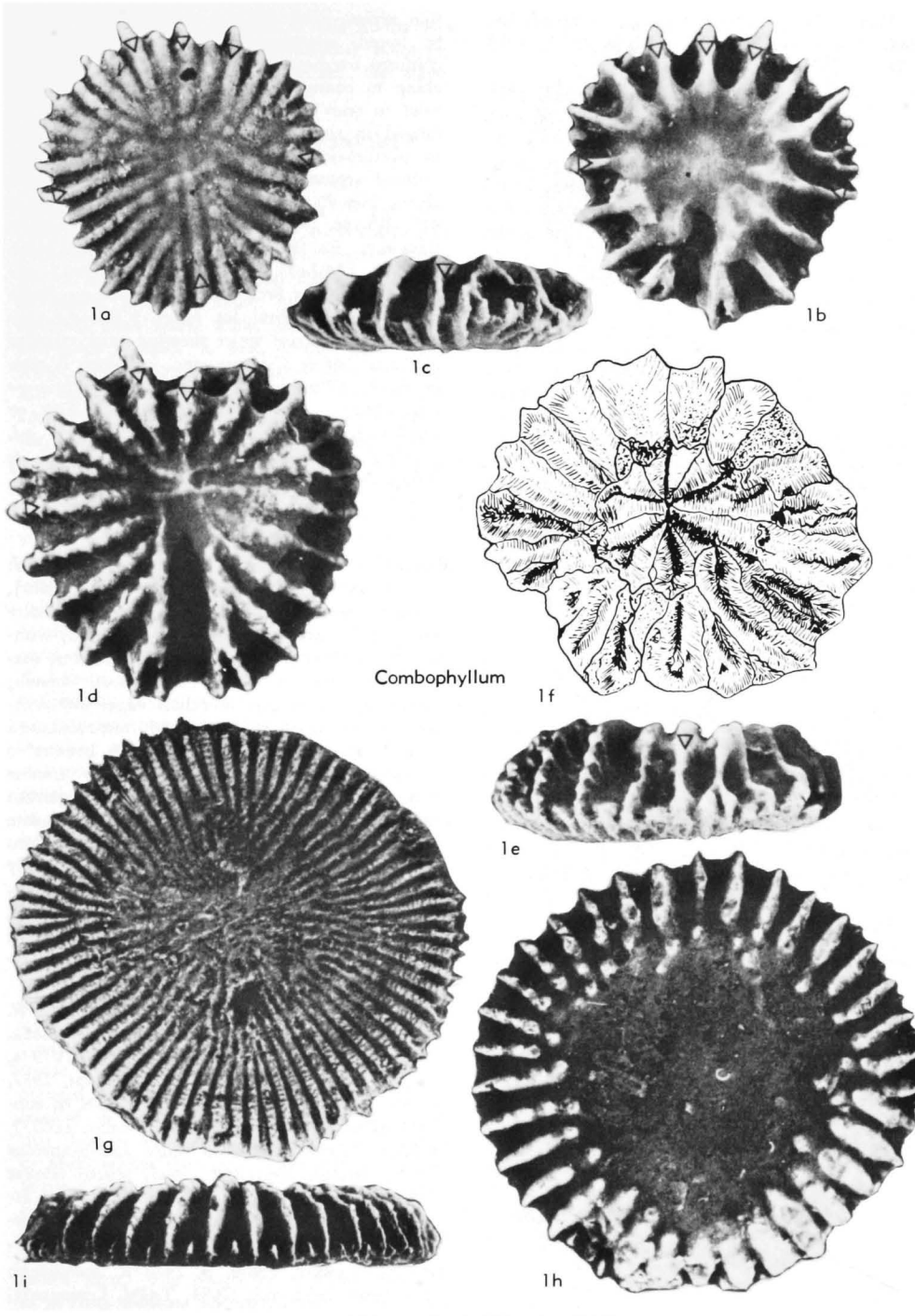


FIG. 124. Combophyllidae (p. *F*204).

required; topotypes appear worn; see also WEYER, 1975a, p. 23.] *?L.Dev., M.Dev.(Couvin.)*, N.Am. (Ky.-Ind.-Ohio)-?Eu. (Ger.-Spain)-Australia (New S.Wales)-N.Afr.(Alg.).——FIG. 123,*2a-d*. ***H. orbignyi**; a,b,* syntype, Jeffersonville Ls., Ind. or Ky., ext. view, ×1.5, calical view, enl. (Milne-Edwards

& Haime, 1851); *c,d,* other specimens, Speeds Ls., Ind., Charlestown, side, calical views, ×3.5, ×4.5 (Weyer, 1975a).

Microcyclus Meek & Worthen, 1868, p. 420 [**M. discus*; M; †not traced]. Solitary, small, discoid, profile lenticular and sharp-edged, epithecate surface subhorizontal; major and minor septa long, dilated and contiguous, those of cardinal quadrants arranged pinnately about open, parallel-sided fossula, those of counter quadrants directed at angles to less distinct, parallel-sided alar fossulae; cardinal and commonly also counter septum short in late stages; minor septa may appear contraclined or contratingent in calice, but *Km* commonly longer and radial; septal trabeculae indistinct; no tabulae [see Frauenfelter & Engstrom, 1970, p. 1085; Plusquellec, 1971, p. 129; Weyer, 1975a, p. 15]. *M.Dev.,* N.Am.(Ill.-Mo.-Ont.)-N. Afr.(Alg.)-Eu.(Ger.).——Fig. 123,*1a-h.* **M. discus,* topotypes, ?Hamilton Gr., St. Laurent Ls., Ill., N. end of Backbone Ridge, Grand Tower; *a,b,* calical views, ×2.0; *c,* diagram. transv. sec., ×3.0 (Frauenfelter & Engstrom, 1970); *d–f,* calical, side, and basal views, ×1.5 (Stauffer, 1952); *g,h,* basal, calical views, ×3.0 (Plusquellec, 1971).

Family COMBOPHYLLIDAE Weyer, 1975

[Combophyllidae Weyer, 1975a, p. 17]

Solitary, discoid, free, without epithecal sheath; calice everted, coarse trabeculae diverging fanwise from axis in each septum; outer ends of outwardly diverging trabeculae projecting beyond wall in denticulate ridges; weak axial structure in some; fossula commonly with shortened cardinal septum; no tabulae, no dissepiments. *L.Dev.-M.Dev.*

Combophyllum Milne-Edwards & Haime, 1850, p. lxvii [**C. osismorum*; OD; e-102, de Verneuil Coll., EM, Paris; lectotype by Plusquellec & Semenoff, 1973, p. 412] [=*Parmasessor* Ludwig, 1869, p. 131 (type, *P. ovatus,* SD Flügel, 1970, p. 199; †not traced; M.Dev., "Lenneschiefer," Wissenbach, Ger.), see Weyer, 1975a, p. 14, 29; *Cambophyllum* Le Maître, 1952, p. 44, *nom. van.*; *Ludwigacia* Weyer, 1975a, p. 29 (type, *Combophyllum ibericum* Plusquellec in Marin & Plusquellec, 1973, p. 42, OD; †2397, LP, Brest; up.Ems. or low.Couvin., near Cabrero, Teruel, Spain; lacks overhanging extension from axial calicular platform)]. Solitary, small, discoid, free, without epitheca; septal trabeculae coarse and diverging fanwise from axis in plane of wall formed between major and minor septa, and imparting denticulation to calical and basal edges of septa, and carinae to sides of septa; axial part of calice floored by sclerenchyme in which, in thin section, axial structure of septal lamellae may be traced, sclerenchyme may be extended into platform overhanging interseptal loculi by thickening to contiguity of parts of major septa adaxial to ends of minor septa; septa radially arranged in counter quadrants, pinnately arranged to parallel-sided fossula in cardinal quadrants; cardinal septum short; tabulae and dissepiments absent [see Plusquellec & Semenoff, 1973, p. 415; Weyer, 1975a, p. 29]. *L.Dev.-M.Dev.(low. Couvin.),* Eu. (France-Ger.-Spain)-N. Afr. (Alg.).——Fig. 124,*1a-f.* **C. osismorum,* M.Dev.(Couvin.), France, Le Fret, Brest roadstead; *a-c,* lectotype, proximal, calical, lat. views, ×6.6; *d,e,* syntype, calical, lateral views showing axial calicular platform, ×6.6; *f,* transv. sec., specimen 3 mm. in diam. (Plusquellec & Semenoff, 1973).——Fig. 124,*1g-i. C. ibericum,* holotype, up.Ems. or low.Couvin., Spain, near Cabrero, Teruel; *g-i,* proximal, calical, lat. views, ×3.8 (Marin & Plusquellec, 1973).

Family Uncertain

Famaxonia Weyer, 1971c, p. 1026 [**F. reuteri*; OD; †X3885, coll. K. Bartzsch, ZGI, E. Berlin]. Solitary, small, conical, with deep calice; tabulae few, convex, and confined to apical region; without tabular fossula and without dissepiments; major septa few, very thin throughout, smooth; minor septa seen only at calical edge; low styliform columella in calice, formed from conjoined axial ends of major septa, of which counter is dominant; distal edge of septa finely spinose ?(due to monacanthine trabeculae), arrangement of septa essentially radial, but fundamental pinnate arrangement still distinguishable; cardinal septum on convex side of corallum not shortened. [Only one specimen studied.] *U.Dev.(up.Famenn.),* Eu. (Ger.).——Fig. 125,*3a,b.* **F. reuteri,* holotype, low.*Wocklumeria* Stage, Thuringia, Bohlen, S. of Saalfeld; *a,* transv. sec., ×15, *b,* long. sec., diagram., ×2 (Weyer, 1971c).

Rhipidophyllum Sandberger, 1889, p. 100 [**R. vulgare*; M; †not traced] [=*Teleosteus* Volger, 1860, p. 37 (type, *T. primaevus,* M; †XXV194a, SM, Frankfurt; =*R. vulgare, fide* Zilch, 1937, p. 431, who reported a request to ICZN to suppress name *Teleosteus primaevus* Volger, 1860)]. Solitary Rugosa with deep calice and numerous almost parallel, horizontal, closely spaced tabulae and thin ?carinate major septa bilaterally arranged. [Insufficiently known. Occurs poorly preserved in slaty rocks.] *L.Dev.(Siegen.),* Eu.(Ger.).

Ridderia Spasskiy, 1960c, p. 24 [**R. dubatolovi*; OD; †slide 2495, coll. 7653, TsGM, Leningrad]. Solitary, small, conical; calice deep, sharp-edged; septa almost reaching axis, axial ends commonly confluent, leaving axial space; fossula outlined; septa of counter side strongly thickened and contiguous; tabulae complete, weakly convex. [Insuffi-

ciently known.] *M.Dev.(Eifel.),* Asia(Rudny Altay).——FIG. 125,*1*. **R. dubatolovi,* holotype, Leninogorsk mining field; transv. sec., late stage, ×4 (Spasskiy, 1960c).

Doubtfully Assigned to Suborder Metriophyllina

Lyliophyllum KELUS, 1939, p. 37 [**L. pulcherrimum*; OD; †destroyed by fire in Warsaw, *fide* PICKETT, 1967b, p. 42]. Small, weakly ?compound, a few conicocylindrical individuals united by lateral processes; calice funnel-shaped, with flattened base; major septa thin, extending over two-thirds distance to axis, minor septa represented by short peripheral ridges. [Internal structure unknown.] *M.Dev.,* Eu.(Pol.).——FIG. 125, *2a,b*. **L. pulcherrimum,* syntype, Pol., Kamieniarnia, Volhynia; *a,b,* ext. views, ×1 (Kelus, 1939).

Gymnophyllum HOWELL, 1945, p. 1 [**G. wardi*; OD; †58161, PU, Princeton]. Small, discoid, point of attachment central; epitheca absent or present as separated rings only, so that septa are exposed on basal as well as calical surface; major septa long, thick, and contiguous basally and axially, radially or subradially arranged, cardinal fossula commonly inconspicuous; in mature stages axial parts of major septa may be obscured by skeletal thickening layered parallel to base; basally and peripherally major septa appear split ?(due to contratingent minor septa or because of weathering along median dense plane); smaller ?(tertiary or minor) septa alternate; trabeculae of septa moderately coarse judging from rounded dentations on calical edges, their inclination varying along length of septa [median longitudinal sections required]; tabulae very rare. [See SUTHERLAND & HAUGH, 1969, p. 30; JEFFORDS, 1955, p. 13. WEYER (1975a, p. 19) assigned the genus to his new subfamily Gymnophyllinae of the family Cyathaxoniidae MILNE-EDWARDS & HAIME, 1850, with the subfamily diagnosis: discoid, with everted calice, costae, eutheca, and isolated epithecal rings, without archaeotheca and with certain split septa (cardinal, counter, and *Km*). Use of the terms costae, eutheca, and archaeotheca are not recommended in this *Treatise*. WEYER's interpretation, implied in his diagnosis immediately preceding, that there is an axis of divergence of trabeculae or fibers within the radial plates and that an internal discoid wall develops about or in the place containing these axes of divergence, requires proof from median longitudinal thin sections of septa and from tangential sections through the wall between septa. The possibility in *Gymnophyllum,* as in *Ditoecholasma* SIMPSON, 1900, that the strict relationship between median plane of septum and septal groove in epithecal sheath required by KUNTH's Law does not occur deserves investigation. Compare SUTHERLAND, 1965, pl. 27, 32, with SUTHERLAND & HAUGH, 1969, pl. 3.] *?U.Carb.,* Eu.(USSR, epithecate); *M.Penn.,* N.Am.(Okla.). ——FIG. 126,*1a-d*. **G. wardi,* topotypes, M.Penn.,

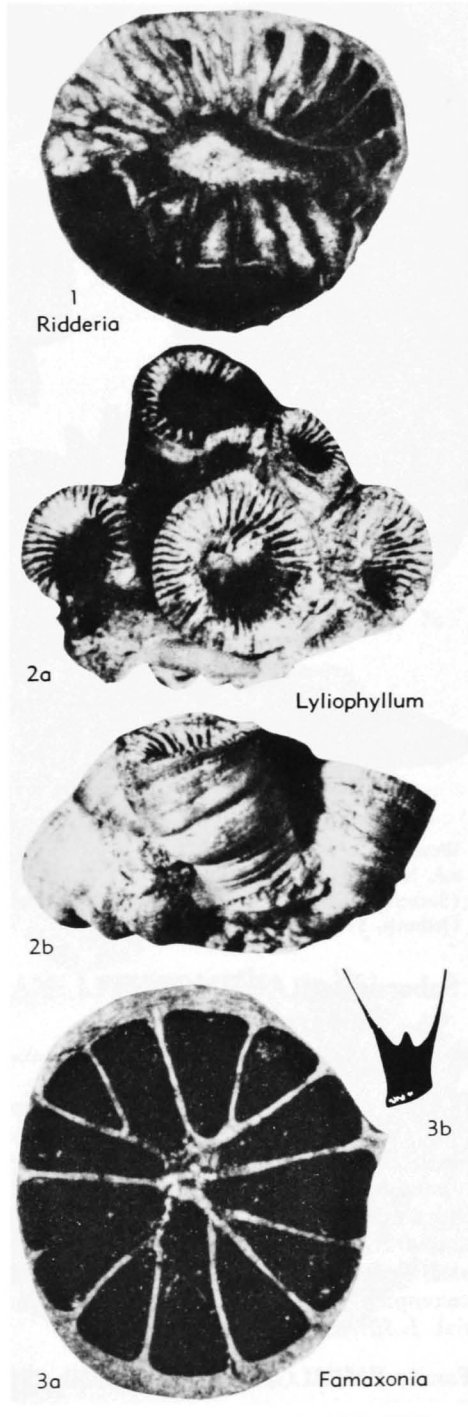


FIG. 125. Family Uncertain (p. *F*204-*F*205).

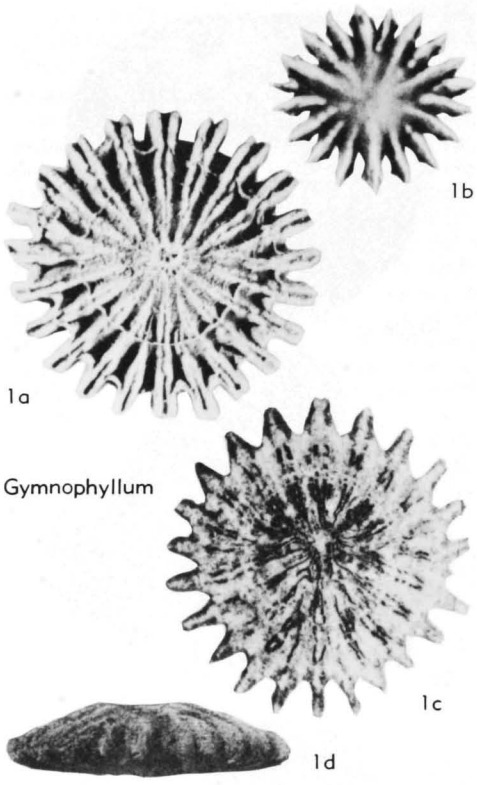


FIG. 126. Family Uncertain (p. *F205*).

Wewoka F., Okla., vicinity of L. Okmulgee; *a,b,* basal, calical views, ×1, *c,* tranv. sec., ×1 (Sutherland & Haugh, 1969); *d,* side view, ×3 (Jeffords, 1955).

Suborder ARACHNOPHYLLINA Zhavoronkova, 1972

[Arachnophyllina ZHAVORONKOVA, 1972, p. 36] [?=Evenkiellida ZHELTONOGOVA, 1961, p. 86, order]

Solitary or compound Rugosa; septa commonly long and may be carinate or complexly structured in dissepimentarium with numerous small subglobose normal dissepiments; subordinate lonsdaleoid dissepiments may develop; tabular floors low domes with axial depression, or flat; tabulae commonly incomplete; increase dominantly marginarial. *L.Sil.-M.Dev.*

Family ENTELOPHYLLIDAE Hill, 1940

[Entelophyllidae HILL, 1940c, p. 410] [=Entelophyllinae WANG, 1950, p. 224; Ramulophyllidae NIKOLAEVA, 1964, p. 50; Evenkiellidae SOSHKINA in IVANOVA *et al.*, 1955, p. 126]

Solitary, fasciculate or cerioid; corallites with moderately wide dissepimentarium and long septa that may have asymmetrical trabecular carinae or in a few be complexly structured; minor septa contratingent in some; tabular floors commonly domes with margins turned out or up, when major septa withdraw somewhat from axis, flat or depressed axially; tabulae commonly incomplete, in many, tabellae of upturned margins may form series outside imperfect axial column of periaxial and axial tabellae; in some, concave tabular floors develop in places; dissepiments commonly small, globose, and interseptal, in some, large lonsdaleoid dissepiments may disrupt septa; cardinal fossula indistinct except in solitary genera. *Sil.-L.Dev.*

Entelophyllum WEDEKIND, 1927, p. 22 [**Madreporites articulatus* WAHLENBERG, 1821, p. 97; SD LANG, SMITH, & THOMAS, 1940, p. 57; †neotype, Cn54823, HISINGER Coll., RM, Stockholm; by SMITH & TREMBERTH, 1929, p. 363] [=*Xylodes* LANG & SMITH, 1927, p. 457 (type, *Madreporites articulatus* WAHLENBERG, 1821, p. 97, OD), *non Xylodes* WATERHOUSE, 1876, a recent coleopteron; *?Stereoxylodes* WANG, 1944, p. 24 (type, *Cyathophyllum pseudodianthus* WEISSERMEL, 1894, p. 591, OD; †not traced, ?formerly in Ostpreussisches Provinzial-Museum, Königsberg (now Kaliningrad), lectotype by LANG & SMITH, 1927, p. 473; Pleistocene drift, Lauth, E. Prussia; IVANOVSKIY, 1976, p. 165, invalidly named as neotype the holotype of *Stereoxylodes pseudodianthus* var. *sinensis* WANG, 1945, S4211-3, Geol. Dept. Nation. SW. Assoc. Univ., China, from M.Sil., E. Yunnan; fasciculate, with thick, asymmetrically carinate septa; restudy of type required); *?Carinophyllum* STRELNIKOV, 1964, p. 59 (type, *Cyathophyllum confusum* POČTA, 1902, p. 102, OD; †in NM, Prague, lectotype by PRANTL, 1940, p. 24; U.Sil., eβ, Tachlowice, Czech.; fasciculate, with thick, asymmetrically carinate septa; restudy of type required)]. Fasciculate; septa long, radially arranged, smooth or asymmetrically carinate; major septa slightly withdrawn from axis; minor septa may be contratingent in some; tabular floors broad domes commonly with depressed centers and marginal troughs formed by small subhorizontal or concave peripheral tabellae; dissepiments small, globose, numerous, and interseptal; fossula commonly indistinct. *Sil.,* Eu.(U.K.-Nor.-Swed.-Est.-Podolia-Urals)-Asia (Sib. Platf.-C. Asia-China)-?Australia (New S. Wales-Queensl.)-N. Am. (Que.-Alaska). ——FIG. 127,*2a,b*. **E. articulatum* (WAHLENBERG), neotype, Gotl.; *a,b,* transv., long. secs., ×3 (Hill, n).——FIG. 127,*2c*. *?E. pseudodianthus* (WEISSERMEL), lectotype, Pleist. drift, E. Prussia, Lauth, calical view, ×2 (Weissermel, 1894).——FIG. 127,*2d,e*. *?E. confusum* (POČTA), syntypes, U.Sil., Czech.; *d,e,* transv., long. secs., ×2 (Hill,

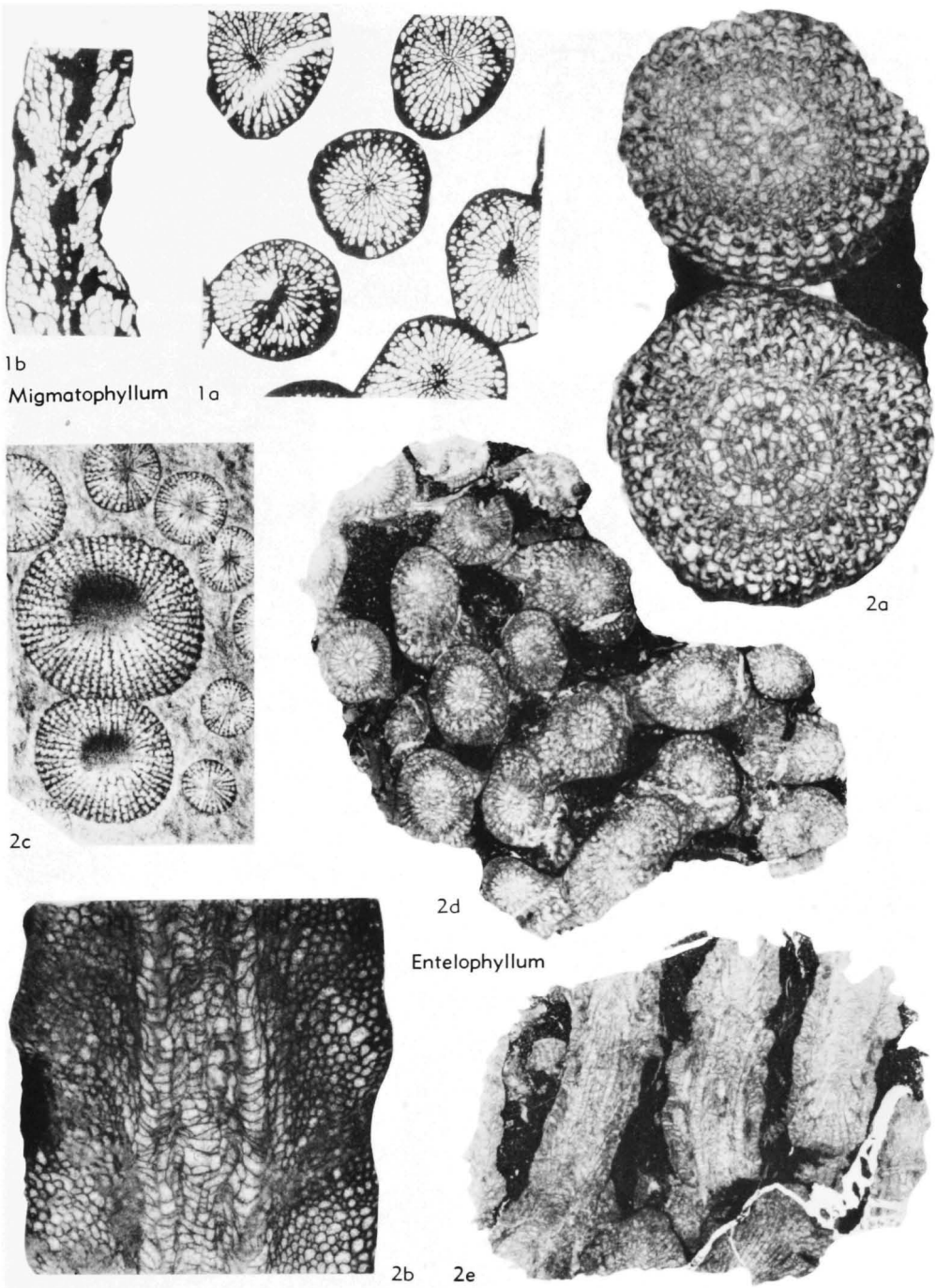


FIG. 127. Entelophyllidae (p. *F*206-*F*209).

n; photographs courtesy W. A. Oliver).

Altaja ZHELTONOGOVA in MARKOVSKIY, 1960, p. 226 [**A. silurica*; OD; †3692, coll. 1508, ZSGUp, Novokuznetsk]. Small, cerioid or fasciculate with lateral increase; each calice with flat marginarium and tall columella in center of calical pit; major

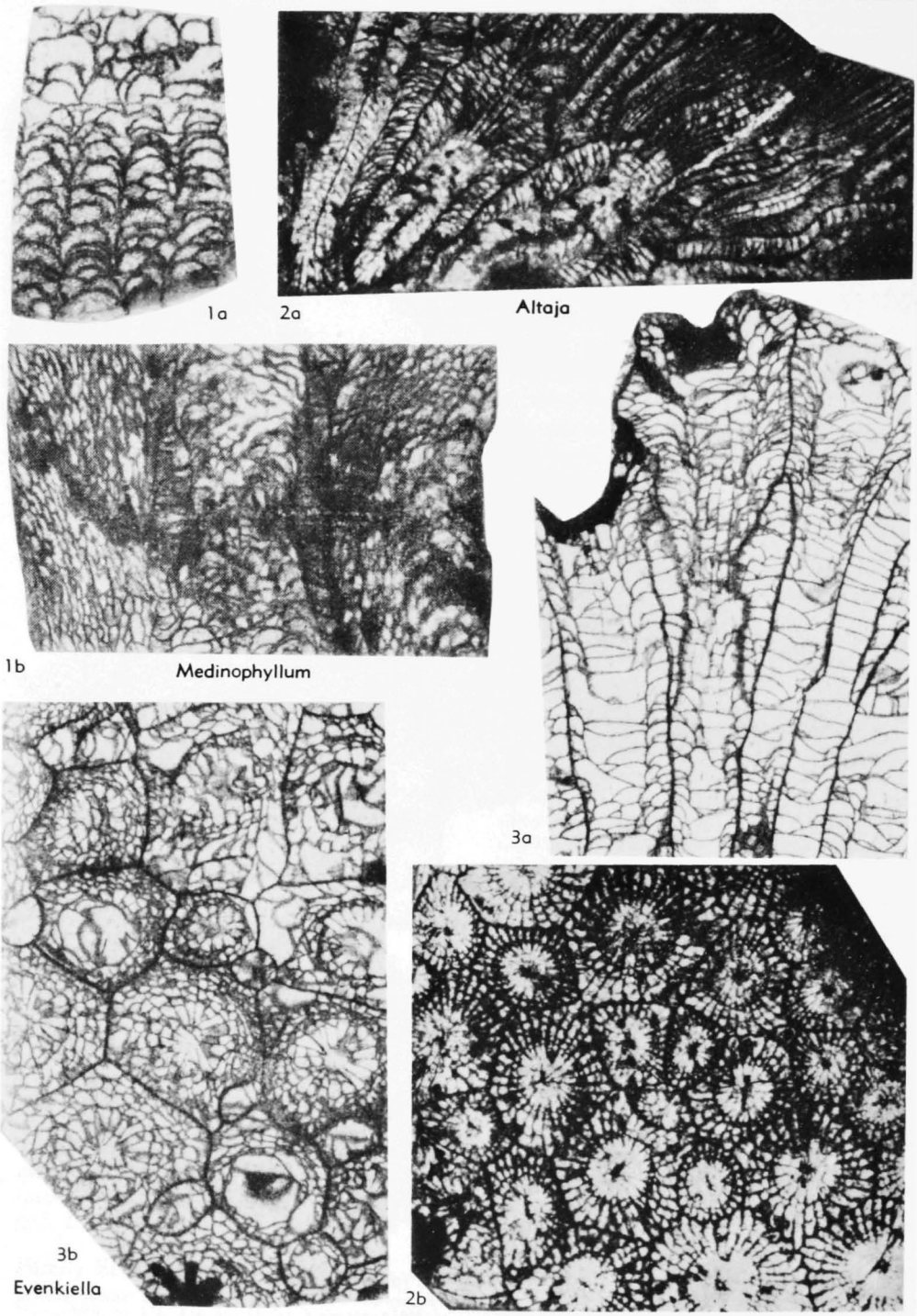


FIG. 128. Entelophyllidae (p. *F207-F209*).

septa thin in tabularium, connected to columella; tabularium sharply bounded from dissepimentarium; tabellae numerous, convex, in conical floors; dissepiments small, horizontally disposed at outer wall, but vertically declined at boundary with tabularium; rodlike columella present from early stages, oval in transverse section and appearing to be thickened end of long cardinal septum [homeomorph of Carboniferous *Lithostrotion* FLEMING, 1828]. *L.Sil.-M.Sil.(Wenlock.)*, Asia (Salair-Altay)-?N.Am.(Alaska).——FIG. 128,*2a,b*. **A. silurica*, holotype, Yurman suite, SW. Salair; long., transv. secs., ×3.8 (Markovskiy, 1960).

Evenkiella SOSHKINA in IVANOVA *et al.*, 1955, p. 126 [**E. helenae*; OD; †341, coll. 587, PIN, Moscow] [=*Evenkiellina* IVANOVSKIY, 1976, p. 70, invalid *nom. subst. pro Evenkiella* SOSHKINA]. Corallum cerioid, with lateral, nonparricidal increase; septa of two orders, variably developed, in early stages very short, in late stages thin, may have irregular lonsdaleoid discontinuity, and major septa may almost reach or be somewhat withdrawn from axis; tabularium wide, tabular floors flat, concave or convex, tabulae complete or represented by few large tabellae; dissepiments large, in few series, horizontal at periphery, steeply inclined at boundary with tabularium. *Sil.(L.Sil.-M.Sil. boundary)*, Asia(W.Sib.Platf.-?Uzbek.); *?L.Dev. (Kunzhak.)*, Asia(Tadzhik.).——FIG. 128,*3a,b*. **E. helenae*, holotype, Kochumdek Suite, Gk_3, W. Sib.Platf., R. Stony Tunguska; *a,b*, long., transv. secs., ×3.8 (Ivanova *et al.*, 1955).

Kysylagathophyllum KAPLAN, 1971b, p. 18 [**K. michnevitchi*; OD; †16, coll. 10287, TsGM, Leningrad]. Cerioid; increase tabularial, staurioid and quadripartite; peripheral ends of major and minor septa commonly thickened, composed of thick, close trabeculae that diverge adaxially in a half-fan; axial ends of major septa thin, reaching or almost reaching axis, which is without columella; tabular floors convex in center and sagging at edges, tabulae commonly incomplete; dissepiments normal, concentric, subglobose, in several series. *L.Dev.(Gedinn.)*, Asia(Kazakh.).——FIG. 129,*4a,b*. **K. michnevitchi*, holotype, lower part of Pribalkhash horizon, near Kyzyl-Agat; *a,b*, transv., oblique secs., ×2.7 (Sytova & Kaplan, 1975).

Medinophyllum SYTOVA in SYTOVA & ULITINA, 1966, p. 235 (invalid junior synonym, *non Medinophyllum* HANCOCK, 1910, an orthopteron) [**M. crispum*; OD; †119, coll. 8732, TsGM, Leningrad]. Solitary, of medium size; septa long, thin adaxially but in wide marginarium each represented by column of naotic dissepiments; cardinal and counter septa may unite axially, major septa may reach axis; tabular floors shaped like hat with upturned brim and flatly domed crown, of tabellae, peripheral concave tabellae forming distinct series; dissepimentarium wide, of naotic plates and small globose interseptal plates; fossula indistinct. *U.Sil.*, Asia(C.Kazakh.).——FIG. 128,*1a,b*. **M. crispum*, Akkan horizon, zone of *M. crispum crispum*, S. flank of Karaganda Basin, Sulu-Medina interfluve; *a*, syntype, part of transv. sec., ×9.4; *b*, syntype, long. sec., ×2.8 (Sytova & Ulitina, 1966).

Migmatophyllum PEDDER, 1971c, p. 14 [**M. lenzi*; OD; †25867, GSC, Ottawa] [*?=Petrozium* SMITH, 1930a, which see]. Fasciculate; increase peripheral and parricidal; septa long, commonly dilated and carinate peripherally, elsewhere smooth and only slightly dilated; trabeculae probably monacanthine; major septa commonly contiguous at axis; tabular floors commonly elevated at axis, sigmoidally descending from it, but in places sagging; tabulae incomplete; dissepiments small, interseptal. *U.Sil.(Pridol.)*, N.Am.(N.Yukon).——FIG. 127,*1a,b*. **M. lenzi*, holotype, Prongs Cr. F., Prongs Cr.; *a,b*, transv., long. secs., ×3 (Pedder, 1971c).

Nanshanophyllum Yü, 1956, p. 612 [**N. typicum*; OD; †PB8693-5, IGP, Nanking]. Corallum solitary; septa very numerous, dilated and faintly asymmetrically carinate in wide dissepimentarium of small, rather elongate dissepiments; major septa extending unequally into axial region, axial ends may be slightly curving in indistinct groups; cardinal fossula extending into axial region, cardinal septum may attain axis; tabular floors axially depressed domes with edges turned out or up, each floor of many tabellae [see also PEDDER, 1976b, p. 291]. *?L.Sil.*, Australia(New S.Wales); *M.Sil.*, Asia(Kansu-Shensi-Hunan); *U.Sil.(Pridol.)*, N. Am.(Devon I.).——FIG. 130,*5a,b*. **N. typicum*, holotype, Kansu, Chiyinkungtai, Chiuchan; *a,b*, transv., long. secs., ×2 (Yü, 1956).

Ornatophyllum NIKOLAEVA, 1964, p. 57 [**O. ornatum*; OD; †R-8/5747, TsGM, Leningrad] [*?=Scyphophyllum* STRELNIKOV, 1964, which see]. Solitary, small; calical platform declined adaxially; septa asymmetrically carinate and somewhat dilated in marginarium, in some more so near its junction with tabularium; major septa long, thinning in tabularium, but axial ends thickened in irregular axial complex forming axial calical boss; minor septa moderately long; tabular floors domes with upturned edges, tabulae incomplete; dissepiments not large, subglobose, interseptal. *U.Sil.(Aynasu.)*, Asia(C.Kazakh.).——FIG. 130,*2a,b*. **O. ornatum*, holotype, Aynasu horizon, SE. flank of Karaganda Basin, S. of Aynasu R.; *a,b*, transv., long. secs., ×4 (Nikolaeva, 1964).

Petrozium SMITH, 1930a, p. 307 [**P. dewari*; OD; †48,674, GSM, London] [*?=Migmatophyllum* PEDDER, 1971c, which see; *?Shensiphyllum* GE & Yü, 1974, which see]. Fasciculate, corallites slender, thin-walled; increase peripheral, nonparricidal, with numerous long, thin, asymmetrically carinate septa meeting or almost meeting at axis; tabular floors domed, with edges turned out, tabu-

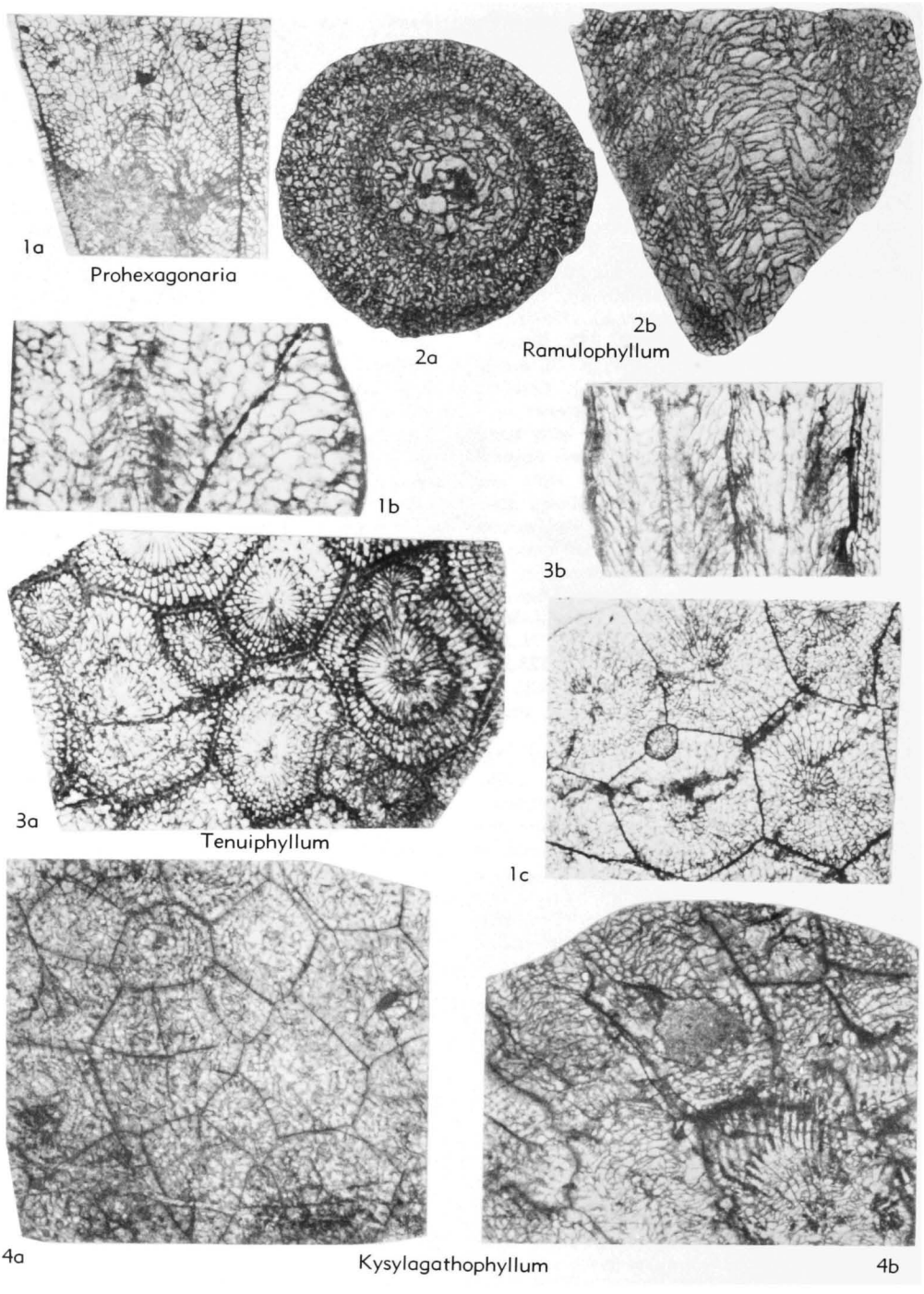


FIG. 129. Entelophyllidae (p. *F209-F212*).

lae commonly incomplete, in places outermost tabellae may form distinct series; dissepimentarium relatively narrow, dissepiments small, interseptal; fossula inconspicuous in late stages. *L.Sil. (Llandov.)*, Eu. (U. K.); *?low. M. Sil.*, N. Am. (Calif.).——FIG. 130,*1a-c*. **P. dewari*, *Pen-*

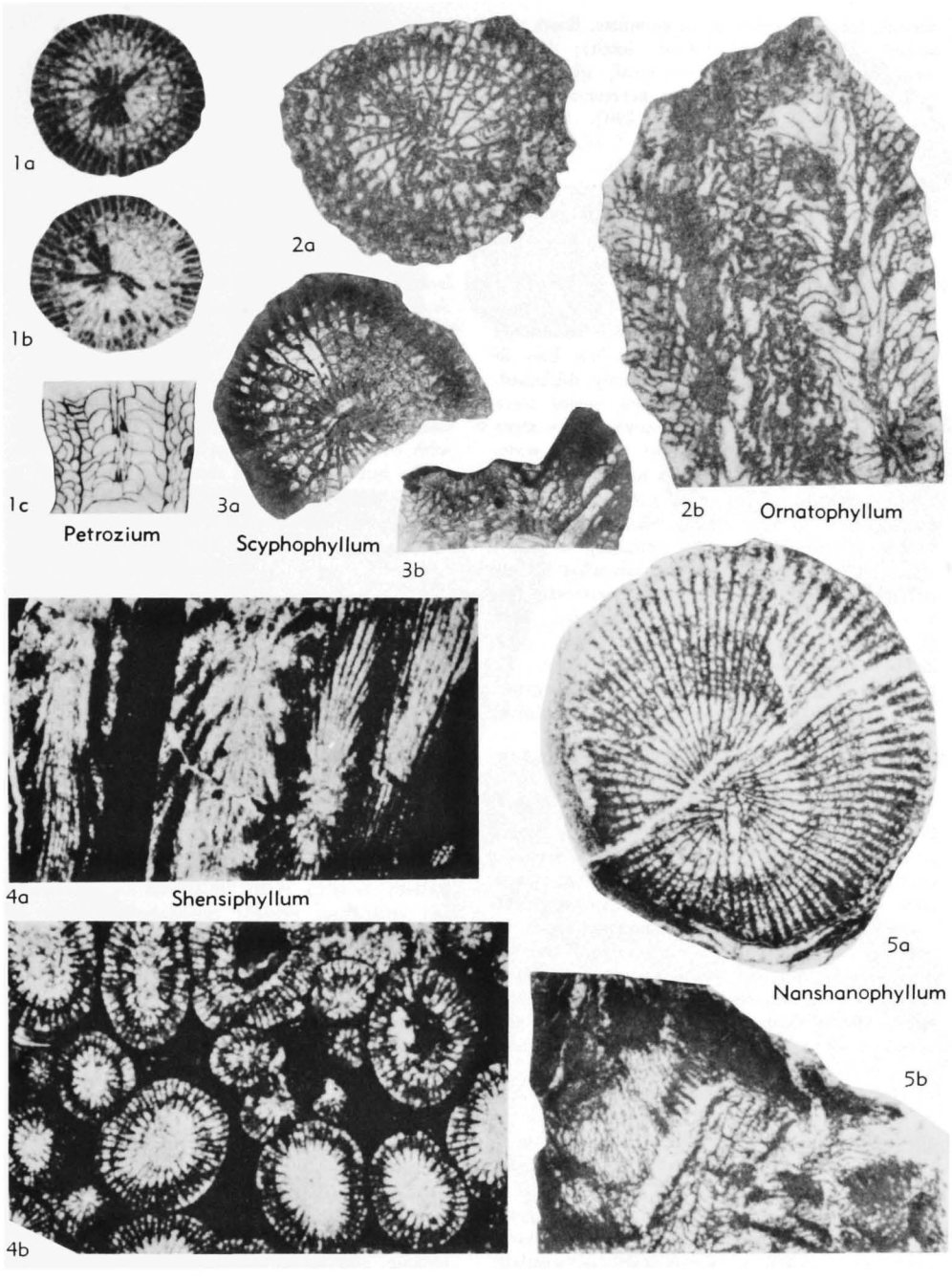


FIG. 130. Entelophyllidae (p. *F*209-*F*212).

tamerus beds, U.K., Morrell's Wood Brook, near Buildwas; *a,b,* transv. secs., ×3; *c,* long. sec., ×2 (Smith, 1930a).

Prohexagonaria MERRIAM, 1973a, p. 50, as subgenus of *Entelophyllum* [**Entelophylloides (Prohexagonaria) occidentalis*; OD; †159410, USNM, Washington] [?=*Tenuiphyllum* SOSHKINA, 1937, which see]. Cerioid; increase peripheral, nonparricidal; septa thin, with inconspicuous asymmetrical carinae, long, some reaching axis; tabularium

narrow, tabulae incomplete or complete, floors uparched (no median depression noted); dissepimentarium wide, plates interseptal, globose in most series, in some series a few horizontally elongate [see also PEDDER, 1976b, p. 290]. *M.Sil.* or *U.Sil.*, Eu.(Gotl.)-N.Am.(Nev.); *U.Sil.(Pridol.)*, N.Am.(Cornwallis I.-Yukon).——FIG. 129,*1a-c*. **P. occidentalis*, holotype, low. beds unit 3, Roberts Mt. F., coral zone C, Nev., NW. side of Roberts Cr. Mt.; *a,b*, long. secs., ×2.3, ×4.0, *c*, transv. sec., ×2.0 (Merriam, 1973a).

Ramulophyllum NIKOLAEVA, 1964, p. 52 [**R. heterozonale*; OD; †R-2, coll. 5747, TsGM, Leningrad]. Solitary, medium-sized; calice commonly with slightly everted platform and low boss in tabularial pit; septa may be unevenly thickened, asymmetrically carinate or areolate, major septa may be long or abaxially withdrawn; minor septa may be contratingent; tabularium relatively wide, tabular floors domes with edges turned out or up, tabulae incomplete, in some, peripheral concave tabellae form regular series; where major septa withdraw unequally toward periphery of tabularium, tabular floors may sag somewhat irregularly; dissepiments small, globose, interseptal; fossula commonly indistinct. *U.Sil.(Aynasu.)*, Asia (C. Kazakh.)-?Eu. (Czech.-Gotl.).——FIG. 129, *2a,b*. **R. heterozonale*, Aynasu horizon, C. Kazakh., R. Aynasu, SE. flank of Karaganda Basin; *a,b*, transv., long. secs., ×2.7 (Nikolaeva, 1964).

Scyphophyllum STRELNIKOV, 1964, p. 56 [**S. clavum*; OD; †3, coll. 8503, TsGM, Leningrad] [?=*Ornatophyllum* NIKOLAEVA, 1964, which see]. Small, solitary; septa thickened; in early stages peripheral ends of major and minor septa laterally contiguous in narrow stereozone, in later stages zone of thickening wider but interseptal loculi containing small globose dissepiments appearing between major and minor septa; axial ends of major septa thickened and contiguous or almost so to form incomplete tube around axial space; tabular floors domed, with axial deepening and upturned edges, and of large tabellae; cardinal fossula distinct, may open into axial space. *U.Sil.(Pridol.)-L.Dev.(Gedinn.)*, Eu.(N.Urals)-?Asia(C. Kazakh.).——FIG. 130,*3a,b*. **S. clavum*, holotype, Bolshezemelskaya Tundra; *a,b*, transv., long. secs., ×4 (Strelnikov, 1964; photographs courtesy S. I. Strelnikov).

Shensiphyllum GE & YÜ, 1974, p. 171 [**S. aggregatum*; OD; †22140-1, IGP, Nanking] [?=*Petrozium* SMITH, 1930a, which see]. Fasciculate, corallites slender; septa long, radially arranged and asymmetrically carinate in moderately wide dissepimentarium; tabular floors domed with upturned margins, each floor of numerous tabellae; dissepiments small, outermost series horizontally based and globose, inner series obliquely based. *M.Sil.*, Asia(Shensi-Hunan).——FIG. 130,*4a,b*. **S. aggregatum*, holotype, Ningqiang F., Shensi, Ningqiang; *a,b*, long., transv. secs., ×3 (Ge & Yü, 1974).

Tenuiphyllum SOSHKINA, 1937, p. 31 [**T. ornatum*; OD; †346-347 in sample 231, coll. 143, PIN, Moscow] [?=*Prohexagonaria* MERRIAM, 1973a, which see]. Cerioid, increase peripheral; septa long, thin, major reaching or almost reaching axis; tabular floors tall cones with edges turned up or out and some additional tabellae at axis of corallite; dissepiments inclined, unequal, and rather shallow, some lonsdaleoid. *M.Sil.(up.Wenlock.)*, Asia(E.Urals)-?Eu.(Gotl.).——FIG. 129, *3a,b*. **T. ornatum*, holotype, E. Urals, right bank of R. Vya, near Elkino; *a,b*, transv., long. secs., ×2.7 (Ivanovskiy & Shurygina, 1975).

?Trachyphyllum ULITINA, 1975, p. 275 [**T. shovdolense*; OD; †2281, coll. 3294, PIN, Moscow]. Closely phaceloid and in part cerioid; septa long, with corroded lateral faces and thickened peripherally, but thinning and somewhat interrupted at boundary between narrow dissepimentarium and tabularium; tabulae incomplete, tabular floors convex, sagging axially and near edges. *M.Sil.-U.Sil. (Wenlock.-Ludlov.)*, Asia(E.Mongolia).

Family EXPRESSOPHYLLIDAE Strelnikov, 1968

[Expressophyllidae STRELNIKOV, 1968b, p. 71]

Solitary, with moderately wide dissepimentarium in which minor septa may be discontinuous in some; major septa unequal, thin and amplexoid in tabularium in some; septal trabeculae uniseriate, directed inward and slightly upward; tabularium wide, tabular floors moderate or shallow domes with flattened or upturned and troughed edges; tabulae complete or incomplete, tabularial fossula more or less distinct, cardinal septum may shorten within it. *M.Sil.-U.Sil.; ?L.Dev.*

Micula SYTOVA, 1952, p. 133 [**M. antiqua*; OD; †neotype 62, coll. 454, PIN, Moscow; SD SYTOVA, 1970, p. 73] [=*Expressophyllum* STRELNIKOV, 1968b, p. 72 (type, *E. simplex*, OD; †1, coll. 9403, TsGM, Leningrad; U.Sil., Durnayu horizon, R. Kozhim, Polar Urals; *fide* SYTOVA, 1970, p. 72)]. Solitary; calicular platform erect or but slightly declined adaxially; marginarium moderately wide stereozone in which narrow interseptal loculi may develop increasingly in later stages, with small, globose, and concentric or angulate dissepiments; septa thickened in dissepimentarium, septal trabeculae directed inward and slightly upward, ?uniseriate; tabularium wide, tabular floors flattened domes with edges irregularly turned out or up and with elongate subhorizontal tabellae in wide axial zone; cardinal fossula indistinct; one peripheral offset may arise from calice. *M.Sil.-U.Sil., ?L.Dev.*, Eu.(Polar Urals-Vaygach-C.Urals).——

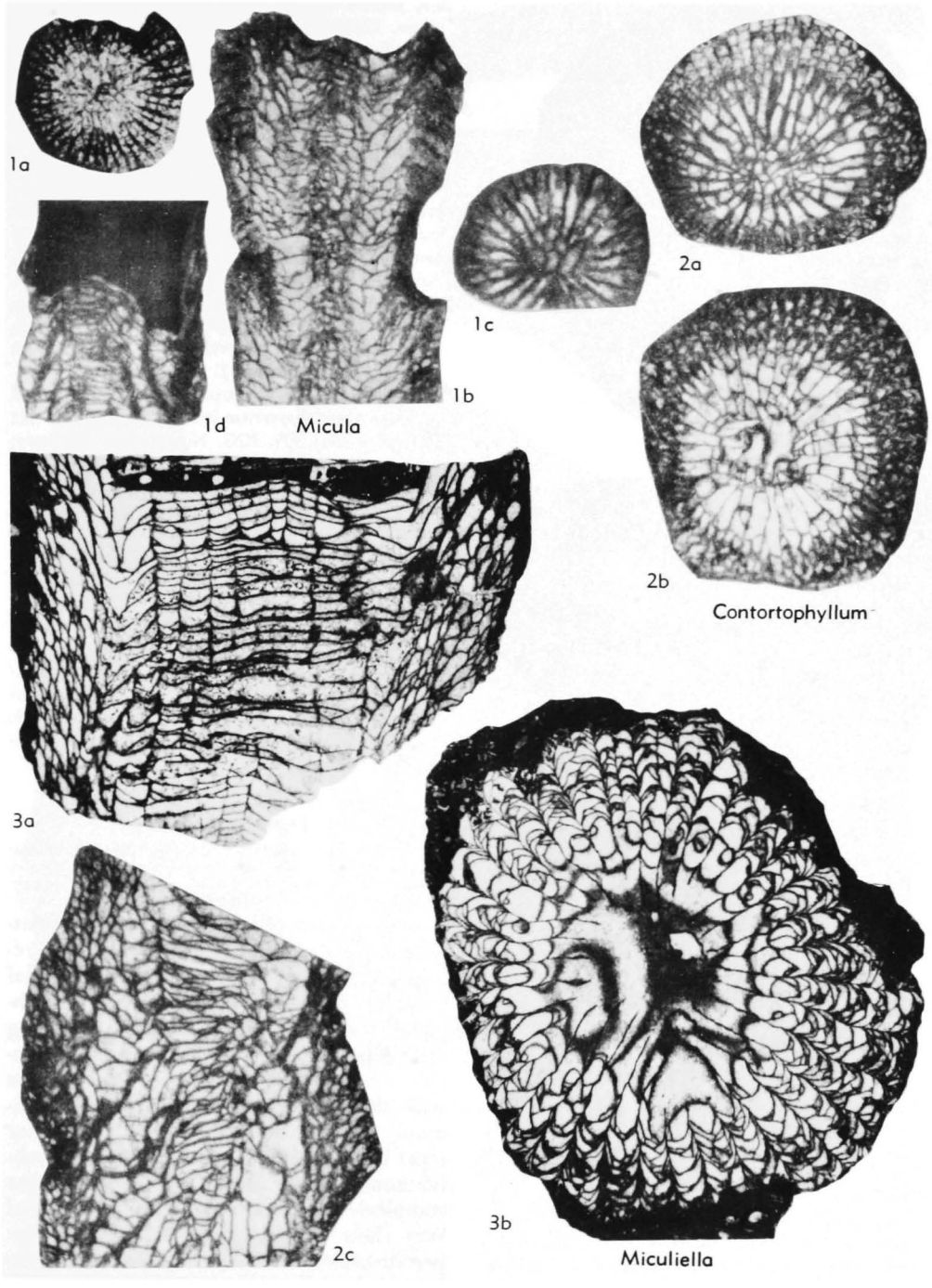
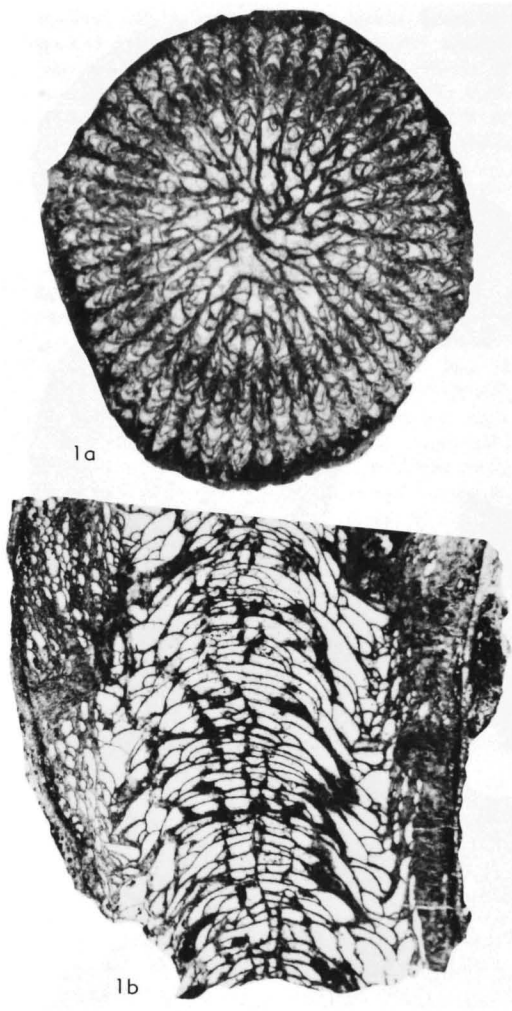


FIG. 131. Expressophyllidae (p. *F*212-*F*214).

FIG. 131,*1a,b*. **M. antiqua,* paratypes, M.Sil. (Wenlock.), W. slope of C. Urals, N. shore of Mikhailovskii pond; *a,b,* transv., long. secs., ×4 (Sytova, 1952).——FIG. 131,*1c,d*. *M. simplex*



Pseudopilophyllum

FIG. 132. Expressophyllidae (p. *F*214).

