Lemonea Senowbari-Daryan, 1990, p. 151 [**Guadalupia cylindrica* Girty, 1909, p. 81; OD]. Conical to cylindrical with central cloaca partly or completely filled with parallel, exhalant canals formed from expansion of trabecularium; surrounding thalamidarium as in *Guadalupia* Girty, 1909, with which this intergrades. *Cystothalamia* Girty, 1909, also may have parallel, exhalant canals partly filling cloaca. [*Lemonea conica* Senowbari-Daryan, 1990, has multiple bundles of parallel, exhalant tubes, each bundle surrounded by a thalamidarium, but the whole forming a single, continuous, conical individual. It probably should be made a separate genus.] *Permian (Wordian–Guadalupian):* USA (Texas, New Mexico), Tunisia, Italy (Sicily), Yugoslavia, China.——Fig. 456,*2a–c*. **L. cylindrica* (Girty), Capitan Limestone, Guadalupian, Guadalupe Mountains, Texas; *a,* transverse section of holotype showing radial chambers around broad spongocoel that contains vesiculae, ×5; *b,* longitudinal section showing arcuate, radial chambers and vesiculae in spongocoel, ×5 (Girty, 1909); *c,* polished surface with longitudinal sections of three cylindrical specimens that have characteristic chamber development in their walls and vesiculae of their broad spongocoels, USNM 35019, ×1 (Rigby, Senowbari-Daryan, & Liu, 1998).

Praethalamopora Russo, 1981, p. 14 [**P. zardinii;* OD]. Cylindrical, chambers not apparent externally; exterior covered with small, closely spaced, circular pores; central cloaca narrow, diameter approximately one-fifth that of sponge; chamber height less than diameter; chambers more or less radially arranged around cloaca and ovoid in section (or alternatively, superposed discoid chambers subdivided by radial partitions); chamber walls perforated by pores; trabecularium not evident; microstructure spherulitic (isodiametric). *Triassic (Carnian):* Italy.——Fig. 454,*3a–c*. **P. zardinii,* San Cassiano Formation, Cortina d'Ampezzo, Dolomite Alps; *a,* side view of holotype exterior; *b,* longitudinal section with a tubular spongocoel and slightly arched chambers on margins, ×2; *c,* transverse section illustrating spherulitic microstructure, IPUM 19291, ×200 (Russo, 1981).

Family UNCERTAIN

Fluegelispongites Mostler, 1994, p. 345 [**F. trettoensis;* OD]. Agelasid sponges characterized by isolated, slender, C- to S-shaped acanthostrongyles that have their spines arranged in spirals. *Middle Triassic:* Italy.——Fig. 450,*4*. **F. trettoensis,* Buchensteiner Schichten, Trettoe; isolated holotype, s-shaped acanthostrongyle with spines arranged in spiral, ×300 (Mostler, 1994).

Madonia Senowbari-Daryan & Schäfer, 1986, p. 251 [**M. conica;* OD]. Porate sphinctozoan with tubular filling structure where tubes are more or less regularly developed; tubes penetrating chamber or segment roofs and more or less bind segments together; shield-shaped, overlapping chambers arranged around retro- to pseudosiphonate spongocoel; outer segmentation barely visible. [The genus was originally included in the Polytholosidae Seilacher but the tubes and their orientation in the chamber walls separate the genus from other forms in the family. Segment development and their structure are similar to the cliefdenellids of the Ordovician, but those forms do not have porous walls as in *Madonia.* For the present *Madonia* is considered to be of uncertain family relationship.] *Triassic (Norian):* Italy (Sicily).——Fig. 450,*6a–b*. **M. conica,* Reef limestone, Norian, Madonie Mountains, Sicily; *a,* transverse section of holotype showing low, shield-shaped chambers with tubular connections and central canal cut marginally in upper right, SPIE P/244/2, ×2; *b,* parallel, transverse section showing tubular structures well in lower part and their connections between chamber walls in upper part, SPIE P/244/1, ×2 (Senowbari-Daryan & Schäfer, 1986).

Thamnonema Sollas, 1883, p. 549 [**T. pisiforme;* OD]. Small, globular sponge without central cavity; skeleton a network of fibers radiating and branched upwardly from base where three equally spaced, basic fibers originate; summit with larger meshes that appear as small oscules; sides ridged meridionally. *Middle Jurassic:* England.——Fig. 450,*3*. **T. pisiforme,* Great Oolite, Hampton Down; arrangement of fibers of base; *a,* primary and, *b,* secondary fibers radiating from base, *c,* ×15 (Sollas, 1883).

Order VACELETIDA new order

[Vaceletida Finks & Rigby, herein]

Basal skeleton of microgranular aragonite organized in small, irregular units bounded by organic membrane and with organic center, the whole forming a cortex of sphinctozoan morphology, secreted at intervals over newly formed unit of soft tissue; no spicules present in living *Vaceletia* Pickett, 1982, but some fossils contain imbedded monaxons, as well as dubious spicules of more elaborate form; exopores usually lobate or polygonal in outline. *Lower Cambrian–Holocene.*

Family SOLENOLMIIDAE Engeser, 1986

[Solenolmiidae Engeser, 1986, p. 589] [=Deningeriidae Boiko, Belyaeva, & Zhuravleva, 1991, p. 156]

Superposed spheroidal segments; chambers in type genus filled with trabeculae that outline anastomosing tubes that have a dominantly upward and outward orientation (perpendicular to exowall interwall); vesicles present; microstructure microgranular aragonite as in *Vaceletia* PICKETT, 1982. *Lower Cambrian–Triassic, ?Jurassic.*

Subfamily SOLENOLMIINAE Senowbari-Daryan, 1990

[Solenolmiinae SENOWBARI-DARYAN, 1990, p. 89]

Solenolmid sponges with catenulate arrangements of chambers. *Lower Cambrian–Triassic, ?Jurassic.*

Solenolmia POMEL, 1872, p. 115 [**Scyphia? manon* MÜNSTER, 1841, p. 29; OD] [=*Dictyocoelia* OTT, 1967b, p. 55, obj.; *Solenopsechia* POMEL, 1872, p. 155, obj., *nom. van.*]. Cylindrical, segmented segments spheroidal to barrel shaped; central cloaca about one-third sponge diameter; exopores small, uniform, circular, closely spaced; according to POMEL (1872, p. 115) they open on projections or tubercles arranged in longitudinal rows; interpores same as exopores; endopores somewhat larger and more widely spaced; endowall thicker than exowall and interwalls; chambers filled with trabeculae that outline anastomosing tubes that have a dominantly upward and outward orientation; tubes relatively broad and subpolygonal in cross section; filled with thin vesicles whose plates completely cross tube; trabecular microstructure microgranular aragonite of vaceletid type (WENDT, 1979, p. 454; MASTANDREA & RUSSO, 1995, p. 418); no spicules known. *Permian (Lopingian)–Triassic:* Tunisia, Sicily, *Lopingian;* Europe, Oman, Canada (Yukon), *Triassic;* Tajikistan, Austria, *Carnian–Rhaetian.*——FIG. 457,*1a–b.* **S. manon* (MÜNSTER), Wettersteinkalk, Ladinian, Karwendel, Austria; *a,* weathered, longitudinal section showing tubular spongocoel and reticular filling structure in chambers of wall, BSPGM 1967 II 6, ×1; *b,* longitudinal section showing nature of chamber walls, porous endowall around spongocoel, and extensive, reticular filling structures, BSPGM thin section G 412 a/67, ×2.5 (Ott, 1967a; courtesy of *Neues Jahrbuch für Geologie und Paläontologie, Monatshefte*).

Ambithalamia SENOWBARI-DARYAN & INGAVAT-HELMCKE, 1994, p. 17 [**A. permica;* OD]. Cylindrical, rarely branched sponges without a spongocoel; exterior and interior segmentation poorly developed; possible chamber interwalls or possible growth lines marked by very thin, interrupted (perforated) lines; chamber interiors or internal skeleton of sponge composed of relatively regular fibers of reticular type. *Permian (Lopingian):* Thailand.——FIG. 457,*3a–b.* **A. permica,* upper Permian limestone, Dorashamian, Phrae; *a,* oblique section through holotype (*H*) and associated sponges of species showing poor segmentation and open, reticulate skeleton, ×4; *b,* elongate section (*B*) showing typical dermal layer and reticulate, endosomal skeleton without a spongocoel, with associated *Bisiphonella* (*A*) and *Solutossaspongia* (*C*), BSPGM R6, ×4 (Senowbari-Daryan & Ingavat-Helmcke, 1994).

?Cryptocoeliopsis WILCKENS, 1937, p. 197 [**C. gracilis;* OD]. Hemispheroidal, overlapping segments; no cloaca; thin exowall or interwall pierced by pores of variable size and irregular distribution; interior of chambers filled with anastomosing trabeculae that have a dominantly upward and outward arrangement; trabeculae outline anastomosing, tubular spaces, some of which are larger than others; microstructure unknown; no spicules known. [May be a synonym of *Deningeria* WILCKENS, 1937.] *Triassic, ?Jurassic:* Indonesia, *Triassic;* Poland, *?Jurassic.*——FIG. 458,*1.* **C. gracilis,* Pharetrone limestone, Upper Triassic, Seran, Moluccas, Indonesia; longitudinal holotype with spheroidal chambers filled with anastomosing, trabecular filling structures, S 197, ×2 (Wilckens, 1937; courtesy of *Neues Jahrbuch für Mineralogie, Geologie und Paläontologie, Abteilung B*).

?Deningeria WILCKENS, 1937, p. 200 [**D. camerata;* OD] [=?*Seranella* WILCKENS, 1937, p. 198 (type, *S. tenuissima,* OD); =?*Cryptocoeliopsis* WILCKENS, 1937, p. 197 (type, *C. gracilis,* OD)]. Cylindrical with spheroidal segments; narrow, central cloaca; endowall thin but well developed; interwalls obscure or absent; exowall a thickening of trabecular net; all pores appear to be intertrabecular spaces; interior filled with fine, trabecular net that outlines anastomosing, meandriform, tubular spaces with tendency to upward and outward orientation; microstructure not known; no spicules known. *Triassic, ?Jurassic:* Indonesia, Italy, Tajikistan, *Triassic;* Poland, *?Jurassic.*——FIG. 457,*2.* **D. camerata,* Pharetrone limestone, Upper Triassic, Moluccas, Indonesia; longitudinal section of holotype with spheroidal chambers and fine, trabecular filling structure, S 200, ×2 (Wilckens, 1937; courtesy of *Neues Jahrbuch für Mineralogie, Geologie und Paläontologie, Abteilung B*).

Panormida SENOWBARI-DARYAN, 1980, p. 186 [**P. priscae;* OD]. Moniliform to dichotomously branched sponges of stacked, strongly conical to dish-shaped chambers; spongocoel pseudosiphonate; coarse, reticulate filling structure. *Triassic (Norian–Rhaetian):* Italy (Sicily).——FIG. 458,*2a–b.* **P. priscae,* Triassic reef limestone, Norian, Madonia Mountains; *a,* longitudinal section showing distinctive growth form, with narrow spongocoel in upper part and coarse filling structures in chambers, SPIE P/418, ×1; *b,* reconstruction showing form of genus and a longitudinal section of upper part of one branch showing perforate spongocoel and outer walls, with coarse, reticulate chamber filling, not to scale (Senowbari-Daryan, 1990; courtesy of *Münchner Geowissenschaftliche Abhandlungen,* Verlag Dr. Friedrich Feil).

Paradeningeria SENOWBARI-DARYAN & SCHÄFER, 1979, p. 22 [**P. alpina;* OD]. Porate sponges with prosiphonate, central spongocoel; reticular filling structure in inner parts of chambers is coarse and

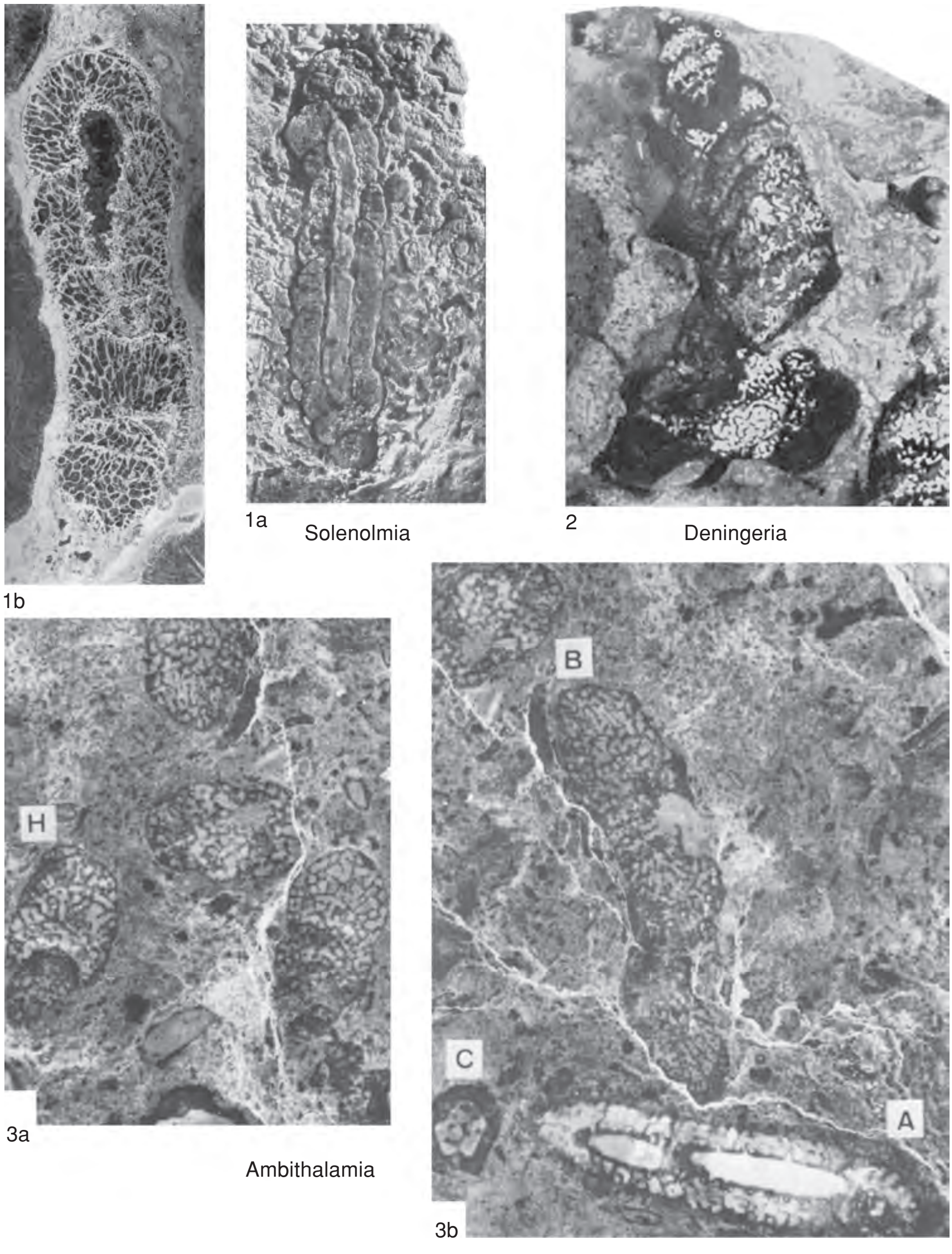

FIG. 457. Solenolmiidae (p. 692).

porous but in outer parts is finer and more compact. *Permian (Guadalupian)–Triassic (Rhaetian):* Ukraine, *Wordian–Guadalupian;* Italy (Sicily), Austria, Yugoslavia, Russia, Iran, USA (Oregon), Canada (Yukon), Tajikistan, *Norian–Rhaetian.*——FIG. 458,*3a–c.* **P. alpina,* Rhaetian reef limestone, Rhaetian, Salzburg, Austria; *a,* holotype, longitudinal section (*1*) with filling structure in outer parts of chambers, SPIE G/8, ×4; *b,* transverse sections showing filling structures inside perforate exowalls, paratype, SPIE SZ/b, ×5; *c,* paratype, transverse section with coarse filling structures in interior,

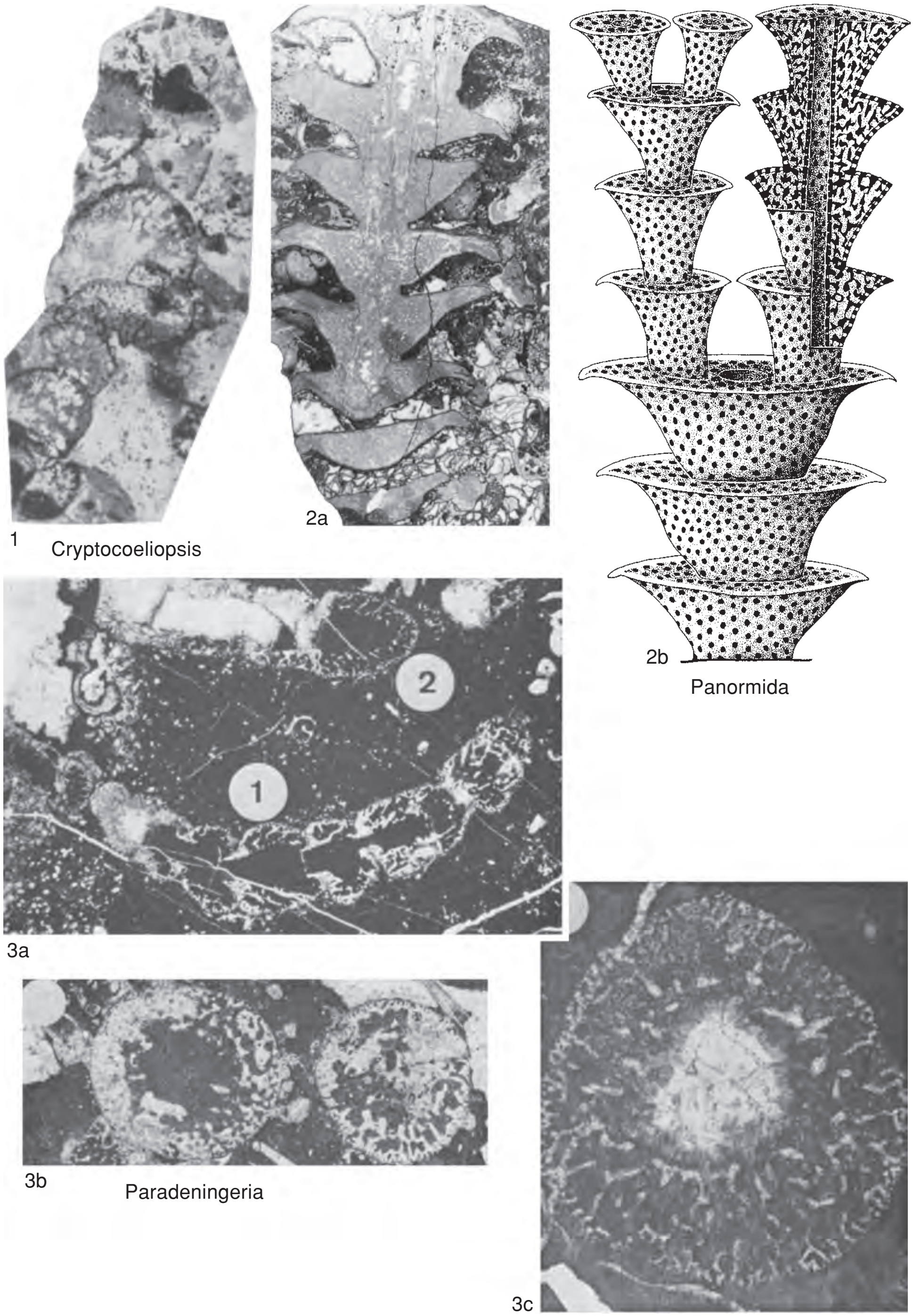

FIG. 458. Solenolmiidae (p. 692–695).

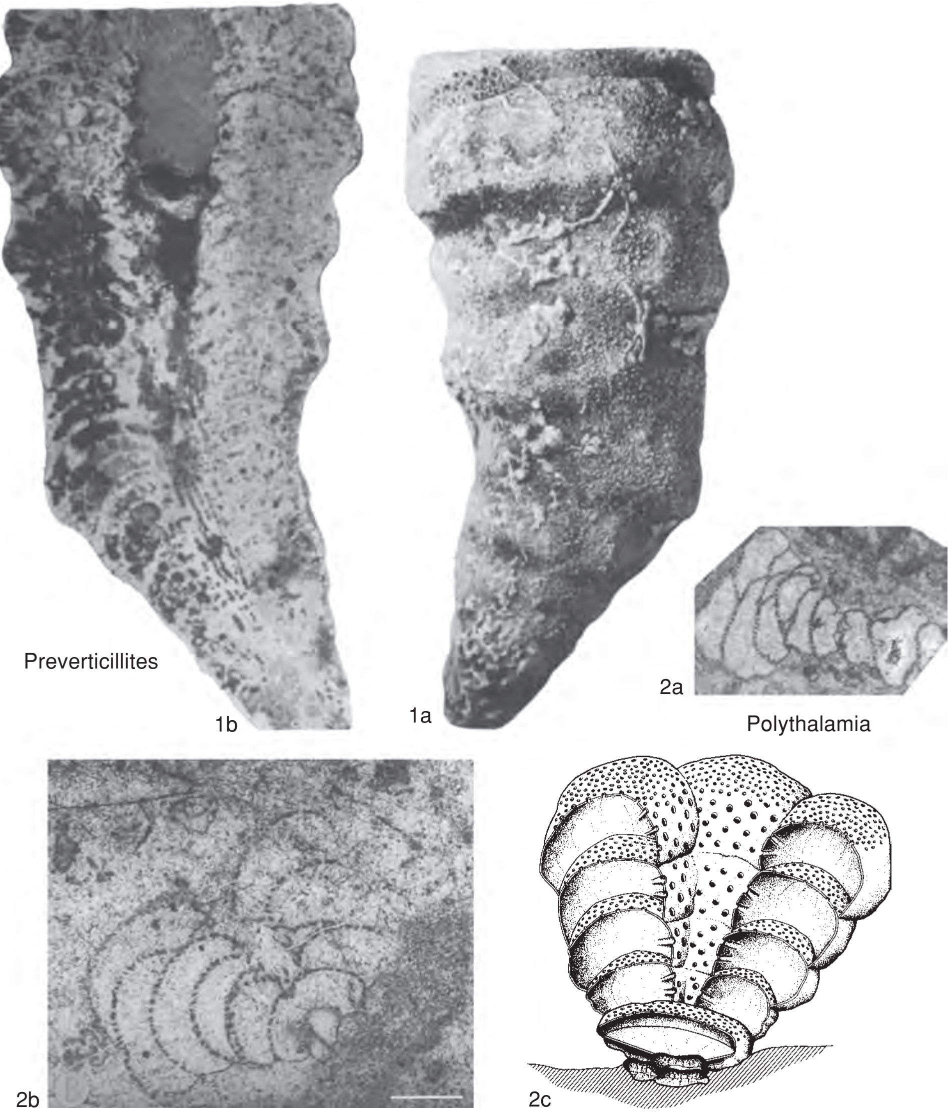

FIG. 459. Solenolmiidae (p. 695–696).

which become finer in outer part of chamber, SPIE G/153/q/2, ×3.9 (Senowbari-Daryan & Schäfer, 1979).

Polythalamia DEBRENNE & WOOD, 1990, p. 436 [**P. americana;* OD]. Globular or irregularly proliferating, chambered sphinctozoan, with thin walls that have numerous regularly arranged exopores and a retrosiphonate, perforate, central spongocoel; without primary filling structures although secondary vesiculae may be present; apparently without spicules, microstructure irregular. [As DEBRENNE & WOOD (1990) pointed out, classification of sphinctozoan sponges is difficult because of the probable polyphyletic origins of the skeletal grade. Placement in the family here, thus, is tentative.] *Lower Cambrian:* USA (Nevada, Alaska).——FIG. 459,*2a–c*. **P. americana,* clasts in Ordovician Valmy Formation, Antler Peak quadrangle, Nevada; *a,* longitudinal section of holotype showing glomerate arrangement and development of axial spongocoel, USNM 434924, ×20; *b,* longitudinal section of chambered paratype with porous walls, USNM 434922, ×10; *c,* generalized reconstruction, approximately ×15 (Debrenne & Wood, 1990).

Preverticillites PARONA, 1933, p. 46 [**P. columnella;* OD]. Cylindrical; exterior horizontally rugose,

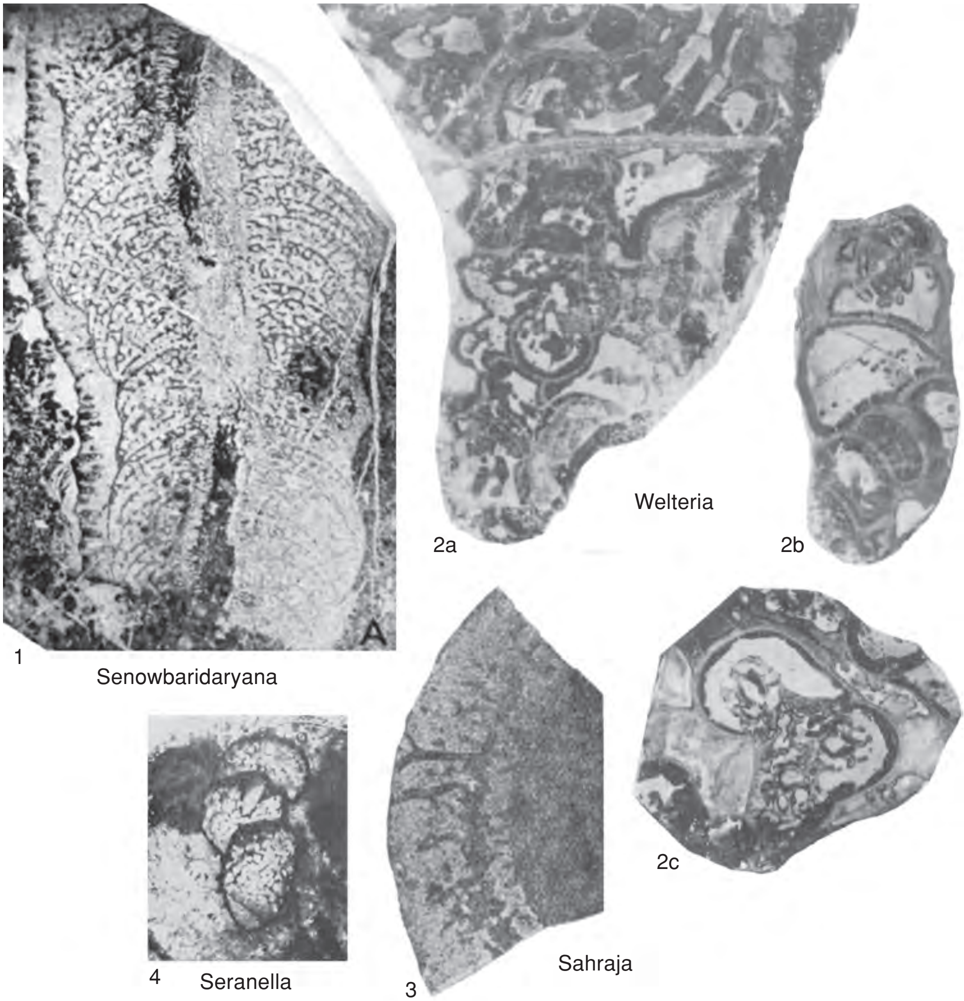

FIG. 460. Solenolmiidae (p. 696–697).

more or less related to interior chambers; exowall possibly minutely porous; narrow, central cloaca about one-fifth sponge diameter; endowall well defined, endopores apparently small; low chambers filled with dominantly radial and vertical, but meandriform and anastomosed, trabeculae that outline tubular spaces; trabecular microstructure not known; no spicules observed. [This genus bears considerable resemblance to early forms of *Stylopegma* KING, 1943, as well as to *Phragmocoelia* OTT, 1974. This genus includes the species *Verticillites rectangilaris* BOIKO in BOIKO, BELYAEVA, & ZHURAVLEVA, 1991, p. 154 and *Verticillites convexus* BOIKO in BOIKO, BELYAEVA, & ZHURAVLEVA, 1991, p. 174.] *Permian–Triassic:* Italy (Sicily), Tunisia, Oman, China (Hubei), Russia, *Permian;* Hungary, Greece, *Ladinian–Carnian;* Italy (Sicily), Tajikistan, *Norian;* Tajikistan, *Triassic.*——FIG. 459,*1a–b.* **P. columnella,* Djebel Tebaga Biohermal Complex, Changhsingian, Djebel Tebaga, Tunisia; *a,* exterior of annulate, steeply obconical sponge with porous exowall, ×2; *b,* polished, longitudinal section showing prominent, central spongocoel and arcuate chambers with pillar filling structures, USNM 427368, ×2 (Senowbari-Daryan & Rigby, 1988; courtesy of *Facies*).

Sahraja MOISEEV, 1944, p. 19 (MOISEEV, 1939, p. 816, *nom. nud.*) [**S. triassica;* OD]. Segmented sponges with broad, central canal; proportionally thick, outer wall and thinner, inner wall separated by a more or less continuous cavity; wall perforated with many branched, radial canals and pores; spicules unknown. [Name proposed by MOISEEV (1939, p. 816) but no description given.] *Triassic (Norian–Rhaetian):* Russia (Caucacus), Tajikistan (Pamir region), Iran, Turkey.——FIG. 460,*3.* **S. triassica,* Norian–Rhaetian sediments, Valley Sahraja, Caucasus; transverse section showing thicker, outer wall perforated by convergent, inhalant, radial canals that terminate in a cavity that separates thinner, inner and thicker, outer walls, ×3 (Moiseev, 1944).

Senowbaridaryana Engeser & Neumann, 1986, p. 153 [**Verticillites triassicus* Kovács, 1978, p. 690; OD]. Sphinctozoan with chambered structure and reticular, internal structure; isolated chambers comparatively flat; spongocoel pseudosiphonate; microstructure unknown. *Middle Triassic–Upper Triassic:* Italy, Austria, Hungary, Greece, Russia.——Fig. 460,*1*. **S. triassicus* (Kovács), Wetterstein reef limestone, Ladinian–Norian, Tornanádaska, northern Hungary; longitudinal section of holotype with reticular filling structure in uparched, low chambers with very porous walls around tubular spongocoel, MAGI T-0421/A, ×3 (Kovács, 1978; courtesy of *Neues Jahrbuch für Geologie und Paläontologie, Monatshefte*).

?Seranella Wilckens, 1937, p. 198 [**S. tenuissima;* OD] [=?*Deningeria* Wilckens, 1937, p. 200 (type, *D. camerata,* OD)]. Cylindrical with spheroidal to hemispheroidal segments; slender, central cloaca; exopores, interpores, and endopores numerous, small, but of more than one size, form unknown; chamber interior filled with fine, trabecular net that outlines anastomosing tubes that connect with pores; microstructure unknown; no spicules known. *Triassic:* Indonesia.——Fig. 460,*4*. **S. tenuissima,* Pharetrone limestone, Upper Triassic, Moluccas; longitudinal section of holotype with spheroidal chambers with narrow spongocoel and porous walls, chambers with fine, trabecular filling structure, S 198, ×2 (Wilckens, 1937; courtesy of *Neues Jahrbuch für Mineralogie, Geologie und Paläontologie, Abteilung B*).

Welteria Vinassa De Regny, 1915, p. 84 [**W. repleta;* OD]. Cylindrical with spheroidal segments externally visible; central cloaca present; few large exopores in each segment, exowall otherwise imperforate; numerous circular interpores in interwall; endowall developed only in vicinity of interwalls (ambisiphonate) where pierced by few large, circular interpores; chamber lumen filled with vesicles; microstructure unknown; no spicules known. *Permian–Triassic:* ?Oman, *Permian;* Indonesia (Timor), *Triassic;* Austria, Italy, Oman, *Upper Triassic.*——Fig. 460,*2a–c*. **W. repleta,* Triassic, Lelogama, Timor; *a,* longitudinal section of type with spheroidal segments; *b,* longitudinal section with tubular spongocoel cut in lower part; *c,* diagonal section with chambers filled with vesiculae, ×2 (Vinassa de Regny, 1915).

Subfamily BATTAGLIINAE Senowbari-Daryan, 1990

[Battagliinae Senowbari-Daryan, 1990, p. 99]

Solenolmid sponges with glomerate arrangement of chambers. *Triassic (Norian–Rhaetian).*

Battaglia Senowbari-Daryan & Schäfer, 1986, p. 244 [**B. major;* OD]. Glomerate stems with a pseudosiphonate to retrosiphonate, central canal; central opening filled with bubblelike fabric, but not vesiculae; chamber openings partially filled with reticular filling structure. *Triassic (Norian–Rhaetian):* Italy (Sicily), Slovenia.——Fig. 461*a–b*. **B. major,* Reef limestone, Norian, Madonie Mountains, Sicily; *a,* holotype, longitudinal section with branched canals that lead to central, exhalant canal and reticular filling of glomerate chambers, ×1.5; *b,* drawing of holotype showing its chambers and canal patterns, SPIE P/424/1, ×1 (Senowbari-Daryan & Schäfer, 1986).

Family COLOSPONGIIDAE Senowbari-Daryan, 1990

[Colospongiidae Senowbari-Daryan, 1990, p. 63] [=Colospongiidae Boiko, Belyaeva, & Zhuravleva, 1991, p. 143; Parauvanellidae Wu Ya Sheng, 1991, p. 81; Imbricatocoeliidae Wu Ya Sheng, 1991, p. 88]

Porate, thalamid sponges without a central canal or spongocoel and without filling structures; pores of segments unbranched or with only dichotomous branches; basal skeleton primarily aragonitic. *Lower Cambrian–Triassic.*

Subfamily COLOSPONGIINAE Senowbari-Daryan, 1990

[Colospongiinae Senowbari-Daryan, 1990, p. 63]

Chambers or segments in linear, moniliform arrangements. *Lower Cambrian–Triassic.*

Colospongia Laube, 1865, p. 237 [**Manon dubium* Münster, 1841, p. 28; OD] [?=*Takreamina* Fontaine, 1962, p. 205, *nom. nov. pro Steinmannia* Waagen & Wentzel, 1888, p. 979, *non* Fischer, 1886 (type, *Steinmannia salinaria* Waagen & Wentzel, 1888, p. 980, OD), =*Waagenium* de Laubenfels, 1957, p. 249, *nom. nov. pro Waagenella* de Laubenfels, 1955, p. 102, obj., *non* de Koninck, 1883, *nec* Yabe & Hayasaka, 1915]. Spheroidal segments in linear series, successively increasing in size; no cloaca or central osculum; exopores small, subequal, circular, separated by more than their diameter and confined to upper two-thirds or so of each chamber, lower part of exowall secondarily imperforate, except for occasional, large, circular, lipped exopores, which may occur anywhere; interwall and interpores merely top of preceding chamber with its exopores; interior of chamber may contain large vesicles, continuous with secondary linings of chamber wall, convex inwardly and upwardly but no other skeletal tissue; wall microstructure microgranular aragonite as in living *Vaceletia* Pickett (Mastandrea & Russo, 1995, p. 418); monaxon spicules imbedded in wall (Senowbari-Daryan, 1989, p. 475). [Descriptions

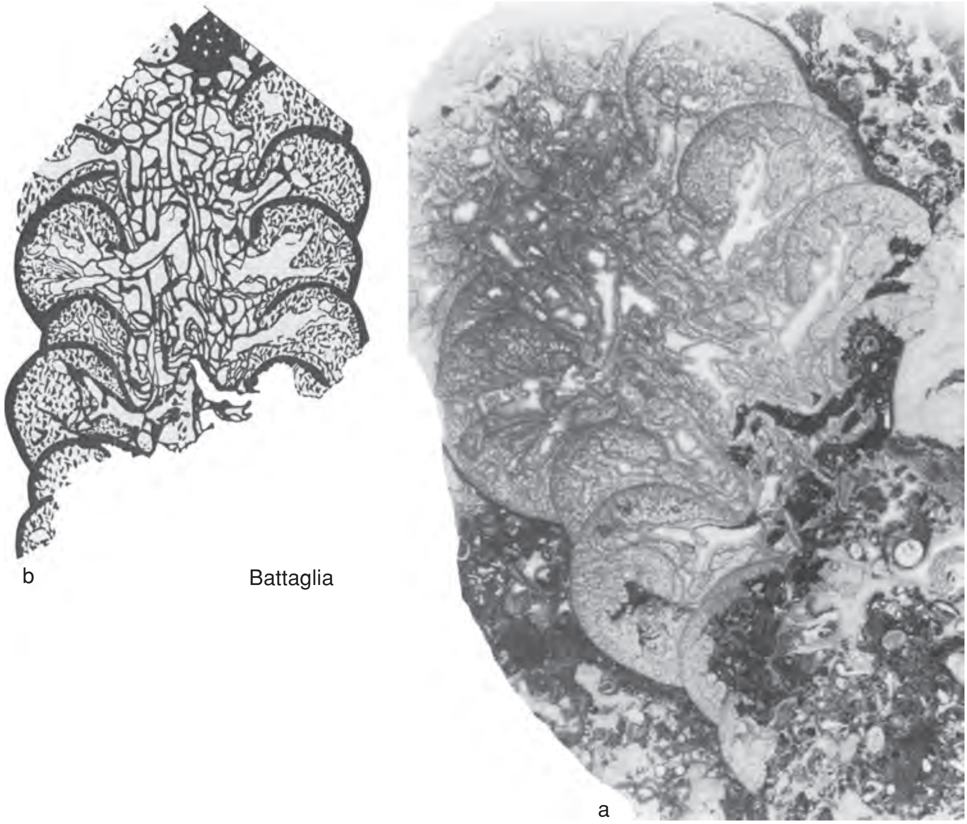

FIG. 461. Solenolmiidae (p. 697).

in the literature (e.g., ZITTEL, 1878b, p. 27; STEINMANN, 1882, p. 172; HERAK, 1943, p. 129; SEILACHER, 1962, p. 738) were of specimens not congeneric with the holotype, which was redescribed by OTT (1967a, p. 50), who considered it congeneric with *Girtycoelia* KING, 1933. Because the latter genus has spherulitic, aragonite microstructure, the not very exact resemblance in gross morphology must be considered homeomorphic. The species described by SENOWBARI-DARYAN and STANLEY (1988, p. 420), with cribribullae and subpolygonal exopores, is so different from the type species that it should probably be assigned to a new genus.] *Carboniferous–Triassic:* Europe, USA (Oregon), Canada (Yukon), Peru, Tunisia, Oman, China, India, Timor, Thailand, Russia, Armenia, Tajikistan, Kyrgyzstan.——FIG. 462,*2a.* **C. dubia* (MÜNSTER), St. Cassian beds, Middle Triassic, St. Cassian, Sud Tyrol, Austria; side view of typical sponge, ×2 (Laube, 1865).——FIG. 462,*2b. C. cortexifera* SENOWBARI-DARYAN & RIGBY, Biohermal complex, Lopingian, Djebel Tebaga, Tunisia; side view showing outer segmentation and coarse pores in chamber walls, ×2 (Senowbari-Daryan & Rigby, 1988; courtesy of *Facies*).

Blastulospongia PICKETT & JELL, 1983, p. 87 [**B. monothalamos;* OD]. Asiphonate, single-chambered, porate sphinctozoans without internal filling structures. [The simple structure and small dimensions of these fossils raise questions about their sponge nature and whether they might be perhaps foraminifera or radiolaria (PICKETT & JELL, 1983; BENGTSON, 1986; MORRIS & MENGE, 1990).] *Lower Cambrian–Upper Cambrian:* China (Hubei), *Lower Cambrian;* Australia (New South Wales), *Middle Cambrian;* Australia (Queensland), *Upper Cambrian.*——FIG. 462,*4a–b.* **B. monothalamos,* Coonigan Formation, Middle Cambrian, Broken Hill quadrangle, New South Wales; *a,* holotype, spherical chamber with porous exowall, ×20; *b,* photomicrograph of part of exowall with details of pores, NMV P75150, ×95 (Pickett & Jell, 1983).

Pseudoimperatoria SENOWBARI-DARYAN & RIGBY, 1988, p. 195 [**Imperatoria mega* RIGBY & POTTER, 1986, p. 23; OD]. Cylindroidal, branching sponge, occasionally anastomosing, composed of

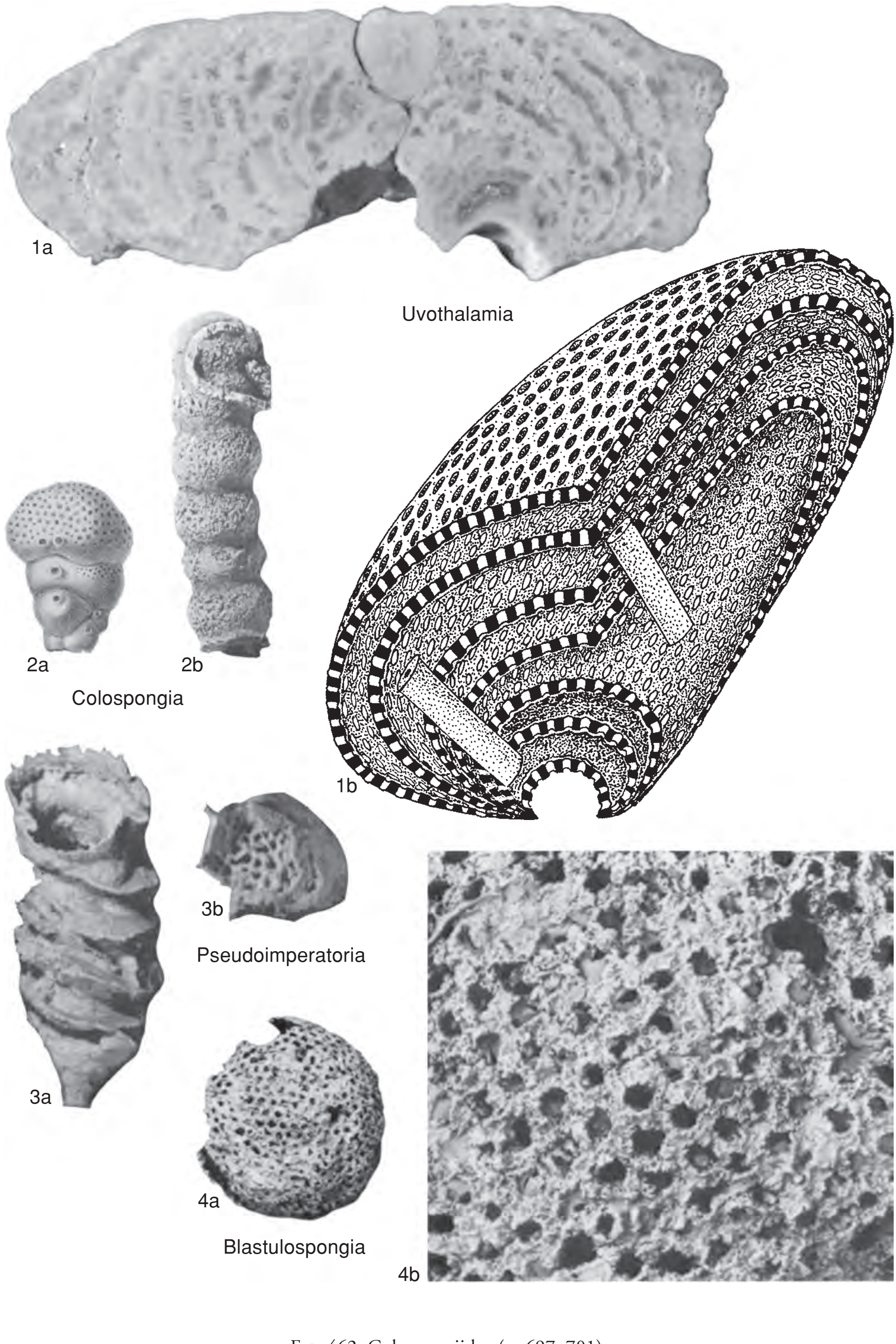

FIG. 462. Colospongiidae (p. 697–701).

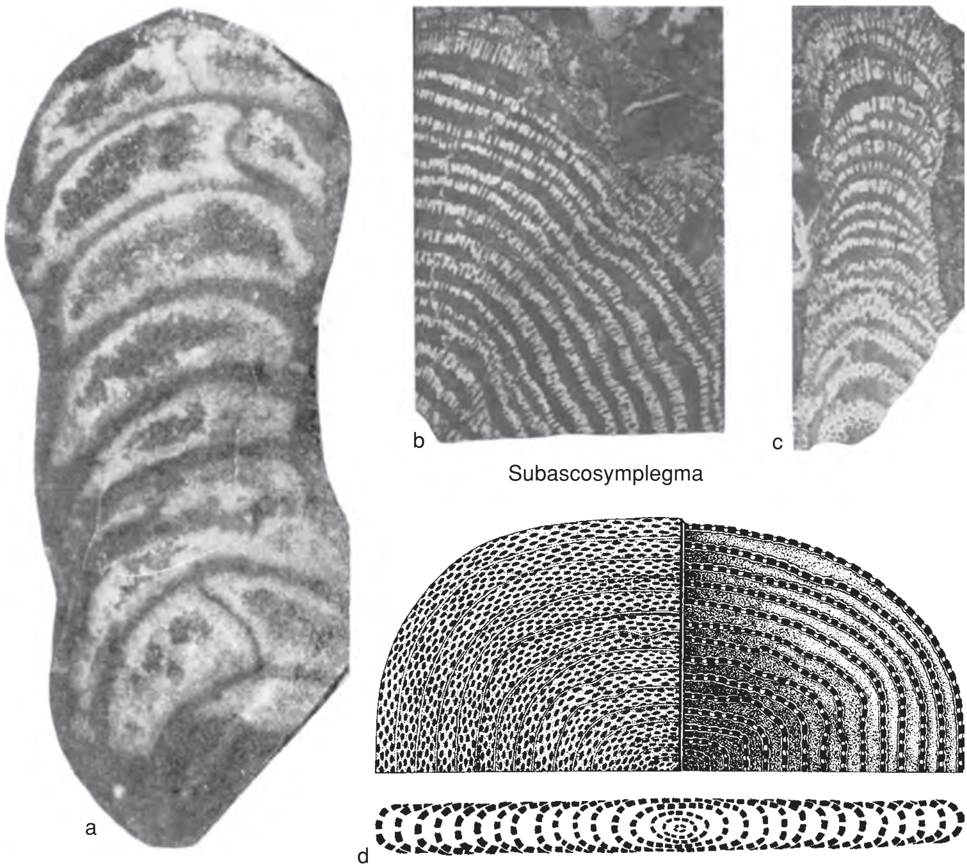

FIG. 463. Colospongiidae (p. 700).

superposed, conical chambers, each flaring to a sharp, upper edge with flat, upper surface; no cloaca; exopores small, widely spaced, of two sizes; interwall sievelike with large, subangular to submeandriform interpores separated by narrow trabeculae; no internal structures in chambers; microstructure not known; no spicules known. *upper Lower Ordovician–Permian (Lopingian):* USA (California), *upper Lower Ordovician–upper Upper Ordovician;* Tunisia, *Lopingian.*——FIG. 462,*3a–b.* **P. mega* (RIGBY & POTTER), Kangaroo Creek Formation, Ashgill, Klamath Mountains, California; *a,* side view of holotype showing pronounced, turriculate form, USNM 395862, ×2; *b,* view from above of porous interwall of paratype with coarse and irregular interpores, USNM 395863, ×2 (Rigby & Potter, 1986).

Subascosymplegma DENG, 1981, p. 425 [**S. guangxiensis;* OD]. Platelike, tabular to flabellate sponges composed of several concentric, annular-appearing to crescentic, cylindrical chambers; walls perforated by numerous small pores; vesiculae may be present or absent within chambers. *Permian (Guadalupian–Lopingian):* China (Hubei, Guangxi), Tunisia.——FIG. 463*a.* **S. guangxiensis,* Heshan Formation, Changhsingian, Guangxi, China; vertical section of tabular sponge showing superposed chambers with arched, perforated walls, NIGPAS 59977, ×4 (Deng, 1981).——FIG. 463*b–d. S. oussifensis* TERMIER & TERMIER, Djebel Tebaga Biohermal Complex, Changhsingian, Djebel Tebaga, Tunisia; *b,* thin section cut parallel to axis of saucerlike surface, with long, low chambers and thick, perforated walls, USNM 427315, ×2; *c,* thin section normal to sponge surface showing crescentic cross sections of chambers and porous walls, USNM 427316, ×2, *d,* reconstruction showing arcuate chambers of tabular sponge in horizontal section, above, and vertical section, below, not to scale (Senowbari-Daryan & Rigby, 1988; courtesy of *Facies*).

Tristratocoelia SENOWBARI-DARYAN & RIGBY, 1988, p. 188 [**T. rhythmica;* OD]. Superposed, barrel-shaped chambers with exowalls pierced by fine, closely spaced exopores, plus occasional lipped, larger exopores; these chambers separated by expanded, dense, thick-walled, ringlike elements that

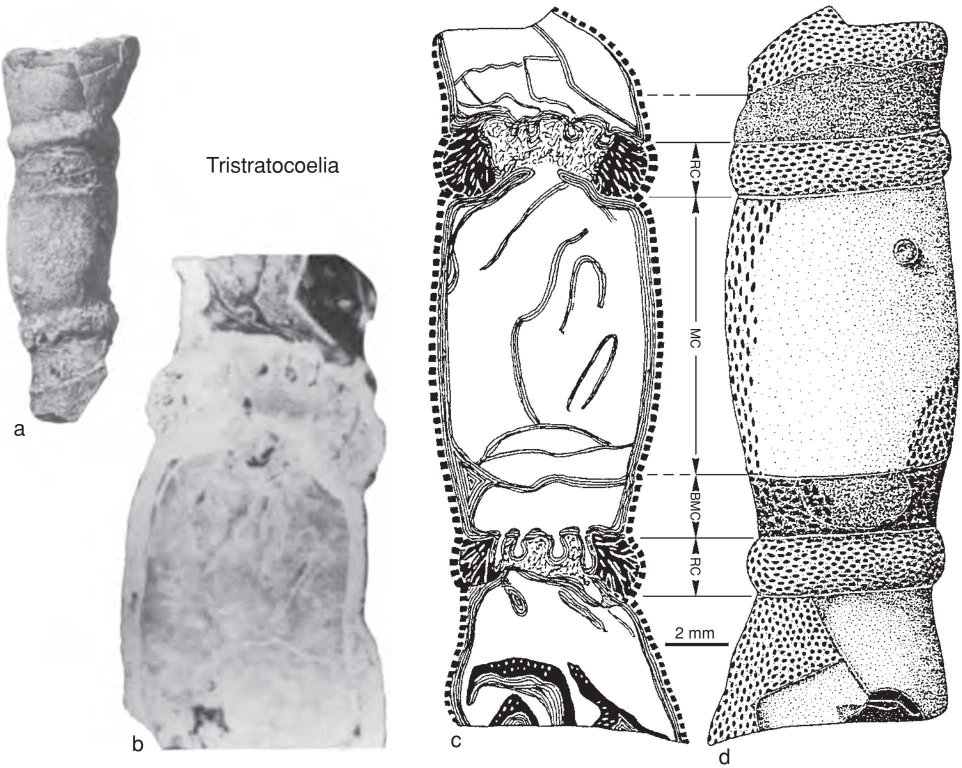

FIG. 464. Colospongiidae (p. 700–701).

form toroidal rolls in exterior and appear as porous, thick interwalls with large interpores in vertical sections; chamber interiors with secondary lamellar lining and vesicles, but no other structure. [This differs from *Girtycoelia* KING, 1933, in the thickened interwall-exowall complex with its large interpores and external roll. The thick interwalls were originally interpreted as thick-walled, special chambers (so-called ring chambers), but subsequent investigation with additional material (RIGBY, SENOWBARI-DARYAN, & LIU, 1998) indicate that it is not a chamber but a porous interwall. Direction of growth of the sponges is suggested by the upwardly arcuate vesicles in the chamber interiors.] *Permian (Lopingian):* Tunisia, USA (New Mexico), China, Thailand.——FIG. 464*a–d*. **T. rhythmica,* Djebel Tebaga Biohermal Complex, Changhsingian, Djebel Tebaga, Tunisia; *a,* holotype exterior with two ring chambers and one complete and two fragments of intervening main chambers, ×2; *b,* polished, axial section showing complex structure of ring chambers and barrel-like main chamber, USNM 427325, ×5; *c–d,* drawings of vertical, axial section (*a*), and exterior (*b*) of holotype; *BMC,* bottom of main chamber; *MC,* main chamber; *RC,* ring chamber, scale indicated by bar (Senowbari-Daryan & Rigby, 1988; courtesy of *Facies*).

Uvothalamia SENOWBARI-DARYAN, 1990, p. 67 [**U. planiinvoluta;* OD]. Porate sponge composed of low, oval chambers that overlap on sides and top of sponge so segmentation not readily apparent except in sections; chambers without filling structures and vesiculae. *Permian (Guadalupian):* Italy (Sicily). ——FIG. 462,*1a–b*. **U. planiinvoluta,* Sosio beds; *a,* cross section of holotype showing low chambers and ovoid growth, SPIE S/15/1, ×2; *b,* reconstruction showing ovoid growth form with low chambers with perforate walls growing around other organisms, not to scale (Senowbari-Daryan, 1990; courtesy of *Münchner Geowissenschaftliche Abhandlungen,* Verlag Dr. Friedrich Feil).

Subfamily CORYMBOSPONGIINAE Senowbari-Daryan, 1990

[Corymbospongiinae SENOWBARI-DARYAN, 1990, p. 64]

Glomerate to stratiform arrangement of chambers. *Ordovician–Triassic (Rhaetian).*

Corymbospongia RIGBY & POTTER, 1986, p. 28 [**C. adnata;* OD]. Clusters of spheroidal to ellipsoidal chambers, possibly encrusting; each chamber bearing long exaulos often arising from a mamelon-like protuberance; exauli of cluster tend to face same

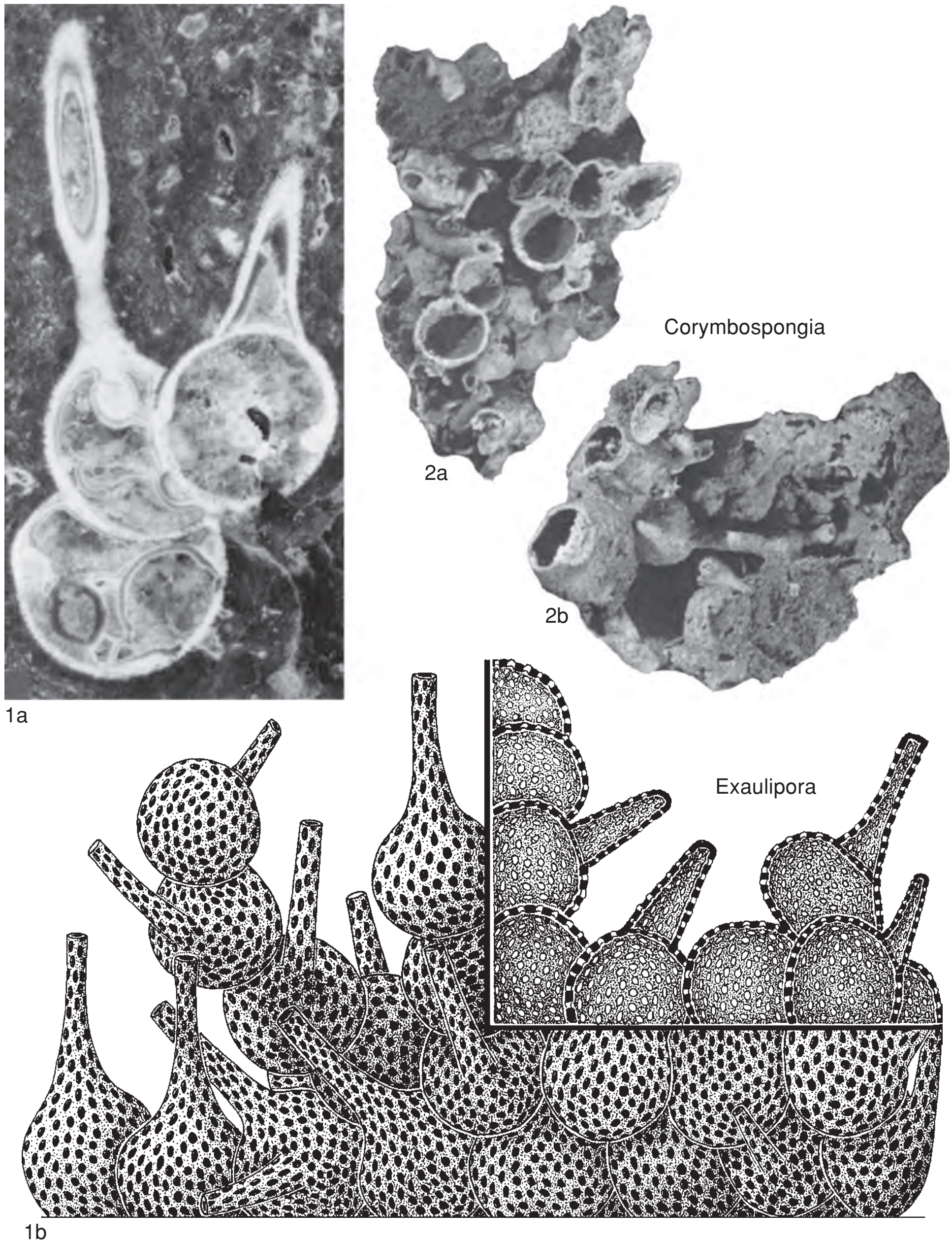

FIG. 465. Colospongiidae (p. 701–703).

direction (possibly upward); chamber walls perforated by small, circular pores that bear lips on inner wall of chamber; adjacent chambers may communicate by these pores but not by exauli; no internal structures except possibly vesicles; microstructure not known; no spicules known. [Genus resembles the protocysts of *Girtyocoelia* COSSMANN, 1909, except for the presence of pores in the walls.] *upper Upper Ordovician, ?Permian:* USA (California, Alaska), *upper Upper Ordovician;* USA (Texas), *?Permian.*——FIG. 465,*2a–b.* **C. adnata,* Horseshoe Gulch limestone unit, Ashgill, Klamath Mountains, California; *a,* silicified holotype consisting of adnate to separated, globular chambers with prominent exaules, BMNH S10163, ×2; *b,* silicified paratype with moderately large chambers with porous walls and prominent, tubular exaules, USNM 395904, ×2 (Rigby & Potter, 1986).

Exaulipora RIGBY, SENOWBARI-DARYAN, & LIU, 1998, p. 48 [**Corymbospongia(?) permica* SENOWBARI-DARYAN, 1990, p. 69; OD]. Thalamid sponges composed of glomerate clusters of spherical to subspherical, occasionally egg-shaped chambers, that may appear partly moniliform; one or two long, coarse, tubular exaules occurring per chamber; exaules and chamber walls both porous; porous, sievelike plates developed at inner base of exaules; chamber interiors with vesiculae. *?Ordovician, Permian (Guadalupian):* USA (?Oregon), *?Ordovician;* USA (Texas, New Mexico), China, *Guadalupian.* ——FIG. 465,*1a–b.* **E. permica* (SENOWBARI-DARYAN), Capitan Limestone, Guadalupian, Guadalupe Mountains, New Mexico; *a,* holotype, section of three chambers with vesiculae and two with extended exauli, both exowalls and exauli porous, WC/41 SPIE, ×2; *b,* reconstruction showing growth form and porous walls of chambers and exauli, which are separated from chambers by porous sieve plates, not to scale (Senowbari-Daryan, 1990).

Imbricatocoelia RIGBY, FAN, & ZHANG, 1989a, p. 419 [**I. paucipora;* OD] [=*Squamella* BELYAEVA in BELYAEVA & ZHURAVLEVA in BOIKO, BELYAEVA, & ZHURAVLEVA, 1991, p. 106 (type, *S. lichatchevi,* OD)]. Cylindrical to club shaped or spheroidal, with narrow, canal-like, central cloaca in type species, which may be locally multiple and discontinuous in another species or completely absent in a third; chambers small, hemispherical, or bun shaped, arranged in typical guadalupiid fashion, alternating quincuncially and molded to underlying chambers, in multiple ranks around central axis, but not strongly elongate either radially or concentrically; interpores, exopores, and endopores few in number; chambers visible on exterior as nodelike bulges. [The genus is placed with some question in the family.] *Permian (Guadalupian–Lopingian):* China (Hubei, Guangxi), Oman, *Guadalupian–Lopingian;* Russia, *Wordian–Capitanian.*——FIG. 466,*2a–b.* **I. paucipora,* Maokou Formation, Kungurian, Guangxi, China; *a,* holotype, oblique section showing prominent, central tube and crescentic chambers with few coarse interpores, ×1; *b,* part of holotype showing smooth interwalls pierced by a few interpores and coarse exopores into exhalant canals, IGASB 5046, ×2 (Rigby, Fan, & Zhang, 1989a).

Lichuanospongia ZHANG, 1983, p. 8 [**L. typica;* OD] [?=*Discosiphonella* INAI, 1936, p. 169 (type, *D. manchuriensis,* OD)]. Cylindrical or subcylindrical to obconical sponges composed of low, radially and vertically overlapping, crescentic chambers in scalelike patterns; central tube retrosiphonate with porous, gastral layer; chamber walls double layered with inner one thicker and perforated by coarse pores, but outer one a thin, porous micromesh; vesiculae rare within chambers. [May be a synonym of *Discosiphonella* INAI, 1936, p. 169.] *Permian (Wordian–Changhsingian):* China (Hubei, Guangxi), *Lopingian;* Russia, *Wordian–Capitanian.*——FIG. 467*a–d.* **L. typica,* Wujiaping-Changxing Formation, Lopingian, Xiangbo, Guangxi; *a,* longitudinal section showing arcuate, overlapping chambers in thin walls around broad, central tube, IGASB 5011, ×1; *b,* transverse section showing overlapping chambers, IGASB 5006, ×2; *c,* photomicrograph of tangential section of endowall to central tube, with netlike appearance, IGASB 5003, ×5; *d,* vertical, tangential section through wall showing overlapping, crescentic chambers with porous interwalls, IGASB 5002, ×5 (Rigby, Fan, & Zhang, 1989a).

