MESOZOIC AND CENOZOIC DEMOSPONGES: RHIZOMORINA AND SUBORDER UNCERTAIN

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Suborder RHIZOMORINA Zittel, 1895

[Rhizomorina Zittel, 1895, p. 52]

Desmas monaxial and all developed as rhizoclones, and never as typical amphitrider-like dendroclones or chiastoclones, although some may resemble simple dendroclones; tetraxial dermalia always absent; some with special ectosomal desmas, in the form of flattened and strongly branched rhizoclones; skeletal framework compact, semifibrous, or with well-developed, composite, skeletal fibers; supplemental oxeas in some; modern examples with microrhabds, sigmaspires, or no microscleres. [In 1895 Zittel subdivided the Lithistidae into 5 suborders (tribus) based on so-called defining families (Tetracladina, Eutaxicladina, Anomocladina, Megamorina, and Rhizomorina).] *Middle Cambrian–Holocene.*

This suborder is understood in Schrammen's (1901, 1910) restricted sense to exclude all genera with tetraxial dermalia that were included by Zittel (1878a) and Rauff (1893, 1894, 1895) and that are now referred to the suborders Dicranocladina Schrammen (*Corallistes* Schmidt, *Pachinion* Zittel) and *Pseudorhizomorina* Schrammen (*Macandrewia* Gray) of the order Tetralithistida Lagneau-Hérenger. Rhizoclones are understood as comprising all the four types of desmas (linear, irregular, bipolar, radiate) shown in Rauff's original figure (1893, fig. 26), which was copied mainly from Zittel's (1878a, pl. 3,*4*) figure of desmas of *Hyalotragos patella* (Goldfuss), in which all these types are present together. Absence of typical amphitrider-like dendroclones and chiastoclones is mentioned in diagnosis because of correspondence between bipolar rhizoclones and the simplest types of dendroclones. Rhizoclones alone are not regarded as distinctive of any suborder, because rhizoclones occur also as supplementary desmas in various Dicranocladina, Didymmorina, and Orchocladina and as the principal desmas of the Pseudorhizomorina and Megarhizomorina.

Family classification of fossil Rhizomorina presents several problems, which need brief explanation.

(a) Sollas (1888) distinguished four families in dealing with modern forms: (i) Azoricidae Sollas, without microscleres or special dermalia; (ii) Cladopeltidae Sollas (no generic type; now Siphonidiidae von Lendenfeld), without microscleres but with dermalia in the form of flattened, strongly branching rhizoclones; (iii) Neopeltidae Sollas, with monaxial plates as dermalia and with amphiaster microscleres; and (iv) Scleritodermatidae Sollas, without special dermal megascleres but with sigmaspire microscleres. Most of the fossils are azoricid in the sense of lacking microscleres and special dermalia; but it cannot be said whether these conditions are original, or due to loss of the spicules of concern after death.

(b) In Schrammen's later classifications (1924a, 1937), fossil Rhizomorina were referred to 18 families with fossil type genera based on various details of habit, wall thickness, canalization, and the form of the desmas, to which occurrence of special dermal desmas is added in some instances. Each consists of a few genera only or a single genus only. While forms grouped together are usually acceptable as related, the grounds for distinguishing some genera and families are tenuous. The most extreme example is seen in treatment of forms placed by Zittel (1878a) into his genera *Verruculina* Zittel and *Amphithelion* ZITTEL, the latter regarded by ZITTEL (1878a, p. 123) as possibly a subgenus only. *Amphithelion* was treated as a synonym of *Verruculina* by HINDE (1884a), MORET (1926b), and initially by SCHRAMMEN (1910); but species at first referred by SCHRAMMEN to *Verruculina sensu* HINDE were divided between eight genera and five families in his later work (SCHRAMMEN, 1924a, 1937; see Scleritodermatidae below, p. 300). All species referred to these taxa are essentially similar in (a) habitus (funnel-like, flabellate, or variant habits); (b) general skeletal structure (framework fibrous internally with more or less compact, surface layers), and the form of skeletal pores (pustular to papilliform on the exhalant surface, and usually on both surfaces). Some criteria relied on by SCHRAMMEN (wall thickness, relative size of ostia and postica) are of doubtful value even at subgeneric level. Other criteria cited included presence (Verruculinidae SCHRAMMEN) or absence (other families) of special dermal desmas and occurrence of distinct, internal canals in some genera (Heterothelionidae SCHRAMMEN) but not others. Of these, the first may be simply dependent on accidents of preservation or on whether the special dermal desmas were united by zygosis in life, the second, simply on the relative size of the skeletal meshes and the canals of the soft parts. SCHRAMMEN's methods are also hard to apply to species apart from those he cited or to imperfectly known species or genera.

(c) MORET (1926b) made a general distinction between Rhizomorina with fibrous and nonfibrous skeletons, also used by LAGNEAU-HÉRENGER (1962) to group various families of SCHRAMMEN's system. This distinction was not made by SCHRAMMEN (1924a) and was rejected by DE LAUBENFELS (1955), who noted the occurrence of intermediate structures. Zoologists since SOLLAS (1888) have placed fibrous and nonfibrous species into the single genus *Azorica* CARTER, and MORET himself accepted treatment of *Azorica* in this manner.

Classification here is based partly on compromise between these divergent opinions and partly on the writer's observations in work preparatory to this volume. First, four types of skeletal structure are distinguished.

(1) In compact, skeletal structures, there are typically no mesh spaces larger than those formed by the union of individual desmas. The desmas may unite without order, or some may have more or less marked, longitudinal and transverse alignments. When alignment of desmas is pronounced, longitudinal sections have strandlike trains of desmas that spread out toward one or both surfaces of the skeletal framework or from the axial parts to the surface in for example, solid pyriform sponges.

(2) In semifibrous structures, as in only a few Jurassic genera, the skeletal framework is internally lacunar, as in fibrous types, but true, composite, skeletal fibers are absent. The internal lacunae may extend in all directions or have a general, longitudinal alignment and may then resemble fine, longitudinal canals or form spaces between radial, septalike lamellae. The desmas forming interlacunar trabeculae or lamellae have corresponding irregular or longitudinal alignments. Irregular and strongly lacunar skeletal structures of this type may locally approach true, fibrous structure.

(3) In truly fibrous skeletons, the skeletal framework is lacunar and consists of a three-dimensional network of stout, composite skeletal fibers, in which individual rhizoclones are densely matted together. The fibers may have no directional alignment, or some may be aligned longitudinally and spread out toward skeletal surfaces or from an axial region to the surface. Longitudinal fibers may lack any special arrangement or be arranged and united to form perforated, septalike, radial lamellae.

(4) Pseudofibrous structure is produced by strong canalization of compact, skeletal meshwork, which may assume a fibrous aspect if skeletal canals (usually epirhyses) are close together, and their lumina are wider than the intervening skeletal partitions. A similar development may occur at skeletal surfaces if external meshwork is formed between subdermal spaces on the soft parts.

The first three types of skeletal structures are then used as the principal basis for arranging the post-Paleozoic Rhizomorina into three superfamilies, here called Azoricoidea, Platychonioidea, and Scleritodermatoidea. These are ascribed nominally to the authors of the corresponding families Azoricidae Sollas, Platychoniidae Schrammen, and Scleritodermatidae Sollas, as required by the *Code* (ICZN, 1999), although comprising new assemblages. It is not claimed that the three types of skeletal structure are completely distinct or completely distinctive or that all forms with the same type of structure must always be closely related; but their use in this manner is convenient, has at least some further justification, and does not appear contrary to any more evident relationships. Further details are as follows.

(1) The families Azoricidae Sollas and Cnemidiastridae Schrammen, in which skeletal structure is compact, comprise the superfamily Azoricoidea. The family Azoricidae is taken as comprising the living azoricids, plus all fossils with compact, skeletal structure in which skeletal canalization is either absent, or of normal types when present. The Cnemidiastridae are distinguished by special canalization, which in one form resembles that of some Orchocladina (e.g., *Archaeoscyphia* Hinde).

(2) Jurassic forms with compact to semifibrous skeletal structure, which appear to be all closely related, are placed in the Platychonioidea, with families Discostromatidae Schrammen (1924a; =Hyalotragosidae Schrammen, 1937) and Platychoniidae Schrammen distinguished by differences in habit and canalization. An additional feature of this group is that rhizoclones are often larger than in most later genera.

(3) Genera with truly fibrous structures and a few that appear to be relatives but lack fibrous structure are grouped as Scleritodermatoidea because fibrous, skeletal structure occurs in the living scleritodermatids *Scleritoderma* Schmidt, *Microscleroderma* Kirkpatrick, and *Taprobane* Dendy. Fossils that resemble these genera in having fibrous structure (but without conspicuous longitudinal fibers) and general habit (mainly funnel-like or flabellate, with pustulelike oscules) are included as members of the family Scleritodermatidae Sollas. Those with longitudinal fibers are placed into families Jereicidae Schrammen, comprising jereiform sponges, and Seliscothonidae Schrammen, resembling some Discostromatidae.

Treatment of *Azorica* Carter as type of an assemblage that is characterized by compact, skeletal structure conflicts with Moret's (1926b) description of this genus as fibrous. Investigation of the holotype of *A. pfeifferae* Carter, type species of *Azorica,* showed it to have compact, skeletal meshwork, with no trace of fibrous structure except in pseudofibrous, external meshwork related to subdermal spaces. This sponge is closely similar to *Coscinostoma* Schrammen, accepted as nonfibrous by Moret (1926b), except for occurrence of an external cortex, which this canalized meshwork underlies. The structure of *"A." chonelloides* (Doederlein), which Moret (1926b, p. 70) cited in ascribing fibrous structure to *Azorica,* is instead like that of scleritodermatids, and the treatment of this sponge as an *Azorica* is herein thought to be clearly mistaken.