(STRELNIKOV), holotype, U.Sil.(Ludlov.), Durnayuiskiy horizon, Polar Urals, R. Kozhim; *c,d,* transv., long. secs., ×4 (Strelnikov, 1968b).

Contortophyllum STRELNIKOV, 1968b, p. 77 [**C. tchernovi*; OD; †7, coll. 9403, TsGM, Leningrad]. Solitary; each septum a plate with denticulate axial edge and composed of single series of subhorizontal trabeculae; in early stages septa thickened peripherally to form narrow irregular stereozone, in later stages dissepimentarium moderately wide, dissepiments curved or angulate in transverse section, small, subglobose; tabularium wide, tabular floors domed or flat axially and with irregularly troughed edges, tabulae incomplete. *U.Sil.,* Eu.(Polar Urals).——FIG. 131,*2a-c.* **C. tchernovi,* holotype, U.Sil.(Ludlov.), Polar Urals, R. Kozhim; *a,b,* transv. secs., ×4; *c,* long. sec., ×4 (Strelnikov, 1968b).

Miculiella IVANOVSKIY, 1963, p. 63 [**M. annae*; OD; †32, coll. 305, IGG, Novosibirsk]. Solitary; septa long, thin, amplexoid in tabularium and not reaching axis, with weak thickening at periphery; minor septa not long, mostly discontinuous longitudinally in angulate dissepimentarium; tabulae broadly and shallowly convex, in places complicated by supplementary tabellae; late stages with many series of long, steeply inclined dissepiments; cardinal fossula deepened in tabularium. *M.Sil.,* Asia (Sib. Platf.-Altay-Sayan); *?U.Sil.,* N. Am. (Alaska).——FIG. 131,*3a,b.* **M. annae,* holotype, mid.Wenlock., Sib. Platf., R. Moyero; *a,b,* long., transv. secs., ×4 (Ivanovskiy, 1963; photographs courtesy A. B. Ivanovskiy).

Pseudopilophyllum LAVRUSEVICH, 1971a, p. 68 [**Pilophyllum moyerense* IVANOVSKIY, 1963, p. 61; OD; †30, coll. 305, IGG, Novosibirsk]. Solitary; septa thick, thickening decreasing in dissepimentarium in later stages with appearance of numerous small angulate dissepiments; major septa unequal, radial, few reaching axis; tabularium wide, tabellae of wide axial region forming domed tabular floors, periaxial tabellae less numerous, mostly declined toward dissepimentarium, a few concave; dissepiments small, unequal, numerous, very steeply declined adaxially; fossula not distinct. *M. Sil. (low. Wenlock.),* Asia (Sib. Platf.-Tadzhik.).——FIG. 132,*1a,b.* **P. moyerense* (IVANOVSKIY), holotype, R. Moyero, Sib. Platf.; *a,b,* transv., long. secs., ×4 (Ivanovskiy, 1963; photographs courtesy A. B. Ivanovskiy).

Family ARACHNOPHYLLIDAE Dybowski, 1873

[Arachnophyllidae DYBOWSKI, 1873c, p. 339] [?=Chonophyllidae HOLMES, 1887, p. 25; Chonophyllinae STUMM, 1949, p. 48; Arachnophyllinae HILL, 1956b, p. *F*274; Arachnophyllicae IVANOVSKIY, 1963, p. 82]

Solitary, astreoid, aphroid, or thamnasterioid; corallites large, commonly with reflexed calicular platform and narrow axial calicular pit; septa numerous, minor subequal with major, major septa extending somewhat into narrow tabularium in species whose tabular floors are low domes with downturned edges and tabulae commonly incomplete, or no longer than minor septa in species whose tabular floors are subhorizontal; marginarium wide, with septa complexly modified either into network of very short trabeculae perpendicular to upper surfaces of numerous low dissepiment-like plates, or into columns of naotic dissepiments on which are based very short, thick trabeculae, the columns being separated by narrow interseptal loculi with fine dissepiments. *L.Sil.-M.Dev.*

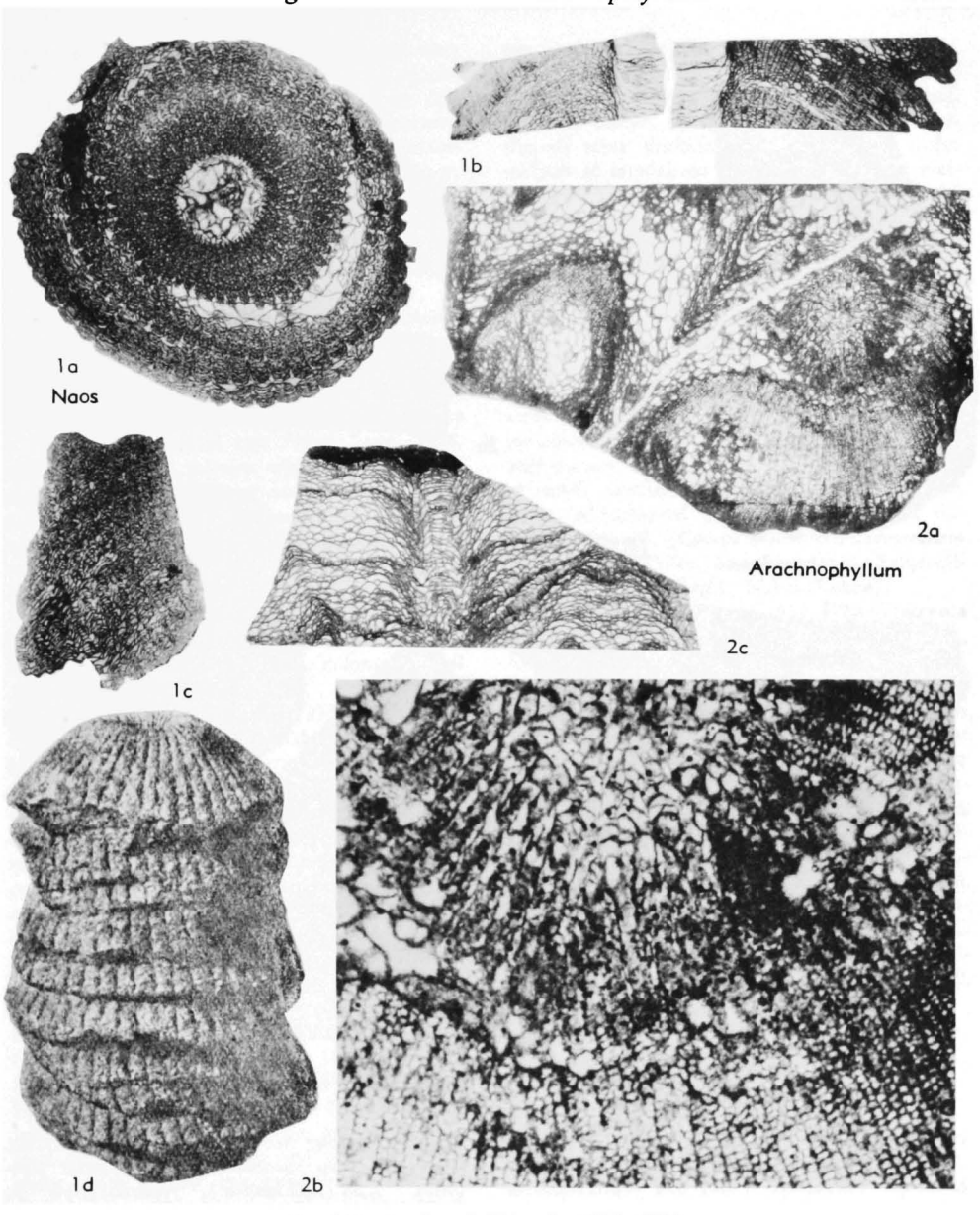


FIG. 133. Arachnophyllidae (p. *F*215-*F*217).

Arachnophyllum DANA, 1846a, p. 186 [**Acervularia baltica* SCHWEIGGER *sensu* LONSDALE, 1839, p. 689, *non* SCHWEIGGER, 1819, table vi; SD LANG & SMITH, 1927, p. 452; †Geol. Soc. 6577, GSM, London; lectotype by LANG & SMITH, 1927, p. 467; =*Strombodes murchisoni* MILNE-EDWARDS & HAIME, 1851, p. 428, †Z112a, MN, Paris] [=*Arachniophyllum* LANG, SMITH, & THOMAS, 1940, p. 19, *nom. van.; Prodarwinia* COTTON, 1973, p. 161, *nom. subst. pro Darwinia* DYBOWSKI, 1873c, p. 336 (type, *D. speciosa,* M; †Col1334, coll. 11, EGM, Tallinn, lectotype by LANG, SMITH, & THOMAS, 1940, p. 40; Sil., Kattentak, Est.), *non Darwinia* BATE, 1857, a crustacean]. Corallum astreoid or aphroid; tabularium narrow, tabulae steeply domed, incomplete; dissepimentarium very wide, of numerous small dissepiments based horizontally, on which septa develop sporadically; septa thickened and contiguous, or each a network of small trabeculae standing perpendicular to

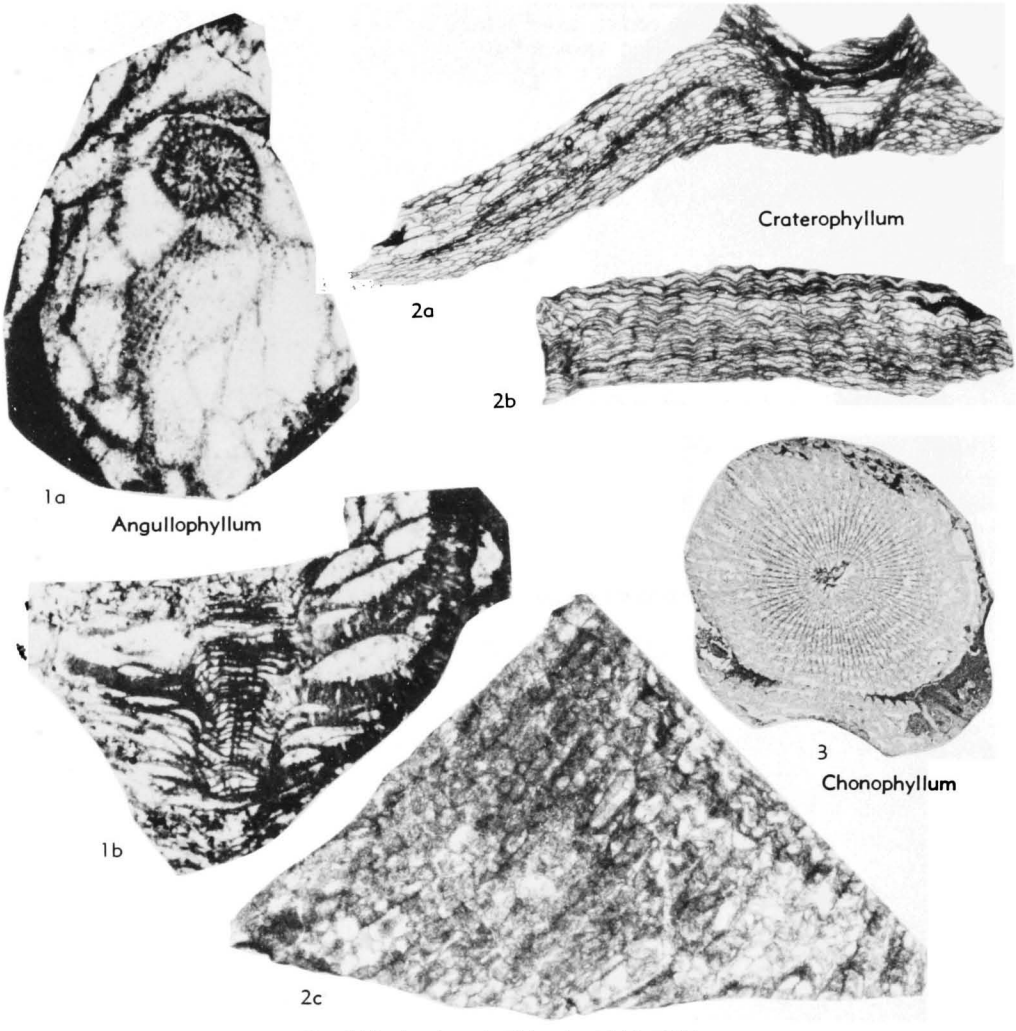


FIG. 134. Arachnophyllidae (p. *F216-F217*).

curvature of dissepiments but not piercing more than one or two successive platforms [see also McLEAN, 1975b, p. 54]. *L.Sil.(up.Llandov.)-M. Sil. (Wenlock.)*, Eu. (U. K.-Gotl.-Est.)-N. Am. (Ky.-Ind.-Mich.-Iowa); *U.Sil.(Ludlov.)*, N.Am. (Tenn.).——FIG. 133,*2a-c*. **A. murchisoni* (MILNE-EDWARDS & HAIME), Wenlock Ls., U.K., Wenlock Edge; *a*, transv. sec., ×1.9; *b*, enl. view of right central portion of *a*, ×3.8; *c*, long. sec., ×1.4 (Hill, n; UQF8238).

?**Angullophyllum** MCLEAN, 1974c, p. 27 [**A. warrisi*; OD; †P 46177, SU, Sydney]. Cerioid; corallites large; tabularium narrow, with tabular floors domed to flat and axial ends of major septa reaching almost to axis; in wide dissepimentarium, septa represented by short fine trabeculae based on upper surfaces of broad, flat-lying dissepiments, possibly forming network, and seldom piercing more than two successive dissepimentarial platforms. *L.Sil.(up.Llandov.)*, Australia(New S. Wales).——FIG. 134,*1a,b*. **A. warrisi*, holotype, low. ls. horizon, C. New S. Wales, Cobblers Cr., Angullong district near Orange; *a,b*, transv., long. secs. of one corallite, ×3.8 (McLean, 1974c).

?**Chonophyllum** MILNE-EDWARDS & HAIME, 1850, p. lxix [**Cyathophyllum perfoliatum* GOLDFUSS MS, MILNE-EDWARDS & HAIME, 1850, p. lxix; †203a,b, GOLDFUSS Coll., IP, Bonn; *nom. subst. pro Cyathophyllum plicatum* GOLDFUSS, 1826, p. 59, pl. 18, fig. 5, *non Cyathophyllum plicatum* GOLDFUSS, 1826, p. 54, pl. 15, fig. 12] [?=*Craterophyllum* FOERSTE, 1909a, which see; *?Naos* LANG, 1926, which see]. Solitary, turbinate; septa dilated wedgewise, thickening toward periphery,

the sclerenchyme with scattered trabecular axes and septa without median dark plane; at periphery thickened septa may be represented by columns of naotic dissepiments; tabularium narrow, nature of tabulae not known; dissepimentarium wide, dissepimented interseptal loculi narrow. [Until a longitudinal section is described and illustrated, generic and family names have doubtful value.] *Sil.*, Eu.(Gotl.).——Fig. 134,*3*. **C. perfoliatum*, holotype; transv. sec., ×0.9 (Smith, 1945).

?**Craterophyllum** Foerste, 1909a, p. 101 [**Chonophyllum (Craterophyllum) vulcanius*; SD Lang, Smith, & Thomas, 1940, p. 42; =*Ptychophyllum vulcanius* Foerste, 1903, p. 713, †84761, USNM, Washington] [?=*Chonophyllum* Milne-Edwards & Haime, 1850, which see; ?*Naos* Lang, 1926, which see]. Large, solitary, with everted calicular platform; septa long, major and minor subequal, naotic, with indistinct narrow interseptal loculi with fine dissepiments; tabularium narrow, tabulae subhorizontal, complete or incomplete. *U.Sil.*, N. Am.(Tenn.); ?*L.Dev.-M.Dev.(Onondag.)*, N.Am. (Ky.-Ind.-Ont.).——Fig. 134,*2a-c*. **C. vulcanium* (Foerste), Brownsport F., Tenn., SE. of Rise Mill; *a,b*, tang., part transv. secs., *c*, long. sec., all ×2.8 (Hill, n; UQF11434).

Idiophyllum Cao in Li *et al.*, 1975, p. 180 [**I. dabashanense*; OD; †G354, IGMR, Sian; M.Sil., Ningqiang, Shensi] [?=*Werneckelasma* Pedder, 1978, which see]. Solitary, with numerous long, thin septa, possibly retiform, but seemingly in three orders; cardinal septum isolated in long, narrow fossula; tabularium narrow, with numerous small tabellae; dissepimental floors ?subhorizontal, of numerous small plates. [Diagnosis based on illustrations. Compare with *Sumsarophyllum* Lavrusevich, 1971c, Streptelasmatina, Paliphyllidae.] *M.Sil.*, Asia(Shensi).

?**Naos** Lang, 1926, p. 428 [**Ptychophyllum pagoda* Salter, 1873, p. 114; OD; †R25165, BM(NH), London; lectotype by Lang, 1926, p. 430] [?=*Chonophyllum* Milne-Edwards & Haime, 1850, which see; ?*Craterophyllum* Foerste, 1909a, which see]. Large, solitary, with reflexed calicular platform; septa long, major and minor subequal, naotic, with narrow interseptal loculi with fine dissepiments; tabularium narrow, tabulae subhorizontal, commonly incomplete. ?*U.Sil.*, N.Am. (Arctic Can.).——Fig. 133,*1a-d*. **N. pagoda* (Salter), Melville I.; *a-c*, transv., long., tang. secs., ×1.2, ×1.4, ×1.4; *d*, lectotype, ?Disaster Bay, ext. view, ×0.9 (Lang, 1926).

?**Ningqiangophyllum** Ge & Yü, 1974, p. 171 [**N. cystosum*; OD; †22137-8, IGP, Nanking]. Like *Zenophila* but tabularia larger and septa so weak as to be represented by only occasional septal crests on upper surfaces of dissepiments. [Possibly spongophyllid.] *M.Sil.*, Asia(Shensi).——Fig. 145, *2a,b*. **N. cystosum*, holotype, Ningqiang F., China, Ningqiang, S. Shensi; *a,b*, transv., long. secs., ×1.7 (Ge & Yü, 1974).

?**Pseudomucophyllum** Lavrusevich, 1977a, p. 226 [**P. pavlovae*; OD; †4712/106, ?UpG, Dushanbe]. Corallites solitary or aggregated, broadly trumpet-shaped; septa thickened to contiguity on upper surfaces of lonsdaleoid dissepiments in wide marginarium and projecting but slightly into relatively narrow tabularium with flat floors and mainly complete tabulae. *U.Sil.*(Maikotta horizon), Asia(Tadzhik.).

Werneckelasma Pedder, 1978, p. 45 [**W. multiseptatum*; OD; †42584, GSC, Ottawa] [?=*Idiophyllum* Cao in Li *et al.*, 1975, which see]. Corallum solitary; septa very numerous and long, seemingly in three orders, carinate, becoming retiform or broken into irregular strands toward periphery; trabeculae monacanthine; tabularium very narrow, floors arched axially and periaxially, of small tabellae; dissepimentarium very wide, floors subhorizontal and somewhat everted, dissepiments small. [Compare with *Sumsarophyllum* Lavrusevich, 1971c, Streptelasmatina, Paliphyllidae.] *L.Dev.(up.Prag.)*, N.Am.(Yukon).

?**Zenophila** Hill, 1940c, p. 414 [**Phillipsastraea walli* Etheridge, 1892, p. 169; OD; †4672, AM, Sydney] [=*Zonophyla* Wang, 1950, p. 224, *nom. null.*]. Aphroid or in part thamnasterioid coralla with slender distant tabularia each surrounded by aureole of regularly radial septal segments that may be discontinuously extended to join with those from neighboring corallites in thamnasterioid manner; with horizontal or concave, close tabulae, and with shallowly arched dissepiments; dissepimental floors sag between tabularia, but dissepiments bounding tabularia are steeply inclined. [Possibly spongophyllid.] *U.Sil.(Ludlov.)*, Australia(New S.Wales).——Fig. 135,*1a-c*. **Z. walli* (Etheridge), Yass district; *a*, transv. sec., *b,c*, different specimen, transv., long. secs., all ×4 (Hill, 1940c).

Suborder KETOPHYLLINA Zhavoronkova, 1972

[Ketophyllina Zhavoronkova, 1972, p. 54]

Solitary or compound Rugosa; septa commonly thickened and disrupted by lonsdaleoid dissepiments in more or less wide dissepimentarium, where their trabeculae may be multiserial, thinning adaxially into tabularium; tabular floors flat or mesa-shaped or low domes with axial depression, tabulae complete or incomplete; increase predominantly marginarial. *U.Ord.-?Carb.*

Family KETOPHYLLIDAE Lecompte, 1952

[Ketophyllidae Lecompte, 1952, p. 467] [=Dokophyllidae Soshkina in Soshkina, Dobrolyubova, & Kabakovich, 1962, p. 319, *nom. subst. pro* Omphymatidae Wedekind, 1927, p. 10, invalid name; Ketophyllicae Ivanovskiy, 1965a, p. 96]

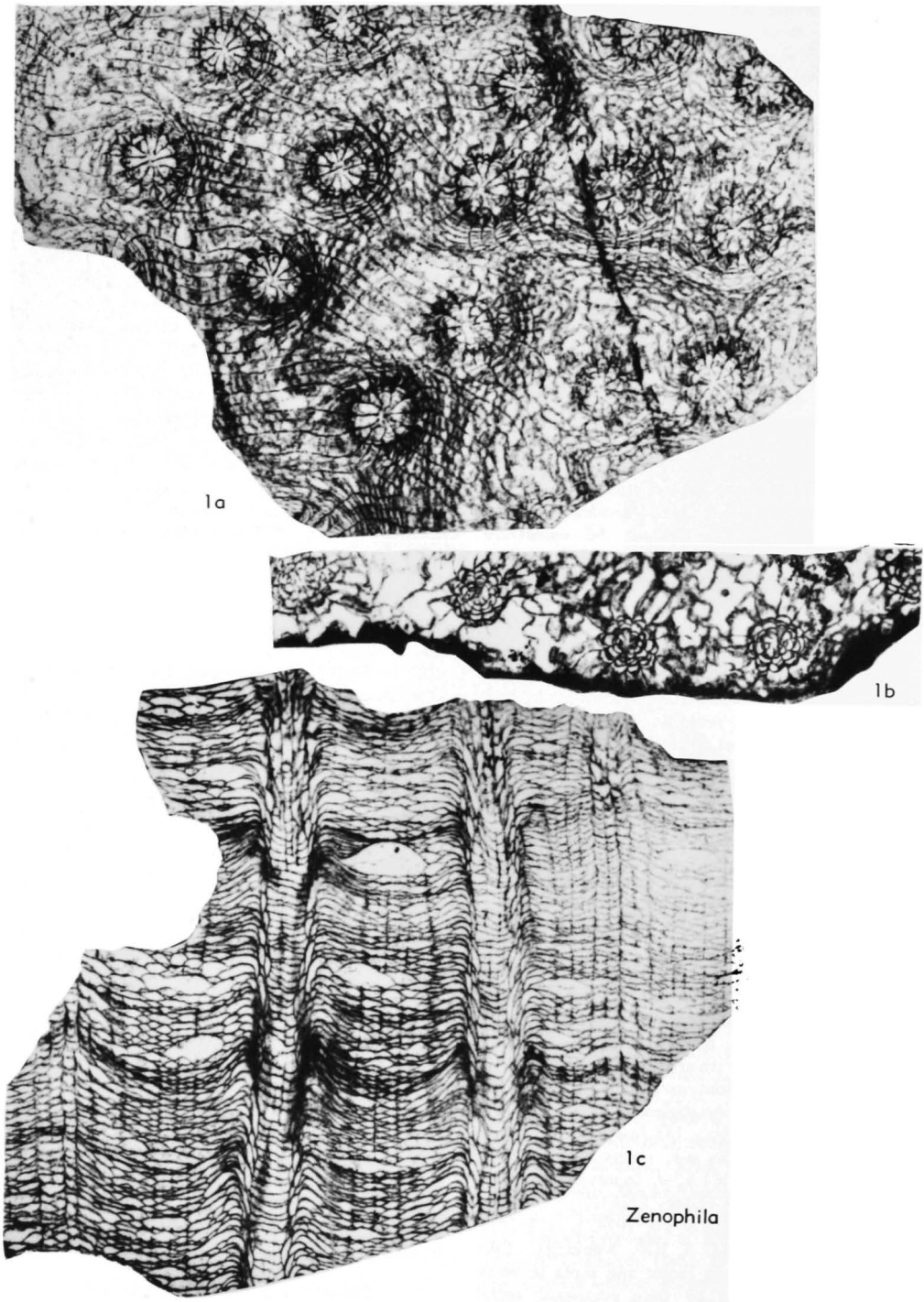


FIG. 135. Arachnophyllidae (p. *F217*).

Solitary or with few offsets, large; except in early stages with dissepimentarium in which large lonsdaleoid plates dominate over small, concentric or angulate interseptal plates; septa long, radially arranged, disrupted by lonsdaleoid dissepiments, may thicken wedgewise toward periphery, major septa may continue into tabularium as low ridges on upper surfaces of tabulae; tabulae flat, with mostly downturned edges, commonly in groups of three or more; cardinal fossula and, in some, alar tabular fossulae also present. *Sil.-L.Dev.(Gedinn.).*

Dokophyllum WEDEKIND, 1927, p. 48 [**D. annulatum*; OD; †Cn54863, 54868, 55001, RM, Stockholm] [=*Omphyma* AUCTT., *non* RAFINESQUE & CLIFFORD, 1820, p. 235, see LANG, SMITH, & THOMAS, 1940, p. 90; *?Heterolasma* EHLERS, 1919, which see; *Ketophyllum* WEDEKIND, 1927, p. 48 (type, *K. elegantulum*, OD; †lectotype by BIRENHEIDE, 1974b, p. 487, not traced in RM, Stockholm; Mulde Marls, Eksta, Djupvik, Gotl.); *Cetophyllum* LANG, SMITH, & THOMAS, 1940, p. 35, *nom. van.*; *Docophyllum* LANG, SMITH, & THOMAS, 1940, p. 54, *nom. van.*]. Solitary, large, septa long, radial, slightly dilated wedgewise in marginarium that is in late stages lonsdaleoid dissepimentarium with some small concentric or angulate interseptal plates; major septa continued into tabularium as thin, low ridges on upper surfaces of tabulae; tabulae flat with edges turned down or up, grouped; cardinal tabular fossula marked, and in some alar fossulae also [see also MINATO, 1961, p. 91]. *M.Sil.-U.Sil.*, Eu. (U. K.-Gotl.-Czech.)-Asia (Tadzhik.-Malaysia-China)-N. Am. (Que.-Ky.-Mackenzie distr.).——FIG. 136,*1a,b*. *D. elegantulum* (WEDEKIND), Gotl., Eksta, Djupvik; *a,b*, long., transv. secs., ×1 (Wedekind, 1927).——FIG. 136,*1c,d*. **D. annulatum*, paratype, Gotl., Visby, N. of Kneippbyn; *c,d*, transv. secs., ×1 (Wedekind, 1927; photographs courtesy Riksmuseet, Stockholm).

?Chavsakia LAVRUSEVICH, 1959, p. 35 [**C. chavsakiensis*; OD; †3427/67, LAVRUSEVICH Coll., IG, Dushanbe] [?=*Nataliella* SYTOVA, 1966, which see]. Solitary, cylindrical or subcylindrical; with epithecal scales; septa represented by radial ridges on dissepiments, dissepiments in single series of very large plates, subhorizontal except inner parts declining steeply to form boundary with tabularium, tabulae subhorizontal or shallowly concave. [Possibly cystiphyllinan.] *L.Dev.(Gedinn.)*, Asia(Tadzhik.).——FIG. 136,*2a-c*. **C. chavsakiensis, Pholidophyllum* beds, Zeravshan-Gissar Ra., Khavsak Gully; *a,b*, transv., long. secs., ×1; *c*, fragment showing epithecal scales and radial ridging of dissepiments, ×1 (Lavrusevich, 1959).

?Dentilasma IVANOVSKIY, 1962, p. 128 [**D. honorabilis*; OD; †67, coll. 305, IGG, Novosibirsk]. Corallum solitary or ?fasciculate; septa very short; dissepimentarium of commonly one series of inclined lonsdaleoid dissepiments; tabulae commonly flat, complete, with supplementary, large, adaxially declined, peripheral tabellae. *L.Sil.(up.Llandov.)*, Asia (W. Sib. Platf.-?E. Urals-?Altay-Kweichow)-?Australia(New S.Wales).——FIG. 137,*2a-c*. **D. honorabile*, holotype, up.Llandov., W. Sib. Platf., R. Mogokta; *a,c*, transv., *b*, long. secs., ×4 (Ivanovskiy, 1962; photographs courtesy A. B. Ivanovskiy).

Heterolasma EHLERS, 1919, p. 461 [**H. foerstei*; OD; †7290, UMMP, Ann Arbor] [?=*Dokophyllum* WEDEKIND, 1927, which see; *Heterelasma* LANG, SMITH, & THOMAS, 1940, p. 67, *nom. van., non Heterelasma* GRABAU, 1922, p. 41, *nec Heterelasma* GIRTY, 1908, a Palaeozoic brachiopod]. Solitary, large, broadly conical with thin wall extending to form wide, flaring platform to shallow calice; major septa developed as thin radial ridges and minor septa as radial rows of small knobs on upper surface of calical platform; tabulae complete, with wide flat axial part and narrow marginal trough; cardinal septum in tabular fossula; dissepiments ?absent [see EHLERS, 1973, p. 65]. *L.Sil.(up.Llandov.)* or *M.Sil.(low.Wenlock.)*, N.Am.(Mich.).——FIG. 137,*3a,b*. **H. foerstei*, holotype, Manistique F., Mich., 0.5 mi. S. of Gould City; *a*, calical view, ×0.7; *b*, side view, ×0.7 (Ehlers, 1973).

?Ketophylloides LAVRUSEVICH, 1971a, p. 93 [**Ketophyllum atlassovi* CHERNYSHEV, 1941b, p. 66; OD; †1, coll. 5957, TsGM, Leningrad]. Phaceloid; septa reduced to thin crests on wall and dissepiments; tabularium wide, tabulae incomplete, ?grouped, horizontal or sagging, with supplementary adaxially declined peripheral tabellae; dissepiments large, lonsdaleoid, in several series; without tabular fossula. *L.Sil.*, Asia(NE.USSR); *low.M.Sil.*, Asia(Tadzhik.).——FIG. 137,*1a,b*. **K. atlassovi* (CHERNYSHEV), holotype, Sil., USSR, right bank of R. Khaliya, 9.5 km. from mouth, E. Verkhoyanya; *a,b*, transv., long. secs., ×3 (Chernyshev, 1941b).

?Nataliella SYTOVA in SYTOVA & ULITINA, 1966, p. 203 [**N. poslavskajae*; OD; †1, coll. 8732, TsGM, Leningrad] [?=*Chavsakia* LAVRUSEVICH, 1959, which see]. Solitary, large, cylindrical; no epithecal scales reported; septa not recorded, very weakly developed; dissepimentarium wide, of large plates with wide subhorizontal peripheral parts and adaxially declined inner parts, supplemented by smaller plates; tabularium narrow, with complete or incomplete subhorizontal tabulae. *U.Sil.* or *L.Dev.(Aynasu.)*, Asia(C.Kazakh.-?Altay).——FIG. 136,*3a,b*. **N. poslavskajae*, holotype, up. part Aynasu horizon, Nurin Syncline, C. Kazakh., left bank R. Medine; *a,b*, transv., long. secs., ×1 (Sytova & Ulitina, 1966).

?Tabularia SOSHKINA, 1937, p. 71 [**T. turiensis*; OD; syntypes slides 65, 66, 204, sample 276, coll.

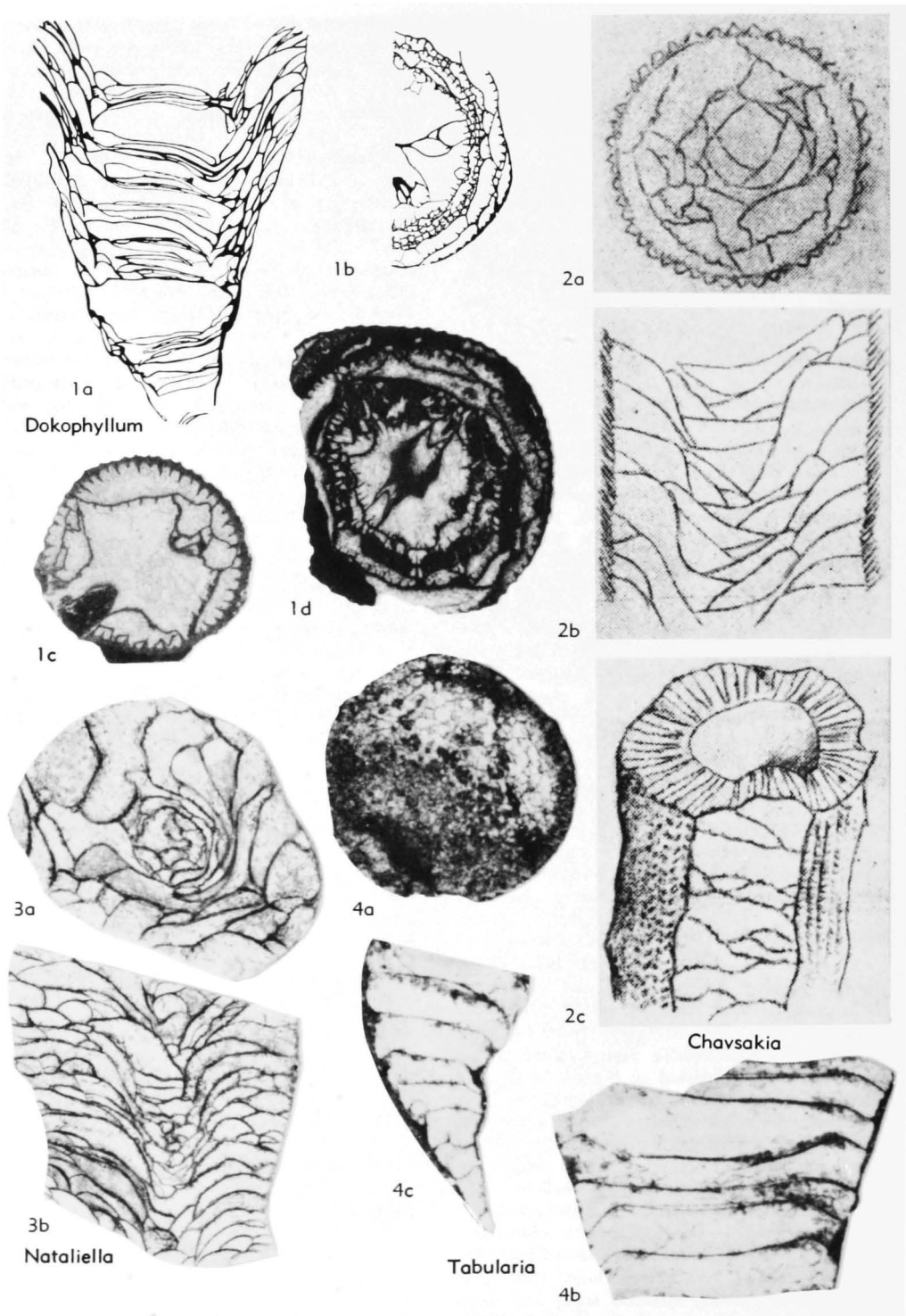


FIG. 136. Ketophyllidae (p. *F219-F221*).

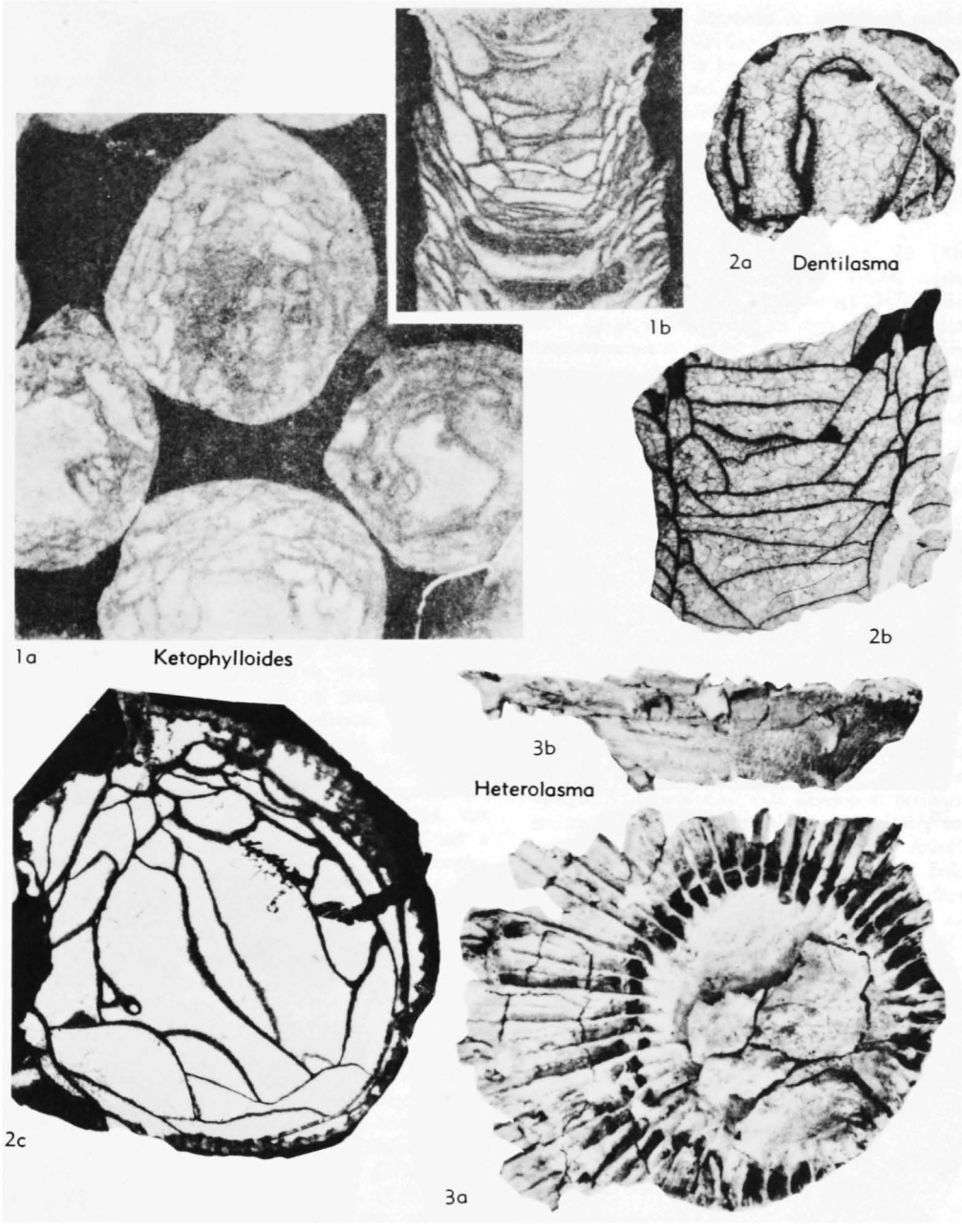


FIG. 137. Ketophyllidae (p. *F219*).

143, PIN, Moscow]. Solitary; septa thin, with very short, longitudinally continuous part peripherally, remainder amplexoid; tabulae complete and flat, some with slightly downturned edges and weak axial sag; tabular fossula present; marginarium a very narrow peripheral stereozone. *M.Sil.*, Asia(E.Urals).——FIG. 136,*4a-c*. ***T. turiensis*,** left bank of R. Tura near Elkino; *a*, transv., *b,c*, long. secs., ×4 (Ivanovskiy & Shurygina, 1975).

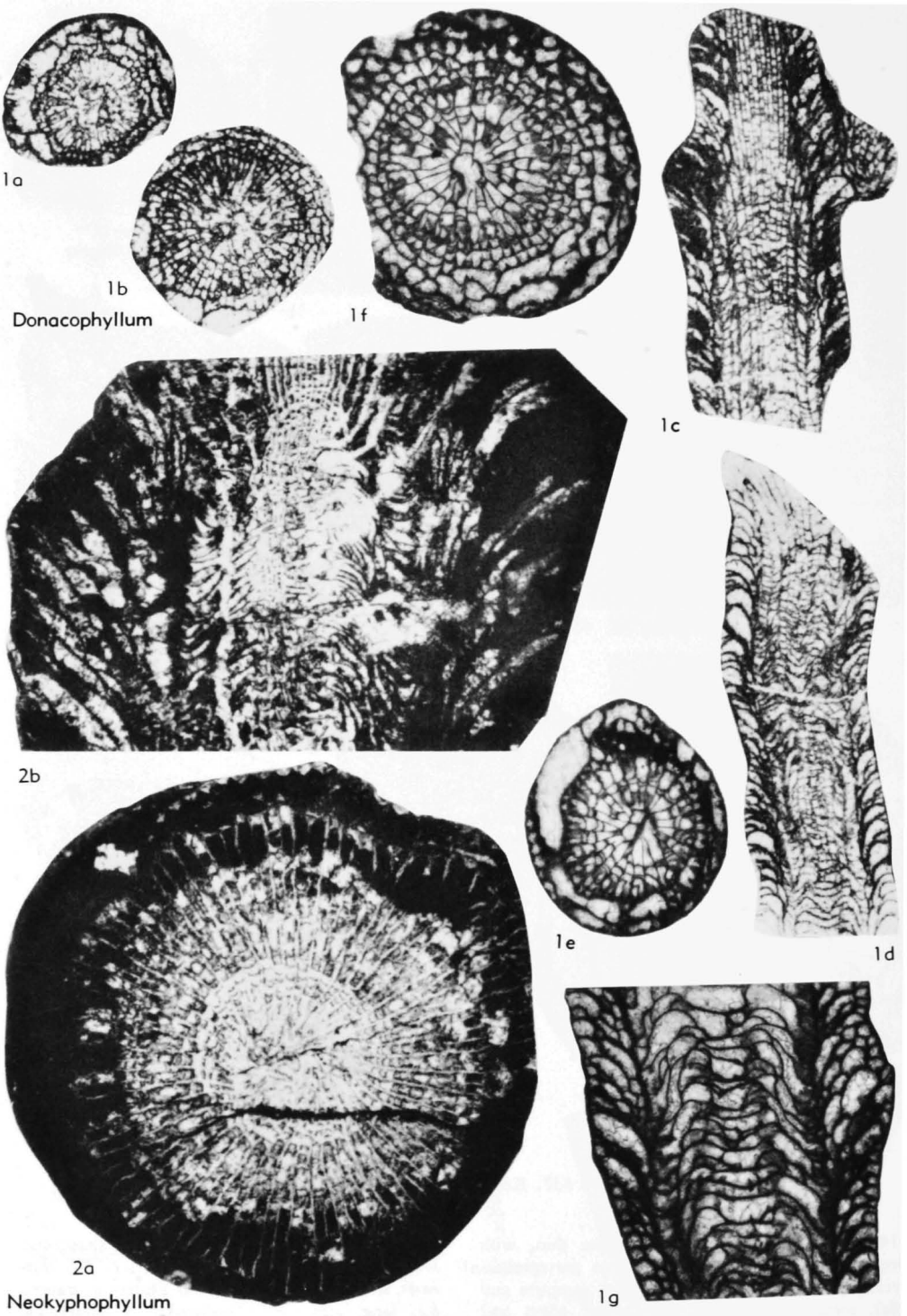


FIG. 138. Kyphophyllidae (p. *F223*).

Family KYPHOPHYLLIDAE Wedekind, 1927

[Kyphophyllidae Wedekind, 1927, p. 18] [=Pilophyllidae Hill, 1942b, p. 19; Cyphophyllidae Reyman, 1956, p. 37; Kyphophyllinae Hill, 1956b, p. F275]

Solitary or fasciculate with nonparricidal peripheral increase; septa long, in some convolute in tabularium, major septa somewhat unequal, one, ?cardinal, may be longer than others and extend to or beyond axis; septa of multiserial small trabeculae, may be periodically thickened; minor septa commonly discontinuous, dissepimentarium commonly lonsdaleoid; but small interseptal dissepiments occur in places; fossula not distinct; tabular floors like hats with flat or upturned brims and shallow axial depression in broad and tall crown; tabulae commonly incomplete. *U.Ord.-L.Dev.*

Donacophyllum Dybowski, 1873c, p. 336; 1874, p. 460 [**D. Schrenkii*; SD Wedekind, 1927, p. 34; †Co1281, EGM, Tallinn] [*?=Strombodes* Schweigger, 1819, which see, also see Kaljo, 1958b, p. 112; *Kyphophyllum* Wedekind, 1927, p. 19 (type, *K. Lindströmi,* OD; †slides Cn54877-9, RM, Stockholm, and 10392-4, Wedekind Coll., SM, Frankfurt; M.Sil., N. of Strenkyrke buk, Gotl.); *Cyphophyllum* Lang, Smith, & Thomas, 1940, p. 47, *nom. van.*]. Phaceloid, in type species with periodic rejuvenescence of corallites indicated by expansions and subsequent contractions of dissepimentaria, or solitary; septa thin, not carinate, long major septa not convolute but a little withdrawn from axis, one may be longer; tabular floors domes with axial depression and margins turned out or up, of large tabellae; dissepimentarium moderately wide, with large lonsdaleoid dissepiments as well as small globose interseptal dissepiments; cardinal fossula not distinct. *U.Ord.,* Eu.(Est.); *L.Sil.,* Eu.(Est.)-Asia (Sib.Platf.)-Australia(New S.Wales); *M.Sil.,* Eu. (Gotl.); *U.Sil.,* ?Eu. (Podolia)-Asia (Kazakh.-Tadzhik.-Urals)-?Australia (New S. Wales).——Fig. 138,*1a-d.* **D. schrenkii,* monotype, L.Sil. (Llandov., G_3), Est., Pühhat; *a,b,* transv. secs., ×2.3; *c,d,* long. secs., ×2.4, ×2.0 (Kaljo, 1958b).——Fig. 138,*1e-g. D. lindstroemi* (Wedekind), holotype, Hogklint beds, Gotl., N. of Stenkyrke huk; *e,f,* transv. secs., *g,* long. sec., all ×3.0 (Hill, n; negatives courtesy Riksmuseet, Stockholm; RM Cn54877-54879).

?Maikottaphyllum Lavrusevich, 1968, p. 109 [**M. maikottaense*; OD; †4713/5, UpG, Dushanbe]. Solitary, large; with peripheral stereozone formed from thickened peripheral edges of numerous major and minor septa and gradually widening during ontogeny; in wide tabularium septa very thin, amplexoid, somewhat convolute; tabular floors low domes, depressed in wide axial region, supplemented by tabellae in periaxial rim where major septa cease to be longitudinally continuous; rarely, in stereozone, septa may lose thickening, and large lonsdaleoid dissepiments appear. [Only one specimen known.] *U.Sil.* or *L.Dev.,* Asia (Tadzhik.).——Fig. 139,*3a,b.* **M. maikottaense,* holotype, Kunzhak horizon, S. slope Turkestan Ra., Maykotta ravine; *a,b,* transv., long. secs., ×2 (Lavrusevich, 1968).

Neokyphophyllum Spasskiy, 1965b, p. 26 [**N. calcareum*; OD; †10, coll. 9349, TsGM, Leningrad] [*?=Pilophyllum* Wedekind, 1927, which see]. Large, solitary, cornute, with rejuvenescence; dissepimentarium wide, with large lonsdaleoid dissepiments peripherally and normal dissepiments in inner parts; septa long, moderately thickened, major septa convolute in axial parts of wide tabularium; tabular floors domed, of numerous complete or incomplete tabulae, in places with subhorizontal to concave accessory peripheral tabellae; dissepiments long, inclined. *L.Dev.(Gedinn.),* Asia(Dzhungar.Alatau).——Fig. 138,*2a,b.* **N. calcareum,* holotype, R. Kunakbay; *a,b,* transv., long. secs., ×3 (Spasskiy, 1965b).

?Pilophylloides Sytova in Sytova & Ulitina, 1966, p. 226 [**P. suluense*; OD; †94, coll. 8732, TsGM, Leningrad]. Solitary, large, turbinate; major septa somewhat withdrawn from axis, subequal; minor septa very short; peripheral ends of septa may be structurally modified; tabulae complete or incomplete, close, thin, each floor shaped like a hat with an upturned brim and an axial depression; lonsdaleoid dissepiments may develop at periphery in late stages; cardinal fossula present. [Only two specimens known.] *U.Sil.(Ludlov.),* Asia(C. Kazakh.).——Fig. 139,*2a,b.* **P. suluensis,* holotype, Akkan horizon, zone of *Medinophyllum crispum crispum,* 4 km. S. Ak-Shoky Hill; *a,b,* transv., long. secs., ×2 (Sytova & Ulitina, 1966).

Pilophyllum Wedekind, 1927, p. 34 [**P. Keyserlingi*; OD; †11099-11101, Wedekind Coll., SM, Frankfurt] [*?=Neokyphophyllum* Spasskiy, 1965b, which see]. Solitary or (less commonly) fasciculate; marginarium a septal stereozone interrupted by lonsdaleoid dissepiments; major septa thin and convolute in wide tabularium; with indistinct cardinal fossula; tabulae incomplete; floors domed with subhorizontal edges, and in places with shallow axial depression; cardinal fossula indistinct. *U. Sil. (Ludlov.),* Eu. (Gotl.-?Est.-Pol.-?Podolia); *?L. Dev. (Lochkov.),* Asia (Tadzhik.-Kazakh.-Salair).——Fig. 140,*2a,b.* **P. keyserlingi,* holotype, U.Sil., Gotl., Lindeklint; *a,b,* transv., long. secs., ×2 (Hill, n; photographs courtesy R. Birenheide).

Strombodes Schweigger, 1819, table vi [**Madrepora stellaris* Linné, 1758, p. 795; SD McCoy, 1849, p. 10; †not traced] [*=Strombastraea* Ehrenberg, 1834, p. 311 (type, *Astraea stellaris* (Linné), SD Lang, Smith, & Thomas, 1940, p.

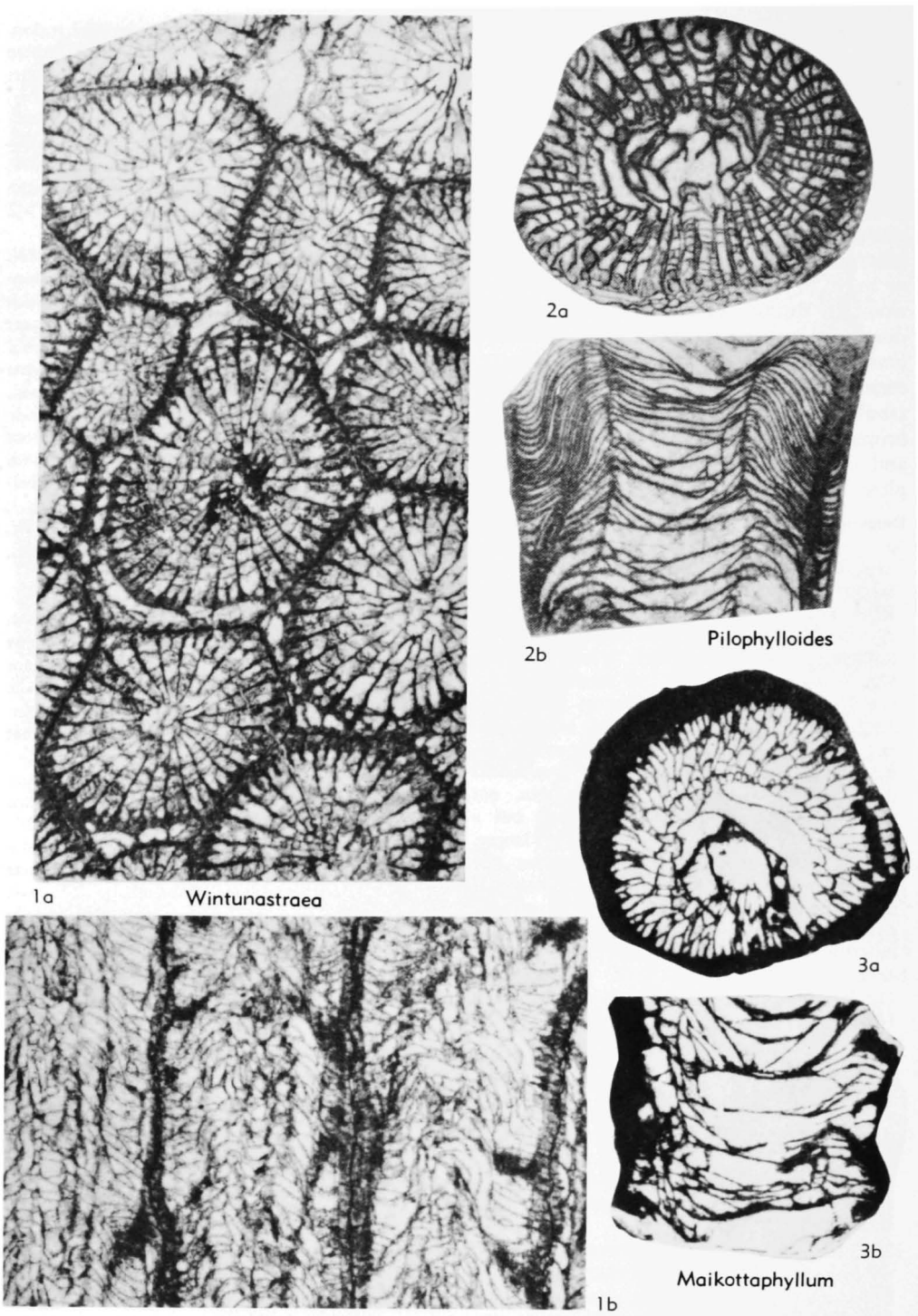


FIG. 139. Kyphophyllidae (p. *F223*, *F225*).

126); *?Donacophyllum* DYBOWSKI, 1873c, which see]. Phaceloid, with periodical expansions of lonsdaleoid dissepimentaria bringing neighboring corallites into contact; major septa long, possibly convolute in wide tabularium; immediately after rejuvenescence commonly no dissepimentarium present and minor septa rudimentary; tabular floors domes with edges turned out or up and broad axial depression, tabulae complete or more commonly incomplete. [Neotype required; diagnosis based on Ludlovian specimen figured by SMITH (1945, pl. 29, fig. 1,2). See also LINDSTRÖM, 1896a, p. 631.] *?M.Sil., U.Sil.*, Eu.(Gotl.). ——FIG. 140,*1a,b*. **S. stellaris* (LINNÉ); *a*, Sil., Gotl., ext. view, ×1; *b*, Ludlov., Hemse Gr., Gotl., Östergarn, long. sec., ×1 (Smith, 1945).

Wintunastraea MERRIAM, 1972, p. 29 [**W. stanleyi*; OD; †159464, USNM, Washington]. Cerioid; increase peripheral, not parricidal; with narrow peripheral stereozone broken by sporadic groups of small and large lonsdaleoid dissepiments but without normal interseptal dissepiments; major septa extending unequally and thinning almost to axis; minor septa not short; tabulae steeply domed axially, flattening suddenly peripherally and with supplementary flat, peripheral tabellae. *U.Sil. (Ludlov.)* or *L.Dev.*, N.Am.(Calif.).——FIG. 139, *1a,b*. **W. stanleyi*, holotype, Gazelle F., Calif., Willow Cr. area, Klamath Mts.; *a,b*, transv., long. secs., ×4 (Merriam, 1972).