Neoguadalupia ZHANG, 1987, p. 237 [**N. elegana;* OD]. Flat to tabular bodies with subspherical to spherical chambers that are generally superimposed one above other; walls of chambers perforated by numerous small pores; filling structures absent; central cavity or spongocoel absent. *Permian (Cisuralian, ?Lopingian), Triassic (?upper Carnian, Norian):* China (Guangxi, Yunnan), *Cisuralian, ?Lopingian;* USA (Oregon), Iran, Russia (Caucasus region), *?upper Carnian, Norian.*——FIG. 466,*1a–b.* **N. elegana,* Maokou Formation, Kungurian, Guangnan County, Yunnan, China; *a,* horizontal section through broad, platelike holotype with chambers connected by coarse interpores, ×4; *b,* vertical section through plate showing crescentic chambers added laterally, IGASB 3011, ×2 (Zhang, 1987).

Parauvanella SENOWBARI-DARYAN & DI STEFANO, 1988, p. 18 [**P. paronai;* OD]. Encrusting masses of superposed, spheroidal to hemispheroidal chambers communicating by closely spaced, circular pores; no internal structures in chambers. [Differs from *Uvanella* OTT, 1967a, in absence of vesicles and more regular, spheroidal form of chambers.] *Permian–Triassic:* Italy (Sicily), Tunisia, Oman, USA (Texas), China, *Permian;* Austria, Iran, Russian Far East, *Triassic.*——FIG. 468,*2.* **P. paronai,* Lercara Formation, Cisuralian, Lercara, Sicily; holotype, longitudinal section of superposed, hemispherical chambers, with sponge overgrowing an inozoan, MGUP S/5/207, ×3 (Senowbari-Daryan & Di Stefano, 1988; courtesy of *Revista Italiana di Paleontologia e Stratigrafia*).

Platythalamiella SENOWBARI-DARYAN & RIGBY, 1988, p. 184 [**P. newelli;* OD]. [The incompletely preserved specimens on which this genus was based agree almost entirely with the type species of *Guadalupia* GIRTY, 1909 (*G. zitteliana* GIRTY), except for the absence of a trabecularium, and of diaphragms within the chambers. It is possible that a trabecularium was present but not preserved or recognized. A possible diaphragm is visible in the illustration of the paratype (SENOWBARI-DARYAN & RIGBY, 1988, pl. 29,*8,* near upper left) and these latter structures are often rare or absent in *Guadalupia* specimens.] *Permian (Lopingian)–Upper Triassic (Rhaetian):* Tunisia, Timor, Italy, Moluccas, *Lopingian;* ?Sicily, *Norian–Rhaetian.*——FIG.

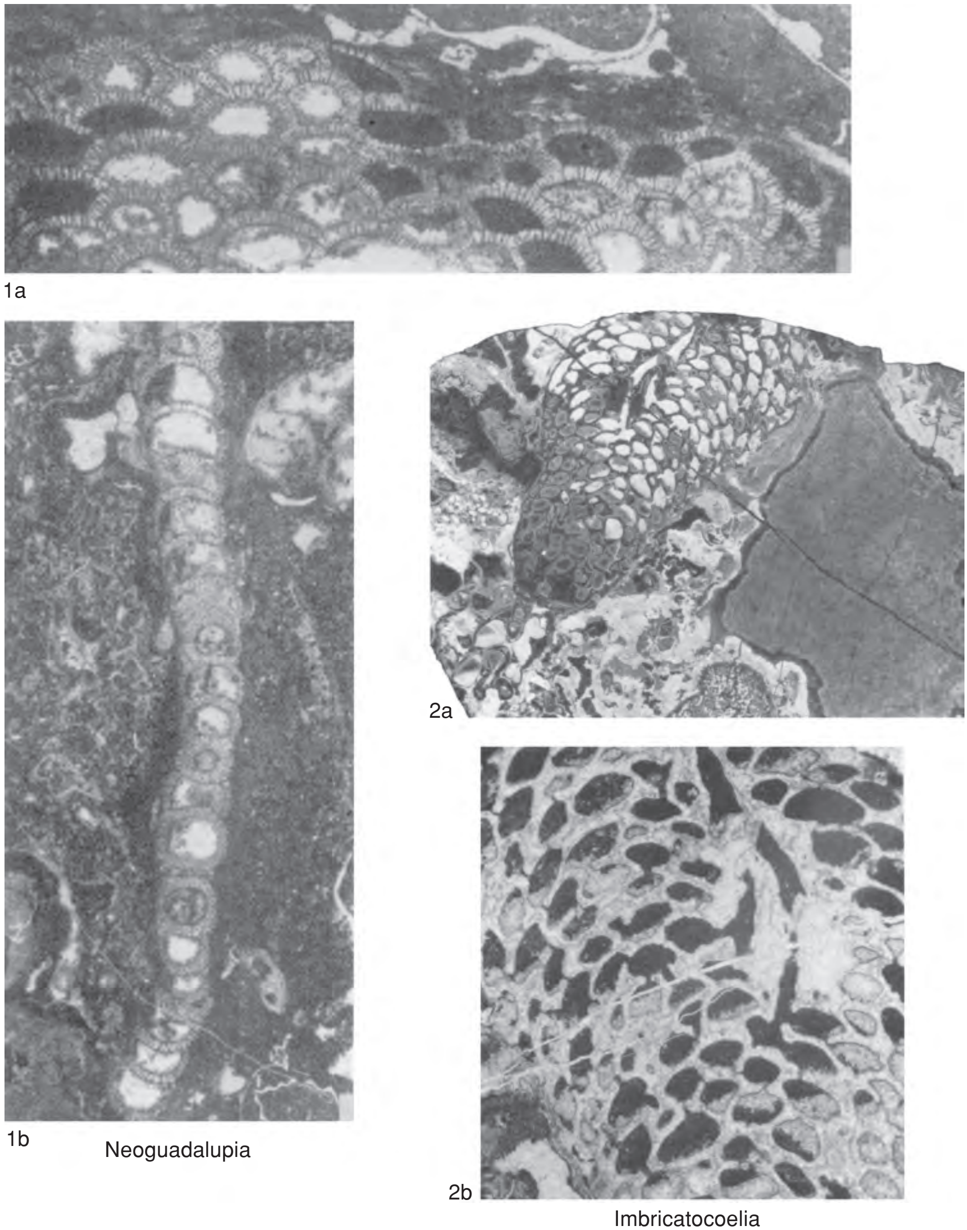

FIG. 466. Colospongiidae (p. 703).

468,*1a–b.* **P. newelli,* Djebel Tebaga Biohermal Complex, Changhsingian, Djebel Tebaga, Tunisia; *a,* holotype, polished horizontal section showing chamber form, thick, perforate walls, and stacking, USNM 427300, ×2; *b,* vertical section through blade of paratype with irregularly overlapping, crescentic, chamber walls, USNM 427301, ×1 (Senowbari-Daryan & Rigby, 1988).

Family GIGANTOTHALAMIIDAE Senowbari-Daryan, 1994

[Gigantothalamiidae SENOWBARI-DARYAN, 1994a, p. 417]

Sponges with low, crescentic and horizontally extensive chambers with a more or less massive and rounded to irregular, massive

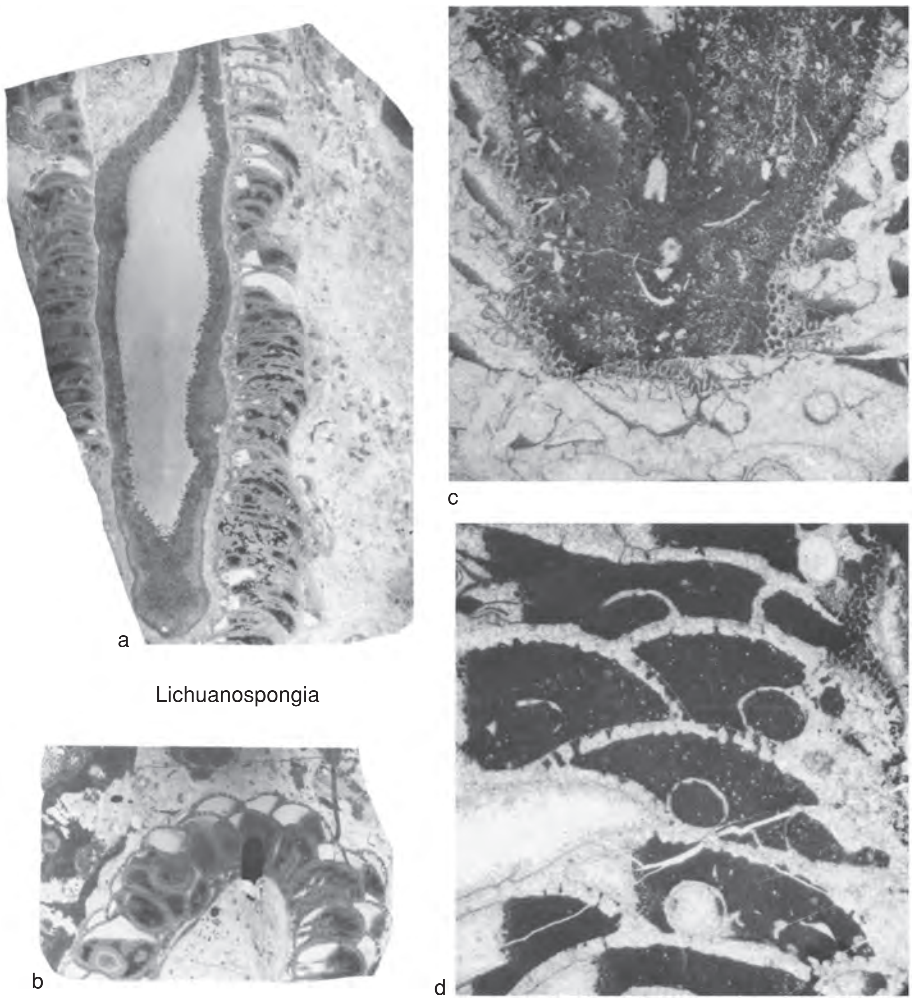

FIG. 467. Colospongiidae (p. 703).

appearance; horizontal growth may exceed vertical growth; segments either hollow or filled with vesiculae; aragonitic, basal skeleton has microspherulitic microstructure; spicular skeleton is not known. *Upper Triassic.*

Gigantothalamia SENOWBARI-DARYAN, 1994a, p. 417 [**G. ovoidalis* SENOWBARI-DARYAN, 1994a, p. 418; OD]. Spherical to oval or irregularly massive sponges composed of numerous very low, crescentic and horizontally extensive, stacked segments or chambers; segment walls perforated with large, but irregularly placed pores; several single, isolated canals serve as spongocoels for water egress; segments or chambers without filling skeletons and without vesiculae; aragonitic, basal skeleton with spherulitic microstructure; spicules unknown. [*Gigantothalamia* is similar to *Zanklithalamia* in growth form, but has single, isolated canals as excurrent features rather than bundles of canals, as in *Zanklithalamia.*] *Triassic (Norian):* Turkey.——FIG. 469*a–b*. **G. ovoidalis,* Cipit limestone blocks, lower Norian, Taurus Mountains; *a,* weathered exterior of holotype with short exaules around large pores in center, ×0.8; *b,* longitudinal section showing low chambers with porous walls cut by a few large, exhalant canals, SPIE 19 G 105/1 and 105/2, ×0.8 (Senowbari-Daryan, 1994b).

Zanklithalamia SENOWBARI-DARYAN, 1990, p. 105 [**Z. multisiphonata;* OD]. Gigantic sponges composed of flat, broad chambers pierced by several canal bundles of prosiphonate type that penetrate through skeleton and are vertical or oblique to outer surface; segment or chamber interiors hollow

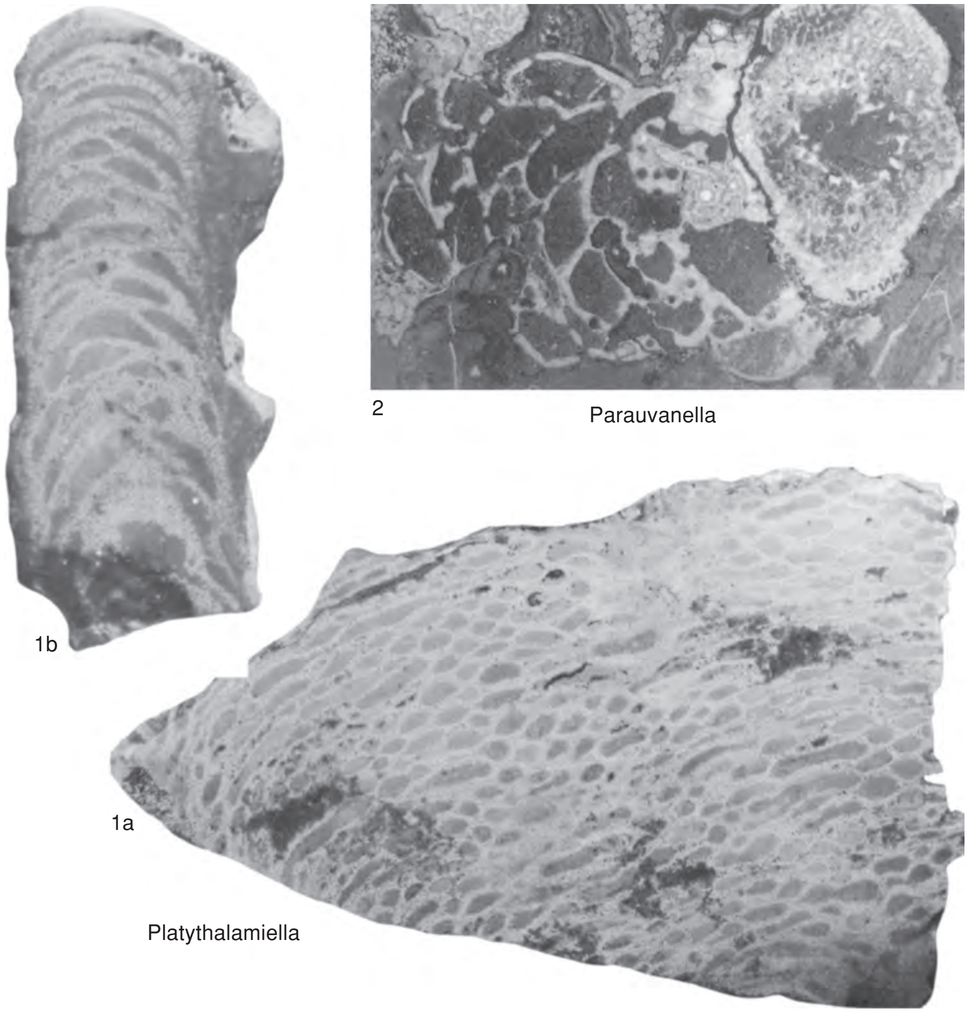

FIG. 468. Colospongiidae (p. 703–704).

or with vertical elements that may be similar to columnar filling structures; vesiculae are rare; primary skeletal mineralogy was probably aragonite; microstructure unknown but probably spherulitic. *Upper Triassic:* Austria.——FIG. 470*a–c*. **Z. multisiphonata,* Dachstein reefs, Norian, Berchtesgadener Alps; *a,* weathered section of holotype with elongate chambers interrupted by faint bundles of vertical, exhalant canals, as in right center, SPIML, Zankl collection, ×0.7; *b,* section showing elongate chambers cut by faint bundles of exhalant canals in center and upper right center, ×0.7; *c,* reconstruction showing low chambers with chamber walls, moderately rare pillars, and walls of canals in black, not to scale (Senowbari-Daryan, 1990; courtesy of *Münchner Geowissenschaftliche Abhandlungen,* Verlag Dr. Friedrich Feil).

Family TEBAGATHALAMIIDAE Senowbari-Daryan & Rigby, 1988

[Tebagathalamiidae SENOWBARI-DARYAN & RIGBY, 1988, p. 192]

Porate sphinctozoans without recognizable outer segmentation in which small spherical to tubular chambers are arranged in one peripheral layer around a very thick-walled spongocoel; each chamber is connected with central tube by only one large, exhalant canal that passes through endowall; few ostia may be present in exowall, in addition to exopores; neither filling tissue nor vesiculae present. *Permian–Upper Triassic.*

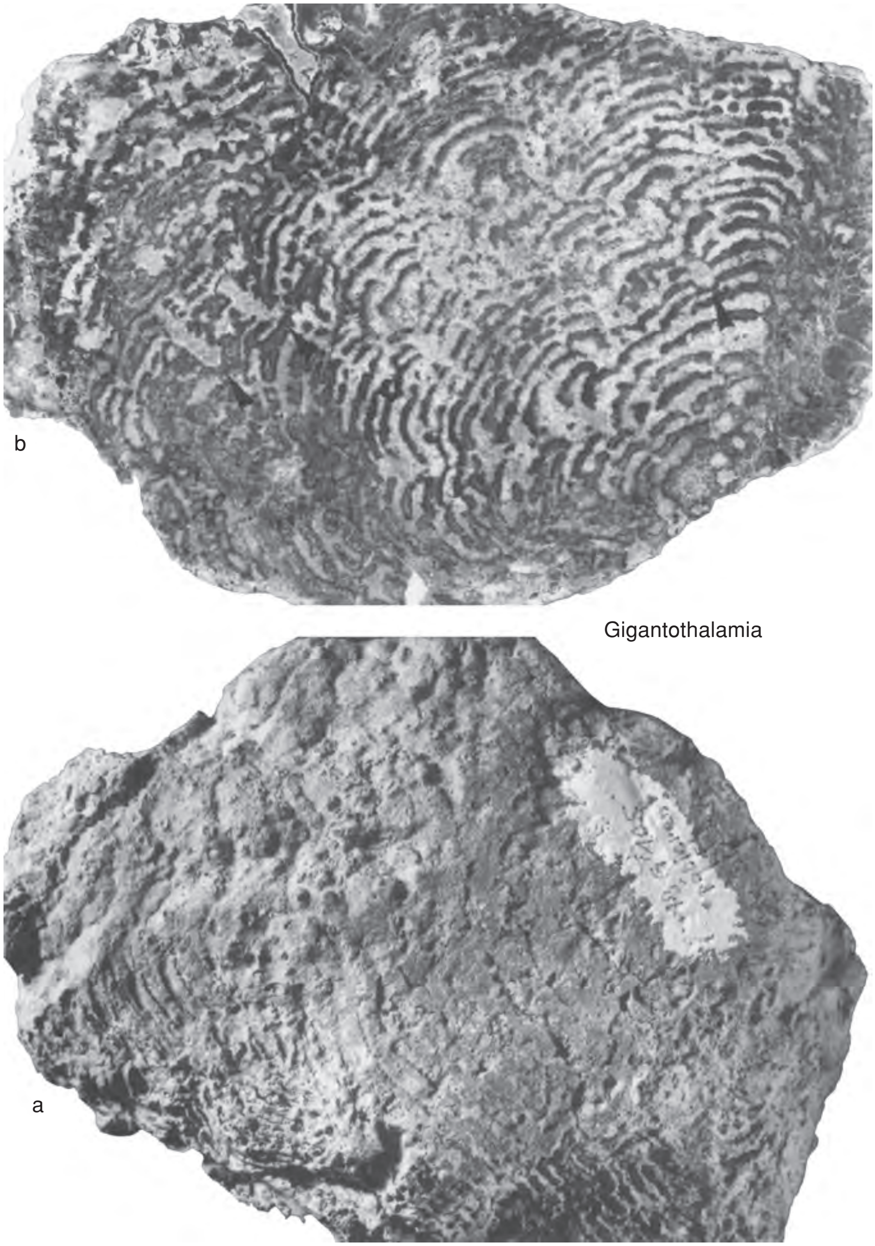

Fig. 469. Gigantothalamiidae (p. 705).

Tebagathalamia Senowbari-Daryan & Rigby, 1988, p. 192 [**T. cylindrica;* OD] [=*Guadalupia* Deng, 1982, p. 250 (type, *G.* sp., OD), *non* Girty, 1909]. Porate cylindrical stems in which radially tubelike chambers have polygonal to subhexagonal cross sections and are arranged in one glomerate layer around thick-walled spongocoel or central tube; segmentation ill defined to unrecognizable in continuous exowall; exowall pierced by fine, closely spaced exopores; interpores slightly larger and more widely spaced; each chamber connected to exhalant, central tube by large, tubular to branched exopore, although such openings from adjacent chambers may unite to form common tubes that empty into spongocoel; microstructure not known; spicules unknown. [The sponges included by Deng in

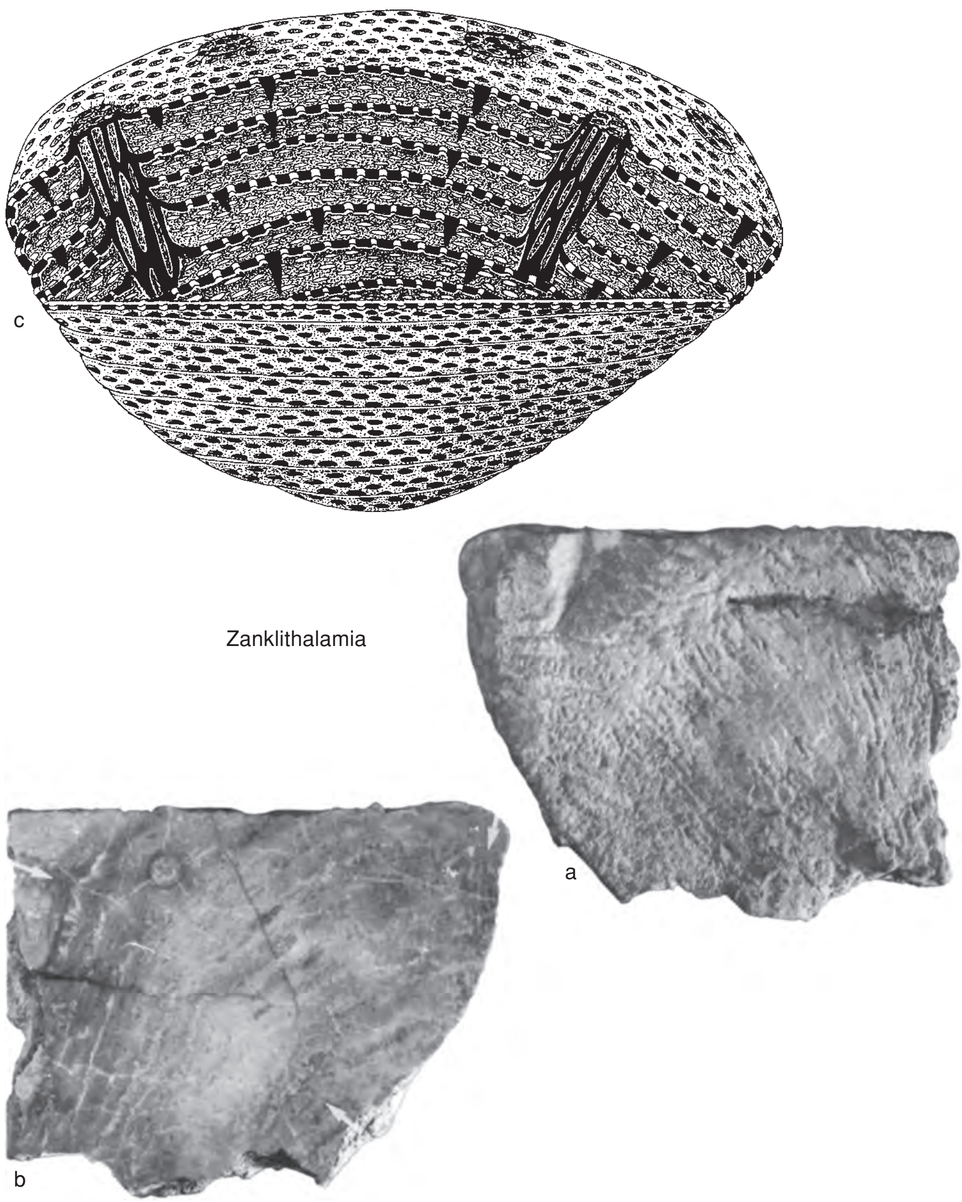

FIG. 470. Gigantothalamiidae (p. 705–706).

Guadalupia sp. are included by SENOWBARI-DARYAN and RIGBY in *Tebagathalamia.*] *middle Permian–upper Permian:* Tunisia, Italy (Sicily), China (Guangxi).——FIG. 471,*1a–c.* **T. cylindrica,* Djebel Tebaga Biohermal Complex, Changhsingian, Djebel Tebaga, Tunisia; *a,* holotype, oblique section showing polygonal, outer chambers on periphery, with porous walls, and each chamber connected to axial spongocoel by narrow, exhalant canal, USNM 427351, ×4; *b,* small paratype showing polygonal chambers around spongocoel in upper part where exowall has been removed, and small pores where exowall is intact, USNM 427353, ×2; *c,* side view of paratype with regular rows of chambers exposed because dermal layer has been removed, USNM 4427355, ×2 (Senowbari-Daryan & Rigby, 1988; courtesy of *Facies*).

Annaecoelia SENOWBARI-DARYAN, 1978, p. 207 [**A. maxima;* OD]. Encrusting sponge built of irregularly superposed (glomerate), hemispheroidal chambers; exowall microporous (and pore canals may branch) and continuous about each chamber

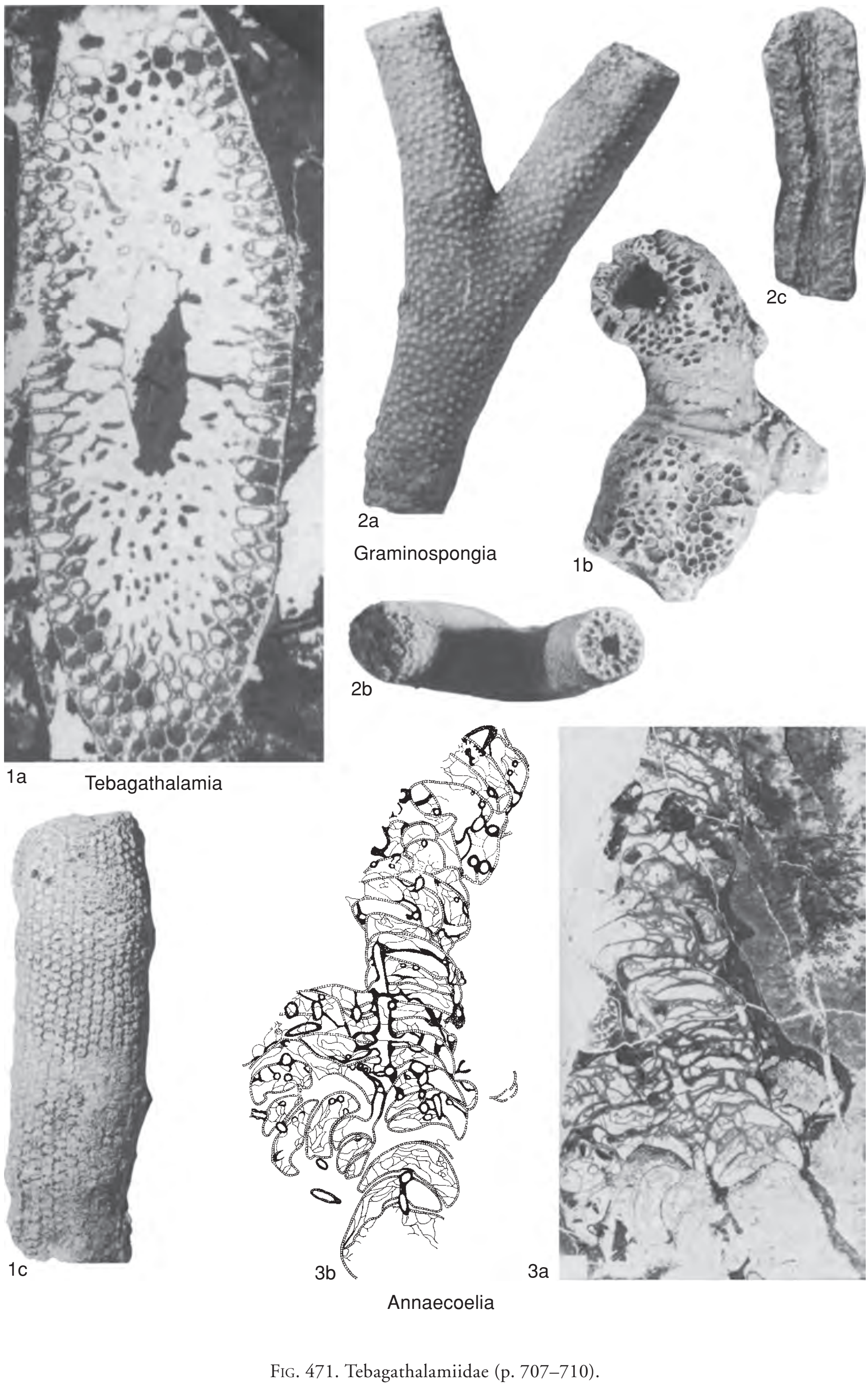

FIG. 471. Tebagathalamiidae (p. 707–710).

(i.e., double where chambers are in contact); exaulos-like tubes arising from some chambers and terminating externally after passing through one or more later chambers that surround and incorporate tubes; tube walls lamellar and imperforate, except for occasional large openings into chambers; vesicles numerous in chambers and in many tubes. *Upper Triassic:* Austria, Italy (Sicily), Yugoslavia, Oman. ——FIG. 471,*3a–b.* **A. maxima,* Gruber-Riff limestone, upper Rhaetian, Salzburg, Austria; *a,* longitudinal thin section of holotype with glomerate, irregular chambers, some of which interconnected by exaulos-like tubes, ×1; *b,* drawing of holotype section showing exaulos-like tubes with thick walls interconnecting irregular chambers with porous interwalls and exowalls and some with vesiculae, SMF 30799c, ×1 (Senowbari-Daryan, 1978; courtesy of *Senckenberg Naturforschende Gesellschaft*).

Graminospongia TERMIER & TERMIER, 1977a, p. 36 [**Guadalupia girtyi* PARONA, 1933, p. 48; OD] [=*Solidothalamia* WU Ya Sheng, 1991, p. 91 (type, *S. lambdiformis,* OD)]. Very thin, branching cylinders; central tube (spongocoel or cloaca) one-tenth to one-fifth branch diameter; exowall with quincuncially arranged, lipped exopores (pustules), each corresponding to an internal, radial chamber; interpores numerous and microscopic; endopores slightly larger than exopores and probably one per chamber; possible rudimentary trabecularium lines cloaca. [An illustration by SENOWBARI-DARYAN and RIGBY (1988, pl. 35,*4*) showing sublongitudinal, meandriform ridges and canals on the cloacal surface, and these may represent the longitudinal canals reported by the authors of the genus and by ALEOTTI, DIECI, and RUSSO (1986, pl. 3,*4*). The interpores originally described appear to be oblique cross sections of the chambers. The small size and peculiar exopores of this genus suggest affinities with the dasycladacean algae, but the possible trabecularium strengthens a poriferan assignment.] *middle Permian–upper Permian:* Italy (Sicily), Tunisia, China.——FIG. 471,*2a–c.* **G. girtyi* (PARONA), Djebel Tebaga Biohermal Complex, Changhsingian, Djebel Tebaga, Tunisia; *a,* side view of branched specimen with pustulose pores in dermal layer, USNM 427360; *b,* top of same specimen showing central spongocoel and chambers in wall; *c,* weathered vertical section showing chambered walls and axial spongocoel, 427362, ×3 (Senowbari-Daryan & Rigby, 1988; courtesy of *Facies*).

Family CHEILOSPORITIIDAE Fischer, 1962

[Cheilosporitiidae FISCHER, 1962, p. 123]

Porate sphinctozoans with ontogenetic differentiation where asiphonate in initial stages but with a retrosiphonate, central tube in later stages; without filling structures or vesiculae. *Triassic (Carnian–Rhaetian).*

Cheilosporites WÄHNER, 1903, p. 98 [**C. tirolensis;* OD]. Sphinctozoan sponges in which spongocoel asiphonate in early stages and retrosiphonate in later stages of growth; stems without filling structures and vesiculae. *Triassic (Carnian–Rhaetian):* Italy (Sicily), Austria, Greece, Jugoslavia, Hungary, Turkey, *Norian–Rhaetian;* Tajikistan, *Carnian–Rhaetian.*——FIG. 472,*1.* **C. tirolensis,* Steinplatten Reef, Rhaetian, northern Calcareous Alps, Italy; thin section including several examples of chambered species cut in various directions and coated by crusts of dark, possible algae, ×3 (Fischer, 1962).

Family SALZBURGIIDAE Senowbari-Daryan & Schäfer, 1979

[Salzburgiidae SENOWBARI-DARYAN & SCHÄFER, 1979, p. 19]

Porate sphinctozoans with differentiated wall structure; chamber walls double layered; chambers without filling structures. *Permian–Triassic (Rhaetian).*

Salzburgia SENOWBARI-DARYAN & SCHÄFER, 1979, p. 19 [**S. variabilis;* OD]. Porate sponges with glomerate chamber arrangement, asiphonate but occasionally with retrosiphonate, central canal; chambers with double-layered walls and without filling structures; ostia irregularly distributed. *Permian–Triassic (Rhaetian):* Italy (Sicily),Oman, China (Guangxi), *Permian;* Austria, Oman, USA (Oregon), Canada (Yukon), *Norian–Rhaetian.*——FIG. 472,*2a–b.* **S. variabilis,* Gruber-Riff, Rhaetian, Salzburg, Austria; *a,* holotype, thin section with glomerate chambers without filling structures and with central canal, chambers with geopetal structures, ×2; *b,* photomicrograph showing double-layered walls in two chambers, with older chamber on right and each with thicker, external layer, SPIE A/16/1, ×10 (Senowbari-Daryan & Schäfer, 1979).

Family CRIBROTHALAMIIDAE Senowbari-Daryan, 1990

[Cribrothalamiidae SENOWBARI-DARYAN, 1990, p. 76]

Simple or branched stems with retrosiphonate spongocoel and glomerate arrangement of chambers; labyrinthic, branched pores in chamber walls; without filling structures but with vesiculae; cribribulla occurring in a well-defined, dermal layer; endowall of spongocoel also has similar appearing layer; inner layers of wall of cribribulla and spongocoel have broad, short canals that appear circular in longitudinal sections and may appear falsely as tubular or spherical filling structures. *Triassic (Norian–Rhaetian).*

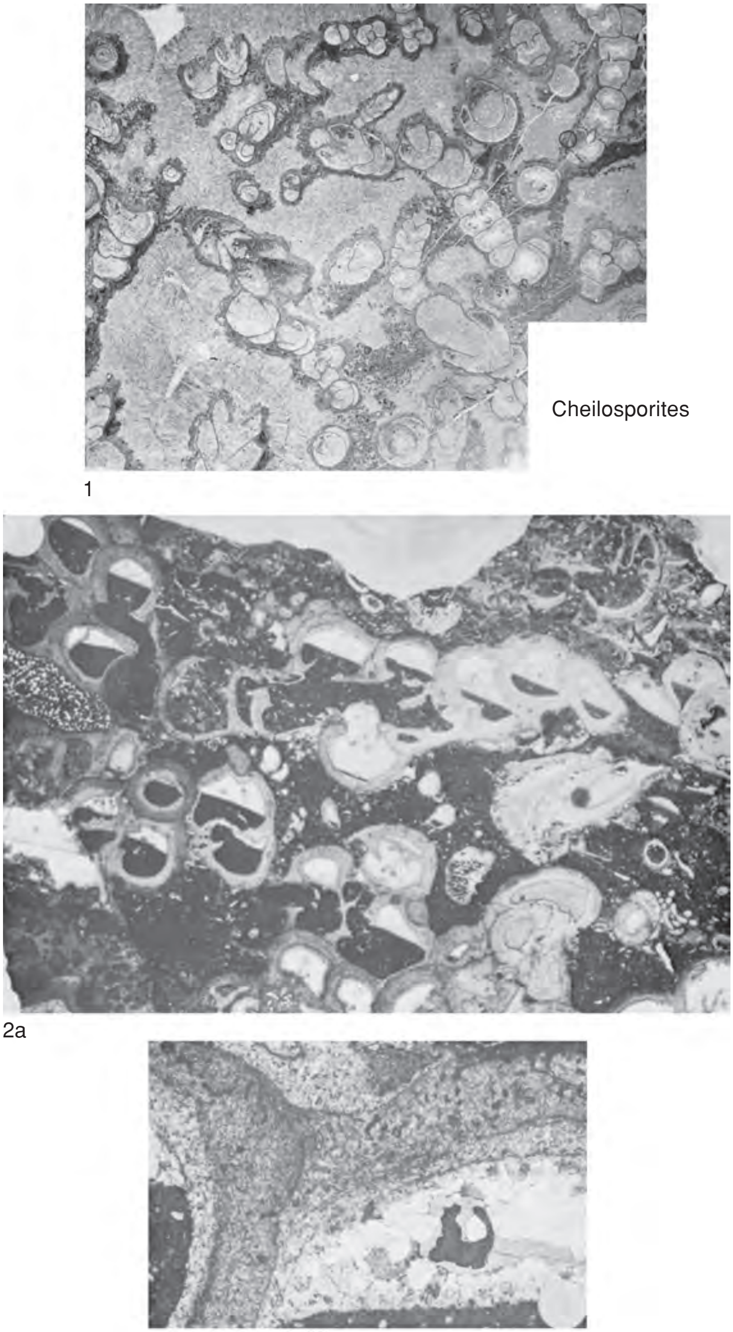

FIG. 472. Cheilosporitiidae and Salzburgiidae (p. 710).

Cribrothalamia SENOWBARI-DARYAN, 1990, p. 76 [**C. gulloae;* OD]. Stems composed of glomerate chambers arranged around retrosiphonate spongocoel; segment walls with labyrinthic, branched pores and additional porous plates as cribribulla in cortex of dermal layer; wall of spongocoel also having development of cribribulla; little filling structure but with vesiculae in interiors of chambers. *Triassic (Norian–Rhaetian):* Italy (Sicily).——FIG. 473*a–c.* **C. gulloae,* Triassic reef limestone, Norian, Madonie Mountains; *a,* holotype of glomerate chambers with coarse pores, spongocoel wall showing in lower part, SGIP MA/10, ×1; *b,* section through glomerate to irregular chambers, three of which each have cribribulla (*arrows*), SGMP MG/3/2, ×2; *c,* reconstruction showing glomerate chambers, some with a sievelike cribribulla, around a tubular spongocoel with cribribulla-like endopores, not to scale (Senowbari-Daryan, 1990; courtesy of *Münchner Geowissenschaftliche Abhandlungen,* Verlag Dr. Friedrich Feil).

Family VERTICILLITIDAE Steinmann, 1882

[Verticillitidae STEINMANN, 1882, p. 172; *emend.,* FINKS & RIGBY, herein] [=Verticillitidae STEINMANN, 1882, p. 172, *partim;* Polytholosiidae SEILACHER, 1962, p. 785, *partim;* Stylothalamiidae REITNER & ENGESER, 1985, p. 163, *partim;* Murguiathalamidae REITNER & ENGESER, 1985, p. 168, *partim;* Boikothalamiidae REITNER & ENGESER, 1985, p. 169, *partim;* Ascosymplegmatidae BOIKO, BELYAEVA, & ZHURAVLEVA, 1991, p. 168]

Chambered end cylindroidal with central cloaca (except in *Ascosymplegma* SEILACHER, 1962); exowall netlike with polygonal or lobate exopores closely spaced; where known, microstructure of aspicular skeleton is microgranular aragonite. *Permian (Guadalupian)–Holocene.*

Subfamily VERTICILLITINAE Steinmann, 1882

[*nom. transl.* FINKS & RIGBY, herein, *ex* Verticillitidae STEINMANN, 1882, p. 172; *emend.,* FINKS & RIGBY, herein]

Chambers low, containing numerous vertical pillars that frequently branch upwardly below interwall. *Permian (Guadalupian)–Holocene.*

Verticillites DE FRANCE, 1829, p. 5 [**V. cretaceus;* OD] [=*Verticillipora* DE BLAINVILLE, 1830, p. 400, obj., *nom. van.; Verticillocoelia* FROMENTEL, 1860a, p. 30, obj., *nom. van.; ?Cystopora* POMEL, 1872, p. 229 (type, *Verticillites truncatus* D'ORBIGNY, 1850 in 1850–1852, vol. 2, p. 96, SD DE LAUBENFELS, 1955, p. 105); *?Wienbergia* CLAUSEN, 1982, p. 111 (type, *Barroisia faxensis* RAVN, 1899, p. 24, OD)]. Conicocylindrical, branching; central cloaca about one-fifth sponge diameter; smaller, auxiliary cloacas occasionally present; exowall netlike with closely spaced, subpolygonal, sometimes elongate, exopores; interwalls and endowalls the same; endowall with internal, anastomosing, microcanal system (REITNER & ENGESER, 1985); chambers low, upwardly arched, connected by vertical pillars; trabecular microstructure unknown; spicules not known. [In its netlike exowall and vertical pillars, this genus resembles the living and Eocene *Vaceletia* PICKETT, 1982, as well as the Triassic *Stylothalamia* OTT, 1967a. *Cystopora* POMEL, 1872 (p. 229) was stated to differ only in the absence of pillars. Permian and Triassic species appear to belong to *Preverticillites* PARONA, 1933, which differs from *Verticillites* in having meandriform trabeculae (walls of possible anastomosing tubes) in chambers rather than pillars.] *Cretaceous:* Europe.——FIG. 474,*1a–b.* **V. cretaceus,* Upper Cretaceous, Maastrichtian, Néhou, Normandie, France; *a,* side view of holotype showing porous walls of branched sponge, ×1; *b,* vertical section showing central cloaca and porous interwalls of chambers, ×2 (Reitner & Engeser, 1985).

Boikothalamia REITNER & ENGESER, 1985, p. 169 [**Verticillites convexa* BOIKO, 1979, p. 79; OD]. Cylindrical; cloaca one-third to one-fifth sponge diameter; chambers low and overlapped by succeeding ones; exowall-interwall netlike with subpolygonal pores; chambers filled with vertical pillars that may branch upwardly; endowall relatively thick with inwardly and upwardly directed canals; possible dichotriaenes imbedded in walls and pillars (cladomes directed upwardly in pillars) are better explained as pseudospicules (see SENOWBARI-DARYAN, 1989). [Except for its supposed spicules, this genus cannot be distinguished from *Verticillites* DE FRANCE, 1829, although data are not available on microstructure or mineralogy.] *Jurassic (Callovian–Kimmeridgian):* Siberia, Tajikistan, Greece.——FIG. 474,*3a–b.* **B. convexa* (BOIKO), Callovian, Tajikistan; *a,* longitudinal section of type specimen with narrow spongocoel and uparched chambers with pillar filling structures connected to porous interwalls and exowall, top to left, ×5; *b* photomicrograph of supposed dichotriaene spicules in calcareous, skeletal element, scale bar, 125 µm (Reitner & Engeser, 1985).

Marinduqueia YABE & SUGIYAMA, 1939, p. 68 [**M. mirabilis;* OD]. Cylindroid sponges without spines; spongocoel about one-third sponge diameter; chambers very low with numerous pillars that may be arranged in rows and produce a netlike appearance in vertical sections; closely spaced, subpolygonal to polygonal exopores; vesicles occasionally present. [Genus is similar to *Vaceletia* PICKETT, 1982, but without the lobate or spinose pores.] *Paleogene (Eocene):* Philippines.——FIG. 475,*1a–e.* **M. mirabilis,* Island of Marinduque; *a,* longitudinal section showing spongocoel in upper part and low chambers with pillar filling structures connecting porous interwalls; *b,* longitudinal section through low chambers with distinctively regular pillars, ×4; *c,* transverse section through porous interwall and with regular pillars in chambers, ×5; *d–e,* drawings of type specimens showing chamber

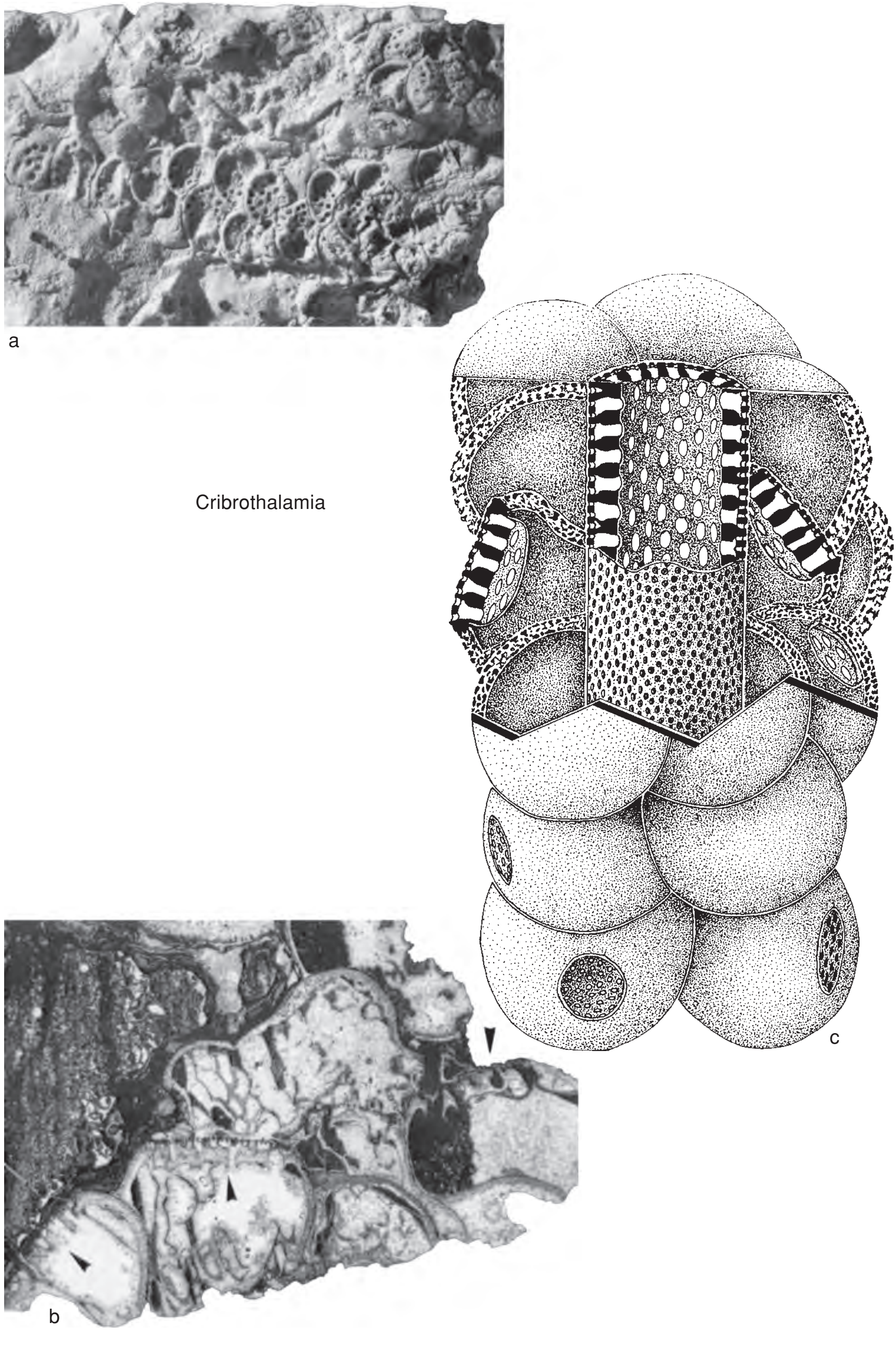

FIG. 473. Cribrothalamiidae (p. 712).

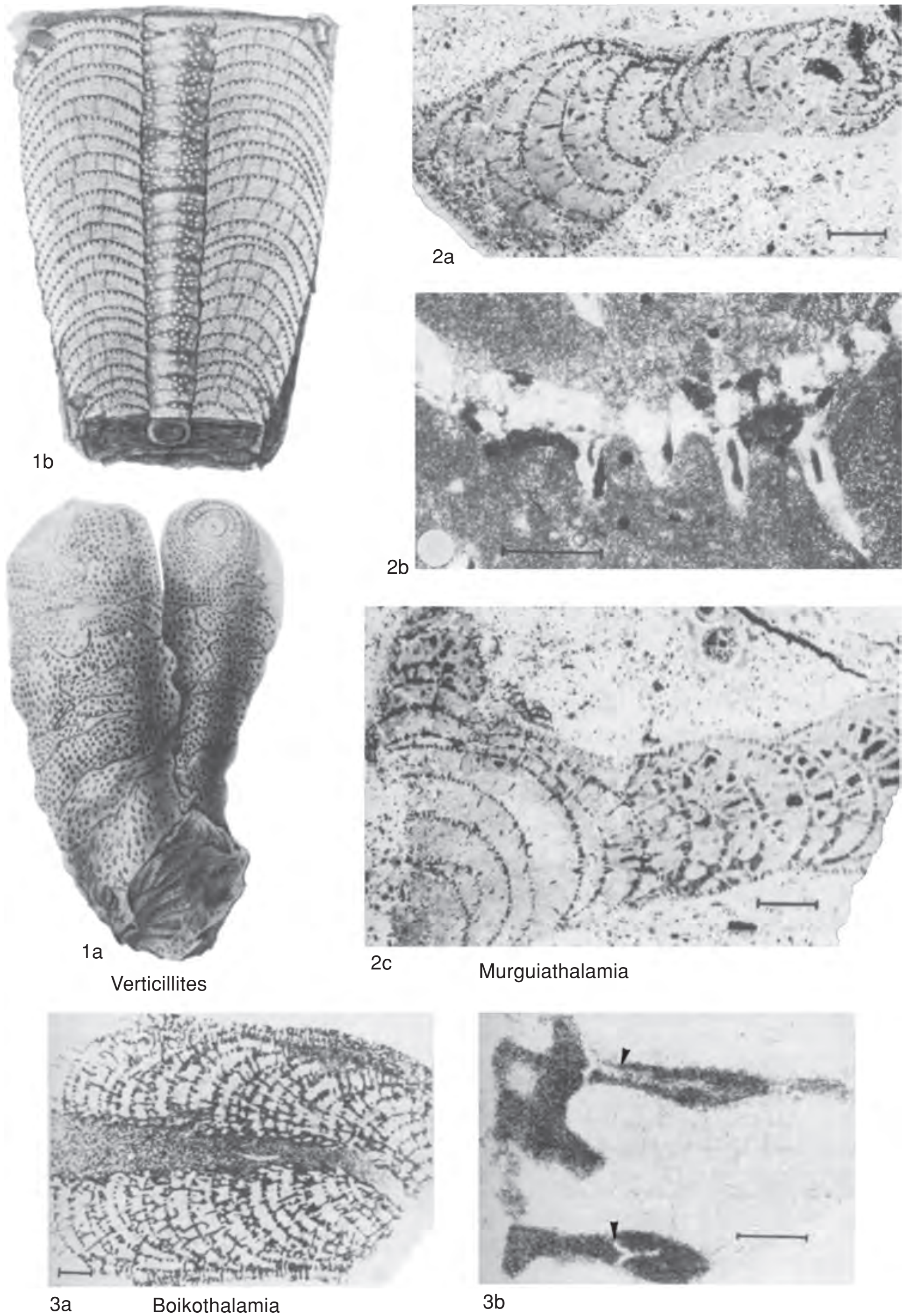

FIG. 474. Verticillitidae (p. 712–717).

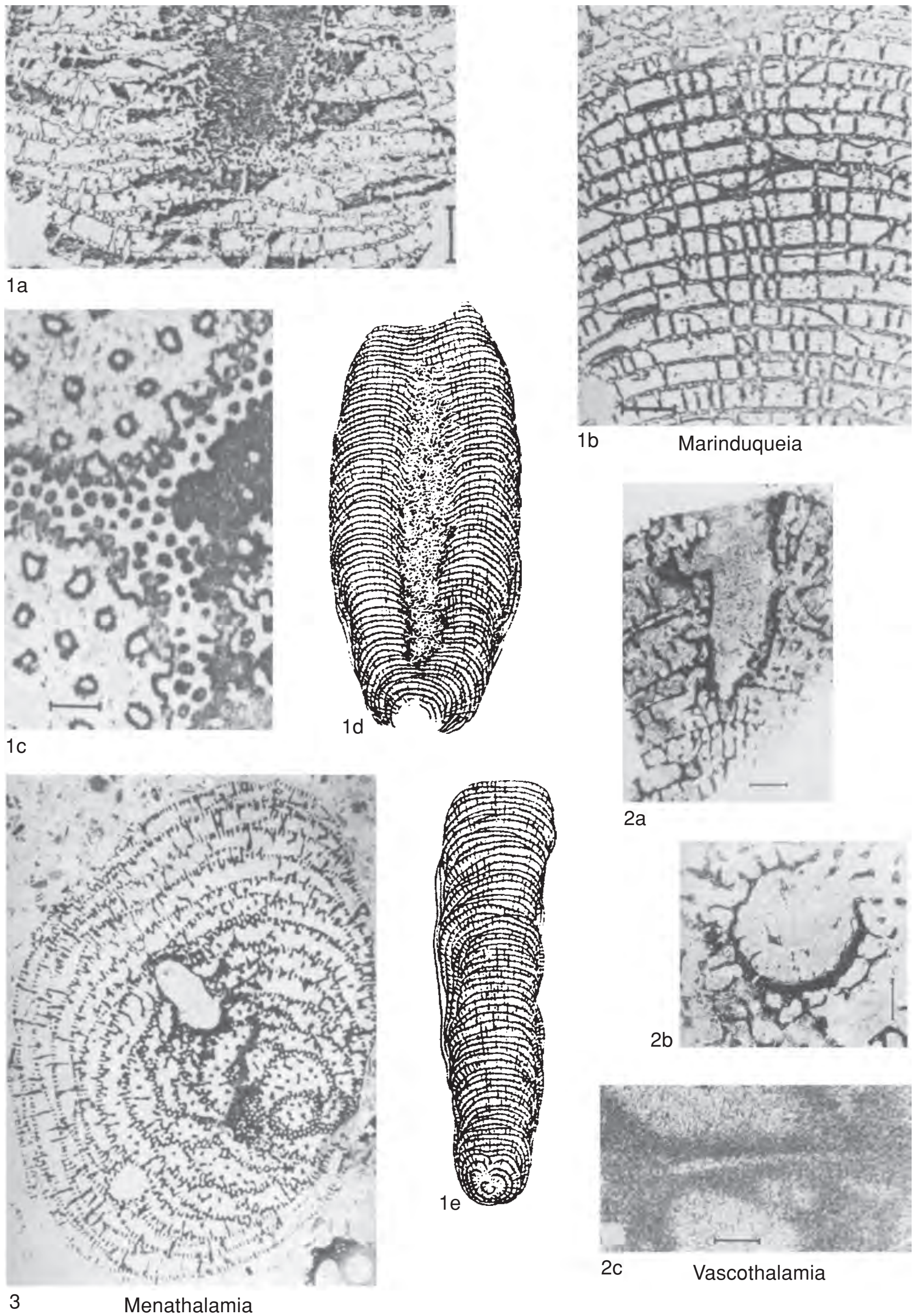

FIG. 475. Verticillitidae (p. 712–717).

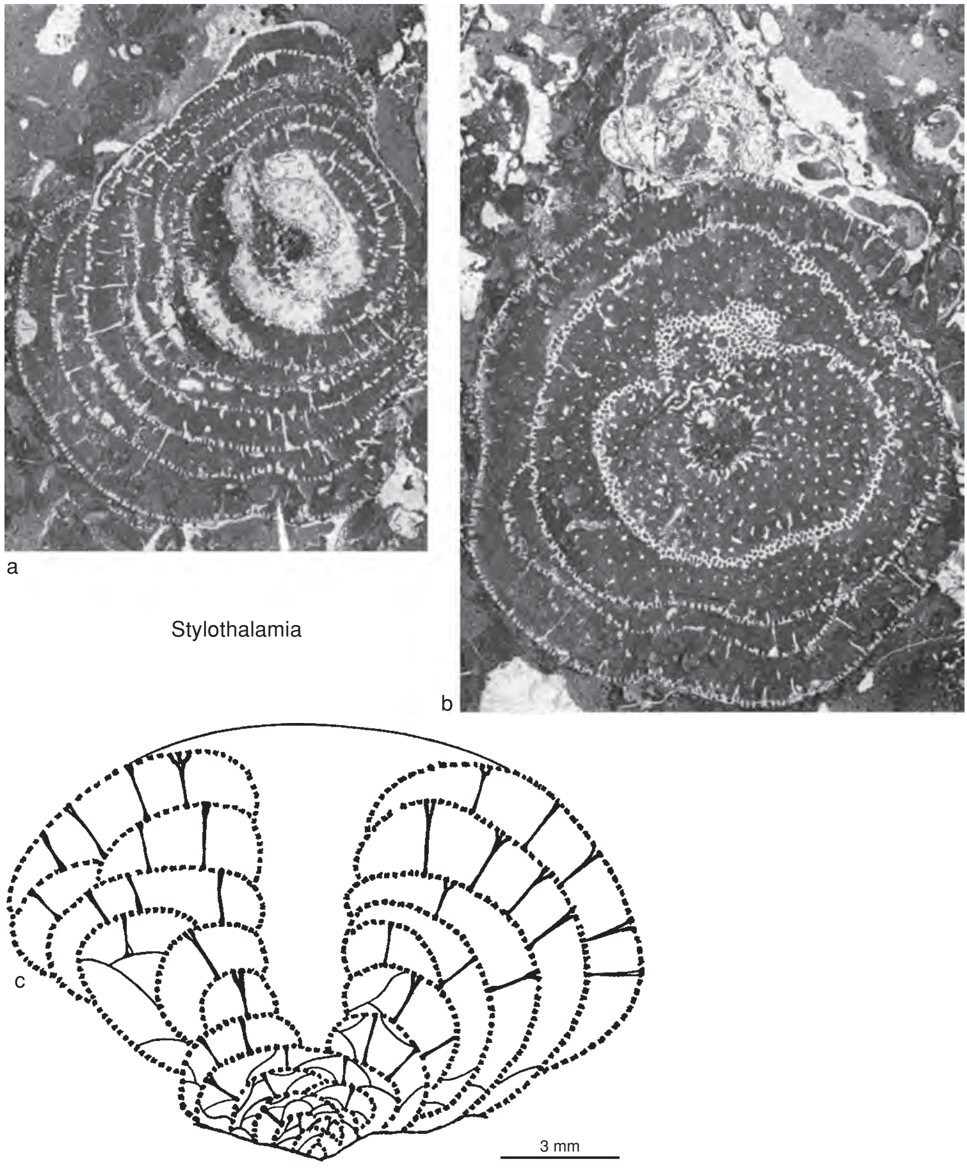

FIG. 476. Verticillitidae (p. 717).

and pillar development and spongocoel, ×1 (Reitner & Engeser, 1985).

?Menathalamia REITNER & ENGESER, 1985, p. 166 [**M. caniegoensis;* OD] [=*?Stylothalamia* OTT, 1967a, p. 44 (type, *S. dehmi,* OD)]. Stylothalamid sponges with a deep spongocoel in upper parts, which lack differentiated gastral layer; pores are comparatively small, of variable diameter and round; early skeletal stages without a spongocoel and prosopores may cluster to form astrorhiza-like, exhalant systems; apopores on retrosiphonate, spongocoel wall are of substantial size and irregular form. [Differs from *Stylothalamia* OTT, 1967a, in having more circular and widely spaced pores that may become confluent in early, noncloacate chambers, to form astrorhiza-like or meandriform openings. Genus may be considered a synonym of *Stylothalamia* OTT, 1967a, if the microstructure and mineralogy prove to be the same.] *Cretaceous (Cenomanian):* Spain.——FIG. 475,*3.* **M. caniegoensis,* Vracon, ?Lower Cenomanian, Caniego, Burgos, northern Spain; transverse section of holotype, negative print, with spongocoel in left center and radiating pillars in low chambers with coarsely porous interwalls, PIFUB 85/4, ×5 (Reitner & Engeser, 1985).

Murguiathalamia Reitner & Engeser, 1985, p. 168 [*M. jugoensis; OD]. Broadly conical with broad, open cloaca whose wall merely overlapping interwalls-exowalls of chambers [an alternative interpretation of illustrated sections is a noncloacate sponge with branches]. Chambers relatively high and hemispheroidal (or hemitoroidal) with few pillars; pores circular; pyritic bodies resembling prodichotriaenes embedded in calcareous skeleton (those in pillars have upwardly directed cladome at pillar-interwall junction) are probably pseudospicules (see Senowbari-Daryan, 1989). *Cretaceous (upper Albian):* Spain.——Fig. 474,*2a–c*. **M. jugoensis,* sideritic limestone, near Murguía, northern Spain; *a,* holotype section with moderately high chambers with pillars, ×4; *b,* photomicrograph of pyrite pseudomorphs of possible megascleres within wall structures, PIFUB 85/5, bar scale, 0.1 mm; *c,* negative print of tangential section through broad, obconical paratype with retrosiphonate spongocoel and pillars in arcuate chambers, PIFUB 85/6, ×4 (Reitner & Engeser, 1985).