Last, de Laubenfels (1955, p. 45) also remarked that " . . . various genera (as *Scytalia, Chonella,* and others) have been interpreted divergently by different authors . . ." in regard to whether skeletal structure is fibrous or nonfibrous. In *Scytalia* Zittel, as pointed out by Moret (1926b, p. 97), the skeleton is essentially compact but may be locally pseudofibrous due to canalization. *Cytoracia* Pomel (1872, p. 228) was described as fibrous by Lagneau-Hérenger (1962) but is considered herein to be similar to *Aulosoma* Schrammen (=*Scytalia sensu* Zittel in part).

Chonella Zittel was regarded as fibrous by Zittel (1878a) and as differing chiefly from the fibrous *Seliscothon* Zittel in lacking a radial arrangement of fibers to form septumlike lamellae. Moret (1926b, p. 95) treated *Chonella* as nonfibrous and thought that fibrous structure occurs only exceptionally in young specimens, disappearing in adults. SCHRAMMEN (1924a), in contrast, divided *Chonella sensu* ZITTEL between two genera, *Chonella s.s.,* placed in the family Chonellidae SCHRAMMEN (=Azoricidae SOLLAS herein), and *Pachyselis* SCHRAMMEN, placed in the family Seliscothonidae SCHRAMMEN. *C. tenuis* (F. A. ROEMER), type species of *Chonella,* as known to the writer, is clearly nonfibrous; but *Pachyselis auriformis* (F. A. ROEMER) (=*C. auriformis,* ZITTEL, 1878a) has a fibrous skeletal structure, described by ROEMER (1864, p. 51) and figured by SCHRAMMEN (1910, pl. 19,*3–4*). On the other hand, some specimens identified by SCHRAMMEN before 1910 as *C. auriformis* (e.g., BMNH P7436) are true, nonfibrous *Chonella.* Hence divergent descriptions in this instance seem to be due to confusion of the two different genera (*Chonella s.s.* and *Pachyselis*) as *Chonella,* and two different species as *C. auriformis.*

ORIGIN AND RELATIONSHIPS

Comment on these topics seems desirable because of the importance of this group among Mesozoic fossils, but the available evidence, frankly, is inadequate for more than speculation.

How the Rhizomorina are related to other Demospongea is hard to assess because of two contrasting indications and lack of other evidence. First, bipolar rhizoclones are not distinguishable from the simplest type of orchocladine dendroclone, and linear rhizoclones accompany dendroclones in various Orchocladina. This suggests origin of the Rhizomorina from the Orchocladina by rhizoclones becoming predominant, although none of the Rhizomorina contains typical dendroclones or chiastoclones. *Cnemidiastrum* ZITTEL of the Azoricoidea, family Cnemidiastridae, has canalization similar to that of *Archaeoscyphia* HINDE of the Orchocladina, for example. Supposed Carboniferous records of *Cnemidiastrum,* however, are based on isolated desmas without diagnostic value, and the skeleton is compact with no suggestion of orchocladine fibers. In contrast, living Scleritodermatidae (e.g., *Scleritoderma* SCHMIDT) have sigmaspire microscleres, apparently identical with those of the choristid Craniellida and a few monaxonid sponges (e.g., *Tentorina* BURTON, order Spirastrellida). Unless the Orchocladina were allied to modern forms with sigmaspires, this could indicate that Rhizomorina have had more than one origin. The microscleres of scleritodermatids suggest relationship to nonlithistid sponges with sigmaspires, but their fibrous skeletal structure suggests a connection with the Carboniferous *Haplistion* YOUNG & YOUNG, which occurs in Ireland and Texas with anthaspidellid Orchocladina and seems likely to be derived from them.

It is also possible in theory for a seemingly rhizomorine sponge to have evolved from the Pseudorhizomorina by loss of tetraxial dermalia in either phylogeny or fossilization. *Neopelta* SOLLAS, with amphiaster microscleres and monaxial discs as dermalia, is here placed with the Pseudorhizomorina; but a fossil example, in which these loose spicules were absent, would appear rhizomorine. Monaxial discs similar to *Neopelta* dermalia have been found loose in Cretaceous sediments (SCHRAMMEN, 1924a, pl. 5,*6*).

Stratigraphic evidence is also not helpful. Most post-Paleozoic Rhizomorina are from the Upper Jurassic or Cretaceous, and most are from Europe. Jurassic and later faunas are also largely different. The predominant Jurassic forms represented by few genera but by numerous individuals in the main outcrops are the cnemidiastrid Azoricoidea and the Platychonioidea, although a few Azoricidae and Scleritodermatoidea are also known. In contrast, nearly all later genera are Azoricidae or Scleritodermatoidea. Hence there seems to have been a post-Late Jurassic extinction of the characteristically Jurassic forms and a burst of new evolution before the Aptian when the characteristic Cretaceous fauna made its first-known, major appearance (LAGNEAU-HÉRENGER, 1962). On the other hand, presence in the Upper Jurassic of the specialized azoricid *Cytoracia* POMEL and a fully evolved jereicid, *Moretispongia*

Breistroffer, suggests that genera now known first from the Cretaceous may already have existed elsewhere.

Comparing all Mesozoic genera, it is tempting to postulate evolution from compact through semifibrous to true, fibrous skeletons. On the other hand, origin of these genera from the fibrous Carboniferous Haplistiidae would require the opposite. Different authors might prefer either picture.

The Upper Jurassic forms seem to show that at least five main lines of descent had already been established, long enough to be well differentiated (Cnemidiastridae, Azoricidae, Platychonioidea, Jereicidae, Scleritodermatidae). Whether Cnemidiastridae and Azoricidae, which share compact skeletal structure, had a common origin is uncertain; but resemblance of some Cnemidiastridae to some Orchocladina in their skeletal canalization seems fairly likely to be convergent. Of the Platychonioidea, *Platychonia* Zittel is structurally a possible ancestor of the fibrous Scleritodermatidae and is also known earlier than most other Jurassic genera (middle Lias, upper Pliensbachian, England). Jereicidae and Seliscothonidae could then be interpreted as representing divergent side lines from this line of descent; but jereicids might also be pictured as derived from a pseudofibrous prototype by acquiring a condition that is fibrous morphologically in relation to canalization. The lamellofibrous structure of some species of *Seliscothon* Zittel, type genus of Seliscothonidae, might be thought to point to origin of Platychonioidea from *Hyalotragos* Zittel, for example, by way of *Proseliscothon* Siemiradzki in which this type of structure is partially anticipated, although this mode of origin seems less likely than that these genera are convergent.

Superfamily AZORICOIDEA Sollas, 1888

[*nom. transl.* Reid, herein, *ex* family Azoricidae Sollas, 1888, p. clviii] [=Cladopeltidae Sollas, 1888, p. clvii]

Meshwork of the skeletal framework compact, unless disrupted by canalization and then pseudofibrous in some genera; most without special dermalia, but some with flattened, strongly branching, ectosomal rhizoclones, which may not be articulated; supplemental oxeas in some; modern examples without microscleres in life. [The family name Cladopeltidae Sollas (1888, p. clvii) is senior to Azoricidae Sollas by page priority but is invalid due to not being based on the name of a genus. The type genus *Azorica* Carter is interpreted in terms of its type species *A. pfeifferae* Carter, in which internal, skeletal meshwork is compact in Carter's holotype, and is not considered to include the fibrous *"A." chonelloides* (Doederlein) of zoologists (e.g., Sollas, 1888) and Moret (1926b), which is a scleritodermatid. The fossils thought nearest to *Azorica* are *Chonella* Zittel, *Coscinostoma* Schrammen, and *Pliobolia* Pomel (Azoricidae, Azoricinae herein).] *Upper Jurassic–Holocene.*

Family AZORICIDAE Sollas, 1888

[Azoricidae Sollas, 1888, p. clviii] [=Leiodermatiidae von Lendenfeld, 1904c, p. 145]

Sponges of various habits in which skeletal canalization of normal types, when present, and never of special types distinctive of Cnemidiastridae; internal meshwork of skeletal framework compact unless strongly canalized, when pseudofibrous structure may occur, and entirely confused or having traces of longitudinal and transverse alignment of desmas; skeletal cortex present or absent, in some instances covering lacunar, subdermal stratum when present; a few with special flattened and strongly branched, ectosomal desmas, which may not be articulated; supplemental monaxons may occur; modern examples with microrhabds or no microscleres. [Rhizomorina grouped here were placed into nine separate families by Schrammen (1924a, 1937; Azoricidae Sollas, Aulosomidae Schrammen, Chonellidae Schrammen, "Cladopeltidae" Sollas (=Siphonidiidae von Lendenfeld), Cytoraciidae Schrammen, Leiochoniidae Schrammen, Lophiophoridae Schrammen, Oncophoridae Schrammen, Trachynotidae Schrammen), but all have compact skeletal structure and normal types of canalization when any is present. All are, hence, included in one family here; but various former families based on genera included are adopted as subfamilies for convenience.] *Upper Jurassic–Holocene.*

Subfamily AZORICINAE Sollas, 1888

[*nom. transl.* REID, herein, *ex* Azoricidae SOLLAS, 1888, p. clviii] [=Chonellidae SCHRAMMEN, 1924a, p. 83; Trachynotidae SCHRAMMEN, 1924a, p. 82; Plinthodermatiidae DE LAUBENFELS, 1955, p. 49]

Funnel-like and flabellate sponges that usually have distinct and similar epirhyses and aporhyses; surfaces of skeletal framework smooth or with superficial furrows, which may form radiating patterns on paragastral surface; some with additional external, cortical meshwork, pierced by small, intracortical ostia that open into underlying, subcortical passages; supplemental monaxons may occur; no microscleres in living examples. [Some fossil genera (*Cnemaulax* POMEL, 1872, *Coscinostoma* SCHRAMMEN, 1910, and *Pliobolia* POMEL, 1872) are similar to *Azorica* CARTER but are treated as distinct because their loose spiculation is unknown.] *Cretaceous (Aptian)–Holocene.*

Azorica CARTER, 1873, p. 439 [*A. pfeifferae; OD] [=*Cisselia* POMEL, 1872, p. 119, *nom. oblit.*]. Funnel-like in some examples but usually flabellate, gently or strongly convoluted, or with convoluted walls anastomosed to form cluster of secondary funnels; inhalant surface of soft parts with fine pores only, but exhalant surface with scattered, more or less prominent, small oscules; inhalant side of skeletal framework with thin, external, skeletal cortex and small, intracortical pores, which open into closely spaced, subcortical canals that have more or less regular alignment toward skeletal margin, or with open, longitudinal furrows if cortical layer absent; ostia of epirhyses in floors of subcortical canals or open furrows; epirhyses and aporhyses more or less sinuous; postica of aporhyses in furrows or subcortical canals that radiate from oscules of paragastral surface; oscules outlined by dense, nonporous, external, cortical layer, which may not be continuous between them; supplemental oxeas but no microscleres in living species. [Skeletal structure described here from CARTER's type material of *A. pfeifferae.*] *Cretaceous (?Santonian), Holocene:* France, *?Santonian;* cosmopolitan, *Holocene.*——FIG. 176,*3.* **A. pfeifferae,* Atlantic Ocean, Holocene; side view of moderately complex specimen, with convoluted walls and prominent, inhalant pores, ×0.85 (Topsent, 1892).