Family ENDOPHYLLIDAE Torley, 1933

[Endophyllidae TORLEY, 1933, p. 633] [=Endophyllinae WANG, 1948, p. 29]

Solitary, fasciculate or massive; corallites large; major septa long, commonly slightly convolute in wide tabularium and may be somewhat withdrawn from axis; septa in their thickened parts of multiserial small trabeculae; tabular floors low domes or mesas, their peripheral parts projecting subhorizontally or troughlike, and their axial parts rarely depressed; tabulae complete or incomplete; marginarium a septal stereozone commonly disrupted by lonsdaleoid dissepiments, and commonly also a median zone of thinner septa and lonsdaleoid dissepiments and, where minor and major septa are longitudinally continuous, an irregular inner zone of normal concentric interseptal dissepiments; fossula indistinct; increase peripheral and commonly nonparricidal. *L.Sil.-?Carb.*

Endophyllum MILNE-EDWARDS & HAIME, 1851, p. 393 [**E. bowerbanki*; SD SCHLÜTER, 1889, p. 309 (51); †neotype, R1448, BM(NH), London; by JONES, 1929, p. 87] [=*Nicholsonia* SCHLÜTER, 1885c, p. 53 (type, *N. perampla*, SD LANG, SMITH, & THOMAS, 1940, p. 89; †176, SCHLÜTER Coll., IP, Bonn; *Stringocephalus* Ls., Holthausen, Westphalia; =*Endophyllum bowerbanki* MILNE-EDWARDS & HAIME, 1851), *non Nicholsonia* DAVIS, 1885, a bryozoan]. Subcerioid, cerioid or tham-

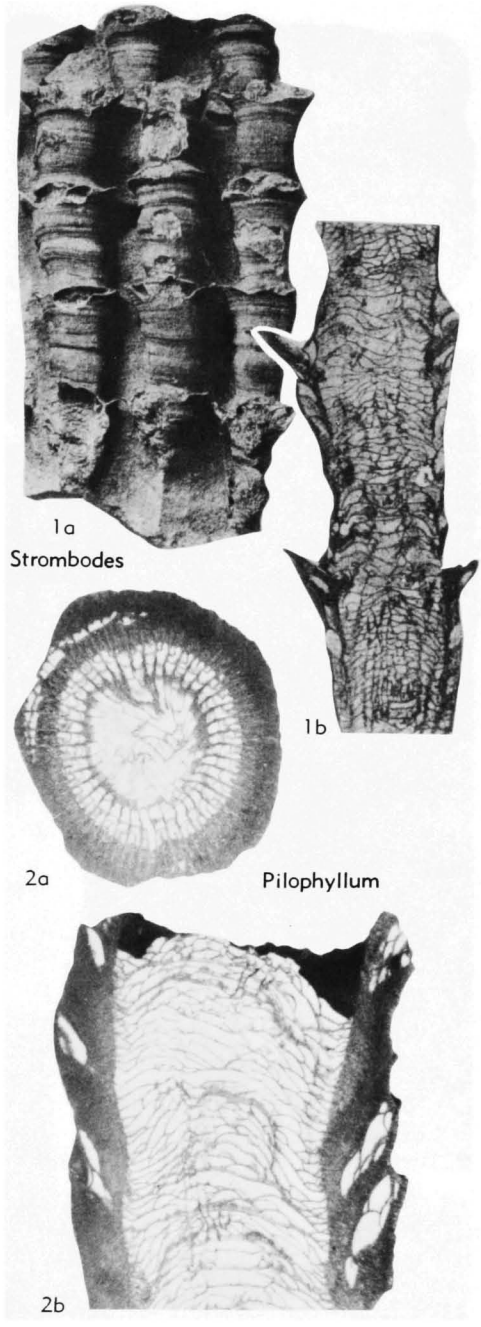


FIG. 140. Kyphophyllidae (p. *F223-F225*).

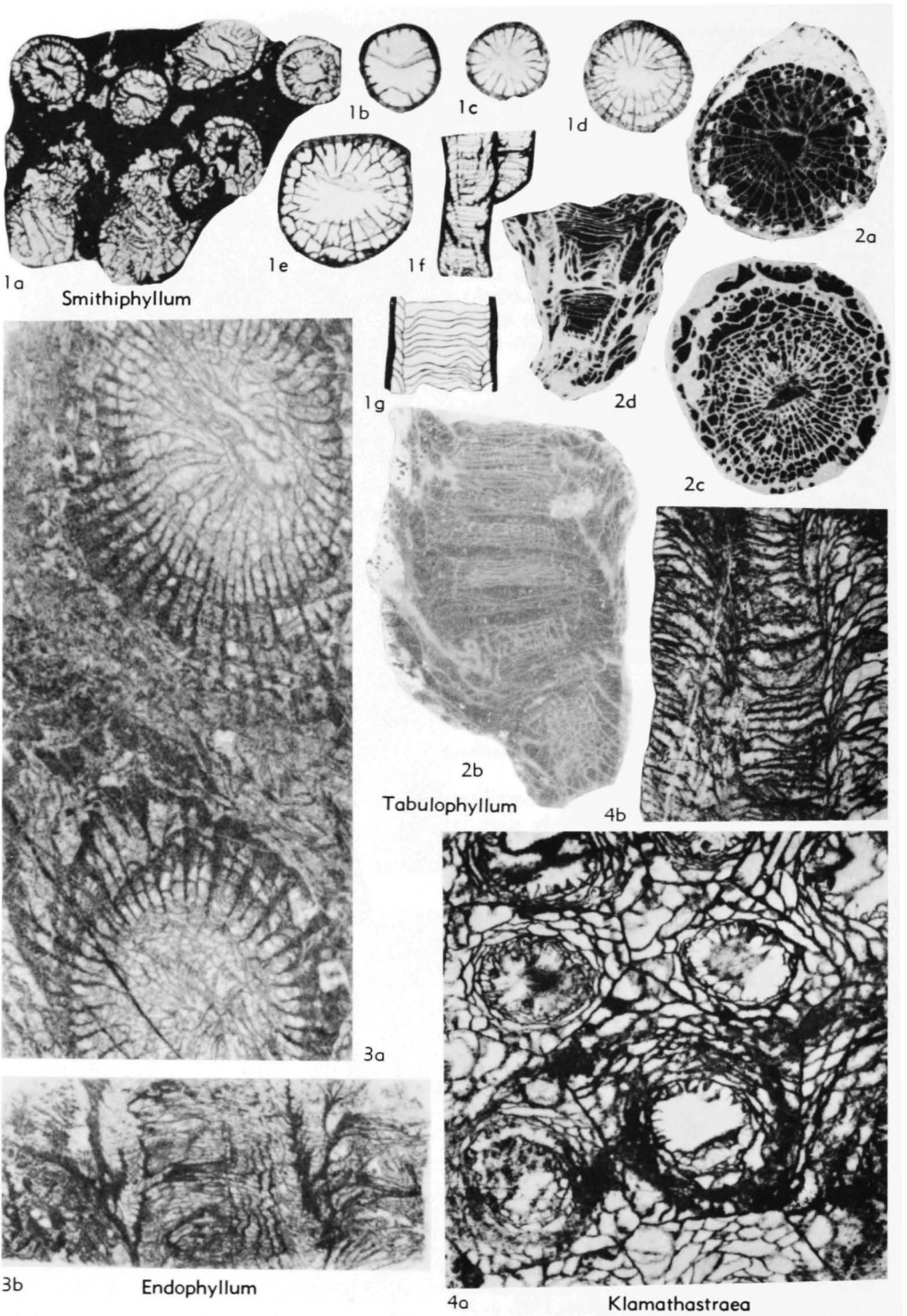


FIG. 141. Endophyllidae (p. *F225-F231*).

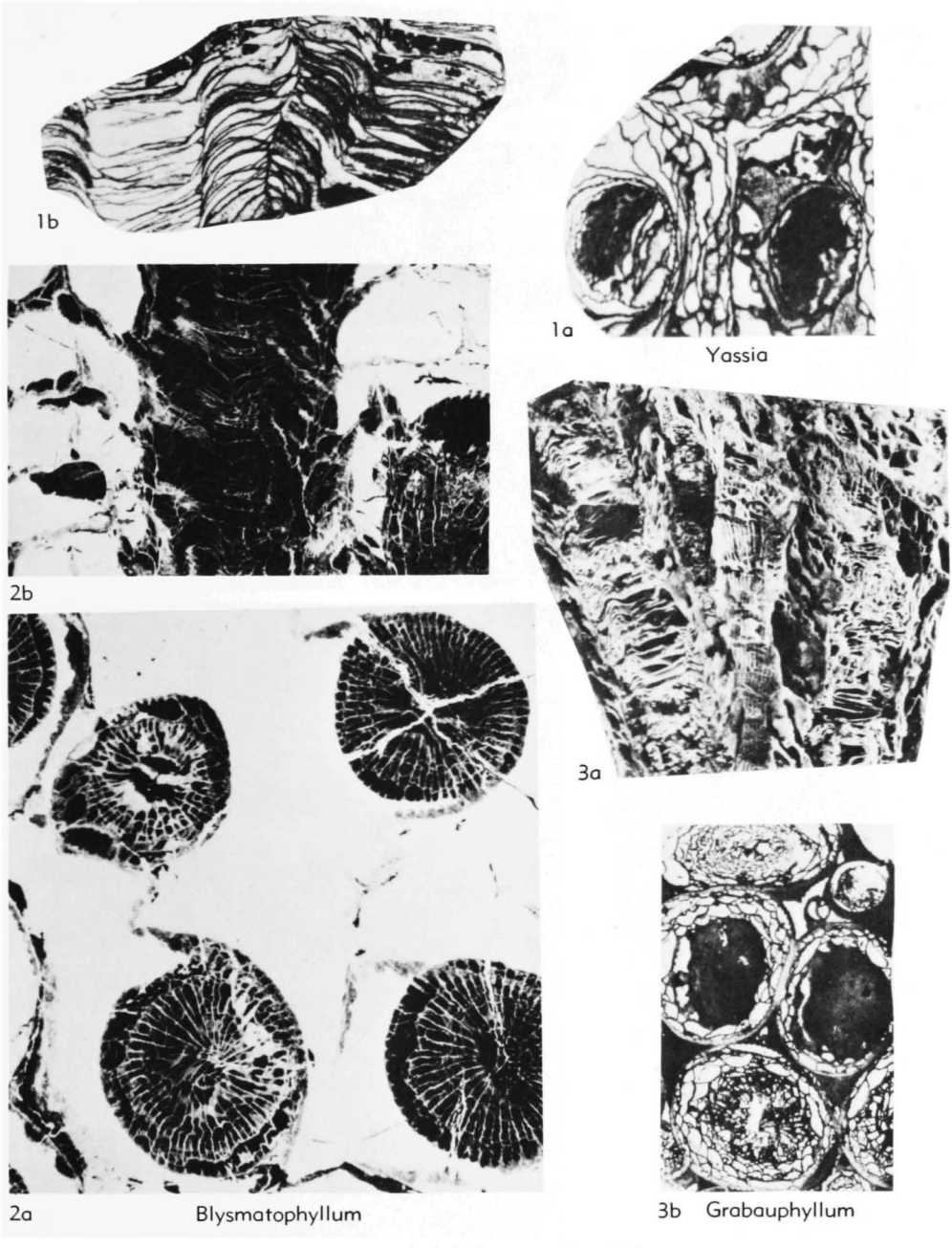


FIG. 142. Endophyllidae (p. *F228-F231*).

nasterioid; corallites large with marginarium consisting mostly of septal stereozone disrupted by large lonsdaleoid dissepiments but in inner parts of normal dissepimentarium; septa long, in wide tabularium commonly thin and somewhat convolute; in peripheral stereozone septal trabeculae fine and multiseriate; tabulae flat-topped domes with upturned edges, cardinal fossula not distinct [see JELL & HILL, 1970a, p. 6]. *?L.Dev.*, Australia (Tasm.); *M. Dev.*, Eu. (U. K.-Ger.)-Asia (?Urals - Kazakh. - Kansu - Szechwan - Kweichow-Yunnan)-Australia(New S.Wales-Queensl.); *U. Dev. (Frasn.)*, Eu. (U. K.-Ger.)-Asia (Kuzbas). ——FIG. 141,*3a,b*. **E. bowerbanki*, neotype,

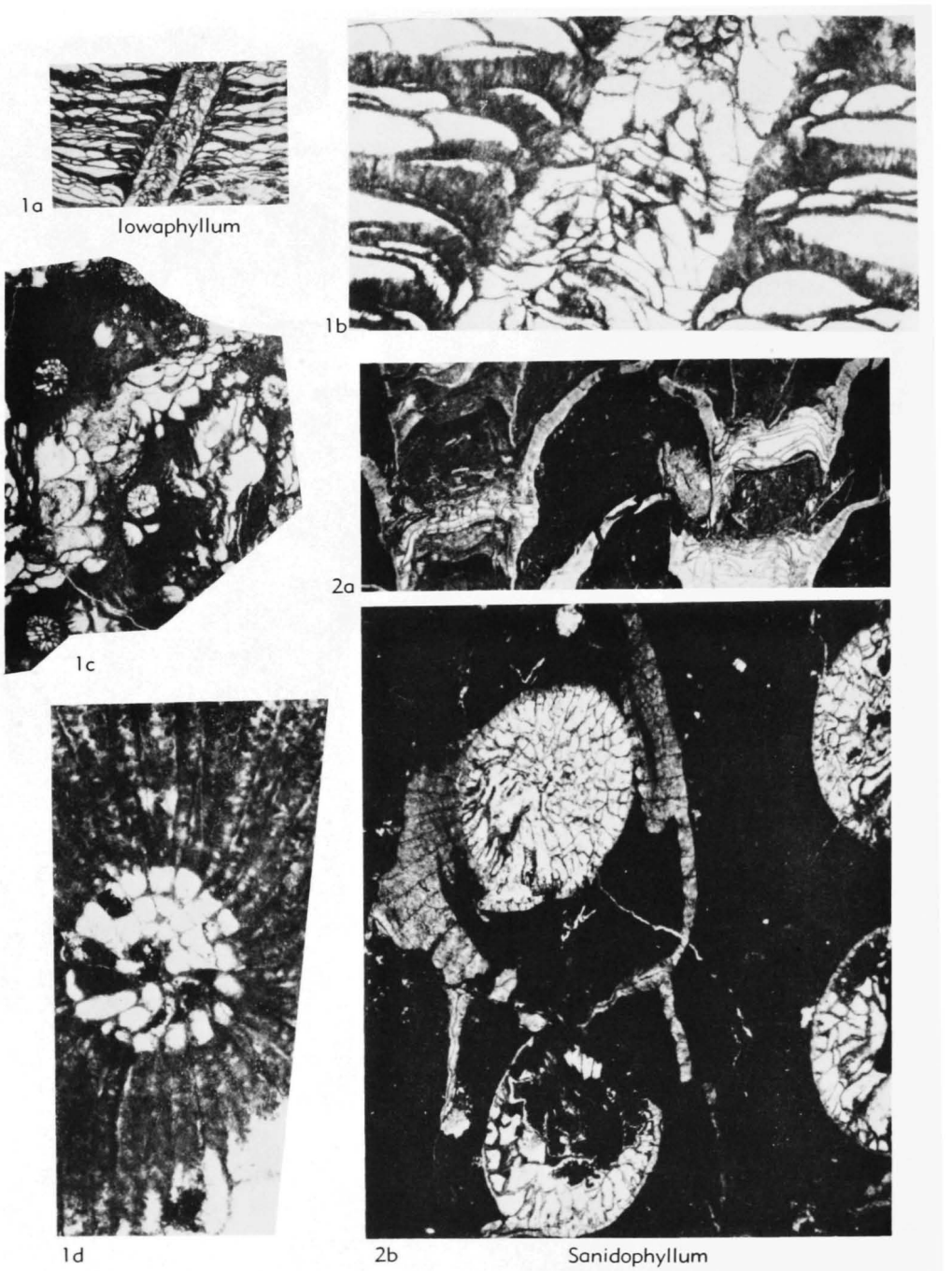


FIG. 143. Endophyllidae (p. *F229*).

Frasn., U.K., Rocky Valley, Torquay; *a,b,* transv., long. secs., ×2 (Jones, 1929).

Blysmatophyllum PEDDER in PEDDER, JACKSON, & ELLENOR, 1970, p. 257 [**B. isisense*; OD; †F10385, UNE, Armidale]. Corallum phaceloid but periodically briefly cerioid, thin connecting platforms of cerioid parts being extensions of slender peripheral stereozone bearing few dissepi-

ments; major septa radially arranged, in thickened parts composed of fine multiseriate trabeculae, and in phaceloid parts commonly withdrawn from periphery leaving lonsdaleoid dissepimentarium; minor septa short; tabular floors flat-topped or depressed domes with upturned edges, tabellae large. *M.Dev.(Givet.),* Australia(New S.Wales). ——Fig. 142,*2a,b.* **B. isisense,* holotype, Timor Ls., NE. New S. Wales, Isis R.; *a,b,* transv., long. secs., ×1.3 (Pedder, Jackson, & Ellenor, 1970).

Grabauphyllum Foerste, 1917, p. 199 [**G. johnstoni*; M; †84899, USNM, Washington]. Corallum cerioid or phaceloceriod; corallites large; marginarium wide, a lonsdaleoid dissepimentarium; calical surface sloping gently from wall; in calice septa in dissepimentarium appear as ?contiguous thickened crests continuous radially on upper surfaces of dissepiments; major septa thin in tabularium, withdrawn somewhat from axis; tabular floors wide with peripheral trough and wide axial depression [see Stumm, 1968, p. 71]. *M.Sil.,* N.Am.(Ill.).——Fig. 142,*3a,b.* **G. johnstoni*; Niagaran dol., Ill., vicinity of Chicago; *a,b,* side view broken specimen, transv. sec., ×0.7 (Stumm, 1968).

Iowaphyllum Stumm, 1949, p. 50 [**Smithia Johanni* Hall & Whitfield, 1873, p. 234; OD; †316, NYSM, Albany]. Corallum aphroid; corallites with septa attenuate and mostly reaching axis in narrow tabularium, strongly dilated at boundary of tabularium and continuing across dissepimentarium as dilated septal ridges of ?endophylloid microstructure on top surfaces of dissepiments, which except at margin with tabularium are more or less horizontally based; tabulae complete or incomplete, domed, with upturned edges in places. [Possibly arachnophyllid. See also Oliver & Galle, 1971a, p. 212; 1971b, p. 81.] *L.Dev. (Prag.-Zlichov.),* Eu.(Czech.); *L.Dev.(Ems.),* Australia(New S.Wales); *L.Dev.(up.Ems.)* or *M. Dev.(low.Eifel.),* Asia(Salair); *M.Dev.(Givet.),* N. Am.(Ky.-Mich.); *U.Dev.(Frasn.),* N.Am.(Iowa). ——Fig. 143,*1a-d.* **I. johanni* (Hall & Whitfield), holotype, U.Dev.(Frasn.), Lime Cr. shale, Hackberry Gr., Iowa, Rockford; *a,* long. sec., ×1.3; *b,* enl. view of central portion of *a,* ×6.7; *c,* transv. sec., ×1.3; *d,* enl. view of upper left portion of *c,* ×6.7 (Oliver & Galle, 1971b).

?Klamathastraea Merriam, 1972, p. 40 [**K. dilleri*; OD; †159456, USMN, Washington]. Cerioid; corallites thin-walled; with wide lonsdaleoid dissepimentarium; septal crests short to absent except in peripheral parts of tabularium; tabulae mostly complete, subhorizontal in broad axial zone, and commonly downturned to form narrow peripheral rim; cardinal fossula not distinct. *?U.Sil.,* N.Am. (Calif.).——Fig. 141,*4a,b.* **K. dilleri,* holotype, Gazelle F., Cal., Siskiyou Co.; *a,b,* transv., long. secs., ×1.5 (Merriam, 1972).

?Mictocystis Etheridge, 1908, p. 20 [**M. endophylloides*; M; †13616, AM, Sydney; lectotype by McLean, 1974b, p. 664]. Aphroid; corallites large; with wide dissepimentarium of coarse lonsdaleoid dissepiments, with traces of septa or septal crests visible only on steeply sloping dissepimentarial wall to tabularium, which is relatively narrow, and in tabularium where septa are more or less amplexoid, leaving small axial space; tabular floors flat, tabulae commonly complete, without axial depression but with downturned peripheral edges. [No cardinal fossula described.] *L.Sil.,* Australia(New S.Wales).——Fig. 144,*2a-c.* **M. endophylloides,* lectotype, Quarry Creek Ls., C. New S. Wales; *a,* distal view, ×1.0; *b,* fractured surface showing long. sec. of tabularium, ×1.0; *c,* drawing from *b,* ×1.5 (McLean, 1974b).

?Neospongophylloides Jia in Jia *et al.,* 1977, p. 158 [**Tabulophyllum butovi* Bulvanker, 1958, p. 171; OD; †slide 90a, coll. 7761, TsGM, Leningrad; M.Dev.(Givet.), Lebedyan beds, Sudzhensky mine, Kuzbas]. Phaceloid, corallites with lonsdaleoid dissepimentarium; major septa long, extending almost to axis; minor septa reduced to short projections from wall; tabulae closely spaced, of tabellae in axial and in wide peripheral series, axial series mesa-shaped, periaxial series sagging. *M.Dev.(Givet.),* Asia(Kuzbas-Hunan).

Sanidophyllum Etheridge, 1899a, p. 154 [**S. davidi*; OD; syntypes F4290, F6040, AM, Sydney]. Phaceloid and periodically briefly cerioid when narrow peripheral stereozone of each corallite expands into thin calical platform meeting similar platforms from its neighbors; major septa may be long and almost meeting at axis where they may be convolute, or somewhat withdrawn from axis; minor septa scarcely extending beyond stereozone; tabulae flattened domes that may sag axially; no dissepiments; cardinal fossula not distinct [see Pedder, Jackson, & Ellenor, 1970, p. 255]. *M. Dev.,* Australia (New S. Wales-Queensl.).—— Fig. 143,*2a,b.* **S. davidi,* up. Couvin., Timor Ls., NE. New S. Wales, Isis R.; *a,b,* long., transv. secs., ×1.3 (Pedder, Jackson, & Ellenor, 1970).

?Smithiphyllum Birenheide, 1962a, p. 81 [**Spongophyllum imperfectum* Smith, 1945, p. 55; OD; †6307, GSC, Ottawa]. Fasciculate or cerioid; corallites with thin, in part rudimentary major and minor septa; with commonly one series only of lonsdaleoid dissepiments that here and there may fail; tabulae very wide, flat, submesa-shaped or slightly waved [see Pedder, 1965b, p. 618]. *L.Dev.,* N.Am.(Nev.); *M.Dev.,* N.Am.(Mich.); *U.Dev.(Frasn.),* N.Am.(NW.Terr.-Alberta-Iowa-Ariz.)-Eu.; *U.Dev.(Famenn.),* Eu.(Pol.); *?Carb.,* Eu.(Timan).——Fig. 141,*1a-g.* **S. imperfectum* (Smith), U.Dev., Jean Marie R., Mackenzie R. reg.; *a-e,* transv. secs., *a,* ×1.5, *b-e,* ×2.5; *f,g,* long. secs., ×2 (Smith, 1945).

Tabulophyllum Fenton & Fenton, 1924, p. 30 [**T. rectum*; OD; †7834, UMMP, Ann Arbor] [?=*Apolythophyllum* Walther, 1928, p. 135 (type, *A. normale,* SD Lang, Smith, & Thomas,

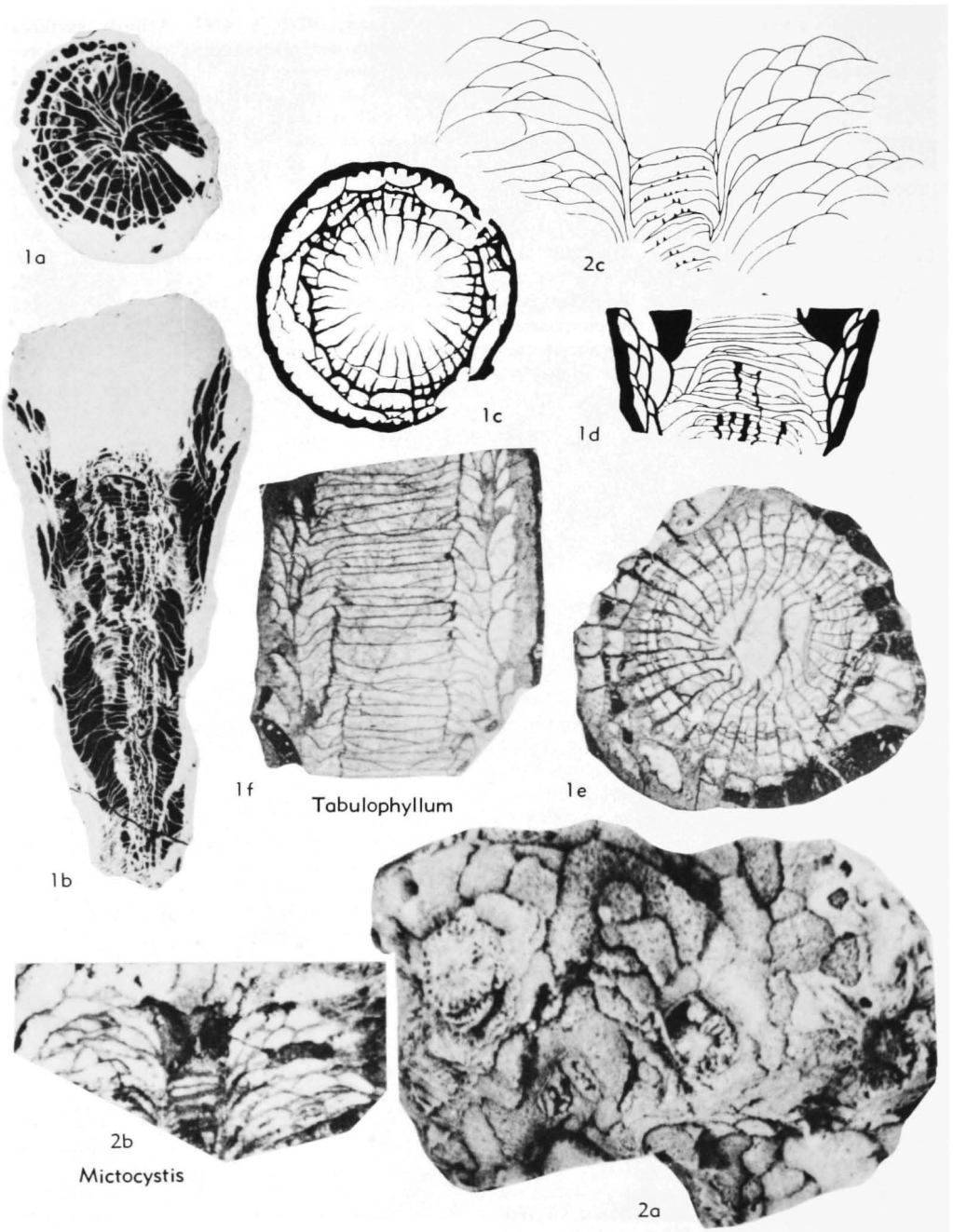


FIG. 144. Endophyllidae (p. *F229-F231*).

1940, p. 18; †7042-3, WEDEKIND Coll., SM, Frankfurt; Frasn. of Grund, Harz); *?Sinospongophyllum* YOH, 1937, p. 56 (type, *S. planotabulatum*, M; †not traced; M.Dev., Chiao-ting, Kwangsi; see also FONTAINE, 1966b, p. 62); *?Diversophyllum* SLOSS, 1939, p. 65 (type, *Zaphrenthis traversensis* WINCHELL, 1866, p. 90, OD; †14355, UMMP, Ann Arbor, and 2720, WINCHELL Coll., Alma College, Mich., lectotype by SLOSS, 1939, p. 68; Givet. of low cliffs on lake

shore near Petoskey Portland Cement Quarry, lower blue shale of Gravel Point F.)]. Solitary; major septa long, somewhat withdrawn from axis; minor septa reduced to low ridges on lonsdaleoid dissepiments that disrupt septa in peripheral zone of variable width; neither skeletal thickening nor distinctive fossula, nor cardinal nor counter septa of distinctive length are seen in adult stages of type species; tabularium wide, tabularial floors low to flat-topped domes with edges curved into somewhat asymmetrical peripheral trough, tabulae complete or incomplete [see HILL & JELL, 1970b, p. 63]. *?L.Dev.*, Australia(Queensl.); *M.Dev.(Givet.)*, N.Am.(Mich.-Nev.)-Asia(Yunnan); *U.Dev.(Frasn.)*, Eu.(Ger.-Russ.Platf.-Urals)-N.Am.(Alaska-Can.-Iowa)-Asia (Armenia-Kazakh.-Kuzbas)-?W.Australia.——FIG. 141,*2a-d*. **T. rectum*, holotype, U.Dev.(Frasn.), Hackberry Gr., Iowa; *a,b*, transv., long. secs., ×2.0 (Hill, n; photographs courtesy E. C. Stumm); *c,d*, topotype, transv., long. secs., ×1.5 (Watkins, 1959a).——FIG. 144, *1a,b*. *?T. traversense* (WINCHELL), M.Dev., lower blue shale of Gravel Point F., Mich., quarry of Petoskey Portland Cement Co., Petoskey; *a*, transv. sec., ×1.5; *b*, long. sec., another specimen, ×1.5 (Watkins, 1959a).——FIG. 144,*1c,d*. *?T. normale* (WALTHER), monotype, Frasn., Grund, Harz; *c,d*, transv., long. secs., ×2.0 (Walther, 1928).——FIG. 144,*1e,f*. *?T. planotabulatum* (YOH), holotype, M.Dev., Kwangsi, Chaioting; *e,f*, transv., long. secs., ×2.0 (Yoh, 1937).

?Yassia JONES, 1930, p. 36 [**Spongophyllum enorme* ETHERIDGE, 1913, p. 35; OD; †F8572, AM, Sydney; lectotype by HILL, 1940c, p. 409] [=*Crinophyllum* JONES, 1932, p. 61, obj.]. Cerioid, corallites very large with septa developed only as weak crests on dissepiments and tabulae, but traces of their bases contiguous and naotic; tabularium wide, tabulae complete, very shallowly concave; dissepiments very large, steeply inclined near tabularium; cardinal fossula indistinct [see also MCLEAN, 1974b, p. 665; PEDDER, 1976a, p. 286]. *?L.Sil.-M.Sil.*, Asia(Sib.Platf.); *U.Sil.(low.Ludlov.)*, Australia(New S.Wales); *U.Sil.(Pridol.)*, N.Am.(Yukon).——FIG. 142,*1a,b*. **Y. enormis* (ETHERIDGE), syntypes, Bowspring Ls., New S. Wales, escarpment NE. of Boonoo Ponds Cr., near Yass; *a,b*, transv., long. secs., ×1 (McLean, 1974b; photographs courtesy R. A. McLean).

Suborder PTENOPHYLLINA Wedekind, 1927

[*nom. correct.* HILL, herein, *pro* Ptenophyllacea WEDEKIND, 1927, p. 9] [=Spongophyllina SPASSKIY, 1965a, p. 85]

Solitary or compound Stauriina with wide dissepimentarium commonly of small, subglobose, normal dissepiments, but in some with lonsdaleoid dissepiments disrupting minor and commonly also major septa; pipes of horseshoe and flat dissepiments lacking; tabularial floors commonly with axial notch or median depression; tabulae complete or incomplete; increase commonly marginarial. *L.Sil.-U.Dev.*

Family SPONGOPHYLLIDAE Dybowski, 1873

[Spongophyllidae DYBOWSKI, 1873c, p. 332] [=Spongophyllinae WEDEKIND, 1922a, p. 3; Spongophyllicae IVANOVSKIY, 1965a, p. 85]

Phaceloid or massive coralla, corallites slender with slightly thickened wall; major septa thin, straight, with smooth sides, unequal, one or a few reaching to or almost to axis, in places with weak curving of their tabularial parts; minor septa commonly discontinuous longitudinally or withdrawn to wall; tabularium narrow, tabulae flat or concave, moderately widely separated, commonly complete; dissepimentarium commonly of one or few series of large dissepiments, a few or many of which may disrupt major septa. *L.Sil.-?M.Sil.-M.Dev.*

Spongophyllum MILNE-EDWARDS & HAIME, 1851, p. 425 [**S. sedgwicki*; M; †neotype R4999 and 26300-1, BM(NH), London; by JONES, 1929, p. 89] [?=*Carlinastraea* MERRIAM, 1976, which see]. Cerioid; corallites with slightly thickened wall; major septa thin, unequal, one or more almost reaching axis, their tabularial parts and axial edges smooth but may be slightly twirled; minor septa mostly discontinuous longitudinally, withdrawn toward wall; septal trabeculae fine, uniserial, contiguous monacanths; tabularium narrow, of rather widely separated horizontal or slightly sagging tabulae; dissepimentarium commonly of large dissepiments in single series of strongly curved plates, supplemented by smaller plates. [Diagnosis based on neotype. Revision of species referred to genus necessary. See also BIRENHEIDE, 1962a, p. 72.] *?M.Sil.*, *U.Sil.*, Asia(Japan)-Australia(New S. Wales); *U.Sil.*, Eu.(Gotl.); *L.Dev.*, Eu.(Urals)-Asia (Urals-Kuzbas)-Australia (Queensl.-New S. Wales)-N.Am.(Yukon); *M.Dev.*, Eu.(U.K.-USSR)-N.Am.(Alaska).——FIG. 145,*3a,b*. **S. sedgwicki*, neotype, beach pebble probably from M.Dev., S. Devon.; *a,b*, transv., long. secs., ×3.3 (Hill, n; photographs courtesy J. S. Jell).

Carlinastraea MERRIAM in MERRIAM & MCKEE, 1976, p. 32 [**C. tuscaroraensis*; OD; †166482, USNM, Washington] [?=*Spongophyllum* MILNE-EDWARDS & HAIME, 1851, which see]. Cerioid; corallites slender with moderately thick walls; marginarium wide, of very large, steeply inclined lonsdaleoid dissepiments; tabularium narrow, tabulae complete and sagging, axial ends of major septa of irregular length, discontinuous and pos-

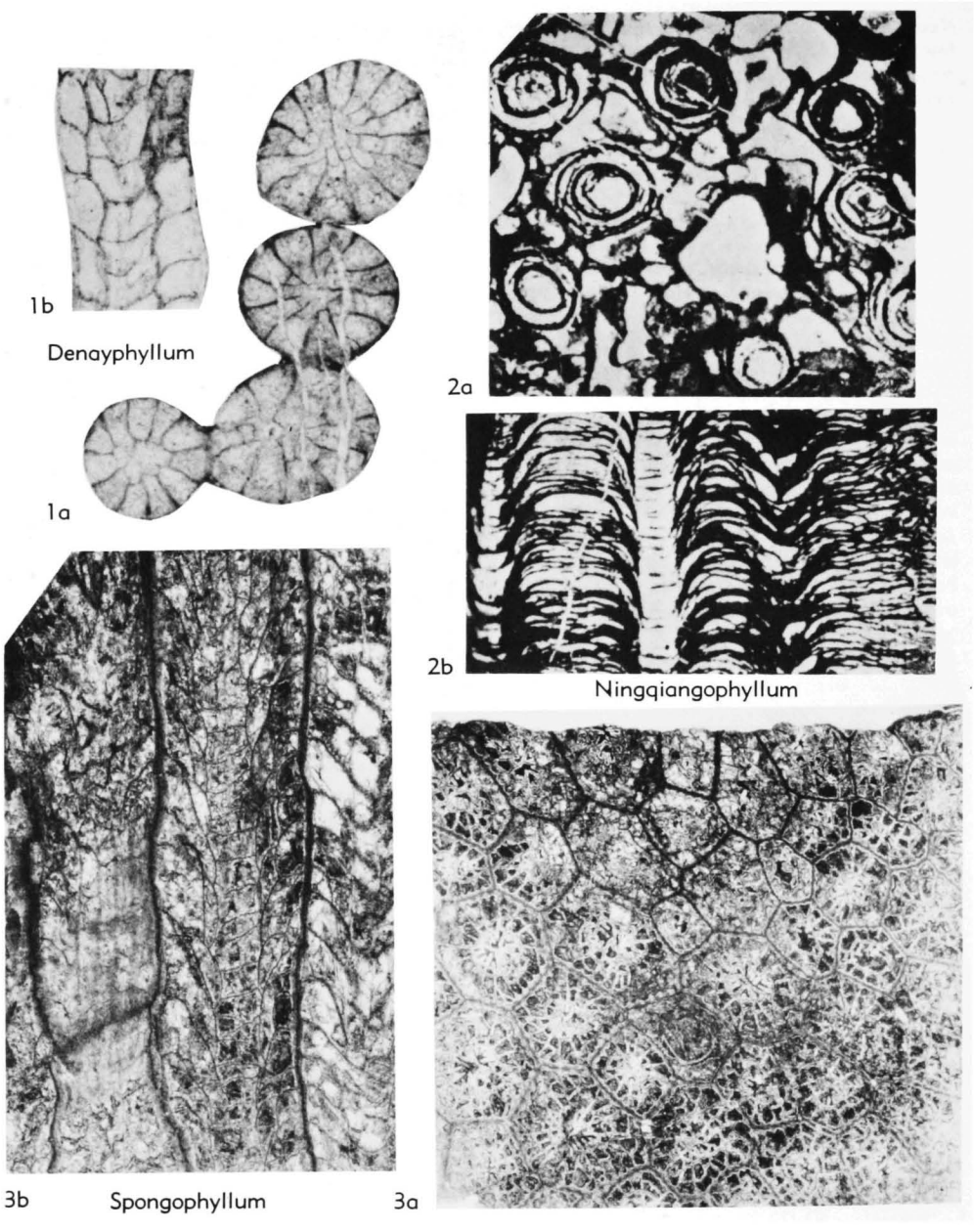


FIG. 145. Spongophyllidae (1, 3); Arachnophyllidae (2) (p. *F217*, *F231-F232*).

sibly flanged. *L.Dev.(Lochkov.)*, N.Am.(Nev.).

Denayphyllum MERRIAM, 1973a, p. 56 [**D. denayense*; OD; †159407, USNM, Washington] [=*Denaphyllum* MERRIAM, 1973a, expl. to pl. 6, *nom. null.*]. Phaceloid; corallites very slender; wall thin or only moderately thickened; major septa thin, mostly slightly withdrawn from axis; minor septa rudimentary; large globose dissepiments between major septa ?(or peripheral tabellae) forming irregular inner wall, within which are narrow sagging tabulae. *U.Sil.(?Pridol.)*, N. Am.(Nev.-Yukon).——FIG. 145,*1a,b*. **D. denayense*, holotype, Roberts Mt. F., coral zone C, Unit 3, Nev., Roberts Mt. Cr.; *a,b*, transv., long. secs., ×8.3 (Merriam, 1973a).

?Heterospongophyllum HUANG & KONG in KONG &

HUANG, 1978, p. 117 [**Spongophyllum simplex* HE MS in KONG & HUANG, 1978, p. 117; OD; †Gcr 957-958, GB, Guiyang; L.Sil., Shiniulan F., Shiqian, Guizhou (Kweichow)]. Cerioid; septa numerous, thin, longitudinally discontinuous, thin low crests appearing on dissepiments and wall; tabularium wide, tabular floors flat or sagging, tabulae complete or incomplete; one to two large series of lonsdaleoid dissepiments may be supplemented by smaller dissepiments. [Diagnosis tentative, from illustrations.] *L.Sil.*, Asia (Kweichow-Japan).

Neovepresiphyllum JIA in JIA *et al.*, 1977, p. 117 [**Spongophyllum immersum* HILL, 1942a, p. 254; OD; †F2413, GSQ, Brisbane; M.Dev., Givet., Arthur's Cr., Burdekin Downs, Queensl.]. Phaceloid or cerioid; with a peripheral septal stereozone in which lonsdaleoid dissepiments are developed, and an inner dissepimentarium with fine concentric dissepiments; tabulae flat or somewhat concave. *M.Dev.(Givet.)*, Eu.(Ger.)-Australia (Queensl.).

Family PTENOPHYLLIDAE Wedekind, 1923

[*nom. transl.* WEDEKIND, 1924, p. 35, *ex* Ptenophyllinae WEDEKIND, 1923, p. 33] [=Stenophyllidae WEDEKIND, 1925, p. 1; Actinocystidae WEDEKIND, 1927, p. 42; Acanthophyllidae HILL, 1939a, p. 220; Leptoinophyllidae STUMM, 1949, p. 23; Leptoinophyllinae STUMM, 1949, p. 23; Grypophyllinae STUMM, 1949, p. 27; Xystriphyllidae (as Xistriphyllidae) SPASSKIY, 1965a, p. 85; Lyrielasmatidae KONG in KONG & HUANG, 1978, p. 122]

Solitary, fasciculate or massive; major septa long, extending unequally into tabularium, straight or flexuous, especially in tabularium where short flanges may develop and there may be some convolution; their axial ends may be grouped by length and curvature commonly in four unequal groups; minor septa in some members discontinuous longitudinally or withdrawn to wall; *Km* may be elongate; septal trabeculae contiguous, fine to moderately coarse, commonly uniserial; tabularium of moderate width, tabular floors commonly close together, flat or concave, commonly with axial or ?median pit; tabellae wide; dissepimentarium normal, concentric, with sparse lonsdaleoid dissepiments, but in some with peripheral lonsdaleoid zone. *Sil.-Dev.*

Subfamily PTENOPHYLLINAE Wedekind, 1923

[Ptenophyllinae WEDEKIND, 1923, p. 33] [=Leptoinophyllinae STUMM, 1949, p. 23; Grypophyllinae STUMM, 1949, p. 27]

Solitary, fasciculate or massive Ptenophyllidae; flexing and flanging of septa commonly slight to moderate and in tabularial parts of major septa only. *U.Sil.-U.Dev.*

Acanthophyllum DYBOWSKI, 1873c, p. 339 [**Cyathophyllum heterophyllum* MILNE-EDWARDS & HAIME, 1851, p. 367; SD SCHLÜTER, 1889, p. 296; figured syntype, Z47a, MN, Paris] [=*Mesophylloides* WEDEKIND, 1922b, p. 51 (type, *Mesophyllum* [*sic*] *richteri* WEDEKIND, 1922b, p. 52, pl. 1, fig. 2, SD STUMM, 1937, p. 441; †2569-2571, 8872, WEDEKIND Coll., SM, Frankfurt; Eifel., Nimsbachtal, Prüm, Ger.); *Neostringophyllum* WEDEKIND, 1922a, p. 16 (type, *N. ultimum*, OD; †4044-4045, WEDEKIND Coll., SM, Frankfurt; Givet., "Düsseltal," Bergisches Land, Ger.); *Ptenophyllum* WEDEKIND, 1923, p. 28 (type, *P. praematurum*, SD LANG, SMITH, & THOMAS, 1940, p. 110; †364-368, WEDEKIND Coll., SM, Frankfurt; Eifel., hairpin curve at Nohn, Hillesheimer Mulde, Ger.; =*Cyathophyllum torquatum* SCHLÜTER, 1884, p. 83, †244, 244a,b, IP, Bonn, lectotype by BIRENHEIDE, 1961, p. 99, Eifel., Gerolsteiner Mulde, hill to left of Kyllufer opposite Lissengen, Ger.); *Astrophyllum* WEDEKIND, 1924, p. 46 (type, *A. gerolsteinense*, SD LANG, SMITH, & THOMAS, 1940, p. 22; †2282-2291, 8709, 8732, SM, Frankfurt, lectotype by BIRENHEIDE, 1962b, p. 106; Eifel., Salmer-Weg, Gerolsteiner Mulde, Ger.; =*Cyathophyllum torquatum* SCHLÜTER, 1884, see above); *Rhopalophyllum* WEDEKIND, 1924, p. 52 (type, *Cyathophyllum heterophyllum* MILNE-EDWARDS & HAIME, 1851, see above, SD HILL, 1939a, p. 222); *Stenophyllum* WEDEKIND, 1925, p. 9, see BIRENHEIDE, 1961, p. 80, footnote (type, *S. diluvianum*, OD; †1701-2, 8048-8051, WEDEKIND Coll., SM, Frankfurt; Givet., Niederehe, Hillesheimer Mulde; =*Cyathophyllum vermiculare* GOLDFUSS, 1826, p. 54, †198, GOLDFUSS Coll., IP, Bonn, 4098, 4099, WEDEKIND Coll., SM, Frankfurt, M.Dev., Hillesheimer Mulde Eifel., *fide* BIRENHEIDE, 1961, p. 117), *non Stenophyllum* VERHOEFF, 1897, a recent myriapod; *Leptoinophyllum* WEDEKIND, 1925, p. 4 (type, *L. multiseptatum*, see BIRENHEIDE, 1962b, p. 110, OD; †1495, WEDEKIND Coll., SM, Frankfurt, lectotype by BIRENHEIDE, 1962b, p. 110; =*Cyathophyllum vermiculare* GOLDFUSS, 1826, see above); see BIRENHEIDE, 1961, p. 80; 1962b, p. 101; 1963b, p. 406; 1972, p. 411]. Moderately large, solitary or rarely weakly fasciculate, with deep calice either inversely conical or with broad, sloping, flat to everted peripheral platform; septa long, major septa extending with unequal curvature to axis or to short median plane and arranged commonly in groups about longer septa; minor septa commonly well developed, commonly thinner than major; in tabularium, septal faces may be coarsely vepreculate or flanged; trabeculae slender monacanths arranged in radial series except at periphery where each septal base may be composed of several rows of simple or tufted monacanths; dissepimentarium wide, typically of small, globose to elongate dissepiments; lonsdaleoid dissepiments and lateral dissepiments may be developed; tabu-

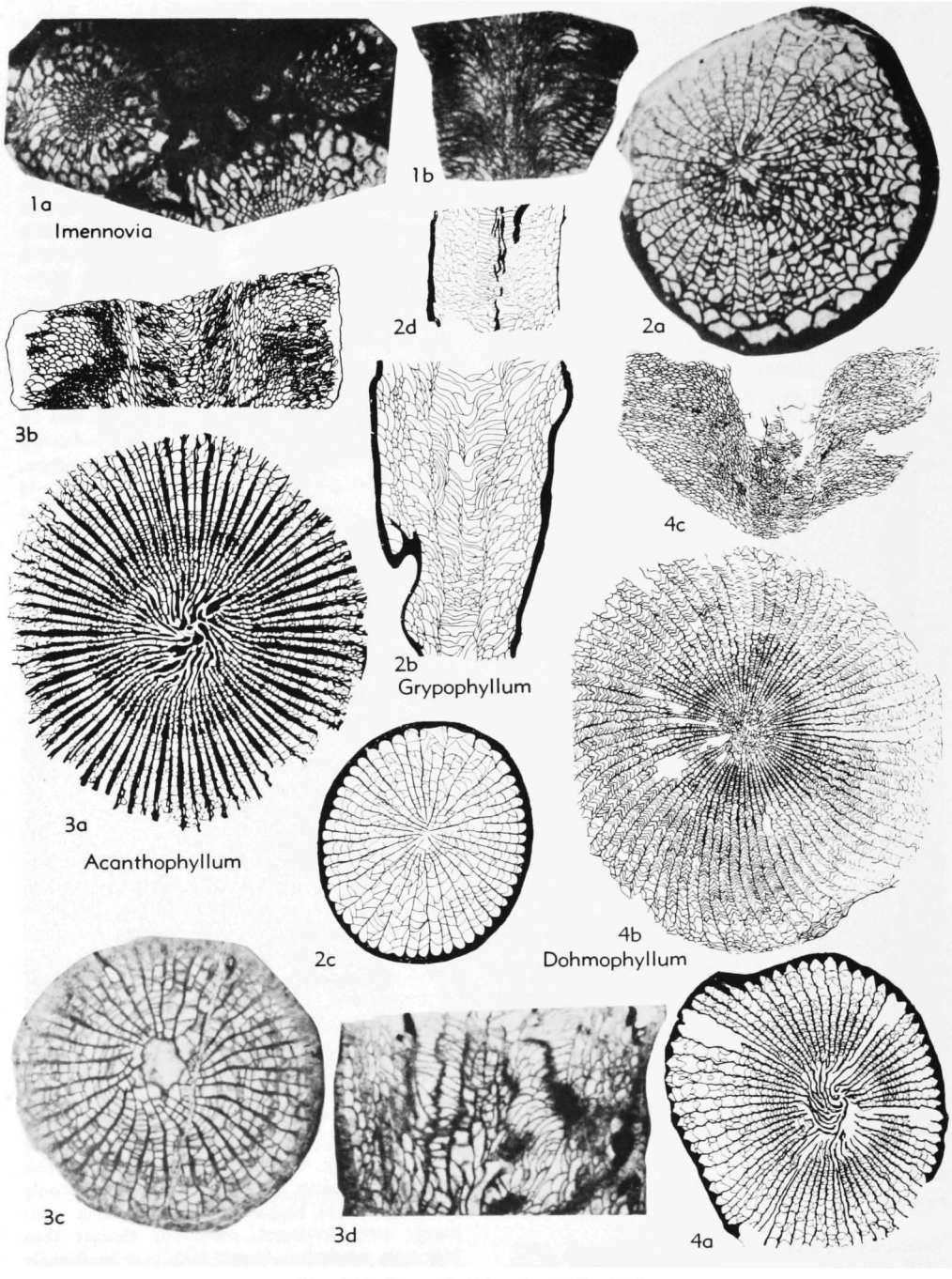


FIG. 146. Ptenophyllidae (p. *F233-F238*).

larial floors concave with median notch or ?trough; tabulae incomplete, commonly close together. *?L.Dev.*, Australia(Queensl.-New S.Wales)-Asia (NE.USSR); *M.Dev.(Couvin.-Givet.)*, Eu.(U.K.-Belg.-France-Ger.-Czech.-USSR)-Asia(USSR-China-Indoch.)-Australia (Tasm.-Vict.-New S. Wales-Queensl.)-N. Afr. (Alg.-Moroc.)-N. Am.——FIG. 146,*3a,b*. **A. heterophyllum* (MILNE-EDWARDS & HAIME), M.Dev., Junkerberg beds, Ger., Eifel.; *a*, transv. sec., *b*, long. sec. another specimen, both

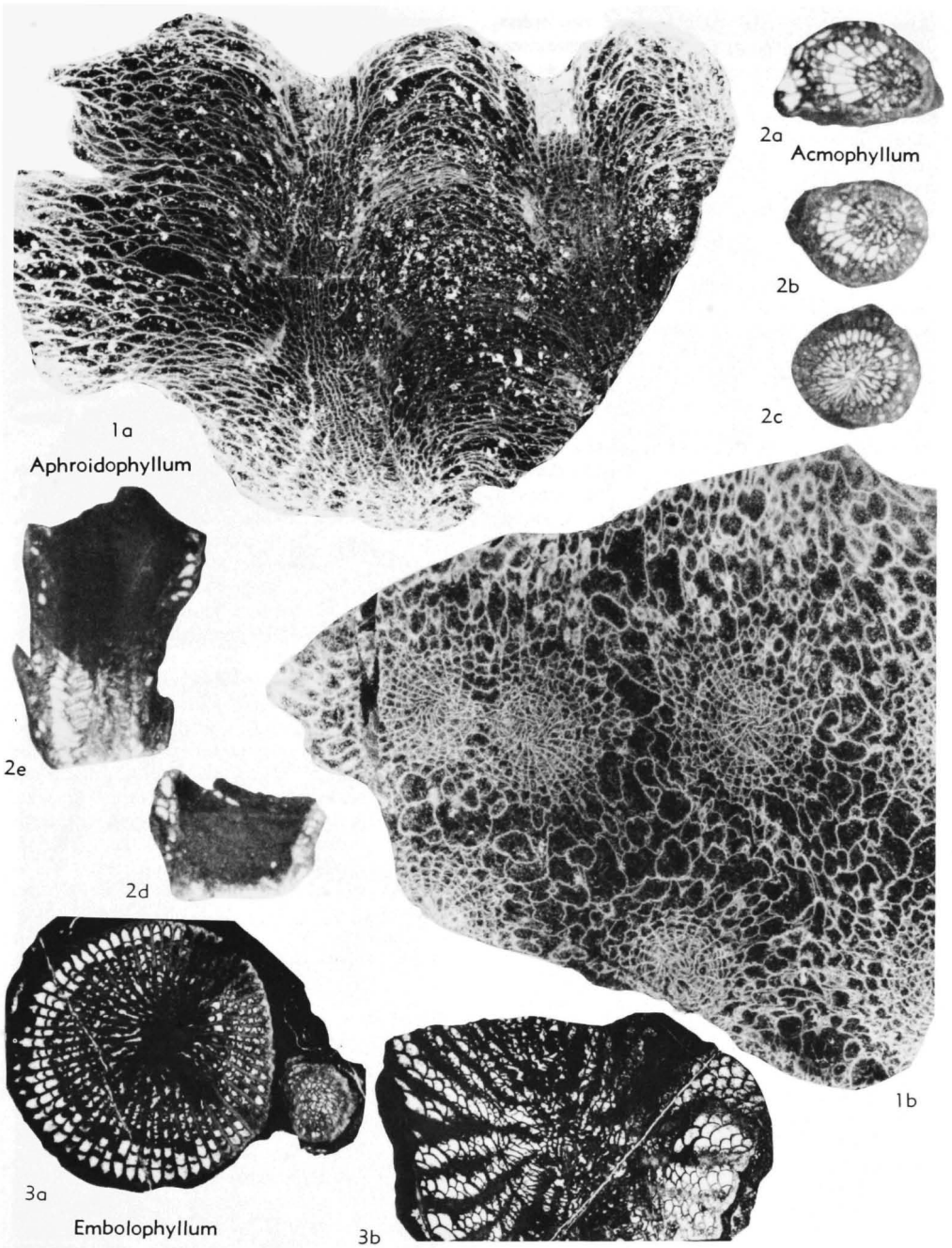


FIG. 147. Ptenophyllidae (p. *F235-F236*).

×1.3 (Birenheide, 1961).——FIG. 146,*3c,d*. *A. ultimum* (WEDEKIND), Givet., "Düsseltal," Ger.; *c*, holotype, transv. sec., ×2.0; *d*, ?paratype, long. sec., ×2.0 (Pedder, 1973).

Acmophyllum SYTOVA, 1968, p. 60 [**A. armatum*; OD; †6, coll. 9743, TsGM, Leningrad] [?=*Lyrielasma* HILL, 1939a, which see; ?*Salairophyllum* BESPROZVANNYKH, 1968, which see]. Solitary, slender, small, erect, conical corals with rejuvenescence; calice deep, goblet-shaped, with steep

flanks and wide axial floor; septa of two orders, dilated peripherally to form narrow stereozone; dissepiments globose, commonly in one row; major septa long, straight, unequal, flanged in tabularium; tabulae not revealed. *L.Dev.(Gedinn.)*, Eu.(Podolia).——FIG. 147,*2a-e*. **A. armatum*, mid. Borshchov., Borshchov, Podolia; *a-c*, holotype, transv. secs., ×4, *d*, holotype, long. sec., ×4, *e*, paratype, long. sec., ×4 (Sytova, 1968).

Aphroidophyllum LENZ, 1961, p. 505 [**A. howelli*; OD; †41224, GSC, Ottawa] [?=*Taimyrophyllum* CHERNYSHEV, 1941a, which see]. Compound, mostly aphroid, but at some levels with well-developed naotic septa of thamnasterioid arrangement; septa with zigzag carinae near inner margin of dissepimentarium and major septa commonly somewhat twirled at axis; tabulae incomplete, closely spaced, generally forming axially depressed tabularial floors [PEDDER, 1971b, p. 46]. *L.Dev.*, N.Am.(Nev.); *M.Dev.(Eifel.)*, Asia(Kuzbas)-N. Am.(W.Can.).——FIG. 147,*1a,b*. **A. howelli*, holotype, Eifel., Hume F., Can., Lac à Jaques, 66°05′N., 127°28′W.; *a,b*, long., transv. secs., ×2 (Hill, n; photographs courtesy A. H. Pedder).

Australophyllum STUMM, 1949, p. 34 [**Spongophyllum cyathophylloides* ETHERIDGE, 1911, p. 7; OD; †F9494-9497, AM, Sydney, F2522, GSQ, Brisbane; lectotype by JONES, 1932, p. 55]. Cerioid, like *Xystriphyllum* but septa attenuate and separated from wall by one or several series of lonsdaleoid dissepiments; in early stages of offsets, dissepiments and tabulae only are seen [JELL & HILL, 1970d, p. 102]. *L.Dev.-?M.Dev.(low. Eifel.)*, Asia(Altay Mts.)-Australia(Queensl.-New S.Wales)-?Asia (Laos-NE.USSR)-?N.Am.(Nev.-W. Can.-Mich.)-?Eu.(Ger.).——FIG. 148,*2a,b*. **A. cyathophylloides* (ETHERIDGE), lectotype, L.Dev., Douglas Ck. Ls., Queensl., 4.75 mi. SSW. of Clermont; *a,b*, transv., long. secs., ×2.7 (Jell & Hill, 1970d; F2522).