Stylothalamia Ott, 1967a, p. 44 [*S. dehmi; OD] [?=*Menathalamia* Reitner & Engeser, 1985, p. 166 (type, *M. caniegoensis,* OD)]. Broadly conical with narrow, central cloaca or without cloaca; chambers low; widely spaced, vertical pillars may branch upwardly, of circular cross section, sometimes hollow, their lumen connecting with that of overlying chamber; imperforate vesicles may be present in earlier chambers; endopores, interpores, and exopores essentially the same, mostly small, closely spaced, and ranging from circular to elongate to subpolygonal or lobate; a few larger, circular pores may be present; trabecular microstructure a feltwork of aragonite needles of vaceletid type (Cuif & others, 1979, p. 460); no spicules known. [Genus is similar to *Vaceletia* Pickett, 1982.] *Permian (Guadalupian)–Upper Cretaceous:* China (Hubei), *Guadalupian;* Europe, Turkey, Iran, Tajikistan, *Triassic;* Peru, Morocco, Iran, *Lower Jurassic;* USA (Texas), *Upper Cretaceous.*——Fig. 476*a–c*. **S. dehmi,* Raibler beds, Carnian, Karwendel, Austria; *a,* transverse section of lower part of holotype with porous walls of circular chambers around narrow spongocoel, and with widely spaced, radial pillars in chambers, 4 mm above base of sponge, BSPGM G 416 a/67, ×4; *b,* transverse section of holotype above that of view *a,* with chamber wall cut tangentially near center where pores are well shown, and sections of pillars relatively uniformly distributed in inner two chambers, around spongocoel, 6 mm above base of sponge, BSPGM G 418 a/67, ×4; *c,* schematic, longitudinal section showing position of transverse sections, view *a* at level 2 and view *b* at level 4 (Ott, 1967a; courtesy of *Neues Jahrbuch für Geologie und Paläontologie, Monatshefte*).

Vaceletia Pickett, 1982, p. 241, *nom. nov. pro Neocoelia* Vacelet, 1977b, p. 509, *non* McKellar, 1966 [**Neocoelia crypta* Vacelet, 1977b, p. 509; OD]. Cylindrical, externally segmented, upper surface domical, sometimes branching; cloaca narrow, about one-eighth sponge diameter; exowall netlike, with subpolygonal or lobate exopores; outer surface of exowall granular and microspinose, microspines alternate with micropores of same diameter; upper surface of interwalls and inner surface of endowall (lining cloaca) same as outer surface of exowall, with interpores and endopores same size and shape as exopores; lower surface of interwall, chamber size of endowall, and surface of pillars, smooth; earlier chambers filled in by secreted sclerosome in layers concave distally; patches of smooth, calcareous deposit partly or wholly cover abandoned, basal part of skeleton exterior, ultimately closing over exopores; trabecular microstructure irregular feltwork of aragonite needles; spicules absent. [Genus is similar to *Stylothalamia* Ott, 1967a.] *Cretaceous (Campanian)–Holocene:* Spain, *Campanian;* Australia, Indo-West Pacific, *Eocene–Holocene.*——Fig. 477,*1a–c*. *V. progenitor* Pickett, Pallinup Siltstone, upper Eocene, north of Walpole, Western Australia; *a,* side view of holotype showing cylindrical branches and minor annulations associated with incremental growth, WAM81.2729, ×1; *b,* diagonal surface across walls into spongocoel with apopores in gastral layer and irregular, fibrous skeleton, ×10; *c,* reverse side of fragment with chamberlike increments with pillars and connecting bars, and dermal layer with numerous uniform prosopores, WAM 81.2734, ×10 (Pickett, 1982).

Vascothalamia Reitner & Engeser, 1985, p. 162 [*V. arayaensis; OD]. Steeply obconical to subcylindrical sponges with spongocoel of nearly constant diameter throughout, except in juvenile part of skeleton, and wall with irregular canal system except in juvenile part where not developed; thickened structure of gastral layer producing small apopores; megascleres in basal skeleton monaxons (possible oxeas). *Cretaceous (upper Albian):* northern Spain. ——Fig. 475,*2a–c*. **V. arayaensis,* limestone reef rubble, lower upper Albian, Ort Araya; *a,* longitudinal section with thickened, gastral layer to spongocoel and irregular, fibrous skeleton, ×5; *b,* transverse section through gastral layer around spongocoel and parts of surrounding chamber, ×10; *c,* oxea megasclere in transverse element of wall, PIFUB 85/3, ×100 (Reitner & Engeser, 1985).

?Wienbergia Clausen, 1982, p. 111 [**Barroisia faxensis* Ravn, 1899, p. 24; OD]. Cylindrical with central cloaca approximately one-fifth sponge diameter; chambers moderately high; exopores subpolygonal. [Apart from somewhat higher chambers and absence of branching, genus does not differ from *Verticillites* De France, 1829.] *Paleogene (Danian):* Denmark.——Fig. 477,*2a–c*. **W. faxensis* (Ravn), coral limestone, middle Danian, Fakse Sjaelland; *a,* polished, vertical section (inverted) of lectotype showing central spongocoel and arcuate, sediment-filled chambers with pillars, MMH 15345, ×1; *b,* side view of exterior of paralectotype showing ornamentation on outer

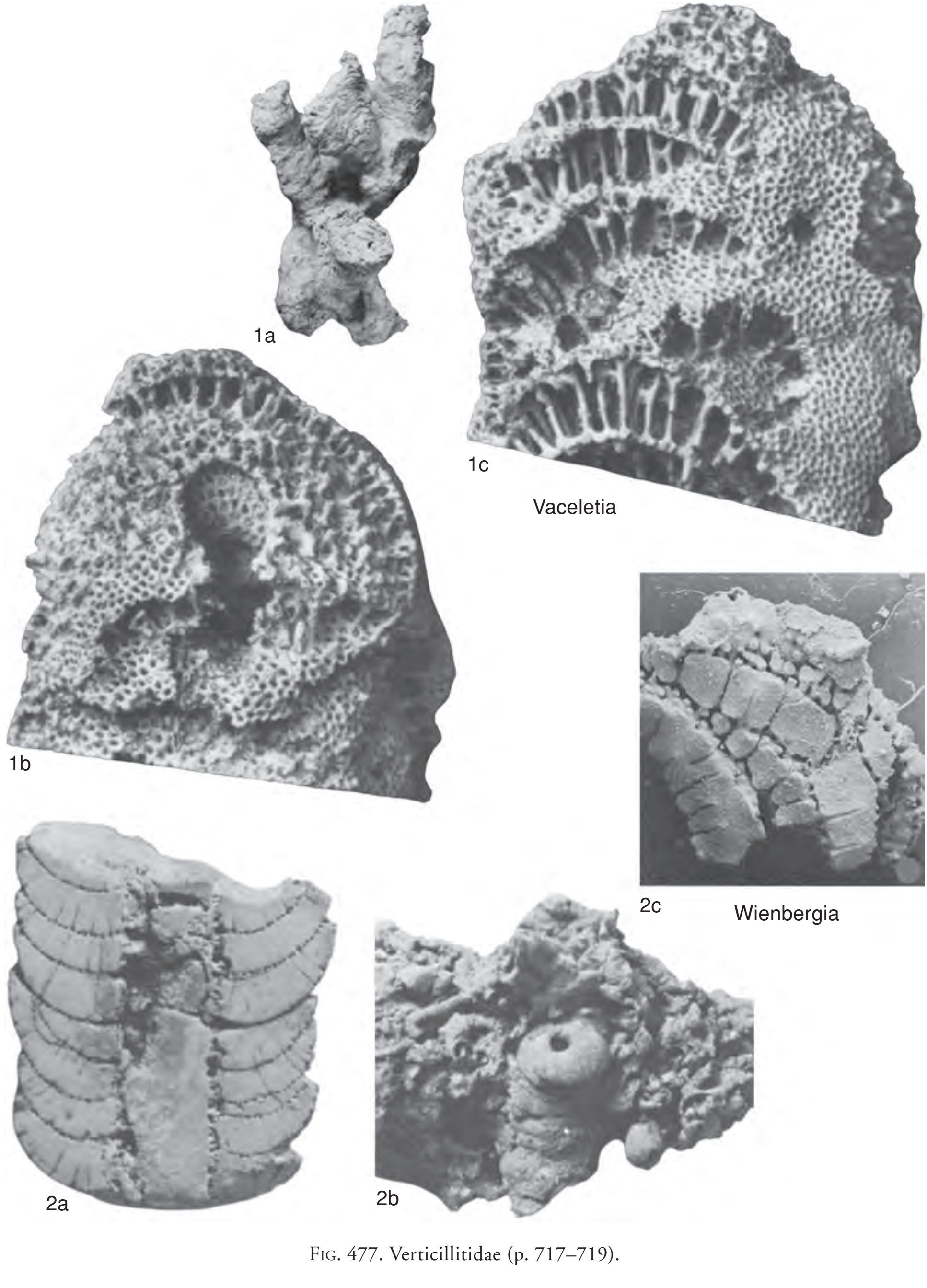

FIG. 477. Verticillitidae (p. 717–719).

walls, J. P. J. Ravn collection, ×1.5; *c,* details of reference specimen showing chamber interwalls and vertical pillars between them, ×10 (Clausen, 1982).

Subfamily POLYTHOLOSIINAE Seilacher, 1962

[*nom. transl.* FINKS & RIGBY, herein, *ex* Polytholosiidae SEILACHER, 1962, p. 785] [=Ascosymplegmatidae BOIKO, BELYAEVA, & ZHURAVLEVA, 1991, p. 168]

Chambers relatively high; no vertical pillars; trabeculae within chambers may outline branching and anastomosing, radial tubes; microstructure not known, but assigned to Verticillitidae on basis of lobate exopores. *Permian (?Lopingian), Triassic.*

?Polytholosia RAUFF, 1938, p. 186 [**P. complicata;* OD] [=*?Tetraproctosia* RAUFF, 1938, p. 180 (type, *T. peruana,* OD)]. Cylindrical; exowall netlike with closely spaced, subpolygonal, lobate, or confluent exopores; cloaca one-third to one-fourth sponge diameter; interwall similar to exowall but pores slightly larger; endopores much larger than exopores and interpores; chambers moderately high and partly filled by trabeculae that outline anastomosing, radial tubes leading to endopores; trabeculae chiefly developed on surfaces of interwalls. Trabecular microstructure unknown; no spicules known. [SEILACHER (1962, p. 764–767) described a species from Nevada in which tubes converge inwardly from exopores to form large, radial canals that connect by small canals with parallel, large, radial canals that branch toward endopores, often via a longitudinal canal running along chamber side of endowall; bundle of vertical tubes may substitute for cloaca in early chambers, and diaphragm-like, horizontal, imperforate partitions may occur in lower part of cloaca proper.] *Permian (?Lopingian), Triassic:* Tunisia, China (Guizhou), *?Lopingian;* Peru, USA (Nevada), *Triassic;* Italy (Sicily), Canada (Yukon), Pamir region, Tajikistan, *Norian–Rhaetian.*——FIG. 478,*1a–d.* **P. complicata,* Triassic chert, Ladinian, Nevada Acrotambo near Huacrachuco, Peru; *a,* side view of subcylindrical type specimen, in lower center and upper right center, intergrown and capped with sheets of *Ascosymplegma,* upper part and right; *b,* side view of second type specimen with chambers and porous exowall; *c,* view from above of same specimen with central spongocoel and radial canals on upper, chamber wall, ×1; *d,* enlarged view of exowall with angular pores that range somewhat in diameter, ×3 (Rauff, 1938).

Ascosymplegma RAUFF, 1938, p. 195 [**A. torosum;* OD]. Flat, curving, or undulose sheets whose complete shape is unknown; one species (not type) has fingerlike protrusions; chambers of type species resemble laterally elongate *Guadalupia* chambers, that is, elongate parallel to growing edge of sponge, pinching out laterally in usual quincuncial arrangement; in other species, however, and in parts of type species, chambers so elongate that they do not terminate laterally within fragmentary specimens; in longitudinal section interwalls meet one surface tangentially and other almost perpendicularly—by analogy with *Guadalupia* tangent surface is exowall (inhalant) side and perpendicular surface is endowall-trabecularium (exhalant) side [sides of sponge referred to by SEILACHER (1962, pl. 8) and by DIECI & others (1968, pl. 31) as lower and upper, respectively]; no trabecularium apparent; exopores and interpores smaller than endopores; interpores may be secondarily closed and interwalls thickened; walls netlike and pores subpolygonal, especially visible on endowall, with its larger pores, where endopores may be stellate from incipient growth of fibers across them. [The walls and pores are reminiscent of those of *Vaceletia* PICKETT, 1982; there is a suggestion of trabecular infilling of chambers in some specimens; microstructure is unknown; no spicules are known. May be a synonym of *Discosiphonella* INAI, 1936.] *Triassic:* Peru, USA (Nevada), Canada (Yukon), Italy, Russia (Caucasus region).——FIG. 479*a–c.* **A. torosum,* Triassic chert, ?Ladinian, Acrotambo near Huacrachuco, Peru; *a,* side view of type showing growth form of chamberlike sheets, overgrowing type of *Polytholosia,* behind; *b,* convex, arched growth of chambered-appearing, lower part of type specimen, ×1; *c,* enlarged view of chamber exowalls with numerous exopores, ×2 (Rauff, 1938).

Nevadathalamia SENOWBARI-DARYAN, 1990, p. 81 [**Polytholosia cylindrica* SEILACHER, 1962, p. 764; OD]. Chambers catenulate in single or branching stems with a retrosiphonate spongocoel and tubular filling structure; pores simple or multiple branched; vesiculae missing or only rarely present. *Triassic (Norian–Rhaetian):* USA (Nevada), Mexico (Sonora), Canada (Yukon), Austria, Iran.——FIG. 478,*3a–c.* **N. cylindrica* (SEILACHER), Luning Formation, Norian, Pilot Mountains, Nevada; *a,* longitudinal section of reference specimen showing porous chambers, some with isolated vesiculae, around large spongocoel, ×1; *b,* transverse section showing endowall around spongocoel thinner than exowall, but both porous, ×1; *c,* outer surface of holotype showing outer sculpture on right, with arcuate, porous, chamber walls in center and tubular filling

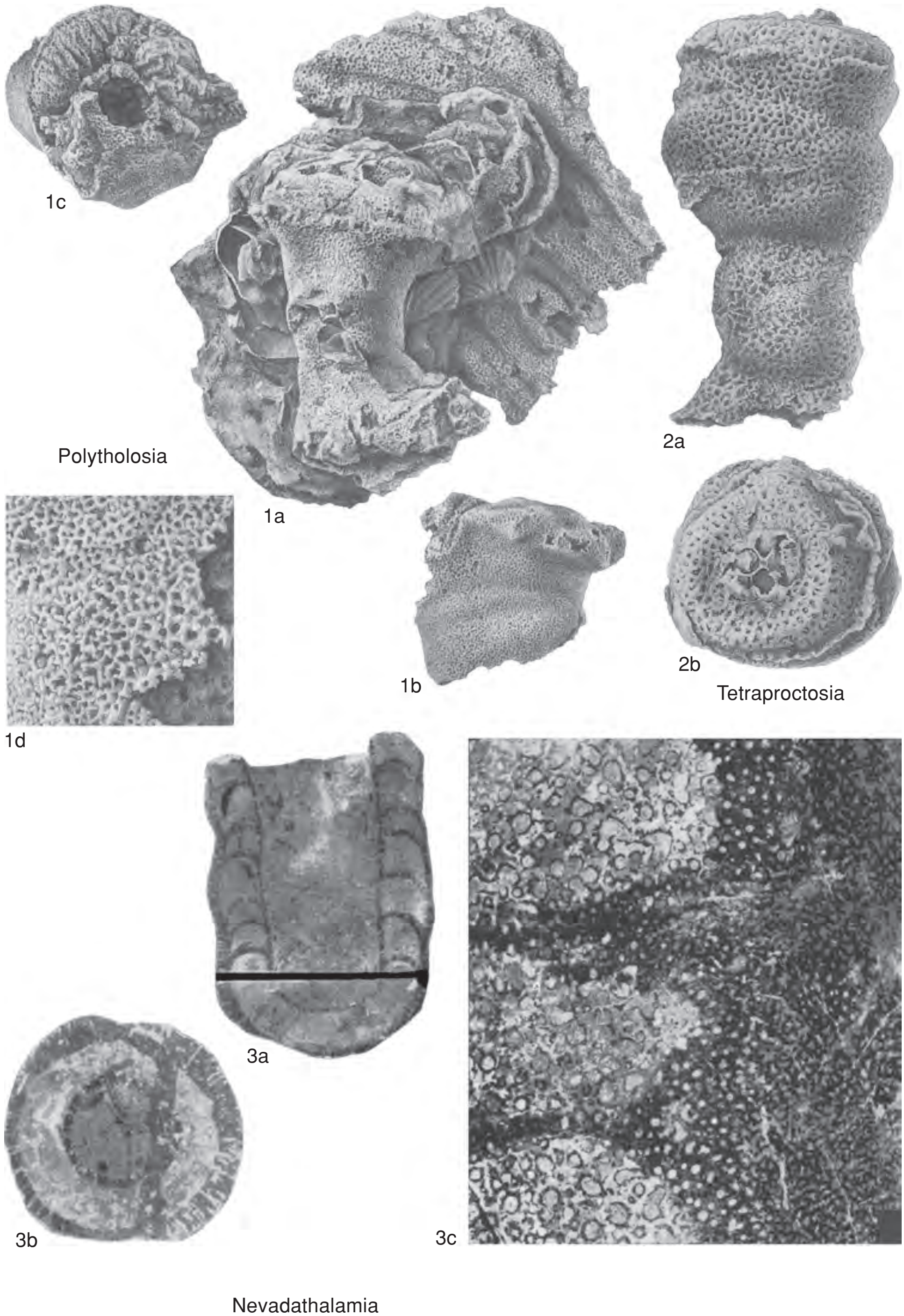

FIG. 478. Verticillitidae (p. 719–721).

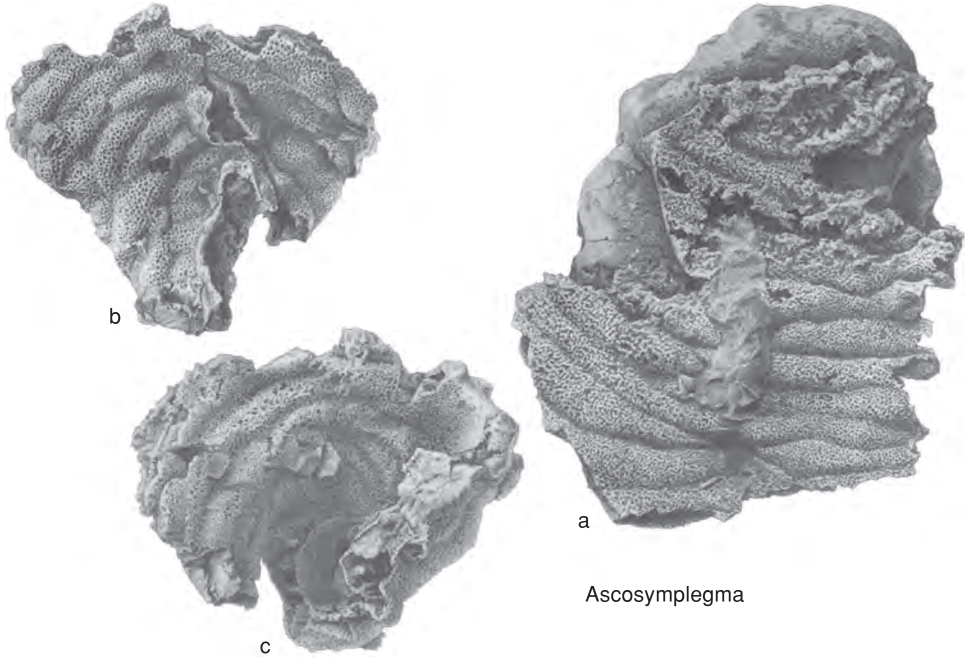

FIG. 479. Verticillitidae (p. 719).

structures in chambers on left, ×2 (Seilacher, 1962).

?Tetraproctosia RAUFF, 1938, p. 180 [**T. peruana;* OD] [=?*Polytholosia* RAUFF, 1938, p. 186 (type, *P. complicata,* OD)]. Conicocylindrical but basally expanded for attachment; exowall netlike with closely spaced, subpolygonal, lobate or confluent exopores; cloaca one-third sponge diameter, but subdivided into four subpolygonal, subequal openings at oscular end of sole specimen; interior structures unknown. [This may be an individual variant of *Polytholosia* RAUFF, 1938, with which it occurs; the exowall is the same.] *Triassic:* Peru, Pamir region, Tajikistan.——FIG. 478,*2a–b.* **T. peruana,* Ladinian beds, Middle Triassic, near Huacrachuco, Nevada de Acrotambo, Cordillera blanca, Peru; *a,* side view, chambered sponge with flared foot, and projecting nodes of tetraproct opening on upper, oscular end, ×2; *b,* view of tetraproct opening in oscular area, ×2 (Rauff, 1938).

Subfamily FANTHALAMIINAE Senowbari-Daryan & Engeser, 1996

[Fanthalamiinae SENOWBARI-DARYAN & ENGESER, 1996, p. 269, *nom. nov. pro* Faniinae SENOWBARI-DARYAN, 1990, p. 83, based on invalid junior homonym]

Polytholosiids with moniliform to uviform arrangement of chambers; without spongocoel. *Triassic (Carnian–Norian, ?Rhaetian).*

Fanthalamia SENOWBARI-DARYAN & ENGESER, 1996, p. 269, *nom. nov. pro Fania* SENOWBARI-DARYAN, 1990, p. 83, *non* BARNES & MCDUNNOUGH, 1911 [**Polytholosia astoma* SEILACHER, 1962, p. 760; OD]. Moniliform to irregular stems without spongocoel; exhalant openings or oscula may be developed with various spacing; filling structure is of tubular type and rudimentary to absent; pores are multiple branched; vesiculae have not been observed. *Triassic (?Carnian, Norian):* Turkey, Russia, *?Carnian;* USA (Nevada), Mexico (Sonora), Canada (British Columbia), *Norian.*——FIG. 480,*1a–c.* **F. astoma* (SEILACHER), Luning Formation, Norian, Cedar Mountains, Nevada; *a,* branched holotype, ×2; *b,* section of holotype with skeletal pores and ostia between branches of holotype, ×5; *c,* longitudinal section of three stems with chambers of one on left with tubular filling structures, ×1 (Seilacher, 1962).

Cinnabaria SENOWBARI-DARYAN, 1990, p. 85 [**Ascosymplegma expansum* SEILACHER, 1962, p. 768; OD]. Dish- or saucer-shaped sponges composed of numerous overlapping, tubular chambers arranged in radially concentric or moniliform, stacked series; chamber or segment walls with branching pores; filling structure rudimentary and of granular type through which thick tubes may develop; without spongocoel and vesiculae. *Triassic (Carnian–Norian, ?Rhaetian):* Turkey (Taurus Mountains), *Carnian;* USA (Nevada), Canada (Yukon, British Columbia), India (Himalayan Mountains), Mexico, *Norian;* Austria, *?Rhaetian.*——FIG. 480,*2a–b.* **C. expansum* (SEILACHER), Luning Formation, Norian,

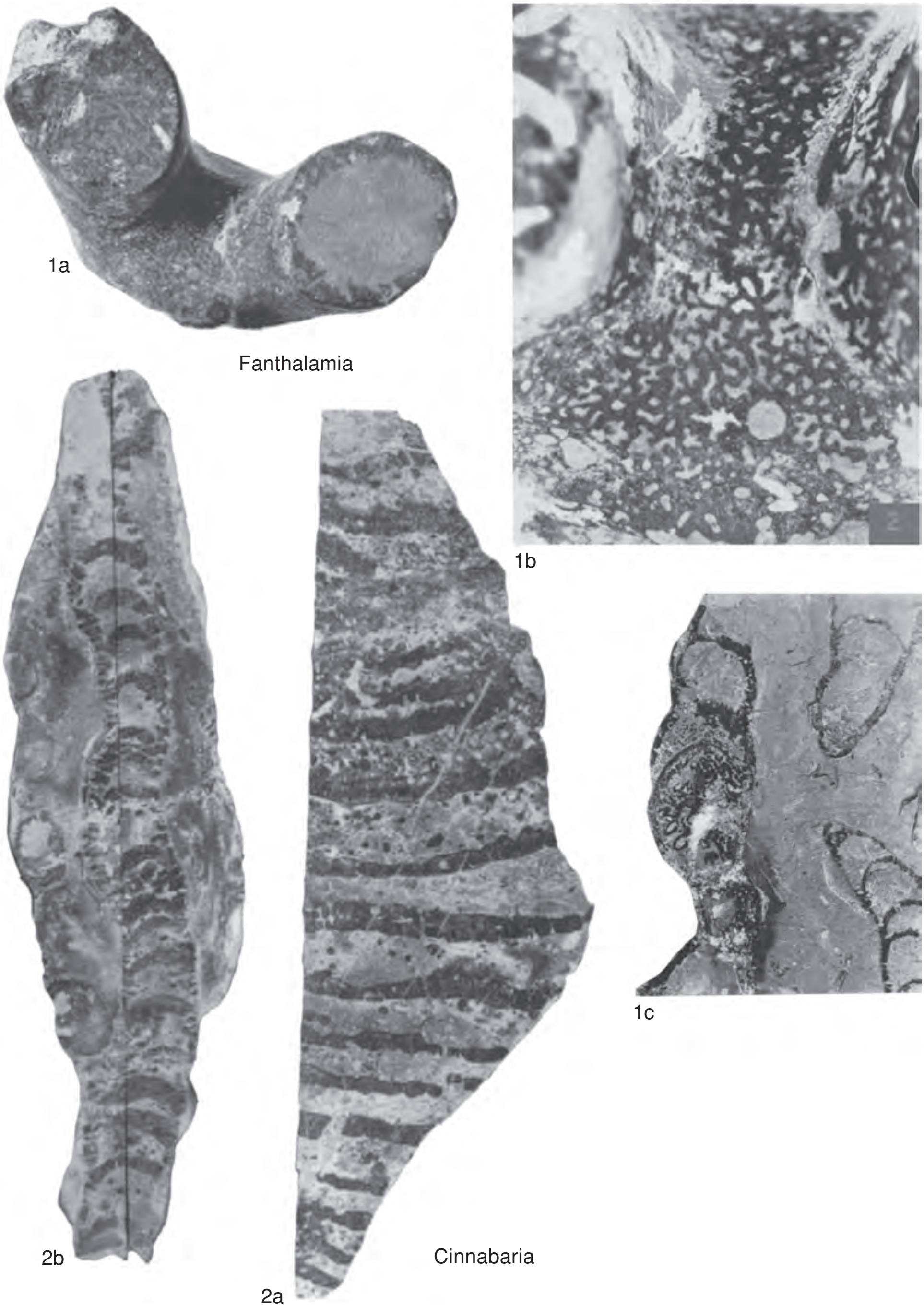

FIG. 480. Verticillitidae (p. 721–723).

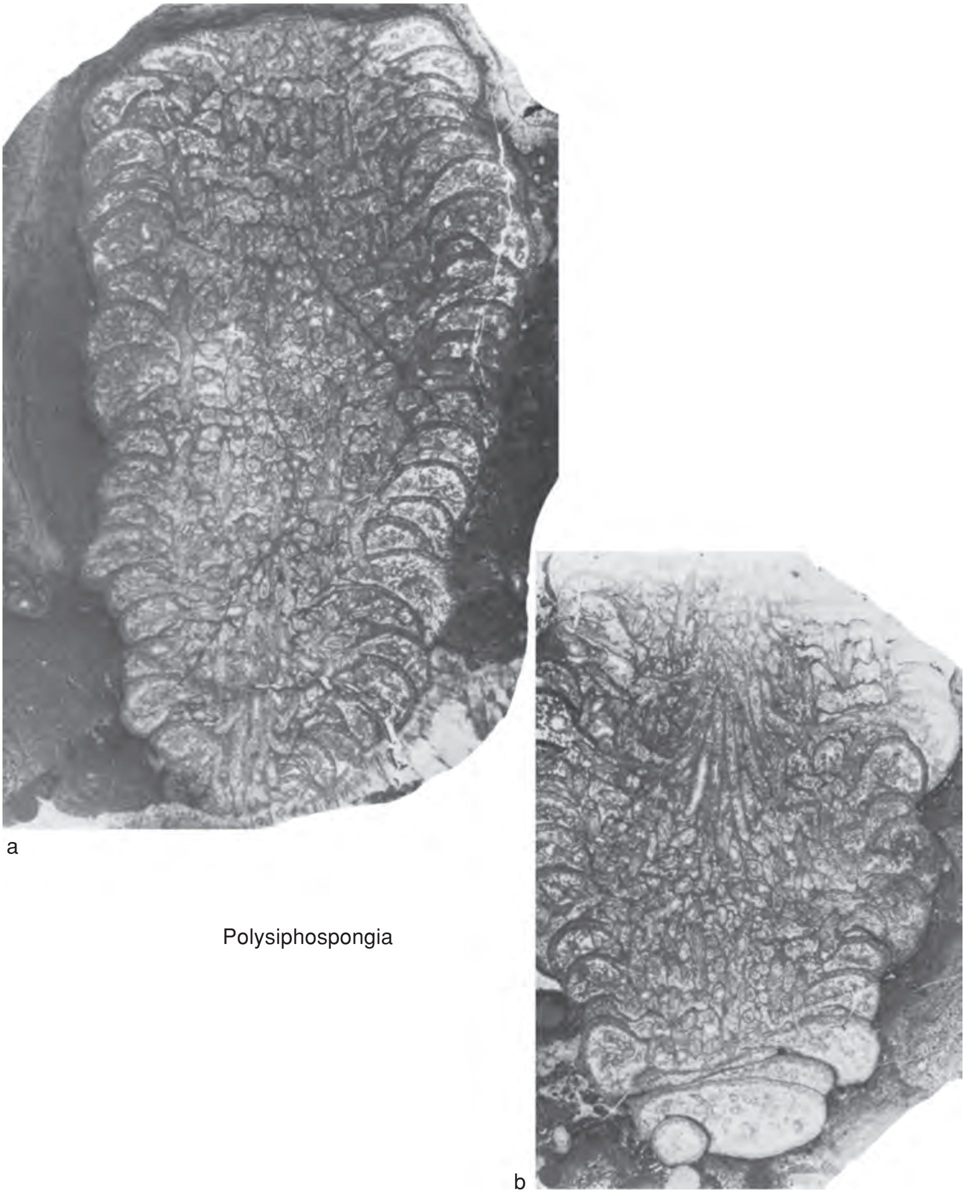

FIG. 481. Verticillitidae (p. 724).

Mina, Mineral County, Nevada; *a,* section normal to plate showing cross sections of stacked, arcuate chambers with porous walls, ×1; *b,* section cut parallel to plate showing long, tubular chambers, SPIT, collections of A. Seilacher, ×1 (Senowbari-Daryan, 1990; courtesy of *Münchner Geowissenschaftliche Abhandlungen,* Verlag Dr. Friedrich Feil).

Subfamily POLYSIPHOSPONGIINAE Senowbari-Daryan, 1990

[Polysiphospongiinae SENOWBARI-DARYAN, 1990, p. 88]

Polytholosiids with glomerate arrangement of chambers or segments and with

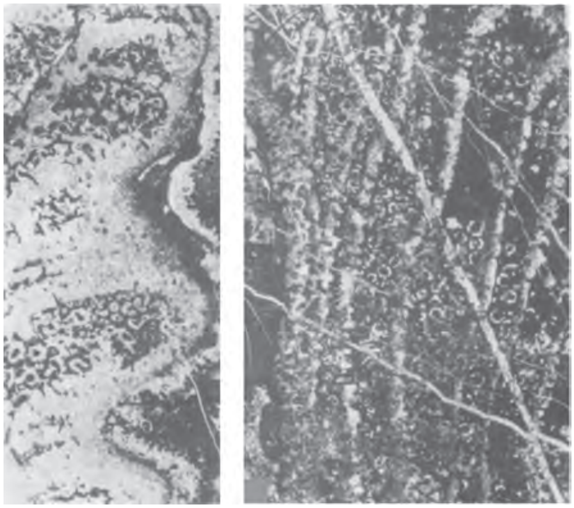

FIG. 482. Uncertain (p. 724).

through-going spongocoel. *Triassic (Norian–Rhaetian).*

Polysiphospongia SENOWBARI-DARYAN & SCHÄFER, 1986, p. 249 [**P. fluegeli;* OD]. Sphinctozoans with glomerate arrangement of chambers and tubular filling structure; central canal bundle consisting of multiple, separate canals; canal structure pro- to retrosiphonate. *Triassic (Norian–Rhaetian):* Italy (Sicily).——FIG. 481*a–b.* **P. fluegeli,* Reef limestone, Norian, Palermo; *a,* longitudinal section of holotype showing prominent, glomerate chambers along margin and irregularly canaled interior lateral to axial cluster of exhalant canals, SPIE P/126/1, ×1.5; *b,* parallel section of holotype that intersects axial cluster of exhalant canals in upper part, and low chambers in lower part, SPIE P/126/2, ×1.5 (Senowbari-Daryan & Schäfer, 1986).

Family UNCERTAIN

Platysphaerocoelia BOIKO in BOIKO, BELYAEVA, & ZHURAVLEVA, 1991, p. 158 [**P. aksuensis;* OD]. Massive colonies composed of flat and wide chambers; chamber interiors containing empty, spherical, skeletal elements of various sizes; chamber exowalls thicker than interwalls and with numerous uniform pores. [Genus somewhat similar to *Intrasporocoelia* and *Rhabdactinia* but with massive growth form and in having spherical, skeletal elements forming walls and as filling structures.] *Triassic (Norian–Rhaetian):* Russia (Tajikistan and Pamir regions). ——FIG. 482*a–b.* **P. aksuensis,* Triassic limestone, Tajikistan; *a,* tangential section showing chamber dimensions and abundant, isolated, hollow, spherical filling structures; *b,* subvertical section showing broad chambers with numerous hollow filling structures, ×2 (Boiko, Belyaeva, & Zhuravleva, 1991).

Subclass TETRACTINOMORPHA Lévi, 1953

[*nom. correct.* BERGQUIST, 1967, p. 166, *pro* subclass Tétractinomorphes LÉVI, 1953, p. 855]

Generally radiate architecture with ectosomal crust of microscleres; triaenes present in some but not all groups; microscleres asters or sigmaspires; basal skeleton, when present, almost always calcite. *Ordovician–Holocene.*

Order HADROMERIDA Topsent, 1898

[*nom. correct.* DE LAUBENFELS, 1955, p. 39, *pro* suborder Hadromerina TOPSENT, 1898, p. 93]

Megascleres exclusively tylostyles and other stylote spicules; microscleres (when present) various forms of euasters, spirasters, and microrhabds; architecture radiate with ectosomal crust of microscleres when present; basal skeleton, when present, magnesian calcite, of either lamellar, homogeneous-granular, or penicillate microstructures. [The living *Merlia* KIRKPATRICK, 1908, has been placed in a separate but related order Merliida by VACELET (1979) although others (e.g. HARTMAN & GOREAU, 1970) have placed it in the order Poecilosclerida. The Carboniferous and later *Chaetetes* FISCHER DE WALDHEIM, 1830 in 1830–1837, with its relatives, also may either belong here or with the Poecilosclerida. Both groups have basal skeletons of penicillate calcite unlike other hypercalcified hadromerids.] *Permian–Triassic.*

Family CELYPHIIDAE de Laubenfels, 1955

[Celyphiidae DE LAUBENFELS, 1955, p. 102; *emend.,* FINKS & RIGBY, herein] [=Celyphiidae DE LAUBENFELS, 1955, p. 102, *partim;* Annaecoeliidae SENOWBARI-DARYAN, 1978, p. 206, *partim;* Pisothalamiidae SENOWBARI-DARYAN & RIGBY, 1988, p. 203; Alpinothalamiidae SENOWBARI-DARYAN, 1990, p. 137]

Sphinctozoan morphology with hemispheroidal or spheroidal chambers, either glomerate-encrusting or cateniform; filling tissue often of branching tubes; wall structure lamellar; microstructure of microgranular magnesian calcite in those genera that have been investigated; spicules found in some genera include euaster and spiraster microscleres and various monaxon megascleres but not styles. Assignment to order based on mineralogy, microstructure, and microscleres. *Permian (Guadalupian)–Triassic.*

Celyphia POMEL, 1872, p. 229 [**Manon submarginatum* MÜNSTER, 1841, p. 27; OD]. Earlier chambers smaller than later ones; spheroidal to hemispheroidal chambers encrusting shells or one another to form irregular clusters; exowall imperforate except for large, circular exopores (or oscules) with strong lips or short exauli; interior of chamber containing branched tubules that diverge interiorly from each exopore and open into chamber lumen; still finer trabecular tissue and vesicles have been mentioned and illustrated by various authors, but unclear whether latter specimens are conspecific (or congeneric) with type; exowall structure reported as laminar. [This genus bears some resemblance to protocysts of the agelasid *Girtyocoelia* COSSMAN, 1909, which are similarly adnate and without the cloaca of the adults. *Celyphia,* however, is not spherulitic, and has the wall structure of other members of this family, which are more clearly hadromerids. It is possible *Celyphia* is a juvenile stage of some other genus or else a paedomorphic adult. Branching tubules under each exopore could be analogues of the cribribullae of *Girtyocoelia,* or they could be exhalant systems as in *Pisothalamia* (or some one and some the other).] *Permian (Wordian)–Cretaceous (Cenomanian):* Russia, China, *Wordian–Capitanian;* Italy, Austria, Hungary, Tajikistan (Pamir region), Turkey, Yugoslavia, *Lower Triassic–Upper Triassic;* ?Germany, *Cenomanian.*

Alpinothalamia SENOWBARI-DARYAN, 1990, p. 137 [**Cystothalamia bavarica* OTT, 1967a, p. 36; OD]. Gross porate to aporate stems composed of glomerate chambers that are in two or more layered positions (polyglomerate), with one or more axially located canal clusters that have a retrosiphonate structure; filling structures absent, but with vesiculae; skeleton of high magnesium calcite with a homogenous, granular microstructure. *Middle Triassic–Upper Triassic:* Italy, Austria, Yugoslavia, Hungary, Greece, Turkey, Oman, Russia.——FIG. 483,*1a–b.* **A. bavarica* (OTT), Wettersteinkalk, Middle Triassic, Karwendel-Gebirges, Austria; *a,* holotype with coarsely porous, axial spongocoel and polyglomerate chambers, BSPGM 1967 II 9, ×2; *b,* section of counterpart of holotype with multiple, largely imperforate chambers around axial spongocoel and common vesiculae, BSPGM 1331 a/67, ×3.5 (Ott, 1967a; courtesy of *Neues Jahrbuch für Geologie und Paläontologie, Monatshefte*).

Cassianothalamia REITNER, 1987a, p. 573 [**C. zardinii;* OD]. Conical, occasionally branching, with hemispherical, upper surface; narrow, central cloaca appearing in later ontogenetic stages; chambers low, formed by overlapping, hemispherical interwalls connected by numerous vertical pillars that are cylindrical to submeandroid in cross section; neither endowall nor exowall well defined; interpores small, circular, and closely spaced; thin, vertical vesicles connecting pillars occur in earlier, abandoned parts of skeleton; rare spicules found imbedded in skeleton, namely, spiraster and sterraster microscleres and monaxon megascleres; skeleton itself of homogeneous-granular magnesian calcite, found also in *Jablonskya, Uvanella,* and *Zardinia* (MASTANDREA & RUSSO, 1995, p. 423). *Triassic (Carnian):* Austria, Italy, Turkey.——FIG. 484,*3a–d.* **C. zardinii,* Cassian Formation, Seeland-Alpe, Dolomite Alps, Italy; *a,* side view of holotype showing globular form and common, inhalant ostia, ×2; *b,* view from above showing osculum of shallow spongocoel and uniform, inhalant ostia, MCCA, ×2; *c,* longitudinal section of paratype showing spongocoel cavity and skeletal structure, PIFUB 87/2, ×4; *d,* transverse section of paratype showing concentric interwalls and radiating pillars around small spongocoel, PIFUB 87/1, ×1 (Reitner, 1987a; courtesy of *Geobios*).

Jablonskyia SENOWBARI-DARYAN, 1990, p. 140 [**Colospongia andrusovi* JABLONSKY, 1975, p. 267; OD]. Catenulate sponge built of hemispheroidal to barrel-shaped chambers without cloaca or endowall; numerous exopores or interpores; chamber interior filled with vesicles in earlier chambers; wall microstructure microgranular magnesian calcite; spicules originally described considered to be pseudospicules by SENOWBARI-DARYAN (1990, p. 140). *Triassic (Carnian–Norian):* Austria, Italy, Yugoslavia, Romania, Greece, Turkey.——FIG. 485,*2a–b.*

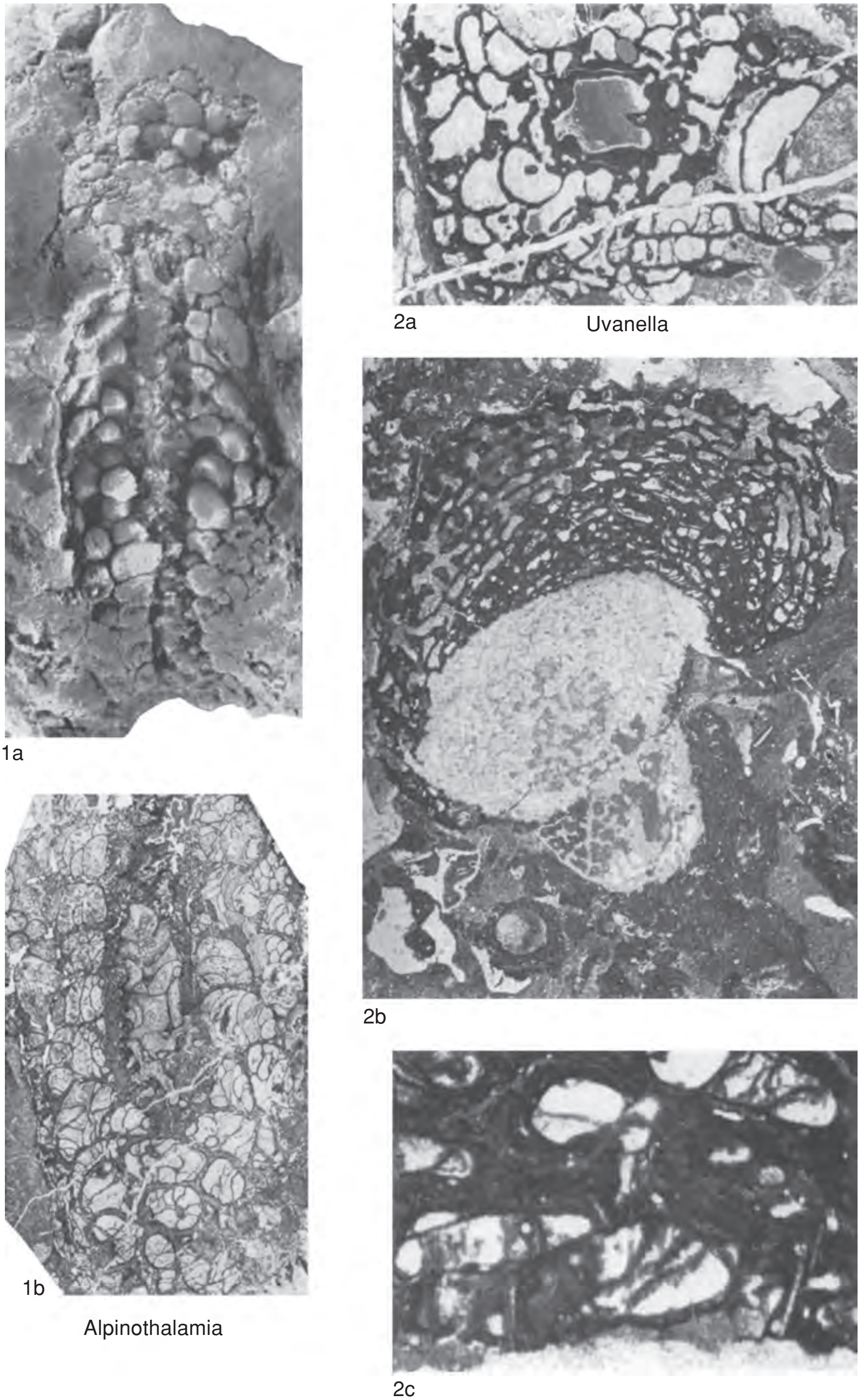

FIG. 483. Celyphiidae (p. 725–732).

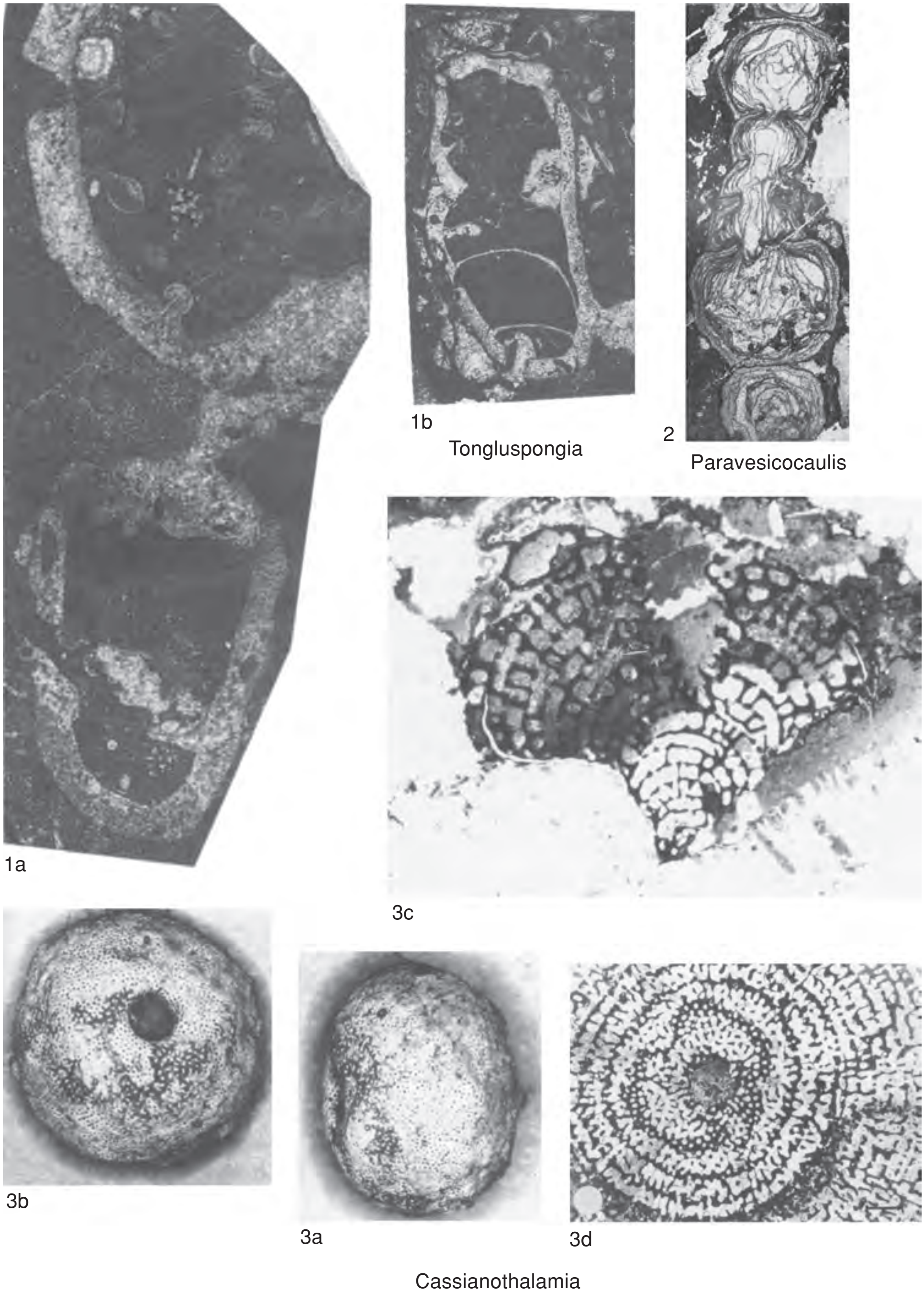

FIG. 484. Celyphiidae (p. 725–732).

**J. andrusovi* (Jablonsky), San Cassiano Formation, Carnian, Norian, Dolomite Alps, Austria; *a,* longitudinal section with porous walls to hemispheroidal chambers and with vesiculae in early chambers, but absent in later ones, SPIE D/69/9/4, ×4; *b,* transverse sections of two specimens showing light, pore fillings in dark, chamber walls, with vesiculae in chamber interiors, SPIE H/52, ×4 (Senowbari-Daryan, 1990; courtesy of *Münchner Geowissenschaftliche Abhandlungen,* Verlag Dr. Friedrich Feil).

Leinia Senowbari-Daryan, 1990, p. 144 [**L. schneeburgensis;* OD]. Porate, cylindrical sponge made of very low and shield-shaped chambers or segments; spongocoel retrosiphonate, extending through sponge; chambers hollow, without vesiculae; basal skeleton composed of high magnesium calcite with granular microstructure; spicules unknown. *Triassic (Carnian):* Austria, Greece (Hydra).——Fig. 486,*1a–b.* **L. schneeburgensis,* Upper Triassic limestone, Carnian, Hochschwab, Austria; *a,* longitudinal thin section, holotype, with low, shield-shaped chambers and retrosiphonate spongocoel, chambers walls porous, SPIE 29E26/2, ×1.5; *b,* oblique section of reference specimen with broad spongocoel and with porous chamber walls, SPIE E23/1, ×1.5 (Senowbari-Daryan, 1990; courtesy of *Münchner Geowissenschaftliche Abhandlungen,* Verlag Dr. Friedrich Feil).

Loczia Vinassa De Regny, 1901, p. 16 [**L. cryptocoelioides;* OD]. Conicocylindrical; coated with dermal layer bearing widely and irregularly spaced, small pores; no osculum on rounded, upper surface, which also bears dermal layer; interior with closely spaced, horizontal, skeletal elements connected by less continuous, vertical ones, suggesting latilaminae and pillars of a stromatoporoid, with central area in which vertical elements are more continuous; trabecular microstructure showing curvilinear elements parallel to course of skeletal elements, here interpreted as a laminar wall structure. *Triassic:* Hungary, Austria.——Fig. 487,*2a–b.* **L. cryptocoelioides,* Upper Triassic, Veszprém, Jeruzsálemhegy, Bakony, Austria, *a,* side view of typical specimen showing general growth form, ×1; *b,* enlarged vertical section of interior showing horizontal fibers and less continuous, vertical, pillarlike fibers, approximately ×3 (Vinassa de Regny, 1901).

Montanaroa Russo, 1981, p. 12 [**M. dolomitica;* OD]. Spheroidal, cateniform, summit opening a circular, cribrate plate surrounded by low rim; same structure serving as interpores between chambers; remainder of exowall imperforate except for rare, lipped ostia; no internal structures except for occasional, thin vesicles lining inner surface of exowall; exowall layered with irregular microstructure. [The layered wall and summit cribrate plate as in *Pisothalamia* are the principal reasons for placing this genus in the family.] *Triassic (Carnian):* Italy.——Fig. 487,*3a–d.* **M. dolomitica,* San Cassiano Formation, Cortina d'Ampezzo, Dolomite Alps; *a,* side view of chambered holotype, ×9; *b,* view of summit of holotype with cribrate osculum, IPUM 19295, ×9; *c,* longitudinal section showing chambered growth and cribrate oscula, ×8; *d,* microstructure of irregular type in layered wall, IPUM 19298, ×150 (Russo, 1981).

Pamirocoelia Boiko in Boiko, Belyaeva, & Zhuravleva, 1991, p. 133 [**P. sphaerica;* OD]. Chambers spherical to conical and forming glomerate colonies without central spongocoel or axial canal; distal part of chambers with up to four ostia covered with very thin, perforate membrane; chamber walls solid and imperforate.[Differs from related sponges in having the distinct, fine, porous membrane over the distal ostia in the imperforate wall and in absence of an axial exhalant structure.] *Triassic (Norian–Rhaetian):* Tajikistan.——Fig. 487,*1a–c.* **P. sphaerica,* Triassic limestone, southeastern Pamir, River Karauldandaly; *a,* cluster of spheroidal chambers with coarse, inhalant ostia in thick walls, MIGT 191-x-1,116/4, ×3; *b,* transverse section with distinctive inhalant canals in pore fields and possible small, central, exhalant canal in center, MIGT 191-x-1, 116/4, ×10; *c,* photomicrograph of section through pore field in lower left of *b,* with screen over ostia shown only as aligned, dotlike sections of elements, MIGT 191-x-1, 116/4, ×25 (Boiko, Belyaeva, & Zhuravleva, 1991).

Paravesicocaulis Kovács, 1978, p. 689 [**P. concentricus;* OD]. Spheroidal segments forming chain; exowall pierced by very small, closely spaced exopores (150 to 200 μm); endowall apparently absent, but vesicles subparallel with exowall filling chambers and outlining discontinuous, central, tubular space corresponding to cloaca; more widely spaced vesicles, some horizontal, may occur in this space; interwall merely two exowalls in contact, pierced by central opening width of cloaca, which corresponds to terminal osculum; wall said to be nonspherulitic and composed of several layers; no spicules known. *Triassic (Ladinian–Rhaetian):* Austria, Hungary, Yugoslavia, *Ladinian–Carnian;* Italy (Sicily), Greece, Iran, Tajikistan, *Norian–Rhaetian.*——Fig. 484,*2.* **P. concentricus,* Wetterstein reef limestone, Ladinian–middle Carnian, Tornanádaska, northern Hungary; longitudinal section of holotype of spheroidal chambers with vesicles that outline central, tubular space equivalent to spongocoel in some, and with interwalls as double exowalls, MHGI T-430/A, ×5 (Kovács, 1978; courtesy of *Neues Jahrbuch für Geologie und Paläontologie, Monatshefte*).

Pisothalamia Senowbari-Daryan & Rigby, 1988, p. 206 [**P. spiculata;* OD]. Spheroidal segments; central, circular oscule one-fifth sponge diameter or less, in a depression of exowall that bulges downwardly to form spheroidal, cribribulla-like structure bearing small, closely spaced interpores; exowall bearing numerous, scattered, large, circular exopores, each of which bears internal cribribulla; very small exopores between them connect with branching tubes within exowall; chambers lined with lamellar, secondary tissue that also invests partly fused, oolith-like bodies that fill lower parts of chamber; comparable lamellar tissue fills oscular cribribulla, lamellae run upwardly and inwardly to

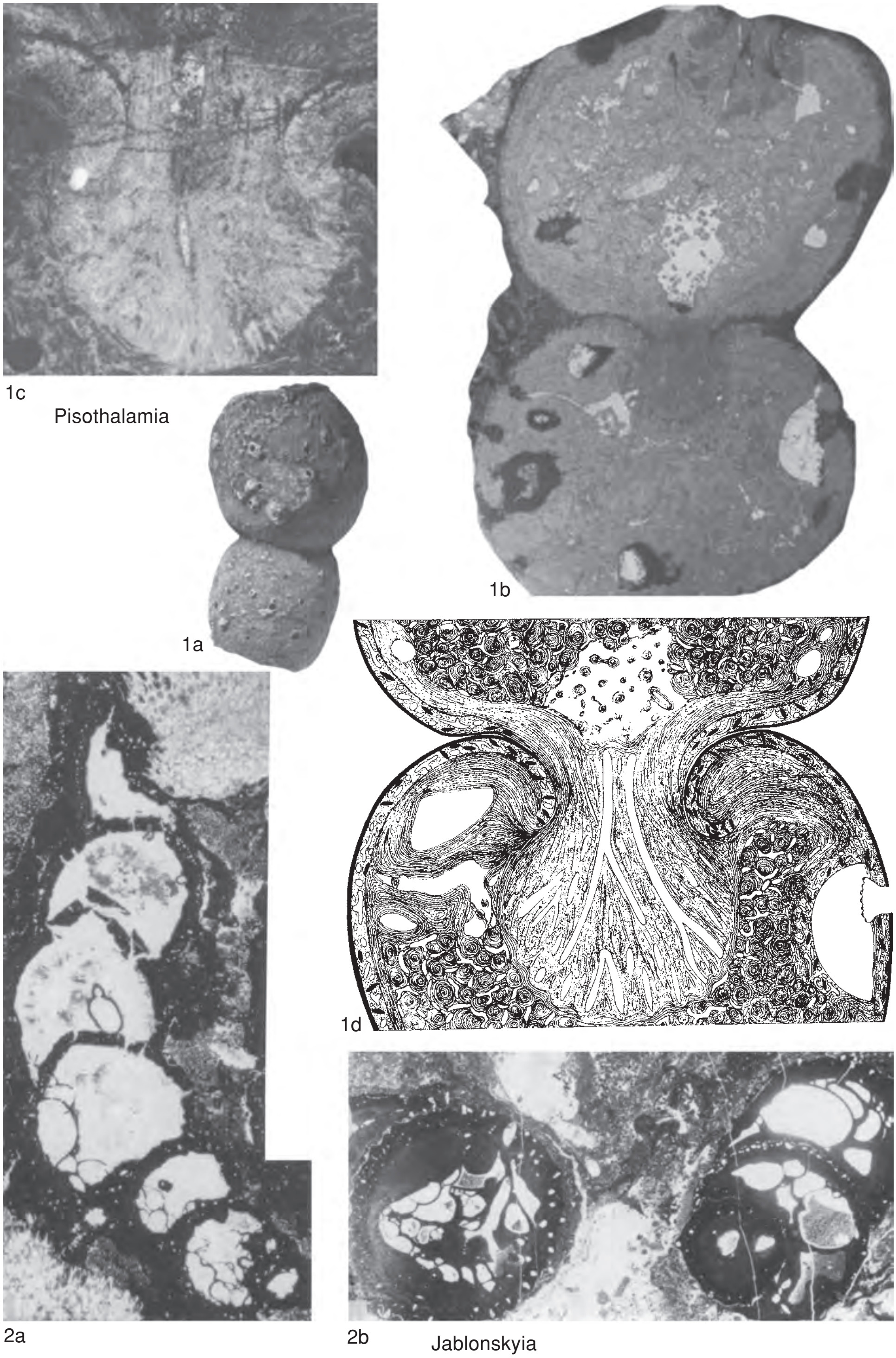

FIG. 485. Celyphiidae (p. 725–732).