Chonella ZITTEL, 1878a, p. 116 [**Cupulospongia tenuis* F. A. ROEMER, 1864, p. 51; OD] [=*Pumicia* POMEL, 1872, p. 118, *nom. oblit.*]. Funnel-, cuplike, or flabellate, some examples being irregularly convoluted or with infolded margins united to form secondary funnels; stalked or not; when rigid skeleton completely developed, both surfaces with thin, external, cortical layer with numerous small, intracortical ostia or postica, underlain by labyrinthine, subcortical canals from which sinuous epirhyses or aporhyses run into internal framework; surfaces with irregular furrowing and exposed ostia or postica when cortical meshwork absent; supplemental oxeas may occur; microscleres unknown. *Cretaceous (Aptian)–Holocene:* Spain, *Aptian;* Czech Republic, Slovakia, *Cenomanian;* France, *Santonian;* Germany, *Cenomanian–Campanian;* Algeria, *Miocene;* Mediterranean Sea, *Holocene.*——FIG. 176,*4.* **C. tenuis* (F. A. ROEMER), Quadratenkreide, Campanian, Oberg, Germany; small, flabellate example showing paragastral surface that is mostly noncorticate, ×1 (Schrammen, 1910).

Cnemaulax POMEL, 1872, p. 213 [**C. verrucosus;* OD]. Bowl shaped, attached eccentrically, not stalked; lower (inhalant) surface with finely furrowed, irregular ridges and bosses, between which rest of surface forms depressed, poriferous areas; skeletal canals more or less radial; paragastral surface with postica of aporhyses at centers of groups of radiating, superficial furrows, which may reticulate from one group to another; loose spicules unknown. [Skeleton incompletely known, but the genus was compared by POMEL (1872) with *Azorica* CARTER (as *Cisselia* POMEL, 1872). The same species of POMEL (1872) was transferred to *Chonella* ZITTEL by MORET (1924, p. 14), but the paragastral surface of type species agrees with *Coscinostoma* SCHRAMMEN; and the external surface is unique, unless poriferous areas mark indentations by foreign bodies.] *Neogene (Miocene):* Algeria, Spain.——FIG. 177,*1a–b.* **C. verrucosus,* Djebel Djambeida, Algeria; *a,* broad, upper or paragastral surface with numerous exhalant postica at centers of radiating canals; *b,* lobate to ridged, lower or inhalant surface, ×0.5 (Pomel, 1872).

Coscinostoma SCHRAMMEN, 1910, p. 162 [**C. fragilis;* SD SCHRAMMEN, 1924a, p. 113]. Irregularly funnel-like or flabellate, stalked or not; inhalant side of skeleton with finely porous, external cortex, under which labyrinthine, subcortical canals have locally longitudinal alignment; ostia of internal epirhyses in floors of these canals, exposed in furrows when cortex absent; paragastral surface with small pores in furrows that radiate from numerous centers, at which small, pitlike depressions may be present; no loose spicules known. [Subcortical canals of the inhalant side were not recognized by SCHRAMMEN but are present in material that he identified; soft parts were probably similar to those of *Azorica* CARTER, but genus apparently lacks paragastral skeletal cortex and oscules.] *Cretaceous (Aptian–Campanian):* Spain, *Aptian;* France, *Santonian;* Germany, Poland, *Campanian.*——FIG. 176,*1a.* **C. fragilis,*

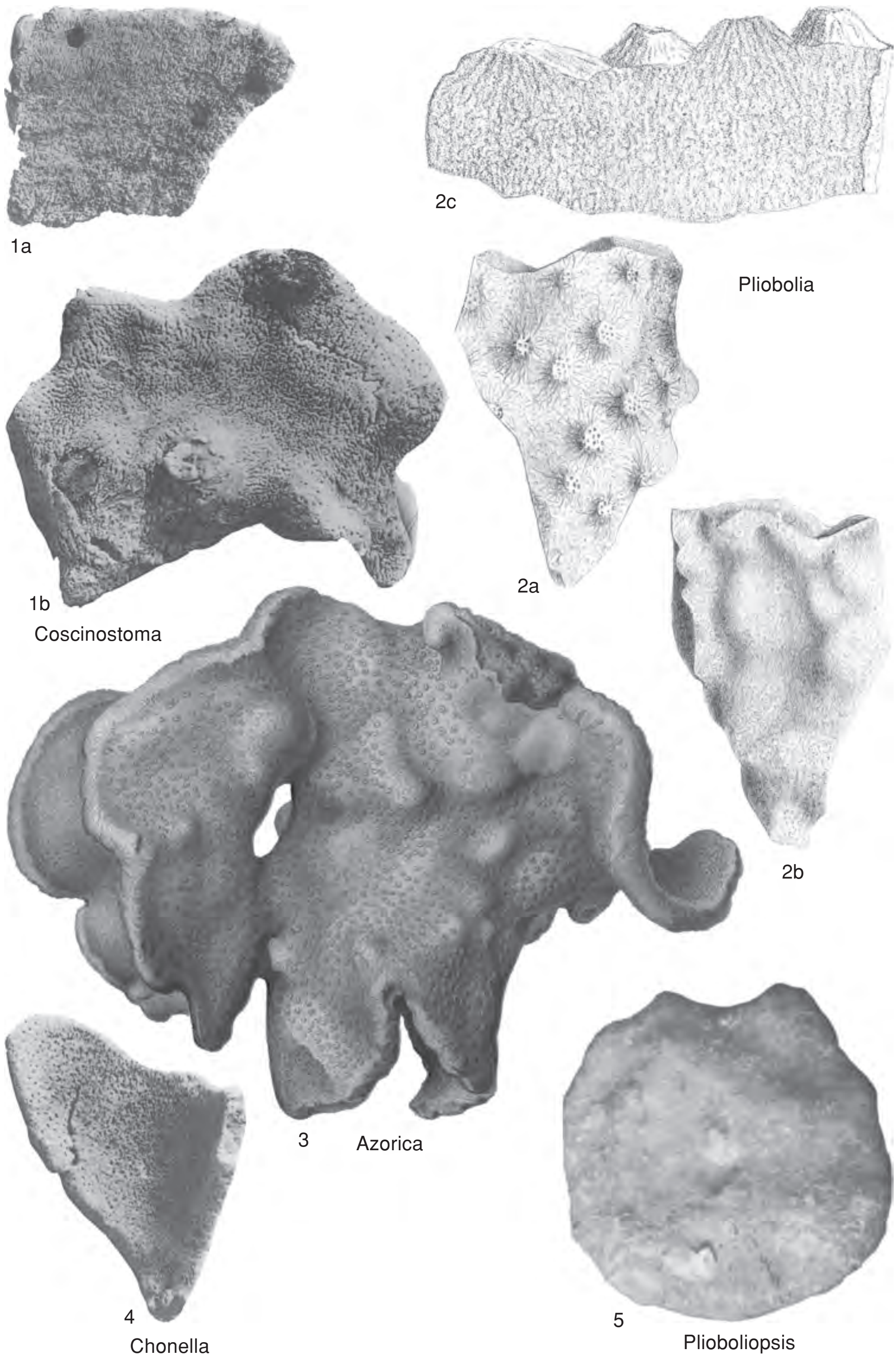

FIG. 176. Azoricidae (p. 280–283).