Dohmophyllum WEDEKIND, 1923, p. 28 [**D. involutum*; M; †2078, 8903, SM, Frankfurt] [=*Trematophyllum* WEDEKIND, 1923, p. 27, 35 (type, *T. Schulzi* WEDEKIND, 1924, p. 76, SD LANG, SMITH, & THOMAS, 1940, p. 135; †1008, WEDEKIND Coll., SM, Frankfurt; Eifel., Niederehe, Eifel, Ger.); *Sparganophyllum* WEDEKIND, 1925, p. 13 (type, *S. difficile*, OD; †4283-4288, WEDEKIND Coll., SM, Frankfurt, lectotype by BIRENHEIDE, 1962b, p. 105; Givet., quarry in Pillingser Bachtal, Sauerland, Ger.); *Pseudoptenophyllum* WEDEKIND, 1925, p. 60, 78 (type, *Cyathophyllum helianthoides* GOLDFUSS mutatio *philocrina* FRECH, 1886, p. 170, M; †Qu.-Katalog P1503, C154, HU, E. Berlin, lectotype by BIRENHEIDE, 1963a, p. 421; M.Dev., Mühlberg, Eifel, Ger.)]. Solitary or weakly phaceloid; corallites large; with strongly widened septal bases; septa numerous, long, thin to strongly thickened; septal trabeculae relatively far apart; lateral septal tubercles irregular, not organized into carinae; axial ends may be somewhat convolute, thickened or crowded; *Km* elongate in some; dissepimentarium very wide, dissepiments small, numerous; tabularium narrow, tabellae close together, forming irregular floors, without median trough or notch [BIRENHEIDE, 1963b, p. 406; 1972, p. 422; PEDDER, 1971d, p. 39]. *L.Dev.(Ems.)*, Eu.(Urals)-Asia(Tadzhik.-Kuzbas)-Australia(Queensl.-New S.Wales-Vict.)-*M.Dev.*, Eu.(Ger.-France-Belg.-U.K.-Czech.-Aus.-Italy-Urals)-Asia (Turkey-Armenia-Tadzhik.-Kuzbas-NE.USSR)-Australia(Queensl.-New S.Wales)-N.Am.(Yukon-NW.Terr.).——FIG. 146,*4a*. **D. involutum*, holotype, Eifel., Ger., Auburg, near Gerolstein; transv. sec., ×1.3 (Wedekind, 1924). ——FIG. 146,*4b,c*. *D. helianthoides* (GOLDFUSS), Eifel., Junkerberg Beds, Ger., SE. Niesenberg, Prüm, Eifel; *b,c*, transv., long. secs., ×0.7 (Birenheide, 1963a).

Embolophyllum PEDDER, 1967a, p. 10 [**Acanthophyllum asper* HILL, 1940b, p. 252; OD; †F4270, UQ, Brisbane]. Corallum dendroid or phaceloid, corallites large, at first ceratoid to trochoid, later subcylindrical; calice deep, steep-sided; peripheral stereozone thin to moderately thick; septa radial to weakly pinnate in arrangement, typically expanded at peripheral edge and rarely withdrawn from periphery; septal flanges strongly to moderately developed in tabularium; *Km* may be longer than other minor septa; septa of contiguous monacanthine trabeculae directed inward and upward and also curving slightly toward axis; dissepimentarium wide, dissepiments numerous, small, subglobose; tabulae incomplete, of wide subplanar tabellae, closely spaced and characteristically declined toward axis. *?U.Sil.*, N.Am. (Calif.); *L.Dev.*, Australia(Vict.-New S.Wales-Queensl.)-N.Am.(Md.)-Asia(NE.USSR); *?M.Dev.*, Asia(NE.USSR).——FIG. 147,*3a,b*. **E. asper* (HILL), holotype, Ems., New S.Wales, Cave Flat road from Wee Jasper; *a,b*, transv., long. secs., ×2 (Hill, 1940b).

Grypophyllum WEDEKIND, 1922a, p. 13 [**G. denckmanni*; OD; †3949, WEDEKIND Coll., SM, Frankfurt] [=*Hooeiphyllum* TAYLOR, 1951, p. 173 (type, *Grypophyllum normale* WEDEKIND, 1925, p. 22, OD; †3864-3868, 3873, WEDEKIND Coll., SM, Frankfurt; Givet., Hand, near Bergisch-Gladbach, Ger., see ENGEL & SCHOUPPÉ, 1958, p. 106); *?Neogrypophyllum* JIA in JIA *et al.*, 1977, p. 163 (type, *N. zhongguoense*, OD; †IV37054, HPRIGS, Yichang; M.Dev., Tianyang Co., Guangxi (Kwangsi)]. Solitary, commonly subcylindrical; septa numerous, finely and closely trabeculate, noncarinate, commonly thin; major septa reach axis, may interdigitate or coil slightly in tabularium; dissepimentarium wide and tabularium narrow; minor septa commonly well-developed but very thin to failing in type species; *Km* more or less significantly lengthened; lonsdaleoid dis-

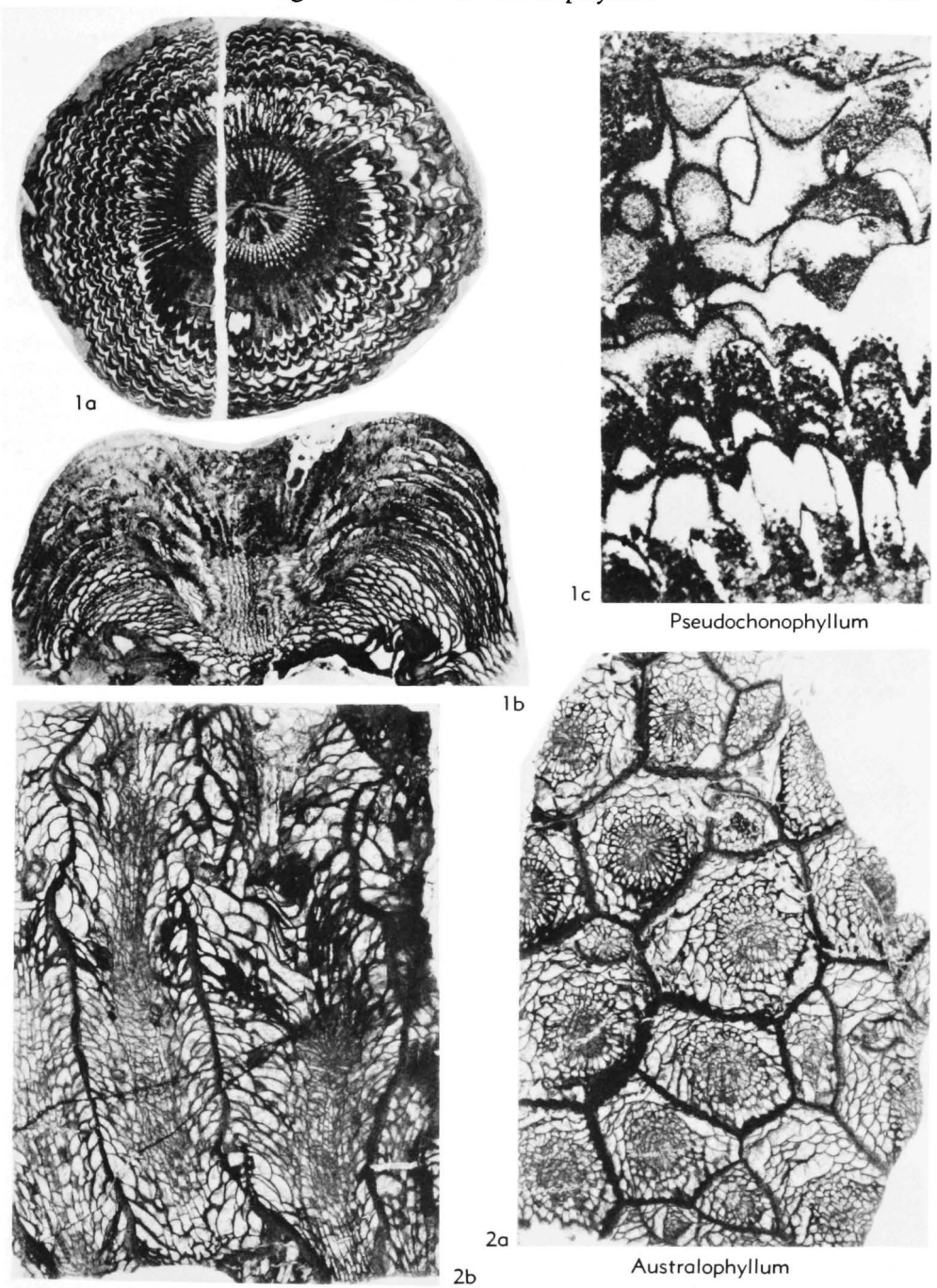


FIG. 148. Ptenophyllidae (p. *F236-F240*).

sepiments commonly sparse; tabular floors close together, flat, with median (or axial) depression [BIRENHEIDE, 1972, p. 407; PEDDER, 1973, p. 99]. *M.Dev.*, Eu.(Ger.-U.K.-Belg.-France-Czech.-Aus.-Urals-N. Zemlya)-Asia (Kuzbas-NE. USSR-Pak.-Kwangsi)-N.Am.(S.Mackenzie); *base U.Dev.*, N. Am.(S.Mackenzie-Alberta).——FIG. 146,*2a,b*. **G. denckmanni*, holotype, Givet., Ger., Hand; *a,b*,

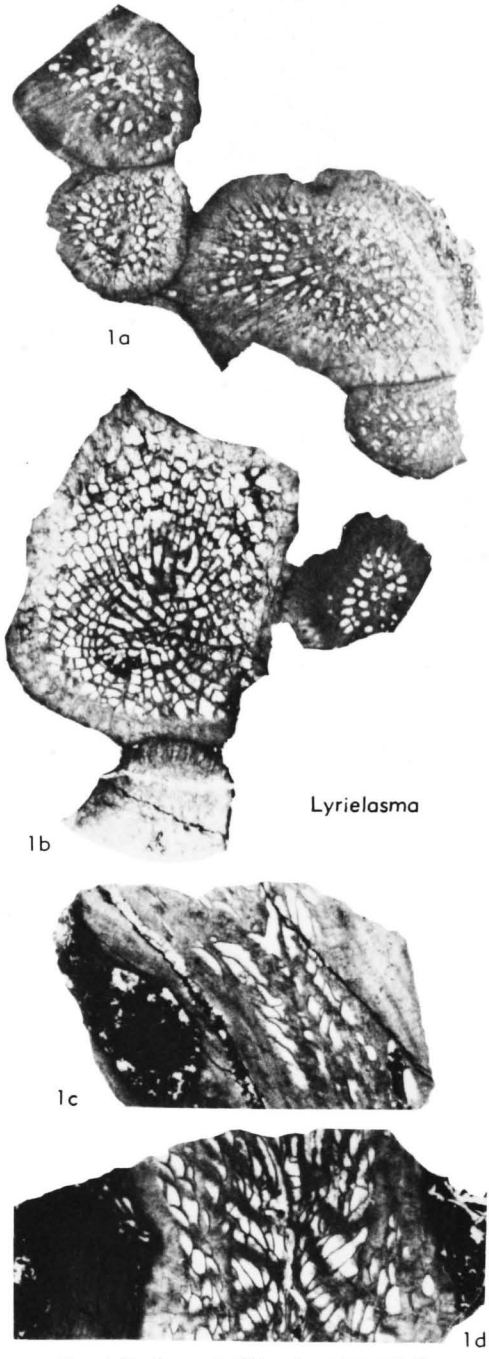


FIG. 149. Ptenophyllidae (p. F238-F240).

transv., long. secs., ×2.0, ×1.3 (*a*, Pedder, 1973; *b*, Wedekind, 1922a).——FIG. 146,*2c,d*. *G. normale* WEDEKIND, holotype, Givet., Ger., Hand; *c,d*, transv., long. secs., ×1.3 (Wedekind, 1925).

Hankaxis BIRENHEIDE, 1978, p. 62 [**Cyathophyllum tinocystis* FRECH, 1885, p. 28; 30 syntypes, not traced; FRECH's figured syntype is from U. Dev., Frasn., Iberger Kalk, Grund, Ger.]. Solitary; may have single offsets; calical platform wide and flat or everted; calical pit with prominent boss; septa numerous, very long, thickened, major thicker than minor; trabeculae multiserial; with a narrow axial structure of septal lamellae and abaxially declined tabellae, surrounded by peri-axial series of less steeply declined tabellae; dissepiments numerous, small, concentric or angulate. *U.Dev.(Frasn.)*, Eu.(Ger.-Eng.).

Hezhangophyllum KONG in KONG & HUANG, 1978, p. 124 [**H. variseptatum*; OD; †Gcr 748, 749–751, GB, Guiyang; L.Dev., Hezhang, Guizhou (Kweichow)]. Solitary; septa long, somewhat thickened; major septa with tabularial parts waved and flanged, some may extend to axis and there form a loose coil, minor septa may be discontinuous longitudinally; in places lonsdaleoid dissepiments may develop; tabular floors sagging; tabulae ?incomplete; dissepimentarium wide, dissepiments small, concentric or inosculating. [Diagnosis tentative, from illustrations.] *L.Dev.*, Asia(Kweichow).

Imennovia SHURYGINA, 1968, p. 133 [**I. uralica*; OD; †284/318, coll. 930, UGUp, Sverdlovsk] [=*Imenovia* FLÜGEL, 1970, p. 136, *nom. null.*]. Fasciculate, with lateral increase; corallites large, calice with broad, slightly everted platform and deep axial pit; septa numerous, long, thin, not carinate or flanged, more or less discontinuous longitudinally in peripheral regions; tabular floors inversely conical and close together, of tabellae; dissepiments numerous, horizontally based in wide peripheral zone, steeply declined against tabularium. *U.Sil.*, Asia(N.Urals).——FIG. 146,*1a,b*. **I. uralica*, holotype, up. Ludlov., E. slopes N. Urals, Lower Turinsk distr., R. Malaya Imennaya; *a,b*, transv., long. secs., ×2.7 (Shurygina, 1968).

Lyrielasma HILL, 1939a, p. 243 [**Cyathophyllum subcaespitosum* CHAPMAN, 1925, p. 112; OD; †P1731, 14065, 15969-15972, NM, Melbourne; *non Cyathophyllum subcaespitosum* MEEK, 1873, p. 470, and in KING, 1877, p. 60; =*Lyrielasma chapmani* PEDDER, 1967a, p. 5, *nom. subst.*] [?=*Acmophyllum* SYTOVA, 1968, which see; *?Salairophyllum* BESPROZVANNYKH, 1968, which see]. Solitary? to fasciculate with subcylindrical corallites; increase peripheral, nonparricidal; wide peripheral stereozone of unequal width; septa radially or pinnately arranged, strongly flanged in tabularium in early stages; septal trabeculae more or less horizontal; dissepiments elongate, steeply inclined and rarely lonsdaleoid, rare or absent in early stages; tabular floors axially depressed, tabellae closely spaced and subplanar. *?U.Sil.(Pridol.)*, N.Am.(Me.); *L.Dev.*, Australia(Vict.-New S. Wales-Queensl.)-Eu.(Urals-?France-?Carnic Alps)-Asia(Altay-Sayan)-?N.Am.(Me.); *M.Dev.*, Asia (NE.USSR).——FIG. 149,*1a-d*. **L. chapmani*,

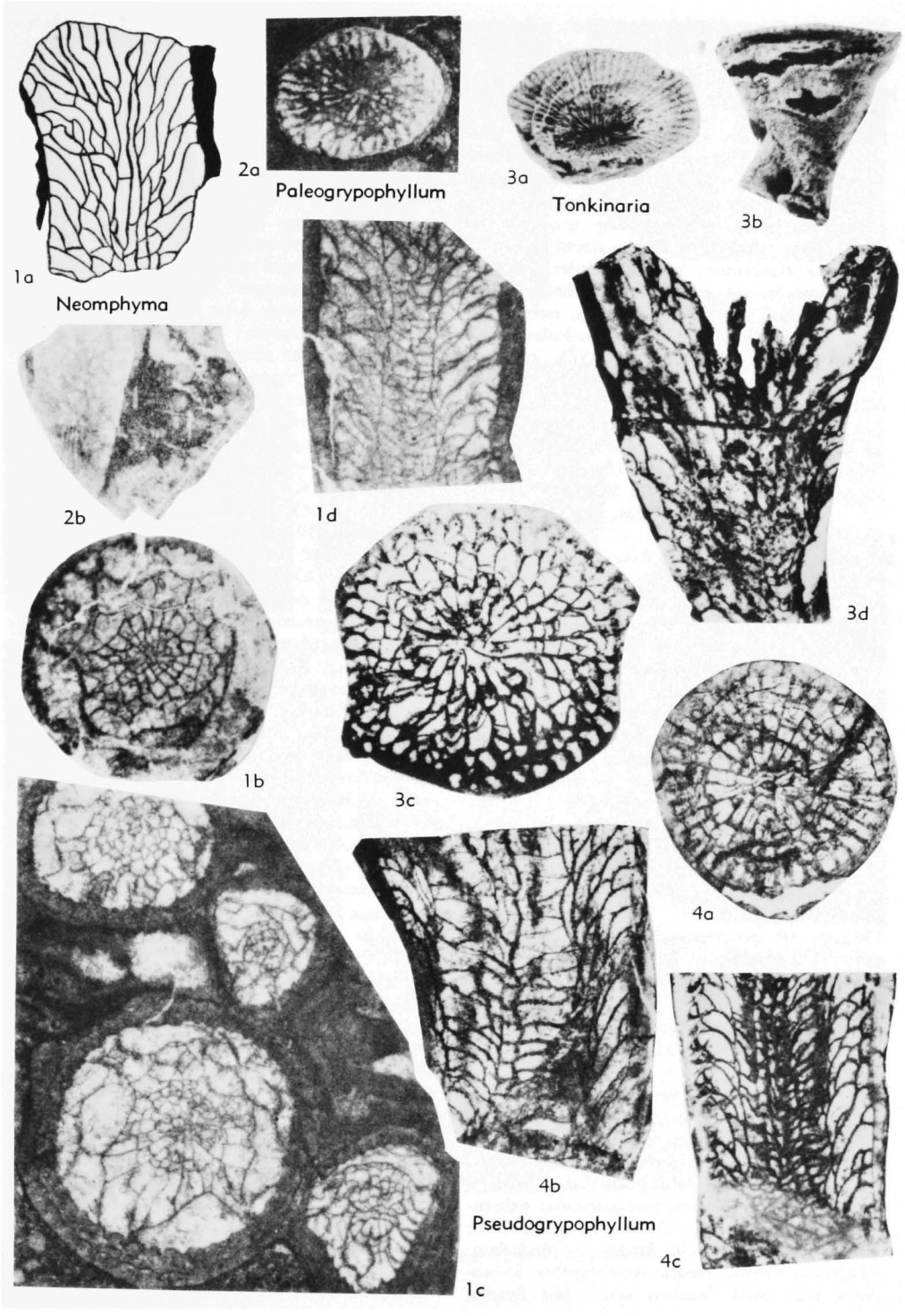


FIG. 150. Ptenophyllidae (p. *F*240, *F*243).

holotype, L.Dev., Lilydale Ls., Vict., Lilydale; *a,b,* transv., *c,d,* long. secs., approx. ×3.5 (Hill, 1939a).

Neomphyma SOSHKINA, 1937, p. 76 [**N. originata*; OD; †slides 311-313, 435-436, coll. 143, PIN, Moscow] [?=*Paleogrypophyllum* IVANIYA, KOSAREVA, & FEDOROVICH, 1968, which see]. Solitary ?(or fasciculate); with narrow peripheral stereozone and wide, commonly lonsdaleoid dissepimentarium; major septa extending unequally to axial region; minor septa thin to absent except in stereozone; tabularium narrow, tabulae concave; dissepiments large, unequal, steeply inclined. [Type species originally described as solitary, redescribed by SHURYGINA, 1968, p. 136, as fasciculate. See also IVANOVSKIY & SHURYGINA, 1975, p. 34.] *?U.Sil.,* Australia(New S.Wales); basal *L.Dev.,* Asia (E. Urals-Kazakh.-Altay)-N. Am.(Nev.).——FIG. 150,*1a-d.* **N. originatum,* Northern Urals; *a,b,* holotype, road from Petropavlovsky works to Pokrovskoye, long. sec., ×4 (Soshkina, 1937), transv. sec., ×4 (Ivanovskiy & Shurygina, 1975); *c,d,* topotypes, transv., long. secs., ×4 (Ivanovskiy & Shurygina, 1975).

Paleogrypophyllum IVANIYA, KOSAREVA, & FEDOROVICH, 1968, p. 88 [**P. spiraleforme*; OD; †18-1-14a, ?TGU, Tomsk] [?=*Neomphyma* SOSHKINA, 1937, which see; *Palaegrypophyllum, Poleogrypophyllum* IVANIYA, KOSAREVA, & FEDOROVICH, 1968, p. 88, *Palaeogrypophyllum* IVANOVSKIY, 1973b, p. 279, all *nom. null.*]. Corallum fasciculate; thin major and minor septa arranged with bilateral symmetry and with slight spiral or geniculate curvature, rarely discontinuous longitudinally; major septa long, unequal, longest attaining axis or median plane; minor septa may be discontinuous longitudinally; tabulae with median concavity, complete and incomplete; dissepiments almost horizontally based or weakly inclined toward axis, convex, arranged commonly in one series. *L.Dev.,* Asia(Mt.Altay); *?L.Dev.,* N.Am.(Nev.).——FIG. 150,*2a,b.* **P. spiraleforme,* holotype, Remnev subsuite, N. Altay, SE. of Mt. Kolpak; *a,b,* transv., long. secs., ×2 (Ivaniya, Kosareva, & Fedorovich, 1968).

Pseudochonophyllum SOSHKINA, 1937, p. 59 [**Chonophyllum pseudohelianthoides* SHERZER, 1892, p. 275; OD; †5298, UMMP, Ann Arbor]. Solitary, rarely with single, small peripheral offset; calicular platform commonly everted; septa long, *C* and *Km* may be longer; major and minor septa dilated, naotic in wide irregular peripheral zone, separated by very small dissepiments; lonsdaleoid dissepiments may disrupt naotic parts of septa; trabeculae of thick septa chonophylloid in arrangement; septa with xystriphylloid flanges in tabularium; tabularium narrow, tabulae close together, incomplete, with axial ?median notch [see STRUSZ, 1966, p. 563; OLIVER & GALLE, 1971b, p. 72]. *L.Dev.,* Eu.(Czech.-France-Urals)-Australia(New S.Wales-Queensl.).——FIG. 148,*1a-c.* **P. pseudohelianthoides* (SHERZER), up. Koněprusy Ls., Boh., Zlatý Kůň near Koněprusy; *a,b,* transv., oblique long. secs., ×1.3; *c,* extreme right portion of *a,* ×6.4 (Oliver & Galle, 1971b; photographs courtesy W. A. Oliver).

?Pseudogrypophyllum CHEREPNINA, 1968, p. 159 [**P. limatum*; OD; †G33-76, coll. 801, SNIIGGIMS, Novosibirsk] [=*Pseudogyrophyllum* FLÜGEL, 1970, p. 226, *nom. null.*]. Fasciculate, weakly branching; corallites slender, cylindrical, with narrow peripheral stereozone and long unequal septa arranged with indistinct bilateral symmetry; septa composed peripherally of spinose trabeculae with wide bases and thin ends, axially of ?(closely contiguous) acicular trabeculae; major septa reaching or almost reaching axis, cardinal septum longest, may join counter septum; tabulae concave; dissepiments large, in a few longitudinal series. [See CHEREPNINA, 1971, p. 89. Holotype possibly stringophyllid.] *L.Dev.(Gedinn.),* Asia (Altay Mts.).——FIG. 150,*4a-c.* **P. limatum,* Remnev Beds, Kamyshenka; *a,b,* holotype, transv., long. secs., ×5; *c,* paratype, long. sec., ×5 (Cherepnina, 1971).

Psydracophyllum PEDDER, 1971d, p. 47 [**P. lonsdaleiaforme*; OD; †25845, GSC, Ottawa]. Weakly to moderately dendroid; increase lateral; septa radially to pinnately arranged, thin, smooth to strongly flanged, mostly withdrawn from periphery at all stages; *Km* may be elongate; minor septa long, commonly almost contratingent; tabularium narrow, of closely spaced, thin tabellae, variably inclined; tabular floors irregular, commonly without median or axial notch; dissepimentarium wide, dissepiments large and lonsdaleoid in wide outer zone. *M.Dev.(up.Couvin.-low.Givet.),* N.Am. (NW.Can.).——FIG. 151,*3a,b.* **P. lonsdaleiaforme*; holotype, up.Couvin.-low.Givet., Nahanni F., N. Funeral Ra., SW. Distr. Mackenzie; *a,b,* long., transv. secs., ×1 (Pedder, 1971d).

?Redstonea CRICKMAY, 1968, p. 7 [**Lyrielasma sperabilis* CRICKMAY, 1962, p. 5; OD; †27079, PRI, Ithaca]. Phaceloid; corallites slender with narrow peripheral stereozone; major septa long, thin, unequal, some longer than radius, convolute in axial part of tabularium; minor septa weak but long, discontinuous longitudinally; tabularial floors commonly tall domes with margins turned out or up and troughlike, of large tabellae, but in places floors may be subhorizontal; dissepiments large in loculi between major septa, subhorizontal peripherally and steeply inclined at inner edge of dissepimentarium [see also PEDDER, 1973, p. 100]. *M.Dev.,* N.Am.(NW.Can.).——FIG. 151,*2a,b.* **R. sperabilis* (CRICKMAY), holotype, NW.Terr., Imperial Redstone No. 1 Borehole, Redstone R., at 2,680 ft.; *a,b,* transv., long. secs., ×1.7 (Crickmay, 1962).

Salairophyllum BESPROZVANNYKH, 1968, p. 111 [**Pilophyllum angustum* ZHELTONOGOVA, 1961, p. 78; OD; †3106, coll. 1508, ZSGUp, Novokuz-

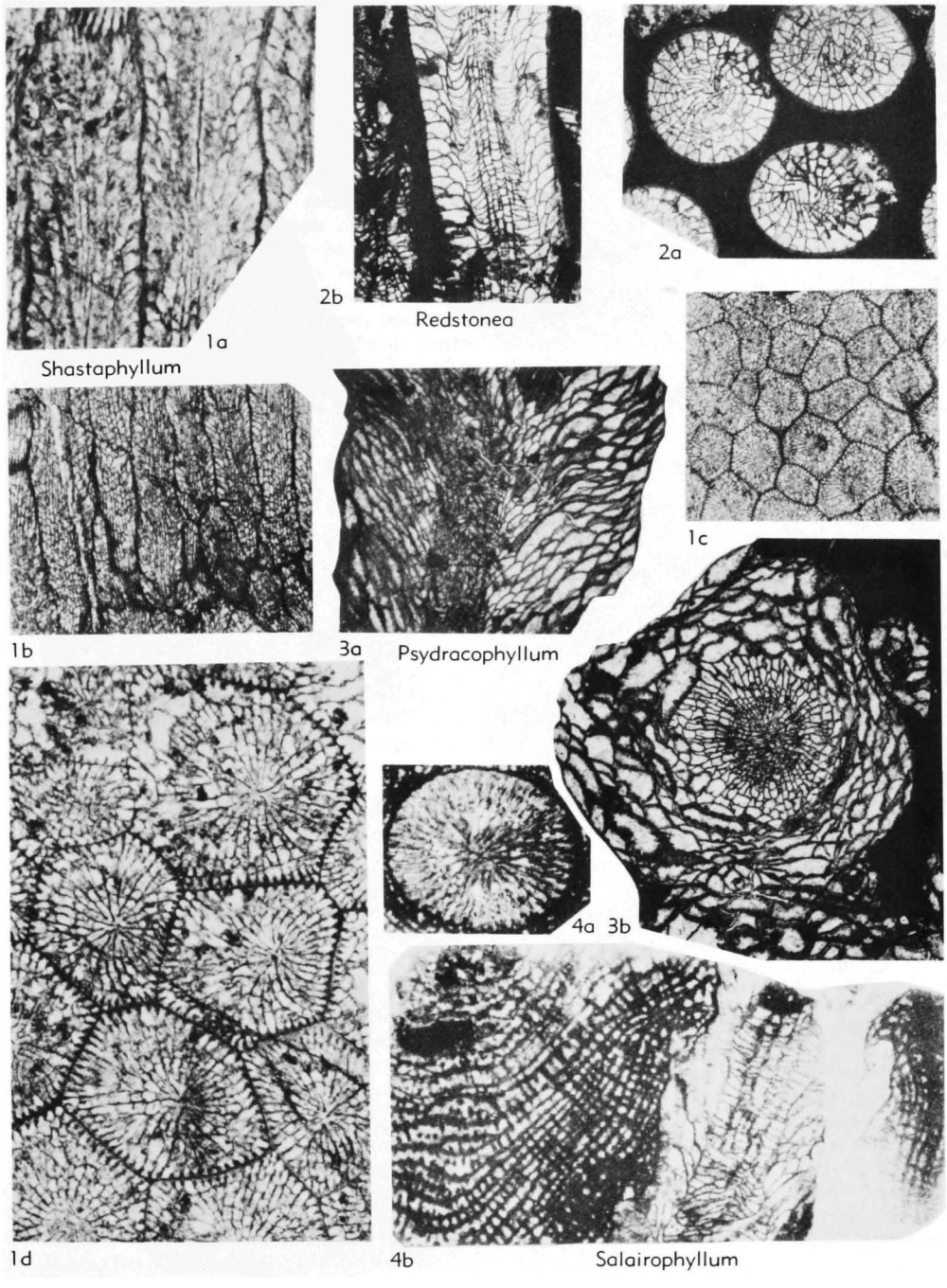


FIG. 151. Ptenophyllidae (p. *F*240-*F*243).

netsk] [?=*Lyrielasma* HILL, 1939a, which see, but with closer, subhorizontal tabularial floors; ?*Acmophyllum* SYTOVA, 1968, which see]. ?Solitary; septa of both orders dilated and mostly contiguous in wide peripheral stereozone; major septa sinuous, attaining axis, arranged either bisym-

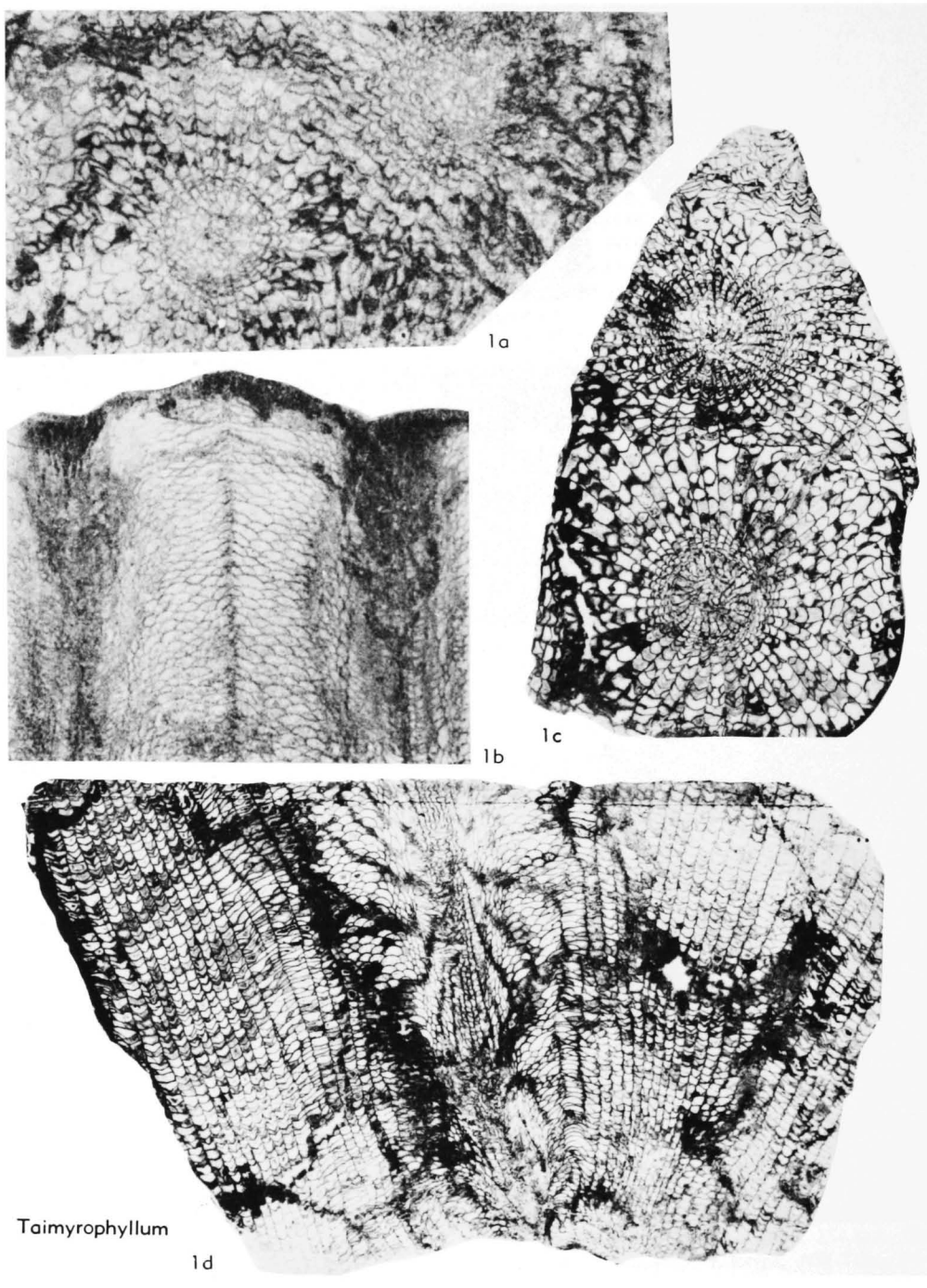


FIG. 152. Ptenophyllidae (p. *F*243).

metrically or twirled; some dissepiments may develop in or adaxial to stereozone; tabular floors close together, flatly concave or convex. *?U.Sil.*, N.Am.(Alaska); *L.Dev.(Gedinn.)*, Asia(Salair-E. Urals)-?N.Am.(Nev.).——FIG. 151,*4a,b*. **S. angustum* (ZHELTONOGOVA), holotype, Tomchumysh

beds, below Tomsk, left bank R. Tomchumysh; *a,b,* transv., long. secs., ×2.7 (Zheltonogova, 1961).

Shastaphyllum MERRIAM, 1972, p. 38 [**S. schucherti*; OD; †159457, USNM, Washington] [?=*Xystriphyllum* HILL, 1939b, which see]. Cerioid; corallites thin-walled with numerous thin septa; major septa unequal in length, ?cardinal extending to axis where it may be joined by others, axial ends of major septa may be slightly thickened; minor septa may be discontinuous longitudinally; dissepimentarium relatively wide, of normal dissepiments but including sporadic lonsdaleoid plates; tabularium narrow, tabulae flat or depressed, closely spaced, complete or incomplete. *U.Sil.* or *L.Dev.,* N.Am.(Cal.).——FIG. 151,*1a-d.* **S. schucherti,* holotype, Gazelle F., Cal., Willow Ck. area, Klamath Mts.; *a,d,* long., transv. secs., ×4, *b,c,* long., transv. secs., ×2 (Merriam, 1972).

Taimyrophyllum CHERNYSHEV, 1941a, p. 12 [**T. speciosum*; OD; †3, coll. 5958, TsGM, Leningrad] [=*Eddastraea* HILL, 1942c, p. 147 (type, *Phillipsastraea grandis* DUN in BENSON, 1918, p. 379, OD; syntype F69930 thin sections in UQ, Brisbane, rest of type material untraced; M.Dev., Loomberah Ls., Loomberah, New S. Wales); *?Aphroidophyllum* LENZ, 1961, which see]. Astreoid, thamnasterioid or weakly aphroid; dissepimentarium wide, of small, highly arched dissepiments; tabularium narrow, with shallowly concave, axially deepened tabulae and with long septa; the unequal axial ends of major septa arranged in groups in tabularium, straight or convolute, curvature differing in degree from group to group; cardinal septum typically short [PEDDER, 1964b, p. 436]. *L.Dev.,* Asia(Taymyr-NE.USSR-Salair)-N.Am.(Yukon); *M.Dev.,* Australia(New S.Wales-Queensl.)-N. Am. (NW. Terr.-Nev.)-Asia (Salair).——FIG. 152,*1a,b.* **T. speciosum,* holotype, base L.Dev., Taymyr, R. Tareia, canyonlike valley 40 km. from mouth; transv., long. secs., ×3 (Chernyshev, 1941a).——FIG. 152,*1c,d.* *T. grande* (DUN), syntype, M.Dev., Loomberah Ls., New S. Wales, Loomberah; *c,d,* transv., long. secs., ×2 (Hill, n).

?Tonkinaria MERRIAM, 1973a, p. 51 [**T. simpsoni*; OD; †159403, USNM, Washington]. Solitary or with peripheral offsets; corallites ceratoid or trochoid, commonly with flaring calice; septa thinning adaxially, major septa long and unequal, minor septa moderately long; tabulae irregularly concave [imperfectly known]; dissepiments longitudinally elongate, interseptal. *L.Dev.(Gedinn.),* N.Am.(Nev.).——FIG. 150,*3a-d.* **T. simpsoni,* Coral Zone D, Unit 3 of Roberts Mt. F., Nev., Roberts Ck. Mt.; *a,b,* holotype, calical and lat. views, ×1.5; *c,d,* paratype, transv., long. secs., ×4.0, ×3.5 (Merriam, 1973a).

Toquimaphyllum MERRIAM, 1973a, p. 54 [**Australophyllum (Toquimaphyllum) johnsoni*; OD; †159420, USNM, Washington]. Cerioid; increase

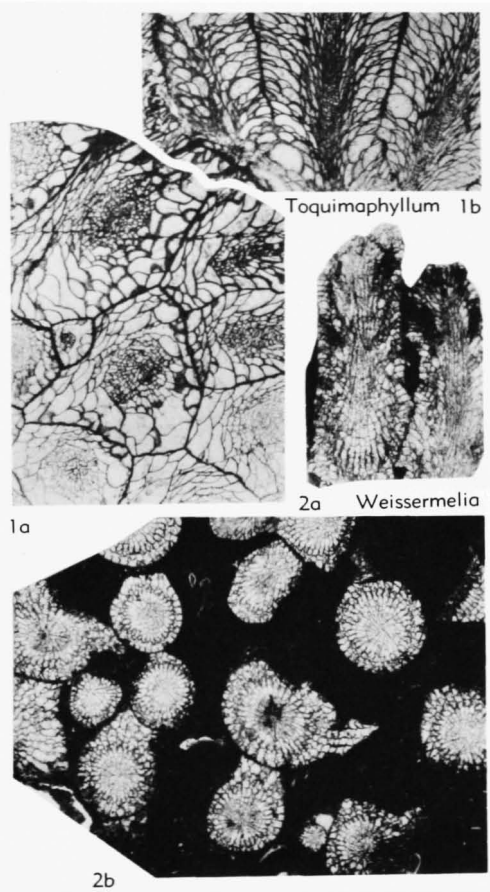


FIG. 153. Ptenophyllidae (p. *F243-F244*).

nonparricidal; corallites with thin, somewhat wavy septa, discontinuous peripherally in wide lonsdaleoid dissepimentarium of large plates; major septa subradial but unequal, some reaching or almost reaching axis, septal spinules or flanges on their tabularial parts sparse and fine; in some corallites septa reduced to crests on dissepiments; tabularium narrow, tabulae sagging, crowded, complete or incomplete. *U.Sil.(Ludlov.),* Australia (New S.Wales)-Eu.(Czech.); *L.Dev.(Gedinn.),* N. Am.(Nev.)-Asia(E.Urals).——FIG. 153,*1a,b.* **T. johnsoni,* holotype, coral zone "Sil."E, Nev., Ikes Canyon, Toquima Ra.; *a,b,* transv., long. secs., ×1.2 (Merriam, 1972).

Weissermelia LANG, SMITH, & THOMAS, 1940, p. 139, *nom. subst. pro Ptilophyllum* SMITH & TREMBERTH, 1927, p. 309, *non Ptilophyllum* GUÉRIN-MÉNEVILLE, 1845, an insect [**Ptilophyllum lindströmi*; OD; †R24356, BM(NH), London]. Phaceloid, corallites slender; septa thin, carinate; major septa long, unequal, radial or slightly twirled, one, ?cardinal, reaching axis; tabulae incomplete, axially depressed; dissepi-

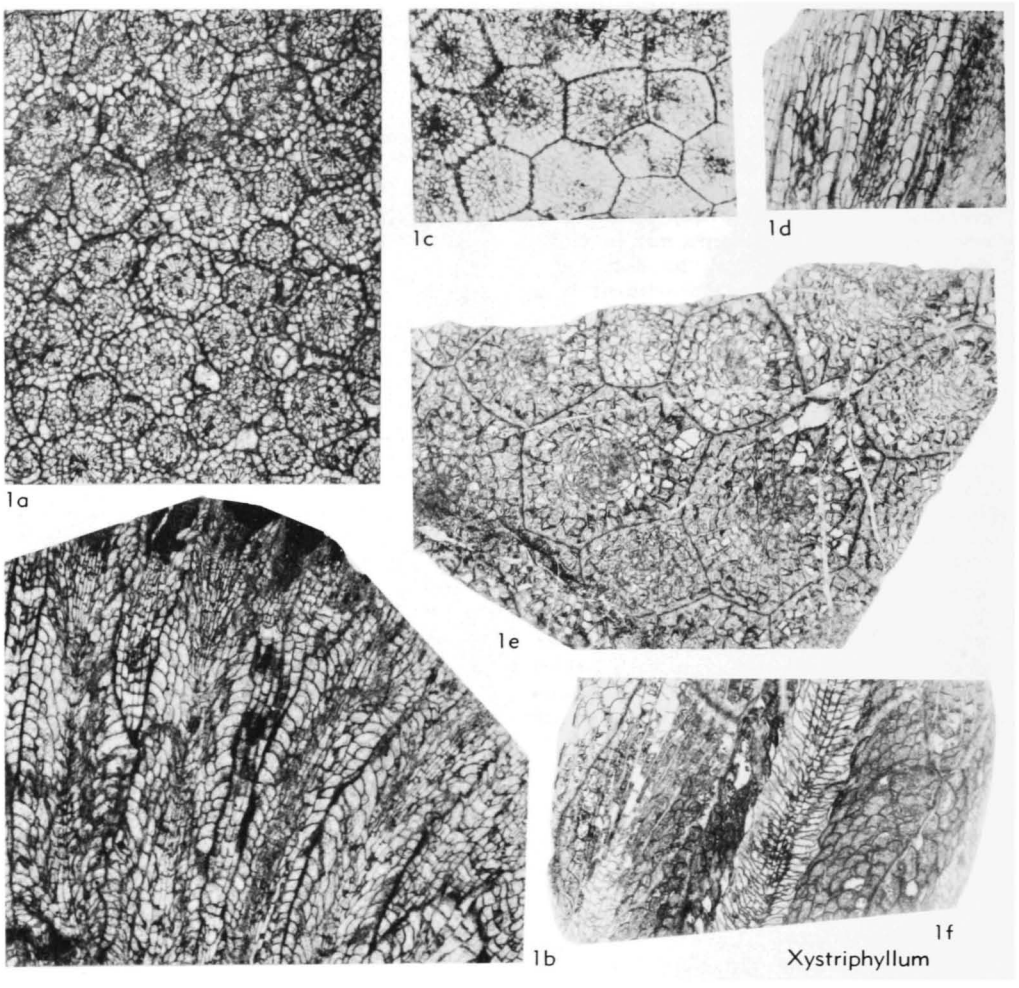


FIG. 154. Ptenophyllidae (p. *F244-F245*).

mentarium wide, peripheral plates large, interseptal, horizontally based and flattened. *U.Sil.*, Eu.(Gotl.-Podolia).——FIG. 153,*2a,b*. **W. lindstroemi* (SMITH & TREMBERTH); Hemse Gr., Gotl., Oestergarn; *a,b,* long., transv. secs., ×2.4 (Hill, n; UQF14015).

Windelasma PEDDER, 1978, p. 48 [**W. werneckense*; OD; †46087, GSC, Ottawa]. Corallum cerioid; septa markedly bilateral in arrangement, thin, commonly somewhat curving or wavy, some with short vepreculae; major septa long, minor septa mostly withdrawn toward periphery; dissepiments steeply inclined, a few lonsdaleoid; tabularium elliptical in transverse section, tabular floors depressed in median plane, tabulae complete or incomplete. *L.Dev.(low.Lochkov.),* N.Am.(Yukon).

Xystriphyllum HILL, 1939b, p. 62 [**Cyathophyllum dunstani* ETHERIDGE, 1911, p. 3; OD; †2425, GSQ, Brisbane; lectotype by HILL, 1939b, p. 63] [?=*Entelophylloides* RUKHIN, 1938, p. 23 (type, *Columnaria inequalis* HALL, 1852a, p. 323, pl. 72, figs. 3,4, OD; †not traced; L.Dev., Schoharie, N.Y.), not adequately known from type material; ?*Kozlowiaphyllum* RUKHIN, 1938, p. 34 (type, *K. pentagonum,* OD; †not traced; ?L.Dev., right bank R. Yasachnaya, below mouth of R. Tarynakh, NE.USSR), not adequately known from type material; *Pseudospongophyllum* ZHMAEV in KRAEVSKAYA, 1955, p. 213 (type, *P. massivum,* OD; †not traced; Eifel., Kuzbas); ?*Shastaphyllum* MERRIAM, 1972, which see]. Cerioid, with peripheral increase; major septa long, interdigitate or somewhat convolute in tabularium, ?cardinal septum and, in some, ?counter septum may be longer than others; dissepimentarium moderately wide and minor septa may locally thin to disappearance; lonsdaleoid dissepiments sparse; tabular floors close together,

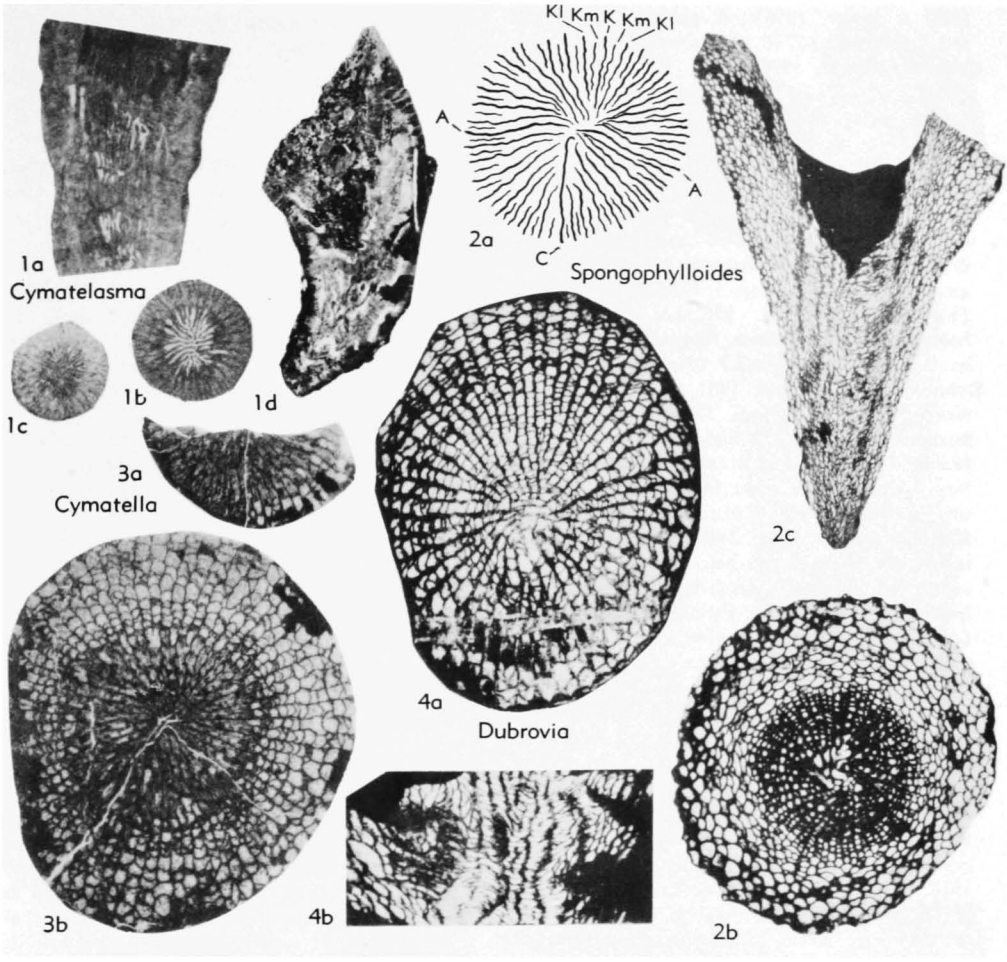


FIG. 155. Ptenophyllidae (p. *F245-F246*).

slightly concave, with ?median or axial pit [JELL & HILL, 1970d, p. 100]. *U.Sil.(Pridol.)*, N.Am. (Yukon-Me.-Que.); *L.Dev.-low.M.Dev.*, Australia (Queensl.-New S.Wales-Vict.-Tasm.)-Asia(?Laos-NE. USSR-Taymyr-Kuzbas-Altay-Salair-Fergana)-Eu. (Urals-Czech.-Minorca)-N.Am. (?N.Y.-Alaska-Yukon).——FIG. 154,*1a,b*. *Entelophylloides inequalis* (HALL), L. Dev., N.Y., hill slope 1.4 mi. WSW. of Central Bridge, Schoharie; *a,b*, transv., long. secs., ×2.7 (Hill, n; UQF50371).——FIG. 154,*1c,d*. *Pseudospongophyllum massivum* ZHMAEV, Eifel., SW. margin of Kuzbas, R. Bachat, 2.5 km. above Shyndy; *c,d*, transv., long. secs., ×2.0 (Kraevskaya, 1955).——FIG. 154,*1e,f*. **X. dunstani* (ETHERIDGE), lectotype, ?Ems., Douglas Ck. Ls., Queensl., Clermont; *e,f*, transv., long. secs., ×2.7 (Hill, n).

Subfamily ACTINOCYSTINAE Wedekind, 1927

[*nom. transl.* HILL, herein, *ex* Actinocystidae WEDEKIND, 1927, p. 42]

Solitary Ptenophyllidae with septa strongly flexuous to zigzag and flanged in inner parts of dissepimentarium and in tabularium, thickened in some. *Sil.-L.Dev.*

Cymatelasma HILL & BUTLER, 1936, p. 516 [**C. corniculum*; OD; †A7761, SM, Cambridge]. Solitary, small, conical or cornute; septal dilation very marked in young stages, becoming progressively reduced from axis outward during ontogeny; peripheral stereozone present in adult; septa waved parallel to distal edges, and may develop flanges along crests of waves; major septa unequal, septal symmetry as in *Spongophylloides* MEYER, 1881, with elongate *Km*; tabulae inversely conical, with median trough; dissepiments absent [SCRUTTON, 1971, p. 213]. *Sil.(Wenlock.-Ludlov.)*, Eu.(U.K.-Gotl.); *Sil.(Ludlov.)*, S.Am.(Venez.).——FIG. 155,*1a-d*. **C. corniculum*, Woolhope Ls., U.K., Woolhope; *a-c*, holotype, long., transv. secs., ×2.0

(Hill & Butler, 1936); *d*, paratype, long. sec., ×2.7 (Hill, n; A7770, SM, Cambridge).

Cymatella Sytova, 1970, p. 79 [**C. nordica*; OD; †107, coll. 10316, TsGM, Leningrad]. Solitary, cornute; calice deep, funnel-shaped; septa of two orders, long, in early stages thick and contiguous laterally, thinning regularly toward axis during ontogeny; septa flanged parallel to upper edges; incomplete ring of lonsdaleoid dissepiments may develop at periphery; tabulae concave with median depression; boundary between dissepimentarium and tabularium sharp. *U.Sil.(Pridol.)*, Eu. (Vaygach I.).——Fig. 155,*3a,b*. **C. nordica*, holotype, Grebeni horizon, Vaygach, Belushya Inlet; *a,b*, transv. secs., ×2.7 (Sytova, 1970).

Dubrovia Zheltonogova, 1961, p. 80 [**D. dubroviensis*; OD; †1506, coll. 1508, ZSGUp, Novokuznetsk]. Solitary, cylindroconical with deep funnel- or beaker-shaped calice; wall thin; septa long, thin, sinuous, may be reduced or discontinuous in marginarium, bisymmetrically arranged; *Km* elongate; tabulae shallowly concave, close, incomplete; dissepiments heterogeneous, concentric or angular, commonly small but a few large and lonsdaleoid. *U.Sil.*, Eu.(Podolia-Gotl.-Urals)-Asia (Altay-?Iran); *L.Dev.(Gedinn.)*, Asia(Salair-Altay)-Eu. (Podolia-Urals)-N.Am. (Yukon).——Fig. 155,*4a,b*. **D. dubroviensis*, holotype, Sukhaya Suite, Tomchumysh Beds, Salair, L. bank R. Baskuskan, near Dubrovo; *a,b*, transv., long. secs., ×2.7 (Zheltonogova, 1961).

Spongophylloides Meyer, 1881, p. 109 [**S. schumanni*; OD; †not traced; =*Cystiphyllum grayi* Milne-Edwards & Haime, 1851, p. 465, †lectotype A4830, SM, Cambridge, by Lang & Smith, 1927, p. 480] [=*Actinocystis* Lindström, 1882a, p. 21 (type, *Cystiphyllum grayi* Milne-Edwards & Haime, see above, M)]. Solitary, subturbinate or trochoid; major septa unequal, reaching or nearly reaching axis but not extending peripherally much beyond tabularium; septa zigzag and flanged or waved parallel to their distal edges; *Km* elongate; tabular floors of elongate tabellae sloping gently to median shallow trough; dissepimentarium wide, of small lonsdaleoid dissepiments [Butler, 1934, p. 541]. *M.Sil.-U.Sil.*, Eu.(U.K.-Gotl.-Czech.-?Podolia-Polar Urals)-N.Am.(Okla.-Ore.).——Fig. 155,*2a-c*. **S. grayi* (Milne-Edwards & Haime); *a*, septal symmetry diagram, *C*, cardinal septum, *K*, counter septum, *KL*, counter lateral septa, *Km*, first minor septa, A, alar septa; *b,c*, Wenlock Ls., Dudley, U.K., transv., long. secs., ×2 (Butler, 1934).

Family FASCIPHYLLIDAE Soshkina, 1954

[Fasciphyllidae Soshkina, 1954, p. 20]

Phaceloid or cerioid; corallites with thick walls; septa long and commonly wavy and vepreculate; major septa unequal, cardinal and counter commonly longest; tabulae complete and sagging; an incomplete series of dissepiments may be developed, in some between septa, in others disrupting septa. *L.Dev.-M.Dev.*

Fasciphyllum Schlüter, 1885c, p. 52 [**Fascicularia conglomerata* Schlüter, 1881, p. 99, M; †?in Schlüter Coll., IP, Bonn] [?=*Battersbyia* Milne-Edwards & Haime, 1851, p. 151 (type, *B. inaequalis*, M; †R31152, BM(NH), London; Dev., Teignmouth; imperfectly known); *Tasciphyllum* Tsyganko, 1970, Ref. Zhurn., 10b252, *nom. null.*, see Cotton, 1973, p. 208]. Fasciculate; corallites slender, with narrow peripheral stereozone, with unequal major septa, counter and cardinal being longest, and minor septa moderately long; septa of both orders may be wavy and bear sparse vepreculae; one commonly incomplete series of large, elongate dissepiments may be present between septa; tabulae sagging, commonly complete [Jell & Hill, 1970d, p. 103]. *L.Dev.-M.Dev.(Givet.)*, Eu.(Ger.-Belg.-U. K.-Carnic Alps-Urals)-Asia (Urals-S. Ferghana)-Australia(Vict.-Queensl.); *?M.Dev.*, Asia (Kwangsi).——Fig. 156,*2a,b*. **F. conglomeratum* (Schlüter), Givet., Ger., Eifel; *a,b*, transv., long. secs., ×8, ×3 (Schlüter, 1881).

?Crista Tsyganko, 1971, p. 39 [**C. compacta*; OD; †Mtsh26/142-1, coll. 608, IG, Syktyvkar]. Cerioid or subcerioid, corallites slender; peripheral ends of long major and minor septa thickened and forming moderately wide stereozone; septa thin elsewhere, in places discontinuous longitudinally; ?counter septum may extend beyond axis; septa composed of contiguous trabeculae directed radially upward and inward; tabulae complete, close, horizontal or slightly concave in wide tabularium; one discontinuous series of long dissepiments may develop. *M.Dev.*, Eu.(Polar Urals).——Fig. 156,*3a,b*. **C. compacta*, holotype, Givet., R. B. Nadota, Polar Urals; *a,b*, long., transv. secs., ×4 (Tsyganko, 1971).