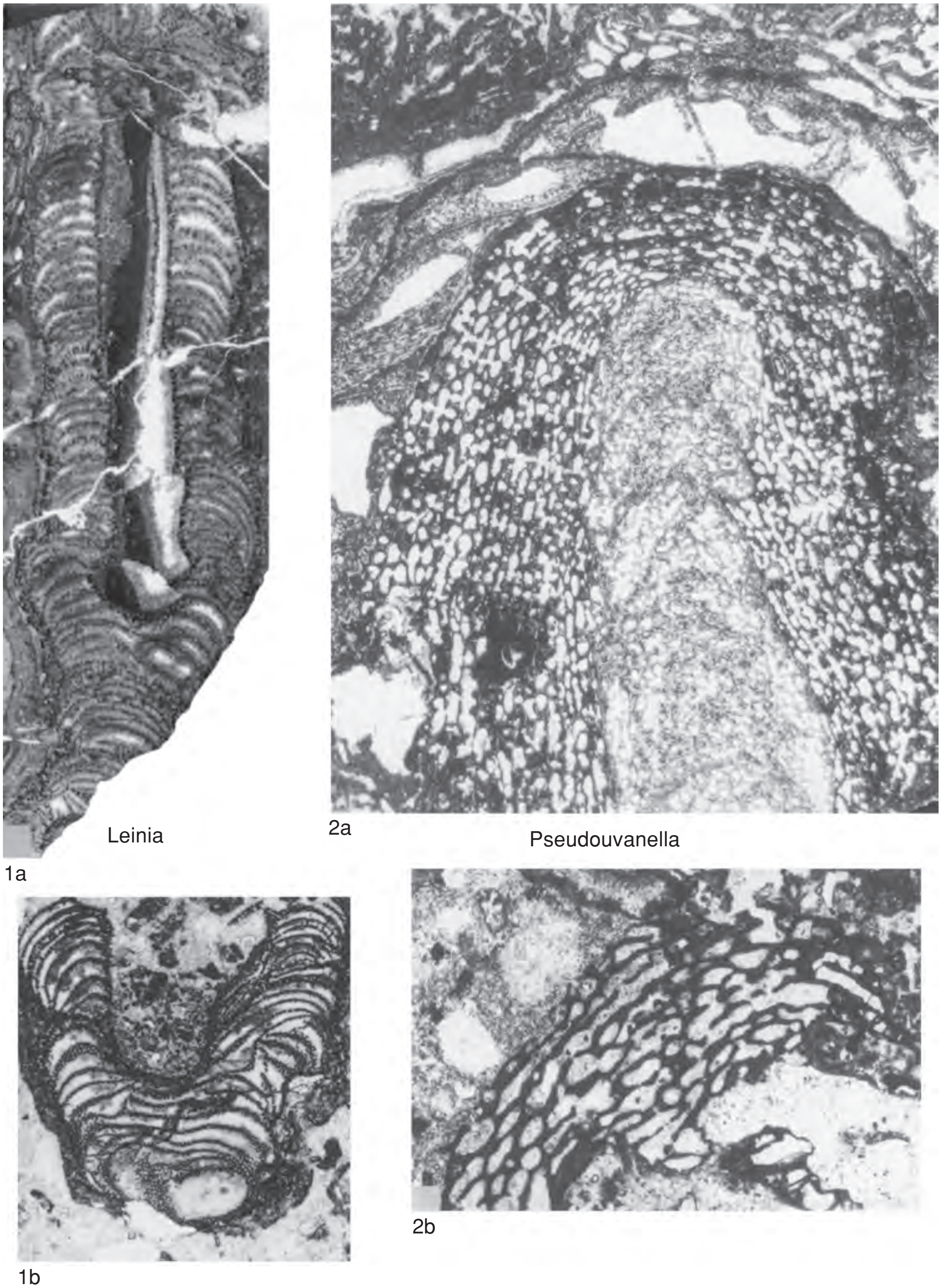

FIG. 486. Celyphiidae (p. 728–732).

outline subparallel, dendritic canals that arise at interpores and converge upwardly; imbedded in exowall are thin, curved, oxea or strongyle-like bodies (presumably limonite after pyritized opal) that are irregularly arranged, but more concentrated near oscule, and occasionally occur in lamellar tissue, especially near cribribullae. [Apart from the spicules and the ooids, the latter of which also occur in the agelasid *Intrasporeocoelia* FAN & ZHANG, 1985, the structure of this sponge resembles the

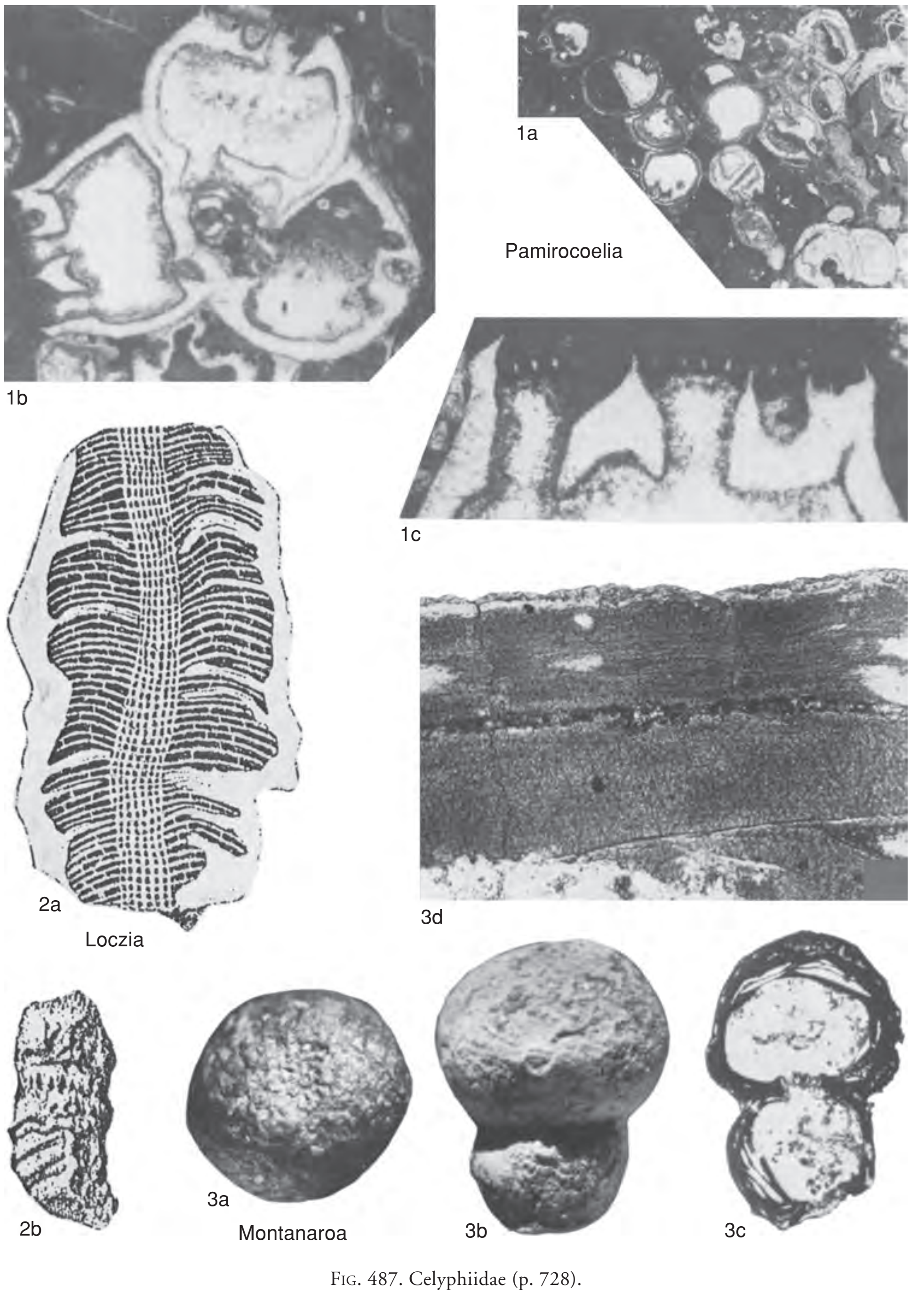

FIG. 487. Celyphiidae (p. 728).

thaumastocoeliids, but even more *Montanaroa* RUSSO, 1981, which has an oscular cribribulla. The lamellar tissue and ooids may be secondary deposits formed as the sponge tissue withdrew from the chamber, and correspond to vesicles of other sphinctozoans, but are here interpreted as homologues of the branching tubes present in *Celyphia* and other members of the family.] *Permian (Lopingian):* Tunisia.——FIG. 485,*1a–d*. **P. spiculata,* Djebel Tebaga Biohermal Complex, Changhsingian, Djebel Tebaga; *a,* small paratype with several rimmed ostia in each chamber, USNM 427421, ×2; *b,* longitudinal section of holotype with saclike structures in oscular areas in each of two chambers, ×2; *c,* peel of structure between chambers showing canal details and laminate structure, ×5; *d,* drawing of oscular system between chambers showing complex canal pattern and laminate structure, as well as dark, rodlike spicules in exowalls and interwalls and pisoid filling structures within chambers, not to scale (Senowbari-Daryan & Rigby, 1988; courtesy of *Facies*).

Pseudouvanella SENOWBARI-DARYAN, 1994a, p. 422 [**P. parallela;* OD]. Aporate and incrusting sponges composed of numerous oblong segments, whose long axis developed perpendicular to growth direction; segment walls not straight but bent undulatory or wavy; in various places upper or younger wall of chamber bends backwardly or downwardly to form column with broad base; locally merger of chamber walls produces walls double thickness of regular segment walls; pillars similar to those of stromatoporoids or stylothalamiids, very numerous; vesiculae may be developed locally in some chambers; spicules unknown. [Placement in the family is uncertain, but the genus appears similar to *Uvanella* and it is tentatively included here.] *Triassic (Norian):* Turkey.——FIG. 486,*2a–b.* **P. parallela,* Cipit limestone, lower Norian, Taurus Mountains, southern Turkey; *a,* holotype with relatively thick walls of oblong segments, encrusting inozoan sponge and, in turn, encrusted by sponge with lenticular structure, SPIE "Trias Türkei" 19 F29/2, ×4; *b,* section of irregular, older, interconnected segments of reference specimen, SPIE "Trias Türkei" 19 G102/4, ×10 (Senowbari-Daryan, 1994b).

Tongluspongia BELYAEVA, 2000, p. 42 [156] [**T. yangae;* OD]. Sponge with large, irregularly shaped, noncatenulate chambers that are irregularly joined with or without tubes; chamber walls with outer, granoblastic layer and inner, faintly recrystallized layer with spherulitic relicts; walls massive, imperforate but pierced by large, isolated, solitary ostia that may have rims or extend short distances above walls; walls may contain a few monaxial spicules; vesiculae or outgrowths of skeletal material from walls may occur in chamber interiors. *upper Permian (Wuchiapingian):* China (Zhejiang Province).——FIG. 484,*1a–b.* **T. yangae,* Maokou Formation, Maokouan, Tonglu; *a,* holotype, diagonal, longitudinal section of large, irregular, thick-walled chambers, with coarse, thick, outer layer and thinner, finer textured, inner layer, both pierced by coarse ostia, FEGI no. 165-MB, no. 14(2), ×5; *b,* longitudinal section with arched vesiculae in lower part of chamber, and coarse-textured, thick chamber walls, FEGI no. 14(4), ×2 (Belyaeva, 2000).

Uvanella OTT, 1967a, p. 38 [**U. irregularis;* OD]. Hemispheroidal, encrusting masses of more or less concentrically layered, blisterlike chambers or irregular, interconnecting spaces between latilaminalike and pillarlike structures reminiscent of stromatoporoids; chambers intercommunicate through small, irregular pores in their walls; chambers of earlier, abandoned parts of skeleton filled with thin-walled vesicles crossing narrow, vertical dimension of chamber; wall microstructure irregularly laminar of homogeneous-granular magnesian calcite (MASTANDREA & RUSSO, 1995, p. 423); one specimen contains vertically oriented oxeas in its basal part, the spicules crossing chamber lumens and walls alike. [It is possible that these spicules belong to the underlying inozoan sponge on which the *Uvanella* is growing.] *middle Permian–Triassic (Rhaetian):* China (Guangxi), *middle Permian–upper Permian;* Europe, Alpine-Mediterranean area, *Ladinian–Carnian*; Italy (Sicily), Greece, Iran, Oman, Tajikistan, ?Canada (Yukon), *Norian–Rhaetian.*——FIG. 483,*2a–c.* **U. irregularis,* Wettersteinkalk, Norian, Jovenspitze, Austria; *a,* holotype, tangential section showing irregular chambers and distinct pores in walls, BSPGM 1340 a/67, ×5; *b,* longitudinal section of reference specimen encrusting an inozoan, showing layered, blisterlike chambers and vesiculae in early chambers, BSPGM G 411 a/67, ×5; *c,* photomicrograph of walls of basal chambers with monaxon spicules, which may be from encrusted sponge below, BSPGM 1340 a/67, ×40 (Ott, 1967a; courtesy of *Neues Jahrbuch für Geologie und Paläontologie, Monatshefte*).

Family CEOTINELLIDAE Senowbari-Daryan, 1978

[Ceotinellidae SENOWBARI-DARYAN in FLUGEL, LEIN, & SENOWBARI-DARYAN, 1978, p. 165]

Aporate sponges with a reticular-tubular filling structure (in *Ceotinella* tubes developed exclusively in periphery); other segmentation hardly recognizable; basal skeleton composed of high magnesium calcite with granular and homogenous microstructure; spicular skeleton not known. *Triassic (Ladinian–Carnian).*

Ceotinella PANTIC, 1975, p. 154 [**C. mirunae;* OD]. Aporate, cylindrical to conicocylindrical sponges without, or with barely recognizable, outer segmentation, but interior segmented; segments separated in peripheral part of skeleton by radial, septal elements of erect, tubular-formed sections; reticular filling structures developed near spongocoel; through-going spongocoel ambisiphonate; skeletal microstructure granular. *Triassic (Ladinian–Carnian):* Yugoslavia, *Ladinian;* Austria, Yugoslavia, Greece (Hydra), Italy (Sicily), Turkey, Oman, *Carnian.*——FIG. 488,*4.* **C. mirunae,* Kleine Reef, Ladinian, Huda Juzna, Yugoslavia; transverse section with thick exowall and axial spongocoel, peripheral tubular-formed sections, and inner, reticulate filling structures, SPIE H/36/2, ×10 (Senowbari-Daryan, 1990; courtesy of *Münchner Geowissenschaftliche Abhandlungen,* Verlag Dr. Friedrich Feil).

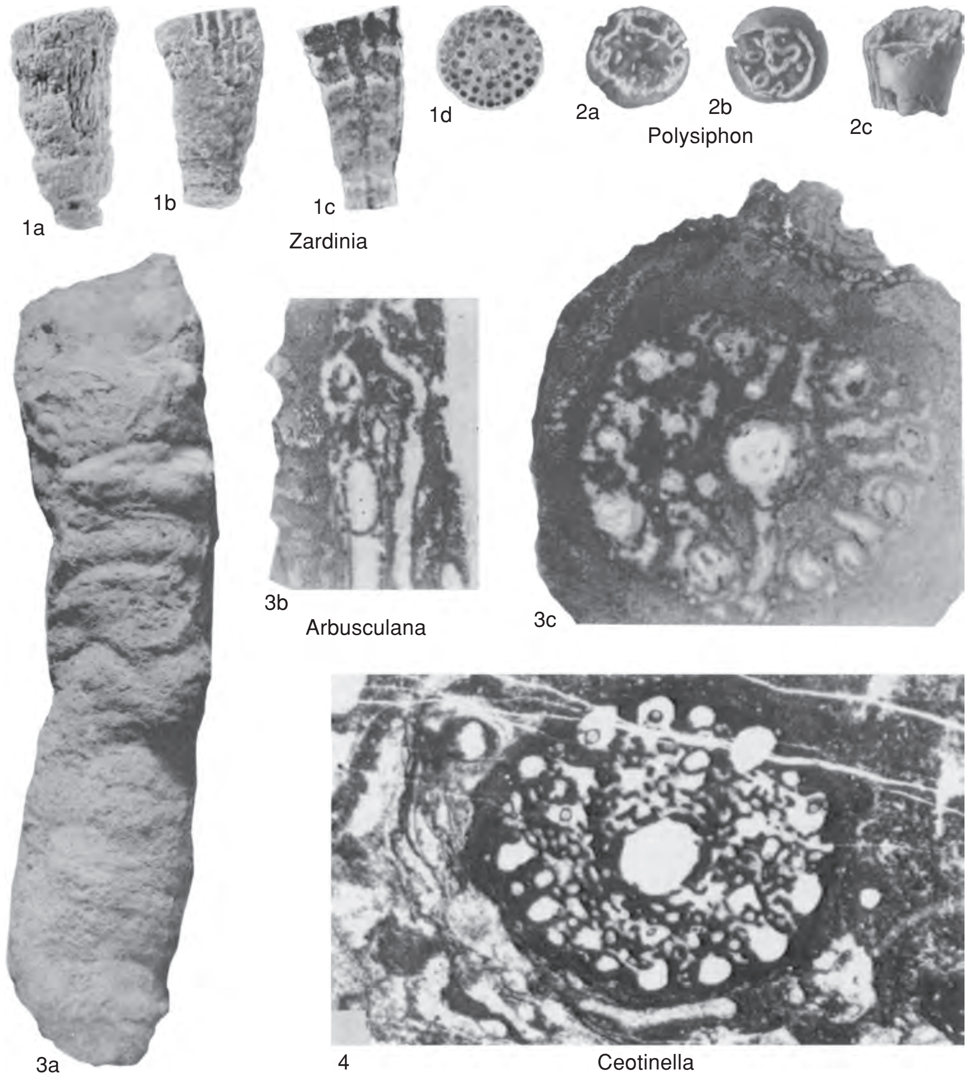

FIG. 488. Ceotinellidae and Polysiphonidae (p. 732–734).

Family POLYSIPHONIDAE Girty, 1909

[Polysiphonidae GIRTY, 1909, p. 86]

Cylindroid; narrow, central cloaca surrounded by ring of longitudinal canals, connected to cloaca by horizontal, radial canals; interwalls may be absent and external segmentation variably developed; fine, trabecular net may fill rest of chamber, but not in poorly preserved type genus; microstructure homogeneous-granular magnesian calcite in *Zardinia* but not known in other genera, which are assigned here on basis of resemblance to *Zardinia* in gross morphology. *Permian–Triassic.*

Polysiphon GIRTY, 1909, p. 87 [**P. mirabile;* OD]. Conical fragments; imperforate exowall; discontinuous, narrow, central cloaca defined by imperforate endowall from which imperforate tubes branch upwardly and outwardly to end tangent to inner side of exowall, forming peripheral ring of tubes; intervening interior space empty as preserved. [Type material too fragmentary to characterize but resembles *Arbuscula* PARONA, 1933, and *Zardinia* DIECI, ANTONACCI, & ZARDINI, 1968.] *Permian (Guadalupian):* USA (Texas).——FIG. 488,*2a–c.* **P. mirabile,* Bell Canyon Formation, Guadalupe

Mountains; *a,* silicified holotype from above; *b,* holotype from below; *c,* side view of holotype, ×3 (Girty, 1909).

?Arbusculana FINKS & RIGBY, herein, *nom. nov. pro Arbuscula* PARONA, 1933, p. 22, *non* BOLIVAR, 1855 [**Arbuscula contortiplicata* PARONA, 1933, p. 22; OD]. Cylindrical, with horizontal folds and grooves on surface; narrow, central cloaca; external pores fine, intertrabecular spaces; interior with fine, trabecular net that forms anastomosing tubules; halfway between outer surface and cloacal surface is a ring of large, longitudinal tubes of circular cross section, about half diameter of cloaca; large, radial canals enter cloaca through large pores and also communicate with longitudinal tubes through short branches; no interwalls; exowall and endowall not clearly differentiated from trabecular net; trabecular microstructure unknown; no spicules known. *Permian:* Italy (Sicily), USA (?Texas).——FIG. 488,*3a–c.* **A. contortiplicata* (PARONA), Permian limestone, Palazzo di Adriano, Sosio, Sicily; *a,* side view of annulate, cylindrical sponge, ×1; *b,* longitudinal section with narrow spongocoel and somewhat smaller, subparallel, vertical canal, both as interruptions in trabecular, skeletal net, ×2; *c,* transverse section with axial spongocoel and ring of smaller, vertical tubes in outer part of sponge, in trabecular skeletal net, all part of syntype suite, ×2 (Parona, 1933).

Zardinia DIECI, ANTONACCI, & ZARDINI, 1968, p. 139 [**Z. perisulcata;* OD] [=*?Arbusculana* FINKS & RIGBY, herein, p. 734, *nom. nov. pro Arbuscula* PARONA, 1933, p. 22 (type, *A. contortiplicata,* OD), *non* BOLIVAR, 1855]. Conical, externally segmented; narrow, central cloaca surrounded by ring of smaller, longitudinal canals near periphery of sponge and sometimes an additional ring or rings nearer cloaca; exowall present, exopores possibly absent; endowall with large, circular endopores; endowall thicker immediately above and below interwalls (ambisiphonate); interwalls with large, circular interpores corresponding to longitudinal canals, latter otherwise unbounded other than by trabecular ends; remaining interior of chambers filled with fine, trabecular net that defines anastomosing tubules of circular cross section; trabecular microstructure of homogeneous-granular magnesian calcite (MASTANDREA & RUSSO, 1995, p. 423); no spicules known. [Genus differs from *Arbusculana* FINKS & RIGBY (herein, p. 734, *nom. nov. pro Arbuscula* PARONA, 1933), in the presence of exowall, endowall, and interwalls, together with the resulting segmentation. Inasmuch as the same range of structure is shown within *Fissispongia* KING, 1938, *Zardinia* could be considered a junior subjective synonym of *Arbusculana.*] *Triassic:* Italy, Austria, Hungary, Yugoslavia, Greece, Turkey, Oman.——FIG. 488,*1a–d.* **Z. perisulcata,* San Cassiano Formation, Norian, Dolomite Alps, Italy; *a,* side view of weakly annulate holotype with some vertical, exhalant canals visible in upper part where dermal layer has been eroded away, IPUM 17597, ×2.5; *b,* side view of paratype with dense, dermal layer, below, and parts of vertical, exhalant canals, above, IPUM 17598, ×2.5; *c,* longitudinal section of paratype showing chamber interwalls perforated by axial spongocoel and vertical, exhalant canals, IPUM 17599, ×2.5; *d,* transverse section at level of interwall with sections of central spongocoel and several vertical canals, IPUM 17600, ×2.5 (Dieci, Antonacci, & Zardini, 1968).

Class CALCAREA Bowerbank, 1864

[Calcarea BOWERBANK, 1864, p. 160] [=class Calcispongea DE BLAINVILLE, 1834, p. 494, *nom. transl. et correct.* DE LAUBENFELS, 1955, p. 95, *ex* order Calcispongiae DE BLAINVILLE, 1834, p. 494; Calcarosa HAECKEL, 1872b; Megamastictora SOLLAS, 1887, p. 421]

Spicules and aspicular basal skeleton, if present, of magnesian calcite secreted extracellularly. Spicules include triradiates (three rays in one plane) and derived forms. *Lower Cambrian–Holocene.*

Subclass CALCINEA Bidder, 1898

[Calcinea BIDDER, 1898, p. 73]

Choanocyte nucleus basal; larva a parenchymella (coeloblastula); spicules normally include equiangular and equiradiate triradiates. *Holocene.*

Order CLATHRINIDA Hartman, 1958

[Clathrinida HARTMAN, 1958a, p. 108]

Skeleton composed exclusively of separate spicules. This order includes families Clathrinidae MINCHIN, 1900, p. 110 (type genus, *Clathrina* GRAY, 1867, p. 557); Soleneiscidae BOROJEVIC & others, 2002, p. 1,144 (type genus, *Soleneiscus* BOROJEVIC & others, 2002, p. 1,144); Levinellidae BOROJEVIC & BOURY-ESNAULT, 1986, p. 444 (type genus, *Levinella* BOROJEVIC & BOURY-ESNAULT, 1986, p. 444); Leucaltidae DENDY & ROW, 1913, p. 736 (type genus, *Leucaltis* HAECKEL, 1872b, p. 142); Leucascidae DENDY, 1893, p. 71 (type genus, *Leucascus* DENDY, 1893, p. 72); Leucettidae BOROJEVIC, 1968, p. 207 (type genus, *Leucetta* HAECKEL, 1872b, p. 118). *Holocene.*

Order MURRAYONIDA Vacelet, 1981

[Murrayonida VACELET, 1981, p. 315]

Skeleton of overlapping calcite scales forming cortex, or trabecular, basal skeleton

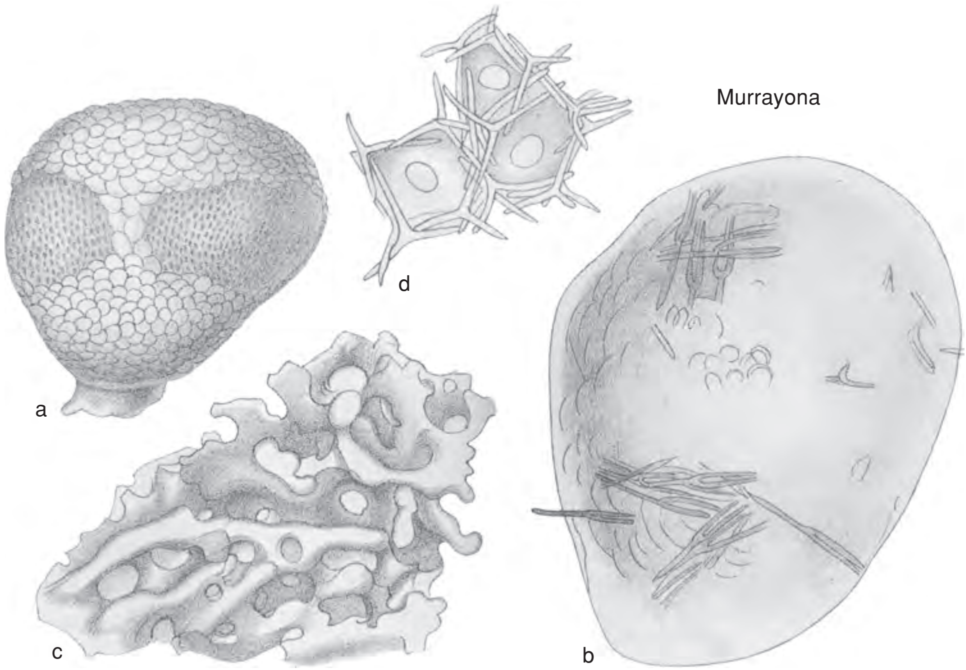

FIG. 489. Murrayonidae (p. 735).

of spherulitic to penicillate calcite, or bundles of spicules; tuning fork spicules usually present. *Holocene.*

Family MURRAYONIDAE Kirkpatrick, 1910

[*nom. transl.* DENDY & ROW, 1913, p. 741, *ex* Murrayoninae KIRKPATRICK, 1910a, p. 132]

Basal skeleton rigid, aspicular network of calcite; cortex mainly overlapping calcareous plates in oscular region and of small triactines in lower walls; choanosome includes free, diapason triactines. *Holocene.*

Murrayona KIRKPATRICK, 1910a, p. 127 [**M. phanolepis;* OD]. Spheroidal, stipitate; single, circular oscule at summit; remainder of surface covered by imperforate layer of overlapping but unfused, subcircular, planoconvex scales, except for equatorial groove bearing closely spaced, small, inhalant pores outlined by bundled triradiates; laminar forms also occur, with one side bearing scales and multiple oscules, other side similar to an equatorial groove; between scales and principal skeleton is thin layer of unfused triradiates, both equiangular and sagittal, as well as bundles of tuning-fork spicules; principal skeleton built of flattened, curved, anastomosing trabeculae outlining anastomosing, tubular spaces, which contain central canal lined by choanocyte chambers; scales of calcite and developed from triradiates with flattened, laterally expanded rays; trabeculae of principal skeleton calcitic and built solely of flaky spherulites, whose radiating fibrillae give trabecular surface a microhispid character; choanocyte nuclei basal, larva a blastule. [An endolithic alga (*Osterobium queketti* BORNET & FLAHAUT, *fide* VACELET, 1977a, p. 349) commonly penetrates both scales and trabeculae.] *Holocene:* Indo-Pacific.——FIG. 489*a–d.* **M. phanolepis,* Indian Ocean, Christmas Island; *a,* side view of small type specimen showing inner, fibrous, calcareous skeleton and outer layer of imbricate scales, ×5; *b,* inner surface of one scale with loosely adhering, tuning-fork spicules, ×100; *c,* broken surface of inner part of skeleton showing curving trabeculae, ×20; *d,* part of pore area with three pores and surrounding, triradiate spicules, ×125 (Kirkpatrick, 1910a; courtesy of the Royal Society, London).

Family PARAMURRAYONIDAE Vacelet, 1967

[Paramurrayonidae VACELET, 1967a, p. 49]

Choanosomal skeleton of bundles of diapason triactines without rigid structure; cortex with outer layer of aspicular, overlapping, calcareous plates and inner layer of free plates. *Holocene.*

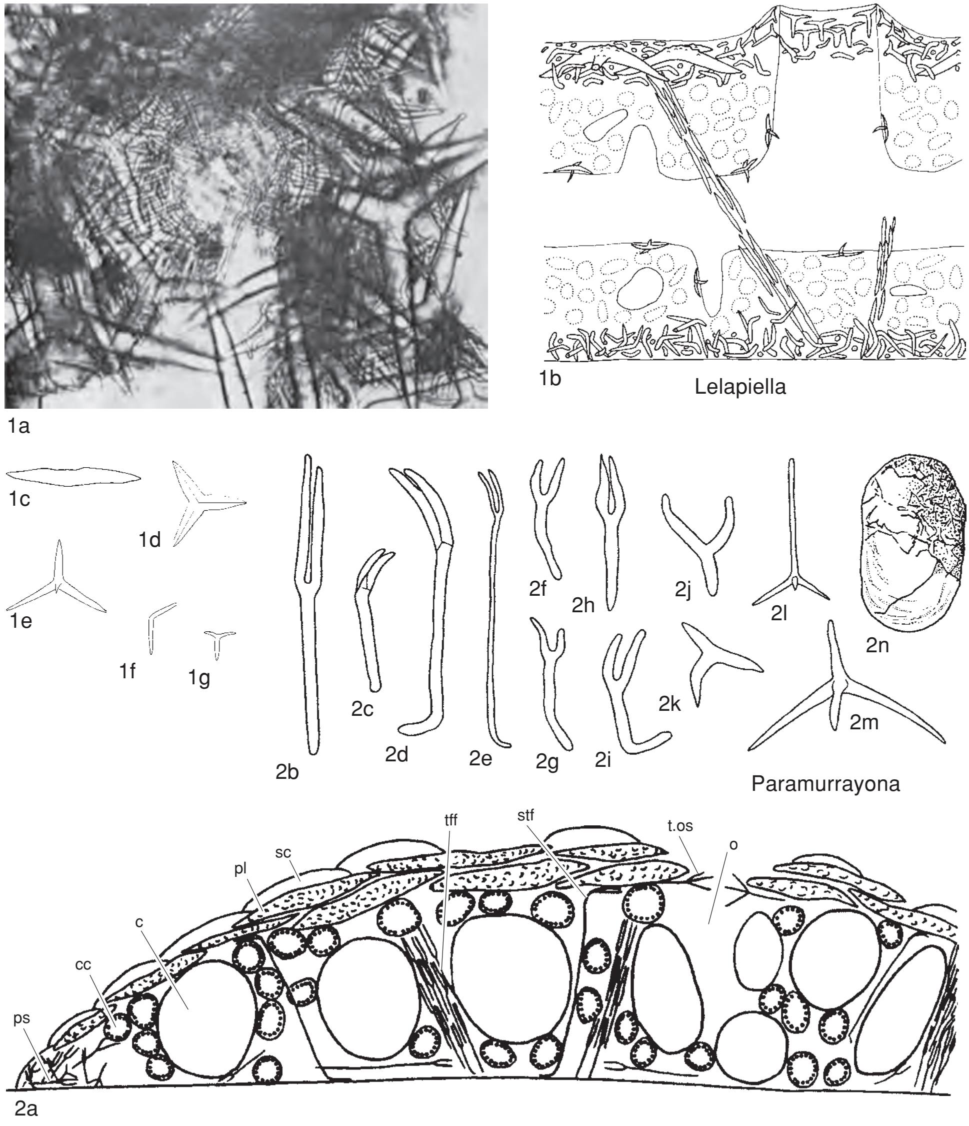

FIG. 490. Paramurrayonidae (p. 736–737).

Paramurrayona VACELET, 1967a, p. 49 [**P. corticata;* OD]. Encrusting, very small; surface covered with overlapping, oval scales, beneath which is denser layer of imbricated, irregular, rectangular flakes, apparently derived from scales; both types of body composed of radially fibrous calcite and surfaces mammellonated; no intermediates between flakes or scales and spicules; interior of sponge containing vertical bundles of tuning-fork spicules; central oscule penetrating layers of flakes and scales and surrounded by ring of quadriradiates with paired rays tangent to oscule and fourth ray pointing obliquely upward to oscular center; peripheral areas of sponge with free sagittal and equiangular quadriradiates and triradiates; choanocyte nuclei basal; larva possibly a parenchymella; scales and flakes penetrated by an endolithic fungus. *Holocene:* Madagascar, Malagasy.——FIG. 490,*2a–n*. **P. corticata,* Grand Récif de Tuléar, Madagascar; *a,* schematic drawing through encrusting sponge showing canals, *c;* choanocyte chambers, *cc;* supporting tuning-fork spicules, *stf;* surface scales, *sc;* fibers of tuning-fork spicules, *tff;* oscula, *o;* calcareous plates, *pl;* peripheral spicules, *ps;* tetractines of oscula, *t.os; b–i,* spicules including tuning fork spicules of several types, ×200 (*b–d, f–i*), ×100 (*d–e*); *j–k,* triactines, ×200; *l–n,* tetractine, periosculator tetractine, scale, ×100 (Vacelet, 1967a).

Lelapiella VACELET, 1977a, p. 358 [**L. incrustans;* OD]. Encrusting, very small; one, rarely two, oscules with rim; inhalant pores scattered over surface; cortical layer of large, anapodal, equiangular triradiates with papillose, upper surface, together with smaller diactines bent at 120°; latter also forming dense, basal layer; two layers connected by oblique bundles of straight, parallel diactines; oscule surrounded by paired rays of sagittal triradiates and internal canals by equiangular quadriradiates whose fourth ray is directed toward lumen; choanocyte nucleus questionably basal; larva not known. *Holocene:* Indo-Pacific.——FIG. 490,*1a–g.* **L. incrustans,* Grand Reef of Tuléar, and in Mozambique Channel, Indian Ocean; *a,* photomicrograph of oscula and surrounding spicules seen from above, MNHN J.V.-76-2, ×70; *b,* diagram of general structural and spicule organization, ×50; *c–g,* characteristic spicules including *c,* diactine of fibers ×100; *d,* triactine of outer skeleton, ×50; *e,* tetractine of canal, ×100; *f,* curved diactine, ×50; *g,* periosculator triactine, ×50 (Vacelet, 1977a; courtesy of *Publications Scientifiques du Muséum national d'Histoire naturelle, Paris*).

Subclass CALCARONEA Bidder, 1898

[Calcaronea BIDDER, 1898, p. 73]

Choanocyte nucleus apical; larva an amphiblastula; triradiates predominantly sagittal except in Lapidoleuconidae. *Lower Cambrian–Holocene.*

Order LEUCOSOLENIDA Hartman, 1958

[Leucosoleniida HARTMAN, 1958a, p. 108]

Asconoid. [Family included is Leucosoleniidae MINCHIN, 1900, p. 110 (type genus, *Leucosolenia* BOWERBANK, 1862, p. 1,094).] *Holocene.*

Order SYCETTIDA Bidder, 1898

[Sycettida BIDDER, 1898, p. 73]

Syconoid or leuconoid. Families included are Sycettidae DENDY, 1893, p. 72 (type genus, *Sycetta* HAECKEL, 1872b, p. 235); Grantiidae DENDY, 1893, p. 72 (type genus, *Grantia* FLEMING, 1828, p. 524); Leuconiidae VOSMAER, 1887, p. 373 (type genus, *Leuconia* GRANT, 1833, p. 199); Heteropiidae DENDY, 1893, p. 75 (type genus, *Heteropia* CARTER, 1886, p. 47); Amphoriscidae DENDY, 1893, p. 76 (type genus, *Amphoriscus* HAECKEL, 1870, p. 238); plus the families treated below. *Carboniferous–Holocene.*

Family GRANTIIDAE Dendy, 1893

[Grantiidae DENDY, 1893, p. 72]

Sycon architecture persistent within an enclosing dermis or cortex, inhalant and exhalant systems consistently developed. *Carboniferous–Holocene.*

Grantia FLEMING, 1828, p. 524 [**Spongia compressa* FABRICIUS, 1780, p. 448; OD]. Syconoid sponges with cortex of tangential triactines or tetractines and smaller, perpendicular diactines; choanosome spicules may include larger triactines and diactines, which may protrude on dermal surface. *Holocene:* cosmopolitan.——FIG. 491,*3. G. socialis* BOROJEVIC, New Caledonia; diagram of transverse section showing spicule composition of cortex above and principal skeleton below; *a,* atrium, *ar,* articulate choanosomal skeleton, *as,* atrial skeleton composed of tangential triactines and tetractines, *cx,* cortex, *ss,* subatrial spicules, thickness 700 µm (Borojevic, 1967).

Protoleucon BOLKHOVITINOVA, 1923, p. 67 [**P. pavlovi;* OD]. Cylindrical sponges with deep spongocoel; skeleton of vermiform looping fibers forming either irregular swellings or hollow, irregularly curved tubes; large canals extending in from dermal surface to interior of sponge; smaller canals also present. *Carboniferous:* Russia.——FIG. 491,*1a–c.* **P. pavlovi,* Krasnaya Pakhra, Moscow region; *a,*view from above showing relatively thin walls around matrix-filled spongocoel, ×2; *b,* view of gastral surface with irregular ostia, ×2; *c,* skeletal fibers in tangential section, ×10 (Rezvoi, Zhuravleva, & Koltun, 1962).

Protosycon ZITTEL, 1878b, p. 48 [**Scyphia punctata* GOLDFUSS, 1826, p. 10; OD]. Resembles *Grantia. Upper Jurassic:* Germany.——FIG. 491,*4a–d.* **P. punctatum* (GOLDFUSS); *a,* side view of small sponge, ×1; *b–d,* diact, triacts, and tetract spicules, ×150 (de Laubenfels, 1955).

Family LEUCONIIDAE Vosmaer, 1887

[*nom. correct.* DE LAUBENFELS, 1955, p. 96, *pro* Leuconidae VOSMAER, 1887, p. 373]

Initially similar to Grantiidae but developing simple, rhagon architecture, generally with single spongocoel of simple type. *Lower Jurassic, Holocene.*

Leuconia GRANT, 1833, p. 199 [**Spongia nivea* GRANT, 1826, p. 339; SD BOWERBANK, 1862, p. 1,094] [see

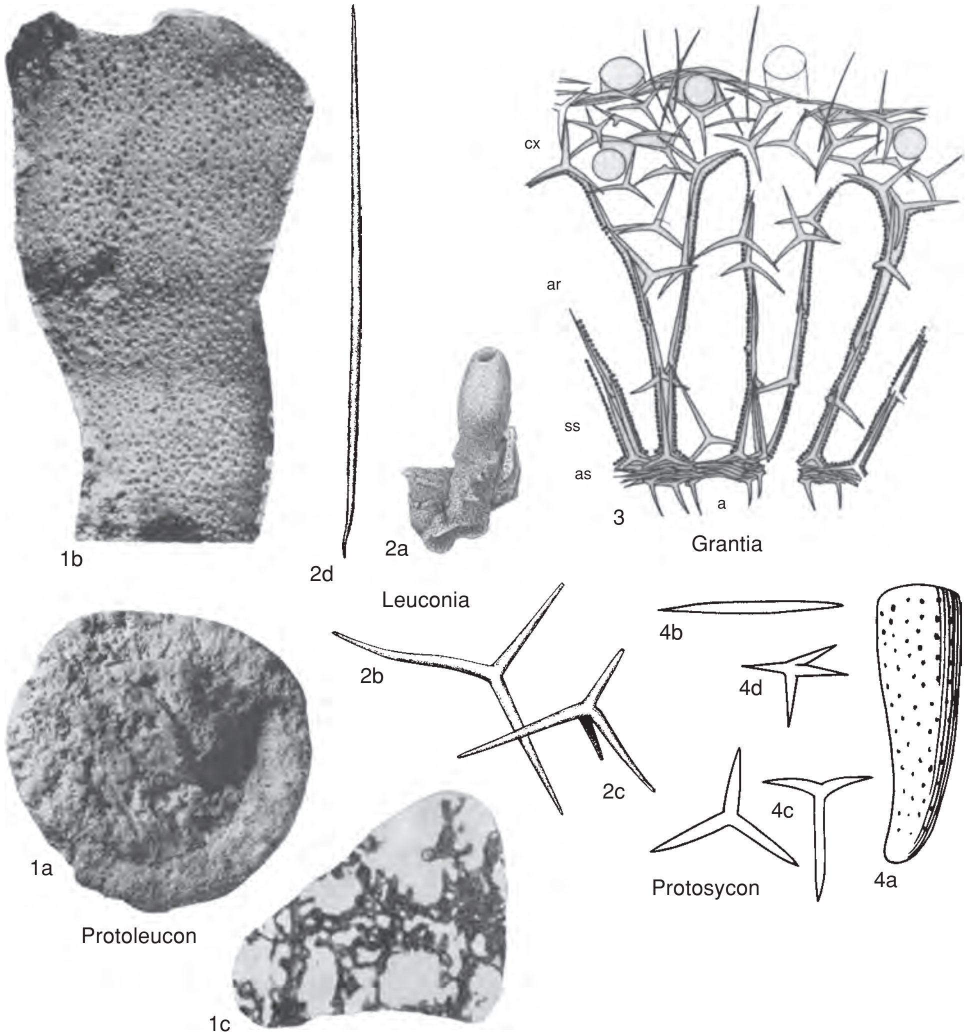

FIG. 491. Grantiidae and Leuconiidae (p. 737–738).

BURTON, 1963, p. 232 for extensive synonymy of *Leuconia*]. Simple, rhagon sponges with dermal triacts over endosomal diactines, triactines, and tetractines. *Lower Jurassic–Holocene:* England, *Lower Jurassic;* cosmopolitan, *Holocene.*——FIG. 491,*2a–d. L. walfordi* (HINDE), middle Lias, Northhampton, England; *a,* side view of small sponge, ×10; *b–d,* spicules from species, ×100 (Hinde, 1893b).

Order STELLISPONGIIDA new order

[Stellispongiida FINKS & RIGBY, herein]

Calcaronea with an inozoan basal skeleton. *Permian–Holocene.*

Family STELLISPONGIIDAE de Laubenfels, 1955

[Stellispongiidae DE LAUBENFELS, 1955, p. 97; *emend.,* FINKS & RIGBY, herein] [=Stellispongiidae DE LAUBENFELS, 1955, p. 97, *partim;* Elasmostomatidae DE LAUBENFELS, 1955, p. 98, *partim;* Discocoeliidae DE LAUBENFELS, 1955, p. 99, *partim;* Elasmocoeliidae DE LAUBENFELS, 1955, p. 99, *partim*]

Trabeculae of central spicule or spicules coated by smaller spicules. [The majority of Jurassic genera have a single central spicule while the majority of Cretaceous genera have multiple central spicules.] *Permian–Neogene (Miocene).*

Subfamily STELLISPONGIINAE de Laubenfels, 1955

[*nom. transl.* FINKS & RIGBY, herein, *ex* Stellispongiidae DE LAUBENFELS, 1955, p. 97; *emend.,* FINKS & RIGBY, herein]

Multiple central spicules in trabeculae. *Permian–Paleogene (Eocene).*

Stellispongia D'ORBIGNY, 1849, p. 549 [**Tragos stellatum* GOLDFUSS, 1826, p. 14; OD] [=*Operytis* POMEL, 1872, p. 229, obj.; *?Trachysphecion* POMEL, 1872, p. 223 (type, *Spongia stellata* LAMOUROUX, 1821, p. 89; SD RAUFF, 1893, p. 71); *?Diasterofungia* DE FROMENTEL, 1861, p. 358 (type, *D. insignis,* OD)]. Bun-shaped or tuberoid, with flattened base covered by concentrically wrinkled, dermal layer; upper surface bearing mamelons, each with astrorhiza-like, exhalant, groove system without central osculum or pore cluster; entire upper surface covered with small, circular, intertrabecular pores, some clearly larger than others. [Trabecular microstructure of the type species, which is Cretaceous (Cenomanian), was described by DUNIKOWSKI (1883, p. 318, pl. 4,*5*) as having triradiates in the middle of trabecular and sagittal tetraradiates on outside with unpaired rays projecting into lumen of intertrabecular space, such as typical of oscular assemblies of living, nonpharetronid Calcarea. Triassic specimens belonging to *Cnemidium variabile* MÜNSTER, 1841 (which has been considered incorrectly the type species by many authors) have penicillate (aragonitic) to irregular, partly spherulitic microstructure (WENDT, 1974, p. 503–507; 1979, p. 454) or spherulitic microstructure (FINKS, 1983a, p. 64, 69; but this is perhaps *Stellispongia subsphaerica* DIECI, ANTONACCI, & ZARDINI, 1968), or sinuous bodies (possibly flaky, asymmetric spherulites) (STEINMANN, 1882, p. 180, pl. 9,*2;* RAUFF, 1938, p. 197 ff., pl. 21,*30.2*). WENDT (1974, p. 507) cited occasional monaxons for the Triassic *Stellispongia manon* (MÜNSTER) but no triradiates. The Triassic sponges with spherulitic or penicillate, aragonitic basal skeletons should not be assigned to *Stellispongia.* They are agelasid demosponges. *Ateloracia* POMEL, 1872 (p. 228), (*q.v.*) with type *Cnemidium manon* MÜNSTER, 1841, is available. HINDE (1893b, p. 226) established *Holcospongia* for Jurassic and Cretaceous species assigned to *Stellispongia* because he considered (incorrectly) the Triassic *Cnemidium variabile* MÜNSTER to be the type (this is the source of the SD cited by DE LAUBENFELS, 1955, p. 97). It is questionable, however, whether HINDE's Jurassic species of *Holcospongia* (among which is the type) are congeneric with the Cretaceous type of *Stellispongia.* Nonspiculate, Paleozoic sponges originally included in *Stellispongia* (TERMIER & TERMIER, 1955, 1973, 1977a) have been placed in *Stellispongiella* WU Ya Sheng (1991) by RIGBY and SENOWBARI-DARYAN (1996a), in the family Stellispongiellidae WU Ya Sheng, 1991. That classification is followed here.] *?Jurassic, Cretaceous:* Europe.——FIG. 492,*4.* **S. stellata* (GOLDFUSS), Upper Cretaceous, Cenomanian, Essen, Germany; camera lucida drawing of spicules around canal, with coarser triradiates near opening and smaller ones associated with monaxons farther away, ×50 (Dunikowski, 1883).

Amorphofungia FROMENTEL, 1860a, p. 50 [**Achilleum tuberosum* GOLDFUSS, 1829, p. 93; OD]. Tuberous and lobate; closely spaced, small, subcircular, and subequal pores represent openings of more or less radial and anastomosing, intertrabecular spaces; microstructure and spicules not known. *Jurassic:* Germany.——FIG. 492,*1.* **A. tuberosa* (GOLDFUSS), upper beds of Jurassic limestone, Hattheim; fragment showing lobate, tuberose form with small, inhalant ostia to irregularly convergent, trabecular spaces, shown in broken surfaces, ×1 (Goldfuss, 1833).

Amorphospongia D'ORBIGNY, 1849, p. 550, *non* FROMENTEL, 1860a [**Achilleum truncatum* GOLDFUSS, 1829, p. 93; SD FINKS & RIGBY, herein]. Cylindrical, branching; surface bearing circular to submeandriform pores of subequal size, and coated in patches with dermal layer; pores separated by thin trabeculae and presumably represent openings of internal, intertrabecular spaces; microstructure and spicules unknown. [GOLDFUSS (1829, p. 93) said that the skeletal net has great similarity to that of the type specimen of *Pachytilodia* ZITTEL, 1878b. The other species originally included by D'ORBIGNY (1849, p. 550), *Achilleum chirotonum* GOLDFUSS (1826, p. 2), appears to be a hexactinellid. DE LAUBENFELS's (1955, p. 104) designation of *Achilleum tuberosum* GOLDFUSS, 1829, as the type is invalid; this species was not originally included by D'ORBIGNY (1849, p. 550) when he established the genus. That species is the valid type of FROMENTEL, 1860a.] *Jurassic:* Germany.

Blastinoidea RICHARDSON & THACKER, 1920, p. 182 [**B. frithica;* OD]. Minute, spherical to subspherical sponges similar to *Stellispongia,* but surface smooth and without furrows; no osculum visible and dermal cortex not developed. *Middle Jurassic:* England.——FIG. 493,*7.* **B. frithica,* middle Inferior Oolite, Gloucestershire; side view of subspherical type specimen, ×2 (Richardson & Thacker, 1920).

Conocoelia ZITTEL, 1878b, p. 34 [**Siphonocoelia crassa* FROMENTEL, 1861, p. 360; SD DE LAUBENFELS, 1955, p. 99]. Broadly conical with flattish top; solitary or with budded individuals springing from top edge; central, deep cloaca narrow and funnel shaped; outer surface porous but with horizontal constrictions; no internal canals except intertrabecular spaces; meandriform, trabecular mesh showing horizontal layering; trabecular microstructure large, central, tri- or tetraradiates coated by smaller, sinuous spicules (HINDE, 1884a, p. 177–178). *Lower Cretaceous:* Europe.

Diaplectia HINDE, 1884a, p. 193 [**D. auricula;* SD DE LAUBENFELS, 1955, p. 98] [=*?Trachyphlyctia* POMEL, 1872, p. 237 (type, *Spongia helvelloides*

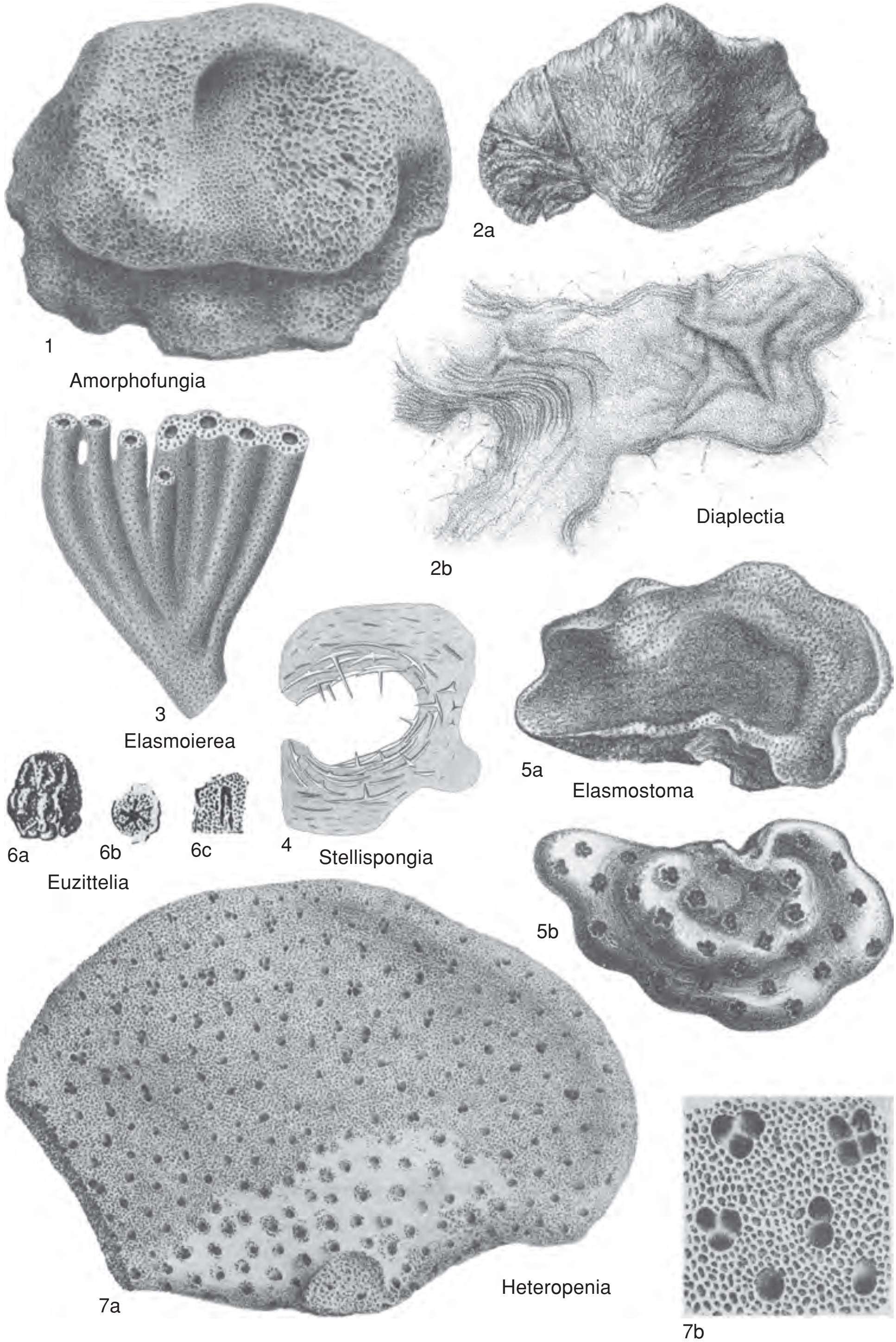

FIG. 492. Stellispongiidae (p. 739–741).

LAMOUROUX, 1821, p. 87)]. Ear, fan, or cup shaped, stipitate; trabeculae dominantly subparallel and vertical; no pores other than intertrabecular spaces; no dermal layer; trabecular microstructure consisting of large, central, tri- and tetraradiates coated by small, sinuous spicules, small pitchfork spicules reported. *Jurassic:* Europe.——FIG. 492,*2a–b.* **D. auricula,* Inferior Oolite, Middle Jurassic, Cheltenham, England; *a,* ear-shaped type specimen viewed from below, ×1; *b,* camera lucida drawing of interior fiber showing large, three- and four-rayed spicules with minute, sinuous spicules bordering fiber, ×75 (Hinde, 1884a).

Elasmoierea FROMENTEL, 1860a, p. 34 [**E. sequana;* OD] [=*Elasmocoelia* ROEMER, 1864, p. 31, obj., *nom. van.*]. Erect, plicate, sometimes branching laminae with many vertical, exhalant canals (or narrow cloacae) opening in single row (occasionally several abreast) on upper edge; sides of lamina may bulge around each cloaca; sides of lamina covered with small, closely spaced pores; trabecular microstructure of *E. faringdonesis* (MANTELL), according to HINDE (1884a, p. 177), consists of tri- and tetraradiates with some "slender filiform spicules." *Lower Cretaceous:* Europe.——FIG. 492,*3.* **E. sequana,* Hils, near Berklingen, northern Germany; side view of branched sponge with aligned oscula on upper edge, ×1 (Roemer, 1864).

?Elasmostoma FROMENTEL, 1860a, p. 42 [**E. frondescens* FROMENTEL, 1860a, p. 43; OD] [=*?Heteropenia* POMEL, 1872, p. 153 (type, *Manon peziza* GOLDFUSS, 1826, p. 3, SD DE LAUBENFELS, 1955, p. 105)]. Ear or bracket shaped, with attachment near middle of straight side; concentrically rugose parallel to semicircular growing edge; one surface (possibly exhalant) covered with dermal layer pierced by irregularly circular, large pores (possible oscules); this surface is convex in type species, therefore questionably exhalant; other (possibly inhalant) surface covered by small, irregular, intertrabecular spaces. [HINDE (1884a, p. 193) described the trabecular microstructure of *Tragos acutimargo* ROEMER, 1839 (which he, as well as ZITTEL, 1878b, p. 44, considered a senior subjective synonym of the type species) as large, central, tri- and tetraradiates coated by smaller, sinuous spicules. The concave face bears the dermal layer and oscules in *T. acutimargo,* according to POMEL (1872, p. 151–152). This genus is externally similar to some species of *Raphidonema* HINDE, 1884a, but differs in the presence of large, central spicules in the center of the trabeculae.] *Jurassic (Oxfordian)–Paleogene (Eocene):* Poland, Germany, *Oxfordian;* Europe, *Cretaceous;* Mexico, *Eocene.* ——FIG. 492,*5a–b.* **E. frondescens,* Neocomian, Lower Cretaceous, St. Dizier, Germany, *a,* dermal surface of irregular, small sponge with small, inhalant ostia, ×1; *b,* gastral view of same sponge with several relatively large, exhalant oscula, ×1 (Fromentel, 1860a).

Euzittelia ZEISE, 1897, p. 329 [**E. magnifica;* OD]. Sponges bud to rounded club shaped, with upper surface marked by elongate furrows that have networks of horizontal elements; sponges characterized by well-developed spongocoel or paragaster, which extends full length of sponge, and well-developed aporhysal or exhalant canal system; radial, aporhysal canals penetrate approximately halfway through sponge wall and terminate distally with irregular, blunt ends; inhalant canal system has not been recognized; skeletal fibers range 0.1 to 0.3 mm thick, but individual spicules have not been recognized. *Jurassic–Cretaceous:* Europe.——FIG. 492,*6a–c.* **E. magnifica,* Stramberger Schichten, Germany; *a,* side view of small, furrowed sponge, Palaeontologisches Museum München, ×1; *b,* horizontal section showing axial spongocoel and radial, exhalant canals, ×1; *c,* vertical section with tubular, axial spongocoel and cellular-appearing skeleton, ×1 (Zeise, 1897).

?Heteropenia POMEL, 1872, p. 153 [**Manon peziza* GOLDFUSS, 1826, p. 3; SD DE LAUBENFELS, 1955, p. 105] [=*Catagma* SOLLAS, 1878, p. 354, SD DE LAUBENFELS, 1955, p. 105, obj.; *?Elasmostoma* FROMENTEL, 1860a, p. 42–43 (type, *E. frondescens* DE FROMENTEL, 1860a, p. 43, OD)]. Cup shaped with short stalk or foot; basal part may be covered with dermal layer; concave (possibly exhalant) surface bearing fine, closely spaced, round pores; convex (possibly inhalant) surface bearing meandriform, intertrabecular spaces and small, round pores arranged more or less quincuncially; latter lead into canals that rise obliquely to, but not through, concave surface. [This description is based on POMEL's description (1872, p. 153) but agrees roughly with the figure of *Manon peziza* of GOLDFUSS (1833, pl. 5,*1*) which POMEL cited, although less so with GOLDFUSS's other figures of that species. They seemingly all share the unusual feature of larger pores on the convex, outer surface, a feature shared also with the type species of *Elasmostoma* FROMENTEL, 1860a. POMEL stated (1872, p. 153) that the type, *Heteropenia peziza* POMEL, 1872, resembled *Manon peziza* sufficiently to be considered identical, but clearly implied that the type specimen was not one of GOLDFUSS's original lot. DE LAUBENFELS (1955, p. 105) unambiguously designated *Manon peziza* GOLDFUSS as the type.] *Cretaceous (Cenomanian):* Europe.——FIG. 492,*7a–b.* **H. peziza* (GOLDFUSS), St. Petersburg and Essen, Ruhr region, Germany; *a,* view of upper surface with coarse, exhalant pores, ×1; *b,* enlarged part of upper, gastral surface showing variation in exhalant openings, approximately ×4 (Goldfuss, 1833).

Pachymura WELTER, 1911, p. 58 [**P. goldfussi;* OD]. Cup to goblet-shaped sponge with markedly elongate funnels of gastric cavity; canal system not defined, skeletal fibers coarse with irregular orientation, and composed of parallel, possibly three-rayed spicules. *Lower Cretaceous:* Germany.——FIG. 493,*2.* **P. goldfussi,* Essener Grünsand, Cenomanian, Tourtia of Essen; side view of irregular, funnel-shaped sponge with porous walls, ×1 (Welter, 1911).

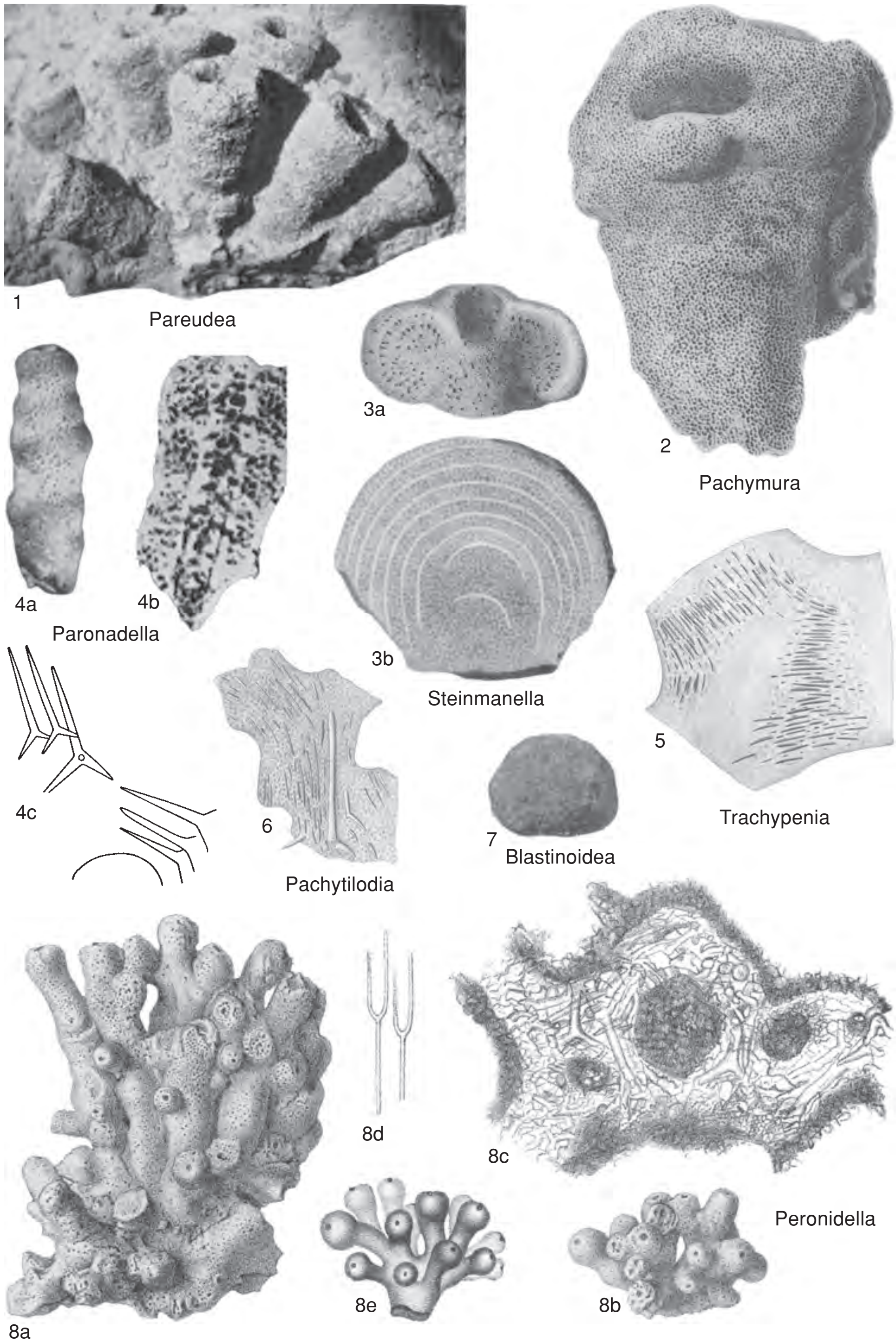

FIG. 493. Stellispongiidae (p. 739–745).

Pachytilodia ZITTEL, 1878b, p. 46 [**Scyphia infundibuliformis* GOLDFUSS, 1826, p. 12; OD]. Very large, goblet or cup shaped with short stalk; smaller, younger individuals pear shaped with shallow depression on top; no pores other than coarse, irregular, intertrabecular spaces; trabecular microstructure, according to DUNIKOWSKI (1883, p. 322), consisting of monaxons parallel to length of fibers and very large triradiates. *Cretaceous:* Europe.——FIG. 493,*6.* **P. infundibuliformis* (GOLDFUSS), Upper Cretaceous, Cenomanian, Essen, Germany; camera lucida drawing of parallel monaxons, ×50 (Dunikowski, 1883).

Pareudea ÉTALLON, 1859b, p. 542 [**Scyphia bronnii* GOLDFUSS, 1829, p. 91; SD DE LAUBENFELS, 1955, p. 106] [=*Eusiphonella* ZITTEL, 1878b, p. 34, obj.] Tubular, cylindrical to conical, solitary or branching; central cloaca one-third total diameter; osculum may have stellate outline from short, radial slits; meandriform trabeculae thickened at surface to outline larger and smaller, circular pores; imperforate dermal layer may be present near base. [HINDE (1893b, p. 219) added further diagnostic features of horizontal, exhalant canals that enter the cloaca in vertical rows of elongate pores, producing the oscular slits, and whose presence distinguishes the genus from *Peronidella* ZITTEL in HINDE, 1893b. HINDE (*loc. cit.*) illustrated the trabecular microstructure of *Eusiphonella prolifera* HINDE, 1893b, as multiple, central, large triradiates coated by a few filiform or sinuous spicules; this would distinguish it somewhat from the more numerous central spicules of *Peronidella.* HINDE (1884a, p. 178) also noted triradiates in the dermal layer of the type species. It should be noted that GOLDFUSS's (1829, p. 91, pl. 33,*9*) original description and illustration of the type species is indistinguishable in gross form from *Peronidella* and does not have radial slits. WAGNER (1964, p. 27 and pl. 5,*1a–c*) chose as lectotype a branching group of somewhat conical individuals and emphasized the presence of the short, longitudinal, radial slits in the cloacal wall (HINDE's rows of elongate pores) as a diagnostic character. WAGNER placed *Epitheles* FROMENTEL, 1860a (as *Myrmecium* GOLDFUSS, 1826 and *Myrmecidium* VINASSA DE REGNY, 1901) in subjective synonymy, but their trabecular microstructure is different, as is also their spheroidal form. HINDE, 1893b, p. 219, designated *Scyphia bronnii* MÜNSTER in GOLDFUSS, 1829, as type of *Eusiphonella* ZITTEL, 1878b; the same species was the first cited and described by ÉTALLON (1859b, p. 542) under his new genus *Pareudea,* and was designated as type of that earlier genus by DE LAUBENFELS (1955, p. 106).] *Upper Triassic–Upper Jurassic:* Peru, *Upper Triassic;* Peru, *Lower Jurassic;* England, Poland, France, Germany, *Oxfordian;* Czech Republic, Slovakia, *Tithonian;* Italy, *Upper Jurassic.*——FIG. 493,*1.* **P. bronnii* (GOLDFUSS), Weissjura Zeta, Upper Jurassic, Nattheim, southern Germany; lectotype, branched cluster with exhalant ostia in rows in spongocoels, BSPGM AS VII 254, ×1.5 (Wagner, 1964).