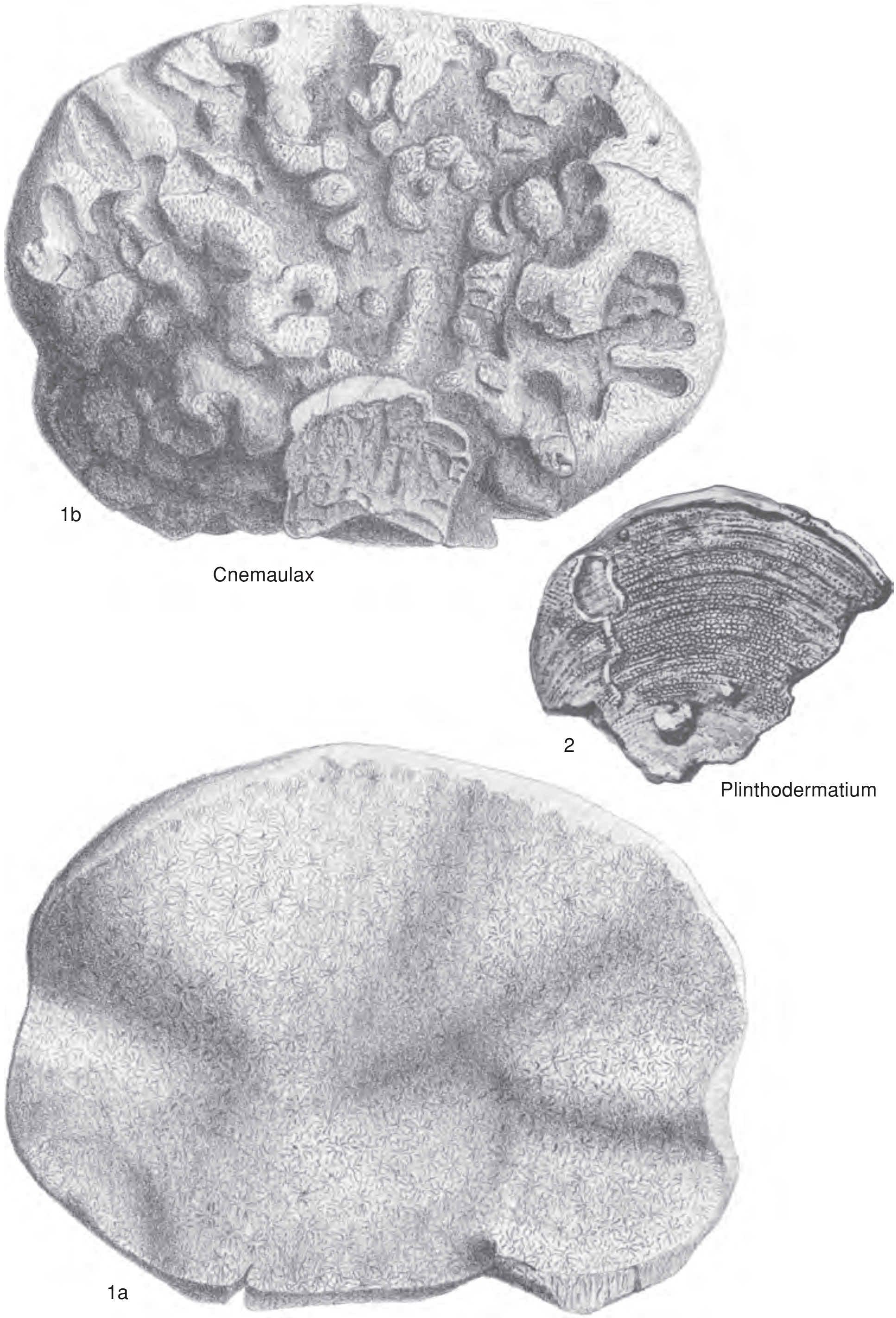

FIG. 177. Azoricidae (p. 280–283).

Quadratenkreide, Campanian, Oberg, Germany; paragastral surface with pitlike depressions and canals that radiate from them, ×1 (Schrammen, 1910).——FIG. 176,*1b. C. auricula* SCHRAMMEN, Mucronatenkreide, Campanian–Maastrichtian, Misburg, Germany; outer or lower surface showing skeletal pores in irregular growth form, ×1 (Schrammen, 1910).

Plinthodermatium SCHRAMMEN, 1910, p. 158 [**P. exile;* OD]. Flabellate, earlike or fanlike, or forming an incomplete funnel; one surface of skeletal framework, presumed to be external, with conspicuous, transverse corrugations linked by short, oblique or longitudinal furrows, surface has scaly appearance; closely spaced, small, skeletal pores, presumed to be ostia, in floors of these furrows; opposite surface coated by smooth, skeletal cortex; skeletal surface beneath this has apertures of skeletal canals in longitudinal furrows, which radiate from base to skeletal margin; no loose spicules known. *Cretaceous (Campanian):* Germany.——FIG. 177,*2. *P. exile,* Mucronatenkreide, Misburg; external view with transverse corrugations linking short, oblique or longitudinal furrows, ×0.5 (Schrammen, 1910).

Pliobolia POMEL, 1872, p. 212 [**P. vermiculata;* OD] [=*Trachynoton* DE LAUBENFELS, 1955, p. 49, *nom. nov. pro Trachynotus* SCHRAMMEN, 1924a, p. 112 (type, *Coscinostoma auricula* SCHRAMMEN, 1910, p. 163, OD), *non* LATREILLE, 1829]. Flabellate, earlike or platelike, stalked or not; external, skeletal surface finely porous; canals more or less sinuous; paragastral surface with postica in elevated groups or in hollows at tops of conical prominences, and with anastomosing, superficial furrows that radiate from groups of postica; surfaces may be coated by layer of flattened and strongly branching, ectosomal desmas. [*Pliobolia* was equated with *Coscinostoma* SCHRAMMEN by DE LAUBENFELS (1955, p. 47) and is probably similar to that genus, but is here equated with *Trachynoton* following BREISTROFFER (1949, p. 103).] *Cretaceous (Campanian)–Neogene (Miocene):* Germany, Poland, *Campanian;* Algeria, Spain, *Miocene.*——FIG. 176,*2a–c. *P. vermiculata,* Miocene, Djebel Djambeida, Algeria; *a,* older specimen with postica at tops of conical prominences, as seen from paragastral surface, with postica and radiating furrows; *b,* irregularly nodose undersurface of same, ×0.5; *c,* vertical section, ×1 (Pomel, 1872).

?Plioboliopsis BRIMAUD & VACHARD, 1986, p. 310 [**P. hispanica* BRIMAUD, 1984, p. 421, *nom. nud.;* OD]. Sponge a flattened, thick-walled, stalked cup; inhalant pores small, simple, and numerous on lower face; exhalant pores on upper face a little larger and surrounded by short, radial furrows. [Species was proposed in BRIMAUD's unpublished thesis.] *Neogene (Miocene):* Spain.——FIG. 176,*5. *P. hispanica* (BRIMAUD), Tortonien strata, upper Miocene, Almeria, southern Spain; upper surface with faint, exhalant openings and canals, IPM R6951, ×1 (Brimaud & Vachard, 1986; courtesy of *Publications Scientifiques du Muséum national d'Histoire naturelle, Paris*).

Subfamily CYTORACIINAE Schrammen, 1924

[*nom. transl. et correct.* REID, herein, *ex* Cytoraceidae SCHRAMMEN, 1924a, p. 81]

Pyriform or globular to irregularly nodular sponges, simple or compound, in which ostia are restricted to depressed poriferous areas, between which skeletal surface is more or less conspicuously furrowed. *Upper Jurassic–Neogene (Miocene).*

Cytoracia POMEL, 1872, p. 228 [**Stellispongia impressa* F. A. ROEMER, 1864, p. 49; SD SCHRAMMEN, 1910, p. 153; not *Stellispongia grandis* F. A. ROEMER, 1864, p. 49, SD DE LAUBENFELS, 1955, p. 47 [=*Cytoracea* ZITTEL, 1878a, p. 115, *nom. null.; Cnemispongia* QUENSTEDT, 1877 in 1877–1878, p. 258 (type, *C. goldfussii,* SD DE LAUBENFELS, 1955, p. 47); *Coelocorypha* ZITTEL, 1878a, p. 128 (type, *Siphonocoelia nidulifera* ROEMER, 1864, p. 29, SD DE LAUBENFELS, 1955, p. 45)]. Solitary or compound sponges of pyriform or globular to irregularly nodular shapes, with narrow, tubular, paragastral cavities, and with ostia restricted to broad or pitlike, depressed, poriferous areas, between which surface forms more or less prominent ridges; external surface typically strongly furrowed between poriferous areas, with some furrows radiating from margins of paragastral oscula, others crossing ridges between poriferous areas transversely; paragastral surface with postica of fine aporhyses that are sometimes in vertical series; parts of surface may be coated by external cortex; no loose spicules known. [*Coelocorypha* was regarded as distinct from *Cytoracia* POMEL by DE LAUBENFELS (1955, p. 45, 47), who placed the two nominal genera in different families; but the type designated by DE LAUBENFELS (1955, p. 45) was identified previously by SCHRAMMEN (1924a, p. 105) as *Cytoracia nidulifera.*] *Upper Jurassic (Kimmeridgian)–Upper Cretaceous (Campanian), Neogene (?Miocene):* Germany, Switzerland, *Upper Jurassic (Kimmeridgian)–Upper Cretaceous;* Spain, *Aptian;* France, *Santonian–Campanian;* Germany, Poland, *Turonian–Campanian;* North Africa, *?Miocene.*——FIG. 178,*3a–b. C. variabilis* (KOLB), Weiss Jura, Kimmeridgian, Gestalten, Germany; *a,* nodular, compound example showing multiple, paragastral openings surrounded by radial canals, ×0.5; *b,* rhizoclone desmas, ×20 (Schrammen, 1937).——FIG. 178,*3c–d. C. turbinate* SCHRAMMEN, Mucronatenkreide, Campanian, Misburg, Germany; *c,* oblique view showing terminal osculum, with poriferous area at right; *d,* lateral view showing depressed, poriferous area and furrowing of surrounding surface, ×0.5 (Schrammen, 1910).