Vepresiphyllum Etheridge, 1920, p. 61 [**V. falciforme*; M; †F51713, AM, Sydney]. Cerioid or fasciculate; corallites slender with moderately thick walls; major and minor septa commonly wavy, both bearing curved vepreculae arranged in rows that curve upward and inward from wall; axial edges of septa spinose; tabular floors concave, of complete tabulae; occasional irregular, large, lonsdaleoid dissepiments in a few; increase lateral, offsets small, in cerioid coralla appearing at corners of parent calices [see Hill, 1940b, p. 263; Pedder, Jackson, & Philip, 1970, p. 219]. *L.Dev.(Ems.)*, Australia(New S.Wales).——Fig. 156,*1a,b*. **V. falciforme*, Taemas Ls. some 500 m. along strike from type locality, New S. Wales, Portion 6, Parish Goodradigbee, Wee Jasper area; *a,b*, long., transv. secs., ×4 (Pedder, Jackson, & Philip, 1970).

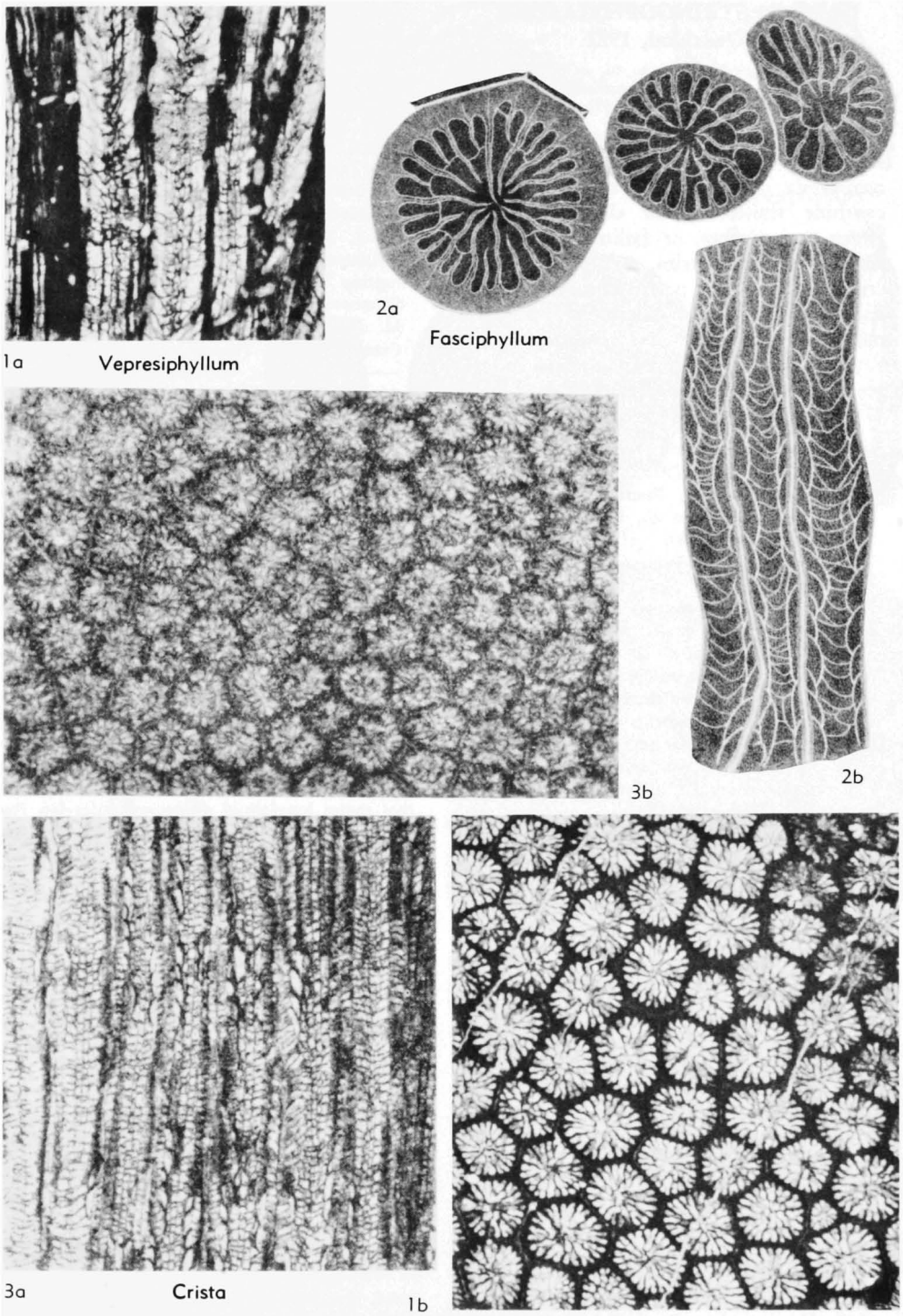


FIG. 156. Fasciphyllidae (p. *F*246-*F*248).

?Family STRINGOPHYLLIDAE Wedekind, 1922

[*nom. transl.* Wedekind, 1925, p. 46, *ex* Stringophyllinae Wedekind, 1922a, p. 3] [?=Sunophyllinae Kong in Kong & Huang, 1978, p. 118]

Solitary and phaceloid Rugosa with bilaterally arranged major septa; minor septa commonly only as septal crests, or monacanthine trabeculae on dissepiments between major septa, or failing; monacanths coarse, in single series, contiguous or discrete; marginarium partly or totally of lonsdaleoid dissepiments; tabularium predominantly of close, concave or more or less flat tabulae, deepest part in cardinal-counter plane [Birenheide, 1962a, p. 52]. *L.Dev.-M.Dev.*

Stringophyllum Wedekind, 1922a, p. 8 [**S. normale*; SD Wedekind, 1925, p. 64; †4524, 4534, Wedekind Coll., SM, Frankfurt] [?=*Stringophylloides* Jia in Jia *et al.*, 1977, p. 157 (type, *S. tianyangensis,* OD; †IV37042, HPRIGS, Yichang; M.Dev., Tianyang Co., Guangxi (Kwangsi)]. Solitary coralla; septa consisting of single series of coarse contiguous or discrete monacanthine trabeculae; major septa long and arranged bisymmetrically about counter-cardinal plane; minor septa commonly discontinuous longitudinally, represented by short segments or monacanths based on dissepiments; lonsdaleoid dissepiments may disrupt major septa either sporadically or in more or less continuous wide peripheral zone; tabular floors close, depressed toward counter-cardinal plane; tabulae in some complete, more commonly incomplete. *L.Dev.-M.Dev.*

S. (Stringophyllum). With only sporadic disruptions of major septa by lonsdaleoid dissepiments [Birenheide, 1962a, p. 52; Engel & Schouppé, 1958, p. 88]. *L.Dev.,* Eu.(Carnic Alps-France); *M.Dev.,* Eu.(Ger.-Belg.-France-U.K.-Italy-Czech.-Aus.-N.Zemlya)-N.Afr. (Moroc.)-Asia (E.Urals-Armenia-Salair-Kuzbas-Nepal-Yunnan-Kweichow-NE. USSR)-Australia (Queensl.-New S. Wales-W. Australia).——Fig. 157,*1a,b.* **S. normale,* holotype, Givet., Sundwig near Iserlohn, Ger.; *a,b,* long., transv. secs., ×2 (Wedekind, 1925).

S. (Neospongophyllum) Wedekind, 1922a, p. 10 [**N. variabile*; SD Wedekind, 1925, p. 52; †3789-3790, Wedekind Coll., SM, Frankfurt; lectotype by Birenheide, 1962b, p. 121; =*Spongophyllum buechelense* Schlüter, 1889, p. 321, †179, Schlüter Coll., IP, Bonn, lectotype by Engel & Schouppé, 1958, p. 96, which see)] [=*Loipophyllum* Wedekind, 1925, p. 55 (type, *L. kerpense,* OD; †1634, 8346-8347, Wedekind Coll., SM, Frankfurt; Givet., Kerpen, Eifel, Ger.; =*Stringophyllum primordiale* Wedekind, 1922a, p. 10, †3773, 6055, Wedekind Coll., SM, Frankfurt, *fide* Birenheide, 1962b, p. 119, 120, Givet., Hand, near Bergisch-Gladbach, Ger.), =*Loepophyllum* Lang, Smith, & Thomas, 1940, p. 79, *nom. van.; Schizophyllum* Wedekind, 1925, p. 59 (type, *Spongophyllum buechelense* Schlüter, 1889, see above, OD), *non Schizophyllum* Verhoeff, 1895, a recent myriapod; *Vollbrechtophyllum* Taylor, 1951, p. 182 (type, *Spongophyllum buechelense* Schlüter, 1889, see above; OD); *Schizophyllum* Taylor, 1951, p. 182, *nom. null.*]. With more or less continuous and wide peripheral zone of lonsdaleoid dissepiments disrupting both major and minor septa [Engel & Schouppé, 1958, p. 93]. *L.Dev.,* Eu.(?France); *M. Dev.,* Eu. (Ger.-U. K.-Belg.-France-Italy-Czech.)-N. Afr. (Moroc.)-Australia (Queensl.).——Fig. 157,*2a-c.* **N. buechelense* (Schlüter); *a,b,* holotype of *N. variabile,* Givet., Ger., Hand near Bergisch-Gladbach, transv., long. secs., ×2 (Wedekind, 1922a, 1925); *c,* lectotype of *N. buechelense,* Givet., Ger., Büchel, Bergisch-Gladbach, transv. sec., ×2 (Engel & Schouppé, 1958).

Parasociophyllum Kong in Kong & Huang, 1978, p. 111 [**Cyathophyllum isactis* Frech, 1911; OD; †Frech's 1911, p. 49 specimen from the up. M. Dev. of Tshon Terek, Tien Shan, C. Asia, appears conspecific with *Cyathophyllum isactis* Frech, 1886, p. 189 (75), of which there are about 100 syntypes in ZGI, E. Berlin and Wroclaw (Breslau) Museums, from the Givetian of Bergisch-Gladbach and Sötenich, Ger., and Villmar and Pry between the rivers Sambre and Meuse, Belg.]. Like *Stringophyllum* but phaceloid; minor septa completely withdrawn to wall and major septa may be discontinuous longitudinally in places, so that sparse lonsdaleoid dissepiments develop [but see Birenheide, 1978, p. 154]. *M.Dev.,* Eu.(Ger.-Belg.-Czech.)-Asia (Kweichow-Tien Shan)-Australia(Queensl.).

Melrosia Wright, 1966, p. 265 [**M. rosae*; OD; †21104, SU, Sydney] [=*Melasmaphyllum* Wright, 1966, p. 267 (type, *M. mullamuddiensis,* OD; †21103, SU, Sydney)]. Cerioid; increase (in *M. mullamuddiensis*) axial and quadripartite; septa of monacanthine trabeculae that are contiguous or discrete; major septa bilaterally arranged about cardinal-counter plane; minor septa represented mainly by discrete trabeculae based on wall or dissepiments; dissepimentarium with sporadic lonsdaleoid dissepiments, or with more or less continuous peripheral zone of lonsdaleoid dissepiments; tabular floors concave to flat. *L.Dev., ?M.Dev.,* Australia(New S.Wales).——Fig. 157, *4a,b.* **M. rosae,* holotype, Mt. Frome Ls., New S. Wales, N. of quarry NW. of Melrose homestead, near Mudgee; *a,b,* transv., long. secs., ×2.0, ×2.4 (Wright, 1966).——Fig. 157,*4c,d. M. mullamuddiensis* (Wright), holotype, Sutcher's Ck. F., Portion 152, New S. Wales, Parish Broombee,

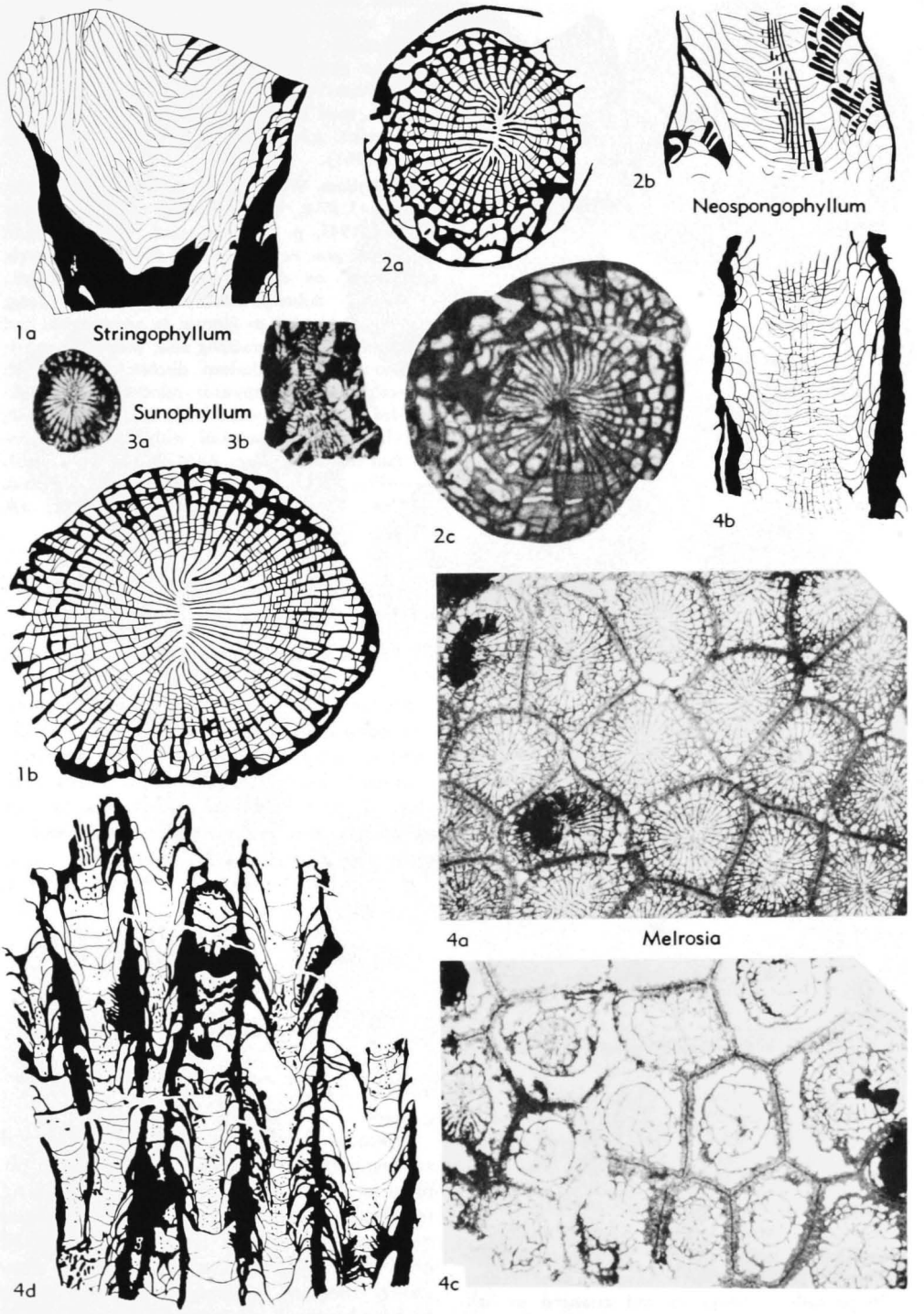


FIG. 157. Stringophyllidae (p. *F248-F250*).

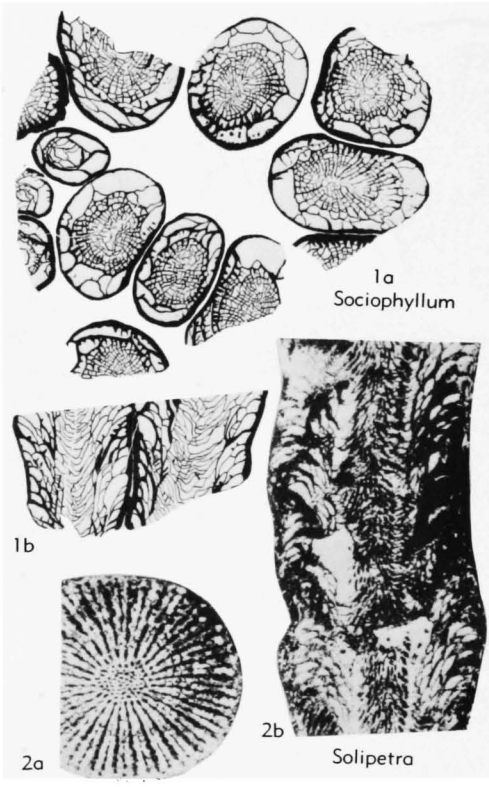


FIG. 158. Stringophyllidae (p. *F250*).

County Wellington, near Mudgee; *c,d,* transv., long. secs., ×3.0, ×2.4 (Wright, 1966).

Sociophyllum BIRENHEIDE, 1962a, p. 53 [**Spongophyllum elongatum* SCHLÜTER, 1881, p. 213; OD; †2 (=B_1), SCHLÜTER Coll., IP, Bonn] [=*Paraspongophyllum* WANG, 1945, p. 30, *nom. nud.,* in combination *P. semiseptatum* only in table; cited p. 29 as "*Paraspongophyllum (Spongophyllum)* SCHLÜTER"]. Like *Stringophyllum (Neospongophyllum)* WEDEKIND, 1922a, but phaceloid [see PEDDER, 1964b, p. 444]. *L.Dev.,* Eu.(France-Aus.)-Asia(Mt.Altay); *M.Dev.,* Eu.(Ger.-Belg.-U. K.-N. Zemlya)-Asia (E. Urals-Nepal-Kuzbas-Yunnan-Kweichow)-Australia(Queensl.-New S.Wales)-N.Am.(Yukon-NW.Terr.-Nev.).——FIG. 158,*1a,b.* **S. elongatum* (SCHLÜTER), lectotype, "Berndorf," ?Givet., presumably within range Ahbach Beds to Cürten Beds, Ger., Eifel; *a,b,* transv., long. secs., ×1.2 (Birenheide, 1962a).

?Solipetra FONTAINE, 1961, p. 159 [**S. vietnamica*; OD; †5183, MSG, Saigon]. Solitary, cylindrical, small; septa straight, thick at periphery, thinning adaxially, each composed of single series of oblique ?monacanths, ?contiguous and arranged in half fan in dissepimentarium, but disjunct and upturned adaxially in tabularium forming loose axial structure; minor septa discontinuous, thinner; tabulae thin, close, subhorizontal or updrawn into axial structure; dissepiments large, horizontally and broadly based near periphery, steeply inclined in inner parts of dissepimentarium. *M.Dev.,* Asia (Viet Nam-Yunnan).——FIG. 158,*2a,b.* **S. vietnamica,* road from Quan-Ba to Yen-Minh, before the bridge; *a,b,* transv., long. secs., ×2.4 (Fontaine, 1961).

?Sunophyllum WANG, 1948, p. 23 [**S. typicum*; OD; †43187-8, GSGI, Peking] [=*Sunophyllum* WANG, 1945, p. 30, *nom. nud.,* in combination *S. tenue gen. et sp. nov.* in table, incompletely diagnosed, no descriptions or figures, M.Dev., Yunnan]. Solitary, small; major septa long, thickened, biradial to pinnate in arrangement and reaching or almost reaching axis; trabeculae coarse, compound, in tabularium discrete and straight, directed adaxially upward; minor septa not extended beyond thin outer wall; dissepiments small, tabularial floors subconical with upturned edges, of thin tabellae. *M.Dev.,* Asia(Yunnan-Kweichow). ——FIG. 157,*3a,b.* **S. typicum,* holotype, mid. M.Dev., Kweichow, 2 km. S. of Silung; *a,b,* transv., long. secs., ×1.5 (Wang, 1948).

Suborder LYCOPHYLLINA Zhavoronkova, 1972

[Lycophyllina ZHAVORONKOVA, 1972, p. 44] [=Lykophyllina STRELNIKOV, 1972, p. 99]

Solitary, rarely fasciculate; septa numerous, commonly long, may be variably thickened in tabularium, more or less pinnately arranged about fossula; tabular floors variable, sagging or flat or low domes, tabulae in some complete, more commonly incomplete; dissepimentarium commonly wide and normally concentric; fossula distinct. *Sil.-M.Dev.*

Family LYKOPHYLLIDAE Wedekind, 1927

[Lykophyllidae WEDEKIND, 1927, p. 11; incl. Lykophyllinae HILL, 1956b, p. *F272*; Lykophyllicae IVANOVSKIY, 1965a, p. 66] [=Lycophyllidae FLÜGEL & SALEH, 1970, p. 277; Lukophyllidae LAVRUSEVICH, 1964, p. 23; Neocystiphyllidae WEDEKIND, 1927, p. 13; Pycnactidae HILL, 1940c, p. 401; Semaiophyllidae STRELNIKOV, 1963, p. 15; ?Stratiphyllidae SCHEFFEN, 1933, p. 35]

Solitary, ?and fasciculate; major septal arrangement in tabularium asymmetrically bilateral, septa of each quadrant differing in flexure and length, those of cardinal quadrants commonly remaining thickened until late stages; cardinal septum commonly shortens in fossula; in early stages (where known), all septa dilated and filling lumen and cardinal septum commonly very long; dissepimentarium when present nor-

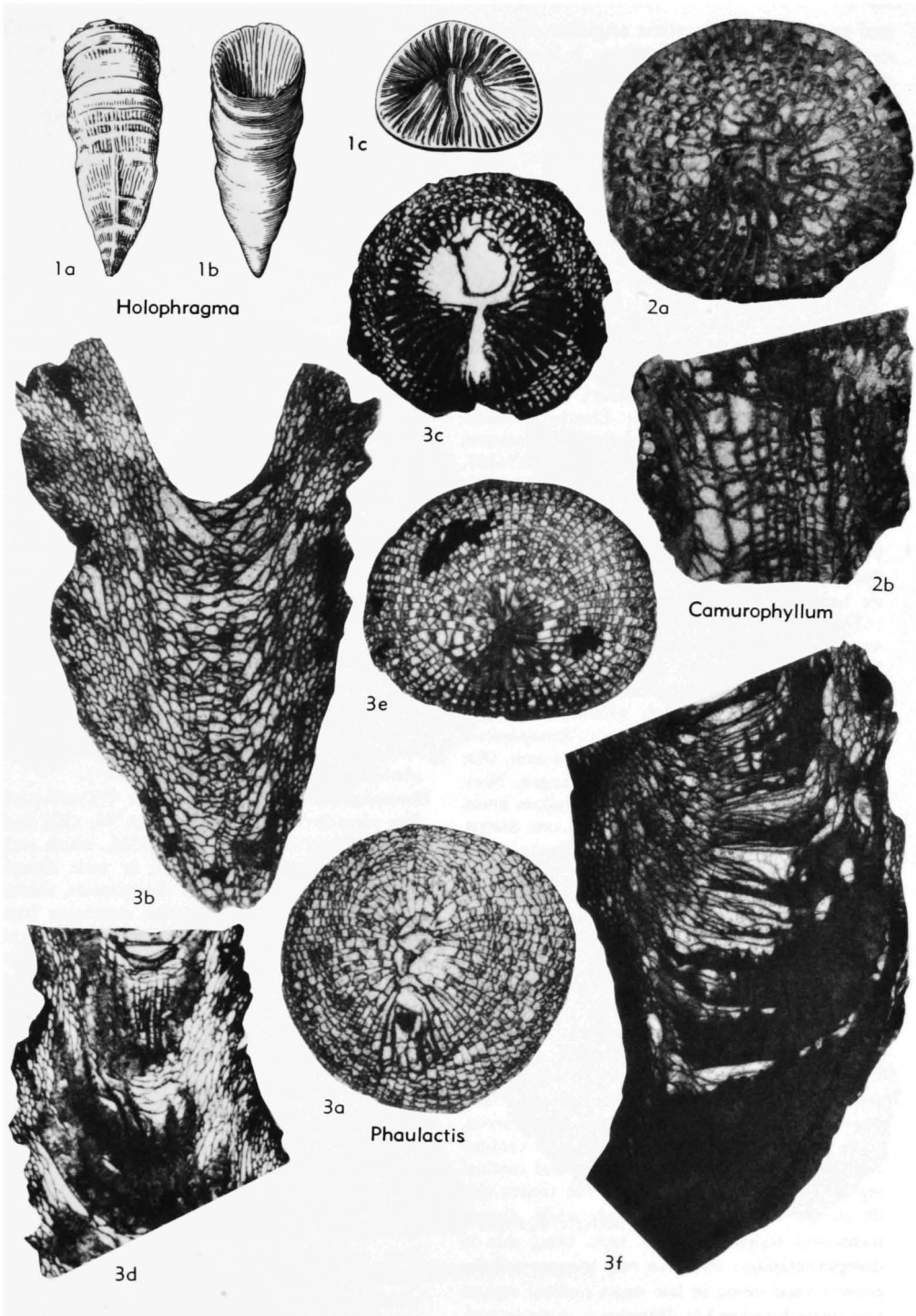


FIG. 159. Lykophyllidae (p. *F252-F253*).

mal concentric, or in some angulate, dissepimentarial parts of septa thin; minor septa commonly complete, may be contratingent, in some withdrawn toward periphery; tabularium wide, tabular floors low domes that may be depressed axially or concave; tabulae incomplete. *Sil.-L.Dev.*

Phaulactis RYDER, 1926, p. 392 [**P. cyathophylloides*; OD; †R25469, BM(NH), London; lectotype by LANG & SMITH, 1927, p. 489] [=*Mesactis* RYDER, 1926, p. 390 (type, *M. glevensis,* OD; syntypes R25449-25464, BM(NH), London; Brinkmarsh Quarry, Whitfield, Gloucestershire, U.K.); *Lykocystiphyllum* WEDEKIND, 1927, p. 69 (type, *L. gracile,* SD LANG, SMITH, & THOMAS, 1940, p. 82; †10366-71, SM, Frankfurt, lectotype by BIRENHEIDE, 1974b, p. 480; Llandov., Snäckgärdsbaden, Gotl.); *Lykophyllum* WEDEKIND, 1927, p. 68 (type, *L. tabulatum,* OD; †Cn54861, 54867, RM, Stockholm; Västkinde, canal through bog S. of Brisund, Gotl.); *?Neocystiphyllum* WEDEKIND, 1927, which see; *Semaiophyllum* VOLLBRECHT in WEDEKIND, 1927, p. 70 (type, *Cyathophyllum angustum* LONSDALE, 1839, p. 690, see LANG, SMITH, & THOMAS, 1940, p. 118, OD; †6574, Geol. Soc. Coll., GSM, London; Sil., Attwood's shaft, Coal Heath, Lickey, Worcestershire, U.K.); *Phragmophyllum* SCHEFFEN, 1933, p. 36, *nom. nud.* (type, *P. corrivatum,* OD, figured but not diagnosed or described; †73688, PM, Oslo; Llandov., Skovengen, Nor.); *?Stratiphyllum* SCHEFFEN, 1933, p. 35 (type, *S. cavernosum,* OD; †73686, PM, Oslo; Zone 7b, Limastangen, Nor.; insufficiently characterized); *?Hercophyllum* JONES, 1936a, which see; *Lycocystiphyllum* LANG, SMITH, & THOMAS, 1940, p. 81, *nom. van.; Lycophyllum* LANG, SMITH, & THOMAS, 1940, p. 82, *nom. van.; Semaeophyllum* LANG, SMITH, & THOMAS, 1940, p. 118, *nom. van.; ?Pseudolindstroemia* MA, 1943, p. 53 (type, *P. wedekindi,* M; †not traced; Sil., Gotl.); *Prodesmophyllum* COTTON, 1973, p. 161, *nom. subst. pro Desmophyllum* WEDEKIND, 1927, p. 76 (type, *D. clarkei,* OD; †10927-10929, WEDEKIND Coll., SM, Frankfurt; Wenlock., Fårö, NE. of Gotl.)]. Solitary, in early stages all major septa strongly dilated and contiguous, cardinal septum very long, minor septa very short; in later stages dissepiments first appearing in single series, septal dilatation still pronounced in both cardinal and counter quadrants in tabularium, and cardinal septum shortening so that fossula (on convex side of curved corallum) is marked, while dissepimentarium widens elsewhere, septa being thin in dissepimentarium; dilatation may increase and decrease several times; in late stages cardinal septum may again lengthen but dilatation is slight in both cardinal and counter quadrants; septal arrangement in tabularium irregularly bilateral, each quadrant has individuality in variable curvature and length of major septa; fossula may invade dissepimentarium; tabular floors variable, concave, convex, or subhorizontal, of tabellae; dissepiments small, subglobose, concave toward axis in transverse section and curved or angulate [MINATO, 1961, p. 46]. *Sil.(Llandov.-Ludlov.,?Skal.),* Eu. (U.K.-Nor.-Swed.-Podolia)-Asia (Sib. Platf.)-Australia(Queensl.)-N.Am.(Que.).——FIG. 159,*3a.* **P. cyathophylloides,* lectotype, Wenlock., Slite Gr., Gotl., Västergarn; *a,* transv. sec., ×2.0 (Lang & Smith, 1927).——FIG. 159,*3b.* *P. angusta* (LONSDALE), holotype, U.K., Lickey; *b,* long. sec., ×2.0 (Lang & Smith, 1927).——FIG. 159,*3c,d.* *P. clarkei* (WEDEKIND), holotype, Fårö, NE. of Gotl.; *c,d,* transv., long. secs., ×1.5 (Wedekind, 1927). ——FIG. 159,*3e,f.* *P. tabulatum* (WEDEKIND), holotype, Gotl., Västkinde, canal through bog S. of Brisund village; *e,f,* transv., long. secs., ×2.0 (Hill, n; Cm54867).

?Camurophyllum KRAVTSOV, 1966, p. 55 [**C. camurum*; OD; †36, coll. 8941, TsGM, Leningrad]. Solitary, subcylindrical or conical; calice deep, goblet-shaped, with wide, flat floor and steep walls; septa somewhat dilated in dissepimentarium, thinning adaxially, major septa reaching axial region, about which their axial ends may be convolute; tabularium wide, tabulae incomplete; tabular floors domes with upturned edges; dissepiments small, subglobose. [Possibly ptychophyllid.] *L.Dev.(?Siegen.),* Eu.(N.Zemyla).——FIG. 159,*2a,b.* **C. camurum,* holotype, Tsivolko Bay, N. Zemyla, low. zone Valnevsk horizon; *a,b,* transv., long. secs., ×2 (Kravtsov, 1966; photographs courtesy A. G. Kravtsov).

Hercophyllum JONES, 1936a, p. 53 [**Cyathophyllum shearsbyi* SÜSSMILCH, 1914, p. 44; OD; †not traced] [?=*Phaulactis* RYDER, 1926, which see]. Large, solitary; septa attenuate in wide dissepimentarium of small globose dissepiments, dilated at first in tabularium, dilatation decreasing from axis outward during ontogeny, with or without an early reversal; major septa reaching or almost reaching axis and gently convolute; tabularium wide, with gently domed tabular floors, commonly of large tabellae; dissepiments may be angulate in transverse section. *U.Sil.,* Australia(New S. Wales-Queensl.).——FIG. 160,*1a-e.* **H. shearsbyi* (SÜSSMILCH), New S. Wales, Hatton's Corner, Derrengullen Ck., Yass; *a-d,* transv. secs., ×1.5; *e,* long. sec., ×1.5 (Jones, 1936a).

Holophragma LINDSTRÖM, 1896b, p. 35 [**Hallia calceoloides* LINDSTRÖM, 1866, p. 289; M; syntypes not identified in LINDSTRÖM Coll., RM, Stockholm]. Solitary, small, suberect, calceoloid; long cardinal septum on flattened side; marginarium a septal stereozone without dissepiments; tabularium filled with thickened contiguous major septa; minor septa very short [MINATO, 1961, p. 71]. *L. Sil. (up. Llandov.)-M. Sil. (low. Wenlock.),* Eu.(Gotl.)-N.Am.(Ohio).——FIG. 159,*1a-c.* **H. calceoloides* (LINDSTRÖM), low. Wenlock., Visby,

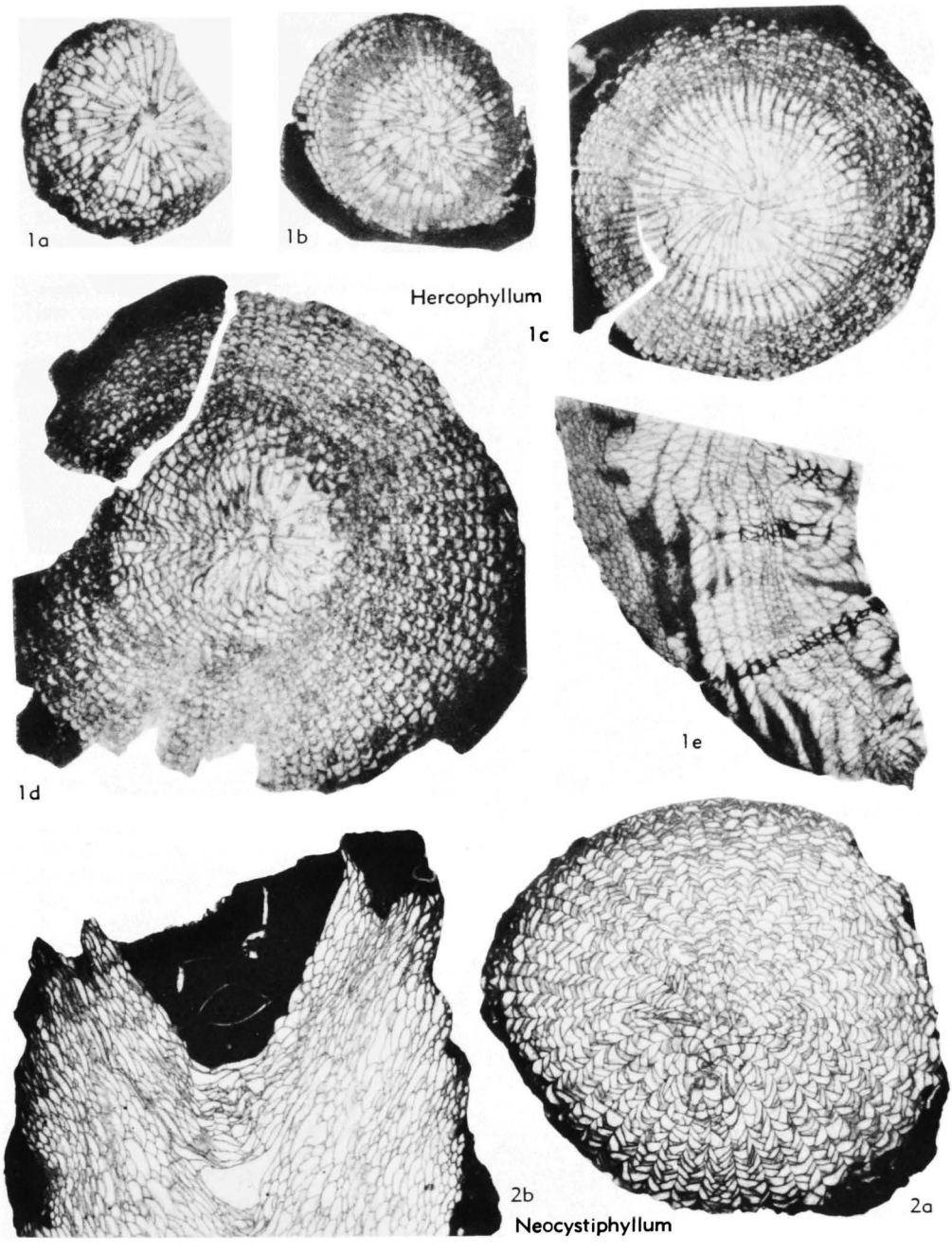


FIG. 160. Lykophyllidae (p. *F252-F255*).

Gotl.; cardinal, counter, calical views, *a,b,* ×1, *c,* ×2 (Lindström, 1896b).

Neocystiphyllum WEDEKIND, 1927, p. 77 [**N. Mc Coyi*; OD; †10933, 10944, WEDEKIND Coll., SM, Frankfurt] [?=*Phaulactis* RYDER, 1926, which see, see also MINATO, 1961, p. 46]. Like *Phaulactis* but minor septa withdrawn almost to periphery, leaving wide angulate dissepimentarium;

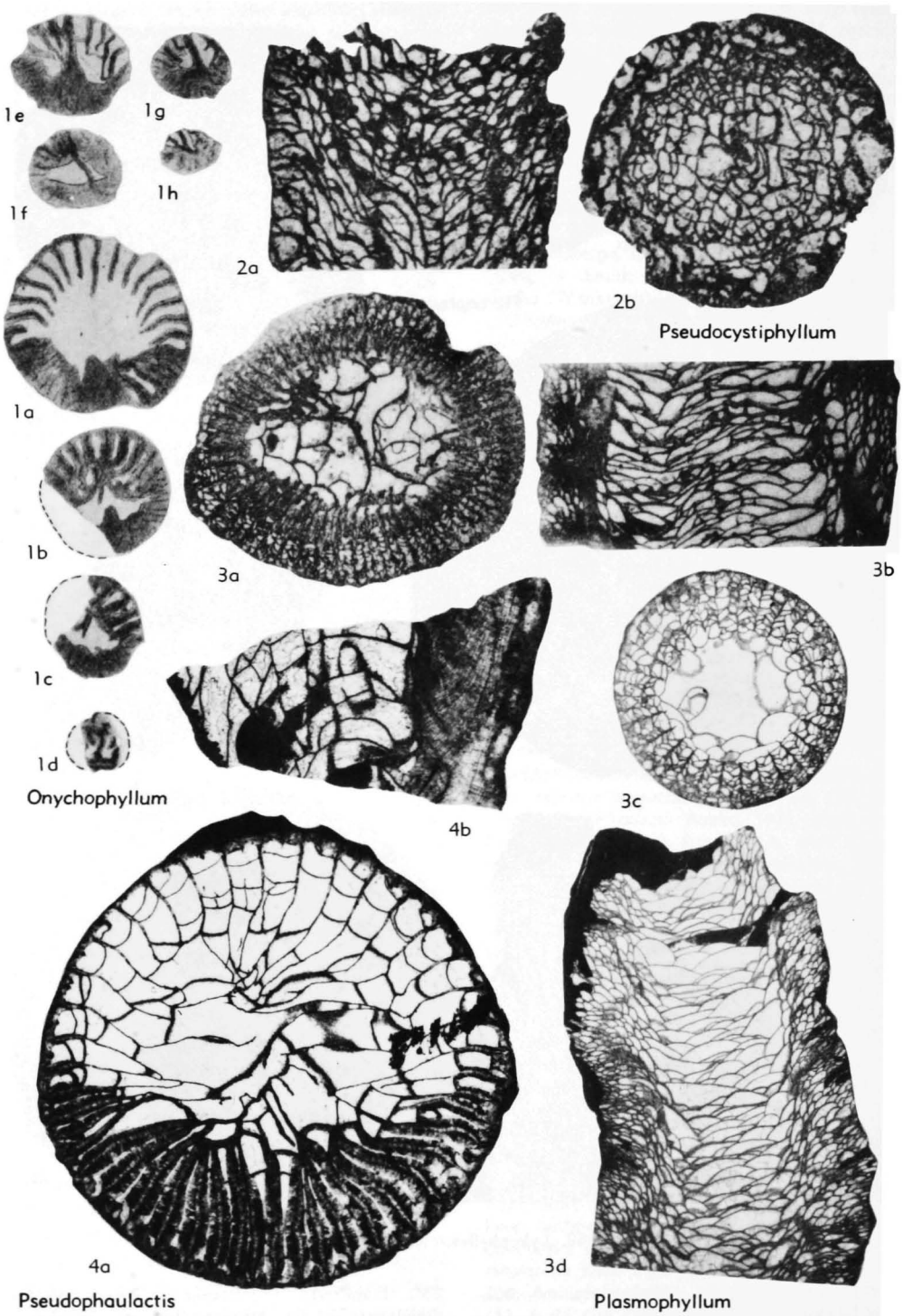


FIG. 161. Lykophyllidae (p. *F255*).

tabular floors commonly inversely conical, of small globose tabellae. *M.Sil.*, Eu.(Gotl.-?Nor.-?Polar Urals)-?Asia(Sib.Platf.).——Fig. 160,*2a,b*. **N. maccoyi*, holotype, beds with *Pentamerus tenuistriatus*, Fårö, near Gotl.; *a,b*, transv., long. secs., ×2 (Wedekind, 1927; photographs courtesy R. Birenheide).

?**Onychophyllum** Smith, 1930a, p. 301 [**O. pringlei*; OD; †49070 and PF4694, GSM, London]. Small, solitary, trochoid, calice deep; septa short, thick, irregular, those of cardinal quadrants longer and thinner than those in counter quadrants, with conspicuous axial septum that parts in late stages into long, thin counter septum and short, thick cardinal septum; tabulae not well known; no dissepiments. [Observations by Dr. J. S. Jell, unpubl.] *L.Sil.(Llandov.)*, Eu.(U.K.)-Asia(Hupei).——Fig. 161,*1a-h*. **O. pringlei; a-d*, holotype, serial transv. secs., *a* through calice, ×3; *e-h*, another specimen, serial transv. secs., ×3 (Smith, 1930a).

Plasmophyllum Dybowski, 1873c, p. 340 [**Cystiphyllum brevilamellatum* McCoy, 1850, p. 276; SD Dybowski, 1875, p. 288; †A4829, SM, Cambridge] [=*Lamprophyllum* Wedekind, 1927, p. 78 (type, *L. De Geeri*, OD; †11139-11140, Wedekind Coll., SM, Frankfurt, SD Birenheide, 1974b, p. 479; Hablingbo, Petesviken, Gotl.); *?Sverigophyllum* Minato, 1961, which see]. Solitary, cylindrical; major septa withdrawn from axis, somewhat thickened marginal to tabularium, thin with pinnately divergent lateral dissepiments in dissepimentarium; minor septa complete or withdrawn to periphery; dissepiments concentric to angulate; tabular floors subhorizontal, of tabellae. *M.Sil.(Wenlock.)*, Eu.(Eng.-Gotl.-Pripolar Urals); *?U.Sil.*, N.Am.(Alaska).——Fig. 161,*3a,b*. **P. brevilamellatum* (McCoy), holotype, Wenlock Ls., Eng., Wenlock; *a,b*, transv., long. secs., ×2 (Lang & Smith, 1927).——Fig. 161,*3c,d*. *P. degeeri* (Wedekind), holotype; transv., long. secs., ×2 (Wedekind, 1927; photographs courtesy R. Birenheide).

?**Pseudocystiphyllum** Wang, 1947a, p. 179 [**P. lini*; OD; †42181-42182, GSGI, Peking]. Corallum solitary, subcylindrical; septa thin, unequally developed, commonly as septal crests on dissepiments and tabellae; dissepimentarium with large, irregularly lonsdaleoid plates; tabular floors concave with indistinct wide median notch. *M.Sil.*, Asia (Yunnan).——Fig. 161,*2a,b*. **P. lini*, holotype, Sayuhokou, Takuan; *a,b*, long., transv. secs., ×2 (Wang, 1947a).

Pseudophaulactis Zaprudskaya in Ivanovskiy, 1963, p. 32 [**P. lykophylloides*; OD; †7, coll. 305, IGG, Novosibirsk] [?=*Pycnactis* Ryder, 1926, which see]. Septa in early stages thickened to contiguity, in adult stages thin, reduction in thickening first affecting those of counter quadrants; axial ends of major septa somewhat withdrawn from axis and flexed to join in groups in each

Fig. 162. Lykophyllidae (p. *F255*).

quadrant; minor septa very short; axial structure absent; tabulae convex; dissepiments absent. *L.Sil. (up.Llandov.)*, Asia(Sib.Platf.-Tadzhik.).——Fig. 161,*4a,b*. **P. lykophylloides*, holotype, R. Gorbiyachin; *a,b*, transv., long. secs., ×4 (Ivanovskiy, 1963; photographs courtesy A. B. Ivanovskiy).

Pycnactis Ryder, 1926, p. 386 [**Hyppurites mitratus* von Schlotheim, 1820, p. 352; OD; †in Schlotheim Coll., HU, E. Berlin; lectotype by Lang, Smith, & Thomas, 1940, p. 112] [?=*Pseudophaulactis* Zaprudskaya, 1963, which see]. Solitary, curved trochoid, with oblique calice; major septa dilated and extending almost to axis; in early stages cardinal septum longer and thicker than others; minor septa very short, dilated; tabulae seldom seen due to dilatation of septa; rare dissepiments may occur in calice only. [Until lectotype is restudied and illustrated, generic name (*sensu* Smith, 1945, p. 53) cannot be used with confidence.] *Sil.*, Eu.(Gotl.-U.K.).——Fig. 162,*1*. **P. mitratus* (von Schlotheim), Gotl., Swed.; ext. view, ×1 (Hisinger, 1831).

?**Reimanophyllum** Lavrusevich, 1971b, p. 84 [**R. reimani*; OD; †203/12, ?UpG, Dushanbe]. Phaceloid; increase peripheral and nonparricidal; septa short; tabulae wide, basin-shaped, complete or incomplete; dissepiments in single series of plates flat peripherally and declined into tabularium. *L.Dev.(Gedinn.)*, Asia(Tadzhik.).——Fig. 163,*4*. **R. reimani*, holotype, up. Argian subsuite, beds with *Chavsakia chavsakiensis*, Turk-parida gully, Zeravshan-Gissar Ra.; transv., long. secs., ×3 (Lavrusevich, 1971b).

Rukhinia Strelnikov, 1963, p. 15 [**R. cuneata*; OD; †20, coll. 654, VNIGRI, Leningrad]. Solitary, cylindrical; major septa long, thick at periphery and thinning toward axis; cardinal septum thin, short, in fossula; axial ends of major septa forming distinctive, loose axial structure in median plane; in late stages septa somewhat thickened in counter quadrants; minor septa very short; dissepiments appearing only in latest stages of development; tabulae incomplete, forming floors convex

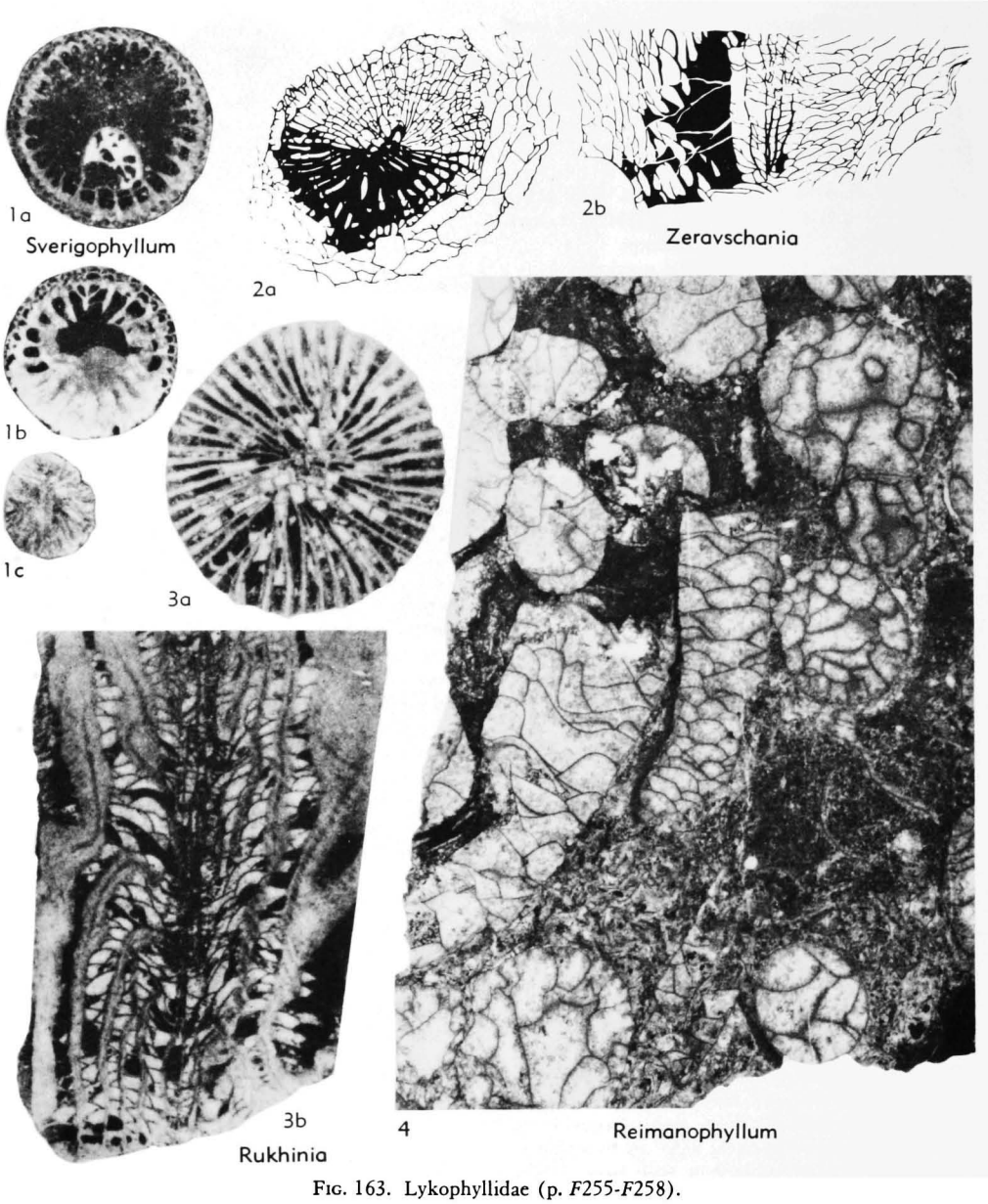


FIG. 163. Lykophyllidae (p. *F255-F258*).

peripherally and flat or concave in center; septal microstructure as in *Phaulactis*. *L.Sil.(up.Llandov.)*, Asia(Sib.Platf.).——FIG. 163,*3a,b*. **R. cuneata*, holotype, up. Llandov., R. Letney, W. part of Sib. Platf.; *a,b*, transv., long. secs., ×3 (Strelnikov, 1963).

Ryderophyllum CHEREPNINA, 1965, p. 31 [**R. kasandiense*; OD; †12/10, coll. 518, SNIIGGIMS, Novosibirsk]. Large, solitary, cylindroconical; with numerous long septa locally discontinuous longitudinally and present as crests in dissepimentarium, and in late stages somewhat withdrawn from axis; cardinal septum shortened in fossula; in young stages all septa long, strongly thickened and extending to axis; in late stages reduction of thickening occurs by quadrants, tabularial parts become thread-thin and in dissepimentarium thickening reduces toward axis; tabularium wide, tabular floors broad, low domes, tabulae complete or incomplete; dissepimentarium concentric or anguloconcentric, with scattered lonsdaleoid dissepiments. [Possibly ptychophyllid.] *Sil.(low.*

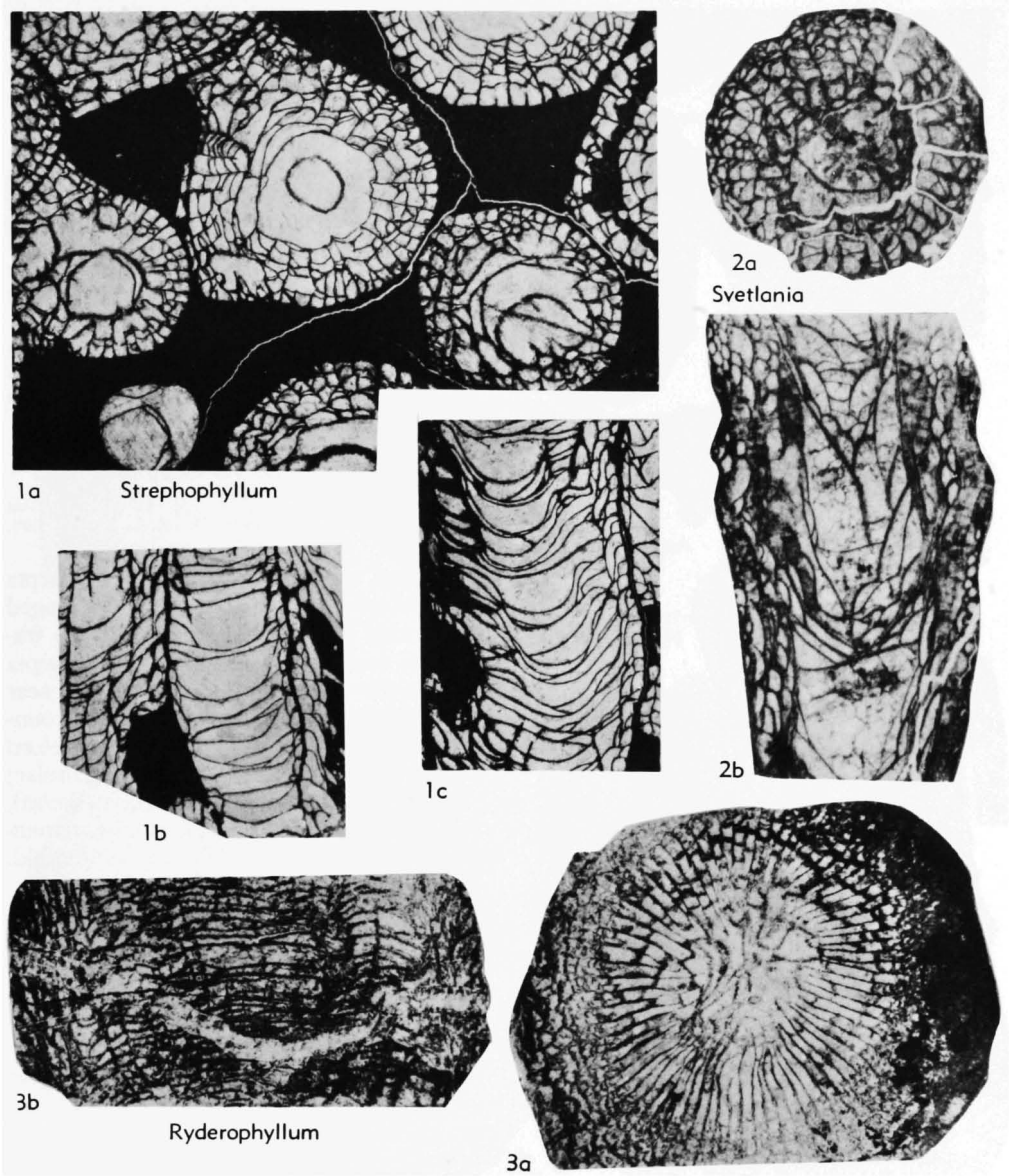


FIG. 164. Lykophyllidae (p. *F256-F258*).

Ludlov.), Asia(Altay)-?N.Am.(Cal.).——FIG. 164, *3a,b*. **R. kasandiense*, R. Kasanda; *a,b*, transv., long. secs., ×1.6 (Cherepnina, 1965).

?**Strephophyllum** LAVRUSEVICH, 1971a, p. 77 [**S. princeps*; OD; †3811, coll. 802, UpG, Dushanbe]. Fasciculate, bushy; increase peripheral, nonparricidal; major septa somewhat withdrawn from axis and may be discontinuous; minor septa withdrawn toward periphery; tabulae complete or incomplete, floors concave; dissepiments unequal, inclined. [Possibly entelophyllid.] *M.Sil.*, Asia(Tadzhik.).——FIG. 164,*1a-c*. **S. princeps*, holotype, low. Wenlock., Bed k, Mt. Daurich, Zeravshan-Gissar Ra.; *a*, transv., *b,c*, long. secs., ×3.2 (Lavrusevich, 1971a).

Sverigophyllum MINATO, 1961, p. 68 [**S. hesslandi*; OD; †Co3, US, Stockholm] [?=*Plasmophyllum* DYBOWSKI, 1873c, which see]. Solitary, small, curved, trochoid, longer side cardinal; in early stage cardinal septum long, extending to end of counter septum, all septa thickened so as to fill lumen; in next stage septa of counter quadrants

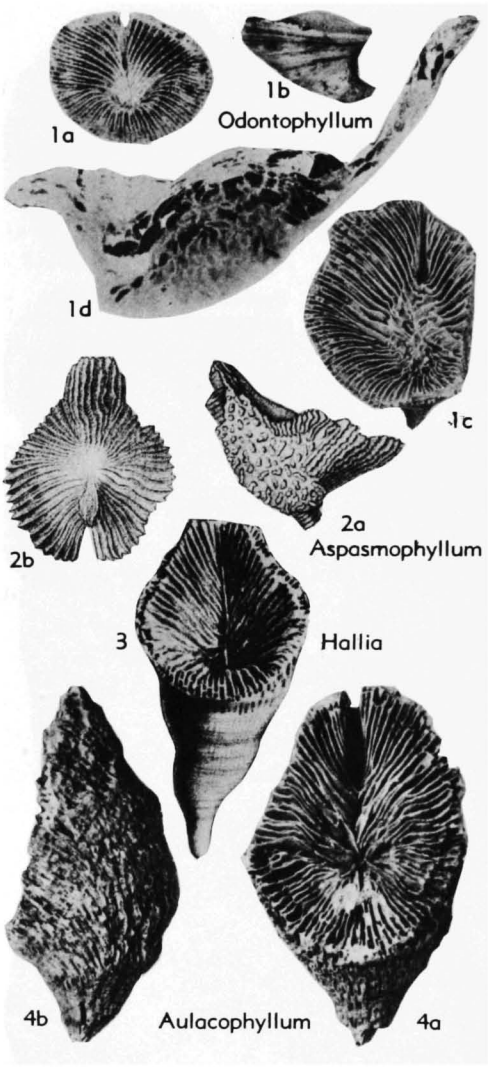


FIG. 165. Halliidae (p. *F258-F260*).

become short and thin, and subsequently those of counter quadrants also shorten; in late stages dissepiments appear, in few series, all septa thin, and sections of tabulae appear. [Only holotype known.] *Sil.*, Eu.(Gotl.).——FIG. 163,*1a-c*. **S. hesslandi*, holotype; *a-c*, transv. secs., ×4 (Minato, 1961).