Paronadella RIGBY & SENOWBARI-DARYAN, 1996a, p. 61 [**Peronidella proramosa* HURCEWICZ, 1975, p. 272; OD]. Sponge single or branched, cylindrical with deep spongocoel that extends nearly through entire sponge; inhalant and exhalant canals or pores absent, with interconnected fiber spaces within wall; spicular skeleton composed of di-, tri-, or tetraclones not united with calcareous cement. [This may be a Paleozoic representative of Triassic and younger peronidellids with spicules.] *Permian–Jurassic (Oxfordian):* Italy (Sicily), *Permian;* Poland, *Oxfordian.*——FIG. 493,*4a–c.* **P. proramosa* (HURCEWICZ), Jurassic limestone, upper Oxfordian, Wydrznów, Polish Jura Chain, Poland; *a,* holotype, side view, UL Sp. VII/131, ×2; *b,* longitudinal section with cylindrical spongocoel and reticulate, almost chambered-appearing skeleton, UL Sp. VII/142, ×5; *c,* sketch of sagittal tetractines from UL Sp. VII/26, ×85 (Hurcewicz, 1975; courtesy of *Acta Palaeontographica Polonica,* Polska Akademia Nauk).

Peronidella ZITTEL in HINDE, 1893b, p. 213, *partim* [**Spongia pistilliformis* LAMOUROUX, 1821, p. 88; SD DE LAUBENFELS, 1955, p. 99] [=*Siphonocoelia* FROMENTEL, 1860a, p. 31 (type, *Scyphia elegens* GOLDFUSS, 1826, p. 6, OD); *Discoelia* FROMENTEL, 1861, p. 357 [360] (type, *Scyphia cymosa* MICHELIN, 1847 in 1840–1847, p. 249, SD RAUFF, 1893), =*Discocoelia* DE LAUBENFELS, 1955, p. 99, obj., *lapsus calami*, *nom. nov. pro Polycoelia* FROMENTEL, 1860a, p. 32, *non* KING, 1849; *Coeloscyphia* TATE, 1865, p. 43 (type, *C. sulcata,* SD DE LAUBENFELS, 1955, p. 87), *nom. van. pro Polycoelia* FROMENTEL, 1860a, p. 32; *Dendrocoelia* LAUBE, 1865, p. 233 (type, *D. dichotoma,* SD FINKS & RIGBY, herein), *nom. van. pro Polycoelia* FROMENTEL, 1860a, p. 32; *Pliocoelia* POMEL, 1872, p. 242, jr. obj. syn. of *Discoelia* FROMENTEL, 1861, p. 357 [360]; *Loenocoelia* POMEL, 1872, p. 243 (type, *L. ramosa,* OD); *?Coeloconia* POMEL, 1872, p. 248 (type, *Scyphia cylindrica* GOLDFUSS, 1826, p. 5, partim); *?Dyoconia* POMEL, 1872, p. 248 (type, *Scyphia cylindrica* GOLDFUSS, 1826, p. 5, *partim*); *?Vermispongiae* QUENSTEDT, 1877 in 1877–1878, p. 171, obj., =*Dermispongia* ZITTEL, 1878b, p. 30, *lapsus calami; ?Radicispongia* QUENSTEDT, 1877 in 1877–1878, p. 179 (type, *Spongites radiciformis* GOLDFUSS, 1826, p. 10); *Peronella* ZITTEL, 1878b, p. 30, obj., *non* GRAY, 1855, *nec* MOERCH, 1863]. Branching cylinders arising from common base and partly fused laterally; may also be solitary; top of cylinder rounded with central osculum; deep, central cloaca; surface pores only regular, intertrabecular spaces; imperforate, dermal layer present on basal part of each branch; trabecular microstructure of Jurassic type species according to HINDE (1893b, p. 214) consists of triradiates, and possibly tetraradiates, including tuning-fork spicules, very closely intermingled; fibers sometimes coated by thin layer of filiform, sinuous spicules that may also line cloaca. [HURCEWICZ (1975, p. 268) described nontopotype material referred to the type species and stated that tetraradiates predominate in the fibers

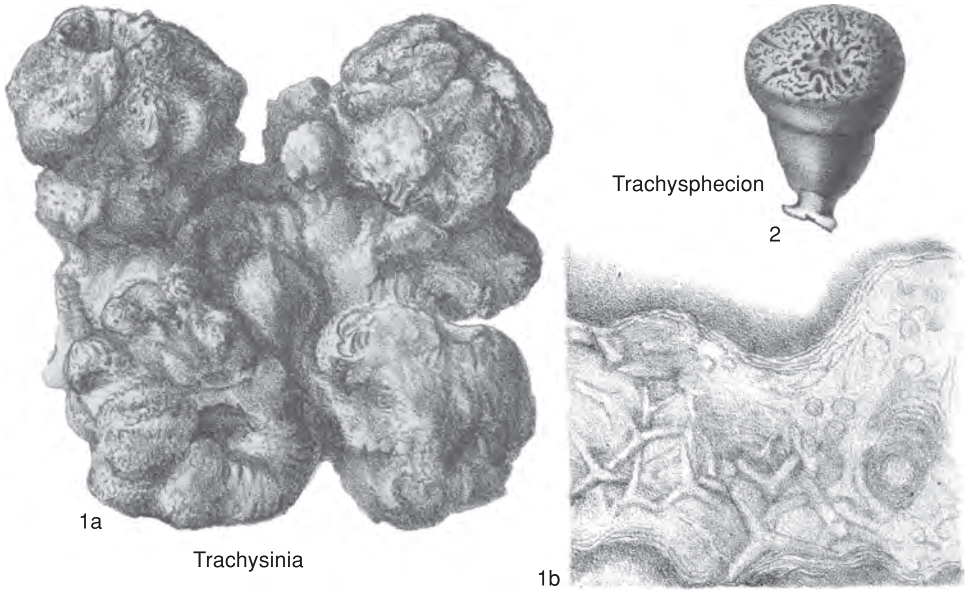

FIG. 494. Stellispongiidae (p. 745).

and that the dermal layer consists of densely spaced, sagittal triradiates with their apical rays set obliquely outward. WENDT (1974, p. 503) characterized the microstructure of some Triassic species referred to *Peronidella* as composed of irregularly arranged needles of aragonite without spicules (i.e., they would be vacelitid demosponges) and DIECI, RUSSO, and RUSSO (1974a) described other Triassic specimens as spherulitic (i.e., they would be agelasid demosponges). The nonspicular, pre-Jurassic species should not be referred to *Peronidella.* They are demosponges. Jurassic and Cretaceous species whose microstructure has been published appear to conform to that of the type species. Several of the genera cited in the synonymy with a query are senior to *Peronidella.* The oldest of these is *Siphonocoelia* FROMENTEL, 1860a (type, *Scyphia elegans* GOLDFUSS, 1826). Their microstructure is not known.] *Jurassic–Cretaceous, Holocene:* Europe, Canadian Atlantic Shelf, Mediterranean Sea.——FIG. 493,*8a–e.* **P. pistilliformis* (LAMOUROUX); *a,* branched cluster showing mode of growth and size of branches, Great Oolite, Upper Jurassic, Bath, United Kingdom, ×1; *b,* smaller cluster with smaller branches to show range of form in type species, Great Oolite, Upper Jurassic, Bath, United Kingdom, ×1; *c,* camera lucida drawing of part of sponge showing spicule structure of fibers, Great Oolite, Upper Jurassic, Bath, United Kingdom, ×60; *d,* drawing of tuning fork spicules from same section, Great Oolite, Upper Jurassic, Bath, United Kingdom, ×200 (Hinde, 1893b); *e,* side view of small type cluster showing form of branches, Holocene, Mediterranean Sea, near Caen, France, ×1 (Lamouroux, 1822).

Steinmanella WELTER, 1911, p. 66 [**S. latidorsata* WELTER, 1911, p. 67; SD DE LAUBENFELS, 1955, p. 98]. More or less sheetlike sponges with fibrous, skeletal structure somewhat similar to *Elasmostoma* or *Sestrostomella;* general structure of more or less parallel layers; coarse canal system absent but short, twisted fibers on under surface around larger and smaller pores. [Included in the family with some question.] *Upper Cretaceous:* Germany.——FIG. 493,*3a–b.* **S. latidorsata,* Essen Grünsand, Cenomanian, Essen; *a,* upper or gastral surface with shallow depression and moderately coarse, exhalant ostia, ×1; *b,* surface of leaflike sponge with parallel, ridgelike beams showing expansion of skeleton, ×2 (Welter, 1911).

Trachypenia POMEL, 1872, p. 152 [**Manon stellatum* GOLDFUSS, 1826, p. 3; SD FINKS & RIGBY, herein]. Auriform, infundibuliform, or frondose, thin sheets; possible exhalant surface covered with meandriform, intertrabecular spaces that converge upon small, circular, evenly spaced pores to form fine-grained pattern of stellate domains; opposite (possibly inhalant) surface covered with more or less circular, intertrabecular spaces that tend to form zones of larger and smaller pores parallel to growing edge of sponge zones corresponding to obscure growth rugae; no dermal layer; internal, intertrabecular spaces meandriform; no larger canals; trabecular microstructure consisting of larger, central spicule or spicules (tri- or possibly tetraradiates) surrounded by small, sinuous monaxons parallel to trabecular surface. [HINDE (1884a, p.

200) referred this species to his genus *Raphidonema* and reported the microstructure as of small, sinuous triradiates. DUNIKOWSKI (1883, p. 320), added monaxons as well, recognized sagittal triradiates, and illustrated (pl. 2 (38),*2*) larger, central spicules. The very characteristic stellate pattern of trabeculae and absence of a dermal layer separate this genus from *Elasmostoma* FROMENTEL, 1860a. The same characters, as well as spicular differences, separate it from the type of *Raphidonema* HINDE, 1884a.] *Cretaceous:* Europe.——FIG. 493,*5.* **T. stellata* (GOLDFUSS), Upper Cretaceous, Cenomanian, Essen, Germany; camera lucida drawing showing large, triradiate spicules surrounded by smaller monaxons, ×50 (Dunikowski, 1883).

Trachysinia HINDE, 1884a, p. 189 [**T. aspera;* SD DE LAUBENFELS 1955, p. 97]. Tubular with shallow to deep, central cloaca; exterior knobby; generally bushy colonies with several individuals fused basally; radial, exhalant canals may enter cloaca but interior with few canals except coarse, intertrabecular spaces; trabecular microstructure consisting of multiple, central, tri- and tetraradiates coated by smaller, sinuous spicules (HINDE, 1884a, p. 189). *Jurassic:* Europe.——FIG. 494,*1a–b.* **T. aspera,* Couche a polypiers, Middle Jurassic, Caen, France; *a,* type specimen from above with knobby exterior, ×1; *b,* camera lucida drawing showing three- and four-rayed spicules within a fiber, ×72 (Hinde, 1884a).

?Trachysphecion POMEL, 1872, p. 223 [**Spongia stellata* LAMOUROUX, 1821, p. 89; SD RAUFF, 1893, p. 71]. Conical, irregular; slightly convex, upper surface bearing one or more oscules, with coarsely stellate outline produced by radial canals or pores surrounding them. [HINDE (1884a, p. 186) stated that the trabecular microstructure consists of central, irregular triradiates or tetraradiates coated by small, sinuous spicules. Genus may be synonymous with *Stellispongia* D'ORBIGNY, 1849 (*q.v.*).] *Jurassic, Holocene:* Europe.——FIG. 494,*2.* **T. stellata* (LAMOUROUX), Holocene, Mediterranean Sea near Caen, France; side view of small, obconical form with stellate-appearing osculum on rounded summit, ×1 (Lamouroux, 1822).

Subfamily HOLCOSPONGIINAE new subfamily

[Holcospongiinae FINKS & RIGBY, herein] [type genus, *Holcospongia* HINDE, 1893b, p. 225]

Single, central spicule in trabeculae. *Permian–Neogene (Miocene).*

Holcospongia HINDE, 1893b, p. 225 [**Spongia floriceps* PHILLIPS, 1829 in 1829–1836, p. 126; SD HURCEWICZ, 1975, p. 259]. Digitiform individuals or branches united by common base; longitudinal grooves running down sides of each branch, radiating from summit; osculum or cloaca limited or absent; internal canals, other than intertrabecular spaces, not well developed; dermal layer covers base of sponge; trabeculae contain central, tri- or tetraradiate coated by several layers of "filiform spicules" or "sinuous spicules" (HINDE, 1893b, p. 225, 227), parallel to trabecular surface. [Foregoing based on type species; other species include solitary, ovoid individuals with same characters, as well as specimens in which triradiates occur imbedded in the dermal layer; species with summit, exhalant, pore clusters or oscular depressions may or may not belong here. HINDE did not designate a type, and we have found no earlier designation of a type than this one, which is, in fact, the first of HINDE's described species.] *Middle Jurassic–Upper Jurassic:* Europe, ?Peru.——FIG. 495,*6a–b.* **H. floriceps* (PHILLIPS), Lower Coral Rag, Upper Jurassic, Hackness, Yorkshire, United Kingdom; *a,* side view of small type specimen with small oscula and surrounding radial canals, York Museum, ×1; *b,* drawing of spicular structure of fibers from type specimen, ×60 (Hinde, 1893b).

?Actinospongia D'ORBIGNY, 1849, p. 548 [**A. ornata;* OD] [=*Actinofungia* FROMENTEL, 1860a, p. 49, *nom. van.*]. Appears somewhat similar to *Leiospongia,* but with very convex, upper part without an oscule and with dermal surface with irregular, radiating structure. *Jurassic (Bathonian):* Europe.

Astrospongia ÉTALLON, 1859a, p. 151 [**Achilleum costatum* GOLDFUSS, 1829, p. 94; OD] [=*Blastinia* ZITTEL, 1878b, p. 42, obj.; *?Actinospongia* D'ORBIGNY, 1849, p. 548 (type, *A. ornata,* OD); *?Actinofungia* FROMENTEL, 1860a, p. 49, *nom. van. pro Actinospongia* D'ORBIGNY, 1849, p. 548; *?Praeoculospongia* GERASSIMOV, 1960 (type, *P. epiconcha,* OD)]. Hemispherical with broadly conical base covered with concentrically wrinkled, dermal layer; upper portion corrugated by prominent, meridional ridges that radiate from summit and alternate with corresponding sulci, both widening downwardly. No pores (nor canals probably) except circular to meandriform, intertrabecular spaces. Trabeculae consist of triradiates according to HINDE (1893b, p. 246), but in a specimen identified by ZITTEL as being of the type species, smaller "filiform spicules" coat a central spicule, as in *Holcospongia.* [ÉTALLON (1859b, p. 151) clearly designated *Achilleum costatum* GOLDFUSS, 1829 as type. The citation of *Astrospongia subcostata* ÉTALLON, 1859b, as type by DE LAUBENFELS (1955, p. 104) is incorrect (RMF).] *Jurassic:* Europe.——FIG. 495,*3.* **A. costata* (GOLDFUSS), Jurakalkes, Streitberg, Germany; side view of globose sponge with wrinkled, lower, dermal layer and radially ridged, upper part, ×3 (Goldfuss, 1833).

Enaulofungia FROMENTEL, 1860a, p. 48 [**E. corallina;* OD] [=?*Holcospongia* HINDE, 1893b, p. 225 (type, *H. floriceps* HINDE, 1893b, p. 226, SD FINKS & RIGBY, herein); *Desmospongia* ÉTALLON, 1863, p. 422 (type, *Spongia semicinctus* QUENSTEDT, 1877 in 1877–1878, p. 219, =*Enaulofungia pedunculata* MÜLLER, 1984, p. 32)]. Spheroidal, sometimes stipitate; shallow, oscular depression at summit, containing exhalant, pore cluster toward which radial, bifurcating, exhalant grooves converge from

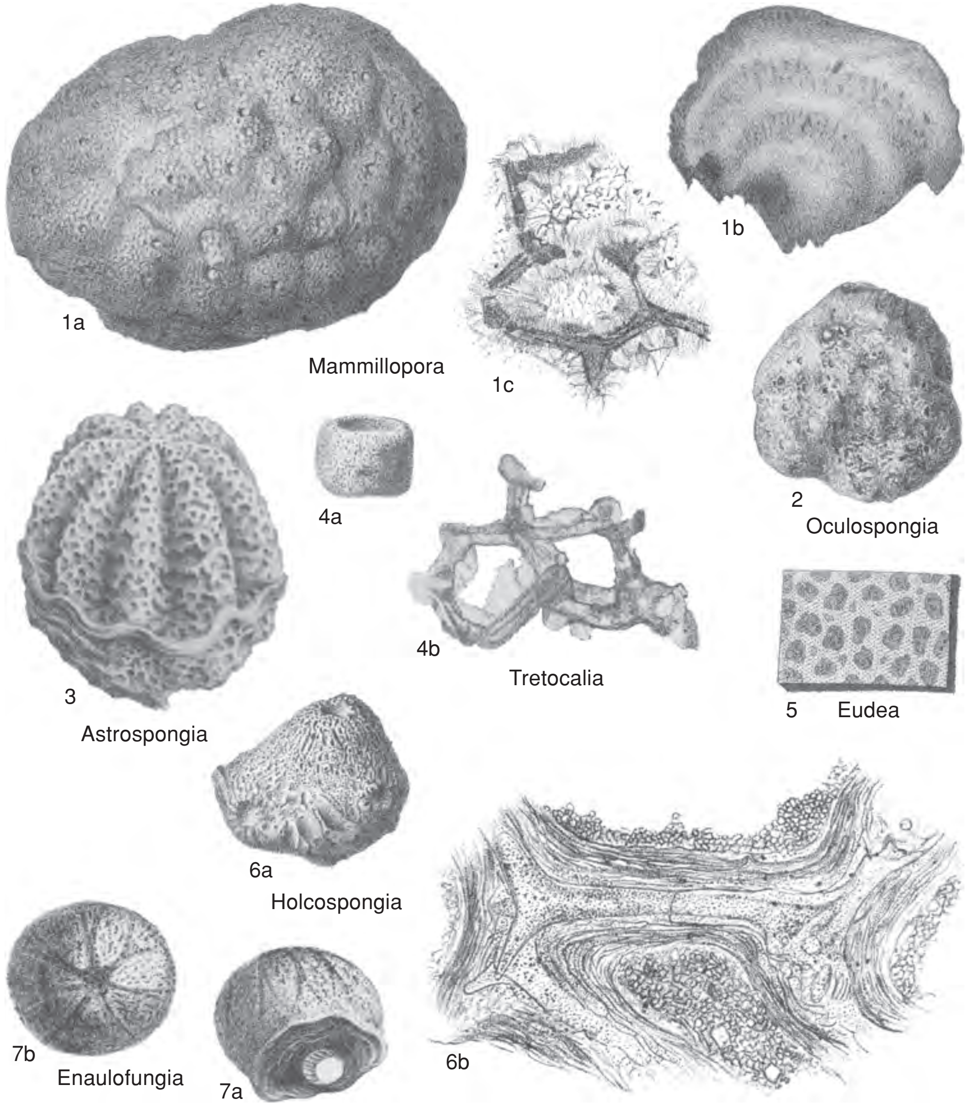

FIG. 495. Stellispongiidae (p. 745–748).

sides of sponge. Trabecular microstructure of topotypes unknown, but HINDE (1884a, p. 186) referred British specimens to the type species, which have a central, tri- or tetraradiate coated by sinuous filiform spicules. [This genus differs from typical *Holcospongia* HINDE, 1893b, in the presence of the summit depression with pore cluster and in being solitary. HINDE (1893b, p. 226) considered this genus (as *Enaulospongia, lapsus calami*) to be a synonym of *Holcospongia,* which would sink the latter into synonymy.] *?Triassic, Jurassic, ?Cretaceous:* Iran, *?Triassic;* Europe, *Jurassic, ?Cretaceous.*——FIG. 495,*7a–b.* **E. corallina,* Oxfordian, Jurassic, Champlitte, France, *a,* diagonal view from below of spheroidal sponge with short stalk and exhalant grooves extending upwardly from near flared base, ×0.5; *b,* view from above with exhalant cluster on summit with convergent exhalant grooves, ×0.5 (Fromentel, 1860a).

Eudea LAMOUROUX, 1821, p. 46 [**E. clavata;* OD] [=*Epeudea* FROMENTEL, 1860a, p. 27–28 (type, *Eudea cribraria* MICHELIN, 1847 in 1840–1847, p. 251); *Orispongia* QUENSTEDT, 1877 in 1877–1878, p. 195 (type, *O. globata,* OD); *?Conispongia*

ÉTALLON, 1859a, p. 150 (type, *C. thurmani,* SD RAUFF, 1893, p. 72); *?Elasmeudea* POMEL, 1872, p. 234 (type, *E. cribaria* MICHELIN, 1847 in 1840–1847, pl. 48,*8c,d*); ?*Stegeudea* FROMENTEL, 1864, p. 26, *nom. null.* (misspelled *Stegendea,* a typographical error)]. Club shaped, occasionally branched; deep, central cloaca with terminal osculum; sides of sponge and walls of cloaca largely covered with dermal layer bearing characteristic large, lipped, irregular openings through which trabecular interspaces are visible; uncovered top of sponge showing intertrabecular spaces directly; trabecular microstructure of Jurassic species bundles of parallel diactines, with subordinate, regular triradiates and tetraradiates, with some diactines bent like paired rays of tuning-fork spicule (KRAUTTER, 1994); HINDE (1893b) described a central spicule (possible triradiate) coated by diactines; Triassic species have felted, aragonite needles in layers parallel to trabecular surfaces, as in *Vaceletia,* and no spicules (DIECI, RUSSO, & RUSSO, 1974a, p. 101; MASTANDREA & RUSSO, 1995, p. 418). [Inasmuch as the type species is Jurassic, the Triassic species require a new generic name; they are demosponges belonging to the order Vaceletida. The Pennsylvanian *Maeandrostia* GIRTY, 1908, is a homeomorph with spherulitic microstructure. It is an agelasid demosponge and is not related to the Triassic so-called eudeas with vaceletid microstructure, nor to *Eudea* itself. *Epeudea* FROMENTEL, 1860a, and *Elasmeudea* POMEL, 1872, have as types different topotype specimens of the same Jurassic species (*Eudea cribraria* MICHELIN, 1847 in 1840–1847) except for one specimen in common (MICHELIN, 1847 in 1840–1847, pl. 58,*8c*). ZITTEL (1878b, p. 26) synonymized this species with the type species of *Eudea* (*E. clavata* LAMOUROUX, 1821); both are from the same locality and formation. The large, lipped openings in the dermal layer, which expose the internal trabeculae, give this possible form genus its characteristic appearance. They are present on the small, attached specimens of the type species of *Conispongia* ÉTALLON, 1859a, which may be a juvenile *Eudea* (RMF).] *Triassic, Jurassic, Holocene:* Europe, Iran.——FIG. 495,*5.* **E. clavata,* Holocene, Mediterranean Sea, near Caen, France; side view of branched sponge with coarser, inhalant openings in lower part than around rounded, upper part and osculum, ×1 (Lamouroux, 1822).

Mammillopora BRONN, 1825, p. 15 [**Lymnorea mamillosa* (*sic*) LAMOUROUX, 1821, p. 77; OD] [=*Lymnorea* LAMOUROUX, 1821, p. 77, obj., *non* PERON & LESUEUR, 1810; *Limnorea* GOLDFUSS, 1826, p. 14, obj., *nom. van. pro Lymnorea* LAMOUROUX, 1821, p. 77; *Lymnoreotheles* FROMENTEL, 1860a, p. 34, obj., *nom. van. pro Lymnorea* LAMOUROUX, 1821, p. 77; *Inobolia* HINDE, 1884a, p. 184 (type, *I. inclusa* HINDE, 1884a, p. 185, M); *?Placorea* POMEL, 1872, p. 225, obj.; *?Gymnorea* POMEL, 1872, p. 225 (type, *Polycoelia gemmans* FROMENTEL, 1860a, pl. 4,*4,* SD RAUFF, 1893, p. 71); *?Dichorea* POMEL, 1872, p. 225 (type, *Lymnorea michelini* D'ORBIGNY, 1850 in 1850–1852, vol. 1, p. 325, OD); *Lymnorella* HINDE, 1893b, p. 234, obj., *nom. van. pro Lymnorea* LAMOUROUX, 1821, p. 77; *?Orecyta* DE LAUBENFELS, 1955, p. 49 (type, *Limnorea nobilis* ROEMER, 1864, p. 37, OD), *nom. nov. pro Cytorea* POMEL, 1872, p. 225, *non* LAPORTE, 1849]. Hemispherical to flabellate with conical base covered by concentrically wrinkled, imperforate layer (i.e., laterally fused, cylindrical branches within a common envelope); upper surface composed of subequal, knoblike protuberances, each bearing a central osculum that may merge with radial, slitlike, exhalant canals to form a stellate outline; rest of upper surface covered with pores that open into intertrabecular spaces; according to HINDE (1884a, p. 161, 184; 1893b, p. 234 ff.) trabeculae composed of central triradiate or tetraradiate, surrounded by fibrous calcite that may have traces of filiform spicules. [HINDE (1893b, p. 236) reported tuning-fork spicules (sagittal triradiates with parallel, paired rays) from the fibers, as well as (in topotype material) dermal triradiates (HINDE, 1884a, p. 184 and pl. 35,*1a*). HINDE (1893b, p. 235) synonymized *Inobolia* HINDE, 1884a with *Mammillopora* (as *Lymnorella*) citing as the only significant difference the absence or rarity of oscules and exhalant canals. If filiform spicules truly coat the fibers, *Mammillopora* is very similar to the Cretaceous *Stellispongia* D'ORBIGNY, 1849 (*q.v.*) but differs in having a single, central spicule. HURCEWICZ (1975, p. 276) described a similar spicular structure to that described by HINDE, but in a different species, which need not be congeneric with the type. HINDE (1884a, p. 160–161) considered *Mammillopora* (as *Lymnorea*) as the typical example of a trabecular structure consisting of a single spicule coated by minimal, structureless calcite. However, HINDE later (1893b, p. 235) cited the occasional presence of filiform spicules in this outer layer. This would render his *Lymnorea* type of fiber distinct only in degree from his *Sestrostomella* type (as found in post-Triassic *Sestrostomella*) with a large, central spicule surrounded by filiform spicules. Although BRONN (1825, p. 15) did not cite any species when he established *Mammillopora,* he clearly intended it as a replacement name for the homonymous *Lymnorea* LAMOUROUX, 1821, p. 77.] *Jurassic, ?Cretaceous, Holocene:* Europe, Iran.——FIG. 495,*1a–c.* **M. mamillosa* (LAMOUROUX), Inferior Oolite, Middle Jurassic, Cheltenham, England; *a,* large specimen with nodular surface and numerous ostia, ×1; *b,* vertical section with alternating, concentric growth and development of exhalant canals, ×1; *c,* drawing of part of section showing axial spicules and surrounding, largely recrystallized parts of skeletal fibers, which in other specimens are composed of filiform spicules, ×60 (Hinde, 1893b).

Oculospongia FROMENTEL, 1860a, p. 37 [**O. neocomiensia;* OD] [=*Homalorea* POMEL, 1872, p. 225 (type, *Tremospongia dilatata* ROEMER, 1864, p.

40, OD); *Sphecidion* POMEL, 1872, p. 223 (type, *Manon tubuliferum* GOLDFUSS, 1826, p. 2, OD); ?*Stenocoelia* FROMENTEL, 1861, p. 357 (type, *S. ferryi,* OD); *?Crispispongia* QUENSTEDT, 1877 in 1877–1878, p. 197 (type, *C. expansa,* SD DE LAUBENFELS, 1955, p. 100)]. Sponge massive, encrusting, rounded to conical with broad, convex top; few small, circular oscules, sometimes lipped, scattered singly over top surface; remaining surface of top and sides covered with coarse pores representing intertrabecular spaces; such pores may be vertically elongate on sides; horizontal layers of denser skeleton or horizontal constrictions imply periodic growth; obscure grooves may be present on upper surface; small patches of imperforate, dermal layer may be present; trabeculae, which are sheetlike and curve about tubular interspaces, are minutely spinose. [According to HURCEWICZ (1975, p. 245 and pl. 34,*4*) trabeculae (of a referred Jurassic species not the type) are built of subparallel, smooth and spinose triactines, both regular and sagittal, and the dermal layer is built of two layers of regular triactines with those in the outer layer being smaller and set obliquely to produce a spinose surface. HINDE (1884a, p. 192; 1893b, p. 240), however, described two Jurassic species (the type is Cretaceous) as having a central spicule coated by "sinuous filiform spicules." GREGORIO (1930, p. 47) proposed *Virmula* as a subgenus of *Oculospongia,* to include the new species *Oculospongia (Virmula) notans,* but *Virmula* was treated as a separate genus by DE LAUBENFELS (1955, p. 99), without explanation. This sponge should probably be treated as a subgenus, as was done by GREGORIO.] *Permian, ?Triassic, Jurassic, Cretaceous:* Sicily, *Permian;* Europe, *?Triassic, Jurassic, Cretaceous.*——FIG. 495,*2. O. dilatate* (ROEMER), Lower Greensand, Cretaceous, Farringdon, Berkshire, England; upper surface of characteristic sponge, ×1 (Hinde, 1884a).

Tremospongia D'ORBIGNY, 1849, p. 548 [**Lymnorea sphaerica* MICHELIN, 1846 in 1840–1847, p. 216; OD] [=*Orosphecion* POMEL, 1872, p. 222 (type, *Manon pulvinarium* GOLDFUSS, 1826, p. 2, OD); *Aplosphecion* POMEL, 1872, p. 222 (type, *A. radiciformis,*OD); *Synopella* ZITTEL, 1878b, p. 42, obj.]. Spheroidal with conical base covered by concentrically wrinkled, imperforate, dermal layer; surface of spheroidal part bearing numerous small clusters of exhalant openings; remainder of upper surface reveals trabeculae and intertrabecular spaces; trabecular microstructure unknown. [External form suggests relationship to *Mammillopora* BRONN, 1825. *Aplosphecion* POMEL, 1872, has only a single exhalant, pore cluster but resembles otherwise the others.] *Cretaceous (Turonian):* Europe.

Tretocalia HINDE, 1900, p. 62 [**T. pezica;* OD]. Small, simple, cup-shaped to cylindrical sponges with flat base and funnel- to cup-shaped spongocoel; dermal and gastral surfaces with numerous small, round ostia and minute, irregular interspaces; wall moderately thick and pierced by exhalant canals that parallel dermal surface and expressed on dermal surface as vertical furrows; skeleton a continuous, anastomosing, regular mesh of small fibers cored by ill-defined spicules, either singly or side by side; gastral wall differentiated and basal and lower, dermal layer locally preserved. [Tentatively included in the family. The Eocene age given by HINDE (1900) is in error (PICKETT, 1983, p. 107).] *Neogene (Miocene):* Australia.——FIG. 495,*4a–b.* **T. pezica,* Sherwood Marl, Flinders, Victoria; *a,* side view of small, cup-shaped sponge, ×1; *b,* transverse section with spicule-cored, skeletal fibers, ×60 (Hinde, 1900).

Family ENDOSTOMATIDAE new family

[Endostomatidae FINKS & RIGBY, herein] [type genus, *Endostoma* ROEMER, 1864, p. 39]

Trabeculae of several subequal spicules cemented together. *?Lower Triassic–?Midde Triassic, Upper Triassic (Norian)–Paleogene (Eocene).*

Endostoma ROEMER, 1864, p. 39 [**Scyphia foraminosa* GOLDFUSS, 1829, p. 86; SD DE LAUBENFELS, 1955, p. 97] [=*Tubulospongia* COURTILLER, 1861, p. 135 (type, *T. insignis,* SD DE LAUBENFELS, 1955, p. 108); *?Polyendostoma* ROEMER, 1864, p. 39 (type, *P. sociale,* SD DE LAUBENFELS, 1955, p. 100); *?Astrolmia* POMEL, 1872, p. 115 (type, *Cnemidium astrophorum* GOLDFUSS, 1829, p. 97; OD); ?*Syncalpia* POMEL, 1872, p. 116 (type, *Cnemidium astrophorum* GOLDFUSS, 1829, p. 97, SD RAUFF, 1893, p. 68); *?Holosphecion* POMEL, 1872, p. 224 (type, *H. tuberosum,* OD); *Corynella* ZITTEL, 1878b, p. 35, obj.]. Conicocylindrical, usually simple but sometimes several basally conjoined, characterized by deep, central cloaca; principal, exhalant canals enter cloaca subhorizontally, and on top surface occur as radial grooves converging on osculum; other canals essentially intertrabecular spaces; patches of imperforate dermal layer may cover lower parts of sponge. According to HINDE (1884a, p. 160) fibers are bundles of subparallel, extremely slender triradiates, and paratangential dermal tri- and tetraradiates may be present locally. [Observations by FINKS appear to confirm HINDE's interpretation of the fibers. DUNIKOWSKI (1883, p. 316) noted a predominance of irregular triradiates. HURCEWICZ (1975, pl. 29,*2*) illustrated paratangential, knobby triradiates on the surface of the dermal layer of a Jurassic species, whose trabeculae have the structure described by HINDE. Absence of longitudinal slits in the cloacal wall and absence of large central spicules in trabeculae separate this from *Eusiphonella* ZITTEL, 1878b. The type species is Cretaceous; Permo-Triassic species with spherulitic microstructure once assigned here were separated off as *Precorynella* DIECI, ANTONACCI, & ZARDINI, 1968. They are agelasid demosponges. DE LAUBENFELS's (1955, p. 97) selection of *Scyphia foraminosa* GOLDFUSS, 1829, as type makes this ge-

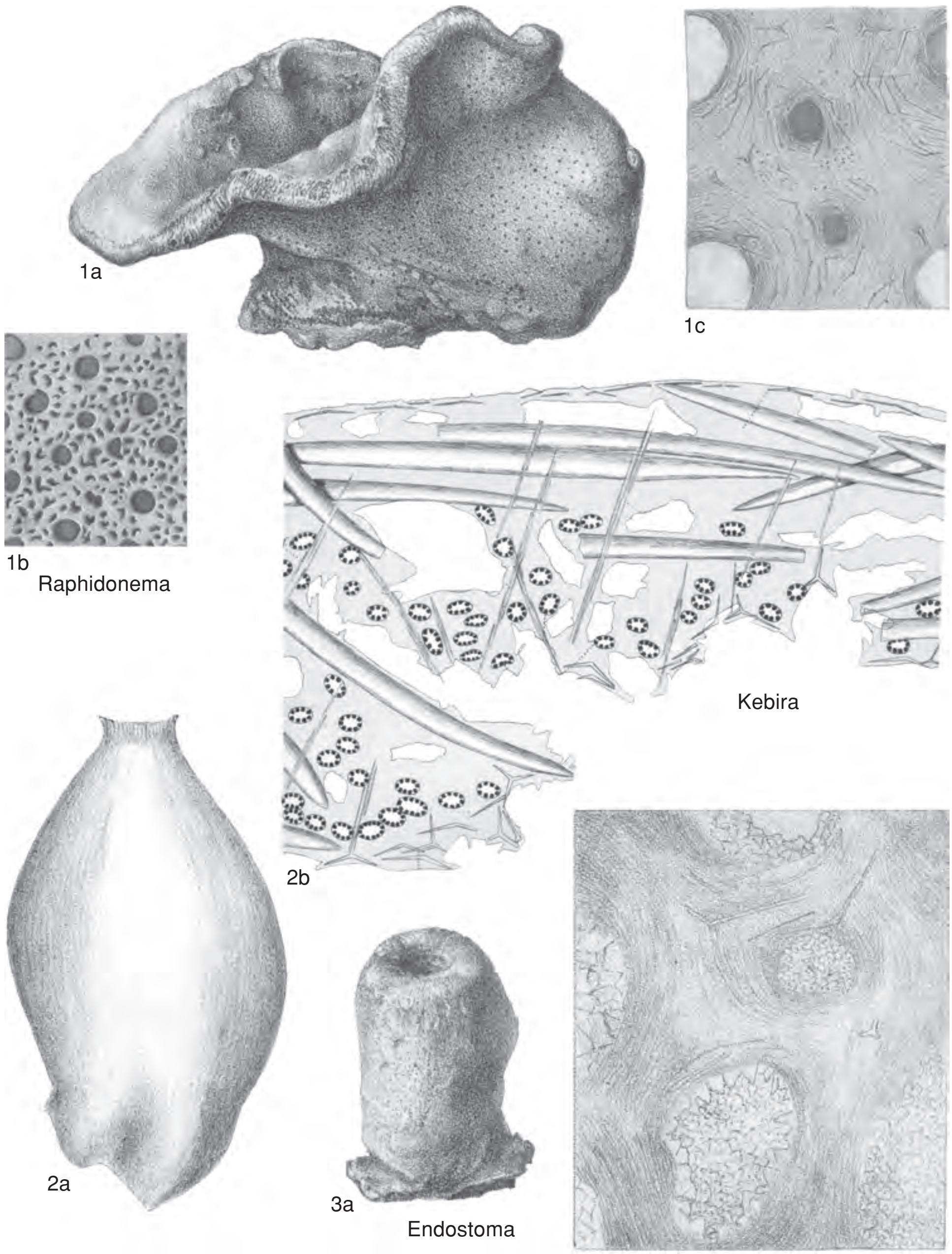

FIG. 496. Endostomatidae and Lelapiidae (p. 748–750).

nus an objective senior synonym of the better-known *Corynella* ZITTEL, 1878b, for which the same species was selected by HINDE, 1884a, p. 179.] *Triassic (Norian)–Cretaceous:* Europe, *?Triassic, Jurassic–Cretaceous;* Iran, *Norian–Rhaetian.*——FIG. 496,*3a–b.* **E. foraminosa* (GOLDFUSS), Lower Greensand, Cretaceous, Farringdon, England; *a,* side view of small, subcylindrical sponge with prominent osculum and spongocoel, ×1; *b,* camera lucida drawing of skeletal relationships showing filiform, three-rayed spicules making up skeletal fibers, ×72 (Hinde, 1884a).

Raphidonema HINDE, 1884a, p. 197 [**R. contortum;* SD DE LAUBENFELS, 1955, p. 99]. Cup shaped, with irregular and wavy outline and relatively thin walls; wall composed of anastomosing, tubular spaces of narrow bore, separated by skeletal trabeculae; larger, straighter tubes more or less perpendicular to inner (exhalant) surface of cup (presumably containing exhalant canals) are spaced quincuncially, penetrating most of wall and opening as pores of same diameter on inner surface (near top of sponge they run obliquely upward); intervening intertrabecular spaces (tubes) open as small, circular pores on both outer and inner surfaces, through a thickened surface layer of skeleton; lower part of inner surface may be so thickened as to obliterate these small pores; fibers (trabeculae) composed of numerous sinuous, laminar or threadlike bodies subparallel to fiber surface, which were interpreted by HINDE (1884a, p. 197 ff.) as triactines with one reduced ray. *Cretaceous–Paleogene (Eocene):* Europe, *Cretaceous;* India, *Eocene.*——FIG. 496,*1a–c.* **R. contortum,* Lower Greensand, Farringdon, Berkshire, England; *a,* side view of specimen with convolute walls with small, inhalant ostia, ×1; *b,* enlargement of dermal surface with circular, inhalant ostia and intervening skeletal net, ×5; *c,* camera lucida drawing of part of interior skeleton with thin, threadlike bodies that HINDE (1884a) interpreted as triradiate spicules in fibers, ×50 (Hinde, 1884a).

Family LELAPIIDAE Dendy & Row, 1913

[Lelapiidae DENDY & ROW, 1913, p. 784]

Spicules organized in tracts. *Holocene.*

Lelapia GRAY, 1867, p. 557 [**L. australis;* OD] [=*Paralelapia* HOZAWA, 1923, p. 185 (type, *Lelapia nipponica* HARA, 1894, p. 369, OD); ?*Kebira* ROW, 1909, p. 210 (type, *K. uteoides,* OD)]. Sponge cylindrical or club shaped with central cloaca and terminal oscule; inhalant pores scattered over surface; dermal layer of sagittal triradiates and microxeas; interior with crisscrossing bundles of tuning-fork spicules, their paired rays usually facing gastrally, as well as separate, irregularly arranged, very large oxeas; gastral layer of sagittal triradiates, and rare sagittal quadriradiates (with short fourth ray facing cloaca); oscule surrounded by vertical palisade of oxeas; choanocyte nuclei apical; larva not known. [*Paralelapia* HOZAWA, 1923 differs only in the subdermal location of the large oxeas and in the radial arrangement of the tuning-fork bundles, which start from the unpaired rays of gastral triradiates, a condition also seen in the type species.] *Holocene:* Indo-Pacific.

?Kebira ROW, 1909, p. 210 [**K. uteoides;* OD]. Ovoid with central cloaca and terminal osculum; dermal layer of small, sagittal triradiates underlain by very large oxeas oriented longitudinally; gastral layer of small, equiangular and sagittal triradiates; in choanosome between these two layers are radial bundles of sagittal triradiates whose paired rays, uniformly directed gastrally, are vestigial bumps; choanocyte nuclear position and larva not known. [The chief distinction between this genus and *Lelapia* GRAY, 1867, lies in the vestigial, paired rays of the tuning-fork spicules, for contrary to ROW's opinion (1909, p. 210) it seems possible for vestigial rays to curve sufficiently to form tuning forks with continued growth, and the bundled spicules need not be regarded as a fundamentally different kind of spicule in this genus.] *Holocene:* Red Sea.——FIG. 496,*2a–b.* **K. uteoides,* Tela Tela Kebira, Red Sea, Sudan; *a,* side view of flask-shaped sponge, ×6; *b,* longitudinal section through sponge showing distribution of large oxeas and smaller, triradiate spicules, ×40 (Row, 1909).

Order SPHAEROCOELIIDA Vacelet, 1979

[Sphaerocoeliida VACELET, 1979, p. 492] [=suborder Sphinctozoa STEINMANN, 1882, p. 149, *partim;* order Thalamida DE LAUBENFELS, 1955, p. 100, *partim*]

Cortex of calcite with embedded, calcite spicules; no trabeculae; body organized in chains of modular segments. *Permian–Cretaceous (Cenomanian).*

Family SPHAEROCOELIIDAE Steinmann, 1882

[Sphaerocoeliidae STEINMANN, 1882, p. 150; *emend.,* FINKS & RIGBY, herein] [=Sphaerocoeliidae STEINMANN, 1882, p. 150, *partim;* Barroisiidae DE LAUBENFELS, 1955, p. 101, *partim*]

Cylindroid, composed of superposed chambers without internal structures; central osculum in each chamber, endowall present only in *Barroisia* MUNIER-CHALMAS, 1882; exopores subpolygonal (circular in *Tremacystia* HINDE, 1884a); calcareous, sagittal triradiates embedded in calcite wall; in addition, tetraradiates present except in *Barroisia,* monaxons except in *Tremacystia. Permian–Cretaceous (Cenomanian).*

Sphaerocoelia STEINMANN, 1882, p. 162 [**Thalamopora michelini* SIMONOWITSCH, 1871, p. 31; OD]. Spheroidal to hemispheroidal segments clearly marked externally, increasing in size noticeably in a curved or bent, linear series; large, central osculum at top of each chamber but no endowall; closely spaced, circular or subpolygonal exopores; interwall with its pores a continuation of exowall of preceding chamber. [HINDE (1884a, p. 173) reported interwall is double; STEINMANN (1882, p. 162) said

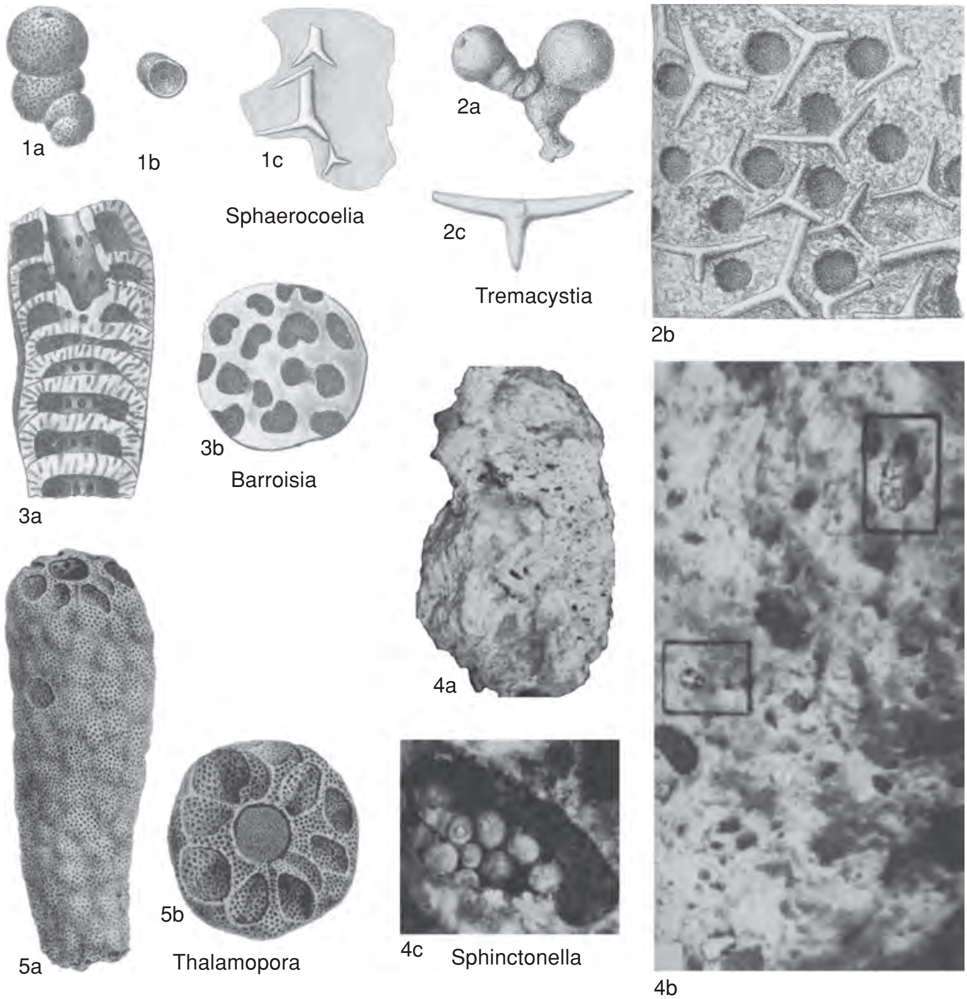

FIG. 497. Sphaerocoeliidae (p. 750–752).

wall built of small, curved monaxons closely packed, but DUNIKOWSKI (1883, p. 317) reported also triradiates (sagittal in his illustration) and a few tetraradiates from topotypes assigned to the same species. In view of homeomorphy of similar Cretaceous forms, and uncertainty as to spicule complement of the type, reported distribution outside the type locality and stratigraphic age (or even within it) must remain doubtful.] *Permian–Cretaceous (Cenomanian):* Tunisia, *Permian;* Germany (Essen), France, Czech Republic, Slovakia, *Jurassic–Cretaceous (Cenomanian).*——FIG. 497,*1a–c.* **S. michelini* (SIMONOWITSCH), Cenomanian beds, Essen area, Germany; *a,* side view of small type with spheroidal, porous chambers, ×2; *b,* view from above showing central osculum and surrounding, coarse pores, ×10 (Steinmann, 1882); *c,* camera lucida drawing showing triradiate spicules in a fragment, ×50 (Dunikowski, 1883).

Barroisia MUNIER-CHALMAS, 1882, p. 425 [**Tubipora anastomosans* MANTELL, 1838, p. 636; OD]. Conicocylindrical branching tubes without external segmentation; central cloaca about one-third sponge diameter; exowall netlike with subpolygonal, substellate exopores; interwalls gently arched distally, chambers low, interpores polygonal; endowall continuous, with horizontal whorl of large, circular endopores in each chamber; exowall consisting of inner layer of felted triradiates parallel to wall and outer layer of penicillately arranged tylostyles, tylote ends outwardly, both embedded in finely fibrous groundmass (REID, 1968d, p. 3). [MUNIER-CHALMAS's publication is dated June 5, 1882. STEINMANN, 1882, p. 163, ascribed the genus to MUNIER-CHALMAS but noted it as a manuscript name. Inasmuch as STEINMANN's publication bears only the date 1882 (published as the second of two Bande for the Jahrgang 1882), and Article 21 of the *Code* (ICZN, 1999) states that in the absence of evidence for a day or month of publication, the date of publication is to be taken as the last day of the year, it would be consistent both with the *Code* and with STEINMANN's intentions to ascribe the genus solely to MUNIER-CHALMAS (RMF).] *Cretaceous (Aptian–Albian, Cenomanian):* Czech Republic, Slovakia, England, France, Germany, Greece, Spain, Romania.——FIG. 497,*3a–b*. **B. anastomosans* (MANTELL), Aptian, Blangy, northern France; *a,* longitudinal section showing tubular spongocoel with coarse endopores, and porous interwalls and exowalls, ×3; *b,* transverse section of exowall with irregular, inhalant ostia, ×10 (Steinmann, 1882).

Sphinctonella HURCEWICZ, 1975, p. 280 [**S. trestiani;* OD]. Massive, sometimes encrusting; composed of blisterlike chambers of irregularly ovate cross section, numerous small chambers interspersed between fewer larger ones; chamber walls microvesicular; small pores in chamber walls communicating with these vesicular spaces, while larger pores communicating between chambers [it is unclear whether some of these vesicular spaces and chambers might not be tubular and anastomosing]; chamber lumens generally empty but some contain obscure, spheroidal bodies or tubular structures; walls said to contain "traces of small, densely spaced numerous monactines and some triactines" (HURCEWICZ, 1975, p. 281). [The genus was placed with some question into the family Cryptocoeliidae by SENOWBARI-DARYAN (1990) because of the uncertain character of the tubular filling structure but is included here in the Sphaerocoeliidae because of the reported spicules.] *Jurassic (Oxfordian):* Poland.——FIG. 497,*4a–c*. **S. trestiani,* Jurassic beds, Kujawy; *a,* holotype, broken surface, with chambers of various sizes, ×1; *b,* enlarged surface of holotype with chambers indicated, ×8; *c,* enlarged chamber with filling structures, UL Sp VII/2, ×10 (Hurcewicz, 1975; courtesy of *Acta Palaeontographica Polonica,* Polska Akademia Nauk).

Thalamopora ROEMER, 1840 in 1840–1841, p. 21 [**Thalamopora (Ceriopora) cribrosa* GOLDFUSS, 1826, p. 32; OD]. Conicocylindrical, small, occasionally branching; central cloaca one-fourth or more of sponge diameter; surrounded by thalamidarium of globose chambers; exopores and interpores subequal, circular, small, numerous, and closely spaced; single larger endopore communicating with cloaca from inner, narrow end of each chamber; no trabecularium. [DUNIKOWSKI (1883, p. 323) stated that he has observed triradiates in the wall, and STEINMANN (1882, p. 168) stated that sections of spicules similar to those of *Barroisia* MUNIER-CHALMAS, 1882, are visible locally in cut sections on a few specimens. Genus resembles *Cystauletes* KING, 1943, perhaps homeomorphically.] *Cretaceous (Cenomanian):* Germany.——FIG. 497,*5a–b*. **T. cribrosa* (GOLDFUSS), Mergelgrande, near Essen, Ruhr region; *a,* side view of typical sponge showing subcylindrical, chambered form with central spongocoel, ×2; *b,* view from above showing central, tubular spongocoel and surrounding, radially arranged chambers, ×3 (Goldfuss, 1833).

Tremacystia HINDE, 1884a, p. 171 [**Verticillites dorbignyi* HINDE, 1882, p. 192; SD DE LAUBENFELS, 1955, p. 101]. Spheroidal, overlapping segments in short, upwardly expanding, branching series, last chamber being noticeably larger and more globose; small, circular, central osculum at top of each chamber, but endowall absent; exopores small, circular, separated slightly more than their diameter; interwall an extension of underlying exowall with its pores; one specimen of type series has imperforate, endowall-like, central tube in terminal chamber, which is of similar structure to a vesicle in preceding chamber; walls composed of small, very thin (filiform), sagittal triradiates with nearly orthogonal, paired rays curved about pores, generally reduced third ray directed away from them (or else completely missing); outside these smaller spicules are larger, sagittal triradiates and tetraradiates, with paired rays often subhorizontal, unpaired ray directed downwardly, and fourth ray, when present, directed inwardly; spicules uncemented or partly to completely embedded in granular calcite, which may be diagenetic; small, sagittal triradiates found on surfaces of imperforate tube and vesicle, their paired rays horizontal and unpaired ray directed downwardly, being much more reduced on inner side of tube (REID, 1969a, p. 2–3). *Cretaceous (Albian–Cenomanian):* England, France.——FIG. 497,*2a–c*. **T. dorbignyi* (HINDE), Upper Greensand, Wiltshire, England; *a,* side view of branching, figured specimen with globose chambers, ×1; *b,* part of outer wall with circular, inhalant ostia and large, tetraradiate spicules of dermal layer, ×30; *c,* detached tetraradiate spicules from dermal layer, ×50 (Hinde, 1884a).

Order LITHONIDA Doederlein, 1892

[Lithonida DOEDERLEIN, 1892, p. 143] [=Lithonia VACELET, 1981, p. 325; *emend.,* VACELET, 1981, p. 325; Stereina DE LAUBENFELS, 1955, p. 99, *partim*]

Hypercalcified Calcaronea. *Jurassic–Holocene.*

Family LEPIDOLEUCONIIDAE Vacelet, 1967

[Lepidoleuconiidae VACELET, 1967a, p. 54]

External armor of scales derived from triradiates; choanosomal skeleton of scat-

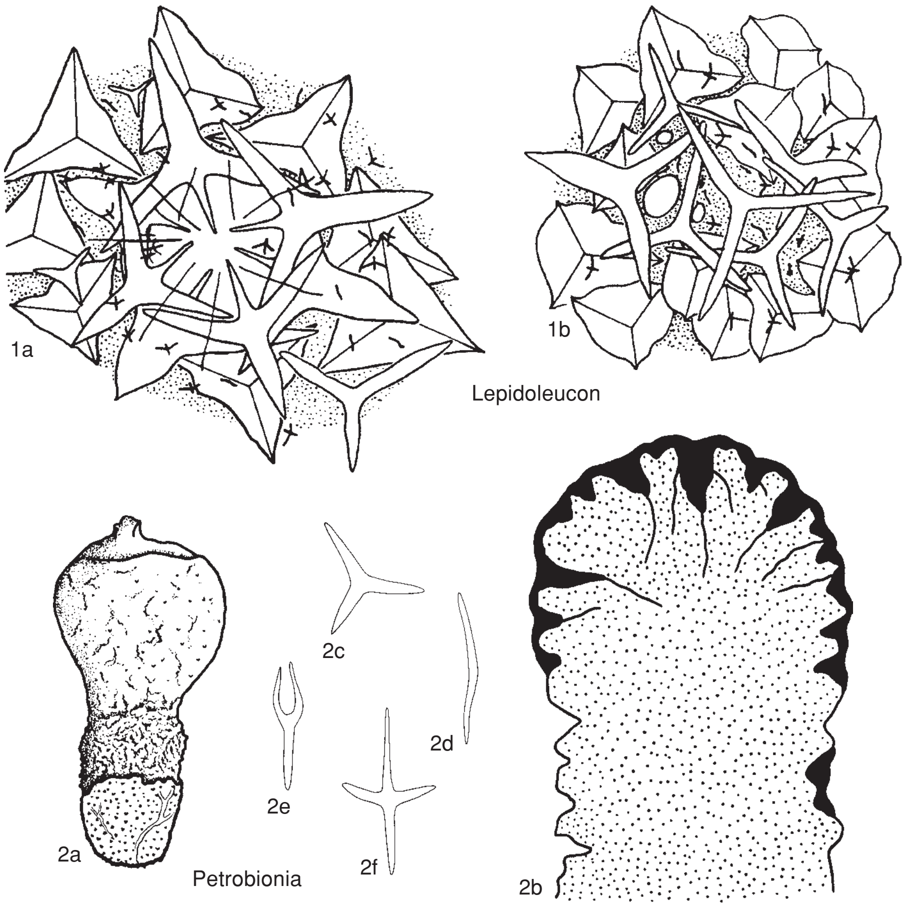

FIG. 498. Lepidoleuconiidae and Petrobionidae (p. 753–758).

tered microdiactines; oscular area with modified tetractines. *Holocene.*

Lepidoleucon VACELET, 1967a, p. 54 [**L. inflatum;* OD]. Domical, encrusting, very small; central, circular osculum and lateral, oval, inhalant area form only openings in armor of triangular to circular, overlapping scales derived from enlargement of equiangular triradiates; inhalant area supported by nonenlarged, equiangular triradiates; osculum surrounded by partially enlarged, equiangular tetraradiates whose short, fourth ray (in the same plane) is directed toward oscular center, as are smaller monaxons radially arranged; sponge interior containing only microbiradiates and microtetraradiates with spinose microbiradiates in inhalant area; choanocyte nucleus apical, and larva an amphiblastula. *Holocene:* Indo-Pacific.——FIG. 498,*1a–b.* **L. inflatum,* reefs at Tulear and Songeritelo, Madagascar; *a,* drawing of spicule arrangement around osculum, includes microdiactine and tetractines as well as larger triactines and tetractines, some of which are enlarged into triactine-based scales, ×100; *b,* drawing of spicule arrangement around inhalant zone with same types of spicules, ×100 (Vacelet, 1967a).

Family MINCHINELLIDAE Dendy & Row, 1913

[Minchinellidae DENDY & ROW, 1913, p. 739] [=Minchinellidae DENDY & ROW, 1913, p. 739, *partim;* Porosphaeridae DE LAUBENFELS, 1955, p. 99, *partim;* Bactronellidae DE LAUBENFELS, 1955, p. 100, *partim*]

Principal skeleton composed of layers of tetraradiates with three curving, downwardly directed rays and one straight, upwardly directed ray, spicules cemented together with fibrous calcite. Additional spicules, including tuning forks, loose in flesh. [The order Lithonida DOEDERLEIN, 1892, as originally defined (group Lithones) is coterminous with the family Minchinellidae. VACELET (1981, p. 315) expanded the definition to include the other calcaronean families with a massive skeleton, namely the Petrobionidae and the Lepidoleuconidae.] *Jurassic–Holocene.*

Minchinella KIRKPATRICK, 1908, p. 504 [**M. lamellosa;* OD]. Flabellate or ear-shaped sponge with one flat side inhalant and other exhalant; inhalant and exhalant chimneys of soft parts represented in rigid skeleton by raised, circular rims occurring in radial rows on inhalant surface, more scattered and larger on exhalant one; principal skeleton formed of spinose tetraradiates with one straight, distal ray and three arcuate, proximal rays, cemented together by coating of radially fibrous calcite (clino- to orthogonal, WENDT, 1979, p. 454) with a finely papillose surface; loose spicules of soft parts including surface layer of spinose monaxons, chimneys also surrounded by apparatus of sagittal triradiates with unpaired ray parallel to axis of chimney, pointing downwardly, and paired rays nearly at right angles to it, along with similar quadriradiates, their fourth ray pointing toward chimney axis; unpaired ray is generally longer than paired rays in both spicule types but may be shorter in some spicules; tuning-fork spicules also present in basal parts of chimneys; leuconoid sponge hermaphroditic and incubating a parenchymella larva; nucleus of choanocytes is apical. *Holocene:* Indo-Pacific.——FIG. 499,*1a–e.* **M. lamellosa,* Api, New Hebrides; *a,* dermal surface of holotype; *b,* gastral surface of holotype, ×1; *c,* quadriradiate, long, gastral ray and nearly equal basal rays; *d,* tuning fork spicule; *e,* monaxon from surface of oscular chimney, ×200 (Kirkpatrick, 1908; courtesy of Taylor & Francis, *Annals and Magazine of Natural History*).

Bactronella HINDE, 1884a, p. 205 [**B. pusillum;* OD]. Sponge club shaped, branching, discoid, or encrusting; principal skeleton formed of spinose quadriradiates with very long, distal ray and three shorter, arcuate, proximal rays with terminal, clasping expansions, spicules arranged so that distal rays line up to form more or less continuous, radial rods and proximal rays outlining radial canals; smaller triradiates with orthogonal, proximal rays may connect larger spicules laterally; net fused together by microhispid smaller spicules; dermal layer covering much of outer surface, spicules of which could not be observed in type species but which in referred species consisting of tangent monaxons and sagittal triradiates; basal layer consisting of uncemented quadriradiates, similar to those of principal skeleton, together with smooth triradiates and quadriradiates. [The basal layer was described by HINDE (1900, p. 59 ff.) from the type species and the associated *Bactronella parrula* HINDE from Victoria, Australia. VACELET (1967a, p. 49) suggested that several Holocene species that he described as *Plectroninia* might be better referred to *Bactronella.*] *Jurassic–Neogene (Miocene), ?Holocene:* Germany, *Jurassic;* France, *Cretaceous;* USA (North Carolina), *Eocene;* Australia (Victoria), *Miocene;* Madagascar, Mozambique, *?Holocene.*——FIG. 499,*3a–c.* **B. pusillum,* Upper Jurassic, probably from Thurnau, Bavaria, Germany; *a,* side view of small type specimen, ×2; *b,* part of transverse section showing canals in outer part and general appearance of central part, ×20; *c,* part of three-rayed spicule showing spinous character of rays, ×200 (Hinde, 1884a).