?Allomera POMEL, 1872, p. 194 [**A. obovata* POMEL, 1872, p. 195; SD DE LAUBENFELS, 1955, p. 9] [=*Pleuromera* POMEL, 1872, p. 199 (type, *P. inaequalis,* OD)]. Small, bilaterally compressed

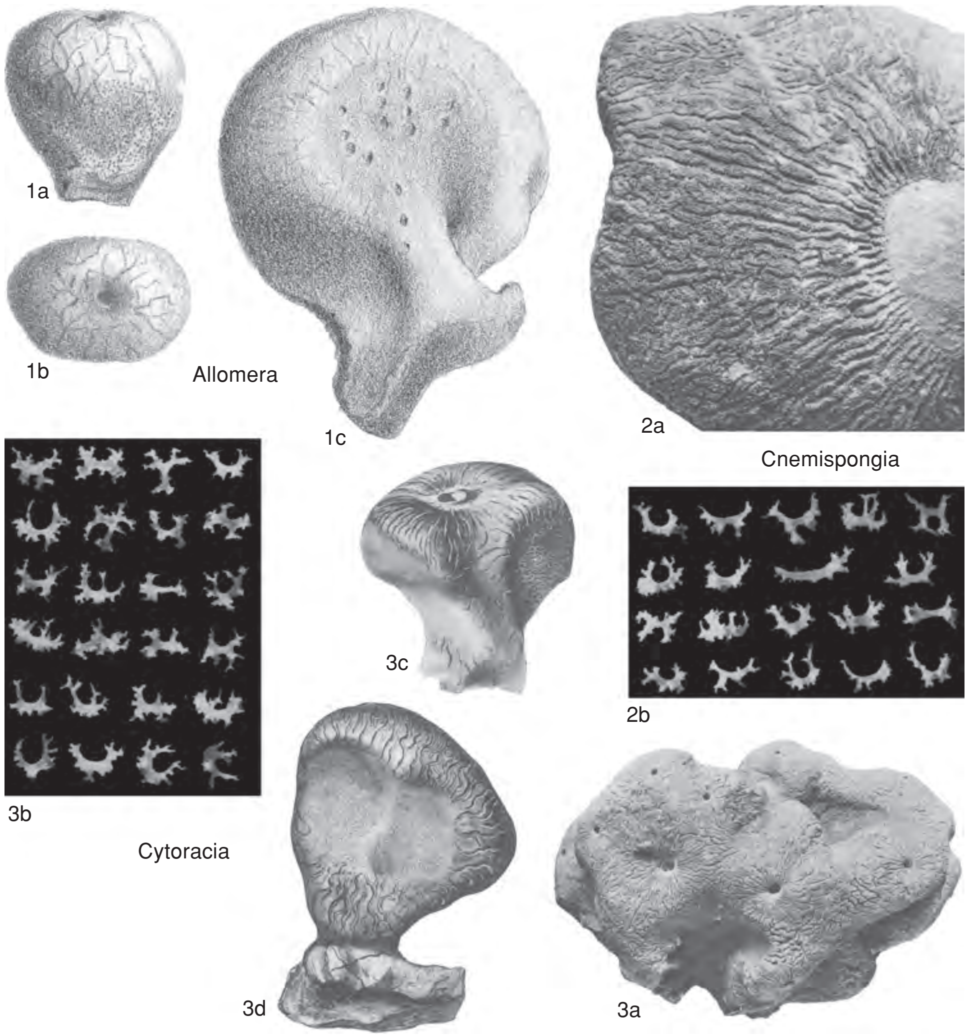

FIG. 178. Azoricidae (p. 283–285).

pyriform, with one side poriferous and opposite side and summit poreless but with fine furrows that radiate from small, terminal osculum; larger examples with number of impressed, poriferous areas, areas between poreless but furrowed ridges, and in some with number of osculelike apertures in terminal or lateral positions; skeletal structure unknown. [Position strictly unknown, but considered rhizomorine by ZITTEL (1878a, p. 125); habitus only matched in *Cytoracia* POMEL, and not distinguishable from that genus except by multiple oscula if the skeleton was compact.] *Neogene (Miocene):* Algeria.——FIG. 178,*1a–b*. **A. obovata,* Djebel Djambeida; *a,* side view of top-shaped sponge; *b,* view from above showing small, radial canals around osculum, ×1 (Pomel, 1872).——FIG. 178,*1c*. *A. inaequalis* (POMEL), Djebel Djambeida; larger example with poriferous areas on one side, multiple oscules on other, ×1 (Pomel, 1872).

Cnemispongia QUENSTEDT, 1877 in 1877–1878, p. 258 [**C. goldfussi;* SD DE LAUBENFELS, 1955, p. 47]. Described by DE LAUBENFELS (1955, p. 47) as, "Externally like *Cnemidiastrum* but skeleton unknown;" type species identified previously as *Cytoracia goldfussi* by SCHRAMMEN, who also figured the desmas (1937, p. 90, pl. 23,*6*); this species depressed, top shaped, with strong, radiating furrows on summit and poriferous areas near base, but not otherwise distinctive. *Jurassic (Oxfordian–Kimmeridgian):* Germany.——FIG. 178,*2a–b*. **C.*

goldfussi, Weiss Jura; *a,* view of summit with radial canals and matrix-filled spongocoel, Kimmeridgian, Hossingen, ×1; *b,* rhizoclone desmas, upper Oxfordian, Streitberg, ×20 (Schrammen, 1937).

Subfamily AULOSOMINAE Schrammen, 1924

[*nom. transl.* REID, herein, *ex* Aulosomidae SCHRAMMEN, 1924a, p. 82]

Typically solitary sponges of globular to cylindrical or branched, cylindrical shapes without special poriferous areas and usually have deep, narrow, paragastral cavity; skeletal framework uncanalized, or with skeletal pores but no canals, or with distinct epirhyses or aporhyses; aporhyses do not perforate external surface when present; some with pseudofibrous structure due to interruption of meshwork by numerous closely spaced epirhyses; distinct, skeletal cortex present or absent; no special ectosomal desmas; no loose spicules known. [Possibly represented at present by *Gastrophanella* SCHMIDT, but desmas figured by some authors are not typical rhizoclones.] *Upper Jurassic–Upper Cretaceous (Campanian).*

Aulosoma SCHRAMMEN, 1924a, p. 106 [**Spongia radiciformis* PHILLIPS, 1835 in 1829–1836, p. 90; OD]. Body elongate, often swollen and constricted alternately but not transversely wrinkled, with a conical summit and a stalk that may divide into root processes; paragastral cavity narrow, extending through most of body but not into stalk; sides finely porous and more or less irregularly furrowed, with larger pores as ostia of tubular epirhyses, which arch downwardly toward paragastral wall; aporhyses rather wider, sloping downwardly toward exterior around paragastral cavity, and with basal group running down stalk; postica covered by superficial network of composite skeletal fibers in some examples, presumably through formation of cortical meshwork in endosomal stratum of soft parts; no loose spicules known. [Diagnosis based on topotype material that has epirhyses and the paragastral cortex not mentioned by SCHRAMMEN.] *Cretaceous (Aptian–Campanian):* Spain, *Aptian;* England, France, Germany, *Turonian–Campanian.*——FIG. 179,*2a–b.* **A. radiciformis* (PHILLIPS); *a,* small example, with constrictions moderately developed, Quadratenkreide, upper Campanian, Oberg, Germany, ×1 (Phillips, 1875); *b,* side view of typical sponge with transverse section showing general interior structure, Chalk, Sowerby, Yorkshire, England, ×0.25 (Phillips, 1829–1836).

Coelosphaeroma SCHRAMMEN, 1910, p. 159 [**C. appendiculata;* OD]. Obliquely distorted ovoid, with eccentric, oscular opening facing upwardly near one end and small root processes at other; paragastral cavity cylindrical near osculum, but expanded irregularly to occupy most of interior of lower parts; outside with fine furrows that radiate from paragastral margin and small ostia of short, radial epirhyses; paragastral surface locally with postica of arching aporhyses, which more or less follow form of external surface; no loose spicules known. [Skeletal meshwork said to be fibrous by LAGNEAU-HÉRENGER, 1962, p. 175, but not so in material identified by SCHRAMMEN, 1910.] *Cretaceous (Aptian–Campanian):* Spain, *Aptian;* Germany, *Campanian.*——FIG. 179,*5a–b.* **C. appendiculata,* Mukronatenkreide, Campanian, Misburg, Germany; *a,* sectioned example showing canals (epirhyses, aporhyses) and form of paragastral cavity; *b,* external view, osculum at right, root processes at left, ×0.5 (Schrammen, 1910).

Oncodona DE LAUBENFELS, 1955, p. 49, *nom. nov. pro Oncophora* SCHRAMMEN, 1924a, p. 112, *non* DIESLING, 1851 [**Oncophora meandrina* SCHRAMMEN, 1924a, p. 112; OD]. Cylindrical or pyriform, with tubular, paragastral cavity, outside wrinkled transversely; no distinct skeletal pores or canals; no cortical meshwork; loose spicules reported to be rhizoclones by SCHRAMMEN (1924a). *Cretaceous (Campanian):* Germany.——FIG. 179,*1.* **O. meandrina* (SCHRAMMEN), Emscher, Sudmerberges; rhizoclones, ×20 (Schrammen, 1924a; courtesy of E. Schweizerbart'sche Verlagsbuchhandlung).

?Polyrhizophora LINCK, 1883, p. 61 [**P. jurassica;* OD]. Hollow-cylindrical to funnel-like; canal system poorly known, but apparently consisting of small, external pores (ostia) and downwardly arched aporhyses; no cortical meshwork; no loose spicules known. *Upper Jurassic:* Germany.——FIG. 179,*3a–b.* **P. jurassica,* Malm, Sontheim; *a,* drawing of longitudinal section showing radial canal system and central spongocoel; *b,* drawing of transverse section showing radial inhalant canals and central exhalant canals, ×1 (Linck, 1883).