Svetlania SYTOVA, 1970, p. 76 [**S. tcherkesovae*; OD; †76/10316, TsGM, Leningrad]. Solitary, cylindroconical; septa thickened in early stages; major septa withdrawn from axis in late stages; minor septa withdrawn toward periphery, leaving angulate dissepiments; tabularium narrow, tabulae infundibuliform, deeply concave, arranged in series; among them develop convex tabellae; dissepiments elongate and highly inclined, may be thickened. *U.Sil.(Greben.)*, Eu.(Vaygach I.).——FIG. 164,*2a,b*. **S. tcherkesovae*, holotype, low. part Grebeni horizon, Belushya Inlet; *a,b*, transv., long. secs., ×3.3 (Sytova, 1970).

?**Zeravschania** LAVRUSEVICH, 1964, p. 25 [**Z. prima*; OD; †3498/15, ?UpG, Dushanbe]. Solitary, large; septa long and in early stages strongly thickened, thickening decreasing during ontogeny so that in late stages it is retained only in cardinal quadrants of tabularium; outer lonsdaleoid zone developed in wide dissepimentarium in late stages; tabular floors concave, of tabellae. *L.Sil.(up. Llandov.)*, Asia(Tadzhik.).——FIG. 163,*2a,b*. **Z. prima*, holotype, up. Llandov., Mt. Daurich, Zeravshan-Gissar Ra.; *a,b*, transv., long. secs., ×1.5 (Lavrusevich, 1964).

Family HALLIIDAE Chapman, 1893

[Halliidae CHAPMAN, 1893, p. 46] [=Aulacophyllidae SOSHKINA, 1949a, p. 37; Hallidae SYTOVA & ULITINA, 1970, p. 119]

Solitary, curved, conical, with metasepta of cardinal quadrants pinnately arranged about long cardinal septum in elongate fossula on convex side of corallum; metasepta of counter quadrants short, radial near counter septum but sequentially from counter septum curving more toward parallelism with alar septa and distinct alar fossulae; tabular floors commonly somewhat arched, tabulae commonly incomplete; dissepimentarium normal concentric or lonsdaleoid. *L.Dev.-M.Dev.*

Subfamily HALLIINAE Chapman, 1893

[*nom. transl.* STUMM, 1949, p. 15, *ex* Halliidae CHAPMAN, 1893, p. 46]

Halliids with normal dissepimentarium of interseptal dissepiments. *M.Dev.*

Hallia MILNE-EDWARDS & HAIME, 1850, p. lxvii [**H. insignis*; OD; †? in DE VERNEUIL Coll., EM, Paris]. Solitary, conical, moderately large, with elongate thin cardinal septum in long narrow fossula on longer side of corallum; metasepta of cardinal quadrants ?thin, arranged pinnately to fossula; minor septa short; septa ?not carinate; dissepimentarium narrow, attitude of tabularial floors not known in type species. [Holotype insufficiently known.] *M.Dev.(Givet.)*, N.Am.(Ohio-?Ind.-Mich.).——FIG. 165,*3*. **H. insignis*, holotype, ?Columbus Ls., Ohio, Columbus; ext. view, cardinal septum at top, ×0.8 (Milne-Edwards & Haime, 1851).

Aulacophyllum MILNE-EDWARDS & HAIME, 1850, p. lxvii [**Caninia sulcata* D'ORBIGNY, 1850, p. 105; OD; †B3157a (=443a), D'ORBIGNY Coll., MN, Paris; lectotype by THEVENIN, 1906, p. 196]

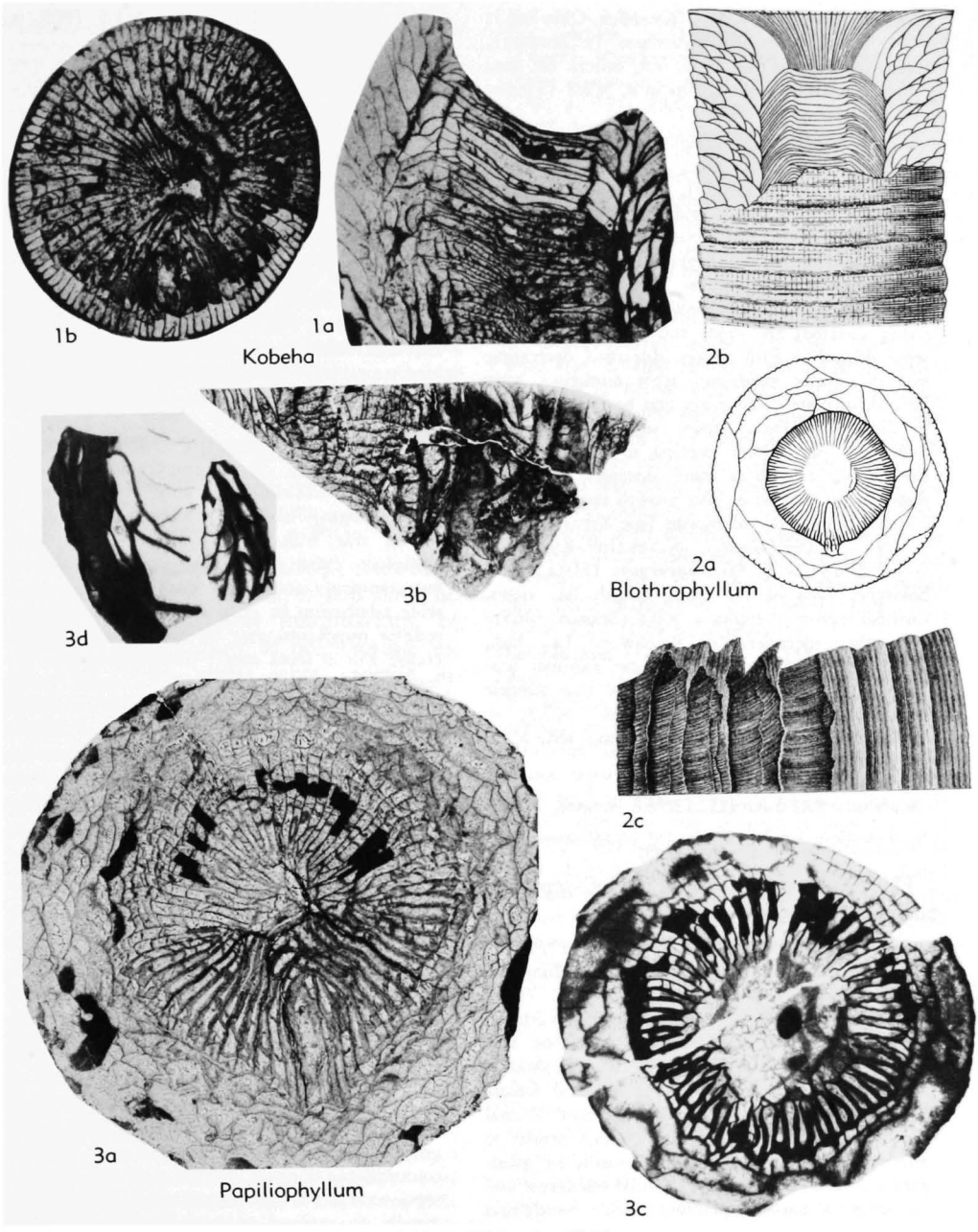


FIG. 166. Halliidae (p. *F260*).

[=*Pinnatophyllum* GRABAU, 1922, p. 13 (type, *Cyathophyllum scyphus* ROMINGER, 1876, p. 103, OD; †8568, UMMP, Ann Arbor, lectotype by STUMM, 1963b, p. 142)]. Solitary, with septa in cardinal quadrants long and pinnately arranged about fossula on convex side of corallum, and radial and shorter in counter quadrants; septa dilated in early stages, dilatation decreasing from periphery to axis first in counter quadrants, later in cardinal quadrants; tabulae incomplete, tabularial floors commonly somewhat arched; small interseptal dissepiments present. [Thin section study of holotype required; STUMM's (1963b, p. 140) interpretation followed herein.] *M.Dev.*

(Couvin.-Givet.), N. Am. (Ky.-Mich.-Ohio-Ind.). ——FIG. 165,*4a,b.* **A. sulcatum* (D'ORBIGNY), lectotype, Falls of the Ohio; *a,b,* calical, lat. ext. views, cardinal septum at top in *a,* ×0.8 (Thevenin, 1906).

Odontophyllum SIMPSON, 1900, p. 210 [**Aulacophyllum convergens* HALL, 1882, p. 22; OD; †11124, NYSM, Albany]. Solitary, patellate, strongly curved; calice wide, shallow, with or without extended platform; axis eccentric, on counter side, cardinal septum on convex side, long, low, in long, narrow, deep fossula toward which metasepta of cardinal quadrants are pinnately directed; alar septa and counter septa tall; septa dilated in early stages, dilatation decreasing first in counter quadrants; septa numerous, may have denticulate distal edges and be finely carinate in dissepimentarium; major septa extending to axis, with or without curving or forming axial boss; minor septa short, small concentric interseptal dissepiments present in later growth stages; tabulae commonly domed, incomplete [see STUMM, 1965, p. 29]. *M.Dev.(Givet.),* N.Am.(Ind.-Ky.-Ont.). ——FIG. 165,*1a-d.* **O. convergens* (HALL); *a,b,* holotype, Falls of the Ohio, calical, lat. views, cardinal septum at top in *a,* ×0.8 (Stumm, 1965); *c,d,* other specimens, *c,* Beechwood Ls., Ind., Charlestown Landing, calical view, cardinal septum at top, paliform lobes in axial boss suggest relationship with Streptelasmatidae, ×0.8; *d,* Hungry Hollow F., Ont., Arkona, long. sec., ×1.6 (Stumm, 1948c).

Subfamily PAPILIOPHYLLINAE Stumm, 1949

[Papiliophyllinae STUMM, 1949, p. 16] [?=Blothrophyllinae STUMM, 1949, p. 19]

Halliidae with lonsdaleoid dissepimentarium. *L.Dev.,?M.Dev.*

Papiliophyllum STUMM, 1937, p. 430 [**P. elegantulum*; OD; †133476, USNM, Washington] [=*Eurekaphyllum* STUMM, 1937, p. 431 (type, *E. breviseptatum,* OD; †94449, USNM, Washington; basal 500 ft. of Nevada Ls., at Lone Mt., 18 mi. NW. of Eureka, Nev.; see BIRENHEIDE, 1974c, p. 253)]. Solitary; long cardinal fossula commonly closed axially, containing short cardinal septum; major septa long, extending nearly to axis or somewhat withdrawn, grouped in quadrants, commonly dilated in cardinal quadrants and attenuate in counter quadrants; wide lonsdaleoid dissepimentarium of elongate dissepiments in later stages; tabularial floors horizontal or weakly convex, greatly deepened in fossula [see BIRENHEIDE, 1974c, p. 253]. *L.Dev.(Ems.),* N.Am.(Nev.)-Eu.(Ger.)-?Asia(NE.USSR).——FIG. 166,*3a,b.* **P. elegantulum,* holotype, basal 500 ft. Nevada Ls., Nev., Lone Mt., 18 mi. NW. of Eureka; *a,b,* transv., long. secs., ×1.3 (Hill, n; photographs courtesy W. A. Oliver).——FIG. 166,*3c,d.* *P. breviseptatum* (STUMM), holotype, locality as above; *c,d,* transv., long. secs., ×1.3 (Hill, n; photographs courtesy W. A. Oliver).

?Blothrophyllum BILLINGS, 1859b, p. 129 [**B. decorticatum*; M; †not traced]. Solitary, large, cylindrical, with repeated and regular rejuvenescence rims; septa numerous, developed as continuous longitudinal plates only in peripheral parts of wide tabularium; in lonsdaleoid dissepimentarium septa represented by radial crests on upper surfaces of large dissepiments; cardinal fossula distinct in inner part of dissepimentarium and outer part of tabularium; tabulae complete, wide, flat-topped domes. *?M.Dev.,* N.Am.(Ont.).——FIG. 166,*2a-c.* **B. decorticatum,* "Corniferous" Ls., Ont., Haldemand Co.; *a,b,* syntype, transv., long. secs., ×0.7 (Lambe, 1899-1901), *c,* another syntype, one-half side view, ?×0.7 (Billings, 1859b).

Kobeha MERRIAM, 1974, p. 47 [**K. walcotti*; OD; †159253, USNM, Washington]. Solitary, large, calice deep, flat-bottomed, with erect walls and acute margin; tabularial fossula commonly on convex side with short cardinal septum; septa numerous, major septa long, many reaching axis but commonly amplexoid, thick to contiguous in wide tabularium in early stages, thinning first in counter quadrants, may be discontinuous peripherally; minor septa short; dissepimentarium narrow, of one or a few series of large, steeply inclined plates; tabularial floors wide, mesa-shaped, tabulae complete or incomplete. *L.Dev.(Siegen.),* N.Am.(Nev.).——FIG. 166,*1a,b.* **K. walcotti,* Nevada F., coral zone B, southern Sulphur Springs Ra.; *a,* holotype, long. sec., ×1; *b,* paratype, transv. sec., ×1 (Merriam, 1974).

Subfamily ASPASMOPHYLLINAE Birenheide, 1978

[Aspasmophyllinae BIRENHEIDE, 1978, p. 70]

Hallidae lacking wall and with counter side of corallum attached, commonly to crinoid stalk, by sclerenchyme. *M.Dev.*

Aspasmophyllum ROEMER, 1880, p. 184 [**A. crinophilum*; M; †not traced; =*A. philocrinum* (sic) ROEMER, 1883, p. 377]. Solitary, curved, trochoid, lacking epithecate wall, attached to foreign body, commonly crinoid stalk, by sclerenchymal outgrowth; cardinal fossula on free side; cardinal-counter plane elongate, cardinal septum long; minor septa very short; major septa commonly thickened distally, in cardinal quadrants pinnately arranged toward cardinal septum; tabulae in proximal parts of corallum. *M.Dev.(Eifel.-Givet.),* Eu.(Ger.).——FIG. 165,*2a,b.* **A. crinophilum,* Eifel, Gerolstein; *a,b,* lat., calical views, ×0.8 (Roemer, 1883).

Suborder COLUMNARIINA Soshkina, 1941

[*nom. correct.* HILL, 1954, p. 37 (*ex* Columnariida SOSHKINA, 1941, *nom. transl.* CHEREPNINA, 1960, p. 391, *ex*

Columnariacea SOSHKINA, 1941, p. 30)] [=Thamnophyllina SOSHKINA, 1954, *emend.* SPASSKIY, 1965a, p. 85, *pro* Thamnophyllida SOSHKINA, 1954, p. 65, taxon above family-group; Phillipsastracina SCHOUPPÉ, 1958, *emend.* SPASSKIY, 1965a, p. 85, *pro* Phillipsastraeacea SCHOUPPÉ, 1958, p. 217, suborder; Macgeeina SPASSKIY, 1965a, p. 88; Marisastrina SPASSKIY in SPASSKIY & CHEREPNINA, 1972, p. 83] [HILL (1956b, p. F296) wrongly assumed that ROMINGER (1876, p. 10) used "sub-order Columnariae" formally; his full text makes it clear that he used both "order" and "suborder" informally to imply several different degrees of subdivision, not necessarily for groups above family-groups]

Solitary or compound Stauriida with dissepimentarium of small, subglobose dissepiments that may include a pipe of horseshoe dissepiments, in some with a pipe of flat dissepiments around it; tabulae complete or, more commonly, incomplete; increase commonly marginarial. *M.Sil.-Dev.*

Family ACERVULARIIDAE de Fromentel, 1861

[*nom. correct.* LECOMPTE, 1952, p. 473, *pro* Acervulariens DE FROMENTEL, 1861, p. 308]

Solitary, fasciculate or cerioid; with inner wall formed at or abaxial to boundary between tabularium and marginarium, by dilatation to contiguity of neighboring major and minor septa; septa radially arranged; septal trabeculae directed adaxially upward from thin outer wall and from adaxial side of inner wall, but diverging radially at inner wall so that in narrow zone related to flat dissepiments they proceed longitudinally or even abaxially upward; tabular floors flat or slightly arched upward, or with broad inversely conical depression; tabulae complete or incomplete; in marginarium interseptal loculi may be crossed by subhorizontal plates alone or by one or two series of small globose dissepiments on axial side of both outer and inner walls; fossula not obvious. *M.Sil.-U.Sil.*

Acervularia SCHWEIGGER, 1819, table vi [**A. baltica*; M; =*Madrepora ananas* LINNÉ, 1758, p. 797, M, †not traced] [?=*Floscularia* EICHWALD, 1829, p. 188 (type, *F. luxurians,* SD LANG, SMITH, & THOMAS, 1940, p. 62; †1, coll. 234, LGU, Leningrad, lectotype by FEDOROWSKI & GORYANOV, 1973, p. 24; Sil., drift, Lithuania, which is probably *Madrepora ananas* LINNÉ), *non Floscularia* CUVIER, 1798, a rotifer; *Favastrea* DE BLAINVILLE, 1834, p. 686 (type, *Astraea baltica* (SCHWEIGGER) DE BLAINVILLE, 1830, p. 340, *partim,* SD LANG, SMITH, & THOMAS, 1940, p. 60; †not traced; Sil., Gotl., =*Madrepora ananas* LINNÉ); *?Arachnium* KEYSERLING, 1846, p. 153, *nom. nud.* (type, *Corallium Arachnion . . . . vorticalis* of VOLKMANN, 1720, pl. xviii, SD LANG, SMITH, & THOMAS, 1940, p. 19; †not traced; presumably from drift, Ger., which is probably *Acervularia ananas* (LINNÉ); *Cyathogonium* CHAPMAN, 1893, p. 45 (type, *Acervularia ananas* (LINNÉ), SD STUMM, 1949, p. 33); *Rhabdophyllum* WEDEKIND, 1927, p. 42 (type, *R. cylindricum,* OD; †Cn54986-7, RM, Stockholm, and F10170-1, WEDEKIND Coll., SM, Frankfurt; M.Sil., Hogklint, Gotl.); *Favastraea* LANG, SMITH, & THOMAS, 1940, p. 60, *nom. van.*; *Rhadophyllum* COTTON, 1973, p. 178, *nom. null.*]. Corallum phaceloceroid with quadripartite parricidal increase; septa finely carinate and dilated near inner ends of long minor septa, forming wall within dissepimentarium, at which septal trabeculae diverge radially; major septa long; ?third order septa may develop in some; tabular floors weakly uparched or flat or with broad, inversely conical depression; tabulae commonly incomplete; dissepimentarium with three zones, outer comprising two or more series of globose plates, middle zone consisting of flat plates just outside inner wall, and inner zone adaxial to inner wall of globose plates interleafing with tabellae; increase commonly peripheral. *M.Sil.-U.Sil.,* Eu.(U.K.-Gotl.-Est.)-N.Am. (?Ohio).——FIG. 167,*2a,b.* **A. ananas* (LINNÉ), Sil., Gotl., Klinteberg; *a,b,* transv., long. secs., ×2.0, ×2.7 (Hill, n; UQF12046).

Diplophyllum HALL, 1852a, p. 115 [**D. caespitosum*; M; †1696:1, AMNH, New York; lectotype by OLIVER, 1963, p. G3]. Phaceloid, phaceloceroid, or cerioid; inner wall separating marginarium from tabularium, where major and minor septa thicken to contiguity; major septa may be long, or short and subequal to minor; septal trabeculae may diverge radially at inner wall so that narrow zone of longitudinally or even abaxially inclined trabeculae may be found on abaxial side of inner wall; tabularium wide, tabulae mostly complete, flat to gently arched; in marginarium flat plates cross interseptal loculi; increase commonly peripheral or lateral [see OLIVER, 1963, p. G1]. *M.Sil.,* N.Am.(N.Y.)-Eu. (Gotl.).——FIG. 167,*3a-d.* **D. caespitosum,* Lockport dol., N.Y., Lockport; *a,b,* lectotype, transv., long. secs., ×6.7; *c,d,* topotype, transv., long. secs., ×6.7, ×2.7 (Oliver, 1963).

Oliveria SUTHERLAND, 1965, p. 32 [**O. planotabulata*; OD; †5505, OU, Norman]. Solitary; septa short, thick, subequal, with multiseriate trabeculae and denticulate distal and axial edges; near inner edge of marginarium, major and minor septa thickened and contiguous forming thick inner wall; minor septa commonly discontinuous between inner and thin outer wall; in median plane of septa, trabeculae directed adaxially upward from outer wall, but within inner wall, at least in minor septa, there may be narrow zone in which trabeculae diverge fanwise and become directed abaxially upward; tabularium wide, tabulae complete and flat or slightly curved upward or downward; loculi between major septa in marginarium crossed transversely by very thin

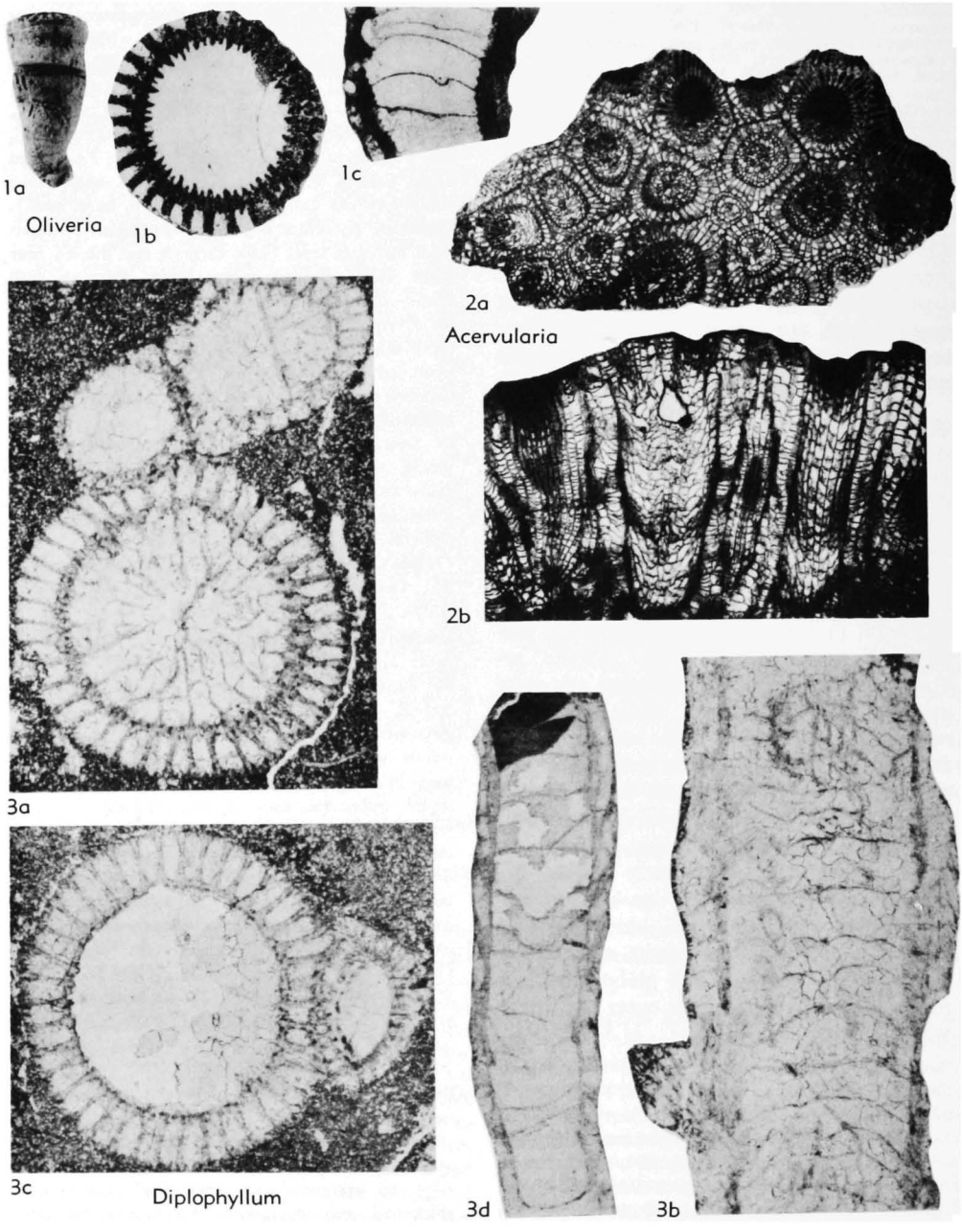


FIG. 167. Acervulariidae (p. *F261-F262*).

more numerous, complete and sagging plates; cardinal fossula not recognized. *U.Sil.*, N.Am. (Okla.).——FIG. 167,*1a-c*. **O. planotabulata*, holotype, Henryhouse F., Lawrence uplift, Okla.; *a*, ext. view, ×1.3; *b,c*, transv., long. secs., ×4.0 (Sutherland, 1965).

Family COLUMNARIIDAE Nicholson, 1879

[*nom. correct.* HILL, 1940a, p. 155, *ex* Columnariadae NICHOLSON, 1879, p. 17] [=Columnaridae, Columnarinae WANG, 1948, p. 27; Columnariinae STUMM, 1949, p. 28; Columnariicae IVANOVSKIY, 1973a, p. 79] [ROMINGER, 1876,

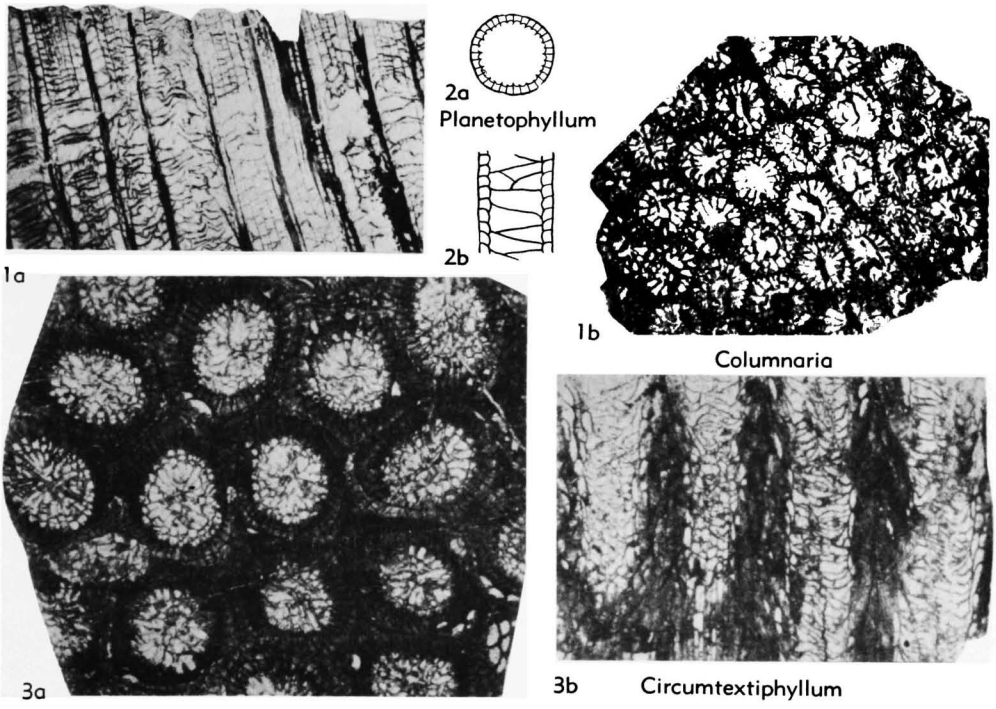


FIG. 168. Columnariidae (p. *F263-F264*).

p. 10, 89, first distinguished a suprageneric grouping typified by *Columnaria* GOLDFUSS, 1826, including in it only the one genus, as a suborder Columnariae of an order Favositidae of an order Tabulata of an order Zoantharia; I do not now believe that this usage can be construed as making Columnariidae ROMINGER, 1876, available as a valid name in accordance with ICZN Article 11e(iii); or similarly, that Columnariina ROMINGER, 1876, can be construed as an available subordinal name]

Corallum fasciculate or cerioid; septa thin, moderately long to long, major septa somewhat amplexoid; narrow dissepimentarium present except in early stages, of unequal small plates in one or a few series; tabularium wide, floors commonly slightly arched but with broad median depression, tabulae commonly complete. *Dev.*

Columnaria GOLDFUSS, 1826, p. 72 [**C. sulcata*; SD MCCOY, 1849, p. 121; †242, GOLDFUSS Coll., IP, Bonn] [=*Lithostroma* RAFINESQUE MS in BRONGNIART, 1829, p. 431 (type, *L. incurvata,* M; *nom. subst. pro Columnaria sulcata* GOLDFUSS, 1826, p. 72, *fide* LANG, SMITH, & THOMAS, 1940, p. 78); *Columniphyllum* QUENSTEDT, 1879, p. 523, as subgenus (type, *C. sulcatum,* SD HILL, 1961, p. 6; =*Columnaria sulcata* GOLDFUSS, 1826]. Corallum cerioid; corallites with very narrow peripheral stereozone from which thin major septa project halfway to axis; minor septa very short, tabulae horizontal or sagging axially or slightly arched; dissepiments absent or in one or very rarely two longitudinal series of small, rather tall plates [see also GLINSKI, 1955, p. 86; BIRENHEIDE, 1969a, p. 43]. *M.Dev.-?U.Dev. (Frasn.),* Eu.(Ger.).——FIG. 168,*1a,b*. **C. sulcata,* monotype, U.Givet. or low. Frasn., Ger., Paffrather Mulde near Bensberg, 10 mi. E. of Cologne; *a,b,* long., transv. secs., ×1.3 (Birenheide, 1969a).

?Circumtextiphyllum KAPLAN, 1971b, p. 17, diagnosed but not illustrated, illustrated in SYTOVA & KAPLAN, 1975, p. 73 [**C. annulatum*; OD; †14, coll. 10287, TsGM, Leningrad]. Massive or fasciculate; major and minor septa forming peripheral stereozone which may be ruptured at angles of corallites by lonsdaleoid dissepiments; septa in stereozone composed of short thick trabeculae like superposed tiles directed slightly upward adaxially; septa commonly subradially arranged, rarely pinnately; major septa may reach axis, attenuate in tabularium; minor septa scarcely projecting from stereozone; one or two series of elongate dissepiments may border tabularium in places; tabulae wide, numerous, incomplete, tabular floors slightly concave or somewhat wavy. [Possibly Stauriidae.] *L.Dev.(Gedinn.),* Asia (Kazakh.).——FIG. 168,*3a,b*. **C. annulatum,* holotype, low. part Pribalkhash horizon, near Kyzyl-Agat; *a,b,* transv., long. secs., ×2.7 (Sytova & Kaplan, 1975).

Planetophyllum CRICKMAY, 1960, p. 4 [**P. plan-*

etum; OD; †27022, PRI, Ithaca] [?=species group of *Disphyllum geinitzi* LANG & SMITH, 1935, p. 570]. Dendroid; corallites slender; major and minor septa very short, subequal; dissepiments normal, in single series; tabulae complete or incomplete, floors horizontal or slightly concave. [Possibly the eridophyllid *Acinophyllum* McLaren, 1959, but presence or absence of septal carinae not noted.] *Dev.*, N.Am.(Alberta).——FIG. 168,*2a,b*. **P. planetum*, paratypes, Alberta, 59°36′N., 111° 26′W., Stony Island, Slave R., *a,b*, transv., long. secs., ×2 (Crickmay, 1960).

Spasskyella TSYGANKO, 1977, p. 41 [**S. pershinae*; OD; †611/1, IG, Syktyvkar; R. Syvyu]. Fasciculate, in places may be catenoid; septa short or stunted, laminar, alternation in length not apparent; tabulae horizontal, a few oblique supplementary tabellae peripherally; dissepimentarium very narrow, of one discontinuous series of very small plates. *M.Dev.(Givet.)*, Eu.(Polar Urals).

Family DISPHYLLIDAE Hill, 1939

[Disphyllidae HILL, 1939a, p. 224] [=Hexagonariidae BULVANKER, 1958, p. 178; ?Marisastridae ROZKOWSKA, 1965, p. 261; Charactophyllidae PEDDER, 1972, p. 698; Utaratuiidae SPASSKIY, KRAVTSOV, & TSYGANKO, 1974, p. 171]

Solitary, fasciculate or massive; septal trabeculae monacanths, commonly arranged in half fans, in some in fans but without pipe of horseshoe dissepiments at zone of divergence in fan, and in some parallel and steeply declined adaxially, waved at border of tabularium; dissepiments small, globose or subglobose; tabularium bizonal, in periaxial zone tabellae commonly large and adaxially declined, in axial zone variably inclined. *U.Sil.-U.Dev.*

Subfamily DISPHYLLINAE Hill, 1939

[*nom. transl.* WANG, 1947a, p. 178, *ex* Disphyllidae HILL, 1939a, p. 224] [?=Charactophyllidae PEDDER, 1972, p. 698]

Solitary, fasciculate or cerioid; septa commonly thin, if thickened, attenuating adaxially or, in some, remaining thick in tabularium until late stages; trabeculae monacanths, may be extended into widely separated and somewhat irregular carinae, arranged either in half fans, or parallel and steeply declined adaxially and waved at tabularial borders; dissepiments small, globose to subglobose; tabularium bizonal, axial tabellae flat, convex or concave, periaxial tabellae large and declined adaxially. *Dev.*

Of the genera here included in Disphyllinae, *Temnophyllum, Alaiophyllum, Charactophyllum* and *?Aphraxonia* show septal thickening continuing into outer part of tabularium where parallel trabeculae are waved as in some *Pterorrhiza* EHRENBERG, 1834, and may be separable; *Minussiella, Pseudocampophyllum* and *?Chalcidophyllum* have predominantly concave tabulae and possibly represent another group.

Disphyllum DE FROMENTEL, 1861, p. 302 [**Cyathophyllum caespitosum* GOLDFUSS, 1826, p. 60; SD LANG & SMITH, 1934, p. 80; †205, GOLDFUSS Coll., IP, Bonn; lectotype by LANG & SMITH, 1934, p. 80] [=*Cannophyllum* CHAPMAN, 1893, p. 45 (type, *Disphyllum goldfussi* GEINITZ, 1846, p. 569, SD STUMM, 1949, p. 33; =*Cyathophyllum caespitosum* GOLDFUSS, 1826, see LANG, SMITH, & THOMAS, 1940, p. 53); *Schlueteria* WEDEKIND, 1922a, p. 3 (type, *S. Emsti*, OD; type material two ?unfigured longitudinal sections labeled "original," from different specimens, 4513-4, WEDEKIND Coll., SM, Frankfurt, figured slide not found; up. Honsel beds, Emst, near Hagen, Ger.), *non Schlueteria* FRITSCH, 1887, a crustacean; *Megaphyllum* SOSHKINA, 1939, p. 14 (type, *M. pashiense*, OD; †slides 237-8, coll. 144, PIN, Moscow; Frasn., near Zykov mine, Pashia distr., C. Urals), *non Megaphyllum* VERHOEFF, 1894, a myriapod; *?Pseudostringophyllum* SOSHKINA, 1939, p. 36 (type, *P. caespitosum*, OD; †slides 41-42, 124, 125, coll. 144, PIN, Moscow; Frasn., Mt. Etapnaya, Satke region, S. Urals); *?Minussiella* BULVANKER, 1952a, which see; *?Solominella* IVANIYA, 1952, p. 141 (type, *S. soshkinae* [as *soshkini*], OD; †119-6, TGU, Tomsk; Frasn., NW. flank of Kuzbas, septa dilated to form imperfect marginarial stereozone); *?Amaraphyllum* PEDDER, 1970, which see; *?Pseudodisphyllum* KONG in KONG & HUANG, 1978, p. 79 (type, *P. jiangzhaiense*, OD; †Gcr 552-553, GB, Guiyang; M.Dev., Dushan F., Jiangzhai, Guizhou [Kweichow]); *?Temnophylloides* LUO MS in KONG & HUANG, 1978, p. 76 (*T. devoniana hunanensis* LUO MS is cited as type species but is not diagnosed, described, or figured; they describe and figure *T. liumaensis* (C. C. YÜ), *T. pingtangensis* KONG *sp. nov.*, and *T. wengdeensis* KONG *sp. nov.*; M. Dev.-U.Dev., Givet.-Frasn., S.China)]. Phaceloid to subcerioid, with lateral or peripheral increase; septa complete, dilated in some, carinae absent or weak; trabeculae monacanths commonly arranged in half fans; dissepiments in several series of small, subequal plates, globose and subglobose, innermost being highly inclined and outermost commonly somewhat peneckielloid; horseshoe dissepiments not developed; tabulae commonly in two series, axial series of flat, concave, or slightly mesa-shaped plates and periaxial series of large, inclined, and dissepimentlike plates [see HILL & JELL, 1970b, p. 37; ROZKOWSKA & FEDOROWSKI, 1972, p. 296]. *L.Dev.(Ems.)*, Asia(NE.USSR); *M.Dev.(Couvin.)*, Eu.(Belg.); *M.Dev.(Givet.)*, Eu. (U.K.-Belg.-Ger.-Pol.-Czech.-Aus.)-Asia (Kazakh.-

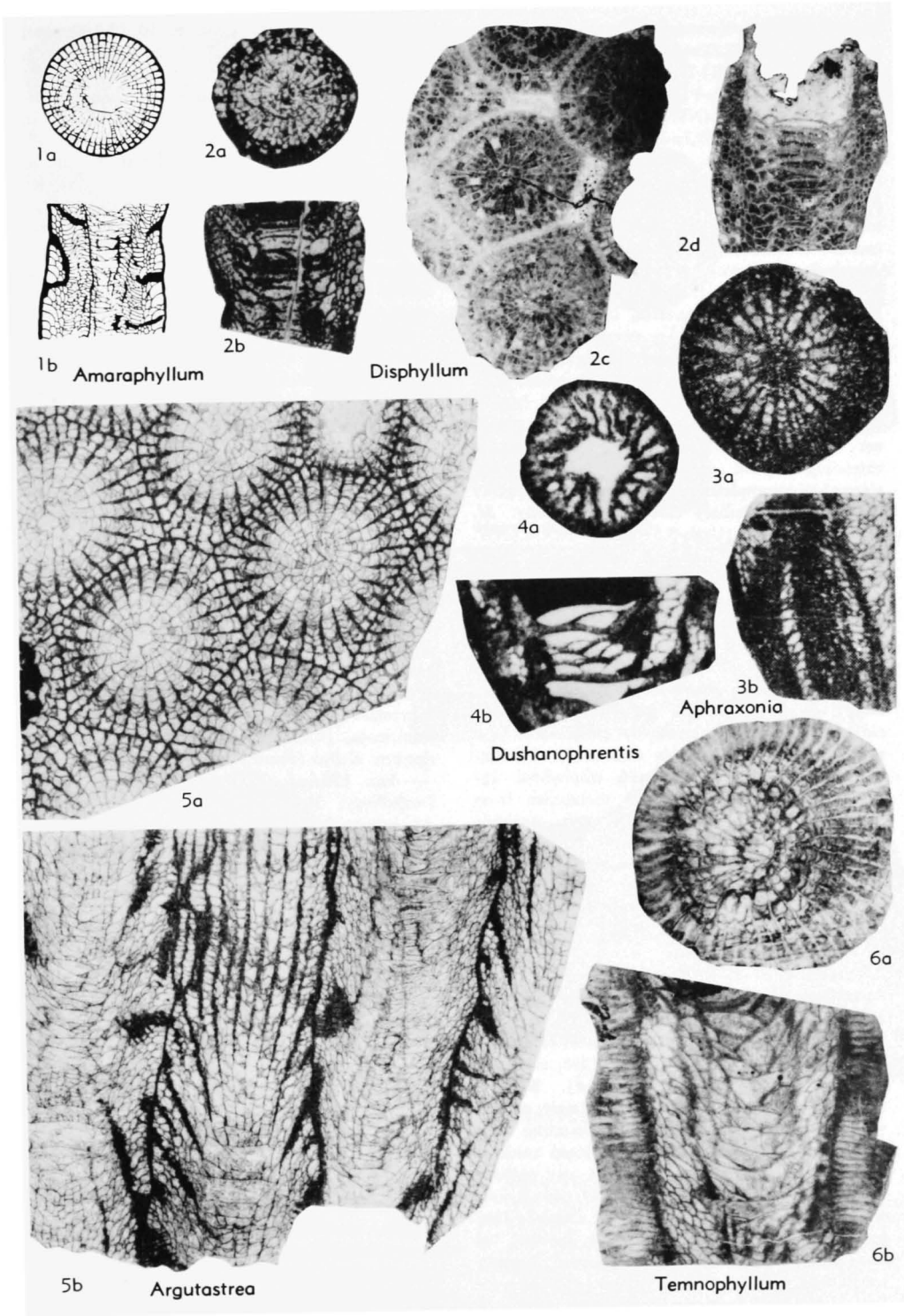


FIG. 169. Disphyllidae (p. *F264-F266*, *F268-F271*).

Kuzbas-Szechwan-Kwangsi)-Australia (W. Australia-Queensl.); *U.Dev.(Frasn.),* Eu.(U.K.-Belg.-Ger.-Spain-Pol.-USSR)-N. Afr. (Alg.)-Asia (Armenia-Turkey-Kuzbas-Pak.-Kwangsi-NE. USSR)-W. Australia-N. Am.(NW. Terr.-Iowa-Nev.-?Que.-Mich.).——Fig. 169,*2a-d.* **D. caespitosum* (Goldfuss), lectotype, M.Dev. or ?Frasn., Ger., Bensberg; *a,* transv. sec., ×2 (Smith, 1946), *b,* long. sec., ×2 (Lang & Smith, 1935), *c,d,* transv., long. secs., ×2 (Hill, n; photographs courtesy R. Birenheide).

Alaiophyllum Goryanov, 1961, p. 70 [**A. jarushevskyi*; OD; †755/1, LGU, Leningrad] [*?=Temnophyllum* Walther, 1928, which see]. Fasciculate; marginarium a stereozone in which thickened septa are commonly contiguous so that there are very few spaces in which small, subglobose dissepiments develop; trabeculae ?monacanthine, subhorizontal, straight; major septa thinner in tabularium, short; minor septa scarcely extending beyond marginarium; tabulae wide, somewhat incomplete, slightly concave or slightly convex, with auxiliary tabellae peripherally. *M. Dev.(Givet.),* Asia(Urals-S.Fergana)-?N.Am.(NW. Terr.).——Fig. 170,*5a,b.* **A. jarushevskyi,* holotype, Boordy Ra., S. Fergana; *a,b,* transv., long. secs., ×2.7 (Goryanov, 1961).

Amaraphyllum Pedder in Pedder, Jackson, & Ellenor, 1970, p. 252 [**A. amoenum*; OD; †F10390, UNE, Armidale] [*?=Disphyllum* de Fromentel, 1861, which see]. Fasciculate, commonly dendroid; increase peripheral and parricidal; septa radially arranged, either thin and smooth with no discernible trabeculae, or somewhat dilated and carinate with disphylloid trabeculae; major septa somewhat withdrawn from axis; tabularial floors like hat with upturned brim and median dent, tabulae incomplete; dissepiments small, no horseshoe dissepiments, forming narrow marginarium. *M.Dev.(Givet.),* Australia(New S.Wales).——Fig. 169,*1a,b.* **A. amoenum,* holotype, Givet., Timor Ls., New S. Wales; *a,b,* transv., long. secs., ×2 (Pedder, Jackson, & Ellenor, 1970).

?**Aphraxonia** Ünsalaner, 1951, p. 132 [**A. taurensis*; OD; †74, Ünsalaner Coll., MTA, Ankara] [*=Hunanaxonia* Jia in Jia *et al.,* 1977, p. 146 (type, *H. zhuzhouensis,* OD; †IV37068, HPRIGS, Yichang; M.Dev., Zhuzhou, Hunan]. Solitary, small, subcylindrical, with septa strongly dilated wedgewise and with columella projecting into calice from median region of conjoined cardinal and counter septa; other major septa may coalesce with columella; minor septa thinner; tabularium wide, of numerous tabellae declined abaxially into periaxial trough; dissepimentarium narrow, of some globose dissepiments. [Monotype only known; see Pedder, 1972, p. 609.] *?U.Dev.,* Asia M.——Fig. 169,*3a,b.* **A. taurensis,* holotype, Adana, 3 km. SE. of Kazikh Koy, Saimbeyli; *a,b,* transv., long. secs., ×3 (Ünsalaner, 1951).

Argutastrea Crickmay, 1960, p. 10 [**A. arguta*; OD; †27036, PRI, Ithaca]. Cerioid, with deep, bell-shaped calice; septa radially arranged, typically noncarinate but may be faintly carinate in dissepimentarium; septa of both orders dilated in outer dissepimentarium, becoming attenuate adaxially; major septa extended almost to axis or withdrawn, leaving wide axial space; trabeculae monacanths, almost parallel and directed upward and inward from periphery; dissepiments small, subequal, numerous and subglobose, commonly declined at moderate angle toward axis; tabularium variable but commonly biserial with periaxial series of small, adaxially declined plates surrounding series of flat or slightly domed tabellae [Hill & Jell, 1970b, p. 51]. *M.Dev.,* N.Am. (Ont.-NW. Terr.-Ellesmere I.-Mich.)-Eu. (Ger.-France-Belg.)-Asia (Armenia-Turkey)-W.Australia; *U.Dev.(Frasn.),* Asia(Kuzbas-Kwantung)-W.Australia-N.Am.(NW.Terr.-Alaska).——Fig. 169,*5a,b.* **A. arguta,* M.Dev., Can., W. end of Carcajou Ridge, NW. Terr.; *a,b,* transv., long. secs., ×2 (Hill & Jell, 1970b).

Aristophyllum Bulvanker, Spasskiy, & Kravtsov in Ivanovskiy, 1975b, p. 78 [**A. terechovi*; OD; †4, coll. 9851, ?TsGM, Leningrad]. Solitary, major septa subequal, not reaching axis, thinning adaxially; minor septa thinner; tabularium wide, with wide axial series of flat, complete tabulae and outer series of inclined, globose tabellae; dissepimentarium moderately narrow, of normal concentric or, in places where minor septa discontinuous, inosculating dissepiments; fossula indistinct. *U.Dev.(Frasn.),* Asia(Taymyr-NE.USSR).——Fig. 170,*6a,b.* **A. terechovi,* holotype, R. Dozhdlivyy, R. Belaya Noch, Ormulev Mts.; *a,b,* transv., long. secs., ×2 (Ivanovskiy, 1975b).

?**Ceratophyllum** Gürich, 1896, p. 163 [**C. typus*; OD; †neotype Tc1/1, Gürich Coll., PZI, Poznan; by Fedorowski, 1967a, p. 216; *=Cyathophyllum ceratites* Goldfuss *sensu* Frech, 1886, p. 177(63)] [*?=Kunthia* Schlüter, 1885a, which see; *?Hunanophrentis* Sun, 1958, which see]. Solitary or with few offsets; septa invariably carinate; septal trabeculae ?rhipidacanthine, arranged in broad, asymmetrical fans or half fans; symmetry bilateral in early stages with prominent counter septum, radial later; septa may be somewhat thickened in tabularium; dissepimentarial floors horizontal peripherally but declined adaxially to tabularium; dissepiments small and globose, no horseshoe dissepiments; tabularium wide, tabular floors horizontal or concave, tabulae incomplete [Fedorowski, 1967a, p. 214; but see also Pickett, 1967b, p. 40]. *M.Dev.,* Eu.(Pol.-?Urals).——Fig. 170,*2a-c.* **C. typus,* low. Givet., Pol., Skaly; *a,* transv. sec., early stage, *b,* transv. sec., late stage, *c,* long. sec., all ×2 (Fedorowski, 1967a).

?**Chalcidophyllum** Pedder, 1965a, p. 204 [**C. campanense*; OD; †F8786, UNE, Armidale]

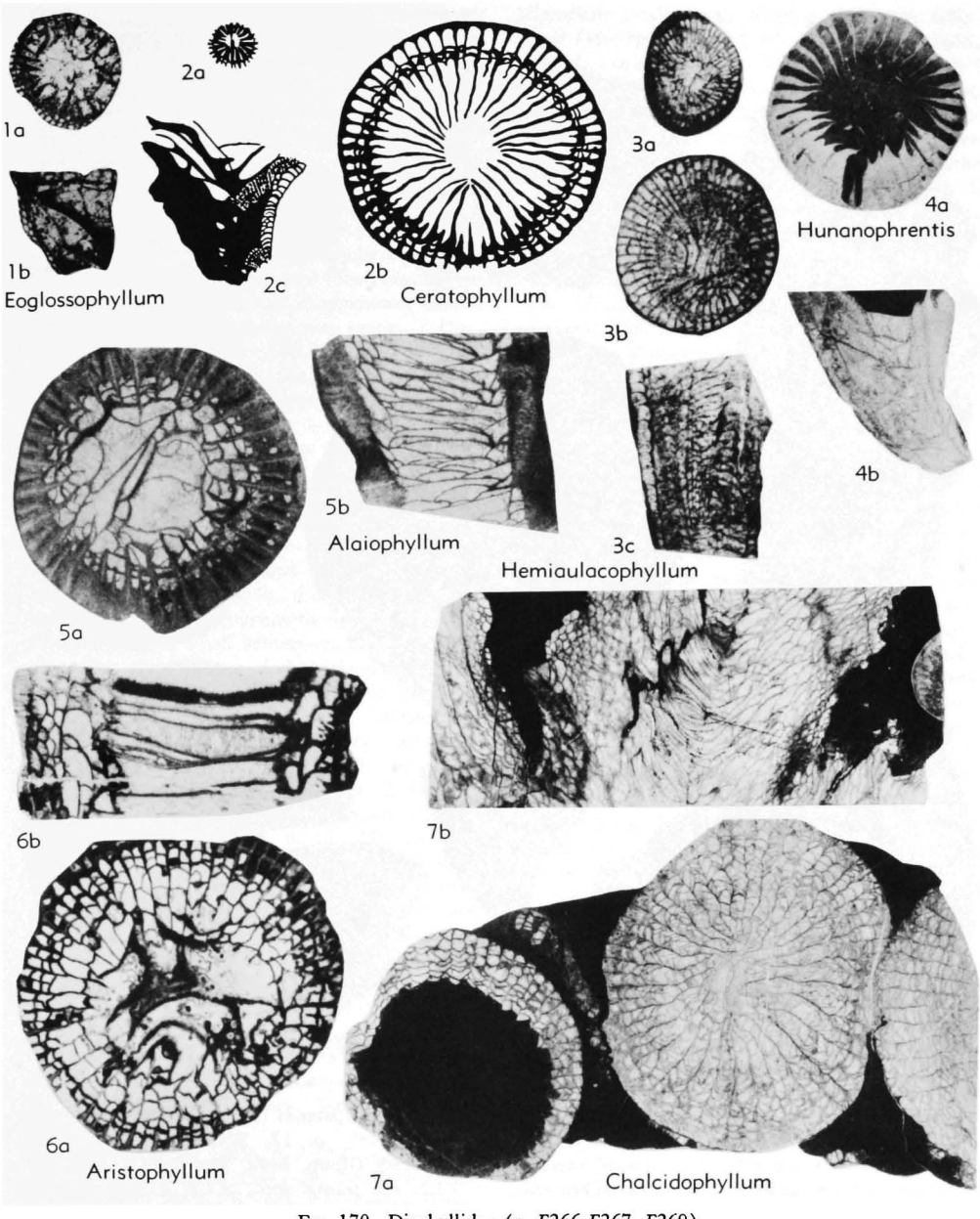


FIG. 170. Disphyllidae (p. *F266-F267*, *F269*).

[?=*Minussiella* BULVANKER, 1952a, which see]. Solitary or weakly compound; corallites trochoid to cylindrical; septa smooth, thin, radially arranged; minor septa may be almost completely withdrawn to outer wall, major septa may extend to axis or stop short of it and may be discontinuous in places; dissepiments numerous, unequal, in herringbone arrangement where minor septa are withdrawn; tabulae broad, incomplete, sloping so that floor of tabularium is depressed axially [PEDDER, JACKSON, & PHILLIP, 1970, p. 237]. *L. Dev. (Siegen.-Ems.)*, Australia (Vict.-New S. Wales).——FIG. 170,*7a,b*. **C. campanense*, holotype, Bell Point Ls., Vict., Waratah Bay; *a,b*, transv., long. secs., ×1 (Pedder, 1965a).

Charactophyllum SIMPSON, 1900, p. 209 [**Campo-*

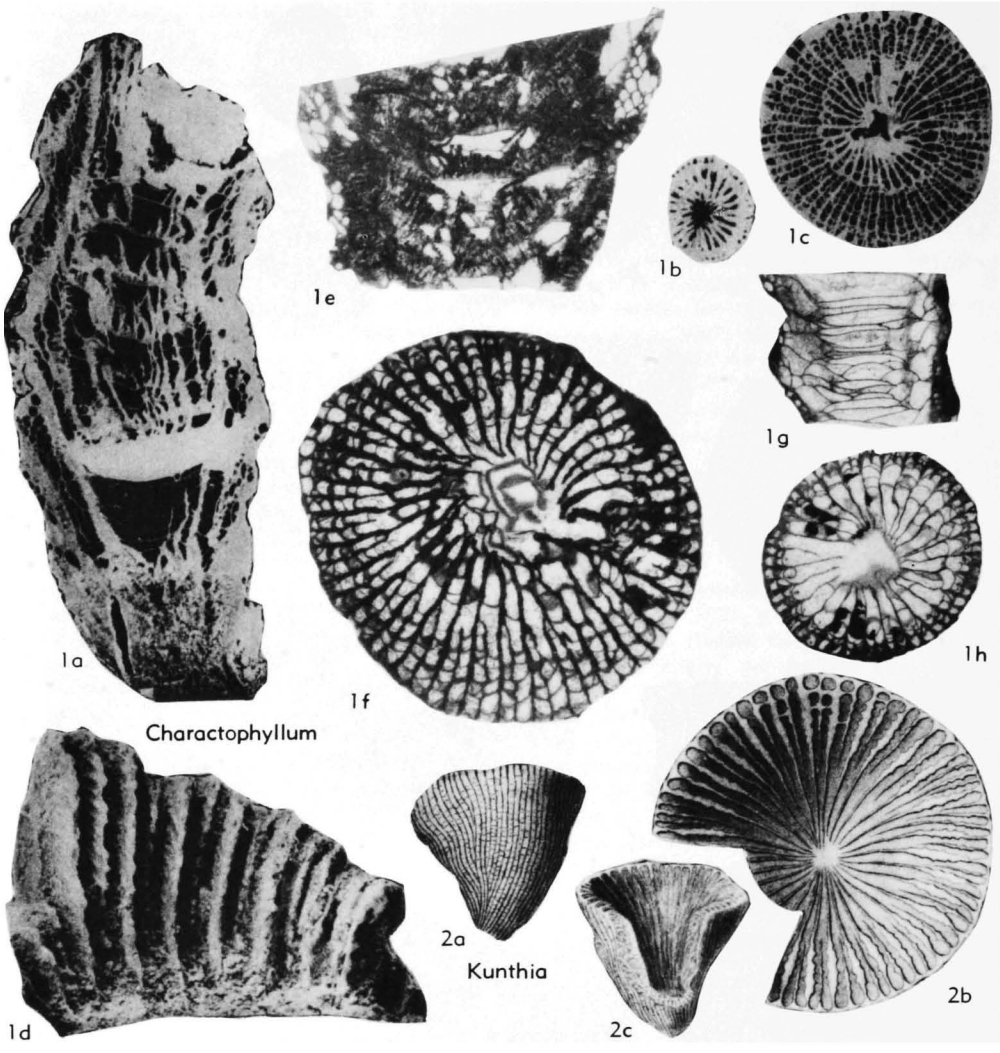


FIG. 171. Disphyllidae (p. *F268-F269*).

phyllum nanum HALL & WHITFIELD, 1873, p. 232; OD; †227, NYSM, Albany]. Solitary, small, fossula indistinct; septa of two orders, of uniserial, contiguous monacanths waved at inner boundary of dissepimentarium, denticulate and faintly carinate in dissepimentarium; major septa dilated in early stages, somewhat amplexoid in successive zones in later stages; dilatation is retained longest in tabularial parts of septa; tabulae horizontal or slightly convex or concave, complete or incomplete; peripheral tabellae commonly large and adaxially declined; dissepimentarium may be wide, of small, normal, subglobose dissepiments. [Type material requires restudy; see WATKINS, 1959a, p. 82; PEDDER, 1972, p. 698.] *U.Dev.(Frasn.)*, N. Am. (Iowa-Can.)-?Eu. (Spain-Urals).——FIG. 171,*1a-h*. **C. nanum* (HALL & WHITFIELD), *sensu* SMITH, 1945, p. 17, WATKINS, 1959a, p. 82, Hackberry Group, Iowa, Rockford; *a*, long. sec., ×1.5; *b,c*, transv. secs., ×1.5; *d*, part of calical view showing denticulate and carinate septa, ×7.0 (Watkins, 1959a); *e,f*, long., transv. sec. (*sensu* SMITH), ×3.0 (Hill, n; UQF10965); *g,h*, transv., long. secs., ×2 (Hill, n; UQF10962).