Muellerithalamia REITNER, 1987b, p. 95 [**Verticillites extensus* LANG, 1985, p. 5; OD]. Minchinellid sponge with calcitic, basal skeleton that may be chambered but without regular, thalamid structure; cylindrical spongocoel may be present; microstructure orthogonal to hemispherical; internal structure irregular (reticulate) to trabecular; prosopores and apopores developed; rigid spicules present within trabecular structures of basal skeleton; spicules are modified monactines, triaenes, and calthrops. *Upper Jurassic:* southern Germany.——FIG. 500,*1a–c.* **M. extensus* (LANG), Frankenalb; *a,* longitudinal section showing irregular, chambered structure and axial spongocoel, ×2; *b,* part of outer wall of *a,* with small, inhalant prosopores but larger apopores (*arrows*), ×4; *c,* drawing of part of basal skeleton with spicules, ×10 (Reitner, 1987b).

Petrostroma DOEDERLEIN, 1892, p. 145 [**P. schulzei;* OD]. Branching twigs arising from encrusting, basal, laminar expansion; principal skeleton composed of quadriradiates cemented together in continuous net with upwardly and outwardly radiating elements (fused distal rays of possible quadriradiates) connected laterally by thinner elements, and showing denser growth laminations parallel to branch tip; principal quadriradiates generally smooth and oriented with three arched, proximal rays facing inwardly and straight, pointed distal ray faced outwardly; more irregular and spinose, smaller quadriradiates fill in mesh spaces near surface; dermal layer of loose spicules including smooth, sagittal triradiates and tetraradiates plus crisscrossing bundles of parallel, tuning-fork spicules. [No known suitable figures.] *Cretaceous–Paleogene (Eocene):* Germany, France, *Cretaceous;* Japan, *Eocene.*

Plectroninia HINDE, 1900, p. 51 [**P. halli;* OD]. Sponge fig shaped, cake shaped, or crustlike; sides covered with dermal layer, large, exhalant canals perpendicular to upper surface with equivalent grooves on side of upper margin; principal skeleton formed of spinose quadriradiates with long, pointed, distal ray and three shorter, curved, proximal rays with terminal expansions, organized roughly into layers with distal rays outwardly and proximal rays fixed to underlying spicules by terminal expansions and by investing calcite cement with microhispid surface; orientation is not uniform and concentric and radial, organization is not evident; dermal layer of uncemented spicules

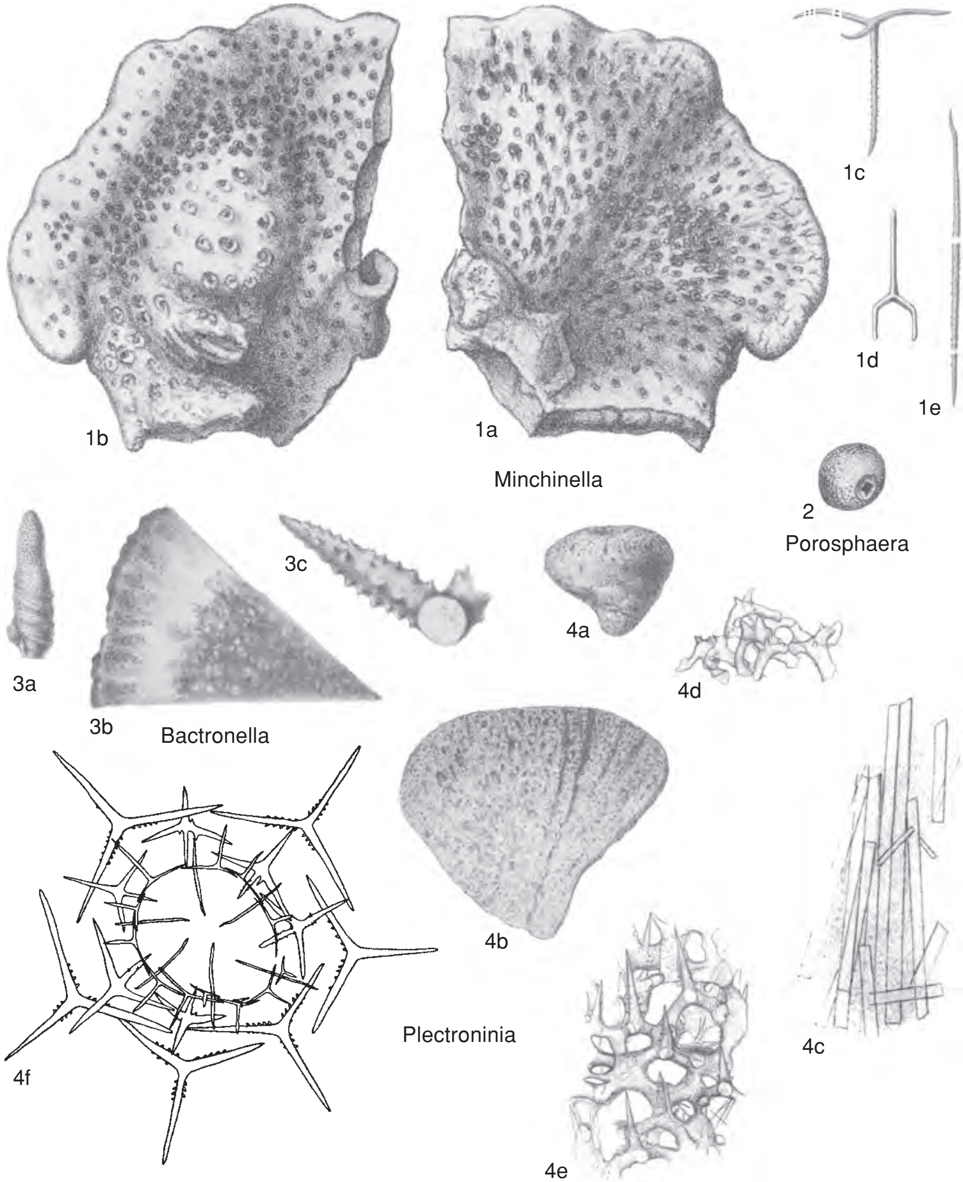

FIG. 499. Minchinellidae (p. 754–756).

consisting of outer thatch of smooth monaxons oriented vertically (perpendicular to top growing edge) under which is layer of irregularly oriented, small monaxons, smooth triradiates, and tetraradiates (both symmetrical and sagittal), tuning-fork spicules, and small, loose spicules similar to those of principal net; basal layer consisting of spicules as in principal net but small and uncemented; periodic intercalations of basal layer, sometimes accompanied by dermal-type spicules, may occur within principal skeleton, parallel to upper surface of sponge, and presumably indicate periodic interruptions (possibly seasonal) in growth; choanoctye chambers in upper layer of principal skeleton, storage cells (thesocytes) may be present in basal layer (VACELET, 1967b, p. 124). *Cretaceous–Holocene:* Europe, *Cretaceous;* USA (North Carolina), *Eocene;* Australia (Victoria), *Miocene;* Indo-Pacific, Mediterranean, *Holocene.* ——FIG. 499,*4a–e.* **P. halli,* Miocene, Fyansford Formation, Moorabool River, Victoria, Australia; *a,* side view of holotype, ×1; *b,* vertical section showing canal development, ×2; *c,* fragment of dermal layer with long, lance-shaped to styliform monaxial spicules, ×100; *d,* fragment of basal layer, ×100; *e,* vertical section of skeletal mesh showing radial arrangement of apical rays and manner of junction of other rays, ×50 (Hinde, 1900).——FIG. 499,*4f. P. pulchella* VACELET, Holocene, reef at Tulear, Madagascar; drawing of spicule arrangement around oscule with representative spicules, ×100 (Vacelet, 1967a).

Porosphaera STEINMANN, 1878, p. 120 [**Millepora globularis* PHILLIPS, 1829 in 1829–1836, p. 186; OD]. Spheroidal to hemispheroidal, latter forms with concentrically wrinkled, concave base, and varying from oblate to prolate; spheroidal forms may have meridional, exhalant grooves, sometimes branched, converging on one end, which may be produced into mamelon; spheroidal forms may be penetrated wholly or partly by central tube that appears to be mold of attachment to seaweed stem or similar object; patches of a dermal layer may occur on outer surface, in addition to concentrically wrinkled, basal layer of hemispheroidal form; narrow, subequal, closely spaced, radial canals radiate from center of sponge or from center of flat base when present, and open as circular pores at surface; principal skeleton consisting of quadriradiates with long, pointed, sometimes laterally spined, distal ray and three short, bowed, proximal rays with terminal, clasping expansions, ensemble of such spicules fused into continuous net by coating of cement; basal, dermal layer of small monaxons parallel to edge of sponge, outside of which is thatch of similar spicules arranged radially; upper, dermal layer composed of tangential, small, smooth triradiates, quadriradiates, and monaxons, not otherwise oriented, except that local, concentric arrangements of monaxons external to rest appear to have surrounded a pore. *Cretaceous:* Europe, USA.——FIG. 499,*2.* **P. globularis* (PHILLIPS), Chalk, Upper Cretaceous, Yorkshire, United Kingdom; small, globular sponge, YM, ×1 (Phillips, 1836 in 1829–1836).

Porosphaerella WELTER, 1911, p. 16 [**P. subglobosa* WELTER, 1911, p. 23; OD]. Club shaped, sometimes clustered or branched, sometimes encrusting; base always concave with concentrically wrinkled, dermal layer; longitudinal sections having longitudinal, subparallel, wide, skeletal fibers that presumably represent fused, superposed, distal rays of quadriradiates, connected by thin, horizontal elements, widely spaced but at same level across sponge, and possibly representing smaller quadriradiates with orthogonal, proximal rays, or else repeated basal layers with monaxons; no spicules observed in concentrically wrinkled, dermal layer at base of sponge, but possible cross sections of such spicules were seen in horizontal elements of sponge interior. [Externally, this genus resembles some specimens of *Porosphaera* described by HINDE (1904, pl. 1,*27–28*), as well as *Bactronella* HINDE, 1884a.] *Cretaceous:* Germany, France.——FIG. 500,*4a–b.* **P. subglobosa,* Essener Grünsand, Cenomanian, Essen, Germany; *a,* view from above of encrusting, globular to nodose form, ×1; *b,* part of dermal skeleton showing coarse, skeletal fibers connected by thin, weblike elements, spinose rays may have arisen from coarse, fiber junctions, ×29 (Welter, 1911).

Retispinopora BRYDONE, 1912, p. 112 [**R. arbusculum;* SD DE LAUBENFELS, 1955, p. 107]. Very small, conoidal or stalagmite-like sponges with concave, sometimes expanded base that may bear few concentric wrinkles; surface pores formed by interspicular spaces of principal skeleton, which is built of anapodal triradiates similar to those of *Porosphaera* STEINMANN, 1878. [Except for their very small size, these sponges resemble *Porosphaera* with which they may occur; it is possible that they are merely juveniles of that genus.] *Cretaceous–Paleogene (Danian):* England, *Cretaceous;* Denmark, *Danian.*——FIG. 500,*2.* **R. arbusculum,* Chalk of Hants, Upper Cretaceous, Cosham, England; side view of small, porous, conoidal sponge, ×12 (Brydone, 1912).

Sagittularia WELTER, 1911, p. 33 [**S. adfixa* WELTER, 1911, p. 34; OD]. Hemispheroidal or encrusting; concave base covered with concentrically wrinkled, dermal layer; principal skeleton built of superposed layers of large, anapodal quadriradiates with long, spinose, distal ray and short, proximal rays fused by cement into continuous, horizontal layers; between these larger spicules are smaller quadriradiates cemented into fine meshwork; spicules of basal dermal layer not ascertainable. *Cretaceous:* Germany, France.——FIG. 500,*3a–b.* **S. adfixa,* Essener Grünsand, Cenomanian, Essen, Germany; *a,* side view of globose, typical specimen, ×1; *b,* enlarged section of skeleton showing coarse rhabdome with axial canal and interconnecting, fine meshwork, ×29 (Welter, 1911).

Tulearinia VACELET, 1977a, p. 354 [**T. stylifera;* OD]. Encrusting, very small; circular oscule; coarse, styliform monaxons in surface layer, both tangential and protruding, together with large, sagittal triradiates interlaced to form cortex; sponge interior with microdiactines; basal layer of large, sagittal quadriradiates with fourth ray directed upwardly and remaining, somewhat irregular rays interlaced and underlain by layer of smaller, sagittal triradiates; oscule enclosed by paired rays of thin triradiates, and of tetraradiates whose fourth ray is directed toward oscular center; choanocyte nucleus apical. *Holocene:* Indian Ocean.——FIG. 500,*5a–e.* **T. stylifera,* off Island of Réunion; *a,* photomicrograph of section perpendicular to surface of oscular opening margined by triradiate spicules, MNHN J.V.-76-1, ×65; *b–e,* characteristic spicules including surficial diactines, tetractines of basal network, perioscular triactines, perioscular tetractines, ×50 (Vacelet, 1977a; courtesy of *Publications Scientifiques du Muséum national d'Histoire naturelle, Paris*).

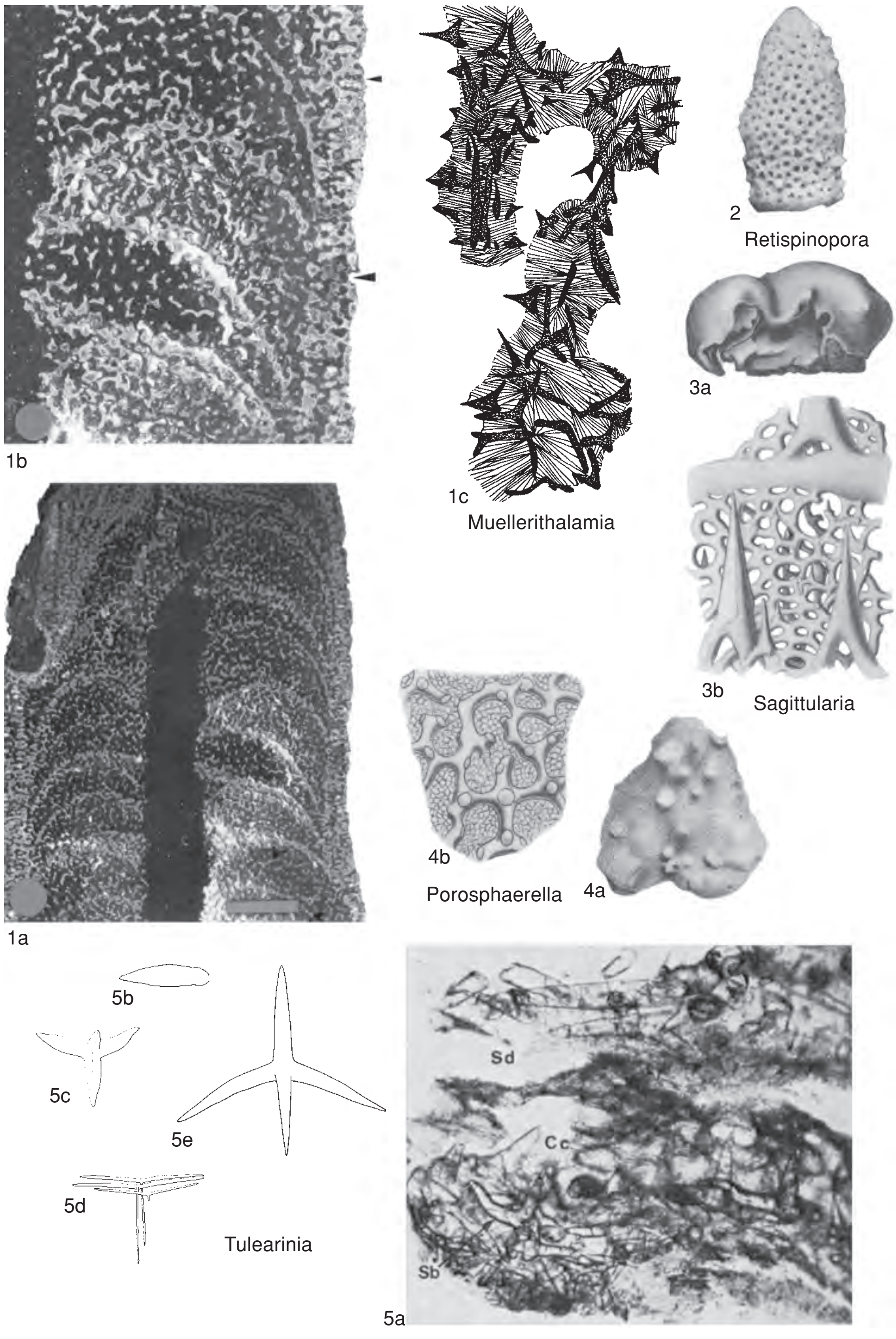

FIG. 500. Minchinellidae (p. 754–756).

Family PETROBIONIDAE Borojevic, 1979

[Petrobionidae Borojevic, 1979, p. 529]

Massive skeleton of spherulitic and penicillate calcite with irregular pits containing flesh of sponge; loose, calcareous spicules also present. *Holocene.*

Petrobionia Vacelet & Lévi, 1958, p. 318 [**P. massiliana;* OD]. Globular, cylindrical, or club shaped; principal skeleton a nearly solid mass of irregular magnesian calcite spherulites and areas of penicillate structure; upper surface deeply and irregularly pitted, in which spaces living tissues are lodged, with extensions into branching tunnels that penetrate more deeply into massive skeleton; spicules of flesh including sagittal quadriradiates and triradiates whose paired rays surround oscules, paired rays of quadriradiates being nearly orthogonal, tuning-fork spicules, and microdiactines; choanocyte nucleus apical and larva amphiblastula. *Holocene:* Mediterranean.——Fig. 498,*2a–f.* **P. massiliana,* Gulf of Marseille; *a,* drawing of side view showing growth form, ×1; *b,* schematic, longitudinal section showing living tissue in black over massive, internal structure, ×2; *c–f,* spicules of sponge, ×100 (Vacelet & Lévi, 1958).

Order and Family UNCERTAIN

Gravestockia Reitner, 1992, p. 99 [**G. pharetroniensis;* OD]. Small, upright sponges that possess a rigid skeleton of tetractine desmas, with uncemented, monaxial spicules and regular triaenes in dermal skeleton; tetractines with branched ray tips comparable to zygomes in demosponges; each spicule a single crystal of calcite. [Taxonomic position of the sponge is uncertain, but Reitner (1992, p. 100) concluded that it is not a heteractinid form. Pickett (2002a, p. 1,119) suggested that the genus is similar to modern, lithonine, calcareous sponges, and hence the genus is tentatively included here.] *Lower Cambrian:* South Australia.——Fig. 501*a–c.* **G. pharetroniensis,* Flinders Range, Atdabanian; *a,* holotype section of sponge that grew on an archaeocyathan, IPFUB/JR 1992/1, ×10; *b,* section of choanosomal skeleton composed principally of calcareous, desmalike spicules, scale bar, 100 µm; *c,* enlarged section of free dermal triaene, REM back scatter image, scale bar, 100 µm (Reitner, 1992).

Class and Order UNCERTAIN

Family POLYACTINELLIDAE Mostler, 1985

[Polyactinellidae Mostler, 1985, p. 14]

Sponges whose forms are unknown, but which are characterized by distinctive, calcareous spicules with three-rayed, basic structure but which may have 3, 5, 6, 9, or 12 additional rays developed. *Lower Cambrian–Permian.*

?Polyactinella Mostler, 1985, p. 15 [**P. furcata;* OD] [?=*Dodecaactinella* Reif, 1968, p. 741 (type, *D. oncera,* OD)]. Spicules with six rays that diverge from a central point, three of which are short and three of which are longer and bifurcate distally into two rays, to produce a nine-rayed spicule. *Lower Cambrian–Middle Cambrian:* Sardinia.——Fig. 502,*1.* **P. furcata,* archaeocyathid limestone of Matoppa Member, Lower Cambrian, Iglesiente, southwestern Sardinia; type spicule with three short rays and three longer primary rays that bifurcate, ×100 (Mostler, 1985; courtesy of *Naturwissenschaftlich-Medizinischer Verein in Innsbruck*).

Bengtsonella Mostler, 1996b, p. 228 [**B. australiensis;* OD]. Sponges characterized by three-rayed spicules whose distal ray tips are trifurcate and whose proximal ray segments are very short; medial ray of trifurcate tip short and two diverging long and curved. *Lower Cambrian:* South Australia.——Fig. 502,*4.* **B. australiensis,* Ajar Limestone, Mt. Scott Range; holotype spicule showing distinctive ray development, ×200 (Mostler, 1996b).

?Dodecaactinella Reif, 1968, p. 741 [**D. oncera;* OD] [?=*Polyactinella* Mostler, 1985, p. 15 (type, *P. furcata,* OD)]. Spicules with six initial rays that diverge from a central point, three shorter and three longer, trifurcating distally to produce spicules with 12 rays. [Bengtson (1990a) placed *Polyactinella* and *Sardospongia* into synonymy with *Dodecaactinella.* Mehl and Lehnert (1997) later concluded that there are no transition forms between *Dodecaactinella* and *Sardospongia* and that those genera should be kept separate. They also concluded that there are transition forms between *Dodecaactinella* and *Polyactinella* and that those genera should be combined.] *Lower Cambrian–Upper Ordovician:* Sardinia, Siberia, Argentina, Australia.——Fig. 502,*2a–b.* **D. oncera,* Borkholmer beds, Upper Ordovician, Borkholm, Estonia; holotype spicules, SPIT Po 1352/24, ×40 (Reif, 1968; courtesy of *Neues Jahrbuch für Geologie und Paläontologie, Monatshefte*).

Dvorcia Nekvasilová & Stemproková, 1960, p. 403 [**D. mira;* OD]. Sponges characterized by synphobetractine spicules whose two lower rays are fused at their tips; lower rays may be much shorter than upper rays. *Lower Ordovician–Permian:* Czech Republic, Slovakia, Sweden.——Fig. 502,*5a–b.* **D. mira,* Lower Devonian, Bohemia; isolated spicules showing variation in growth form, ×75 (Mostler, 1996b).

Kucerella Mostler, 1996b, p. 233 [**K. prokopensis;* OD]. Sponges characterized by synphobetractines whose lower rays are greatly swollen and partially fused. *Lower Devonian (Pragian):* Czech Republic, Slovakia.——Fig. 502,*3.* **K. prokopensis;* isolated

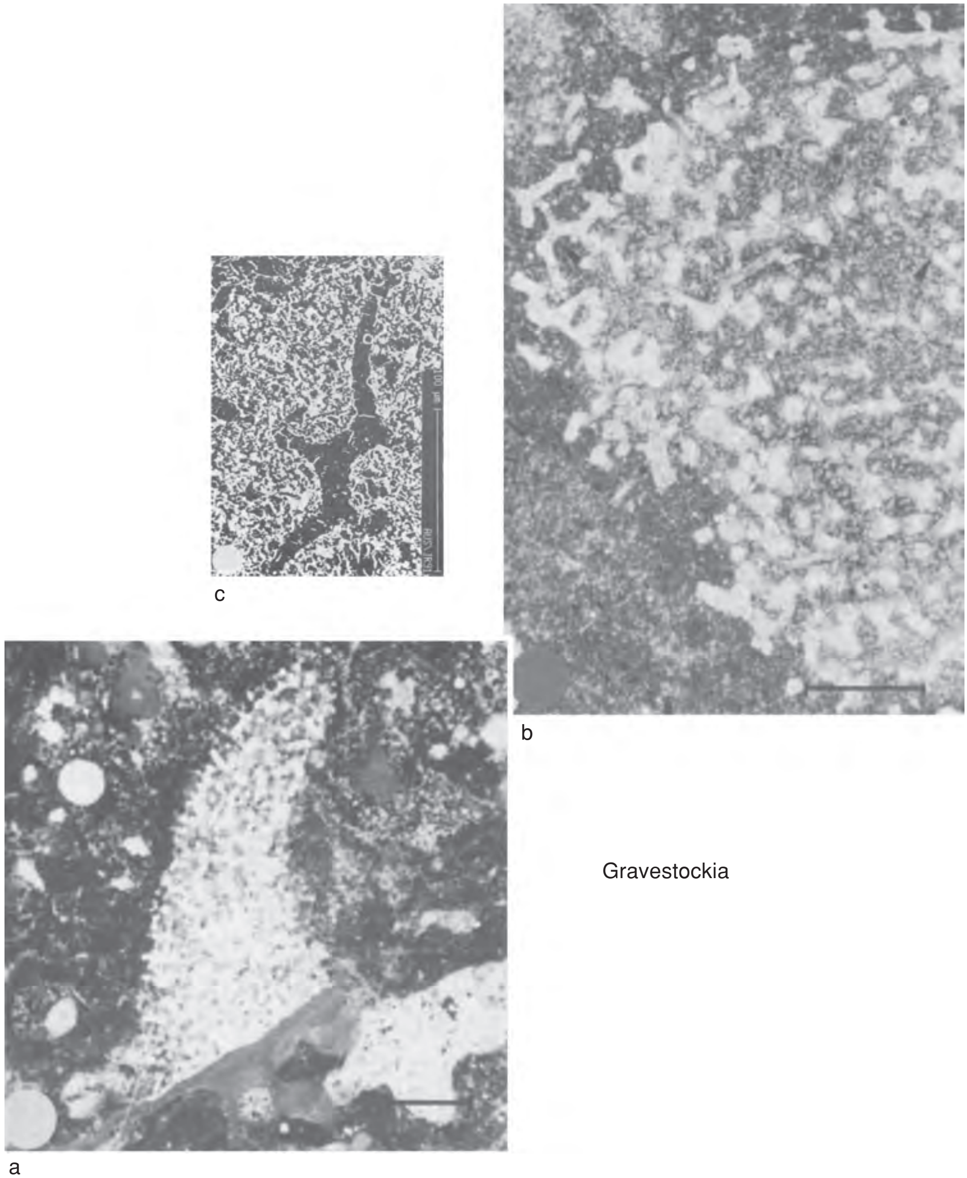

FIG. 501. Uncertain (p. 758).

spicule showing characteristic swollen, lower rays, ×200 (Mostler, 1996b).

Phobetractinia REIF, 1968, p. 739 [**P. polymorpha;* OD]. Triradiate spicules with angles between rays 120 degrees; one main ray unpaired but other two dichotomously branched, with rays that may be parallel as in phobetractines or may converge as in synphobetractine spicules. *Lower Cambrian–Carboniferous (Mississippian), Permian:* Sweden, Estonia, Argentina, Sicily.——FIG. 502,*7a–c.* **P. polymorpha,* limestone; *a,* phobetractine with three lower rays, Lower Cambrian, western Sardinia, ×100; *b,* synphobetractine with converging lower rays, Ordovician, Sweden, ×100; *c,* drawing of phobetractine spicule with named rays, not to scale (Mostler, 1985; courtesy of *Naturwissenschaftlich-Medizinischer Verein in Innsbruck*).

Praephobetractinia KOZUR, 1991, p. 589 [**P. eocambrica;* OD]. Isolated spicules, primarily three-rayed, with rays separated at 120 degrees;

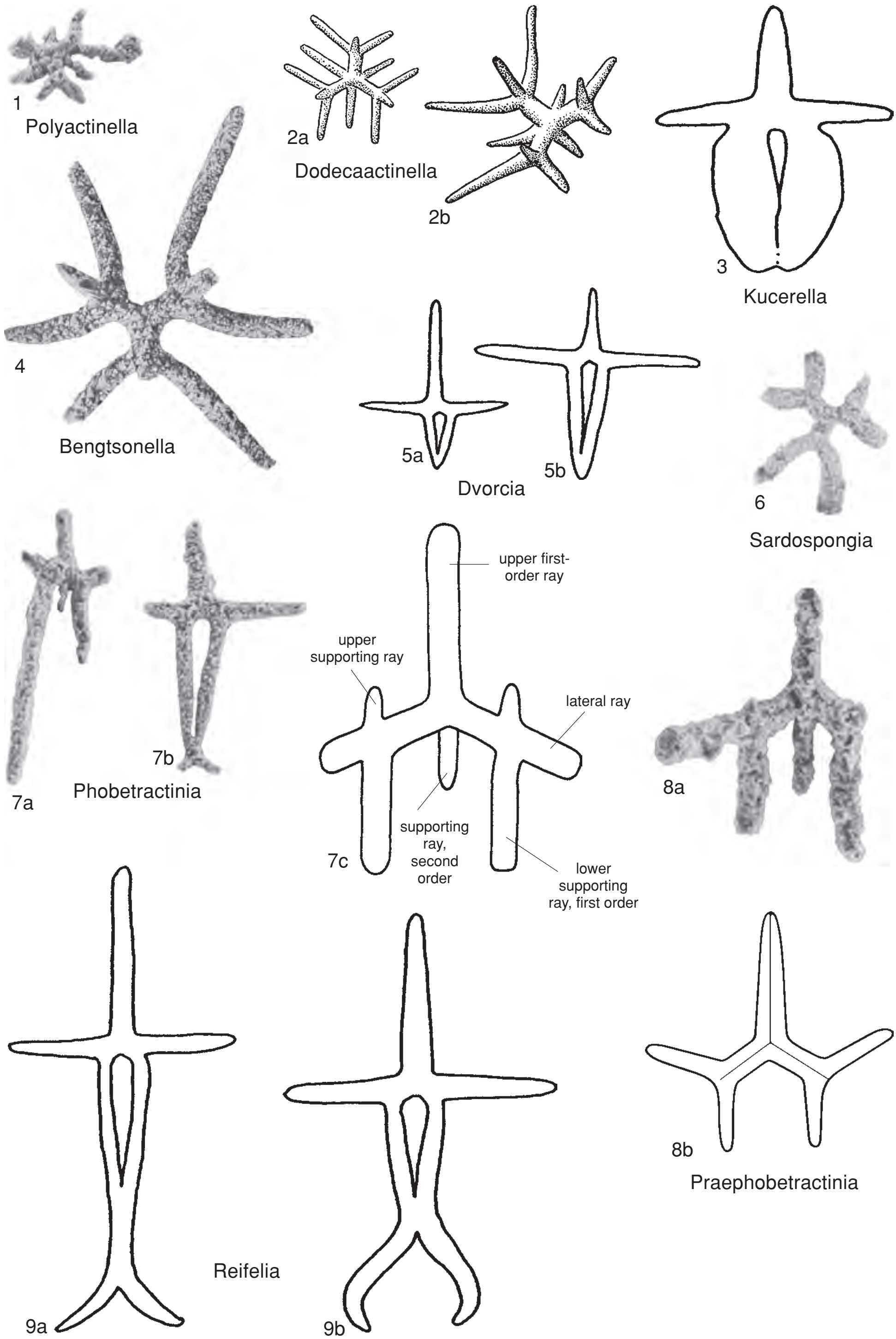

FIG. 502. Polyactinellidae (p. 758–762).

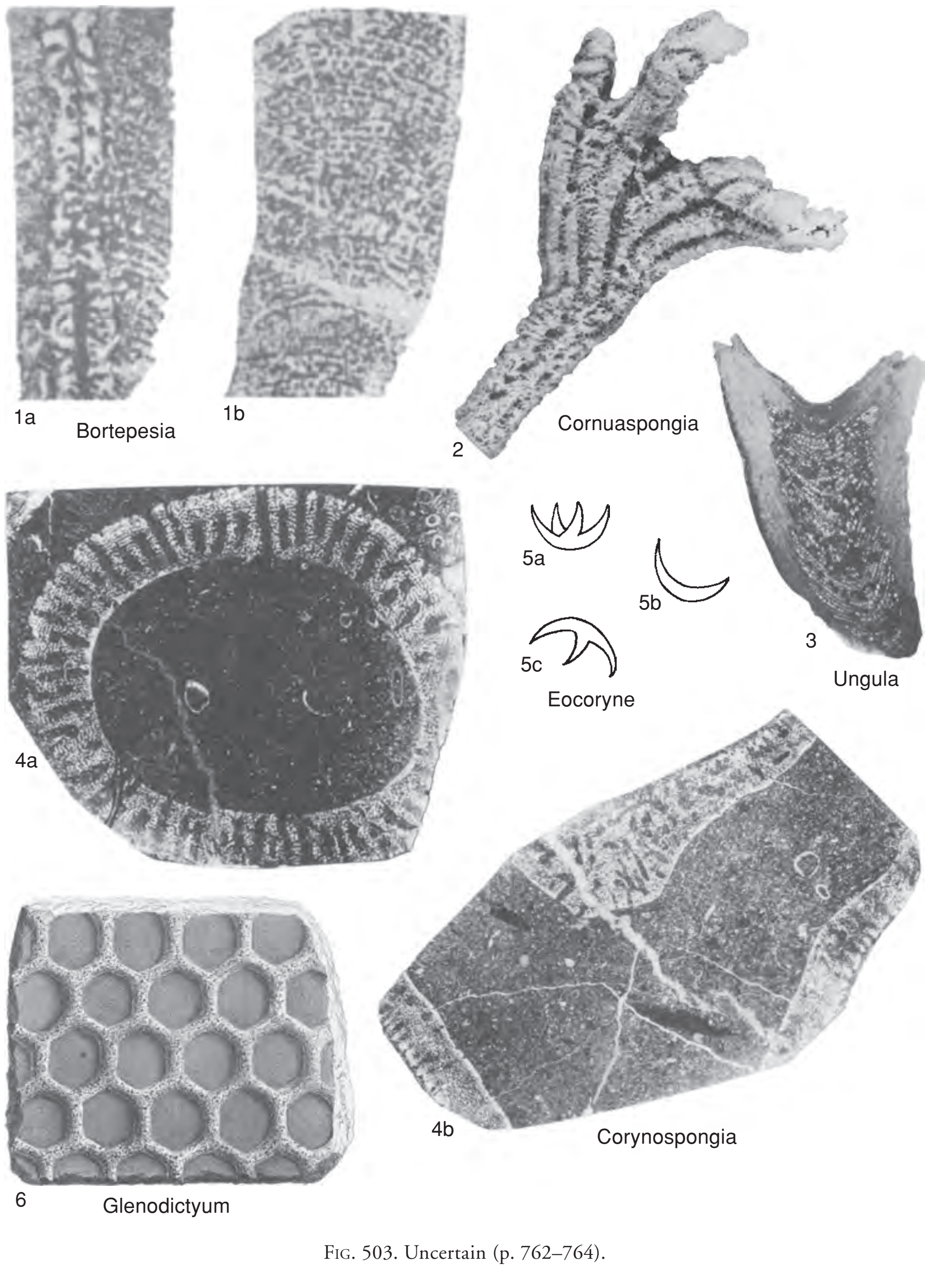

FIG. 503. Uncertain (p. 762–764).

upper ray long and unbranched, but two lower rays each with two secondary rays at 120 percent from main ray and with one of those being parallel, long, upper ray. *Lower Cambrian–Middle Ordovician:* Sardinia.——FIG. 502,*8a–b*. **P. eocambrica,* Lower Cambrian archaeocyathid bioherm, Iglesiente, southwestern Sardinia; *a,* holotype, triradiate spicule with lower branched rays and upper, unbranched main ray, GII, unnumbered, ×200 (Mostler, 1985); *b,* drawing of idealized complete spicule, not to scale (Kozur, 1991; courtesy of *Naturwissenschaftlich-Medizinischer Verein in Innsbruck*).

Reifelia MOSTLER, 1996b, p. 232 [**R. diffissa;* OD]. Sponges characterized by synphobetractine spicules whose two lower, curved rays are fused at some distance from their origins, but whose ray tips diverge distally. *lower Silurian–Carboniferous (Mississippian):* Austria (Karnian Alps), *lower Silurian;* Czech Republic, Slovakia, *Pragian;* Ireland, Afghanistan, *Mississippian.*——FIG. 502,*9a–b.* **R. diffisa;* drawings of restored spicules showing general form of distinctive, lower, partially fused rays, approximately ×100 (Mostler, 1996b).

Sardospongia MOSTLER, 1985, p. 16 [**S. triradiata;* OD]. Triradiate spicules with 120 degrees between the dichotomously or trichotomously branching rays; no accessory, central rays present. *Lower Cambrian–Middle Cambrian, ?Middle Ordovician:* Sardinia, Argentina, Australia.——FIG. 502,*6.* **S. triradiata,* concretionary limestone, Middle Cambrian, Iglesiente, southwest Sardinia; type, triradiate spicule with branched rays, ×100 (Mostler, 1985; courtesy of *Naturwissenschaftlich-Medizinischer Verein in Innsbruck*).

Class and Order UNCERTAIN

Alasonia SIRKOVA, 1938a, p. 16 [**A. remesi;* OD]. *Jurassic:* Czech Republic, Slovakia.

Aphlebospongia SIRKOVA, 1938a, p. 13 [**A. remesi;* OD]. *Jurassic:* Czech Republic, Slovakia.

Astrofungia GREGORIO, 1883, p. 121 [**A. cidariformis;* SD DE LAUBENFELS, 1955, p. 100]. *?Cretaceous:* Italy.

Atikokania WALCOTT, 1912, p. 17 [**A. lawsoni;* OD]. Cylindrical to elongate conical with cloaca-like, central cavity surrounded by radiating and concentric, skeletal strands. [Treated as a trace fossil by HÄNTZSCHEL (1975, p. 171).] *Eoarchean–Neoproterozoic:* Canada.

Bortepesia BOIKO, 1984, p. 35 [**B. cylindrica;* OD]. Cylindrical to branched, colonial sponges with relatively narrow but deep spongocoels or broad, exhalant canals; dermal layer thin, rough, porous; interior skeleton with moderately regularly spaced, upwardly arcuate, transverse or horizontal fibers, more or less connected by irregular, vertical fibers; microstructure bundled and spherulitic. *Upper Triassic:* Tadjhikistan (Pamir).——FIG. 503,*1a–b.* **B. cylindrica,* Norian, southeastern Pamir; *a,* vertical, axial section of holotype with parallel, thick-walled, exhalant canals or spongocoels, surrounded by porous, chambered, outer part of endosome, ×2; *b,* tangential vertical section through outer endosome of holotype showing upwardly arcuate, transverse fibers of chambers with porous walls, specimen oop No. II/II, ×2 (Boiko, 1984).

Coniatopenia POMEL, 1872, p. 152 [**Elasmostoma peziza* ROEMER, 1864, p. 46; OD]. *Cretaceous:* Germany.

Cornuaspongia SENOWBARI-DARYAN, 1994b, p. 66 [**C. longidepressa;* OD]. Multi-branched, handlike to antlerlike sponge without spongocoel; each branch with one or more grooves running through or across branch with large openings in grooves; branches with oval cross sections; spicule structure unknown. *Upper Triassic–Jurassic:* Peru.——FIG. 503,*2.* **C. longidepressa,* Pucará Group, Chaquipuquio; side view of holotype showing growth form and longitudinal grooves, ×1 (Senowbari-Daryan, 1994b).

Corynospongia DENG, 1990, p. 317 [319] [**C. tubuliforma* DENG, 1990, p. 318; OD]. Tubular, branching sponge with prominent spongocoel with a moderately distinct, dense, gastral layer and rows of coarse, horizontal, radial canals that are cross connected by finer canals; spicule structure unknown. *Permian (Cisuralian):* China (Sichuan).——FIG. 503,*4a–b.* **C. tubuliforma,* Maokou Formation, Kungurian, Xingwen County, southern Sichuan; *a,* transverse section of one branch showing large, central spongocoel and thick walls with horizontal rows of prominent, large, radial canals that extend through wall and are cross connected by many fine canals, holotype, ×1.5; *b,* longitudinal section of parts of two branches, each with broad spongocoel and walls pierced by coarse, radial canals, holotype, ×1 (Deng, 1990).

Cotyliscus R. H. KING, 1943, p. 34 [**C. ewersi;* OD]. Cuplike sponges with canals penetrating walls. *Carboniferous (Mississippian):* Texas.

Diestosphecion POMEL, 1872, p. 223 [**Tremospongia grandis* ROEMER, 1864, p. 40; OD]. *Cretaceous:* Germany.

Diplostomella REID, herein, *nom. nov. pro Diplostoma* FROMENTEL, 1860a, p. 42, *non* RAFINESQUE, 1817, *nec* COBBOLD, 1861, *nec* EBENSBERGER, 1962 [**Diplostoma neocomiensis* FROMENTEL, 1860a, p. 42; OD]. Sponge porous platelike, riddled with small ostia on both sides. *Lower Cretaceous:* France.

Dyocopanon POMEL, 1872, p. 226 [**Scyphia monilifera* ROEMER, 1864, p. 37]. *Cretaceous:* Germany.

Eflugelia VACHARD in MASSE & VACHARD, 1979, p. 34 [**Cuneiphycus johnsoni* FLÜGEL, 1966, p. 34, *non* MAMET & ROUX, 1977]. Attached, regularly laminate of weakly undulating meshwork; small branches; general form conical, sometimes biconical; walls hyaline to granular. *Carboniferous (Pennsylvanian)–Permian (Lopingian):* Africa, Europe, Asia.

Eocoryne MATTHEW, 1886, p. 30 [**E. geminum;* OD]. Relatively large, peculiarly shaped spicules 1.5 to 2.0 mm long. *Middle Cambrian:* Canada.——FIG. 503,*5a–c.* **E. geminum;* isolated spicules, approximately ×10 (de Laubenfels, 1955).

Glenodictyum VON DER MARCK, 1876, p. 68 [**G. hexagonum;* OD]. Skeleton with conspicuous, hexagonal network in which mesh spaces are 12 to 15 mm across and intervening skeletal elements are up to 5 mm wide. *Cretaceous:* Germany.——FIG. 503,*6.* **G. hexagonum;* fragment of skeleton with hexagonal structure, ×0.5 (Von der Marck, 1876).

Holocoelia STEINMANN, 1913, p. 86 [**H. toulai;* SD DE LAUBENFELS, 1955, p. 102]. *Cretaceous:* Germany (Baden).

Lamellispongia BOIKO, 1984, p. 31 [**L. gelevus;* OD]. Platelike or bladelike, weakly flexed sponges without major, axial, or vertical canals, but with small,

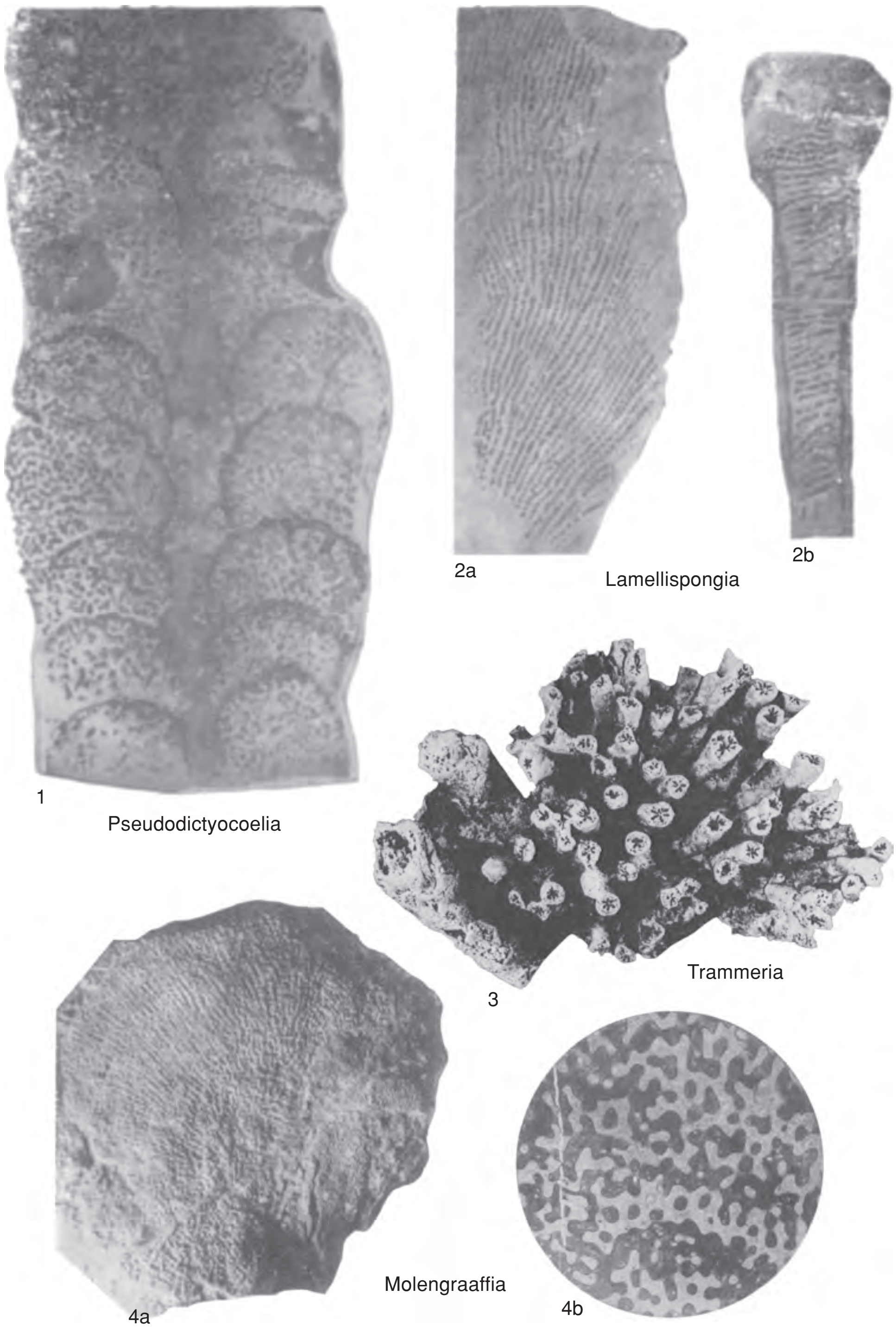

FIG. 504. Uncertain (p. 762–764).

horizontal canals that pierce plate; skeleton with upwardly divergent, major fibers cross connected with finer fibers; skeleton of spherulites 0.05 to 0.07 mm in diameter. *Upper Triassic:* Tadjhikistan (Pamir).——FIG. 504,*2a–b.* **L. gelevus,* uppermost Norian, southeastern Pamir; *a,* dermal surface of thin, bladelike holotype with upwardly and outwardly divergent, ladderlike, skeletal tracts, ×2; *b,* vertical, longitudinal section of holotype with horizontal, skeletal tracts and transverse canals, specimen oop No. 5/II, ×10 (Boiko, 1984).

Megalelasma POČTA, 1903a, p. 9 [**M. dispansum;* OD]. Inverted, cone-shaped sponge with thin walls; skeletal structure poorly preserved. *Upper Cretaceous (Cenomanian):* Czech Republic, Slovakia.

Misraea MAITHY & BABU, 1987, p. 224 [**M. vindhyanensis;* OD]. *Paleoproterozoic–Neoproterozoic:* India.

Molengraaffia VINASSA DE REGNY, 1915, p. 80 [**M. regularis;* OD] [=*Molengraafia* DE LAUBENFELS, 1955, p. 100, *nom. null.*]. Skeleton of moderately coarse fibers, 0.2 mm in diameter, spaced 0.5 mm apart in regular, reticulate structure; interconnected canals round, diameter of 0.5 mm, and with skeletal fibers converge to, and surround, a moderately large, central area; spicule structure unknown. *Triassic:* East Indies.——FIG. 504,*4a–b.* **M. regularis,* Fatu Kaoniki, Timor; *a,* side view of sponge showing upwardly divergent canal and skeletal structure, ×1; *b,* cross section showing round canals and interconnected, skeletal fibers, ×5 (Vinassa de Regny, 1915).

Oligoplagia HERAK, 1944, p. 130 [**O. carnica;* OD]. [Distinguished from related genera by having horizontal walls or tabulae in ovate cylindrical stems, with common, open (but barely visible in the walls), eye-shaped pores.] *Triassic:* Austria.

Plectinia POČTA, 1903b, p. 122 [**P. minuta;* SD DE LAUBENFELS, 1955, p. 100]. *Cretaceous:* Czech Republic, Slovakia.

Polycnemiseudea FROMENTEL, 1860a, p. 29 [**Cnemidium gregarium* D'ORBIGNY, 1850 in 1850–1852, vol. 2, p. 285; OD]. *Upper Cretaceous:* France.

Pseudodictyocoelia BOIKO, 1984, p. 32 [**P. elongata;* OD.] Cylindrical, chambered sponge with deep, axial spongocoel; chamber walls distinctly porous, thicker, and more compact than moderately uniformly spaced, branched and interwoven, fibrous, chamber-filling structures; entire skeleton composed of spherulites 0.02 to 0.04 mm in diameter. *Upper Triassic:* Tadjhikistan (Pamir).——FIG. 504,*1.* **P. elongata,* uppermost Norian, base of Aktash Mountains, southeastern Pamir; vertical, axial section of holotype showing upwardly arcuate, porous chambers, filled with endosomal, skeletal mesh, surrounding axial spongocoel, specimen oop No. 8/II, ×2 (Boiko, 1984).

Rauffia ZEISE, 1897, p. 326 [**R. clavata;* OD]. *Lower Triassic–Upper Cretaceous:* Europe.

Scribroporella SPRIESTERBACH, 1935, p. 477 [**S. socialis;* OD]. *Middle Devonian:* Germany.

Strambergia ZEISE, 1897, p. 330 [*Strambergia* sp.; OD]. *Lower Triassic–Upper Cretaceous:* Europe.

Trammeria SENOWBARI-DARYAN, 1994b, p. 65 [**T. dendroida;* OD]. Multibranched, coral-like sponge, spongocoel with starlike cross section passing through entire branches and producing radially arranged, skeletal sections; numerous exhalant canals with oval pores in vertical rows ending in spongocoel; spicule structure unknown. *Triassic–Jurassic:* Peru.——FIG. 504,*3.* **T. dendroida,* Upper Triassic, Pucará Group, Shalipayco; holotype from above showing bushy form and sections of branches with starlike spongocoels, ×1 (Senowbari-Daryan, 1994b).

Ungula TERMIER & TERMIER in TERMIER, TERMIER, & VACHARD, 1977a, p. 85 [**U. kaisini;* OD]. Steeply obconical to dentiform, with outer, relatively dense crust of fibrous, lamellar structure around inner layered, more porous, vesicular, central part where layers rise upwardly in obconical fashion toward margin and merge with or terminate against outer crust. No distinct canals; possible concave operculum with same microstructure as outer crust. [Poriferan nature of the specimen is questionable.] *Permian (Lopingian):* Tunisia.——FIG. 503,*3.* **U. kaisini,* Djebel Tebaga; longitudinal section of holotype showing finely fibrous, lamellate, thick, outer wall and thin, capping, possible operculum, and layered, more coarsely vesicular, interior structure, collection H. & G. Termier, ×5 (Termier & Termier, 1977a).

UNRECOGNIZABLE SUPPOSED SPONGES

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Many supposed sponge genera described in the early development of paleontology were inadequately documented because methods of ascertaining skeletal details and microstructure of sponge fossils were not available. If original type material were to be reexamined using modern techniques, perhaps some of them might prove to be recognizable, as has been the case with a few forms listed as unrecognizable in the 1955 sponge volume of the *Treatise.*

As noted by de Laubenfels (1955), unfortunately many fossils, particularly sponges, have been so altered during preservation that their microstructure and other critical details of their skeletons are not preserved. This makes definition and classification difficult, in spite of all efforts to understand them. Consequently, in the following compilation, names are listed alphabetically because too little information is available to place them in a meaningful classification.

Achilleum Oken, 1815, p. 81 [**A. manus;* SD de Laubenfels, 1955, p. 104]. *Cretaceous–Holocene:* Europe.

Adelphocoelia Étallon, 1859a, p. 136 [**Scyphia propinqua* Goldfuss, 1829, p. 89; OD]. *Jurassic:* Europe.

Alcyoniolithes Blumenbach, 1815, p. 24 [**A. stadensis;* OD] [=*Alcyonolithes* de Laubenfels, 1955, p. 104, *nom. null.*]. Age and locality uncertain.

Amorphocoelia Étallon, 1859a, p. 136 [**A. incrustans;* OD]. *Jurassic:* Europe.

Angidia Pomel, 1872, p. 122 [**A. cribrosa;* SD de Laubenfels, 1955, p. 104]. *Paleogene–Neogene:* Algeria.

Aplorytis Pomel, 1872, p. 229 [**Lymnorea bajocensis* d'Orbigny, 1850 in 1850–1852, p. 294; OD; as cited by Pomel, but not listed in genus by d'Orbigny; but d'Orbigny, 1850 in 1850–1852, vol. 1, p. 294 cites as *Cnemidium bajocense* d'Orbigny, 1847]. Conical with imperforate, dermal layer covering all but broad, convex, upper surface; radial, exhalant grooves converging on center of summit; exhalant pores open only into these grooves; internal structures and fiber microstructure unknown. [No known suitable figures.] *Jurassic:* Europe.

Araeoplocia Pomel, 1872, p. 104 [**Achilleum morchella* Goldfuss, 1826, p. 2; SD Rigby, herein]. [The subsequent designation of *Meandrospongia annulata* Roemer, 1864, p. 53, as the type species of the genus by de Laubenfels (1955, p. 104) is invalid because the species was not mentioned by Pomel (1872).] *Devonian.*

Arthrocypellia Pomel, 1872, p. 77 [**Scyphia articulata* Goldfuss, 1826, p. 9; OD]. *Devonian.*

Asteriscosella Christ, 1925, p. 1 [**A. nassovica;* OD]. *Devonian:* Germany.

Asteropagia Pomel, 1872, p. 245 [**Asterospongia globosa* Roemer, 1864, p. 50; SD de Laubenfels, 1955, p. 104]. *Cretaceous:* Europe.

Astrolmia Pomel, 1872, p. 115 [**Cnemidium astrophorum* Goldfuss, 1829, p. 97; OD]. *Cretaceous:* Europe.

Atelosphecion Pomel, 1872, p. 224 [**A. commutatum;* OD]. *Paleogene–Neogene:* Algeria.

Badinskia Pomel, 1872, p. 84 [**B. lobata;* OD]. *Paleogene–Neogene:* Algeria.

Batalleria Hérenger, 1946b, p. 46 [**B. cylindrata* Hérenger, 1946b, p. 47; OD]. *Cretaceous:* Spain.

?Batospongia Ulrich in Miller, 1889, p. 154 [**B. spicata* Ulrich in Miller, 1889, p. 155; OD]. Sponge possibly globose, no cloaca; radial-reticulate, somewhat meandriform spiculofibers; fiber an open, porous, uncored mesh of monaxons (probably oxeas) tangent to surface of fiber, echinated by numerous smooth monaxons (possible oxeas) at approximately 90° to fiber; smaller desmoids of uncertain form may also be present as a coating on fiber but poor preservation makes this uncertain. [This genus does not clearly belong to the dystactospongiids but is difficult to place elsewhere unless with the haplistiids. Probable dystactospongiid (unrecognizable).] *Carboniferous (Pennsylvanian):* USA (Illinois).——Fig. 505,*1a–c.* **B. spicata,* Lower Coal Measures, Pennsylvanian, Seville; *a,* lower side of holotype from which dermal layer has been removed, ×1; *b,* cluster of silicified spicules; *c,* inner side of basal dermal layer, ISM, ×18 (Ulrich & Everett, 1890).

Bembixastrum Schrammen, 1924b, p. 129 [*"*B. granulosum* Münster in Goldfuss sp.;" OD]. Identity of only cited species uncertain and no diagnosis given; type species may be *Cnemidium granulosum* Münster in Goldfuss, 1829, p. 97, regarded by Zittel (1878a, p. 110) as a synonym of *Cnemidiastrum stellatum* (Goldfuss). Age and locality uncertain, but probably *Jurassic:* Germany (Streitberg).

Bicupula Courtiller, 1861, pl. 35 [**B. gratiosa;* SD de Laubenfels, 1955, p. 104]. *Upper Cretaceous:* France.

Biopalla Wallace, 1878, p. 369 [**B. keokuki;* OD]. *Carboniferous:* Iowa.

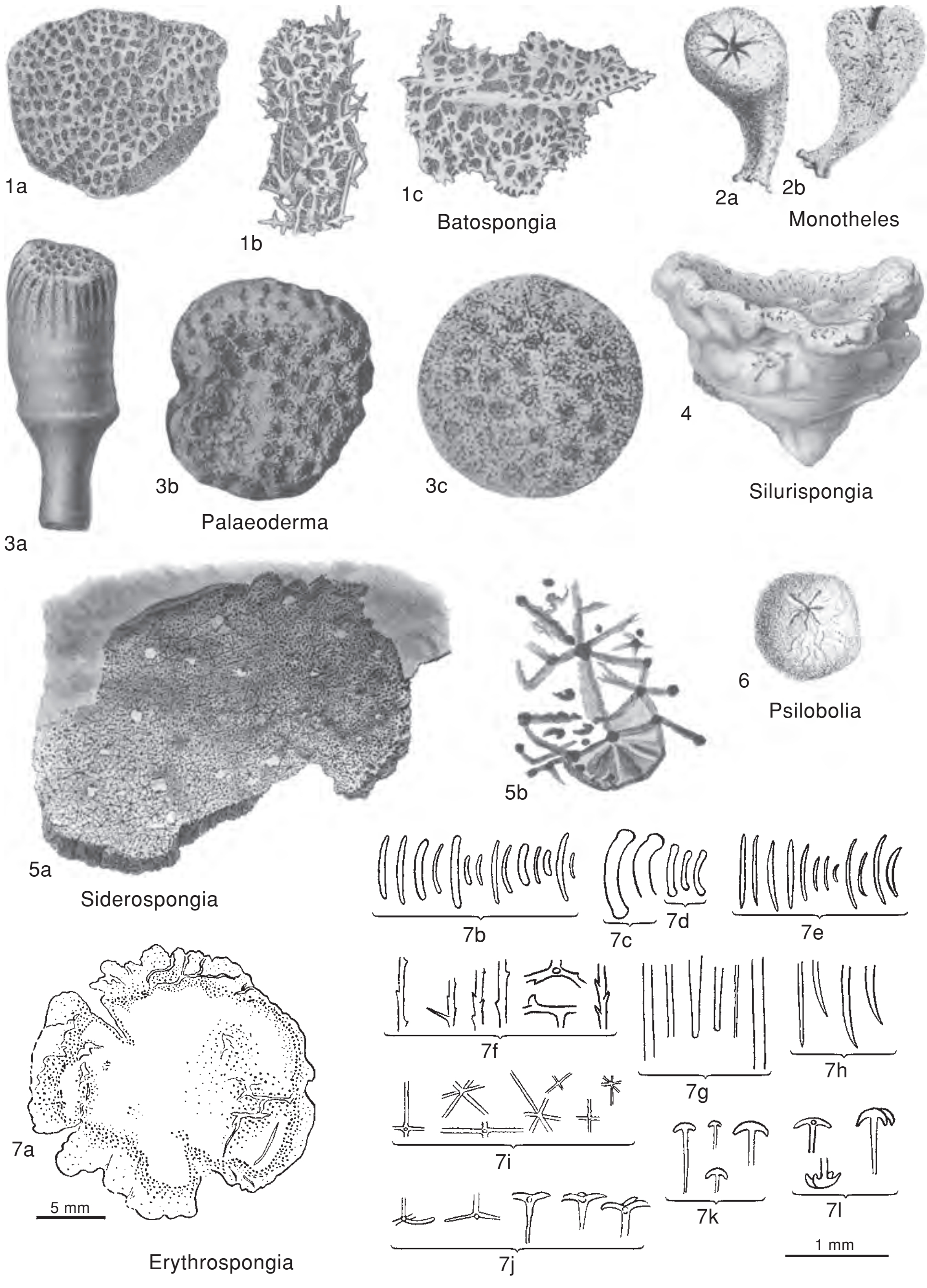

FIG. 505. Uncertain (p. 765–771).

Bonneyia SOLLAS, 1873, p. 79 [**B. bacilliformis;* SD RIGBY, herein]. *Lower Cretaceous:* Europe.

Bothriopeltia POMEL, 1872, p. 81 [**Cribrospongia baugieri* D'ORBIGNY, 1850 in 1850–1852, vol. 1, p. 388; SD RAUFF, 1893, p. 66]. *Cretaceous:* Europe.

Bottonaecyathus RODIONOVA, 1967, p. 87 [**B. astraeformis;* OD]. Solitary, rarely colonial; steeply obconical to cylindrical forms with distinct, central spongocoel; prominent, subhorizontal radial exhalant canals unevenly distributed and locally may extend through thick walls from small, dermal pores or inhalant ostia to larger, gastral exhalant ostia. Skeleton of radial rows of longitudinal and transverse rods, united tangentially. [Genus was included by HILL (1972, p. 107) in the Archaeocyatha, but it may be a spiculate sponge.] *Lower Cambrian:* Russia (Altay-Sayan), Morocco.——FIG. 506*a–b.* **B. astraeformis,* Sanashtikgol'skiy horizon, Altay-Sayan region; *a,* diagrammatic transverse section showing coarse exhalant canals and central spongocoel surrounded by thick walls; *b,* diagram showing radial canals in both longitudinal and transverse sections of cylindrical fossil, ×2 (Hill, 1972).

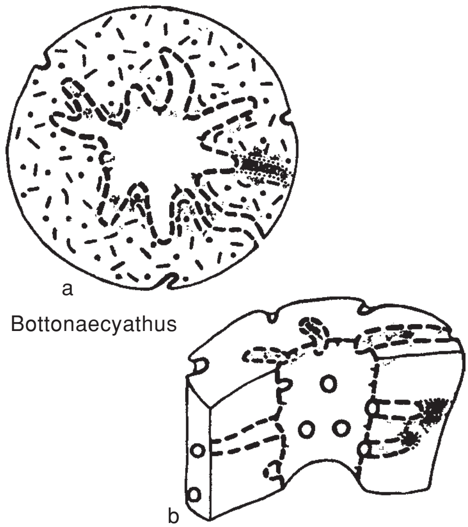

FIG. 506. Uncertain (p. 767).

Broseocnemis POMEL, 1872, p. 81 [**B. asperata;* OD]. *Jurassic:* Algeria.

Bursispongia QUENSTEDT, 1878 in 1877–1878, p. 506 [**B. bursata;* OD]. *Jurassic:* Germany.