Stachyspongia ZITTEL, 1878a, p. 129 [**Siphonocoelia spica* F. A. ROEMER, 1864, p. 30; SD DE LAUBENFELS, 1955, p. 45]. Typically elongate cylindrical with conical summit, deep, tubular, paragastral cavity, and conical, lateral outgrowths; the latter few to numerous and spirally arranged in some specimens, produce resemblance to fir cone; one species branched-cylindrical, with a few fingerlike, lateral outgrowths; outside with fine, reticulating furrows and small ostia; aporhyses branched, more or less radial; cortex usually absent, but may be present in some specimens; no loose spicules known. *Cretaceous (Aptian–Campanian):* Spain, *Aptian;* England, *Cenomanian, Campanian;* Germany, Poland, *Turonian–Campanian.*——FIG. 180*a–b.* **S. spica* (F. A. ROEMER), Grey Chalk, Cenomanian, Dover, England; *a,* side view of part of large specimen showing resemblance to a fir cone where lateral outgrowths are numerous, ×0.5; *b,* transverse section of another example from same locality showing

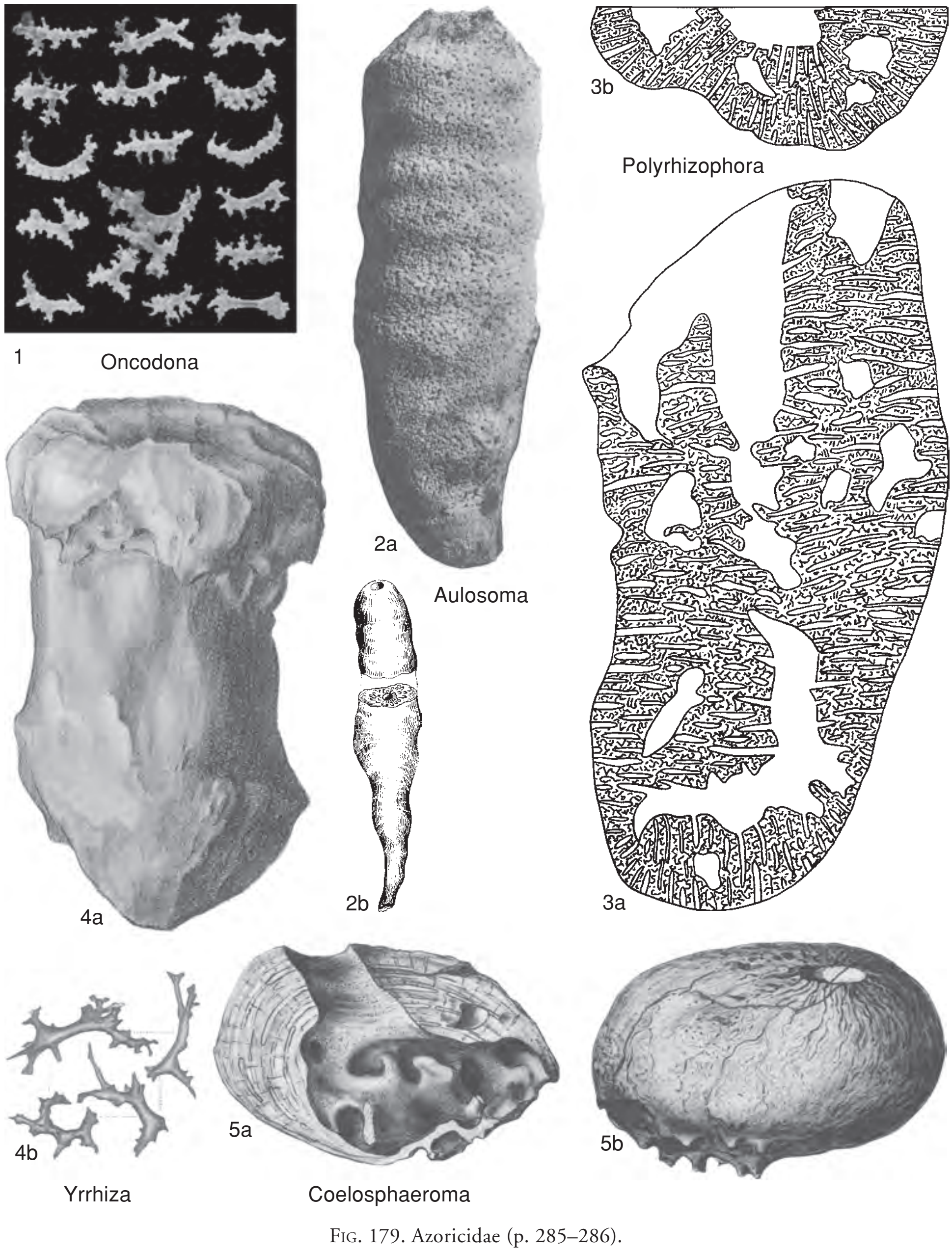

FIG. 179. Azoricidae (p. 285–286).

central spongocoel and parts of radial, horizontal canals, ×1 (Hinde, 1884a).

Yrrhiza DE LAUBENFELS, 1955, p. 45, *nom. nov. pro Rhizinia* KOLB, 1910 in 1910–1911, p. 242, *non* HAMMER SCHMIDT, 1838 [**Rhizinia amanita* KOLB, 1910 in 1910–1911, p. 242; M]. Cylindrical, tapered to base; summit with shallow, paragastral depression from which a few aporhyses may run downwardly; no external pores or epirhyses; rhizoclone spicules reported. *Jurassic (Kimmeridgian):* Germany.——FIG. 179,*4a–b*. **Y. amanita* (KOLB), Weiss Jura, Sontheim; *a,* cylindrical, side view, paragastral cavity on summit, SSPHG, ×1; *b,* characteristic rhizoclone spicules, ×40 (Kolb, 1910–1911).

Subfamily LEIOCHONIINAE Schrammen, 1924

[*nom. transl.* REID, herein, *ex* Leiochoniidae SCHRAMMEN, 1924a, p. 82] [=Scytaliidae DE LAUBENFELS, 1955, p. 45].

Hollow-cylindrical, top-shaped, and funnel-like or flabellate sponges, with skeletal canals opening through both surfaces of skeletal framework, and apertures typically becoming covered by secondary, cortical meshwork on one or both surfaces; external surface often with more or less conspicuous transverse growth lines; no loose spicules known. [Perforation of the skeletal framework by canals suggests comparison with Cnemidiastridae, but external apertures are never arranged in series, and canals have no tendency to merge to form linear fissures. The subfamily is here interpreted as similar to Aulosomatinae but with aporhyses open subdermally.] *Cretaceous (Aptian–Campanian).*

Leiochonia SCHRAMMEN, 1901, p. 16 [**L. cryptoporosa;* OD]. Funnel-, bowl- or platelike, or flabellate, stalked or not; surfaces of primary, skeletal framework with conspicuous, transverse, growth lines and numerous skeletal pores, mainly of irregular shapes; interior with branched and anastomosing, radial canals, some of which open through both skeletal surfaces; margin more or less abruptly truncated and strongly furrowed by incompletely enclosed canals; external and paragastral surfaces may be coated by dense but finely porous, cortical meshwork that conceals underlying skeletal pores of internal framework; no loose spicules known. *Cretaceous (Coniacian–Campanian):* France, *Coniacian–Santonian;* Germany, Poland, *Coniacian–Campanian.*——FIG. 181,*4a–b.* **L. cryptoporosa,* Quadratenkreide, Campanian, Oberg, Germany; *a,* ear-shaped example showing furrowed margin and paragastral surfaces coated with cortical meshwork, ×0.5; *b,* external view of specimen in which cortical meshwork is absent, showing growth lines and external, skeletal pores, ×0.5 (Schrammen, 1910).

Pseudocytoracea LAGNEAU-HÉRENGER, 1962, p. 184 [**P. plicata;* OD]. Irregularly top shaped with conical summit, small, bowl-shaped, paragastral cavity, and sides vertically ridged between broad, concave indentations; outside of skeletal framework with rounded or irregularly shaped, skeletal pores that may be in reticulating furrows in lower parts; skeletal canals radiating outwardly and downwardly from postica in paragastral surface; summit radially furrowed by incompletely formed canals; lower parts may be coated by dense, transversely wrinkled, skeletal cortex; no loose spicules known. [Placed into Cnemidiastridae by LAGNEAU-HÉRENGER, 1962, but here interpreted as similar to *Scytalia* ZITTEL.] *Cretaceous (Aptian):* Spain.——FIG. 181,*3a–c.* **P. plicata,* Can Casanyas Castellet, Catalogne; *a,* side view with small osculum at summit, which is also marked by convergent, radial furrows, lower sides with vertical ridges, ×0.5; *b–c,* characteristic spicules including desmas of interior and cortical desmas that are more strongly branched, ×25 (Lagneau-Hérenger, 1962; courtesy of Société Géologique de France).

Scytalia ZITTEL, 1878a, p. 128 [**Jerea turbinata* F. A. ROEMER, 1864, p. 32; SD SCHRAMMEN, 1924a, p.

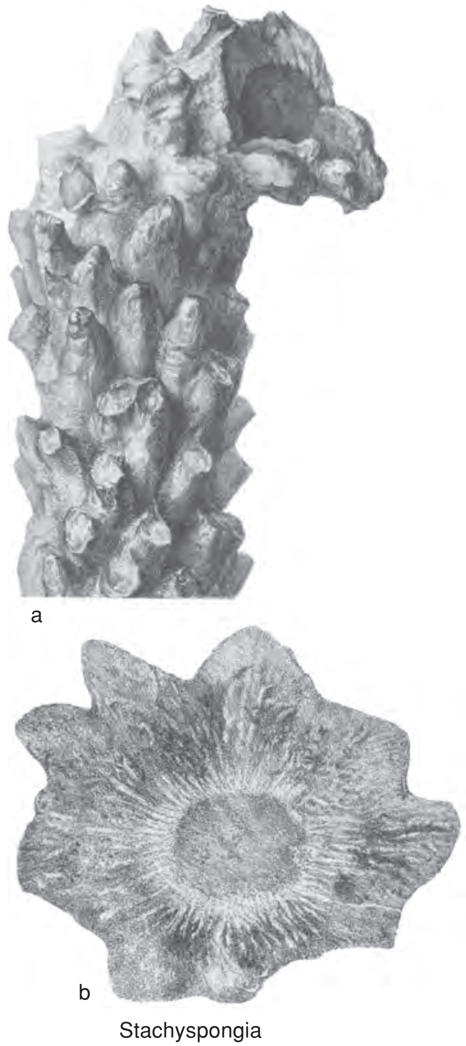

FIG. 180. Azoricidae (p. 285–286).