?Dushanophrentis YÜ, LIAO, & DENG, 1974, p. 224 [**D. cystotabulata*; OD; †18755-18758, IGP, Nanking]. Solitary, small, curved trochoid; septa thickened, their axial ends somewhat withdrawn subequally from axis and may join in quadrants; cardinal fossula distinct, cardinal septum may be short; tabularium wide, axial series forming near-horizontal floors, tabulae complete or incomplete;

periaxial tabellae small, subglobose; dissepimentarium narrow, of few series of small, subglobose plates, inner series steeply declined adaxially. *M. Dev.(Eifel.),* Asia(Kweichow).——Fig. 169,*4a,b.* **D. cystotabulata,* holotype, Houyishan F., Kweichow, Dushan; *a,b,* transv., long. secs., ×3 (Yü, Liao, & Deng, 1974).

?**Eoglossophyllum** Yü in Wang, Yü, & Wu, 1974, p. 30 [**E. minor*; OD; †23681-23685, IGP, Nanking]. Solitary, small; major septa thickened and withdrawn from axis in tabularium, major and minor septa thin in narrow dissepimentarium of small, subglobose normal dissepiments; tabular floors flat or inclined, tabulae very sparse. *L.Dev.,* Asia(Kwangsi).——Fig. 170,*1a,b.* **E. minor,* Nahkaoling F., Kwangsi, Liu Jing; *a,* holotype, transv. sec., ×2; *b,* paratype, long. sec., ×2 (Wang, Yü, & Wu, 1974).

?**Hemiaulacophyllum** Kravtsov in Ivanovskiy, 1975b, p. 84 [**H. accuratum*; OD; †419/17, coll. 419, IGG, Novosibirsk]. Solitary; calice deep; septa spindly, thinning toward axis and somewhat dilated at periphery to form narrow stereozone that narrows distally; septal trabeculae directed obliquely upward adaxially, their axial ends may separate slightly; dissepimentarium narrow, of one to three series of small hemispherical dissepiments, outermost series larger and horizontally based; tabularium wide, tabular floors flat or wavy but depressed and with supplementary tabellae peripherally, tabulae incomplete. *L.Dev.,* Asia(Taymyr-NE.USSR).——Fig. 170,*3a-c.* **H. accuratum,* holotype, Yunkhodsk beds, R. Tareya, C. Taymyr; *a-c,* transv., long. secs., ×2 (Ivanovskiy, 1975b).

Hunanophrentis Sun, 1958, p. 13 [**H. zaphrentoides*; OD; †1297, CU, Peking] [?=*Ceratophyllum* Gürich, 1896, which see]. Solitary, curved, conical; septa strongly thickened, arranged with weak convolution about cardinal fossula with cardinal septum shortened in calice; septal thickening decreases first in counter quadrants; minor septa short, dissepimentarium narrow; tabellae large, distant, tabularial floors concave in some places, flat axially. *U.Dev.,* Asia(Hunan).——Fig. 170, *4a,b.* **H. zaphrentoides,* holotype, Shaitienchiao F., Hsianghsian; *a,b,* transv., long. secs., ×1.3 (Sun, 1958).

?**Kunthia** Schlüter, 1885a, p. 7 [**K. crateriformis*; M; †174d, Schlüter Coll., IP, Bonn; lectotype by Pickett, 1967b, p. 62] [?=*Ceratophyllum* Gürich, 1896, which see]. Small, solitary, with inversely conical calical floor, extending almost to apex of cone; cardinal septum on convex side; septa thickened and carinate in inner part of narrow dissepimentarium; tabulae very few, confined to apical region. [Possibly zaphrentid; see Pickett, 1967b, p. 42.] *M.Dev.(Couvin.),* Eu.(Ger.-Belg.).——Fig. 171,*2a-c.* **K. crateriformis,* Ger., ESE. of Esch, near Yunkerath, Eifel; *a,* ext. view, ×1; *b,* calical view, ×2; *c,* oblique lateral view showing calice, ×1 (Schlüter, 1889).

Minussiella Bulvanker, 1952a, p. 134 [**M. beliakovi* (also spelled *beljakovi*); OD; †1, coll. 8635, TsGM, Leningrad] [?=*Disphyllum* de Fromentel, 1861, which see; ?*Chalcidophyllum* Pedder, 1965a, which see]. Corallum branching, septa unthickened, major septa almost reaching axis or somewhat withdrawn; minor sepa may be withdrawn to wall, leaving herringbone or lonsdaleoid dissepiments; dissepimentarium moderately wide, dissepiments unequal; tabular floors inversely conical or flat, of tabellae [Ivaniya, 1965, p. 167]. *M.Dev.(Eifel.),* Asia(Minussinsk depression).——Fig. 172,*2a-d.* **M. beliakovi,* Tashtyp suite, Mt. Kulagay; *a,b,* holotype, transv., long. secs., ×3.0 (Hill, n; photographs courtesy E. Bulvanker); *c,d,* topotype, transv., long. secs., ×2.5, ×2.7 (Ivaniya, 1965).

Pseudocampophyllum Ivanovskiy, 1958, p. 343 [**P. enisseicum*; OD; †sample 17, slide 30, ?VNIGRI, Leningrad]. Solitary or fasciculate, with parricidal or nonparricidal increase; major septa almost straight, complete, somewhat withdrawn from axis; minor septa contratingent, in some may be almost as long as major septa; tabulae slightly concave, complete or incomplete, with auxiliary tabellae peripherally; dissepiments small, subglobose, in places not distinct from auxiliary peripheral tabellae. *M.Dev.(?Givet.),* Asia(Minussinsk depression).——Fig. 172,*1a,b.* **P. enisseicum,* Beya Suite, Chayzy-Kozy, W. of Abakan; *a,* holotype, transv. sec. of fragment of colony, ×4; *b,* another specimen, long. sec., ×4 (Ivanovskiy, 1958).

Spinophyllum Wedekind, 1922a, p. 5 [**Campophyllum spongiosum* Schlüter, 1889, p. 304; M; 2 syntypes, 174a,b, in Schlüter Coll., IP, Bonn]. Solitary; major and minor septa somewhat thickened and highly and irregularly carinate in dissepimentarium, carinae either irregular yardarm or extending from zigzags, arranged in half fans but flexed at outer part of tabularium; outer series of dissepiments subpeneckielloid, inner series smaller, more or less steeply declined adaxially; tabellae in two series, axial series of horizontal plates and periaxial series smaller and declined adaxially. *M.Dev.(Givet.),* Eu.(Ger.).——Fig. 172,*3a,b.* **S. spongiosum* (Schlüter), W. Ger., Büchel quarry near Herrenstrunden, Bergisch-Gladbach; *a,b,* transv., long. secs., ×3 (Hill, n; UQF50358).

Temnophyllum Walther, 1928, p. 120 [**T. latum*; SD Lang, Smith, & Thomas, 1940, p. 132; †6971-3, Wedekind Coll., SM, Frankfurt] [=*Diplophyllum* Soshkina, 1939, p. 39 (type, *D. verrucosum,* OD; †slides 162-163, 285-286, coll. 144, PIN, Moscow; Frasn., Katov reg., Urals), *non Diplophyllum* Hall, 1851, p. 399; *Temeniophyllum* Lang, Smith, & Thomas, 1940, p. 131, *nom. van.; Pseudozaphrentis* Sun, 1958, p. 14 (type, *P. difficile,* OD; †1299, CU, Peking; U.Dev.,

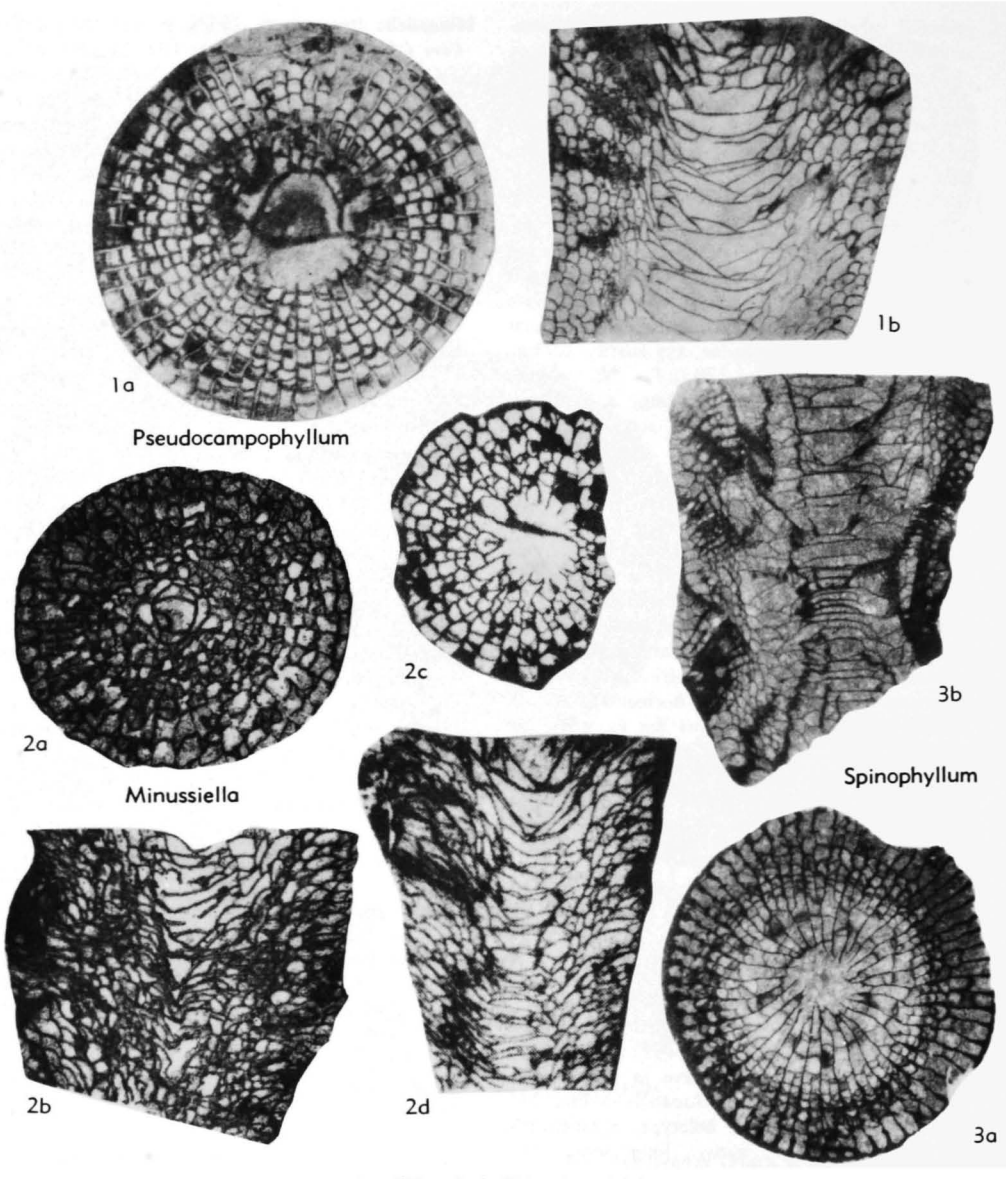


FIG. 172. Disphyllidae (p. *F269*).

Shaitienchiao F., Hunan); *?Alaiophyllum* GORYANOV, 1961, which see; *Paracanthus* MERRIAM, 1973b, p. 32 (type, *?Aulophyllum Richardsoni* MEEK, 1867, p. 81, OD; †14544, USNM, Washington, lectotype by SMITH, 1945, legend to pl. 5; ?Givet., The Ramparts, NW. Terr., Can., see PEDDER, 1972, p. 701); *Prodiplophyllum* COTTON, 1973, p. 162, *nom. subst. pro Diplophyllum* SOSHKINA, 1939; *?Temnocarinia* Yü & LIAO MS in KONG & HUANG, 1978, p. 98 (*Temnophyllum (Temnocarinia) involuta* Yü & LIAO is listed as type, but is not diagnosed, figured, or described; *T. (Temnocarinia) abnormis* KONG sp. nov., †Gcr 653-654, GB, Guiyang; M.Dev., Dushan F., Jiangzhai, Guizhou [Kweichow], is described and figured together with six species previously referred to *Temnophyllum*)]. Solitary; septa thickened in outer part of dissepimentarium either to contiquity or thinning toward outer and inner edges; in thickened zone monacanthine septal trabeculae are subhorizontal but may be waved at tabularial boundary; dissepiments small, subequal, subglobose, their bases almost vertical in outer parts of dissepimentarium; tabularial floors

concave, each consisting of wide, horizontal or concave axial tabellae and smaller tabellae [PICKETT, 1967b, p. 67; PEDDER, 1972, p. 699]. *M.Dev. (Givet.),* Eu. (U.K.-Belg.-Ger.-Urals-?Italy)-Asia (Urals - Armenia - Kuzbas - Yunnan - Kwangsi) - Australia(Queensl.)-N.Am.(NW.Terr.-Nev.); *U. Dev. (Frasn.),* Eu. (USSR)-Asia (Urals-?Afghan.-Altay-NE. USSR-Yunnan-Kwangtung)-N. Afr. (Alg.)-W. Australia-N. Am. (NW. Terr.); *U. Dev. (Famenn.),* Eu.(Urals).——FIG. 169,*6a,b.* **T. latum,* syntype, ?Frasn., Ger., Grund, Harz Mts.; *a,b,* transv., long. secs., ×2 (photographs courtesy R. Birenheide).

Subfamily PARADISPHYLLINAE Jell, 1969

[Paradisphyllinae JELL, 1969, p. 67]

Solitary, fasciculate or massive; septa complete, long, may bear lateral dissepiments in outer parts of dissepimentarium; trabeculae commonly arranged in fans; dissepimentarial floors everted to flat in more or less wide peripheral zone, declined adaxially; dissepiments small, numerous, subglobose to globose; tabularial floors commonly domes with edges turned out or up, tabulae incomplete. *U.Sil.-M.Dev.*

Paradisphyllum STRUSZ, 1965, p. 537 [**P. harundinetum*; OD; †13236, SU, Sydney] [?=*Ivdelephyllum* SPASSKIY, 1971b, which see]. Fasciculate to subcerioid; increase lateral; septa long, fusiform in transverse section, carinate outside zone of greatest dilatation; monacanthine trabeculae arranged in fans or half fans with zone of divergence medial in dissepimentarium; major septa almost reaching axis, somewhat unequal, counter septum longest; tabularium bizonal, periaxial tabellae flat or gently sagging or adaxially declined, axial tabellae globose, arranged in broad domes; dissepiments small, globose, numerous, arranged in shallowly convex floors. *L.Dev.(Ems.),* Australia (New S.Wales-Vict.).——FIG. 173,*1a-c.* **P. harundinetum,* Garra F., New S. Wales, near Wellington; *a,* holotype, transv. sec., ×4 (Strusz, 1965); *b,c,* another specimen, long., transv. secs., ×2 (Hill, n; photographs courtesy A. H. Pedder, F9146, UNE, Armidale).

Exilifrons CRICKMAY, 1968, p. 3 [**E. exilis*; OD; †25533, GSC, Ottawa] [?=*Martinophyllum* JELL & PEDDER, 1969, which see; *Pinyonastraea* MERRIAM, 1974, p. 61 (type, *Prismatophyllum kirki* STUMM, 1937, p. 437, OD; †94456, USNM, Washington; L.Dev., Ems., Nevada F., Lone Mt., Nev.)]. Cerioid, septa thin, ?carinate from sparse zigzags; major septa subequal and long to somewhat withdrawn from axis, minor septa also commonly long and dissepimentarium wide, of subglobose dissepiments of variable size and inclination; dissepimentarial floors may slope more or less evenly adaxially or be slightly reflexed with change of curvature roughly in medial zone of dissepimentarium; tabular floors with axially uparched series and periaxial narrow concave tabellae where major septa almost reach axis, to subhorizontal or concave when septa are withdrawn from axis. [Possibly the eridophyllid *Prismatophyllum* SIMPSON; see also PEDDER, 1977, p. 173.] *L.Dev.-?M.Dev.,* N.Am.(Yukon-Nev.). ——FIG. 174,*4a,b.* **E. exilis,* L.Dev.(Zlichov.), Yukon, near base of Bear Rock equivalent, 65°23′ N., 138°24′W., Ogilvie R.; *a,* holotype, transv. sec., ×3.3; *b,* paratype, long. sec., ×3.3 (Crickmay, 1968).——FIG. 174,*4c,d. E. kirki* (STUMM), holotype, Nev., basal 500 ft. of Nevada F., Lone Mt.; *c,d,* transv., long. secs., ×1.7 (Merriam, 1974).

Gurievskiella ZHELTONOGOVA in ZHELTONOGOVA & IVANIYA, 1961, p. 404 [**G. cylindrica*; OD; †in coll. 1508, ZSGUp, Novokuznetsk]. Solitary or with few offsets; septa radially or bilaterally arranged, thickened in inner dissepimentarium so as to be somewhat fusiform in transverse section, may be weakly carinate; axial ends of major septa carinate, slightly dilated or contiguous laterally; tabularial floor commonly domed, with or without periaxial trough; tabellae numerous; dissepimentarial floor reflexed, dissepiments numerous, globose, subhorizontally based and commonly large in median parts, those of outer and inner series small; trabeculae monacanths in which fibers diverge from axis at low angle; monacanths arranged in broad symmetrical fan in median plane of septum [see JELL & HILL, 1969, p. 11]. *L.Dev. (?Siegen.-Ems.)-M.Dev.(Couvin.-Givet.),* Australia (Queensl.)-Eu.(Urals)-Asia (Salair-China-Burma). ——FIG. 174,*2a,b.* **G. cylindrica,* holotype, L. Dev.(?Siegen.-Ems.), Malobachat Beds, Salair Kara-Chumysh distr.; *a,b,* transv., long. secs., ×3.3 (Zheltonogova, 1961).

Ivdelephyllum SPASSKIY, 1971b, p. 24 [**Keriophylloides caespitosum* VAGANOVA, 1959, p. 81; OD; †slide 29/V43/52, VAGANOVA Coll., UGUp, Sverdlovsk] [?=*Paradisphyllum* STRUSZ, 1965, which see]. Phaceloid, septa moderately long, with spindlelike thickening as seen in transverse section, and weakly carinate; trabeculae arranged fanwise; thickened peripheral ends of septa form narrow stereozone; cardinal septum may intersect axis, when others may be slightly pinnate toward it; tabulae incomplete, an axial series of concave tabellae and periaxial series of tabellae slightly declined adaxially; dissepiments globose or subglobose, outer zone of dissepimentarial floors somewhat everted. *M.Dev.(Eifel.),* Asia(Urals-Tien Shan).——FIG. 174,*3a,b.* **I. caespitosum* (VAGANOVA), holotype, R. Ivdel, C. Urals; *a,b,* transv., long. secs., ×2.5 (Vaganova, 1959).

Martinophyllum JELL & PEDDER, 1969, p. 735 [**M. ornatum*; OD; †F44193, UQ, Brisbane] [?=*Exili-*

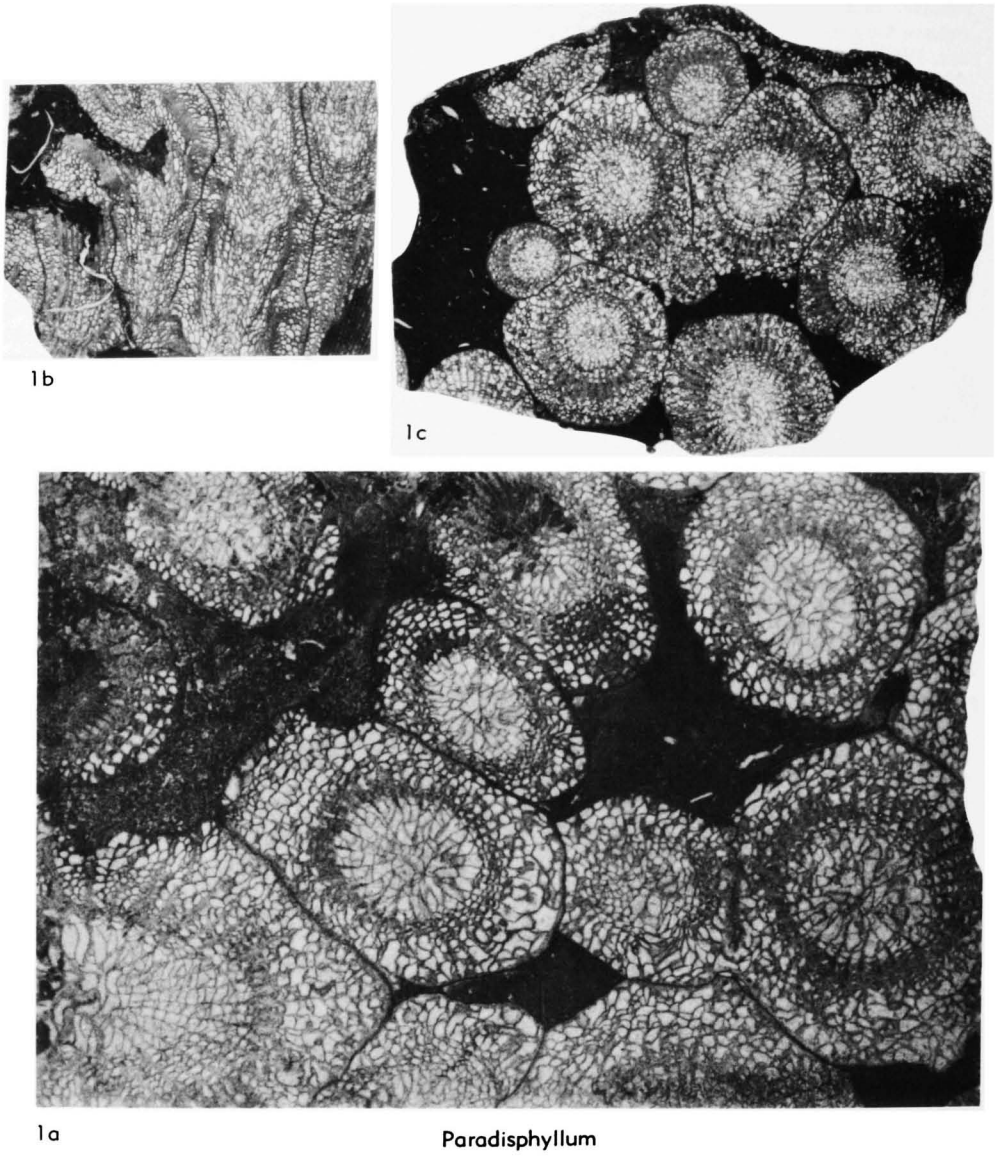


FIG. 173. Disphyllidae (p. *F271*).

frons CRICKMAY, 1968, which see; *?Xystrigona* YÜ, 1974, which see]. Cerioid; calicular platform flat or slightly reflexed; septa commonly fusiform, smooth to carinate, may be retiform or cavernous in outer dissepimentarium; trabeculae are monacanths commonly arranged in broad, symmetrical fans; fibers of trabeculae long, diverging only slightly from axis; dissepiments numerous, small and globose; dissepimentarial floor commonly arched in inner dissepimentarium, sloping steeply toward axis and gradually toward periphery; tabularial floor commonly arched or conical, composed of numerous tabellae. *L.Dev.(Siegen.-Ems.)*, Australia(Queensl.-New S.Wales-Vict.-Tasm.)-N.Am.(Yukon-Alaska); *?M.Dev.(Eifel.)*, Asia(E.Urals-Mt.Altay).——FIG. 175,*3a,b*. **M. ornatum*, holotype, base of Martin's Well Ls., Pandanus Ck., N.Queensl.; *a,b*, transv., long. secs., ×3 (Jell & Pedder, 1969).

Radiastraea STUMM, 1937, p. 439 [**R. arachne*; OD; †94458, USNM, Washington]. Thamnasterioid or astreoid; major and minor septa long,

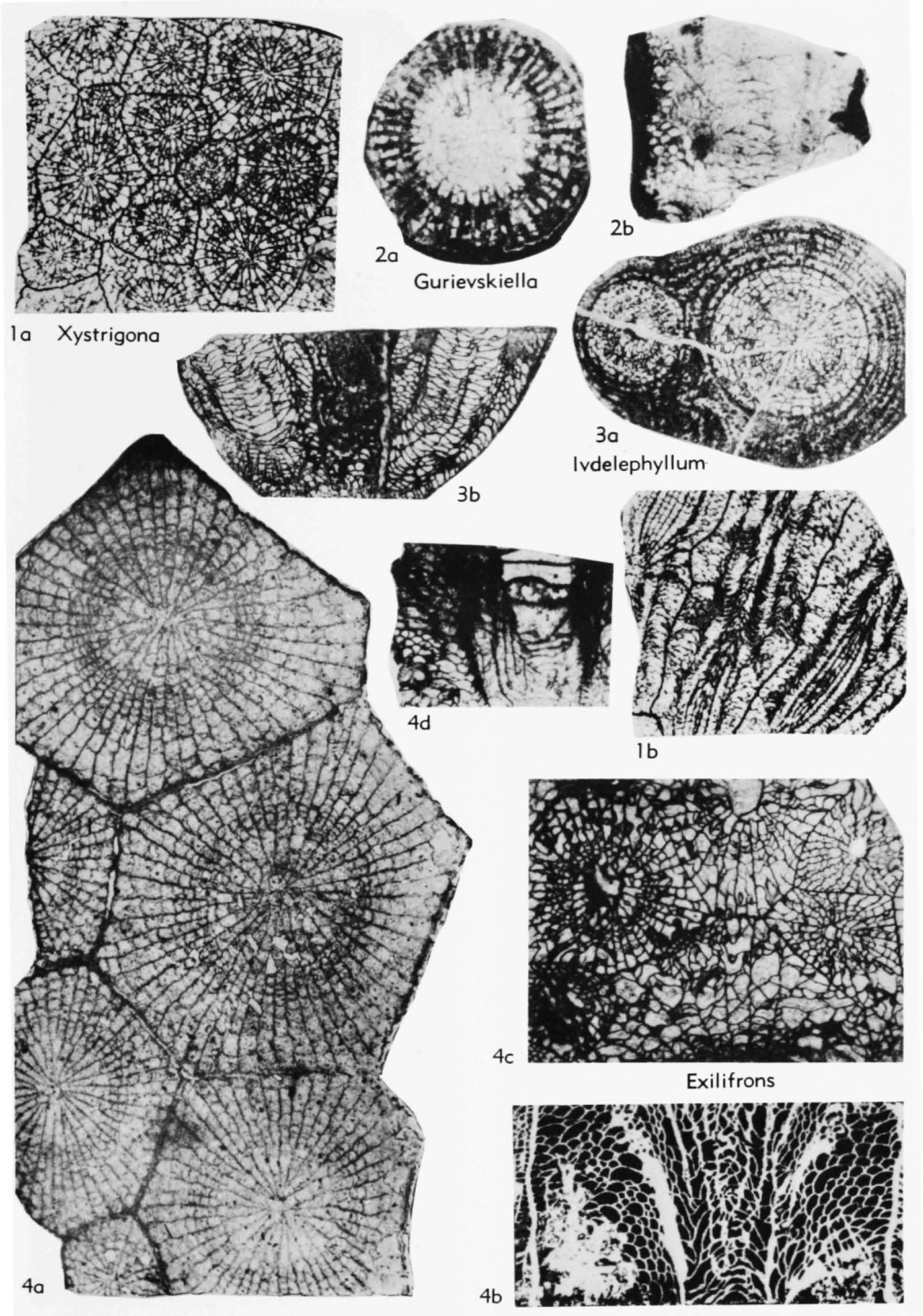


FIG. 174. Disphyllidae (p. *F271-F272*, *F275*).

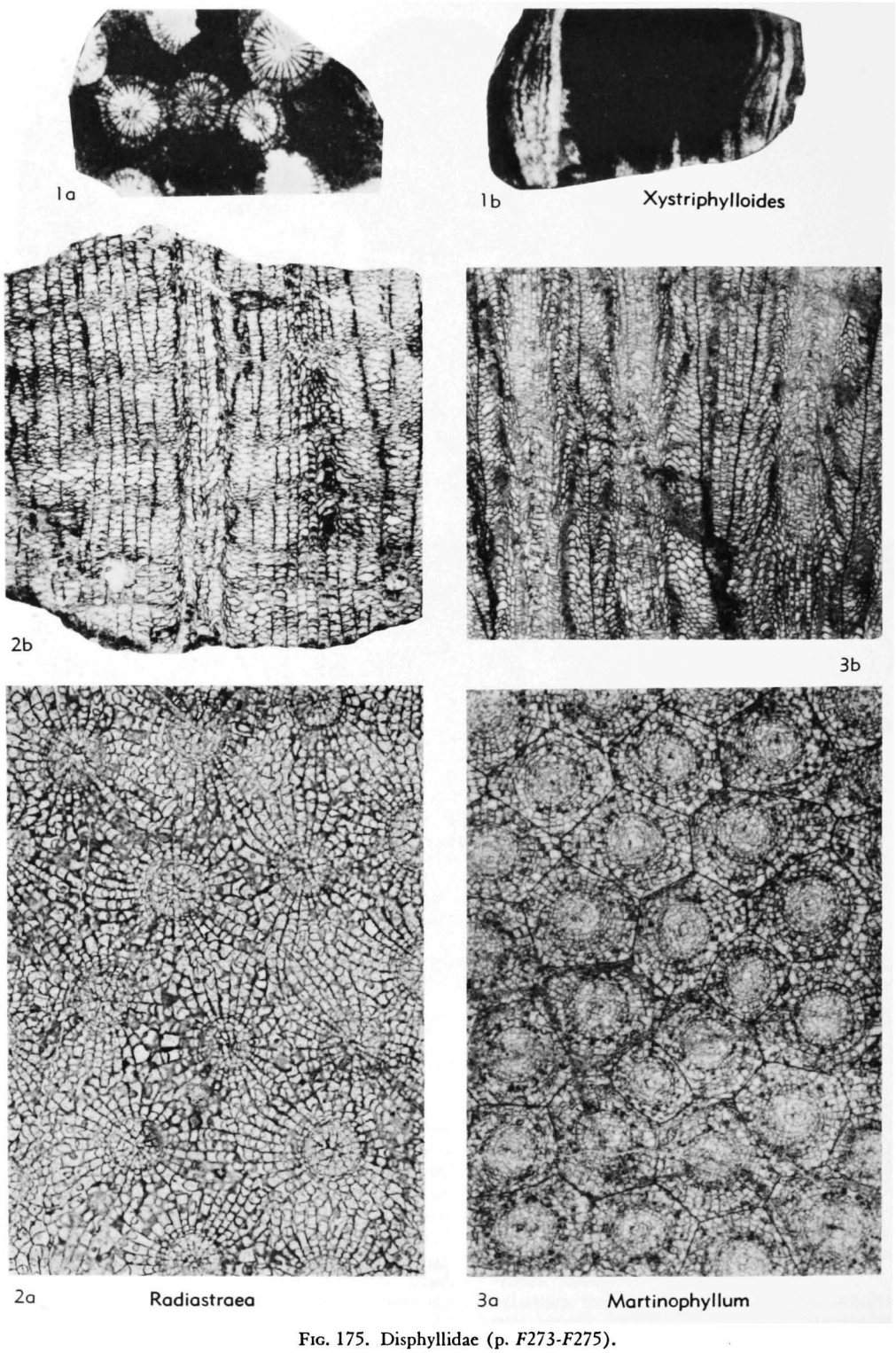


FIG. 175. Disphyllidae (p. *F273-F275*).

attenuate, major septa almost reaching axis; tabulae complete or incomplete, with narrow axial zone of tabellae forming impersistent axial structure, and periaxial zone of subhorizontal tabellae; dissepiments numerous, small, horizontally based except at inner margin of dissepimentarium; trabecular arrangement within septa not known. *U.Sil.*, N.Am.(Can.Arctic); *L.Dev.(Ems.)*, N.Am.(Nev.)-Australia(Queensl.-New S.Wales); *low.M.Dev.*, N.Am.(NW.Terr.-Nev.).——FIG. 175,*2a,b*. **R. arachne*, holotype, L.Dev.(Zlich.), basal 500 ft. of Nevada Ls., Nev., Lone Mt., 18 mi. NW. of Eureka; *a,b*, transv., long. secs., ×2 (Hill, n; photographs courtesy W. A. Oliver).

Xystrigona Yü in WANG, Yü, & WU, 1974, p. 33 [**Xystriphylloides (Xystrigona) trizonata*; OD; †18711-18712, IGP, Nanking] [?=*Martinophyllum* JELL & PEDDER, 1969, which see, both lack septal structural complexity in their type slides]. Cerioid, increase peripheral; major septa long, subequal, two opposite ?(*C* and *K*) may join at axis; minor septa may be somewhat discontinuous longitudinally; septa commonly thin, thickest in inner dissepimentarium; tabularial floors with conical elevation axially and edges turned out or up; dissepimentarium wide, floors subhorizontal to slightly everted, submedian series of dissepiments commonly largest and subhorizontally based. [Diagnosis based only on illustrations of holotype.] *L.Dev.* or *?M.Dev.*, Asia(China).——FIG. 174,*1a,b*. **X. trizonata* (Yü), holotype, L. or ?M. Dev., Shizhou Mbr., Yukiang F., Kwangsi, Liu Jing; *a,b*, transv., long. secs., ×2.5 (Wang, Yü, & Wu, 1974).

Xystriphylloides YÜ, LIAO, & DENG, 1974, p. 224 [**X. nobilis*; OD; †18705-18706, IGP, Nanking] [=*Xystiphylloides* YÜ, LIAO, & DENG, 1974, p. 224, *nom. null.*]. Phaceloceroid; corallites slender, with thin wall; major septa long, subequal, commonly straight and radially arranged, in places their axial ends leaving narrow axial space that may be penetrated by straight or curved edges of one or a few of longest septa; minor septa moderately long; dissepiments globose, horizontally based except in innermost series, where they are steeply inclined; tabulae updrawn to axial edges of major septa, incomplete. *M.Dev.*, Asia(Kwangsi-Yunnan-Szechwan).——FIG. 175,*1a,b*. **X. nobilis*, holotype, Kwangsi, Liu-jeng, Heng-seng; *a,b*, transv., long. secs., ×2 (Yü, Liao, & Deng, 1974).

Subfamily HEXAGONARIINAE Bulvanker, 1958

[*nom. transl.* HILL, herein, *ex* Hexagonariidae BULVANKER, 1958, p. 178] [?=Marisastrinae ROZKOWSKA, 1965, *nom. transl.* JELL, 1969, p. 66, *ex* Marisastridae ROZKOWSKA, 1965, p. 261]

Cerioid; corallites with closely carinate, long septa fusiform in transverse section; septal trabeculae ?tufted monacanths commonly in half fans; dissepimentarial floors with narrow to wide peripheral flat zone, declining adaxially; peripheral zone may be weakly everted in some; dissepiments subglobose, numerous; tabularial floors flat to upraised axially, tabulae incomplete, peripheral adaxially declined tabellae may occur. *M.Dev.(Givet.)-U.Dev.(Frasn.)*.

Hexagonaria GÜRICH, 1896, p. 171 [**Cyathophyllum hexagonum* GOLDFUSS, 1826, p. 61; SD LANG, SMITH, & THOMAS, 1940, p. 69; †neotype, 270c$_1$, GOLDFUSS Coll., IP, Bonn; by PICKETT, 1967b, p. 58] [=*Polyphyllum* DE FROMENTEL, 1861, p. 308 (type, *Cyathophyllum hexagonum* GOLDFUSS, 1826, SD LANG, SMITH, & THOMAS, 1940, p. 103), *non Polyphyllum* BLANCHARD, 1850, a coleopteron; *Hexagoniella* GÜRICH, 1896, p. 500, *nom. null.*; *Hexagoniophyllum* GÜRICH, 1908-1909, p. 102, *nom. van.*]. Cerioid, with septa fusiform in transverse section, thickest in inner parts of dissepimentarium, radially arranged and typically closely carinate with predominantly yardarm carinae formed by lateral extension of fibers of monacanthine trabeculae; major septa attenuate in tabularium and meeting or leaving space at axis; dissepimentarial floors horizontal or slightly declined outward near periphery and steeply declined adaxially near inner margin of dissepimentarium, so that trabeculae are arranged in broad asymmetrical half fan or fan; dissepiments small, numerous, subglobose and with outer two or three series commonly larger and typically flattened above; tabulae incomplete, horizontal or slightly convex with few supplementary peripheral tabellae [BIRENHEIDE, 1969a, p. 41; HILL & JELL, 1970b, p. 44]. *M.Dev.(Givet.)-U.Dev.(Frasn.)*, Eu.(?U.K.-France-Belg.-Ger.-Pol.-Urals)-Asia (Kuzbas-Yunnan)-W.Australia-N.Am.(Wash.-NW.Terr.).——FIG. 176,*1a,b*. **H. hexagona* (GOLDFUSS), neotype, probably up. Givet. or low. Frasn. Refrath beds, Ger., Bensberg; *a,b*, transv., long. secs., ×1.7 (Hill & Jell, 1970b).

Haplothecia FRECH, 1885, p. 68 [**Madreporites filatus* VON SCHLOTHEIM, 1820, p. 359; OD; †Q kat.A138, p.1530, HU, E. Berlin; lectotype by FRECH, 1885, pl. 4] [?=*Marisastrum* ROZKOWSKA, 1965, which see]. Cerioid; corallites with moderately thick common walls; septa moderately thick, trabeculae close and extended laterally in dissepimentarium as yardarm carinae, and curving half-fanwise in median radial longitudinal plane of septa; major septa long, reaching or almost reaching axis; dissepimentarium wide, dissepiments very small, globose, numerous and more or less horizontally disposed, but steeply declined adaxially near narrow tabularium; tabular floors closely spaced, commonly subhorizontal or convex [HILL & JELL, 1970b, p. 34]. *U.Dev.(Frasn.)*, Eu.(Ger.-U.K.-Urals)-?W.Australia.——FIG. 176,*3a,b*. **H. filata* (VON SCHLOTHEIM), lec-

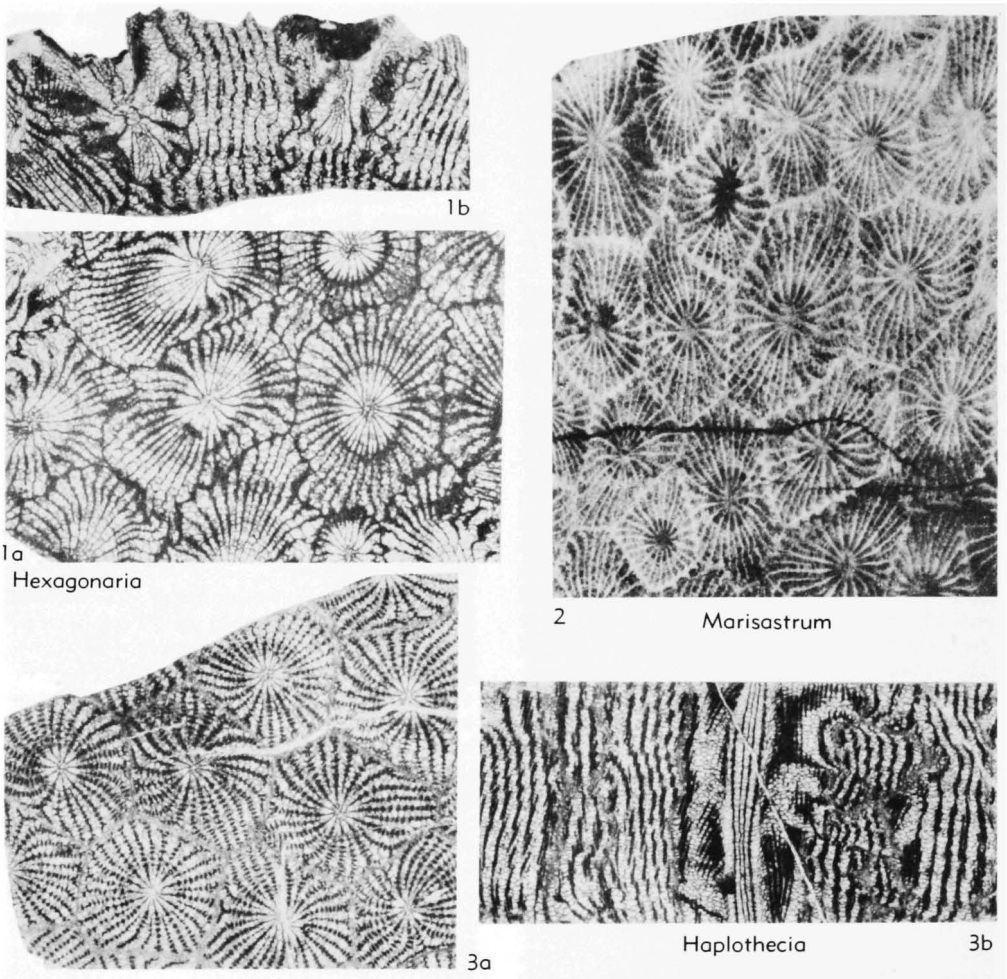


FIG. 176. Disphyllidae (p. *F275-F276*).

totype, Iberg Ls., Ger., Winterberg near Grund, Harz Mts.; *a,b,* transv., long. secs., ×2.7 (Hill & Jell, 1970b).

Marisastrum ROZKOWSKA, 1965, p. 262 [**Cyathophyllum sedgwicki* MILNE-EDWARDS & HAIME, 1851, p. 387; OD; †48451, BM(NH), London; lectotype by SOSHKINA, 1951, p. 96] [?=*Haplothecia* FRECH, 1885, which see]. Cerioid, septa fusiform and carinate or smooth, each composed of full, more or less symmetrical trabecular fan based on slightly arched (reflexed) dissepimentarial floors of small dissepiments; no horseshoe dissepiments; tabular floors convex, tabulae incomplete. [See SCRUTTON, 1967, p. 268. Longitudinal section of lectotype required.] *U.Dev.(Frasn.),* Eu. (France-U.K.-?USSR-Pol.)-?Asia (Kuzbas-NE. USSR).——FIG. 176,2. **M. sedgwicki* (MILNE-EDWARDS & HAIME), lectotype, from ?Frasn. beach pebble, U.K., Torquay; polished transv. sec., ×1.7 (Scrutton, 1967).

Subfamily SPONGONARIINAE Crickmay, 1962

[Spongonariinae CRICKMAY, 1962, p. 2] [=Utaratuiidae SPASSKIY, KRAVTSOV, & TSYGANKO, 1974, p. 171]

Solitary, phaceloid or cerioid; increase peripheral; septa thin, weakly to strongly carinate, carinae commonly from zigzags but in some of yardarm type; major septa extending but little into tabularium or subequal to minor septa, and with regularly or irregularly spinose axial edges; one or more series of dissepiments may be broadly and subhorizontally based, inner series smaller, more globose and adaxially declined; tabularium wide to moderately wide,

tabulae complete or incomplete, floors flat or weakly concave or convex, or when major septa are long, with axial uplifted zone. *Dev.*

Spongonaria Crickmay, 1962, p. 2 [**S. filicata*; OD; †27074, PRI, Ithaca] [=*Spongaria* Bolton, 1974, p. 54, *nom. null.*]. Cerioid; major and minor septa short, equal, thin, some with upturned spines projecting from axial edges; dissepimentarium rather narrow, dissepiments wide and subhorizontally based; tabulae commonly complete, floors horizontal and slightly sagging or slightly uparched. *L.Dev.*, N.Am.(Yukon)-Asia(NE.USSR).——Fig. 177,*1a,b*. **S. filicata,* holotype, Yukon, 65°30′N., 131°15′W., Houston R.; *a,b,* transv., long. secs., ×2 (Hill, n).

Breviseptophyllum Ermakova, 1960, p. 85 [**B. kochanensis*; OD; †? in coll. VNIGNI, Leningrad]. Phacelocerioid; corallites thin-walled; major septa short, few projecting into tabularium, mostly withdrawn somewhat toward outer wall, thinning adaxially and becoming discontinuous as spinelike projections; minor septa shorter; tabularium wide, tabulae commonly complete, flat, may be supplemented by adaxially declined peripheral tabellae; dissepiments moderately large, in one or a few series; septa short in early stages also. *M.Dev. (Eifel.),* Eu.(USSR)-Asia(Kwangsi).——Fig. 177, *2a,b*. **B. kochanense,* holotype, Biya horizon, USSR, borehole 402, core from 3072-8 m., Kokhany, Kuibishev reg.; *a,b,* transv., long. secs., ×3 (Ermakova, 1960).

Disphyllia He, 1978, p. 121 [**Disphyllum (Disphyllia) guanxianensis*; OD; †Scr 587, ?RIGS, ?Chongqing (Chunking); M.Dev., Jiudianping, Guan Co., Sichuan] [=*Donia* Soshkina, 1951, p. 114 (type, *D. russiensis,* OD; †slide 59, coll. 837, PIN, Moscow), *non Donia* Oudemans, 1939, an arachnid]. Cerioid or subcerioid; septa confined to dissepimentarium, withdrawn from periphery and axis and thickened spindlewise, or with carinae interrupted by dissepiments and represented by short septal segments or separate trabeculae based on wall or dissepiments; minor septa represented only by ridges on outer wall; tabulae complete or incomplete, flatly convex or concave, supplemented peripherally by tabellae declined adaxially; dissepiments large, in outer series either horizontally based or declined outward, reflecting everted calice [Hill & Jell, 1970b, p. 48]. *M.Dev.,* Asia(Yunnan); *M.Dev. (Givet.)-U.Dev.(Frasn.),* Eu.(USSR)-Asia(Kwantung-Sichuan)-W.Australia.——Fig. 178,2. **D. russiensis* (Soshkina), holotype, Frasn., Orlov reg., Russ. Platf.; transv. sec., ×4 (Soshkina, 1951).

Tropidophyllum Pedder, 1971a, p. 374 [**T. hillae*; OD; †F11664, UNE, Armidale]. Solitary, trochoid to ceratoid; septa radially arranged, faintly to highly carinate; adaxially dilated and with spinose axial edges, markedly withdrawn from axis; septa

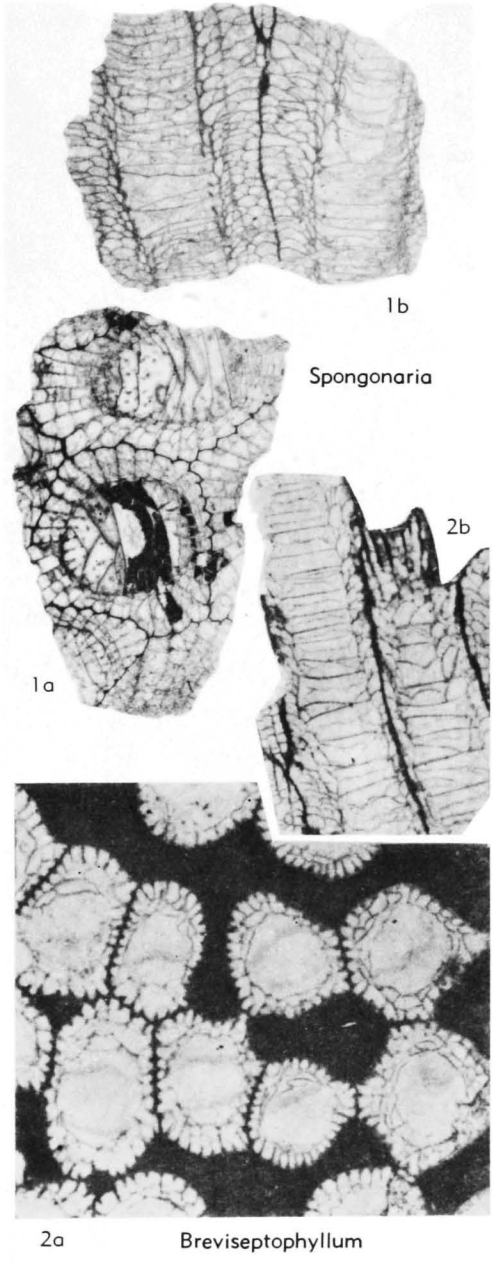


Fig. 177. Disphyllidae (p. *F277*).

contiguous in adaxial stereozone, commonly forming narrow inner wall; trabeculae in half fans, monacanthine, with widely divergent fibers; tabulae broad, horizontal, complete or with peripheral tabellae where tabular floors are concave; dissepiments in a few or several rows, generally adaxially declined, although locally outermost may be larger

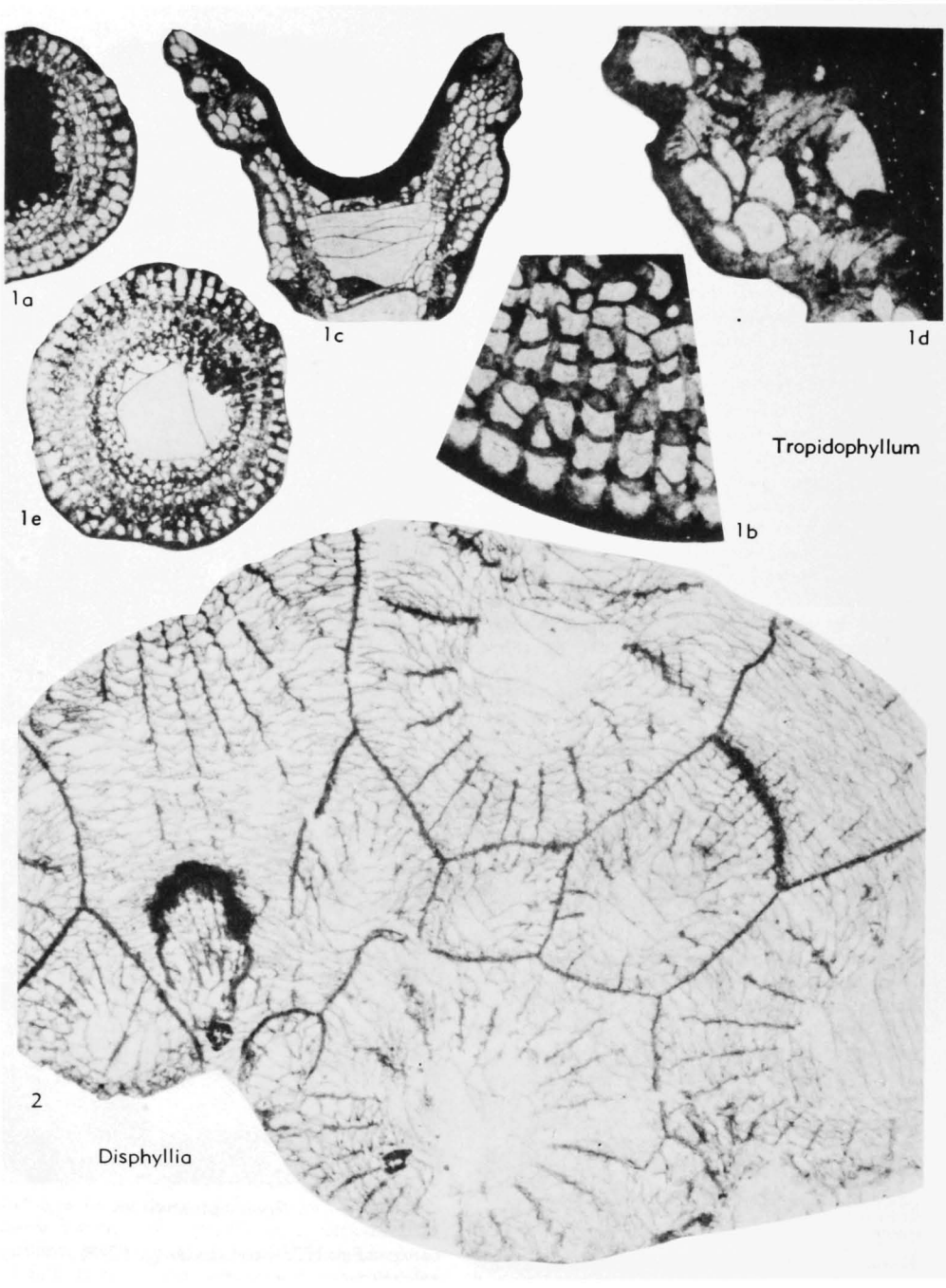


FIG. 178. Disphyllidae (p. *F277-F278*).

and flat-lying and may be rhomboid. *L.Dev.*, Australia(New S.Wales-Vict.).——FIG. 178,*1a-e*. **T. hillae*, ?Prag., New S. Wales, Lick Hole F., Kiandra-Ravine road sec.; *a-d*, holotype, *a*, part of transv. sec., ×3, *b*, lower part of *a*, ×10, *c*, long. sec., ×3, *d*, left part of *c*, ×10; *e*, paratype, transv. sec., ×3 (Pedder, 1971a).

Utaratuia CRICKMAY, 1960, p. 5 [**U. laevigata*,

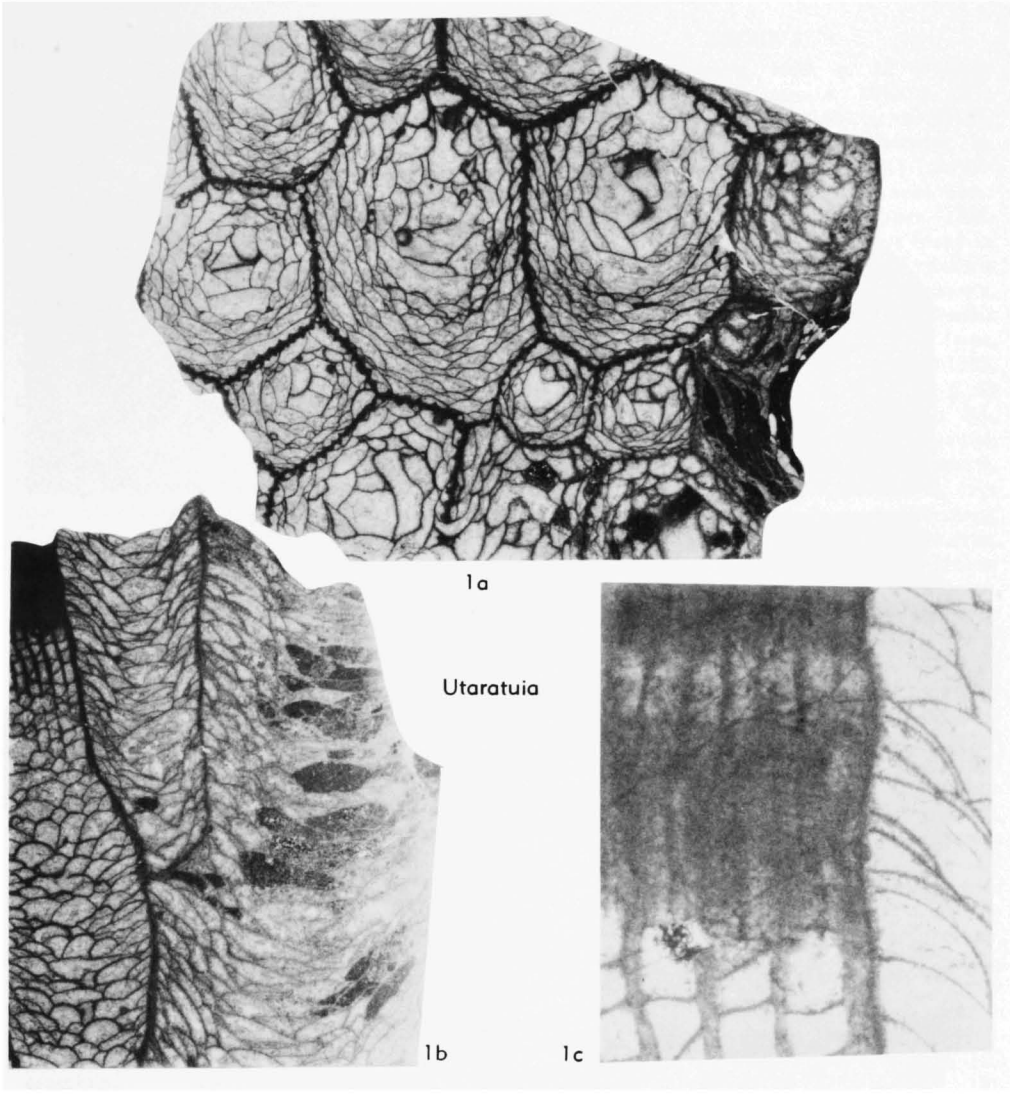


FIG. 179. Disphyllidae (p. *F278-F279*).