Calpia POMEL, 1872, p. 116 [**Cribrospongia cariosa* ROEMER, 1864, p. 13; OD]. *Devonian.*

Calymmospongia STRAND, 1928, p. 33 [**Cystispongia subglobosa* ROEMER, 1864, p. 8; SD RAUFF, 1893, p. 65] [=*Calymma* POMEL, 1872, p. 73, obj., *non* HUEBNER, 1823]. *Cretaceous:* Europe.

Camerocoelia ÉTALLON, 1859a, p. 134. Type species, age, and locality uncertain.

Catalopia POMEL, 1872, p. 205 [**C. gemmans;* OD]. *Cretaceous:* Algeria.

Cephalocoelia ÉTALLON, 1859a, p. 136 [**C. gresslyi;* OD]. *Jurassic:* Germany.

Ceriopeltia POMEL, 1872, p. 81 [no species] [=*Ceriopelta* DE LAUBENFELS, 1955, p. 104, *nom. null.*]. Age and locality uncertain.

Chenendroscyphia FROMENTEL, 1860a, p. 40 [**Chenendopora marginata* MICHELIN, 1847 in 1840–1847, p. 129; OD]. Age and locality uncertain.

Chitoracia POMEL, 1872, p. 227 [**C. roemeri* POMEL, 1872, p. 227; SD RAUFF, 1893, p. 71]. *Devonian.*

Cladocalpia POMEL, 1872, p. 117 [**Tubulospongia dendroides* COURTILLER, 1861, pl. 33,*3;* SD DE LAUBENFELS, 1955, p. 104]. *Upper Cretaceous:* Europe.

Cladocinclis POMEL, 1872, p. 110 [**Amorphospongia dumosa* D'ORBIGNY, 1850 in 1850–1852, vol. 2, p. 188; OD]. *Cretaceous:* Europe.

Cladopagia POMEL, 1872, p. 246 [no species]. Age and locality uncertain.

Cladosmila POMEL, 1872, p. 240 [*?*Anthophyllum proliferum* GOLDFUSS, 1826, p. 46; OD]. Age and locality uncertain.

Clionothes LEES & THOMAS, 1919, p. 605 [**C. lizardensis;* OD]. *Carboniferous (Mississippian):* USA (Iowa).

Cnemicoelia ÉTALLON, 1859a, p. 145. Type species, age, and locality uncertain.

Cnemidium GOLDFUSS, 1826, p. 14 [**C. lamellosum;* SD MILLER, 1889, p. 157]. *Upper Cretaceous:* Europe.

Cnemipsechia POMEL, 1872, p. 155 [**C. fungiaeformis;* OD]. *Paleogene–Neogene:* Algeria.

Cnemiracia POMEL, 1872, p. 227 [**Stellispongia aperta;* SD DE LAUBENFELS, 1955, p. 104]. *Cretaceous:* Europe.

Coelosphaeridium C. F. ROEMER, 1885, p. 57 [**C. cyclocrinophilum;* OD]. Age and locality uncertain.

Coelosmila POMEL, 1872, p. 239 [**Ceriopora favosa* GOLDFUSS, 1826, p. 38; SD DE LAUBENFELS, 1955, p. 104]. *Cretaceous:* Europe.

Collojerea POMEL, 1872, p. 176 [**Siphonia ramosa* MICHELIN, 1847 in 1840–1847, p. 141; OD]. *Devonian.*

Colpoplocia POMEL, 1872, p. 104 [**Plocoscyphia michelini* D'ORBIGNY, 1850 in 1850–1852, vol. 2, p. 188; SD RAUFF, 1893, p. 67]. *Upper Jurassic:* Europe.

Confervites BRONGNIART, 1828, p. 35 [**C. fasciculata;* SD DE LAUBENFELS, 1955, p. 104]. *Jurassic:* Europe.

Corthya POMEL, 1872, p. 109 [no species]. Age and locality uncertain.

Cribrocoelia ÉTALLON, 1859a, p. 134 [**C. striata;* SD DE LAUBENFELS, 1955, p. 104]. *Jurassic:* Europe.

Cribroscyphia FROMENTEL, 1860a, p. 38 [**Scyphia polyommata* GOLDFUSS, 1826, p. 8; OD]. *Upper Jurassic:* Europe.

Criccospongia Mostler, 1986, p. 348 [no type species]. *Upper Triassic:* Austria, Italy.

Cupulospongia d'Orbigny, 1849, p. 550 [**Scyphia porosa* Roemer, 1840 in 1840–1841, p. 7; SD Rigby herein] [=*Cupulochonia* Fromentel, 1860a, p. 44, obj.] [Subsequent designation of *Tragos patella* Goldfuss, 1833, as the type species by de Laubenfels (1955, p. 104) is invalid because that species was earlier listed (de Laubenfels, 1955, p. 48) as the subsequently designated type species for *Hyalotragos* Zittel, 1878a.] *Upper Jurassic:* France.

Cyathoplocia Pomel, 1872, p. 103 [**Scyphia texata* Goldfuss, 1826, p. 7; OD]. Age and locality uncertain.

Cyclospongia Miller, 1892, p. 615 [**C. discus;* OD]. *Devonian:* USA (Indiana).

Cylindrospongia F. A. Roemer, 1864, p. 21 [**C. abreviata;* SD de Laubenfels, 1955, p. 104]. *Cretaceous:* Europe.

Cyronella Beede, 1899, p. 129. Type species, age, and locality uncertain.

Cystoloena Pomel, 1872, p. 76 [**Cystispongia undulata* Roemer, 1864, p. 8; SD Rauff, 1893, p. 65]. *Cretaceous:* Europe.

Cystopora Pomel, 1872, p. 229 [**Verticillites truncatus* d'Orbigny, 1850 in 1850–1852, vol. 2, p. 96; SD de Laubenfels, 1955, p. 105]. *Cretaceous:* Europe.

Dendrospongia F. A. Roemer, 1864, p. 20 [**D. clathrata;* SD de Laubenfels, 1955, p. 105]. *Cretaceous:* Europe.

Dercites Carter, 1871, p. 130 [**D. haldonensis;* OD] [=*Dercitites* Sollas, 1880c, p. 587, *nom. null.*]. *Lower Cretaceous:* Europe.

Desmospongia Étallon, 1863, p. 422 [**Spongia semicinctus* Quenstedt, 1878 in 1877–1878, p. 215; OD]. *Jurassic:* Europe.

Dichoplectella Matthew, 1891, p. 149 [**D. irregularis;* OD]. *Cambrian:* Canada (Acadia).

Dichorea Pomel, 1872, p. 225 [**Lymnorea michelini* d'Orbigny, 1850 in 1850–1852, vol. 1, p. 325; OD]. *Upper Jurassic:* Europe.

Dictyocladia Pomel, 1872, p. 86 [**D. ramosa;* OD]. *Upper Jurassic:* Europe.

Dictyosmila Pomel, 1872, p. 240 [**D. reteporiformis;* OD]. *Cretaceous:* Europe.

Didesmospongia Étallon, 1864, p. 422 [no species]. *Jurassic:* Europe.

Diseudea Fromentel, 1860a, p. 28 [**Siphonia lagenaria* Michelin, 1847 in 1840–1847, p. 250; OD] [=*Copanon* Pomel, 1872, p. 226, obj.]. *Middle Jurassic:* Europe.

Distheles Fromentel, 1860a, p. 36 [**D. depressa;* OD]. *Jurassic:* Europe.

Dolispongia Quenstedt, 1877 in 1877–1878, p. 297 [**Scyphia maeandrina* Goldfuss, 1829, p. 88; SD de Laubenfels, 1955, p. 105]. *Jurassic:* Germany.

Donatispongia Malfatti, 1901, p. 299 [**D. patellaris;* OD]. *Paleogene–Neogene:* Europe.

Dulmius Gregorio, 1930, p. 48 [**D. innovatus;* OD]. *Permian:* Sicily.

Elasmeudea Pomel, 1872, p. 234 [**Eudea cribraria* Michelin, 1847 in 1840–1847, p. 251; SD Rauff, 1893, p. 72]. *Cretaceous:* Europe.

Eligmaella Rigby, herein, *nom. nov. pro Eligma* Regnard, 1926, p. 484, *non* Hubner, 1819 [**Eligma douvilli* Regnard, 1926, p. 484; OD]. *Cretaceous:* France.

Emplociata Rigby, herein, *nom. nov. pro Emplocia* Pomel, 1872, p. 103, *non* Herrich-Schaeffer, 1856 [**Brachiolites foliaceus* T. Smith, 1848, p. 364; OD]. *Cretaceous:* Europe.

Enteropycnus de Laubenfels, 1955, p. 105, *nom. nov. pro Pychnogaster* Schrammen, 1924a, p. 30, *non* Graell, 1851 [**Pycnogaster texturatus* Schrammen, 1924a, p. 30; OD]. *Cretaceous:* Germany.

Erythrospongia Hudson, 1929, p. 185 [**E. lithodes;* OD]. Cylindrical to irregularly bulbous; possibly with central cloaca and osculum; large, parallel, possible rhabdodiactines paratangential to outer surface; cortex or body wall containing small, curved, possible rhabdodiactines, most strongyle-like, some oxeote, together with hexactines, pentactines, clemes, and fragments with dianchorate and quadrianchorate terminations; presumed microscleres are spinose microhexactines and micropentactines, as well as seeming hexasters that range from simply branched microhexactines to polyactinal, euaster-like forms. [These could be burrows lined with assorted, foreign spicules.] *Carboniferous (Visean)*: England.——Fig. 505,*7a–l*. **E. lithodes,* Yoredale Series, northwestern Yorkshire; *a,* drawing of section through sponge nodule, ×2; *b–l,* isolated macroscleres from nodule by etching in weak acid: *b,* monaxons, *c–d,* tylotes; *e,* oxeas; *f,* broken spinose spicules; *g–h,* curved spicule fragments; *i,* hexactines; *j–l,* pentactine-based spicules, ×15 (Hudson, 1929).

Eucoscinia Pomel, 1872, p. 83 [**Scyphia cancellata* Goldfuss, 1829, p. 89; SD de Laubenfels, 1955, p. 105]. *Cretaceous:* Europe.

Evinospongia Stoppani, 1860, p. 90 [**E. cerea;* SD de Laubenfels, 1955, p. 105]. *Triassic:* Italy.

Exosinion Pomel, 1872, p. 91 [**Ventriculites gracilis* Roemer, 1864, p. 20; OD]. *Cretaceous:* Europe.

Favospongia Hinde, 1888, p. 179 [**F. ruthveni;* OD]. *upper Silurian:* Europe.

Floriania Rigby, herein, *nom. nov. pro Floria* Gregorio, 1930, p. 47, *non* Loew, 1879 [**Floria permiana* Gregorio, 1930, p. 48; OD]. *Permian:* Sicily.

Forospongia d'Orbigny, 1849, p. 549 [**Tragos acetabulum* Goldfuss, 1826, p. 13; OD]. *Jurassic:* Europe.

Fungispongia Ringueberg, 1884, p. 147 [**F. irregularis;* OD]. *Silurian:* USA.

Gemmellarella Parona, 1933, p. 21 [**G. permica;* OD]. *Permian:* Europe.

Goniocoelia Étallon, 1859a, p. 136. Type species, age, and locality uncertain.

Goniospongia d'Orbigny, 1849, p. 548 [**G. schlotheimii;* OD] [=*Gonioscyphia* Fromentel, 1860a, p. 40, obj.]. *Upper Jurassic:* France.

Graptospongia Ruedemann, 1934, p. 68 [**G. pusilla;* OD]. *Ordovician:* USA (New York).

Gymnomyrmecium Pomel, 1872, p. 203 [**Myrmecium gracile* Münster, 1841, p. 26; OD]. Club shaped, without dermal layer; shallow, cloacal depression at top. [Differs from *Epitheles* FROMENTEL, 1860a, in absence of dermal layer and shallower cloaca. A topotype identified by ZITTEL has sinuous spicules of the same size as those of *Epitheles,* but the trabecular mesh is much finer, and lacks the large internal canals; no known suitable figures.] *Triassic:* Europe.

Gymnorea POMEL, 1872, p. 225 [**Polycoelia gemmans* FROMENTEL, 1860a, pl. 4,*4;* SD RAUFF, 1893, p. 71]. *Cretaceous:* Europe.

Hallisida POMEL, 1872, p. 230 [**Hallirhoa lycoperdites* LAMOUROUX, 1821, p. 72; OD]. *Cretaceous:* Europe.

Hemicoetis POMEL, 1872, p. 102 [**Scyphia tenuis* ROEMER, 1840 in 1840–1841, p. 9; OD]. *Devonian.*

Hemipenia POMEL, 1872, p. 153 [**Oculispongia polymorpha* ROEMER, 1864, p. 48; SD DE LAUBENFELS, 1955, p. 105]. *Devonian.*

Hemispongia D'ORBIGNY, 1849, p. 549 [**H. rouyana;* OD]. *Cretaceous:* Europe.

Herpophlyctia POMEL, 1872, p. 237 [**H. subregularis;* OD]. *Paleogene–Neogene:* Algeria.

Herpothis POMEL, 1872, p. 247 [**H. saheliensis;* OD]. *Paleogene–Neogene:* Algeria.

Heterosmila POMEL, 1872, p. 239 [**H. diastoporiformis;* OD]. *Paleogene–Neogene:* Algeria.

Holcosinion POMEL, 1872, p. 90 [**Ocellaria laticostata* ROEMER, 1864, p. 17; SD DE LAUBENFELS, 1955, p. 105]. *Devonian.*

Holoracia POMEL, 1872, p. 227 [**Cnemidium turbinatum* MÜNSTER, 1841, p. 30; SD RAUFF, 1893, p. 71]. *Cretaceous:* Europe.

Holosphecion POMEL, 1872, p. 224 [**H. tuberosum;* OD]. Stipitate-spheroidal with variably developed, dermal layer; shallow, summit depression containing cluster of exhalant openings from which radiate rows of smaller, exhalant openings. Internal characters not known. External features somewhat similar to *Precorynella* and *Monotheles,* so far as POMEL's description permits comparison. [POMEL assigned the Triassic type of *Precorynella* to this genus as a second species; no known suitable figures.] *?Triassic, ?Jurassic* (*fide* RAUFF, 1893, p. 71): Europe; *?Paleogene–?Neogene:* Algeria.

Homalorea POMEL, 1872, p. 225 [**Tremospongia dilatata* ROEMER, 1864, p. 40; OD]. *Devonian.*

Homolpia POMEL, 1872, p. 105 [**Spongus townsendi* MANTELL, 1822, p. 164; OD]. *Devonian.*

Homoptychium POMEL, 1872, p. 69 [**Coeloptychium deciminum* ROEMER, 1864, p. 3; OD]. *Cretaceous:* Europe.

Hylospongia SOLLAS, 1873, p. 79 [**H. patera;* SD RIGBY, herein]. *Lower Cretaceous:* Europe.

Hystrispongia ULRICH in MILLER, 1889, p. 160 [=*Hystriospongia* ULRICH, 1890b, p. 245, *nom. null.*]. *Carboniferous:* USA.

Isophyllum DE LAUBENFELS, 1955, p. 105, *nom. nov. pro Coelophyllum* SCHRAMMEN, 1924a, p. 150, *non* SCUDDER, 1875 [**Coelophyllum marginatum* SCHRAMMEN, 1924a, p. 150; OD]. *Cretaceous:* Germany.

Kazakovicyathus KONYUSHKOV, 1972, p. 130 [**K. sajanicus;* OD]. Lower Cambrian: Russia.

Labyrintholites SINTZOVA, 1879, p. 17 [**L. varians;* SD DE LAUBENFELS, 1955, p. 106]. *Cretaceous:* Russia.

Leptomitosia BÖHM, 1927, p. 189 [**L. dubia;* OD]. *Cretaceous:* Europe.

Lithosiella RIGBY, herein, *nom. nov. pro Lithosia* POMEL, 1872, p. 252, *non* FABRICIUS, 1789 [**Turonia radiata* COURTILLER, 1861, pl. 40,*9–10;* OD]. [See also DE LAUBENFELS, 1955, p. 106.] *Cretaceous:* Europe.

Lithospongites CARTER, 1873, p. 439 [**L. kittoni* CARTER; SD DE LAUBENFELS, 1955, p. 106]. *Carboniferous:* Europe.

Loboptychium SCHRAMMEN, 1924a, p. 27 [**L. concavum;* SD DE LAUBENFELS, 1955, p. 106]. *Devonian.*

Lodanella KAYSER, 1885, p. 207 [**L. mira;* OD]. *Lower Cretaceous:* Europe.

Loenocoelia POMEL, 1872, p. 243 [**L. ramosa;* SD RAUFF, 1893, p. 72]. *Cretaceous:* Algeria.

Madrespongia QUENSTEDT, 1877 in 1877–1878, p. 212 [**M. trichotomoides;* SD DE LAUBENFELS, 1955, p. 106]. *Upper Jurassic:* Germany.

Maeandroptychium SINTZOVA, 1879, p. 5 [**M. polymorfum* SINTZOVA, 1879, p. 10; SD DE LAUBENFELS, 1955, p. 106]. *Cretaceous:* Russia.

Manon OKEN, 1815, p. 76 [**Spongia dichotoma* LINNÉ, 1767, p. 1296; SD DE LAUBENFELS, 1955, p. 106]. *?Cretaceous, Holocene:* Europe.

Mantellia PARKINSON, 1822, p. 53 [no species]. *Cretaceous:* United Kingdom.

Mastoscinia POMEL, 1872, p. 106 [**Scyphia verrucosa* GOLDFUSS, 1826, p. 7; SD DE LAUBENFELS, 1955, p. 106]. *Cretaceous:* Europe.

Megaspongia QUENSTEDT, 1877 in 1877–1878, p. 45 [**M. tessellata* QUENSTEDT, 1877 in 1877–1878, p. 48; SD DE LAUBENFELS, 1955, p. 106]. *Jurassic:* Europe.

Megastroma DAWSON, 1883, p. 12 [**M. laminosum;* OD]. *Carboniferous (Mississippian):* Canada (Brookfield, Nova Scotia).

Miassocyathus FOMIN, 1963, p. 17 [**M. lobanovae;* OD]. *Middle Devonian:* Russia (eastern Ural Mountains).

Monamona DE LAUBENFELS, 1955, p. 106, *nom. nov. pro Mona* SMITH, 1911, p. 149, *non* HULST, 1888 [**Mona monensis* SMITH, 1911, p. 149; OD]. *Carboniferous:* Isle of Man.

Monilites CARTER, 1871, p. 132 [**M. haldonensis;* SD DE LAUBENFELS, 1955, p. 106]. *Devonian.*

Monotheles FROMENTEL, 1860a, p. 35 [**M. neocomiensis;* OD] [=*Distheles* FROMENTEL, 1860a, pl. 2,*7* (type, *D. depressa,* OD); *Cnemicopanon* POMEL, 1872, p. 227, *nom. van.,* obj.]. Globular-stipitate or pyriform with deep, exhalant grooves often radiating from central, summit osculum; very shallow cloaca; no dermal layer. Trabecular microstructure unknown, and genus may not be related to *Epiheles.* [*Distheles* differs from *Monotheles* only in being colonial rather than solitary; no known figures of type species.] *Lower Cretaceous:* Europe.——FIG. 505,*2a–b. M. stellata* FROMENTEL, Neocomian, Germany; *a,* side view of obconical sponge, exhalant grooves around osculum, ×1; *b,* vertical section through same specimen with shallow spongocoel and canal structure, ×1 (Fromentel, 1860a).

Nanodiscites Sollas, 1880d, p. 387 [**N. parvus;* OD]. *Cretaceous:* Europe.

Nelumbosium Gregorio, 1930, p. 69 [**N. primum;* OD]. *Permian:* Sicily.

Nexispongia Quenstedt, 1877 in 1877–1878, p. 162 [**N. libera;* OD]. *Jurassic:* Germany.

Nudispongia Quenstedt, 1877 in 1877–1878, p. 220 [**N. cribrata* Quenstedt, 1877 in 1877–1878, p. 219; SD de Laubenfels, 1955, p. 106]. *Jurassic:* Germany.

Occultus Krasnopeeva in Rezvoi, Zhuravleva, & Koltun, 1962, p. 58 [**Archaeospongia radiata* Krasnopeeva, 1937; OD]. *?Precambrian–Lower Cambrian:* Russia.

Ocellarioscyphia Fromentel, 1860a, p. 40 [**Ventriculites radiatus* Mantell, 1822, p. 168; SD de Laubenfels, 1955, p. 106]. *Cretaceous:* England.

Oegophymia Pomel, 1872, p. 141. Type species, age, and locality uncertain.

Olynthia Pomel, 1872, p. 76 [**Manon marginatum* Münster, 1841, p. 27; SD Rauff, 1893, p. 65]. *Cretaceous:* Europe.

Operytis Pomel, 1872, p. 229 [**Tragos stellatum* Goldfuss, 1826, p. 14; OD] [=*Actinopagia* Pomel, 1872, p. 245 (type, *Actinospongia stellata* Roemer, 1864, p. 48, OD)]. *Cretaceous:* Europe.

Orispongia Quenstedt, 1877 in 1877–1878, p. 192 [**Spongites perforatus* Quenstedt, 1877 in 1877–1878, p. 100; SD de Laubenfels, 1955, p. 106]. *Jurassic:* Germany.

Pachaena Sollas, 1880d, p. 392 [**P. hindi;* OD]. *Cretaceous:* Europe.

Pachastrellites Sollas, 1880d, p. 390 [**P. fusifer;* OD]. *Cretaceous:* Europe.

Pachycinclis Pomel, 1872, p. 110 [**Amorphospongia carantonensis* d'Orbigny, 1850 in 1850–1852, vol. 2, p. 188; OD]. *Cretaceous:* Europe.

Pachypegma Schrammen, 1924a, p. 31 [**P. macrostoma;* OD]. *Cretaceous:* Europe.

Pachytoechia Pomel, 1872, p. 230 [**Cnemidium parva* Étallon, 1859b, p. 544; OD]. [=*Pachytoecia* Zittel, 1878b, p. 35, *nom. null.*]. *Cretaceous:* Europe.

Palaeoderma Gerth, 1927, p. 116 [**P. tubulosa;* OD]. Cylindroidal and stipitate with gently concave, upper surface; stalk and lower part of main body covered with imperforate, dermal layer; upper surface covered with large, exhalant pores that open from vertical canals that run through body of sponge; outermost such canals form vertical grooves on sides of upper part; dendroclone rows perpendicular to upper surface. *Permian (Lopingian):* Timor. ——Fig. 505,*3a–c.* **P. tubulosa,* upper Permian limestone, Besleo; *a,* side view of holotype with lower stalk and numerous ostia of vertical, exhalant canals on upper surface, ×1; *b,* summit of holotype with ostia of exhalant canals, ×2; *c,* transverse section through upper part showing sections of vertical canals uniformly distributed in dense skeleton, ×3 (Gerth, 1929; courtesy of E. Schweizerbart'sche Verlagsbuchhandlung).

Palaeoieriea Laube, 1865, p. 233 [**Manon? gracilis* Münster, 1841, p. 28; OD]. Age and locality uncertain.

Paracinclis Pomel, 1872, p. 110 [**Amorphospongia digitata* d'Orbigny, 1850 in 1850–1852, vol. 2, p. 188; OD]. *Cretaceous:* Europe.

Paraglossotubenella Zhang & Zhang, 1990, p. 430 [**P. magma;* OD]. No description nor type locality given. *Permian:* China.

Paramelonella Howell, 1956, p. 30 [**P. etheridegi;* OD]. [Worm burrow trace fossil (see Pickett, 1983, p. 110).] *Permian (Artinskian):* Western Australia.

Paramorphospongia Howell, 1956, p. 34 [**P. globosa;* OD]. Small, encrusted pebble of sandstone (Pickett, 1983, p. 111). *Permian (Artinskian):* Western Australia.

Paramoudra Buckland, 1817, p. 413 [no species]. *Upper Cretaceous:* Ireland.

Parenia Počta, 1885, p. 19 [**P. oculata;* OD]. *Cretaceous:* Bohemia.

Peregrinellus Rigby, herein, *nom. nov. pro Peregrinus* Krasnopeeva, 1940, p. 32, *non* Kirkaldy, 1904 [**Pachytheca conica* Krasnopeeva, 1934; OD]. *Precambrian:* Kuznetsk Ala Tau, Russia.

Periphora Regnard, 1926, p. 483 [**P. robusta;* OD]. *Cretaceous:* Europe.

Perispongia d'Orbigny, 1849, p. 548 [**P. reflexa;* OD]. *Jurassic (Oxfordian):* France.

Phragmoscinia Pomel, 1872, p. 83 [**Scyphia decorata* Goldfuss, 1829, p. 90; OD]. *Cretaceous:* Europe.

Phymatocoelia Pomel, 1872, p. 242 [**Scyphia uvaeformis* Giebel, 1850, p. 57; OD]. [The type species was listed by Giebel (1852, p. 181) as being from the Kreidegebirge.] *Devonian:* France.

Phymatolpia Pomel, 1872, p. 105 [**Brachiolites tuberosus* Smith, 1848, p. 354; OD]. *Cretaceous:* Europe.

Phymocoetis Pomel, 1872, p. 102 [**Ocellaria interrupta* Roemer, 1864, p. 17; OD]. *Devonian.*

Pilosphecion Pomel, 1872, p. 223 [**Tragos acutemarginatum* Klipstein, 1843 in 1843–1845, p. 282; SD Rauff, 1893, p. 71]. *Cretaceous:* Europe.

Placorea Pomel, 1872, p. 225 [**Limnorea mammillaris* Roemer, 1864, p. 37; OD]. *Cretaceous:* Europe.

Planispongia Quenstedt, 1877 in 1877–1878, p. 317 [**P. auriformis* Quenstedt, 1877 in 1877–1878, p. 318, SD de Laubenfels, 1955, p. 107]. *Jurassic:* Europe.

Plectodocis Pomel, 1872, p. 103 [**Brachiolites fenestratus* Smith, 1848, p. 367; OD]. *Cretaceous:* Europe.

Plesiocnemis Pomel, 1872, p. 80 [**P. siphonioides;* SD Rauff, 1893, p. 66]. *Upper Jurassic:* Algeria.

Plethocoetis Pomel, 1872, p. 101 [**Laocoetis irregularis;* SD de Laubenfels, 1955, p. 107]. *Paleogene–Neogene:* Algeria.

Plococoelia Étallon, 1863, p. 427 [**P. obscura;* OD]. *Jurassic:* France.

Polycantha Sollas, 1873, p. 79 [**P. etheridgii;* OD]. *Lower Cretaceous:* Europe.

Polyozia Pomel, 1872, p. 91 [**P. ropalina;* OD]. *Paleogene–Neogene:* Algeria.

Polyproctus Schrammen, 1924a, p. 151 [**P. tuberosus;* SD de Laubenfels, 1955, p. 107]. *Cretaceous:* Europe.

Polyscyphia SINTZOVA, 1879, p. 19 [**P. pseudocoeloptychium* SINTZOVA, 1879, p. 20; OD]. *Cretaceous:* Russia.

Porosmila FROMENTEL, 1860a, p. 46 [**P. martini;* OD]. *Lower Jurassic:* Europe.

Protocoelia WU Ya Sheng, 1991, p. 67 [**P. vermiformis;* OD]. *Permian (Cisuralian):* China.

Pseudosiphonia COURTILLER, 1861, pl. 28,*1–2* [**P. tuberculata;* OD]. *Cretaceous:* Europe.

Psilobolia POMEL, 1872, p. 230 [**P. metaeformis;* OD]. Globular, small, with central group of postica and short, radiating furrows at summit; short aporhyses radiating downwardly and outwardly from postica, with central one largest; no cortex; other skeletal characters unknown. [Position uncertain; but compared with *Astrobolia* by ZITTEL, 1878b, p. 116.] *Neogene (Miocene):* Algeria.——FIG. 505,*6.* **P. metaeformis,* Djebel Djambeida; view from above of globular sponge with central postica and radial furrows, ×1 (Pomel, 1872).

Pterosmila POMEL, 1872, p. 240 [**Ceriopora alata* GOLDFUSS, 1826, p. 38; SD DE LAUBENFELS, 1955, p. 107]. *Cretaceous:* Europe.

Pulvillus CARTER, 1878, p. 137 [**P. thomsoni;* SD DE LAUBENFELS, 1955, p. 107]. *Carboniferous:* Scotland, United Kingdom.

Puppispongia GREGORIO, 1930, p. 70 [**P. prostrema;* OD]. *Permian:* Sicily.

Quenstedtella DE LAUBENFELS, 1955, p. 107, *nom. nov. pro Vermispongia* WHITFIELD, 1905, p. 298, *non* QUENSTEDT, 1878 in 1877–1878 [**Vermispongia hamiltonensis* WHITFIELD, 1905, p. 298; OD]. *Cretaceous:* USA (Indiana).

Radicispongia QUENSTEDT, 1877 in 1877–1878, p. 179 [**R. radiciformis;* OD]. *Jurassic:* Europe.

Rauffella ULRICH, 1889, p. 235 [**R. filosa* ULRICH, 1889, p. 237; SD MILLER, 1889, p. 163]. *Ordovician:* USA.

Reteporites WALCH, 1776?, *non* LAMOUROUX, 1821, p. 50]. Type species, age, and locality uncertain.

Retia SOLLAS, 1873, p. 79 [**R. simplex;* SD RIGBY, herein]. *Lower Cretaceous:* Europe.

Rhabdaria BILLINGS, 1865, p. 357 [**R. fragilis;* SD MILLER, 1889, p. 164]. *Cambrian–Ordovician:* USA.

Rhabdocoetis POMEL, 1872, p. 102 [**Ocellaria cancellata* ROEMER, 1864, p. 17; OD]. *Cretaceous:* Germany.

Rhipidotaxis OPPLIGER, 1921a, p. 205 [No species designated]. Funnel-shaped sponge with rhizoclone spicules. *Jurassic:* Switzerland.

Rhiposinion POMEL, 1872, p. 91 [**Ventriculites decurrens* SMITH, 1848, p. 215; OD]. *Cretaceous:* Europe.

Rhizogonima POMEL, 1872, p. 159 [**Rhizospongia digitata* COURTILLER, 1861, p. 120; OD]. *Cretaceous:* Europe.

Rhytidolpia POMEL, 1872, p. 105 [**Ventriculites striatus* SMITH, 1848, p. 212; OD]. *Cretaceous:* Europe.

Rhyzospongia D'ORBIGNY, 1849, p. 548 [**Polypotecia pictonica* MICHELIN, 1847 in 1840–1847, p. 147; OD] [=*Rhysospongia* D'ORBIGNY, 1850 in 1850–1852, p. 286, obj., *non* CHARLESWORTH, 1848; *Risospongia* FROMENTEL, 1860a, p. 39, obj.; *Rizoscyphia* FROMENTEL, 1860a, p. 39, obj.]. *Upper Cretaceous:* France.

Satratus DE LAUBENFELS, 1955, p. 107 [**Strephochetus brainerdi* SEELEY, 1902, p. 156; OD] [=*Strephorhetus* VOSMAER, 1887, p. 402, obj.]. [SEELEY (1902, p. 157) proposed the species *Strephochetus atratus* (*S. atratus*) and apparently, through some confusion, the new genus *Satratus* was listed by DE LAUBENFELS (1955, p. 107), but that genus was not proposed by SEELEY.] *Middle Ordovician:* USA (Vermont).

Sciadosinion POMEL, 1872, p. 91 [**Coeloptychium plicatellum* ROEMER, 1840 in 1840–1841, p. 11; OD]. *Cretaceous:* Europe.

Scyphia OKEN, 1815, p. 77 [**Spongia scyphiformis* ESPER, 1794, p. 277; SD DE LAUBENFELS, 1936, p. 26]. Hollow, obconical sponges. Over 200 poorly described, fossil species from many systems have been assigned incorrectly to this genus, merely because they were hollow, obconical forms, although in other respects they are very diverse. [No certain fossils of the genus are known.] *Holocene.*

Scythia D'ORBIGNY, 1850 in 1850–1852, vol. 2, p. 284. Type species, age, and locality uncertain. [The genus was listed by DE LAUBENFELS (1955, p. 107) but a search of publications of D'ORBIGNY failed to turn up the term, and it is considered a misprint of *Scyphia.*]

Sestrimia POMEL, 1872, p. 71 [**Manon impressum* GOLDFUSS, 1829, p. 95; OD]. *Cretaceous:* Europe.

Shuqraiopsis JANSA, TERMIER, & TERMIER, 1983, p. 202 [**S. abenakiensis;* OD]. Only sections known, and these include vertically curved, reticulate networks that are interrupted by numerous pores or canals; fused network includes so-called pillars that have circular sections and suggest fusion of desmas; skeletal elements are reported to appear similar to recrystallized lithistid structures. [Identification of spicule type is uncertain, and position in the Astylospongiidae, as was suggested by the authors, is unlikely.] *Jurassic:* Canadian Atlantic Shelf.

Siderospongia TRAUTSCHOLD, 1870, p. 233 [**S. sirensis;* OD]. Broadly saucer shaped with numerous oscules on concave surface; both external form and internal, spicular arrangement similar to that of *Anthaspidella;* poorly known. *Carboniferous (Mississippian):* Russia (Moscow basin).——FIG. 505,*5a–b.* **S. sirenis,* Kaluga; *a,* concave, upper surface of type specimen showing skeletal net interrupted by open oscules, ×0.5; *b,* circular dots of cross sections of trabs connected by long axis of dendroclones, ×4 (Trautschold, 1870).

Silurispongia MARTIN-WISMAR, 1878b, p. 65 [**S. conus;* OD]. Conical with gently concave, upper surface that bears pores arranged in radial rows converging on center; spicules unknown. [Poorly known, but may be a senior synonym of *Trochospongia* and *Zittelella.*] *?Silurian:* Germany (glacial drift).——FIG. 505,*4.* **S. conus,* glacial erratic, Lochemerberg; side view of obconical sponge with broad spongocoel marked by radial rows of exhalant ostia, dermal layer dense, ×0.5 (Martin-Wismar, 1878b).

Solenothyia POMEL, 1872, p. 68 [**Camerospongia schlönbachii* ROEMER, 1864, p. 5; OD]. *Cretaceous:* Europe.

Sparsispongia D'ORBIGNY, 1849, p. 549 [**Tragos rugosum* GOLDFUSS, 1829, p. 96; SD RIGBY, herein]. [ENGESER and MEHL (1993, p. 188) observed that designation by DE LAUBENFELS (1955, p. 107) of *S. polymorpha* GOLDFUSS (1831, p. 215), as the type species of *Sparsispongia* is not valid because that species was not mentioned by D'ORBIGNY (1849), and that the type species must be selected from *Tragos rugosum* GOLDFUSS, 1826, or *Manon pulvinarium* GOLDFUSS, 1826. The latter species was selected as the type species of *Orosphecion* by POMEL, 1872.] *Jurassic:* Europe.

Sphecidion POMEL, 1872, p. 223 [**Manon tubuliferum* GOLDFUSS, 1826, p. 2; OD]. *Cretaceous:* Europe.

Speciopsis POMEL, 1872, p. 224 [**Achilleum poraceum* KLIPSTEIN, 1843 in 1843–1845, p. 281; OD]. *Cretaceous:* Europe.

Sphenodictya HERZER, 1901, p. 30 [**S. cornigera;* SD DE LAUBENFELS, 1955, p. 107]. *Carboniferous (Pennsylvanian):* USA (Marietta, Ohio).

Sphenopoterium MEEK & WORTHEN, 1860, p. 447 [**S. compressum* MEEK & WORTHEN, 1860, p. 448; SD DE LAUBENFELS, 1955, p. 107]. *Carboniferous:* USA.

Spongarium MURCHISON, 1839, p. 696 [**S. edwardsii;* OD] [=*Spongiarum* BRÖNN, 1848, p. 1192, obj.]. *Silurian:* Europe.

Spongillopsis GEINITZ, 1864, p. 517 [**S. dyadica;* SD DE LAUBENFELS, 1955, p. 107]. *Permian:* Europe.

Spongoconia POMEL, 1872, p. 249 [**S. angulosa;* SD DE LAUBENFELS, 1955, p. 107]. *Paleogene–Neogene:* Algeria.

Spongopagia POMEL, 1872, p. 246 [**Spongia informis* MICHELIN, 1847 in 1840–1847, p. 217; OD]. *Cretaceous:* Europe.

Spongospira STOEHR, 1880, p. 120 [**S. florealis;* OD]. Age and locality uncertain.

Sporocalpia POMEL, 1872, p. 117 [**Plocoscyphia morchella* POMEL, 1872, p. 117; SD DE LAUBENFELS, 1955, p. 107]. *Cretaceous:* Europe.

Sporosinion POMEL, 1872, p. 90 [**Ventriculites impressus* SMITH, 1848, p. 205; SD RAUFF, 1893, p. 66]. *Cretaceous:* Europe.

Spumispongia QUENSTEDT, 1877 in 1877–1878, p. 402 [**S. punctata* QUENSTEDT, 1877 in 1877–1878, p. 401; SD DE LAUBENFELS, 1955, p. 107]. *Jurassic:* Europe.

Stamnocnemis POMEL, 1872, p. 80 [**Cnemidium rouyana* D'ORBIGNY, 1850 in 1850–1852, vol. 2, p. 96; OD]. *Cretaceous:* Europe.

Stegendea FROMENTEL, 1875, p. 168 [=*Stegeudea* FROMENTEL, 1864, p. 26, *nom. null.*]. *Triassic–Cretaceous:* Europe.

Stenocoelia FROMENTEL, 1861, p. 357 [**S. ferryi;* OD]. Conical, sometimes stipitate, upper surface with scattered oscules. Trabecular microstructure not known. [The limited information concerning this genus suggests it is similar to *Oculospongia* FROMENTEL, 1860a, or perhaps *Mammillopora* BRONN, 1825. FROMENTEL (1861, p. 357) compared it to *Discoelia* FROMENTEL, 1861, which appears to be a synonym of *Peronidella* ZITTEL in HINDE, 1893b.] *Cretaceous (Berriasian–Hauterivian):* France.

Streblia POMEL, 1872, p. 207 [**S. tuberiformis;* SD DE LAUBENFELS, 1955, p. 107]. *Paleogene–Neogene:* Algeria.

Strephochetus SEELEY, 1885, p. 357 [**S. ocellatus;* SD MILLER, 1889, p. 165] [=*Strephorhetus* VOSMAER, 1887, p. 402, *nom. null.*]. *Middle Ordovician:* USA (Vermont).

Striataspongia HOWELL, 1957a, p. 1 [**S. cylindrica;* OD]. *Upper Devonian:* Western Australia.

Stromatopagia POMEL, 1872, p. 245 [*?*Sparsispongia radiosa* D'ORBIGNY, 1850 in 1850–1852, vol. 1, p. 109]. *Cretaceous:* Europe.

Sulcispongia QUENSTEDT, 1877 in 1877–1878, p. 81 [**S. incisa* QUENSTEDT, 1877 in 1877–1878, p. 82; SD DE LAUBENFELS, 1955, p. 108]. *Jurassic:* Germany.

Syncalpia POMEL, 1872, p. 116 [**Cnemidium astrophorum* GOLDFUSS, 1829, p. 97; SD RAUFF, 1893, p. 68]. *Cretaceous:* Europe.

Taothis POMEL, 1872, p. 246 [**Polytrema pavonia* D'ORBIGNY, 1850 in 1850–1852, vol. 2, p. 278; OD]. *Triassic–Cretaceous:* Europe.

Taseoconia POMEL, 1872, p. 249 [**T. obovata;* OD]. *Paleogene–Neogene:* Algeria.

Testaspongia QUENSTEDT, 1878 in 1877–1878, p. 539 [**T. craniolaris* QUENSTEDT, 1878 in 1877–1878, p. 540; SD DE LAUBENFELS, 1955, p. 108]. *Triassic–Cretaceous:* Europe.

Tethylites SOLLAS, 1880d, p. 390 [**T. cretaceus;* OD]. *Cretaceous:* Europe.

Tetrasmila FROMENTEL, 1860a, p. 46 [**T. corallina;* OD]. *Upper Jurassic:* Europe.

Textispongia QUENSTEDT, 1877 in 1877–1878, p. 60 [**T. coarctata;* SD DE LAUBENFELS, 1955, p. 94]. *Jurassic:* Germany.

Thalamospongia D'ORBIGNY, 1850 in 1850–1852, vol. 2, p. 96 [**T. cottaldina;* OD] [=*Thalamosmila* FROMENTEL, 1860a, p. 45, obj.]. *Triassic–Cretaceous:* Europe.

Thecospongia ÉTALLON, 1859b, p. 551 [**T. gresslyi;* OD]. *Jurassic:* France.

Tholothis POMEL, 1872, p. 246 [**Polytrema urceolata* (LAMOUROUX, 1839, pl. 1,*11*); SD RIGBY, herein]. *Triassic–Cretaceous:* Europe. [POMEL (1872) listed the species *Polytrema convexa* and *P. urceolata*

(LAMOUROUX), as cited by D'ORBIGNY, as members of the genus, but, of the two, only the latter was named in the study by D'ORBIGNY (1850 in 1850–1852, vol. 2, p. 279). Hence, *P. urceolata* should be considered as the type species, and not the former, as proposed by DE LAUBENFELS (1955, p. 108).]

Thrachythyia POMEL, 1872, p. 68 [**Cephalites capitata* SMITH, 1848, p. 288; OD]. *Cretaceous:* Europe.

Thyronia POMEL, 1872, p. 67 [**Cephalites seriatoporus* ROEMER, 1864, p. 7; OD]. *Triassic–Cretaceous:* Europe.

Thyia POMEL, 1872, p. 68, *nom. nud.* [*Thyia* is a large general line with no species, but it includes the genus *Thrachythyia.*] *Cretaceous:* Europe.

Toriscodermia WISNIOWSKI, 1889a, p. 674 [No species]. Loose spicules. *Jurassic:* Europe.

Trachysinion POMEL, 1872, p. 90 [**Ventriculites tuberculosum* ROEMER, 1864, p. 19; SD DE LAUBENFELS, 1955, p. 108]. *Cretaceous:* Germany.

Tretolmia POMEL, 1872, p. 115 [**Scyphia psilopora* GOLDFUSS, 1826, p. 9; OD]. *Cretaceous:* Europe.

Tretolopia POMEL, 1872, p. 204 [**T. sparsa;* SD DE LAUBENFELS, 1955, p. 108]. *?Paleogene–?Neogene:* ?Algeria.

Trinacrianella RIGBY, herein, *nom. nov. pro Trinacriella* PARONA, 1933, p. 32, *non* DEL-GUERCIO, 1913 [**Trinacriella retusa* PARONA, 1933, p. 33; OD]. *Permian:* Italy.

Trioxites RAFINESQUE-SCHMALTZ, 1839, p. 380 [**Achilleum dubium* GOLDFUSS, 1826, p. 9; OD]. Age and locality uncertain.

Triphyllactis SOLLAS, 1880d, p. 390 [**T. elegans;* OD]. Age and locality uncertain.

Triposphaerilla WISNIOWSKI, 1889b, p. 235 [**T. poctae;* OD]. *Jurassic:* Europe.

Ttachycnemis POMEL, 1872, p. 79 [**T. rugosa;* OD] [=*Trachycnemis* RAUFF, 1893, p. 66, *nom. null.*]. *Cretaceous:* Europe.

Tubispongia QUENSTEDT, 1877 in 1877–1878, p. 190 [**T. caecau* QUENSTEDT, 1877 in 1877–1878, p. 191; SD DE LAUBENFELS, 1955, p. 108]. *Jurassic:* Germany.

Tubulospongia COURTILLER, 1861, pl. 31,*1* [**T. insignis;* SD DE LAUBENFELS, 1955, p. 108]. *Cretaceous:* France.

Vermispongia QUENSTEDT, 1877 in 1877–1878, p. 171, *non* WU Ya Sheng, 1991, p. 68 [**V. wittlingensis* QUENSTEDT, 1877 in 1877–1878, p. 230; OD]. *Triassic–Cretaceous:* Germany.

Vomacispongites DE LAUBENFELS, 1955, p. 108, *nom. nov. pro Spongites* SCHLOTHEIM, 1820, p. 369, *non* OKEN, 1814 [**Spongites pertusus* SCHLOTHEIM, 1820, p. 371; OD]. *Cretaceous:* Europe.

GENERA INCORRECTLY ASSIGNED TO PORIFERA BUT BELONGING TO OTHER TAXA

Acanthochonia HINDE, 1884 (receptaculitid).

Alcyonium LINNÉ, 1758 (ascidian).

Alveolites LAMOUROUX, 1801 (coelenterate).

Anomaloides ULRICH, 1878 (receptaculitid).

Anthelia LAMOUROUX, 1816 (coelenterate).

Anthophyllum SCHWEIGGER, 1820 (coelenterate).

Bebryce PHILLIPI, 1842 (coelenterate).

Calceolispongia ETHERIDGE, 1915 (crinoid).

Camarocladia MILLER, 1889 [**C. dichotoma;* OD]. *Cambrian–Ordovician.* (trace fossil).

Cellepora GMELIN, 1789 (bryozoan).

Cerionites MEEK & WORTHEN, 1868 (receptaculitid)

Ceriopora GOLDFUSS, 1833 (bryozoan).

Choanites MANTELL, 1822 (ascidian).

Cyclocrinites EICHWALD, 1842 (receptaculitid).

Cylindrites GOEPPERT, 1842 (alga).

Dictyocrinus HALL, 1859, (receptaculitid)

Eschara LAMOUROUX, 1801 (bryozoan).

Fibularia LAMOUROUX, 1816 (echinoderm).

Fungites MARTINI, 1762 (coelenterate).

Heliolites DANA, 1846 (coelenterate).

Hydnopora PHILLLIPI, 1836 (bryozoan).

Ichnospongia RIGBY, 1980 (trace fossil, burrow)

Ischadites MURCHISON, 1839 (receptaculitid)

Isis LINNÉ, 1758 (coelenterate).

Kaiyangites QIAN & YIN, 1984 (possible conodont or uncertain taxonomy)

Lepidolites ULRICH, 1889 (receptaculitid).

Lichenopora DE FRANCE, 1823 (coelenterate).

Millepora LINNÉ, 1758 (coelenterate).

Nidulites SALTER, 1851 (receptaculitid)

Palaeacis MEEK & WORTHEN, 1860 (coelenterate).

Palaeospongia D'ORBIGNY, 1849 (receptaculitid, =*Ischadites*)

Pasceolus BILLINGS, 1857 (receptaculitid)

Polypatina ARENDT, 1956 (coelenterate, =*Palaeacis*)

Receptaculites DE BLAINVILLE, 1830 (receptaculitid)

Retopora LAMOUROUX, 1801 (bryozoan).

Somphospongia BEEDE, 1899, p. 128 [**S. multiformis;* OD]. *Carboniferous:* USA (Coal Measures, Kansas), (alga).

Sphaerospongia PENGELLY, 1861 (receptaculitid).

Theonoa LAMOUROUX, 1821 (bryozoan).

Vintonia NITECKI & RIGBY, 1965, p. 1,374 [**V. doris;* OD]. *Carboniferous (Mississippian):* USA (Fayetteville Shale, Arkansas), (plant, seedfern).

RANGES OF TAXA

The stratigraphic distribution of the Porifera recognized in this volume is shown graphically in the range chart (Table 1).

Because of the very long stratigraphic ranges of many higher taxa of Porifera, ranges in the chart are rather broad in order to ensure that all periods are included. For more detailed stratigraphic information, refer to the systematic section of the volume.

The following chart was compiled using software developed for the Paleontological Institute by Kenneth C. Hood and David W. Foster.

It must be emphasized that the order of taxa in this chart is governed entirely by their stratigraphic range and, within that, by alphabetical order and differs in some cases from the taxonomic order in the systematic part of the volume. No taxonomic conclusions should be drawn from the position of taxa in this chart.

Explanation of Table 1

PHYLUM	
CLASS SUBCLASS	
ORDER SUBORDER	
SUPERFAMILY FAMILY SUBFAMILY	
Genus Subgenus	
Occurrence questionable	????
Occurrence inferred	- - -

TABLE 1. *Stratigraphic Distribution of the Porifera.*

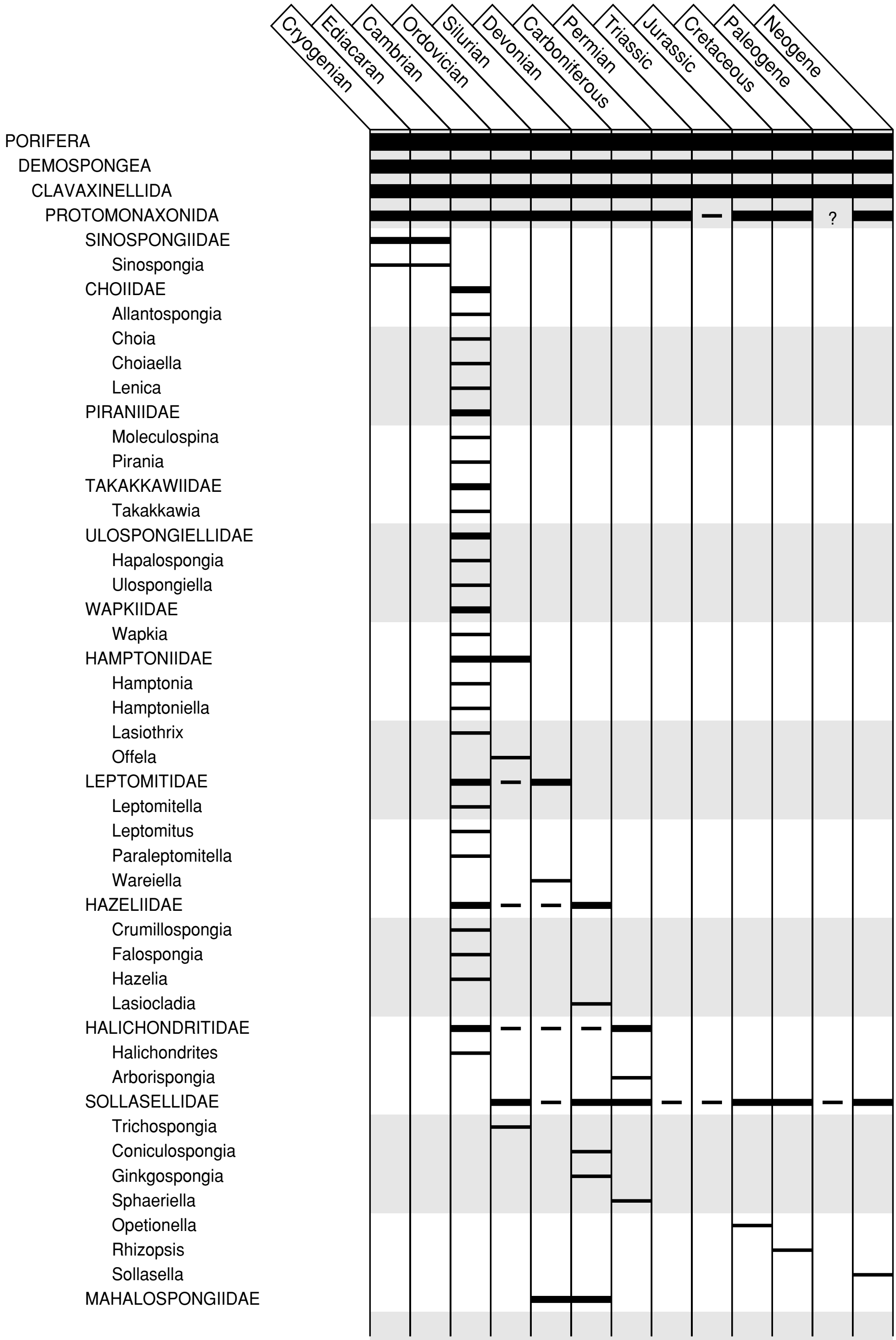

TABLE 1. *(Continued).*

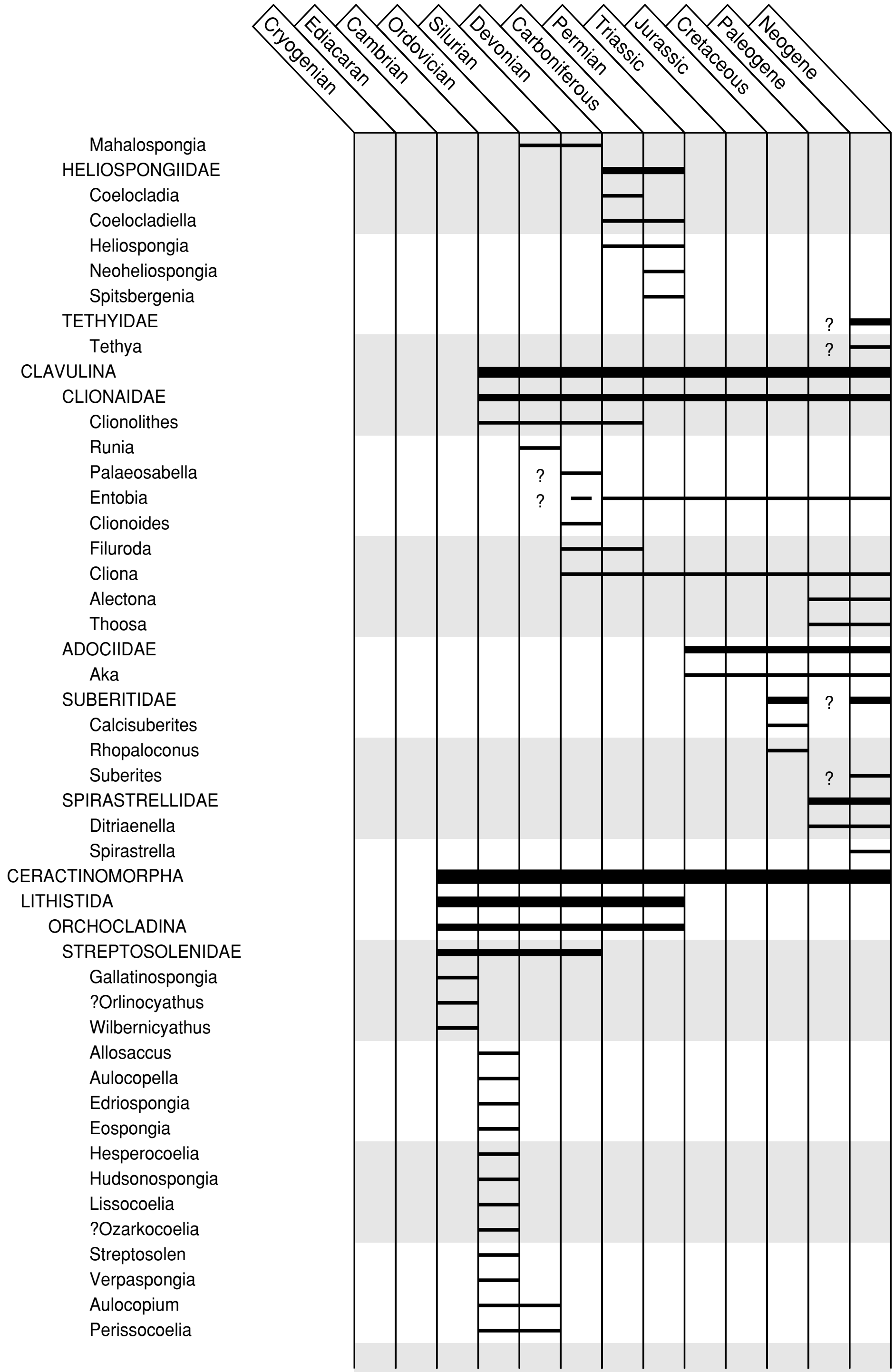

Table 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Antrospongia					—								
Dendroclonella					—								
Aulocopoides						—							
ANTHASPIDELLIDAE			—	—	—	—	—	—					
Capsospongia			—										
Fieldospongia			—										
Rankenella			—										
Amplaspongia				—									
Annulospongia				—									
Colinispongia				—									
Diotricheum				—									
Egania				—									
Exochopora				—									
Fibrocoelia				—									
Gleesonia				—									
Incrassospongia				—									
Jianghania				—									
Malongullospongia				—									
Nevadocoelia				—									
Okulitchina				—									
Protachilleum				—									
Pseudopalmatohindia				—									
Rhopalocoelia				—									
Rugocoelia				—									
Schismospongia				—									
Steliella				—									
Strotospongia				—									
Talacastonia				—									
Trachyum				—									
Vandonia				—									
Vankempenia				—									
Velellospongia				—									
Yarrowigahia				—									
Zittelella				—									
Archaeoscyphia				—	—								
Calycocoelia				—	—								
Dunhillia				—	—								
Patellispongia				—	—								
Psarodictyum				—	—								
Anthaspidella				—	—	—							
Aulocopina					—								
Cauliculospongia					—								
Climacospongia					—								
Finksella					—								
Rhodesispongia					—								
Somersetella					—								
Trochospongia					?								
Australospongia						—							

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Brianispongia						—							
Canningella						—							
Cockbainia						—							
Fistulosospongia						—							
Isispongia						—							
Playfordiella						—							
Syringelasma						—							
Jereina						—	—	—					
Virgaspongia							—						
Phacellopegma							—	—					
Aulacospongia								—					
Incrustospongiella								—					
Mastophyma								—					
Multistella								—					
Palaeojerea								—					
Palaeophyma								—					
Pseudomultistella								—					
Pycnospongia								—					
Timidella								—					
Tschernyschevostuckenbergia								—					
Virgaspongiella								—					
ASTYLOSPONGIIDAE				—	—	—	-	—					
Astylostroma				—									
Caliculospongia				—									
Camellaspongia				—									
Phialaspongia				—									
Astylospongia				—	—								
Carpospongia				—	—								
Caryospongia				—	—								
Astylospongiella					—								
Caryoconus					—								
Palaeomanon					—								
Astyloscyphia						—							
Astylotuba						—							
Attungaia						—							
Devonoscyphia						—							
Garraspongia						—							
Globispongia						—							
Jazwicella						—							
Malinowskiella						—							
Inglispongia						?							
Ellesmerespongia								—					
Raanespongia								—					
CHIASTOCLONELLIDAE				—	—	—	-	—					
Syltispongia				—									
Chiastoclonella				—	—								
Allassospongia						—							
Rutkowskiella						—							

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Actinocoelia								—					
Defordia								—					
Insulipora								—					
Pseudovirgulopsis								—					
ANTHRACOSYCONIDAE						━	-	━					
Devonospongia						—							
Anthracosycon								—					
Collatipora								—					
Dactylites								—					
?Laubenfelsia								—					
AGELASIDA			?	━	━	━	━	━	━	━	━	━	
SEBARGASIIDAE			?	?	-	-	━	━	━				
Amblysiphonella			?	?	-	-	—	—	—				
Sebargasia							—						
Chinaspongia								—					
Crymocoelia								—					
?Laccosiphonella								—					
?Lingyunocoelia								—					
?Paramblysiphonella								—					
Pseudoamblysiphonella								—					
Pseudoguadalupia								—					
Stylocoelia								—					
Vesicotubularia								—					
Polycystocoelia								—	—				
Minisiphonella									—				
Oligocoelia									—				
ANGULLONGIIDAE				━									
Alaskaspongia				—									
Amblysiphonelloides				—									
Angullongia				—									
Belubulaia				—									
Nibiconia				—									
CLIEFDENELLIDAE				━									
Cliefdenella				—									
Khalfinaea				—									
Rigbyetia				—									
THAUMASTOCOELIIDAE				━	-	-	-	━	━				
Porefieldia				—									
Pseudoporefieldia				—									
?Follicatena								—	—				
Thaumastocoelia								—	—				
Pamirothalamia									—				
Pamiroverticillites									—				
Sphaeroverticillites									—				
APHROSALPINGIDAE				━	━	-	━	━	━				
FISTULOSPONGININAE				━	━	-	━	━					
Cystothalamiella				—	—								
Aphrosalpinx					—								

TABLE 1. *(Continued).*

Taxon	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Nematosalpinx					—								
Uvacoelia							—						
Fistulosponginina								—					
PALAEOSCHADINAE					—								
Palaeoscheda					—								
VESICOCAULIINAE									—				
Russospongia									—				
Tolminothalamia									—				
Vesicocaulis									—				
Yukonella									—				
PREPERONIDELLIDAE				—	—	—	—	—	—				
PRECORYNELLINAE				—	—	—	—	—	—				
Imperatoria				—	—	—	—	—					
Bicoelia								—					
Minispongia								—					
Ramostella								—					
Precorynella								—	—				
Stollanella									—				
HEPTATUBISPONGIINAE								—	—				
Heptatubispongia								—					
Marawandia									—				
PERMOCORYNELLINAE								—	—				
Djemelia								—					
Saginospongia								—					
Permocorynella								—	—				
PREPERONIDELLINAE								—	—				
Bisiphonella								—					
Preperonidella								—	—				
Radiofibra								—	—				
GIRTYOCOELIIDAE				—	—	—	—	—	—	- -	- -	—	
Girtyocoelia				—	—	—	—	—	—				
Sollasia							—	—	—				
Amphorithalamia								—					
Phraethalamia								—					
Polyedra								—					
Enoplocoelia								—	—				
Henricellum								?	—				
?Solenocoelia									—				
Calymenospongia												—	
CRYPTOCOELIIDAE					—	- -	- -	—	—				
Rigbyspongia					—								
Cryptocoelia								—	—				
Anisothalamia									—				
Antalythalamia									—				
Sphaerothalamia									—				
FISSISPONGIIDAE						—	—	—					
?Hormospongia						—							
Fissispongia						?	—	—					

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
PHRAGMOCOELIIDAE						■	╌	╌	■				
Radiothalamos						■							
Phragmocoelia									■				
GIRTYCOELIIDAE							■	■	■				
Girtycoelia							■	■	■				
?Takreamina								■	■				
GUADALUPIIDAE							■	■	■				
?Cystauletes							■	■	■				
Cystothalamia							■	■	■				
Discosiphonella							■	■	■				
Guadalupia								■					
Lemonea								■					
Diecithalamia									■				
Praethalamopora									■				
MAEANDROSTIIDAE							■	■	■				
Maeandrostia							■	■	■				
Adrianella								■					
Polysiphonaria								■					
Stylopegma								■					
Eurysiphonella									■				
Prosiphonella									■				
AURICULOSPONGIIDAE								■					
ACOELIINAE								■					
Acoelia								■					
Solutossaspongia								■					
Thallospongia								■					
AURICULOSPONGIINAE								■					
Auriculospongia								■					
Cavusonella								■					
Radiotrabeculopora								■					
DAHARELLINAE								■					
Daharella								■					
GIGANTOSPONGIINAE								■					
Gigantospongia								■					
SPINOSPONGIINAE								■					
Spinospongia								■					
EXOTUBISPONGIIDAE								■					
Exotubispongia								■					
GLOMOCYSTOSPONGIIDAE								■					
Glomocystospongia								■					
Huayingia								■					
INTRASPOREOCOELIIDAE								■					
Belyaevaspongia								■					
Intrasporeocoelia								■					
Rahbahthalamia								■					
Rhabdactinia								■					
SPHAEROPONTIIDAE								■					
Sphaeropontia								■					

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
CATENISPONGIIDAE								X	X				
Catenispongia								X					
Ossimimus								X					
Stratispongia								X					
Hartmanina									X				
VIRGOLIDAE								X	X				
PARAHIMATELLINAE								X					
Parahimatella								X					
PREEUDINAE								X					
Medenina								X					
Microsphaerispongia								X					
Polytubifungia								X					
Preeudea								X					
Pseudovirgula								X					
Vermispongiella								X					
PSEUDOHIMATELLINAE								X					
Pseudohimatella								X					
VIRGOLINAE								X	X				
Intratubospongia								X					
Virgola								X					
Dactylocoelia									X				
Keriocoelia									X				
Reticulocoelia									X				
Sclerocoelia									X				
STELLISPONGIELLIDAE								X	X				
ESTRELLOSPONGIINAE								X					
Estrellospongia								X					
PRESTELLISPONGIINAE								X					
Prestellispongia								X					
STELLISPONGIELLINAE								X	X				
Stellispongiella								X	X				
PHARETROSPONGIIDAE								X	X	X	X		
LEIOFUNGIINAE								X	X	X	X		
Grossotubenella								X					
Radicanalospongia								X					
Leiofungia									X				
Leiospongia									X				
Loenopagia									X				
Aulacopagia										X			
Elasmopagia											X		
PHARETROSPONGIINAE									X	–	X		
Euepirrhysia									X				
Pharetrospongia											X		
OLANGOCOELIIDAE									X				
Olangocoelia									X				
PALERMOCOELIIDAE									X				
Palermocoelia									X				
SESTROSTOMELLIDAE									X	X	X		

TABLE 1. *(Continued)*.