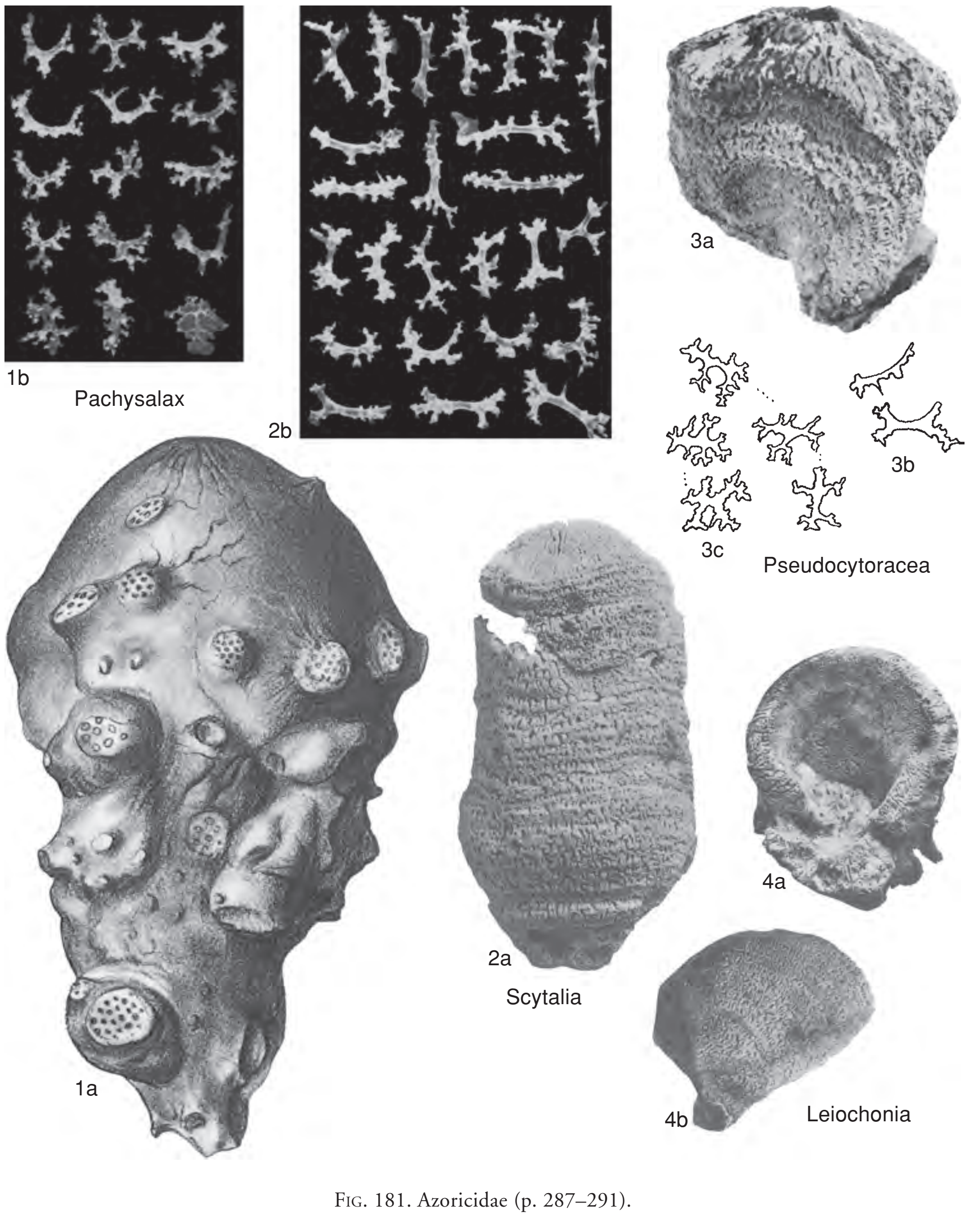

FIG. 181. Azoricidae (p. 287–291).

106; =*Spongia terebrata* PHILLIPS, 1835 in 1829–1836, p. 90, subj., according to SCHRAMMEN, 1910, p. 150] [=*Pseudoscytalia* SCHRAMMEN, 1924a, p. 109 (type, *Spongia terebrata* PHILLIPS, 1835 in 1829–1836, p. 90, OD)]. Top to club shaped or cylindrical with tapered, basal part, usually stalked, and may also have transverse, external constrictions or corrugations; summit flattened, conical, or rounded; paragastral cavity tubular, deep, and may extend into stalk when present; external surface of skeletal framework with transverse growth lines and small, rounded or irregularly shaped, skeletal pores, some of which may be in short, vertical furrows or reticulating furrows; skeletal canals numerous, radial, branching, and horizontal to arched or sloped downwardly in conformity with form of summit; some branches may unite before opening through external surface; paragastral surface with numerous closely spaced, small postica, arranged without order or in furrows between vertical ridges; external surface may be coated by thin, finely porous, cortical layer pierced by numerous minute, intracortical ostia, that covers skeletal pores of primary framework; summit with radiating furrows representing incompletely formed canals, or with these concealed by extension of cortex to oscular margin; no loose spicules known. [Cortex and paragastral furrows were not recognized by SCHRAMMEN (1924a, p. 98), but both are shown in ROEMER's original figure of *S. turbinata* (1864). Cortex is also mentioned in his description (ROEMER, 1864, pl. 12,*1* and p. 32–33); hence presence of a cortex is not regarded as distinctive of *Pseudoscytalia.*] *Cretaceous (Aptian–Campanian):* Spain, *Aptian;* Czech Republic, Slovakia, *Cenomanian;* England, *Campanian;* France, *Turonian–Santonian;* Germany, Poland, *Turonian–Campanian.*——FIG. 181,*2a.* **S. turbinata* (ROEMER), Mucronatenkreide, Campanian, Misburg, Germany; rhizoclone desmas, ×20 (Schrammen, 1924a; courtesy of E. Schweizerbart'sche Verlagsbuchhandlung).——FIG. 181,*2b. S. (Pseudoscytalia) terebrata* (PHILLIPS), Quadratenkreide, Campanian, Oberg, Germany; cylindrical example showing outside of skeletal framework as exposed when cortex is absent, ×0.5 (Schrammen, 1910).

Subfamily ASTROBOLIINAE de Laubenfels, 1955

[*nom. transl.* REID, herein, *ex* Astroboliidae DE LAUBENFELS, 1955, p. 47]

Globular to nodular or branched-cylindrical sponges without depressed, poriferous areas, distinct paragastral cavities, or special oscular outgrowths, and in which skeletal framework has no skeletal pores or canals, or surface showing small pores, not divisible into ostia and postica, or showing numerous small ostia arranged without order and few larger postica, arranged in groups from which short furrows radiate; some with additional skeletal cortex composed of small, finely branching desmas that coat surface of skeletal framework and conceal small pores and furrows; no loose spicules known. *Upper Jurassic–Upper Cretaceous (Maastrichtian).*

Astrobolia ZITTEL, 1878a, p. 115 [**Cnemidium conglobatum* REUSS, 1846 in 1845–1846, p. 72; SD DE LAUBENFELS, 1955, p. 47] [=*Rhagosphecion* POMEL, 1872, p. 223, obj., *nom. oblit.,* SD DE LAUBENFELS, 1955, p. 65]. Hemispherical to nodular; surface of skeletal framework with postica in small, depressed groups from which shallow, superficial furrows radiate; intervening parts of surface with small ostia; no special cortex; no loose spicules known. *Cretaceous (Cenomanian–Campanian):* Czech Republic, Slovakia, *Cenomanian;* Germany, *Cenomanian–Campanian.*——FIG. 182,*4.* **A. conglobatum* (REUSS), Cenomanian, Czech Republic, Slovakia; view from above of broadly conical sponge with several postica surrounded by convergent canals, ×1 (Reuss, 1845–1846).

Bolidium ZITTEL, 1878a, p. 114 [**Amorphospongia palmata* F. A. ROEMER, 1864, p. 55; OD]. Nodular to branched cylindrical; surface of skeletal framework with small, skeletal pores, all of similar size (not divisible into ostia and postica); lower parts coated by skeletal cortex formed from small, finely branching desmas; no loose spicules known. *Cretaceous (Coniacian–Maastrichtian):* Germany, *Coniacian–Maastrichtian;* Poland, *Campanian.*——FIG. 182,*1a–b.* **B. palmatum* (ROEMER), Quadratenkreide, Campanian, Sutmerberges, Germany; *a,* side view of nodose, lobate holotype, ×0.5 (Roemer, 1864); *b,* desmas from holotype, ×50 (Zittel, 1878a).

Microrhizophora KOLB, 1910 in 1910–1911, p. 241 [**M. pentagona;* SD DE LAUBENFELS, 1955, p. 49]. Discoidal or cylindrical with pentagonal outline or cross section; no apparent canalization or cortex; no loose spicules known. [Name based on small size of rhizoclones compared with those of contemporary genera.] *Upper Jurassic:* Germany.——FIG. 182,*2a–b.* **M. pentagona,* Weiss Jura, Kimmeridgian, Sontheim; *a,* side view of obconical sponge, SSPHG, ×1; *b,* representative desmas, ×50 (Kolb, 1910–1911).

Oncocladia KOLB, 1910 in 1910–1911, p. 244 [**O. sulcata;* OD]. Nodular, with broad, encrusting base and number of rounded elevations above; tops of elevated parts with network of anastomosing furrows; other parts with numerous small pores; no distinct postica or cortex; spicules rhizoclone desmas. *Jurassic (Kimmeridgian):* Germany.——FIG. 182,*3a–e.* **O. sulcata,* Weiss Jura, Sontheim; *a,* side view of irregularly nodular sponge, SSPHG, ×0.5; *b–e,* characteristic desmoid spicules, ×40 (Kolb, 1910–1911).