OD; †27026, PRI, Ithaca]. Cerioid, septa represented only by peripheral ridges so that corallites have thick, serrated common walls with rare, porelike spaces; alternate ridges (minor septa) are barely perceptible except as longitudinal dark lines in tangential sections of wall; dissepiments arranged in irregular longitudinal series; peripheral series of tabellae declined adaxially, and axial series horizontal or shallowly curved [see JELL & HILL, 1970b, p. 834; see also OLIVER & SANDO, 1977, p. 422]. *M.Dev.(Givet.)*, N.Am.(NW.Terr.-Nev.)-Asia(Kweichow); *U.Dev.*, Eu.(USSR).——FIG. 179,*1a-c*. **U. laevigata*, holotype, Givet., Hume F., Can., Rainbow Arch, Carcajou R., NW. Terr.; *a,b*, transv., tang. secs., ×2, *c*, part of wall in *b*, showing, between major septal ridges, scarcely projecting minor septal ridges continuous with longitudinal dark lines in wall, ×10 (Jell & Hill, 1970b).

?**Variseptophyllum** KONG in KONG & HUANG, 1978, p. 60 [**V. sinense*; OD; †Gcr 449-451, GB, Guiyang; M.Dev., Dushan, S. Guizhou (Kweichow)]. Fasciculate, in places cerioid; major and minor septa subequal, major septa with axial edges ?(spinose or amplexoid), barely projecting into wide tabularium with flat tabulae; dissepimentarium of large, globose, subhorizontally based dissepiments peripherally, inner series small, ad-

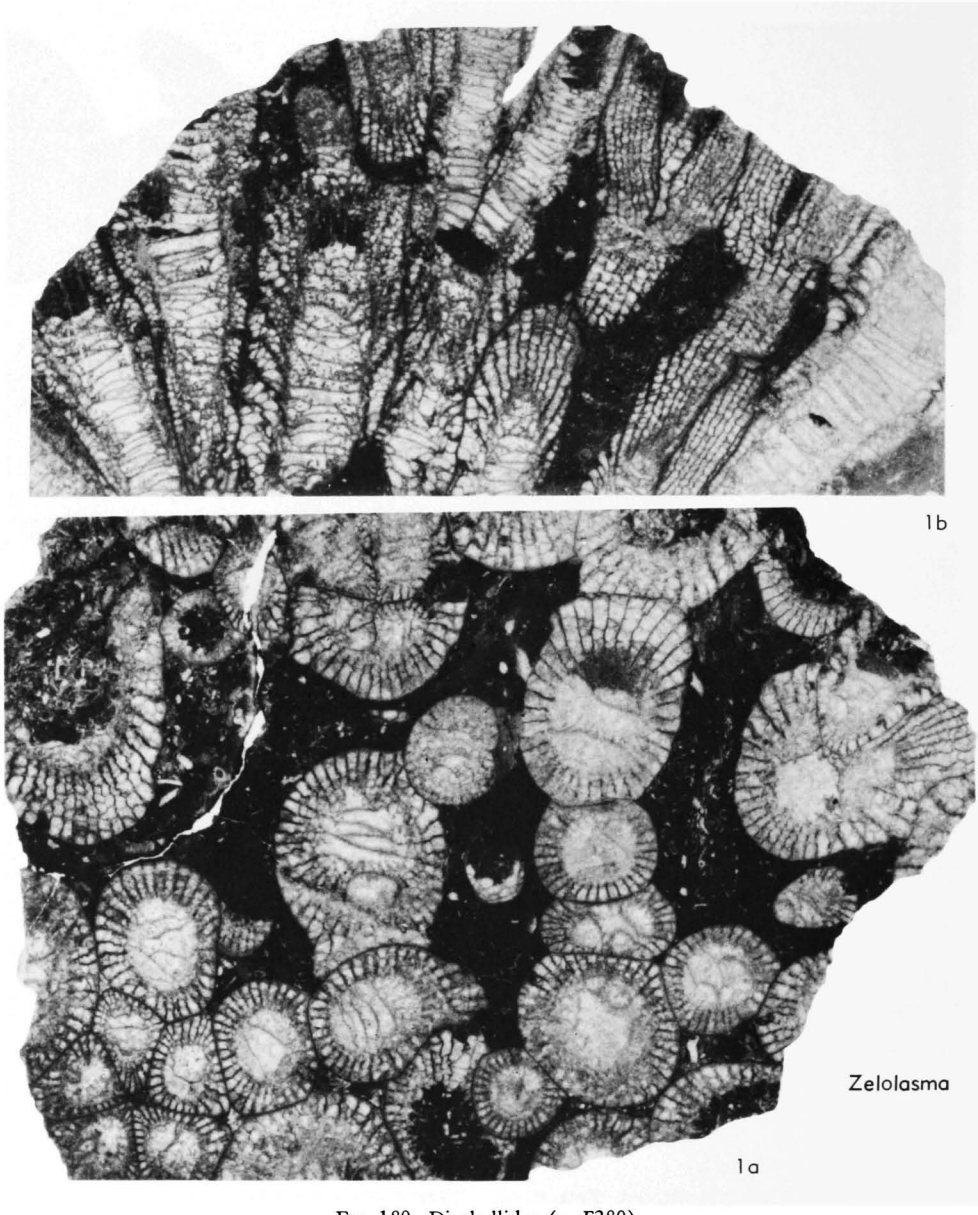


FIG. 180. Disphyllidae (p. *F*280).

axially declined. [Diagnosis tentative; from illustrations.] *M.Dev.*, Asia(Kweichow).

Zelolasma PEDDER, 1964a, p. 364 [**Diphyphyllum gemmiforme* ETHERIDGE, 1902, p. 253; OD; †F5171, AM, Sydney]. Phaceloid or partly cerioid, with peripheral, parricidal increase, in some becoming quadripartite; major and minor septa subequal, of uniserial monacanths, smooth to weakly carinate, axial ends may be spinose in wide tabularium; dissepiments globose to rhomboid, variable in size, larger ones subhorizontally based; tabular floors gently sagging or horizontal or weakly convex; tabulae complete or incomplete. *L.Dev.*, Australia(New S.Wales)-Asia(Tadzhik.)-Eu.(Urals)-?N.Afr.(Alg.).——FIG. 180,*1a,b*. **Z. gemmiforme* (ETHERIDGE), Cavan Bluff Ls., New S. Wales, near Taemas Bridge, N. bank of Murrumbidgee R.; *a,b*, transv., long. secs., ×3 (Hill, n; UQF45755, UQF49834).

Family PHILLIPSASTREIDAE Hill, 1954

[*nom. subst.* Hill, 1954, p. 14, *pro* Phillipsastraeidae Roemer, 1883, p. 389, *nom. inval.* based on Phillipsastraea d'Orbigny, 1850, p. 107, *nom. van.*] [=Phacellophyllidae Wedekind, 1922a, *nom. transl.* Kettnerová, 1932, p. 18, *ex* Phacellophyllinae Wedekind, 1922a, p. 3; Pexiphyllidae Walther, 1928, p. 117; Thamnophyllidae Soshkina, 1941, p. 37; Peneckiellidae Soshkina, 1947, p. 763; Pachyphyllidae Stumm, 1948a (*nom. transl.* Stumm, 1949, p. 35, *ex* Pachyphyllinae Stumm, 1948a, p. 43); Neocampophyllidae Soshkina, 1954, p. 44, *nom. inval.*, based on name of nonexistent genus; Phillipsastreinae Hill, 1956b, p. F279; Macgeeidae Rozkowska, 1957 (*nom. transl.* Schouppé, 1958, p. 218, *ex* Macgeeinae Rozkowska, 1957, p. 83); Peneckiellinae Schouppé, 1958, p. 229; Keriophylloididae Cherepnina, 1969 (*nom. transl.* Cherepnina, 1974, p. 201, *ex* Keriophylloidinae Cherepnina, 1969, p. 69)]

Solitary, fasciculate or massive; septal trabeculae rhipidacanths or tufted monacanths; septal thickening commonly greatest near or at inner boundary of dissepimentarium and coincident with pipe of horseshoe dissepiments which may be but commonly is not separated from tabularium by one or a few series of small, subglobose, adaxially declined dissepiments; where dissepimentarium remains narrow, flat dissepiments may separate pipe from outer wall; where dissepimentarium is wide, several series of horizontally based to outwardly declined, small, subglobose dissepiments separate pipe from wall but may have one series of flat dissepiments between them and wall; tabularium bizonal with axial tabellae domed or flat-lying or in concave floors and periaxial series commonly like large, subglobose dissepiments and declined adaxially. *L.Dev.-U.Dev.*

For taxonomic history see Schouppé, 1958, p. 141; Scrutton, 1968, p. 205; Tsien, 1968b, p. 595; Jell, 1969, p. 61; and Cherepnina, 1974, p. 198. Subdivision is not yet clear-cut. It may be possible to distinguish four groups: 1) a thamnasterioid subfamily, Phillipsastreinae, containing *Phillipsastrea, Keriophylloides,* and *Bensonastraea*; 2) a cerioid, astreoid to thamnasterioid unnamed subfamily comprising *Trapezophyllum, Stellatophyllum, Sulcorphyllum, Frechastraea,* and *Scruttonia*; 3) the Phacellophyllinae, a group of solitary and phaceloid genera, in which a pipe of horseshoe dissepiments is always well developed and surrounded by a single series of flat dissepiments; and 4) the Peneckiellinae, phaceloid and cerioid, for *Peneckiella* and *Sudetia.* Because of the complex intergradations between pairs of members across these group lines, the family is not formally subdivided in this *Treatise.*

GROUP 1

Phillipsastrea d'Orbigny, 1849, p. 12 [**Astrea (Siderastrea) hennahii* Lonsdale, 1840, p. 697; SD Milne-Edwards & Haime, 1850, p. xxi; †6185, Geol. Soc. Coll., GSM, London; lectotype by Milne-Edwards & Haime, 1851, p. 421] [=*Phillipsastraea* d'Orbigny, 1850, p. 107, *nom. van.; ?Pachyphyllum* Milne-Edwards & Haime, 1850, p. lxviii (type, *P. bouchardi,* OD; †not found in MN, Paris; Frasn., Ferques; diameter of tabularia and corallites large, see Semenoff-Tian-Chansky, Lafuste, & Durand, 1962, p. 307); *Smithia* Milne-Edwards & Haime, 1851, p. 171 (type, *Astrea hennahi* Lonsdale, SD Gürich, 1908-1909, p. 102); *?Medusaephyllum* Roemer, 1855, p. 33 (type, *M. ibergense,* M; †not found in BA, Clausthal-Zellerfeld; Frasn., Iberg Ls., near Grund, Ger.); *?Streptastrea* Sandberger & Sandberger, 1850-1856, p. 416 (type, *S. longiradiata,* M; †not traced; Dev., Schalstein congl., near Dillenberg, Nassau, Ger.); *?Pseudoacervularia* Schlüter, 1881, p. 84 (type, *Acervularia coronata* Milne-Edwards & Haime, 1851, p. 416, SD Lang, Smith, & Thomas, 1940, p. 108; †types missing, *fide* Scrutton, 1968, p. 213; up. Givet., Barton, near Torquay, U.K.); *Streptastraea* Lang, Smith, & Thomas, 1940, p. 125, *nom. van.; ?Keriophylloides* Soshkina, 1951, which see]. Thamnasterioid or in places astreoid or aphroid; pipe of small horseshoe dissepiments surrounds tabularium, and rhipidacanthine septal trabeculae are fanned over horseshoes; septa fusiform in transverse section, thickest at edge of tabularium; tabulae complete or incomplete; dissepimentarial floors reflexed from pipe of horseshoes [Scrutton, 1968, p. 210; Jell, 1969, p. 63]. *?L.Dev.,* Australia(Queensl.)-Eu.(Spain); *?M.Dev.,* Australia(Queensl.); *L.Dev. (Siegen.-Ems.),* Australia(Vict.-New S.Wales)-Eu.(France); *M.Dev.,* Eu.(U.K.-France)-Asia(Urals-Yunnan)-Australia(New S.Wales)-N.Am.(Wash.); *U.Dev.(Frasn.),* Eu.(U.K.-France-Ger.-Belg.-Pol.-Urals-Timan-Vaygash)-Asia (Armenia-Kuzbas-NE. USSR)-N.Am.(NW.Terr.-Alberta).——Fig. 181, *3a-c.* **P. hennahi* (Lonsdale); *a,b,* lectotype, up. Givet., U.K., Barton Quarry, near Torquay, transv., long. secs., ×2.3, ×3.0; *c,* another specimen, long. sec., ×4.5 (Scrutton, 1968).

Bensonastraea Pedder, 1966, p. 183 [**B. praetor*; OD; †3463, GSM, Sydney] [*?=Keriophylloides* Soshkina, 1951, which see, *Bensonastraea* differs in presence of ?impersistent series of flat dissepiments]. Thamnasterioid; septa vepreculate; septal trabeculae contiguous rhipidacanths diverging fanwise from zone of horseshoe dissepiments near inner margin of dissepimentarium; on either side of pipe of horseshoes, small globose dissepiments are steeply declined from it; impersistent zone of flat dissepiments lies outside outer declined zone, and peripheral zone is of large and small, normal and lateral dissepiments; tabular floors axially

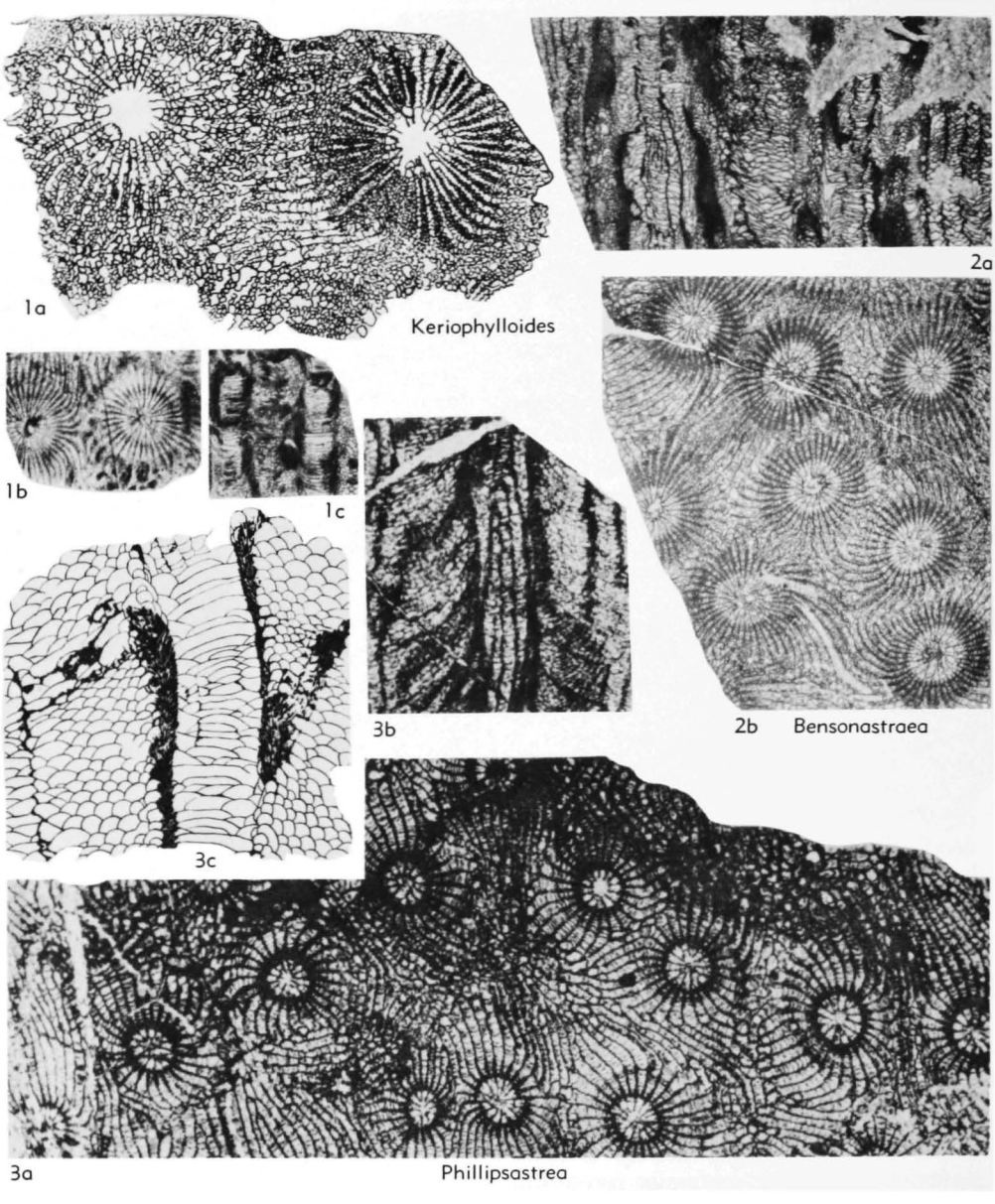


FIG. 181. Phillipsastreidae (p. *F*281-*F*284).

depressed domes with peripheral troughs, of tabellae. *M.Dev.*, Australia(New S.Wales).——FIG. 181,*2a,b*. **B. praetor*, holotype, Timor Ls., New S. Wales, Portion 133, Parish of Lincoln, County of Brisbane; *a,b*, long., transv. secs., ×1.5 (Pedder, 1966; photographs courtesy A. E. Pedder).

Keriophylloides SOSHKINA, 1951, p. 102 [**Keriophyllum astreiforme* SOSHKINA, 1936b, p. 62; OD; †slides 134-6, coll. 2869, PIN, Moscow; lectotype by SOSHKINA, 1951, p. 102] [?=*Phillipsastrea* D'ORBIGNY, 1849, which see; *?Bensonastraea* PEDDER, 1966, which see]. Astreoid or thamnasterioid; offsets marginal, not parricidal; calice with everted dissepimentarial platform, well-developed ridge over irregular zone of horseshoe dissepiments around tabularial pit; septa carinate, ?vepreculate and vesiculate, major septa somewhat withdrawn from axis; tabulae flat or slightly concave or convex, complete or with some peripheral, auxiliary tabellae. *M.Dev.(Eifel.)*, Eu.(N.Urals).

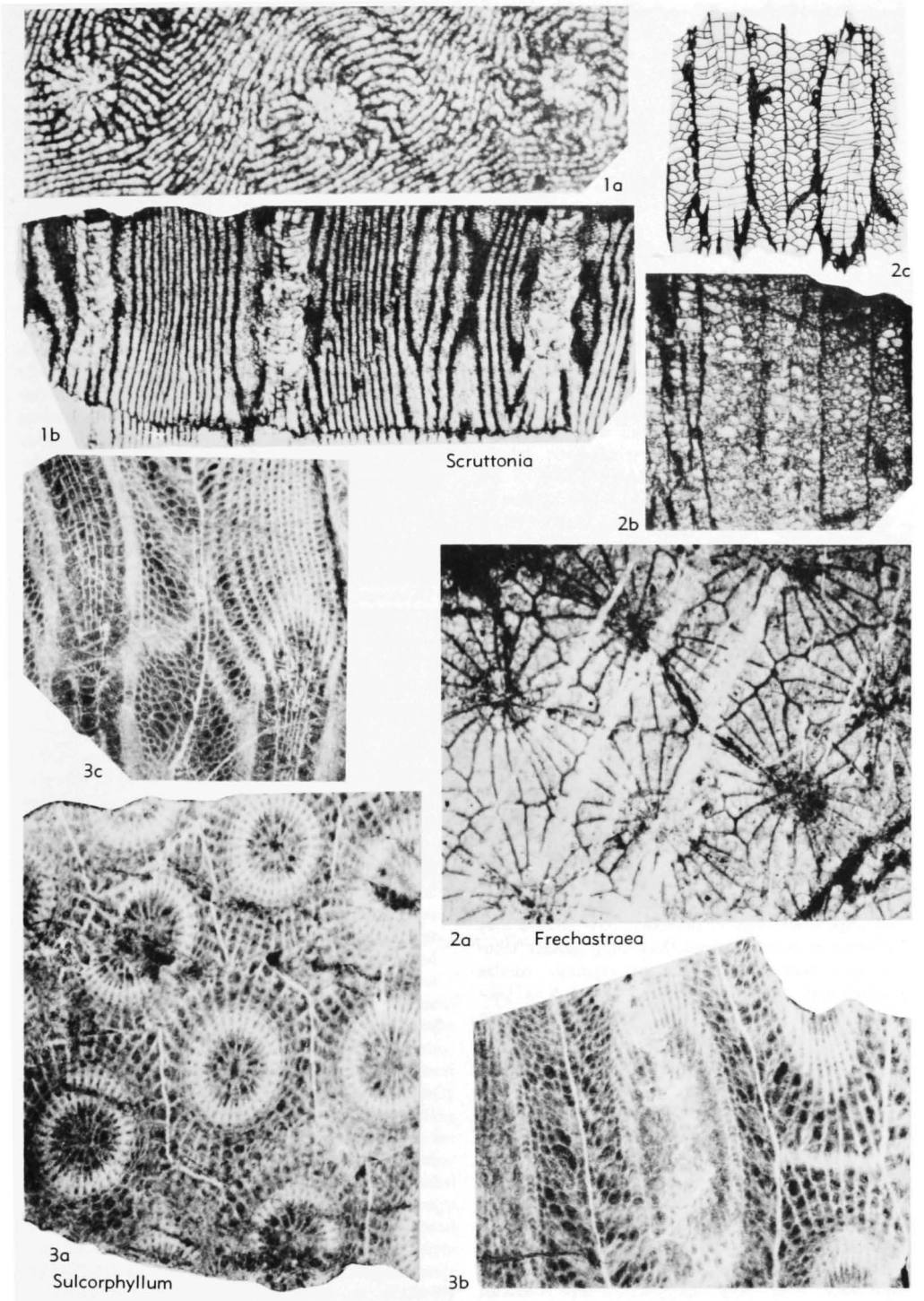


FIG. 182. Phillipsastreidae (p. *F*284).

——Fig. 181,*1a-c.* **K. astreiformis* (Soshkina), holotype, R. Maly Patok; *a,* transv. sec., diagram., ×3.0 (Soshkina, 1936), *b,c,* transv., long. secs., ×1.5 (Soshkina, 1951).

GROUP 2

Frechastraea Scrutton, 1968, p. 231 [**Cyathophyllum pentagonum* Goldfuss, 1826, p. 60; OD; †206, Goldfuss Coll., IP, Bonn; lectotype by Pickett, 1967b, p. 80] [?=*Scruttonia* Cherepnina, 1974, which see]. Astreoid, in places thamnasterioid; major and minor septa uniformly thick in dissepimentarium except in narrow stereozone defining wall to tabularium, attenuate in tabularium; dissepiments small, globose; septal trabeculae arranged in tight fan, axis commonly based on series of dissepiments adjacent to tabularium, which may in places be developed as impersistent pipe of horseshoe dissepiments; dissepimentarial floors almost flat, with slight elevation at wall surrounding tabularium; tabulae complete or incomplete. *M.Dev.(Eifel.),* Eu. (Vaygach I.); *U.Dev.(Frasn.),* Eu.(U.K.-France-Belg.-Ger.-Pol.-?S.Urals-Timan-?Spain)-Asia (Kuzbas-NE. USSR)-N. Am.(NW. Terr.).——Fig. 182, *2a-c.* **F. pentagona* (Goldfuss), lectotype, Frasn., Belg., Namur reg.; *a,b,* transv., long. sec., ×4, ×6; *c,* another specimen, low. Frasn., U.K., road cutting 18 m. W. of Ramsleigh quarry entrance, near Torquay, long. sec., ×6 (*a,* Pickett, 1967b; *b,c,* Scrutton, 1968).

Scruttonia Cherepnina, 1974, p. 202 [**Smithia bowerbanki* Milne-Edwards & Haime, 1851, p. 423; OD; †original of Milne-Edwards & Haime, 1853, pl. 55, fig. 2, not traced; lectotype by Soshkina, 1951, p. 89] [?=*Frechastraea* Scrutton, 1968, which see]. Like *Frechastraea* but thamnasterioid; septa thickened almost to contiguity at inner boundary of dissepimentarium and with carinate trabeculae widely spaced in half fans; dissepimentarium wide with close, flat floors; an impersistent pipe of horseshoe dissepiments may develop in zone of septal thickening against tabularium; tabular floors flat or sagging, tabulae complete or incomplete. *U.Dev.(Frasn.),* Eu.(U.K.-Ger.-?S.Urals).——Fig. 182,*1a,b.* **S. bowerbanki* (Milne-Edwards & Haime), low. Frasn., U.K., Ramsleigh Quarry, Devon; *a,b,* transv. (peel), long. secs., ×6.4, ×3.8 (Scrutton, 1968).

Stellatophyllum Spasskiy in Bulvanker *et al.,* 1968, p. 30 [**S. lateratum*; OD; †7, coll. 9347, TsGM, Leningrad] [?=*Trapezophyllum* Etheridge, 1899b, which see; *Mixogonaria* Kong in Kong & Huang, 1978, p. 87 (type, *M. sanduensis*; †Gcr 600, GB, Guiyang; U.Dev., Frasn., Sandu, Guizhou [Kweichow])]. Cerioid; major septa long, almost reaching axis; minor septa projecting but little from wide dissepimentarium with an inner series of horseshoe dissepiments and several peripheral series of plates either subhorizontally based or somewhat declined toward periphery; flat dissepiments not observed; tabulae subhorizontal, complete or incomplete. *L.Dev.,* Asia(Mt. Altay); *L.Dev.* or *M.Dev.,* Australia(Queensl.); *M.Dev.,* Asia(Kuzbas-S.China)-Eu.(Urals); *U.Dev. (Frasn.),* Asia (NE. USSR-Kweichow).——Fig. 183,*1a,b.* **S. lateratum,* holotype, Baragashskaya Suite, Ganin Log, Gornyy Altay; *a,b,* long., transv. secs., ×2.7 (Bulvanker *et al.,* 1968).

Sulcorphyllum Pedder, 1964a, p. 366 [**Prismatophyllum brownae* Hill, 1942c, p. 152; OD; †8152, SU, Sydney] [?=*Trapezophyllum* Etheridge, 1899b, which see; *Parasulcorphyllum* Jia in Jia *et al.,* 1977, p. 149 (type, *Sulcorphyllum pavimentum* Pedder, 1970, p. 242; OD; †F9544, UNE, Armidale; L.Dev., Wee Jasper, New S. Wales)]. Cerioid, increase peripheral; common wall thin, with median dark plane; septa radially arranged, somewhat thickened in zone of horseshoe dissepiments that divides dissepimentarium from tabularium; major septa subequal, long, may almost reach axis; several series of outwardly declined dissepiments are developed peripheral to pipe of horseshoes, and outermost series of dissepiments may be narrow and flat; tabulae incomplete, subhorizontal, may be raised in axial zone. *?L.Dev.-M.Dev.,* Australia(New S.Wales)-Asia (Kwangsi).——Fig. 182,*3a-c.* **S. brownae,* Sulcor Ls., New S. Wales, near Sulcor quarry, near Attunga; *a,b,* holotype, transv., long. secs., ×3.8; *c,* topotype, long. sec., ×3.8 (Hill, n; 7246, 8152, SU, Sydney).

Trapezophyllum Etheridge, 1899b, p. 32 [**Cyathophyllum elegantulum* Dun, 1898, p. 85; OD; †41717, GSV, Melbourne] [?=*Sulcorphyllum* Pedder, 1964a, which see; *?Stellatophyllum* Spasskiy, 1968, which see; *?Cystitrapezophyllum* Jia in Jia *et al.,* 1977, p. 148 (type, *C. guangxiense,* OD; †IV37027, HPRIGS, ?Wuhan; M.Dev., Pingnan, Guangxi [Kwangsi]; septa discontinuous and dissepiments somewhat globose in outer dissepimentarium)]. Cerioid; corallites with outer series of flat dissepiments, an inner pipe of small horseshoe dissepiments, and an axial series of wide, complete, slightly concave tabulae; major and minor septa subequal, seldom extending beyond pipe of horseshoe dissepiments. [In some the flat dissepiments are replaced by a few series of abaxially declined or subhorizontally based globose dissepiments; Hill, 1939a, p. 234.] *L. Dev.(?Ems.),* Australia(Vict.); *M.Dev.(Couvin.),* Australia(New S.Wales)-N.Am.(Wash.)-Eu.(Ger.)-Asia(Kwangsi).——Fig. 183,*2a-c.* **T. elegantulum* (Dun), topotype, ?Ems., Vict., ls. quarry, Loyola, near Mansfield; *a,b,* transv., long. secs., ×2.7, *c,* long. sec. showing series of peripheral globose dissepiments in places, flat peripheral dissepiments in others, ×2.7 (Hill, n; UQF31114, 54725).

GROUP 3

Farabophyllum Lavrusevich, 1971b, p. 110 [**F.*

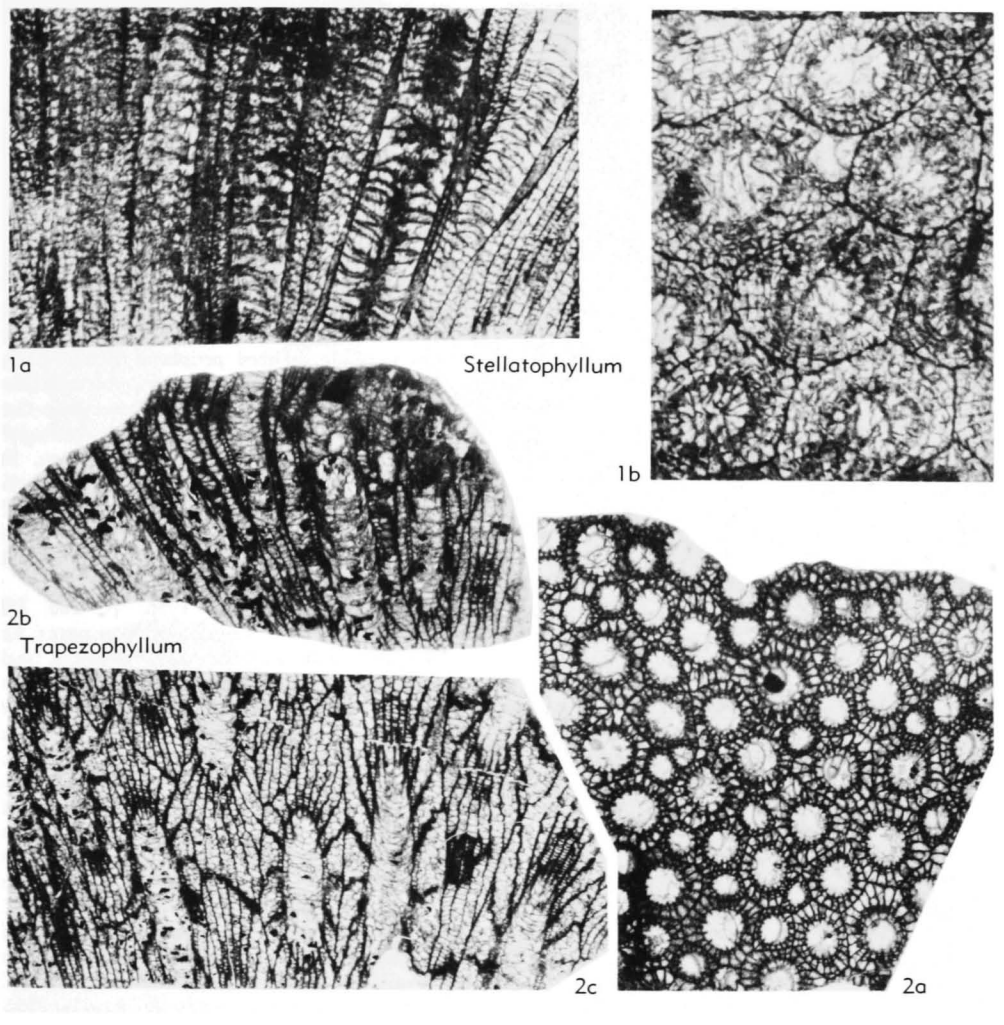


FIG. 183. Phillipsastreidae (p. *F*284).

farabicum; OD; †2225/1, UpG, Dushanbe]. Phaceloid, increase intracalicinal; epithecal scales may occur; each thick septum composed of thick, contiguous trabeculae arranged in an asymmetrical arch whose axis is close to periphery, the adaxially curving trabeculae being very long, becoming horizontal, and those of major septa being deflected upward in outer parts of tabularium; major septa equal, withdrawn from axis leaving axial space, minor septa shorter; interseptal loculi very narrow to suppressed, dissepiments very small and globose [curvature of trabeculae suggests presence of peripheral pipe of horseshoe dissepiments]; tabulae in axial space horizontal or shallowly concave, mostly complete. *L.Dev.(low.Ems.)*, Asia (Tadzhik.)-Australia(Vict.).——FIG. 184,*2a-d*. **F. farabicum*, beds with *Farabophyllum intermedium*, Obi-Kundy mountain ridge, left side of valley of R. Farab, Zeravshan-Gissar Ra.; *a-c*, holotype, transv., oblique, long. secs., ×3; *d*, another specimen, long. sec., ×3 (Lavrusevich, 1971b; photographs courtesy A. I. Lavrusevich).

Phacellophyllum GÜRICH, 1909, p. 102 [**Lithodendron caespitosum* GOLDFUSS, 1826, p. 44; OD; †156, GOLDFUSS Coll., IP, Bonn; lectotype by LANG & SMITH, 1935, p. 574] [?=*Thamnophyllum* PENECKE, 1894, which see; *Phacelophyllum* LANG, SMITH, & THOMAS, 1940, p. 98, *nom. van.*; *?Senceliastraea* TSIEN, 1968a, p. 450, 1969, p. 63, *nom. nud.* for fasciculate Macgeeinae; *Profascicularia* COTTON, 1973, p. 162, *nom. subst. pro Fasciculariа* DYBOWSKI, 1873c, p. 336, *nom. nud.*, 1873d, p. 406 (type, *F. kunthi* (DAMES), OD; †not traced; U.Dev., Mokrzeszow (formerly

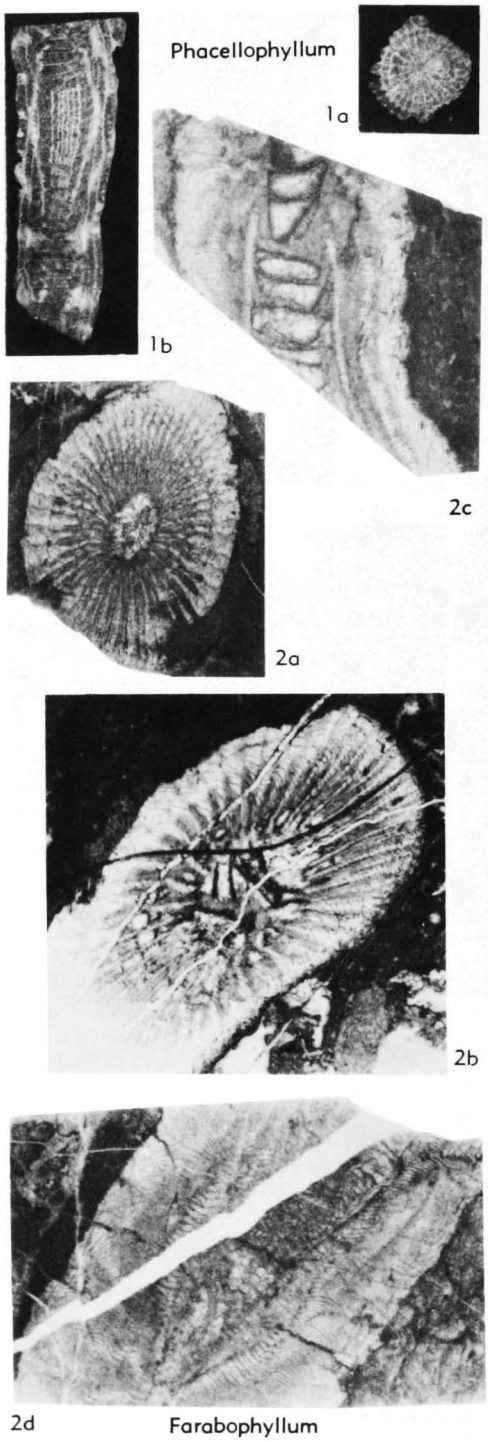


FIG. 184. Phillipsastreidae (p. *F284-F286*).

Oberkunzendorf), Pol.; =*Lithodendron caespitosum* GOLDFUSS, 1826, *fide* LANG, SMITH, & THOMAS, 1940, p. 59, but see ROZKOWSKA, 1960, p. 29, and PICKETT, 1967b, p. 31); *Senceliastrea* COTTON, 1973, p. 187, *nom. null.*]. Dendroid or phaceloid; corallites diverging after increase, may be united by dissepimental tissue in axils of branches; septa fusiform in transverse section, but not carinate; dissepimentarium regular, biserial, with inner row of horseshoe dissepiments arranged in pipe about tabularium, and an outer row of flat dissepiments; in places additional subglobose dissepiments may develop declined inward and outward from pipe; tabulae complete or incomplete, with adaxially declined peripheral tabellae [HILL & JELL, 1970b, p. 27]. *?L.Dev.,* Australia(New S.Wales); *M.Dev.,* Eu.(U.K.-France-Belg.-Ger.-Pol.-Aus.-Czech.-USSR)-Asia (Urals-Kuzbas)-N. Afr.(Zemmour)-Australia(Queensl.); *U.Dev.,* Eu. (USSR-Armenia)-N.Am.(NW.Terr.)-W. Australia. ——FIG. 184,*1a,b.* **P. caespitosum* (GOLDFUSS), lectotype, ?Givet., "Berndorf," Ger., Eifel; *a,b,* transv., long. secs., ×2 (Hill, n; photographs courtesy R. Birenheide).

Protomacgeea ROZKOWSKA, 1956, p. 280 [**P. dobruchnenis*; OD; †original of ROZKOWSKA figs. 2-4, presumably PZI, Poznan]. Solitary, small; lumen almost entirely filled with dilated septa pinnately arranged with cardinal septum greatly reduced in fossula; counter septum elongate; trabeculae ?rhipidacanths, arranged in symmetrical fans in inner dissepimentarium, axis of pipe over horseshoe dissepiments that are almost entirely obscured by septal thickening; some flat dissepiments may be visible at periphery; tabulae rare, complete or incomplete in horizontal or concave floors. *M.Dev.,* Eu.(Pol.)-?Australia(Queensl.). ——FIG. 185,*1a-c.* **P. dobruchnensis*; holotype, Couvin., Pol., Grzegorzowice, Holy Cross Mts.; *a,* ext. view of part of distal end of calice, ×5.7; *b,c,* long., transv. secs., ×4.0 (Rozkowska, 1956).

Pterorrhiza EHRENBERG, 1834, p. 312 [**Cyathophyllum marginatum* GOLDFUSS, 1826, p. 55; SD LANG, SMITH, & THOMAS, 1940, p. 111; †189a, GOLDFUSS Coll., IP, Bonn; lectotype by BIRENHEIDE, 1969a, p. 42] [=*Macgeea* WEBSTER, 1889, p. 710 (type, *Pachyphyllum solitarium* HALL & WHITFIELD, 1873, p. 232, SD FENTON & FENTON, 1924, p. 54; †NYSM, Albany, missing *fide* BIRENHEIDE, 1969b, p. 121; Frasn., Rockford, Iowa); *Pexiphyllum* WALTHER, 1928, p. 128 (type, *P. rectum,* SD LANG, SMITH, & THOMAS, 1940, p. 98; †slides 7070-7071, WEDEKIND Coll., SM, Frankfurt; Frasn., Massenkalk, Deilinghofen and Warrenbeck, Ger., *fide* SCHOUPPÉ, 1958, p. 224)]. Solitary or with few offsets, epitheca not extending quite to rim of calice so that peripheral edges of septa are exposed distally; septa somewhat dilated in moderately wide dissepimentarium, which includes one series of horseshoe dissepiments and one peripheral series of flat dissepi-

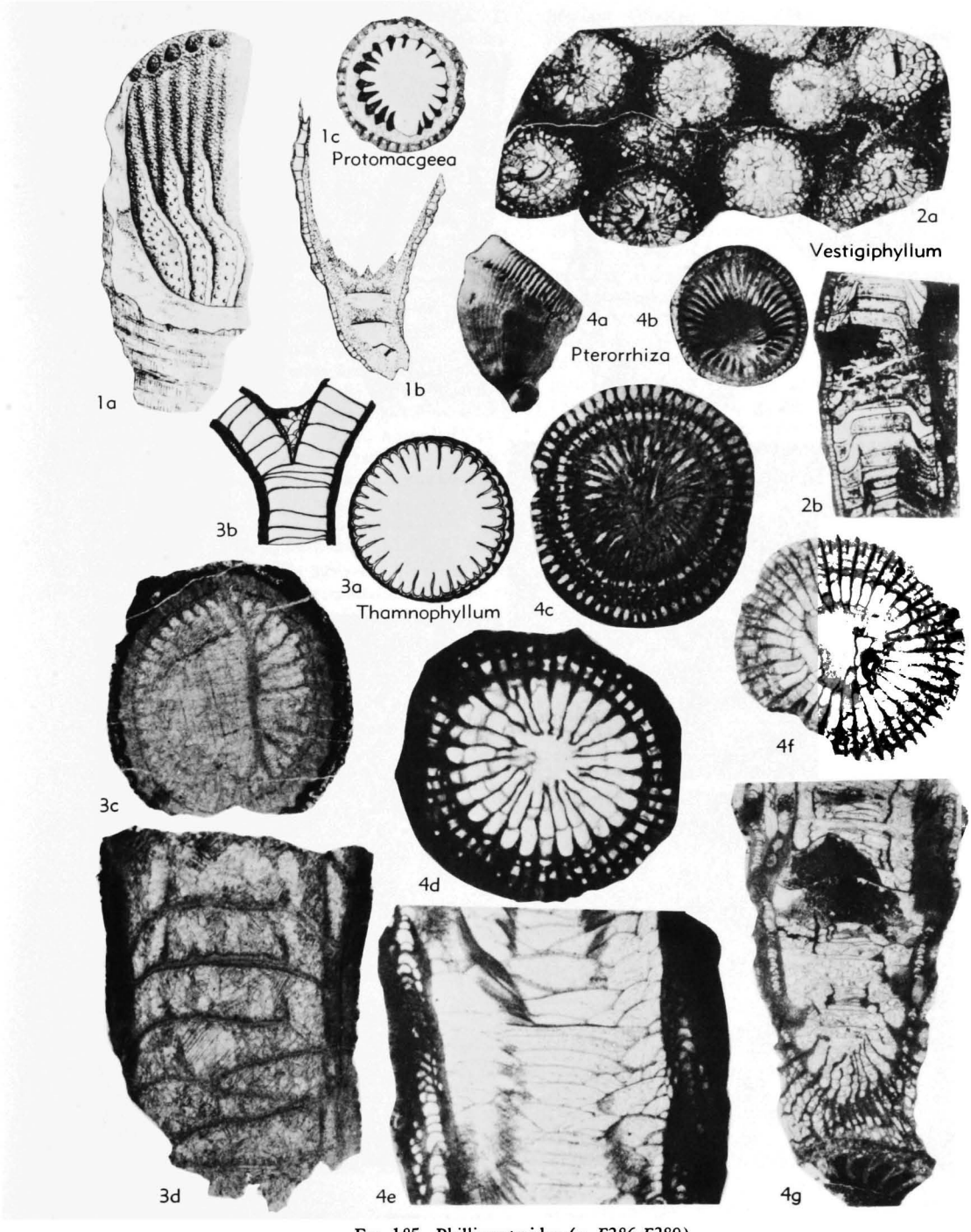


FIG. 185. Phillipsastreidae (p. *F286-F289*).

ments, and in places subglobose plates declined from either or both sides of pipe; trabeculae ?rhipidacanthine, arranged in fans over horseshoe dissepiments; tabulae horizontal or concave, supplemented peripherally by inclined tabellae [ROZKOWSKA, 1957, p. 102; PICKETT, 1967b, p. 28;

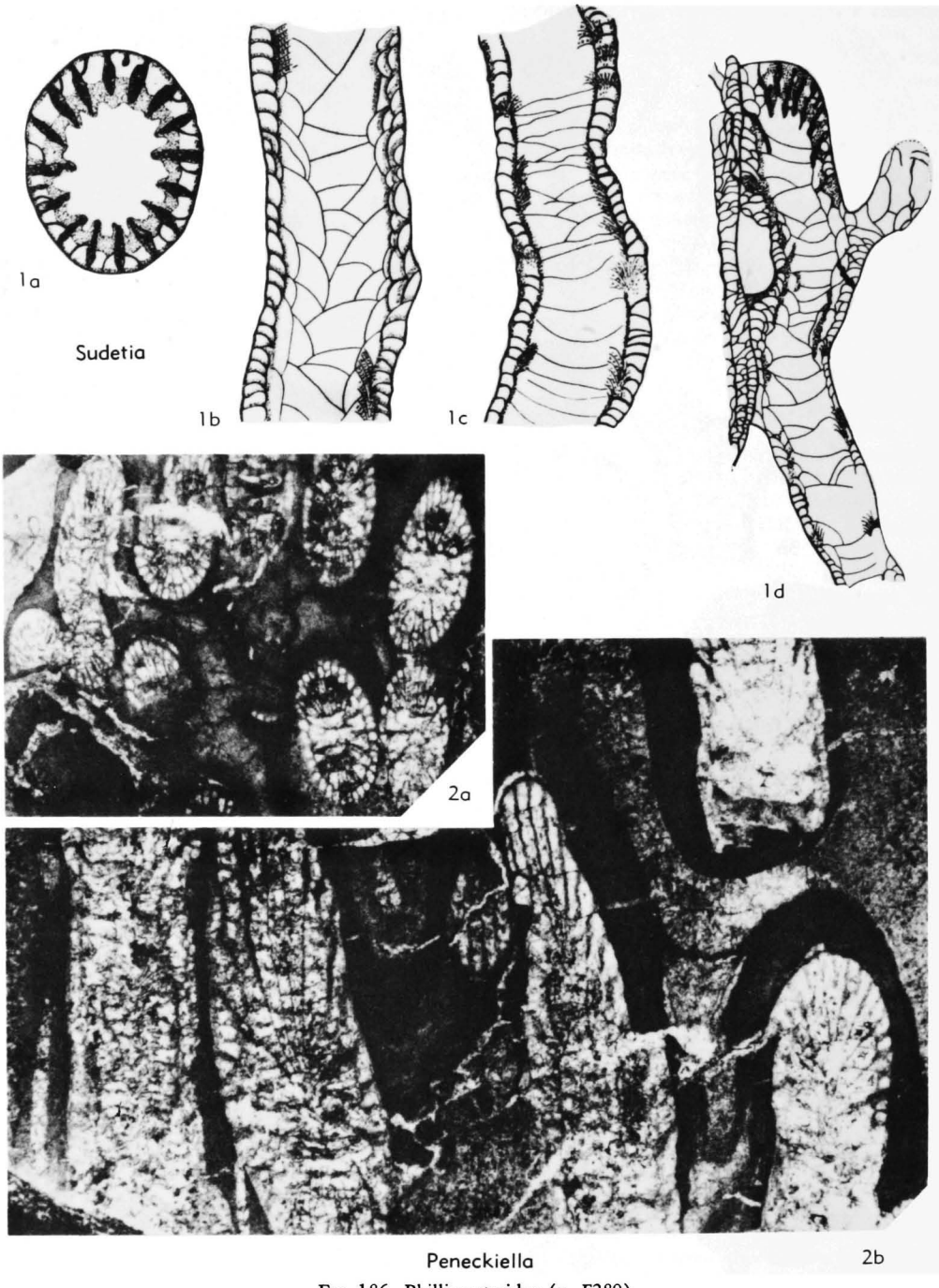


FIG. 186. Phillipsastreidae (p. *F*289).

BIRENHEIDE, 1969a, p. 42; BRICE & ROHART, 1974, p. 47]. *M.Dev.*, Eu.(U.K.-Belg.-Ger.-Pol.)-Asia (Armenia-Afghan.-?Kwangsi); *U. Dev. (Frasn.)*, Eu.(Ger.-France-Pol.-Urals-Timan)-Asia (Armenia-Pak.)-N. Afr.(Alg.)-N. Am.(Iowa-NW.Terr.).——FIG. 185,*4a-c*. **P. marginata* (GOLDFUSS), ?Frasn., Ger., Bensberg; *a,b*, syntype, side and calical views, ×1.0 (Pickett, 1967b); *c*, lectotype, transv. sec.,

×2.7 (Birenheide, 1969a).——Fig. 185,*4d,e*. *P. rectum* (Walther), Frasn., Ger., Deilinghofen and Warrenbeck; *d,e*, transv., long. secs., ×2.7 (Schouppé, 1958).——Fig. 185,*4f,g*. *P. gallica* (Lang & Smith), Frasn., probably from F_{2e} sh. behind Boussu Cemetery, Belg.; *f,g*, transv., long. sec., ×2.0, ×2.7 (Hill, n; UQF12794); see Fig. 8 for an enlarged view of *g*.

Thamnophyllum Penecke, 1894, p. 593 [**T. stachei*; SD Lang & Smith, 1935, p. 564; †886, UG, Graz; lectotype by Flügel, 1958, p. 625] [?=*Phacellophyllum* Gürich, 1909, which see]. Dendroid or phaceloid, with axial increase; septa so dilated in dissepimentarium that only loculi are those enclosed by median series of small horseshoe dissepiments; septal trabeculae ?rhiphidacanths; in tabularium septa are attenuate and do not reach axis; tabulae typically transverse, flat or slightly domed or saucered, mostly complete and commonly widely spaced. *L.Dev.*, Australia(Vict.); *M. Dev. (Eifel.)*, Eu. (Aus.-?France)-Asia (Urals).——Fig. 185,*3a-d*. **T. stachei*, M.Dev., Barrandei beds, Aus.; *a,b*, transv., long. secs., ×2.7, ×1.3 (Lang & Smith, 1935), *c,d*, transv., long. secs., ×3.9, ×4.5 (Hill, n; BM(NH) R30991, R30994).

Vestigiphyllum Sytova in Sytova & Ulitina, 1970, p. 117 [**Thamnophyllum tabulatum* Bulvanker, 1958, p. 79; OD; †99 and slide 720a, coll. 7761, TsGM, Leningrad] [?=*Phacellophyllum* Gürich, 1909, which see, stability of aulos in *Vestigiphyllum* uncertain, no aulos in *Phacellophyllum; Thamnosyringaxon* Ivanovskiy, 1973b, p. 116, *nom. null.* (type, *Thamnophyllum tabulatum* Bulvanker, see above); *Neopetrozium* Jia in Jia *et al.*, 1977, p. 151 (type, *N. zhongguoense*, OD; †IV37034, HPRIGS, Yichang; L.Dev., Gui Xian, Guangxi [Kwangsi])]. Branching, corallites long, cylindrical, increase lateral; major septa withdrawn somewhat from axis to upper edges of mesa-shaped axial tabellae which may be based one upon another thus forming ?impersistent tabular aulos or may have their edges declined to dissepimentarium; adaxially declined or flat periaxial tabellae may occur; minor septa very short; septa somewhat thickened in narrow dissepimentarium which consists of longitudinal series of small horseshoe dissepiments separated from outer wall by very narrow flat or slightly convex dissepiments declined toward outer wall. *L.Dev.*, Asia(Kwangsi); *M. Dev. (Eifel.)*, Asia (Kuzbas-Transcauc.).——Fig. 185,*2a,b*. **V. tabulatum* (Bulvanker), holotype, Shandin beds, Kuzbas, Mt. Krest, SW. of Ashkurek; *a,b*, transv., long. secs., ×2.7 (Bulvanker, 1958).

GROUP 4

Peneckiella Soshkina, 1939, p. 23 [**Diphyphyllum minus* Roemer, 1855, p. 29; OD; †117, BA, Clausthal-Zellerfeld] [=*Penenckiella* Stumm, 1949, p. 37, *nom. null.*; see also under *Phacellophyllum* Gürich, 1909; *?Sudetia* Rozkowska, 1960, which see]. Phaceloid; septa noncarinate but thickened especially at inner edge of dissepimentarium, which is narrow and commonly of one series of globose plates flattened above, each with its inner edge curved down in three-fourths hemisphere to meet plate next below and its outer edge abutting wall at level higher than base of inner edge (peneckielloid) [these have been interpreted by Flügel, 1956b, p. 356, and Schouppé, 1958, p. 229, as horseshoe plates with their outer ends amalgamate with wall]; rarely one or a few horseshoe dissepiments are found; septal trabecular fans may occur with zone of divergence at axis of curvature of upper surface of dissepiments; trabeculae rhipidacanths; tabulae commonly in one series and complete, may be flat-topped domes; peripheral tabellae declined adaxially may occur [Hill & Jell, 1970b, p. 30; Scrutton, 1968, p. 271]. *?L.Dev.(Ems.)*, Australia(New S.Wales); *?M.Dev.(Givet.)*, W.Australia-N.Am.(Wash.); *U. Dev. (Frasn.)*, Eu. (Ger.-U.K.-Pol.)-W. Australia.——Fig. 186,*2a,b*. **P. minor* (Roemer), holotype, Frasn., Iberg Ls., Ger., Winterburg near Bad Grund; *a,b*, oblique transv., long. secs., ×3, ×6 (Scrutton, 1968).

Sudetia Rozkowska, 1960, p. 35 [**S. lateseptata*; OD; †Rozkowska figs. 30-33, PZI, Poznan] [?=*Peneckiella* Soshkina, 1939, which see, *fide* Scrutton, 1968, p. 273]. Dendroid; increase lateral, from connecting process, offset thamnophylloid or aseptate; corallites with slender stereozone at boundary between tabularium and dissepimentarium, major septa short, scarcely extending beyond stereozone; minor septa shorter, not always projecting beyond wall; one series of peneckielloid dissepiments; trabecular fans asymmetrical, with axis of divergence near wall, resting on distal end of peneckielloid dissepiment; trabeculae thick; tabulae mostly complete, concave or horizontal. *U.Dev.(Frasn.)*, Eu.(Pol.-Urals).——Fig. 186,*1a-d*. **S. lateseptata*, holotype, Pol., Mokrzeszow (formerly Oberkunzendorf); *a*, transv. sec., ×7.4; *b-d*, long. secs., ×5.0, ×5.2, ×3.2 (Rozkowska, 1960).

Suborder CYATHOPHYLLINA Nicholson, 1889

[*nom. correct.* Hill, herein, *ex* "Order Zoantharia, Section II Madreporaria Rugosa (Tetracoralla) Section I Cyathophylloidea" Nicholson in Nicholson & Lydekker, 1889, p. 284. It is assumed from this citation that Nicholson's taxon is of ordinal rank; he included Cyathophyllidae Dana, 1846b, Heliophyllidae Nicholson, 1889 (=Zaphrentidae Milne-Edwards & Haime, 1850), and Clisiophyllidae Nicholson in Nicholson & Lydekker, 1889, p. 291.] [=Zaphrentina Nicholson, 1889, *nom. correct.* Weyer, 1972c, p. 448, *pro* Zaphrentoidea Nicholson in Nicholson & Lydekker, 1889, p. 293. Nicholson, not knowing that dissepiments are commonly developed distally in *Zaphrentis*, used the name Zaphrentoidea for those Rugosa without dissepimentarium.]