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Ateloracia									—				
Brevisiphonella									—				
Himatella									—				
Polysiphonella									—				
Sestrostomella									—	—			
Epitheles										—			
Winwoodia										—			
Trachytila											—		
UNCERTAIN									—	—			
Fluegelispongites									—				
Madonia									—				
Thamnonema										—			
VERONGIDA			—	- -	- -	- -	—	- -	- -	- -	- -	- -	—
VAUXIIDAE			—										
Vauxia			—										
VERONGIIDAE							—	- -	- -	- -	- -	- -	—
Aplysinofibria							—						
Verongia													—
SPIROSCLEROPHORIDA			—	—	—	—	—	—	-	—	—	—	—
RHIZOMORINA			—	—	—	—	—	—					
HAPLISTIIDAE				—	—	—	—	—					
Boonderooia				—									
Lewinia				—									
Nipterella				—									
Taplowia				—									
Warrigalia				—									
Haplistion				—	—	—	—	—					
Parodospongia					—								
Columellaespongia						—							
Varneycoelia						—							
Crawneya						?							
Oremo						?							
?Radiatospongia							—						
?Rhaphidhistia							—						
Chaunactis							—	—					
Mortieria							—	—					
Kazania								—					
?Monarchopemmatites								—					
?Pemmatites								—					
UNCERTAIN			—										
Sentinelia			—										
AZORICOIDEA										—	—	—	—
AZORICIDAE										—	—	—	—
ASTROBOLIINAE										—	—		
Microrhizophora										—			
Oncocladia										—			
Astrobolia											—		
Bolidium											—		

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Urnacristata											—		
AULOSOMINAE										—	—		
?Polyrhizophora										—			
Yrrhiza										—			
Aulosoma											—		
Coelosphaeroma											—		
Oncodona											—		
Stachyspongia											—		
CYTORACIINAE										—	—	—	—
Cnemispongia										—			
Cytoracia										—	—	—	?
?Allomera													—
LEIOCHONIINAE											—		
Leiochonia											—		
Pseudocytoracea											—		
Scytalia											—		
SIPHONIDIINAE											—		
Pachysalax											—		
AZORICINAE											—	—	—
Coscinostoma											—		
Plinthodermatium											—		
Chonella											—	—	—
Pliobolia											—	—	—
Azorica											?	—	—
Cnemaulax													—
?Plioboliopsis													—
CNEMIDIASTRIDAE										—	—	—	—
Cnemopeltia										—			
C. (Cnemopeltia)										—			
C. (Tremastrum)										—			
Corallidium										—			
Cnemidiastrum										—	—	—	—
Cucumaltina													—
PLATYCHONIODEA										—	—	—	—
ARETOTRAGOSIDAE										—			
Aretotragos										—			
DISCOSTROMATIDAE										—			
DISCOSTROMATINAE										—			
Discostroma										—			
Hyalospongia										—			
Hyalotragos										—			
Proseliscothon										—			
PYRGOCHONIINAE										—			
?Patanophyma										—			
Pyrgochonia										—			
P. (Actinostrombus)										—			
P. (Pyrgochonia)										—			
PLATYCHONIIDAE										—	—	—	—

TABLE 1. *(Continued)*.

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Bothrolemma										—			
Chonellopsis										—			
Hyaloderma										—			
Platychonia										—			
Amphibleptula										—	—	—	—
SCLERITODERMATOIDEA										—	—	—	—
SCLERITODERMATIDAE										—	—	—	—
LEIODORELLINAE										—			
Epistomella										—			
Leiodorella										—			
AMPHITHELIONINAE											—	—	—
Amphithelion											—		
A. (Amphistomium)											—		
A. (Amphithelion)											—		
A. (Cryptothelion)											—		
Cladostelgis											—		
Verruculina											—	—	—
V. (Amphichondrium)											—		
V. (Verruculina)											—	—	—
Scythophymia													—
SCLERITODERMATINAE											?	-	—
Scleritoderma											?	-	—
UNCERTAIN													—
Pleurophymia													—
JEREICIDAE										—	—	—	—
Jereica										—	—		
Moretispongia										—	—	—	—
Stichophyma											—	—	—
Jereopsis													—
Pomelia													—
SELISCOTHONIDAE											—	—	—
?Laosciadia											—		
Pachyselis											—		
Pseudoseliscothon											—		
Rhabdotum											—		
Trachydictya											—		
Seliscothon											—	—	—
Histiodia													—
Kaliapsis													—
Phlyctia													—
UNCERTAIN										—	—		
Reiswigia										—			
Orecyta											—		
Perimera											—		
Plococonia											—		
Pocillospongia											—		
Verrucospongia											—		
UNCERTAIN								—	-	—	—	—	—

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Mastostroma								—					
Bothrochlaenia										—			
Pachypsechia										—			
Siphonocoelia										—			
Chlaenia											—		
Cladilithosia											—		
Cupulina											—		
Diacyparia											—		
Discodermites											—		
Elasmalimus											—		
Hypothyra											—		
Macandrewites											—		
Ocellaria											—		
Orosphecion											—		
Ortmannispongia											—		
Physocalpia											—		
Placojerea											—		
Platispongia											—		
Podapsis											—		
Polysiphoneudea											—		
Polystomiella											—		
Polythyra											—		
Pterocalpia											—		
Rhizostele											—		
Ishadia												—	—
Plethosiphonia												—	—
VACELETIDA			—	—	—	—	—	—	—	—	—	—	—
COLOSPONGIIDAE			—	—	—	—	—	—	—				
COLOSPONGIINAE			—	—	—	—	—	—	—				
Blastulospongia			—										
Pseudoimperatoria				—	—	—	—	—					
Colospongia							—	—	—				
Subascosymplegma								—					
Tristratocoelia								—					
Uvothalamia								—					
CORYMBOSPONGIINAE				—	- -	- -	- -	—	—				
Corymbospongia				—	- -	- -	- -	?					
Exaulipora				?	- -	- -	- -	—					
Imbricatocoelia								—					
Lichuanospongia								—					
Neoguadalupia								—	—				
Parauvanella								—	—				
Platythalamiella								—	—				
SOLENOLMIIDAE			—	- -	- -	- -	- -	—	—	?			
SOLENOLMIINAE			—	- -	- -	- -	- -	—	—	?			
Polythalamia			—										
Ambithalamia								—					
Paradeningeria								—	—				

TABLE 1. *(Continued).*

Taxon	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Preverticillites								x	x				
Solenolmia								x	x				
Welteria								x	x				
Panormida									x				
Sahraja									x				
Senowbaridaryana									x				
?Seranella									x				
?Cryptocoeliopsis									x	?			
?Deningeria									x	?			
BATTAGLIINAE									x				
Battaglia									x				
TEBAGATHALAMIIDAE								x	x				
Graminospongia								x					
Tebagathalamia								x					
Annaecoelia									x				
SALZBURGIIDAE								x	x				
Salzburgia								x	x				
VERTICILLITIDAE								x	x	x	x	x	x
POLYTHOLOSIINAE								?	x				
?Polytholosia								?	x				
Ascosymplegma									x				
Nevadathalamia									x				
?Tetraproctosia									x				
VERTICILLITINAE								x	x	x	x	x	x
Stylothalamia								x	x	x	x		
Boikothalamia										x			
?Menathalamia											x		
Murguiathalamia											x		
Vascothalamia											x		
Verticillites											x		
Vaceletia											x	x	x
Marinduqueia												x	
?Wienbergia												x	
FANTHALAMIINAE									x				
Cinnabaria									x				
Fanthalamia									x				
POLYSIPHOSPONGIINAE									x				
Polysiphospongia									x				
CHEILOSPORITIIDAE									x				
Cheilosporites									x				
CRIBROTHALAMIIDAE									x				
Cribrothalamia									x				
GIGANTOTHALAMIIDAE									x				
Gigantothalamia									x				
Zanklithalamia									x				
UNCERTAIN									x				
Platysphaerocoelia									x				
SIGMATOSCLEROPHORIDA				x									

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
DYSTACTOSPONGIIDAE				X									
Dystactospongia				X									
Heterospongia				X									
Loganiella				X									
Streptospongia				?									
MEGALITHISTIDA				X	X	-	X	-	-	X	X	X	X
MEGAMORINA				X	X	-	X	-	-	X	X	X	X
NEXOSPONGIIDAE				X									
Nexospongia				X									
SACCOSPONGIIDAE				X	X								
Cliefdenospongia				X									
Epiplastospongia				X									
Rugospongia				X									
Saccospongia				X									
Eochaunactis					X								
Haplistionella					X								
ARCHAEODORYDERMATIDAE							X						
Archaeodoryderma							X						
PLEROMATIDAE							?	-	-	X	X	X	X
PLEROMATINAE							?	-	-	-	X	X	X
Doryderma							?	-	-	-	X		
Homalodoriana											X		
Pachypoterion											X		
?Propleroma											X		
Trachycinclis											X		
Schizorhabdus											X	X	
Pleroma											?	X	X
HETEROSTINIINAE										X	X		
Anomorphites										X			
Megalithista										X			
?Placonella										X			
Amphiplectella											X		
Gigantodesma											X		
Heterostinia											X		
Holodictyon											X		
HELOMORINA										X	X		
CARTERELLIDAE										X	X		
ISORAPHINIINAE										X	X		
Heloraphinia										X	X		
Pachycothon										X	X		
Eulespongia											X		
CARTERELLINAE											X		
Carterella											X		
Inodia											X		
Nematinion											X		
AXINELLIDA								X					
AGELASIDAE								X					
Ropalospongia								X					

TABLE 1. *(Continued).*

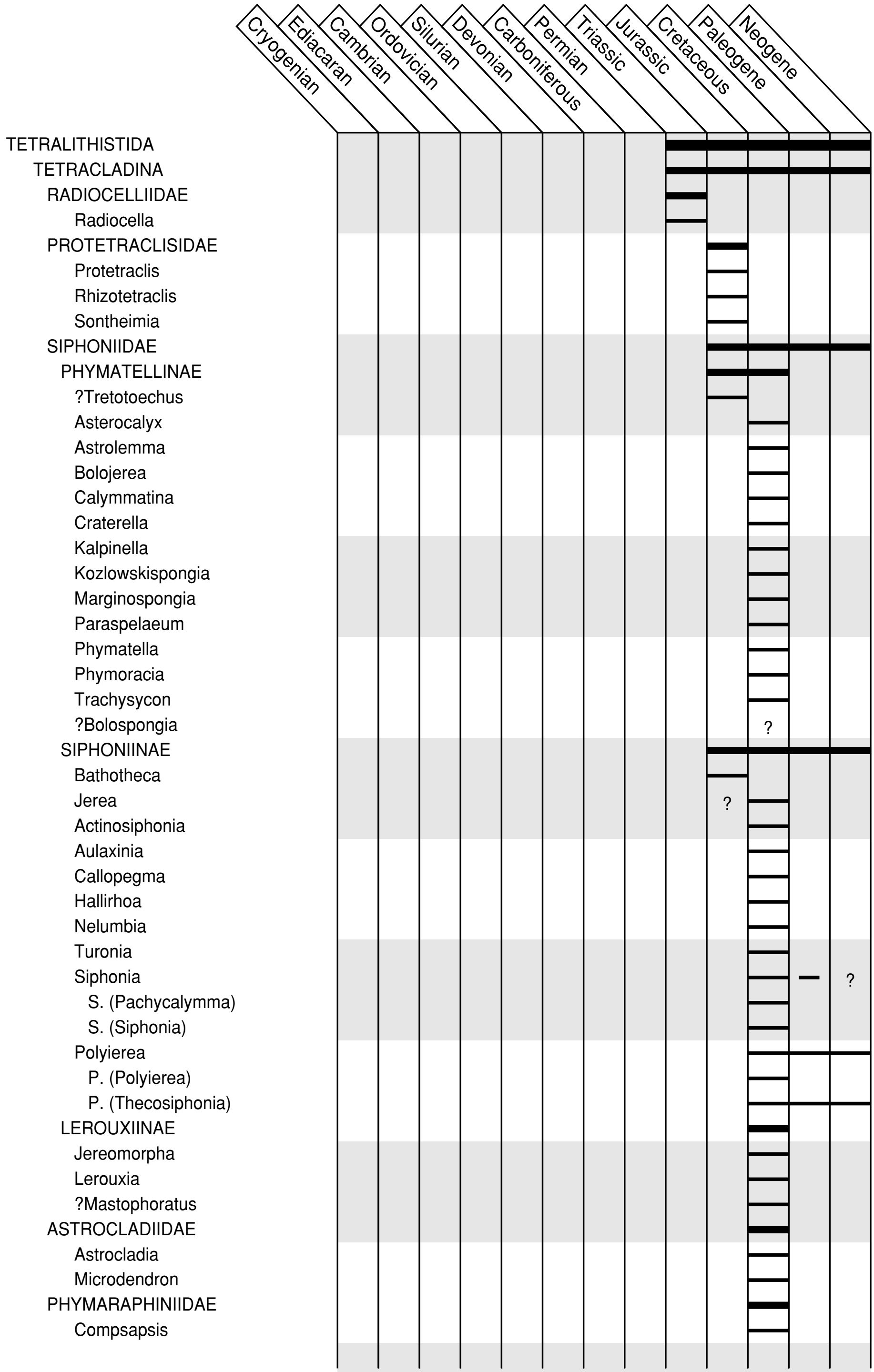

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Cycloclema											—		
Lopadophorus											—		
Pholidocladia											—		
P. (Pholidocladia)											—		
P. (Stelidium)											—		
Phymaraphinia											—		
Polyrhipidium											—		
Prokaliapsis											—		
P. (Prokaliapsis)											—		
PLINTHOSELLIDAE											—		
Ingentilotus											—		
Plinthosella											—		
Pycnodesma											—		
CHENENDOPORIDAE											—	?	
Chenendopora											—		
?Dimorphina											—		
Microcladina											—		
?Tragalimus											—	?	
THEONELLIDAE											—	—	—
PHYMAPLECTIINAE											—	—	
Phymaplectia											—	?	
Thamnospongia												—	
THEONELLINAE											—	?	—
Colossolacis											—		
Leiophyllum											—		
?Placoscytus											—		
Rhoptrum											—		
Stellettites											—		
Racodiscula											?	—	—
Discodermia											?	?	—
Theonella												?	—
ACROCHORDONIINAE											—	—	—
Acrochordonia											—		
Eustrobilus											—		
Pseudojerea											—		
Ragadinia											—		
Phyllodermia											—	?	
P. (Phyllodermia)											—		
P. (Cladodermia)											—	?	
Achrochordiella												—	
Pliegatella													—
UNCERTAIN											—		
Pachycorynea											—		
Rhopalospongia											—		
Verrucodesma											—		
Zitteleus											—		
UNCERTAIN											—	—	—
Vermiculissimum											—		

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Sulcastrella											—	—	—
DIDYMMORINA										—			
CYLINDROPHYMATIDAE										—			
Chonophyma										—			
Coscinodiscus										—			
Cylindrophyma										—			
Linochone										—			
Melonella										—			
DICRANOCLADINA										—	—	—	—
CORALLISTIDAE										—	—	—	—
CORALLISTINAE										—	—	—	—
Dicranoclonella										—			
Kyphoclonella										—			
Leiocarenus										—			
Leiohyphe											—		
Corallistes											?	—	—
Heterophymia													—
PACHINIONINAE											—		
Pachinion											—		
GIGNOUXIINAE											—	—	—
Gelasinophorus											—		
Gignouxia											—		
Gilletia											—		
Phrissospongia											—		
Pycnoclonella											—		
Schrammeniella											—		
Spinocladia											—		
Procorallistes											—	—	—
PSEUDOVERRUCULINIDAE											—		
Pseudoverruculina											—		
PSEUDORHIZOMORINA											—	—	—
NEOPELTIDAE											—	—	—
Neopelta											—	—	—
MACANDREWIIDAE											?	-	—
Macandrewia											?	-	—
MONALITHISTIDA										—	—	-	—
SPHAEROCLADINA										—	—	-	—
LECANELLIDAE										—	—		
Lecanella										—			
Sphaeropegma										—			
Poterionella											—		
Regnardia											—		
VETULINIDAE										—	—	-	—
VETULININAE										—	—	-	—
Jumarella										—			
Mastosia										—			
Rhytidoderma										—			
Cladodia											—		

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Cryptodesma											—		
Exodictydia											—		
Multipocula											—		
Tetraspongia											—		
Vetulina											?	-	—
MACROBROCHINAE											—		
Macrobrochus											—		
Ozotrachelus											—		
UNCERTAIN										—			
Benacia										—			
MEGARHIZOMORINA											—		
MEGARHIZIDAE											—		
Chalaropegma											—		
Megarhiza											—		
DICTYOCERATIDA										—	—	—	—
DYSIDEIDAE										—	-	—	—
Spongelites										—			
Dysidea												—	—
Spongeliomorpha													—
SPONGIIDAE													—
Spongia													—
UNCERTAIN											—		
Felixium											—		
POECILOSCLERIDA										—	—	—	—
ACARNIIDAE											—	-	—
Acanthoraphis											—		
Acarnia													—
AMPHILECTIDAE												—	—
Hamacantha												—	—
Amphilectus												?	—
CLADORHIZIDAE												—	—
Chondrocladia												—	—
Cladorhiza												—	—
LATRUNCULIIDAE												—	—
Latrunculia												—	—
MYXILLIDAE												—	—
Iophon												—	—
Myxilla												?	—
Iophonopsis													—
TEDANIIDAE												—	—
Forcepia												—	—
Acarnus												?	—
Melonanchora												?	—
Tedania													—
UNCERTAIN										—	-	—	—
Oppligera										—			
Makiyama												—	—
HAPLOSCLERIDA										—	—	—	—

TABLE 1. *(Continued).*

Taxon	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
SPONGILLIDAE										—	—	—	—
Eospongilla										—			
Spongilla										—	—	—	—
Palaeospongilla											—		
Lutetia												—	
Ephydatia													—
Eunapius													—
Heteromeyenia													—
Meyenia													—
Oncosclera													—
Radiospongilla													—
DESMACIDONTIDAE												—	—
Guitarra												—	—
Desmacidon												?	—
PETROSIIDAE												—	—
Propetrosia												—	—
Petrosia												?	—
HALICLONIDAE												?	—
Haliclona												?	—
Reniera													—
UNCERTAIN											—		
Esperites											—		
Eurydiscites											—		
HALICHONDRIDA												—	—
?HYMENIACIDONIDAE												—	—
Roepella												—	—
HALICHONDRIIDAE													—
Halichondria													—
UNCERTAIN				—	—	—	—	—	—	- -	—		
CRICCOSPONGIIDAE									—				
Criccophorina									—				
UNCERTAIN				—	—	—	—	—	- -	- -	—		
?Petrosites				—									
Syltrochos				—									
Atractosella					—								
Belemnospongia					—	—	—	—					
Incrustospongia							—						
Hippalimus											—		
TETRACTINOMORPHA				—	—	—	—	—	—	—	—		
STREPTOSCLEROPHORIDA				—	—	—	—	—					
EUTAXICLADINA				—	—	—	—	—					
HINDIIDAE				—	—	—	—	—					
Arborohindia				—									
Belubulaspongia				—									
Cotylahindia				—									
Fenestrospongia				—									
Mamelohindia				—									
?Microspongia				—									

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Palmatohindia				—									
Hindia				—	—	—							
Sphaerolites				—	—	—							
Sadleria						—							
Scheielloides						—							
Scheiia							—	—					
Scheiella								—					
HADROMERIDA								—	—	—	—		
POLYSIPHONIDAE								—	—				
?Arbusculana								—					
Polysiphon								—					
Zardinia									—				
CELYPHIIDAE								—	—	—	—		
Pisothalamia								—					
Tongluspongia								—					
Uvanella								—	—				
Celyphia								—	—	—	—		
Alpinothalamia									—				
Cassianothalamia									—				
Jablonskyia									—				
Leinia									—				
Loczia									—				
Montanaroa									—				
Pamirocoelia									—				
Paravesicocaulis									—				
Pseudouvanella									—				
CEOTINELLIDAE									—				
Ceotinella									—				
CHORISTIDA							—	—	—	—	—	—	—
PACHASTRELLIDA							—	-	—	?	—	—	—
PACHASTRELLIDAE							—	-	-	?	—	—	—
PACHASTRELLINAE							?	-	-	?	?	?	—
Pachastrella							?	-	-	?	?	?	—
Nethea											?	-	—
CALTHROPELLINAE											?	-	—
Calthropella											?	-	—
HALININAE											?	—	—
Dercitus											?	-	—
Triptolemma												—	—
UNCERTAIN							—	-	-	-	—		
Youngella							—						
Acanthophora											—		
Helobrachium											—		
Paropsites											—		
Propachastrella											—		
COSTAMORPHIIDAE									—				
Costamorpha									—				
THENEIDAE											—	?	—

Table 1. *(Continued).*

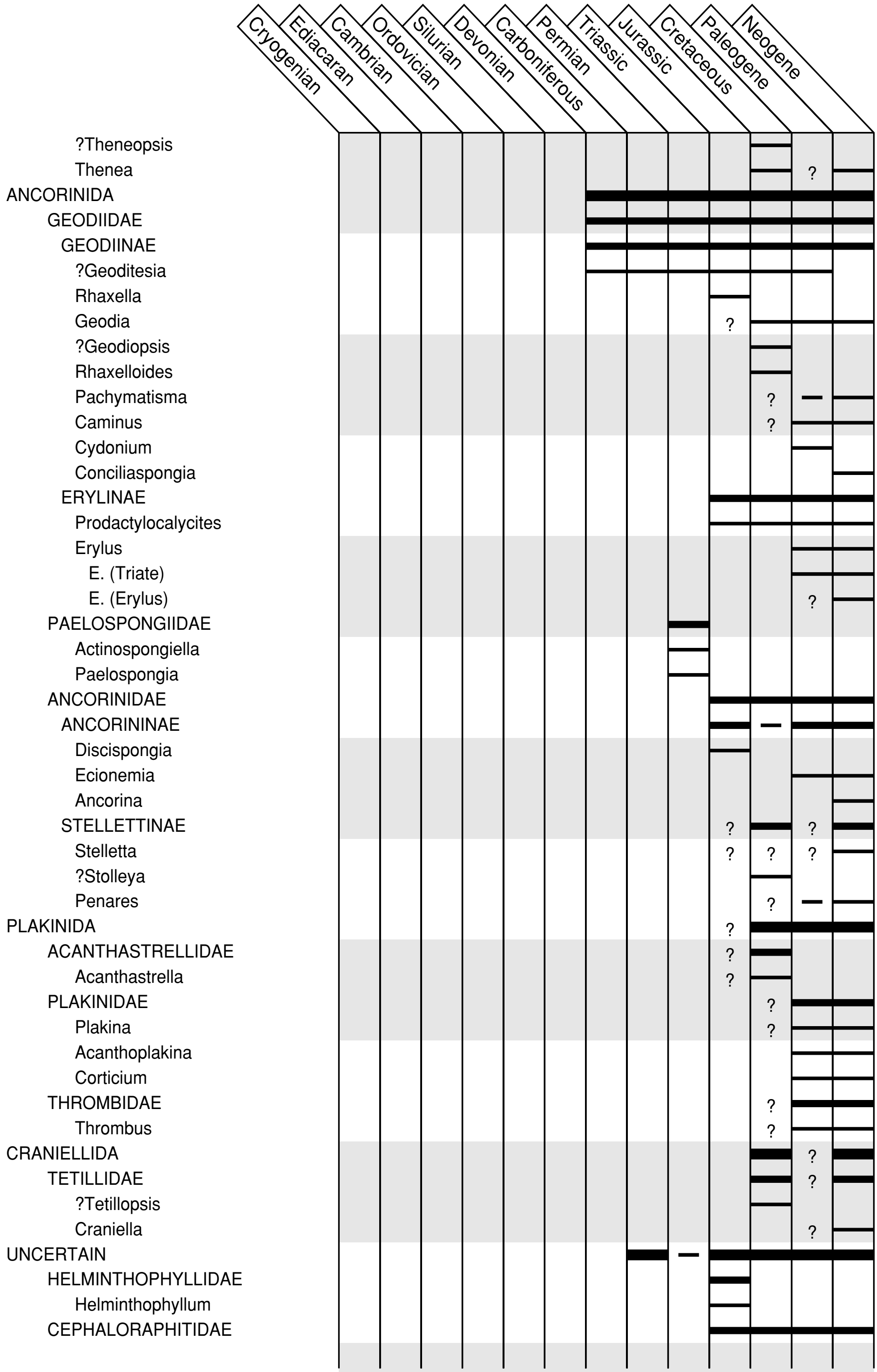

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Euleraphe										—			
Ophiodesia										—			
Cephaloraphidites											—		
Megaloraphium											—		
Polytretia											—		
Rhabdospongia											—		
Heteroraphidites											—	—	—
SCOLIORAPHIDIDAE											—		
Condylacanthus											—		
Scolioraphis											—		
UNCERTAIN								—	- -	—	—		
Ungulaspongia								—					
Arthaberia										—			
Fusiferella											—		
HEXACTINELLIDA		—	—	—	—	—	—	—	—	—	—	—	—
AMPHIDISCOPHORA		—	—	—	—	—	—	—	—	—	—	—	—
RETICULOSA		—	—	—	—	—	—	—	—	—	- -	- -	—
DICTYOSPONGIOIDEA		—	—	—	—	—	—	—	—				
DICTYOSPONGIIDAE		—	—	—	—	—	—	—					
DICTYOSPONGIINAE		—	—	—	—	—	—	—					
Palaeophragmodictya		—											
Hyalosinica			—										
Sanshadictya			—										
Dictyorhabdus				—									
Phormosella					—								
Cyathophycella					—	—							
Dictyospongia					?	—	—						
Lobospongia						—							
Ozospongia						—							
Polonoscyphia						—							
Porsguenospongia						—							
Ramulospongia						—							
Retifungus						—							
Dialyscyphia							—						
Mastodictya							—						
Repospongia							—						
Microstaura								—					
HYDNOCERATINAE			—	- -	- -	—	—						
Protoprisma			—										
Ceratodictya						—							
?Clepsydrospongia						—							
Hydnoceras						—							
Hydnocerina						—							
Rhabdosispongia						—							
Botryodictya						—	—						
Cleodictya							—						
Hydnoangulus							—						
?Tylodictya							—						

TABLE 1. *(Continued).*

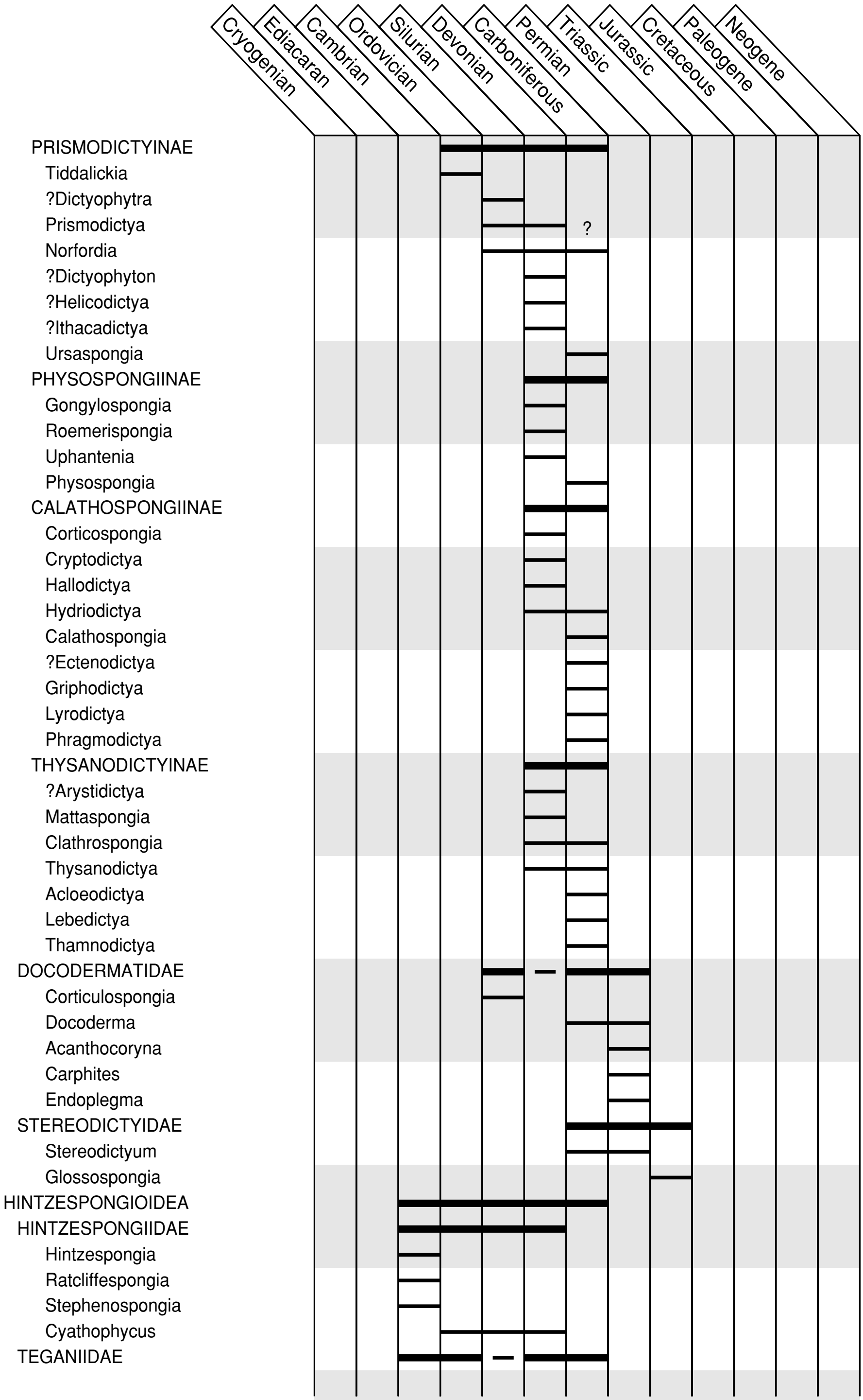

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Echidnina			—										
Teganium				—									
Bulbospongia						—							
Rhombodictyon						—							
Rufuspongia						—							
Taleolaspongia						—							
Teganiella						—	—						
PROTOSPONGIOIDEA			—	—	—	—	- -	- -	- -	—			
PROTOSPONGIIDAE			—	—	—	—	- -	- -	- -	—			
Acanthodictya			—										
Hunanospongia			—										
Kiwetinokia			—										
Palaeosaccus			—										
Pleodioria			—										
Quadrolaminiella			—										
Saetaspongia			—										
Sanshapentella			—										
?Testiispongia			—										
Triticispongia			—										
Diagoniella			—	—	—								
Protospongia			—	—	—	—							
Gabelia			?	- -	—	—							
Asthenospongia				—									
Megastylia				—									
Hexatractiella					—								
Plectoderma					—								
Actinodictya						—							
Iberospongia						—							
Ammonella										—			
DIERESPONGIOIDEA			—	—	—	—	—	—	- -	- -	- -	- -	—
MULTIVASCULATIDAE			—										
Multivasculatus			—										
HYDNODICTYIDAE			—	—									
Valospongia			—										
Hydnodictya				—									
DIERESPONGIIDAE				—	- -	- -	- -	—					
Dierespongia				—									
Foerstella				—									
Polyplectella				—									
Stephanella				—									
Sycodictya				—									
Polylophidium								—					
AMPHISPONGIIDAE					—								
Amphispongia					—								
AGLITHODICTYIDAE						—	—						
Aglithodictya						—							
Asociatella						—							
Pachyspongia						—							

TABLE 1. *(Continued).*

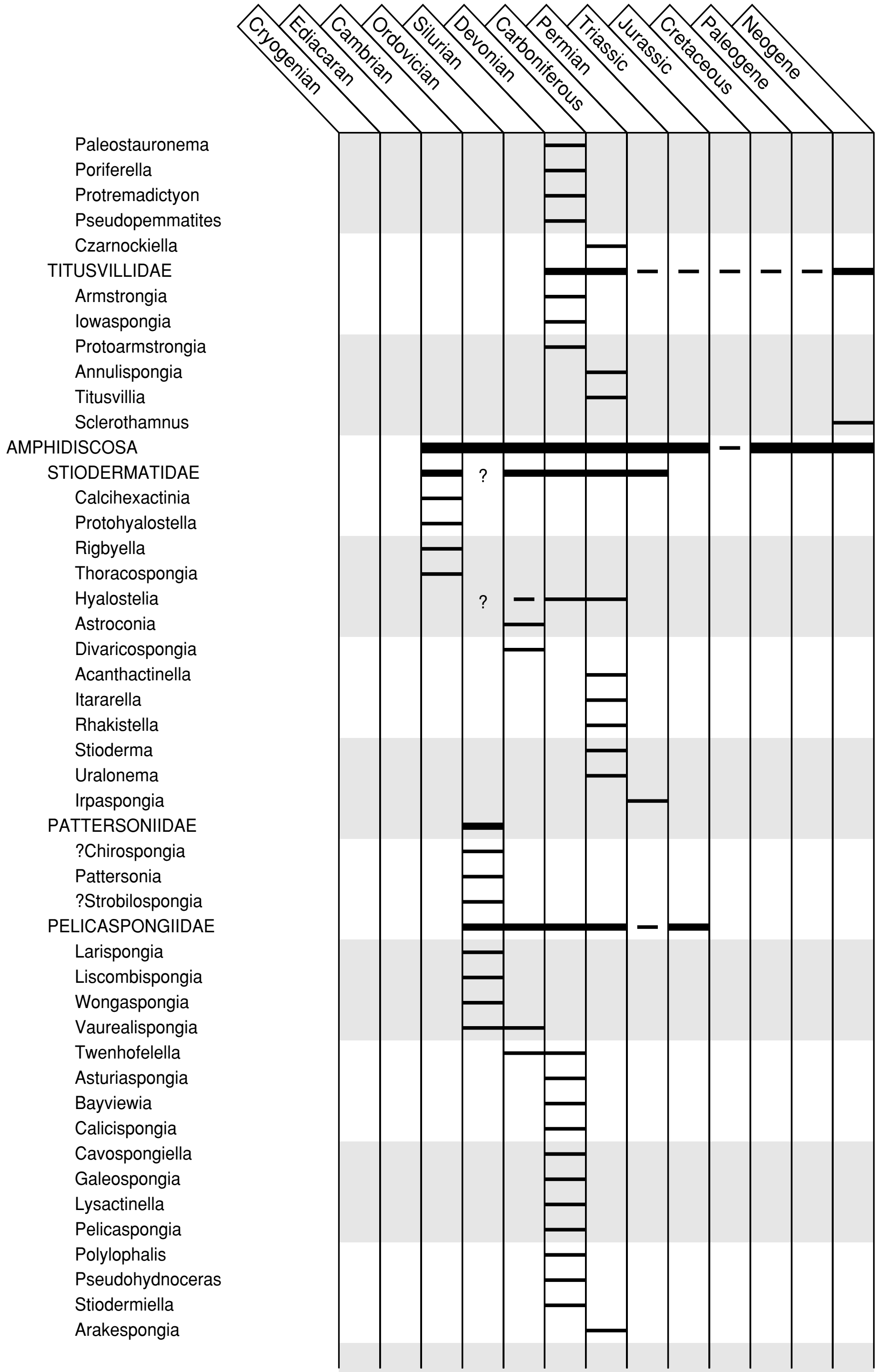

TABLE 1. *(Continued)*.

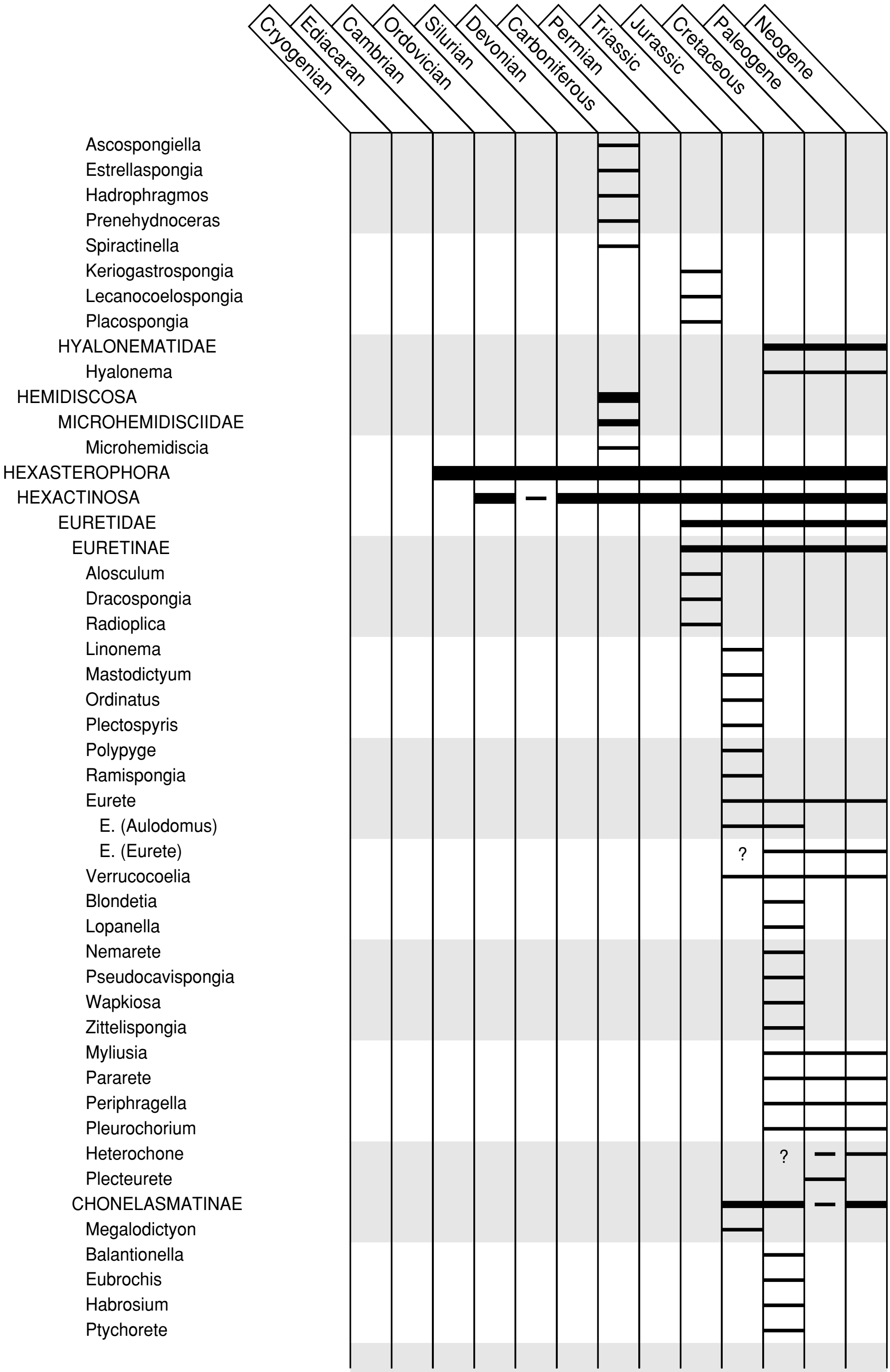

TABLE 1. *(Continued)*.

Taxon	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Typhlopleura											x		
Wollemannia											x		
Chonelasma													x
Tretochone													x
PSEUDOBECKSIINAE											x		
Pseudobecksia											x		
POLYTHYRIDINAE											x	x	x
Polythyris											x		
Lefroyella											?	x	x
UNCERTAIN											x		
Belonisia											x		
CRATICULARIIDAE									x	x	x	x	x
CASEARIINAE									x	x			
Caucasocoelia									x				
Dracolychnos									x				
Pseudoverticillites									x				
Casearia									x	x			
Innaecoelia										x			
CRATICULARIINAE									x	x	x	x	
Sphenaulax									x	x			
Craticularia										x			
Psephosyllogus										x			
Pycnocalyptra										x			
Dictyonocoelia										x	?		
Reticraticularia											x		
Diphyllospira												x	
Eutactostomium												x	
LAOCOETIDINAE									x	x	x	x	x
Scipiospongia									x				
Leptolacis										x			
Pachyascus										x	x		
Laocoetis										x	x	x	x
Botroclonium											x		
Intextum											x		
LEPTOPHRAGMATINAE										?	x	x	x
Leptophragma										?	x		
Pleurostoma											x		
Ptychocoetis											x		
Ptychodesia											x		
Strephinia											x		
Pseudoguettardia												x	
Leptophragmella													x
UNCERTAIN											x		
Ecblastesia											x		
Mimeticosia											x		
Periplectum											x		
Synaulia											x		
CRIBROSPONGIIDAE									x	x	x	x	x

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Nelumbifolium									—				
Tesselospongia									—				
Cribrospongia									—	—	—		
Erineum										—			
Feifelia										—			
Gevreya										—			
Keuppiella										—			
Andreaea											—		
Eubrochus											—		
Petalope											—		
Polyopesia											—		
Stichmaptyx											—		
Guettardiscyphia											—	—	
G. (Guettardiscyphia)											—		
G. (Hillendia)											—		
G. (Koleostoma)											—		
Stereochlamis											—	—	—
Haynespongia												—	
AULOCALYCIDAE										—			
?Polygonatium										—			
EMPLOCIDAE										—			
Emploca										—			
STAURODERMATIDAE										—	—	—	—
Polyschema										—			
Rhodanospongia										—			
Saynospongia										—			
Stauroderma										—			
Zittellospongia												—	—
Placochlaenia													—
TRETODICTYIDAE										—	—	—	—
TRETODICTYINAE										—	—	—	—
Psilocalyx										—	—	—	—
?Prohexactinella											—		
Hexactinella											—	—	—
H. (Parahexactinella)											—	—	—
H. (Hexactinella)											?	—	—
Tretodictyum											—	—	—
Auloplax											?	—	—
Ramalmerina													—
Sclerothamnopsis													—
PLACOTREMATINAE											—		
Cincliderma											—		
Placotrema											—		
APHROCALLISTIDAE											—	—	—
Aphrocallistes											—	—	—
CYSTISPONGIIDAE											—	—	—
Cystispongia											—	—	—
FARREIDAE											—	—	—

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Hormathospongia											—		
Farrea											—	—	—
F. (Farrea)											—	—	—
Chonodictyon											?	-	—
Phyllobrochis													—
EURYPLEGMATIDAE											?	-	—
Euryplegma											?	-	—
UNCERTAIN									—	—			
Carinthiaspongus									—				
Furcicanalis									—				
Imbricareola									—				
Scotospongia									—				
Tesselispongia									—				
Vermifistula									—				
Caseispongia										—			
Idiodictyon										—			
Misonia										—			
Multiloqua										—			
Mysterium										—			
Octobrum										—			
Porospongia										—			
Rhogostomium										—			
Rhombedonium										—			
Tremaphorus										—			
PILEOLITOIDEA				—	-	—	—	—	—				
WAREEMBAIIDAE				—									
Kalimnospongia				—									
Wareembaia				—									
CRATICULARIIDAE						—							
Conicospongia						—							
Cordiospongia						—							
Paleocraticularia						—							
Polonospongia						—							
Urnospongia						—							
EURETIDAE						—							
Paleoramospongia						—							
Paleoregulara						—							
PILEOSPONGIIDAE							—						
Pileospongia							—						
PILEOLITIDAE								—	—				
Pileolites								—					
Hexactinoderma									—				
PILLARASPONGIOIDEA						—							
PILLARASPONGIIDAE						—							
Pillaraspongia						—							
LYSSACINOSA				—	—	—	—	—	—	—	—	—	—
EUPLECTELLIDAE									—	—	—	—	—
TAEGERINAE									—	—	—	—	—

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Cypellospongia									—				
Arhoussia										—			
Guemeuria										—			
Tagountia										—			
Tillichtia										—			
Proeuplectella											—		
Purisiphonia											—		
Regadrella											—	—	—
EUPLECTELLINAE													—
Euplectella													—
UNCERTAIN									—	—			
Silesiaspongia									—				
Euplectellina										—			
STAURACTINELLIDAE										—	—	—	—
Stauractinella										—	—	—	—
PHERONEMATIDAE										?	—	—	—
Pheronema										?	–	?	—
Semperella											—	—	—
LEUCOPSACASIDAE												—	
Reguantella												—	
ASEMEMATIDAE												?	—
CAULOPHACINAE												?	—
Caulophacus												?	—
ROSSELLIDAE												?	—
ROSSELLINAE												?	—
Crateromorpha												?	—
UNCERTAIN				—	—	—	—	–	—	–	—		
Opeamorphus				—	—	—	—						
?Pyritonema					—								
Calycomorpha									—				
Krainerella									—				
Trimonactinophora									—				
Gomphites											—		
BRACHIOSPONGIOIDEA				—	—	–	—	—					
PYRUSPONGIIDAE				—									
Pyruspongia				—									
BRACHIOSPONGIIDAE				—	—								
Brachiospongia				—									
Colpospongia				—									
Rhaeaspongia				—									
Fistellaspongia					—								
MALUMISPONGIIDAE				—	—	–	—						
Walliospongia				—									
Malumispongium					—								
Oncosella					—								
Carbonella							—						
Scaphiomanon							—						
TOOMEYOSPONGIIDAE								—					

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Toomeyospongia								X					
LUMECTOSPONGIOIDEA					X								
LUMECTOSPONGIIDAE					X								
Lumectospongia					X								
CREPOSPONGIOIDEA									X				
CREPISPONGIIDAE									X				
Crepospongia									X				
LYCHNISCOSA										X	X	X	X
CYPELLIIDAE										X			
Cypellia										X			
Paracypellia										X			
Porocypellia										X			
Pseudoporospongia										X			
Sporadopyge										X			
POLYBLASTIDIIDAE										X	X		
Phlyctaenium										X			
Coeloscyphia											X		
SPORADOPYLIDAE										X	X		
Favispongia										X	?		
Xenoschrammenum										X	?		
Sestrodictyon											X		
VENTRICULITIDAE										X	X		
LYCHNISCAULINAE										X			
Discophyma										X			
Lychniscaulus										X			
VENTRICULITINAE										X	X		
Etalloniella										X			
Astropegma											X		
Coscinopora											X		
Flabellispongia											X		
?Leiostracosia											X		
Lepidospongia											X		
Licmosinion											X		
Napaeana											X		
Orthodiscus											X		
Phymosinion											X		
Pleuropyge											X		
Rhizopoterion											X		
Rhizopoterionopsis											X		
Spirospongia											X		
Sporadoscinia											X		
Ubiquiradius											X		
Ventriculites											X		
BOLITESIINAE											X		
Bolitesia											X		
STAURONEMATINAE											X		
Stauronema											X		
PACHYTEICHISMATIDAE										X	X		

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Mastospongia										X	X		
Pachyteichisma										X	X		
Trochobolus										X	X		
CALLODICTYONIDAE										X	X	X	X
CALLODICTYONINAE										X	X		
Coscinaulus										X			
Desmoderma										X			
Beaussetia											X		
Callodictyonella											X		
Cinclidella											X		
Diplodictyon											X		
Pleurope											X		
Porochonia											X		
Regnardielasma											X		
CALLICYLICINAE										X	X	X	X
Ceriodictyon										X			
Brachiolites											X		
Centrosia											X		
Cephalites											X		
Tremabolites											X		
Callicylix											X	X	X
C. (Cyclostigma)											X		
C. (Callicylix)											X	X	X
MICROBLASTIDINAE											X		
Microblastidium											X		
Spirolophia											X		
BECKSINAE											X	X	X
Becksia											X		
Discoptycha											X		
Oncolpia											X		
O. (Oncolpia)											X		
O. (Polyptycha)											X		
Plocoscyphia											X		
Sarophora											X		
Manzonispongia												X	X
DACTYLOCALYCIDAE										X	X	X	X
DACTYLOCALYCINAE										X	X		
?Calathiscus										X			
Exanthesis											X		
E. (Eligma)											X		
E. (Exanthesis)											X		
Moretiella											X		
Paraplocia											X		
?Scolecosia											X		
OPHRYSTOMATINAE											X		
Ophrystoma											X		
UNCERTAIN											X	X	X
Jima											X		

TABLE 1. *(Continued).*

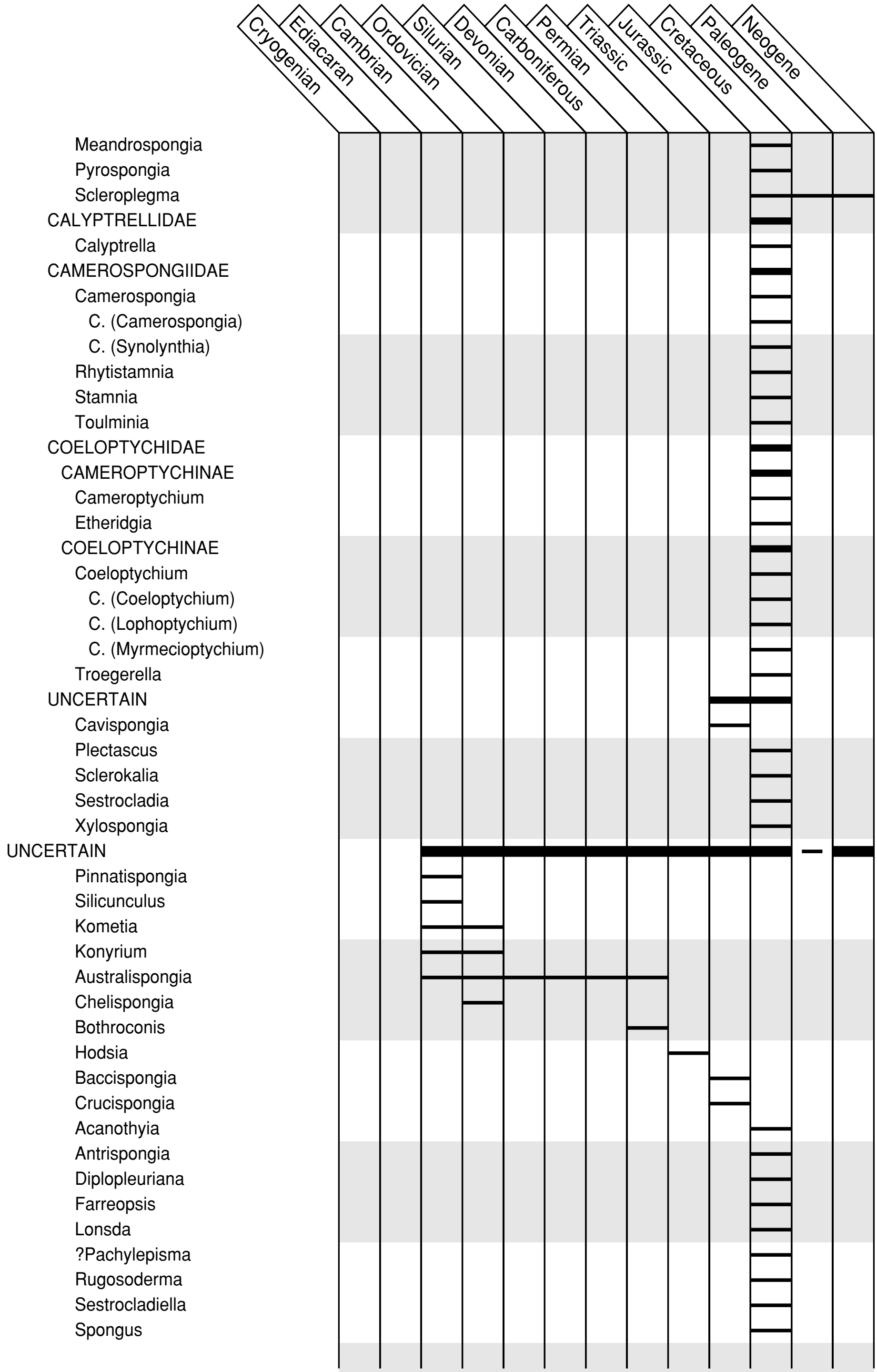

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Silicosphaera													—
HETERACTINIDA			—	—	—	—	—	—					
?HETAIRACYATHIDA			—										
HETAIRACYATHIDAE			—										
Girphanovella			—										
Gonamispongia			—										
Radiocyathus			—										
Uranosphaera			—										
UNCERTAIN			—										
Archicladium			—										
Polycladium			—										
OCTACTINELLIDA			—	—	—	—	—	—					
NUCHIDAE			—										
Jawonya			—										
Nucha			—										
Wagima			—										
ASTRAEOSPONGIIDAE			—	—	—	—							
Blastasteria			—										
Kuraya			—										
Asteriospongia				—									
Constellatospongia				—									
Astraeospongium				?	—	—							
Magenia					—								
Ensiferites					—	—							
Malluviospongia						—							
Stellarispongia						—							
Blumenbachium						?							
EIFFELIIDAE			—	—	- -	—	—						
Eiffelia			—										
Eiffelospongia			—										
Petaloptyon			—										
Astraeoconus				—									
Chilcaia				—									
Toquimiella				—									
Gondekia						—							
Zangerlispongia							—						
WEWOKELLIDAE							—	—					
Asteractinella							—						
Tholiasterella							—						
Wewokella							—						
Regispongia							—	—					
Talpaspongia								—					
CALCAREA			—	- -	- -	- -	—	—	—	—	—	—	—
CALCARONEA			—	- -	- -	- -	—	—	—	—	—	—	—
SYCETTIDA							—	- -	- -	—	—	—	—
GRANTIIDAE							—	- -	- -	—	- -	- -	—
Protoleucon							—						
Protosycon										—			

TABLE 1. *(Continued).*

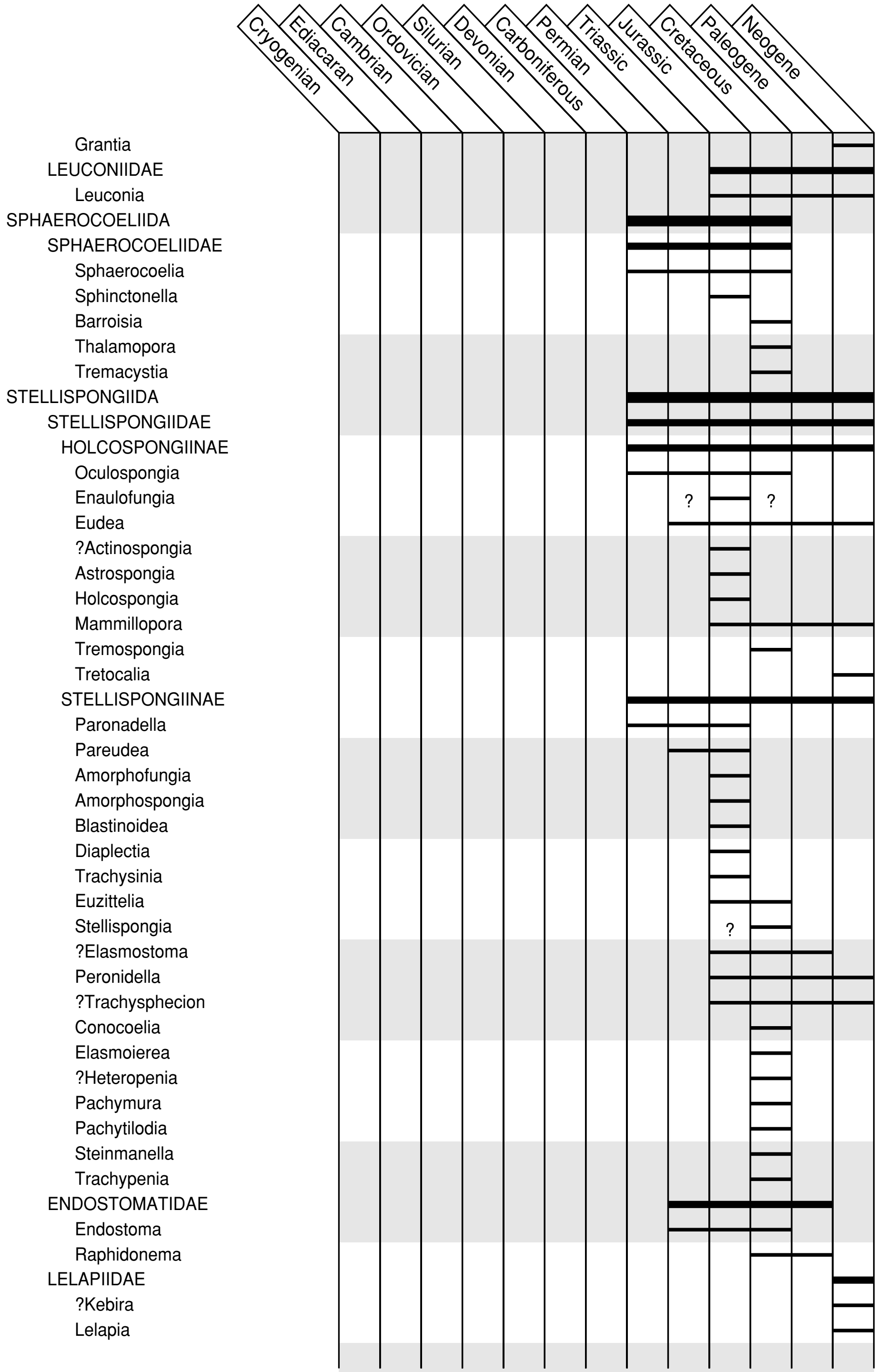

TABLE 1. *(Continued).*

Taxon	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
LITHONIDA										X	X	X	X
MINCHINELLIDAE										X	X	X	X
Muellerithalamia										X			
Bactronella										X	X	X	X
Porosphaera											X		
Porosphaerella											X		
Sagittularia											X		
Petrostroma											X	X	
Retispinopora											X	X	
Plectroninia											X	X	X
Minchinella													X
Tulearinia													X
LEPIDOLEUCONIIDAE													X
Lepidoleucon													X
PETROBIONIDAE													X
Petrobionia													X
UNCERTAIN			X										
Gravestockia			X										
CALCINEA													X
MURRAYONIDA													X
MURRAYONIDAE													X
Murrayona													X
PARAMURRAYONIDAE													X
Lelapiella													X
Paramurrayona													X
UNCERTAIN	X	X	X	X	X	X	X	X	X	X	X		
TADASSIIDAE			X										
Tadassia			X										
POLYACTINELLIDAE			X	X	X	X	X	X					
Bengtsonella			X										
?Polyactinella			X										
Sardospongia			X	?									
?Dodecaactinella			X	X									
Praephobetractinia			X	X									
Phobetractinia			X	X	X	X	X	X					
Dvorcia				X	X	X	X	X					
Reifelia					X	X	X						
Kucerella						X							
STROMATIDIIDAE								X					
Stromatidium								X					
UNCERTAIN	X	X	X	X	–	X	X	X	X	X	X		
Atikokania	X	X											
Misraea	X	X											
Nabaviella	X	X	X	X									
Eocoryne			X										
Heterostella			X										
?Solactiniella			X										
Taraxaculum			X										

TABLE 1. *(Continued).*

	Cryogenian	Ediacaran	Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Cretaceous	Paleogene	Neogene
Pseudolancicula				x									
Nepheliospongia						x							
Scribroporella						x							
Cotyliscus							x						
Eflugelia							x	x					
Corynospongia								x					
Ungula								x					
Bortepesia									x				
Lamellispongia									x				
Molengraaffia									x				
Oligoplagia									x				
Pseudodictyocoelia									x				
Cornuaspongia									x	x			
Trammeria									x	x			
Rauffia									x	x	x		
Strambergia									x	x	x		
Alasonia										x			
Aphlebospongia										x			
Coniatopenia											x		
Diestosphecion											x		
Diplostomella											x		
Dyocopanon											x		
Glenodictyum											x		
Holocoelia											x		
Megalelasma											x		
Plectinia											x		
Polycnemiseudea											x		
Astrofungia											?		