Urnacristata DE LAUBENFELS, 1955, p. 49, *nom. nov. pro Lophiophora* SCHRAMMEN, 1924a, p. 101, *non* BRYK, 1915 [**Lophiophora sulcata* SCHRAMMEN, 1924a, p. 101; OD]. Encrusting or unattached, nodular, with broadly rounded to nipplelike elevations; skeletal framework with postica at summits of elevated parts, and with very small ostia and network of superficial furrows on its intervening parts; surface of skeletal framework may be coated by skeletal cortex, formed from small, finely branched and flattened desmas; no loose spicules known. [The genus resembles *Oncocladia* KOLB, 1910 in 1910–1911, but is distinguished apparently by the occurrence of a cortex and special cortical desmas.] *Cretaceous (Campanian):* Germany.——FIG. 182,*5a–b.* **U. sulcata* (SCHRAMMEN), Mukronatenkreide, upper Campanian, Misburg; *a,* unattached example, ×0.75; *b,* rhizoclone and dermalia desmas, top row probably from cortex, ×20 (Schrammen, 1924a; courtesy of E. Schweizerbart'sche Verlagsbuchhandlung).——FIG. 182,*5c. U. incrustans* (SCHRAMMEN), Mukronatenkreide, upper Campanian, Misburg; irregular sponge showing superficial

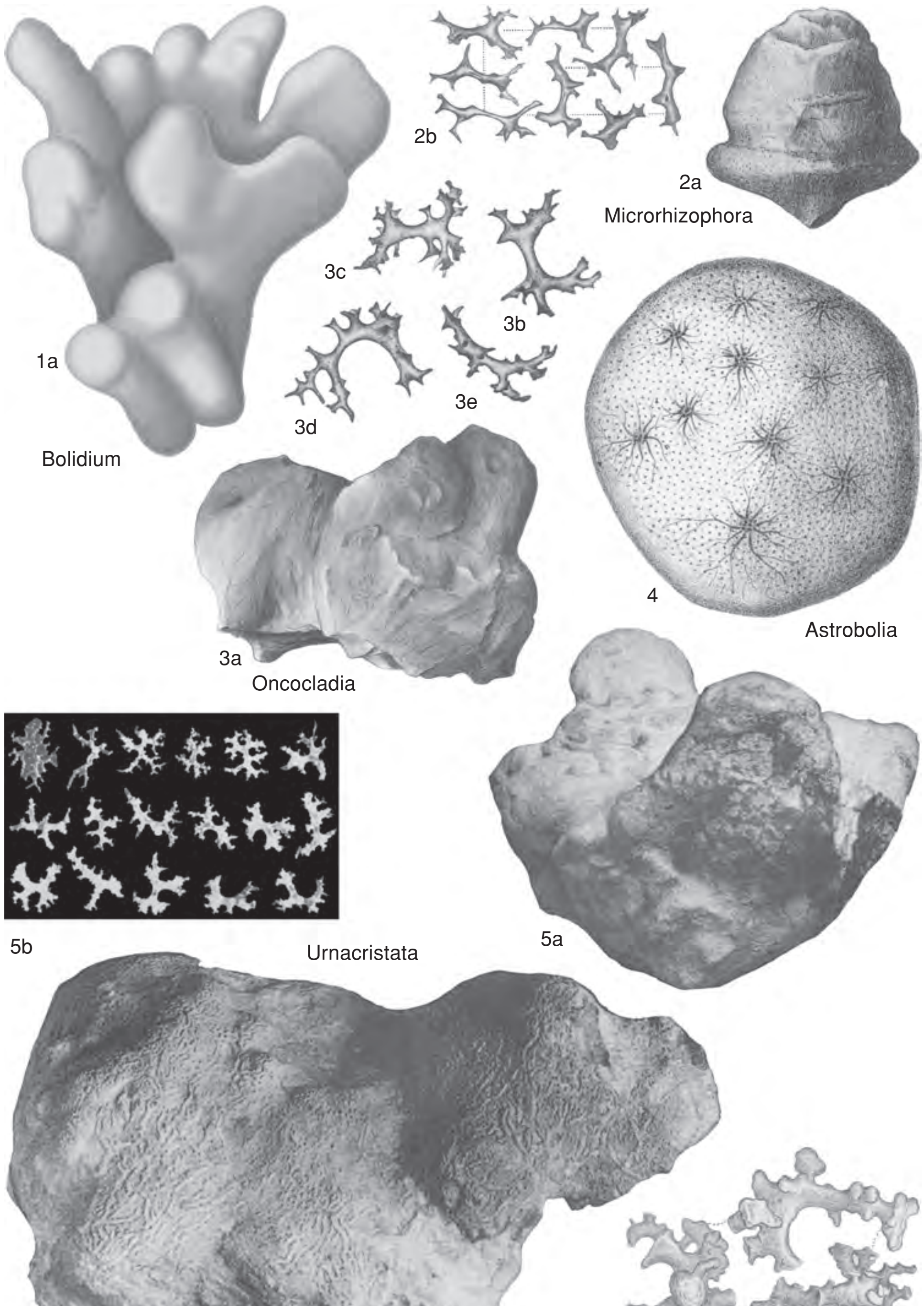

FIG. 182. Azoricidae (p. 289–291).

furrows as seen when cortex is absent, ×0.75 (Schrammen, 1924a; courtesy of E. Schweizerbart'sche Verlagsbuchhandlung).

Subfamily SIPHONIDIINAE von Lendenfeld, 1904

[*nom. transl.* REID, herein, *ex* Siphonidiidae VON LENDENFELD, 1904c, p. 140] [=Cladopeltidae SOLLAS, 1888, p. clvii; invalid, not based on a genus name]

Sponges with nodular to tuberose or trunklike body bearing stump or branchlike, oscular outgrowths, and also with strongly branching, flattened ectosomal (cortical) desmas that may not be articulated; supplemental monaxons but no microscleres in single modern genus. [The living type genus, *Siphonidium* SCHMIDT, has a short to elongate, tree-trunklike body that bears thin, branchlike, oscular outgrowths, with an oscule at end of each, through which an exhalant canal discharges.] *Cretaceous (Campanian.*

Pachysalax SCHRAMMEN, 1910, p. 157 [**P. processifera;* OD]. Encrusting, nodular, or tuberlike, erect or not, with postica of aporhyses in groups at flattened ends of tree-stumplike outgrowths; intervening surface of skeletal framework with fine, superficial furrows and small ostia, which may be covered by layer of finely branched, flattened, cortical desmas; no loose spicules known. *Cretaceous (Campanian):* Germany.——FIG. 181,*1a.* **P. processifera,* Mucronatenkreide, Misburg; holotype with nodes that contain ostia of aporhyses on ends, ×0.5 (Schrammen, 1910).——FIG. 181,*1b. P. sinuosa* SCHRAMMEN, Mukronatenkreide, Misburg; desmas with cortical desmas in bottom row, ×20 (Schrammen, 1924a; courtesy of E. Schweizerbart'sche Verlagsbuchhandlung).

Family CNEMIDIASTRIDAE Schrammen, 1924

[Cnemidiastridae SCHRAMMEN, 1924a, p. 151]

Typically symmetrical, from top shaped with narrow, central cavity to funnel-, bowl-like, or discoidal, in which skeletal wall is traversed radially by regular, longitudinal series of closely spaced, tubular canals, which open through both skeletal surfaces, or by a network of branching and anastomosing, longitudinal fissures, or by some intermediate condition; meshwork of skeletal framework compact, except between closely spaced canals, and typically with more or less conspicuous, longitudinal and transverse alignment of many of the desmas; distinct, cortical meshwork present or absent; loose spiculation unknown. [Publication of this family name without diagnosis (SCHRAMMEN, 1924a, p. 151) is accepted as valid because *Cnemidiastrum* ZITTEL and three other recognizable genera were listed. *Cnemidiastrum* ZITTEL is understood here *sensu* DE LAUBENFELS as identical with *Lithostrobilus* SCHRAMMEN. This is contrary to previous practice but is required by DE LAUBENFELS's choice of *Cnemidium stellatum* GOLDFUSS as the type species. *Cnemidiastrum sensu* SCHRAMMEN (1924a, 1936) becomes *Cnemopeltia* POMEL.

When developed in the form of regular series of closely spaced canals, the canalization of this family is strikingly similar to that of *Archaeoscyphia* HINDE of the Orchocladina; but the desmas are all rhizoclones and the skeleton is not fibrous. Description of the skeleton as fibrous by LAGNEAU-HÉRENGER (1962) is mistaken and may refer to the regular alignment of many desmas.] *Upper Jurassic (Oxfordian)–Neogene (Miocene).*

Cnemidiastrum ZITTEL, 1878a, p. 109 [**Cnemidium stellatum* GOLDFUSS, 1826, p. 15; SD DE LAUBENFELS, 1955, p. 47] [?=*Bembixastrum* SCHRAMMEN, 1924b, p. 129 (type, *Cnemidium granulosum* MUNSTER in GOLDFUSS, 1833; see p. 765 herein); *Lithostrobilus* SCHRAMMEN, 1937, p. 87, obj.]. Top to carrot shaped, with narrow, central cavity and flattened or conical summit, or funnel, bowl, or mushroom shaped; some elongate examples with conspicuous, external constrictions; skeletal framework traversed by more or less regularly longitudinal series of closely spaced, tubular canals, which open through both skeletal surfaces, and may merge locally to form continuous clefts; canals all simple, or some branching toward exterior, and then anastomosing or crossing one another; both surfaces with regular, longitudinal series of small, skeletal pores as apertures of internal canals; these pores in regular, longitudinal series, typically not reticulating, and sometimes in longitudinal furrows; summit or margin with conspicuous, radiating furrows, representing incompletely formed canals, which may produce markedly coral-like appearance in poor material; lower parts of some examples may have secondary cortical meshwork obscuring skeletal pores; no loose spicules known. [*Lithostrobilus* was originally published without a diagnosis (SCHRAMMEN, 1924b, p. 130), but is based on an identifiable species. It was distinguished by SCHRAMMEN (1937, p. 87) from *Cnemidiastrum* ZITTEL *sensu* SCHRAMMEN as comprising forms here referred to *Cnemopeltia* POMEL. *Lithostrobilus* is now an objective synonym of *Cnemidiastrum* ZITTEL because of designation of *Cnemidium stellatum* GOLDFUSS as the type species of that genus by DE LAUBENFELS (1955, p. 47); the record from Italy is based on dubious material, thought to be "scarcely convincing" by MORET (1924, p. 7).] *Upper Jurassic (Oxfordian)–Neogene (Miocene):* France, Germany, Poland, Switzerland, *Oxfordian–Kimmeridgian;* Spain, *Aptian;* Spain, ?Italy, *Miocene.*——FIG. 183,*1a–c.* **C. stellatum* (GOLDFUSS), Weiss Jura, Kimmeridgian, Streitberg, Germany; *a,* camera lucida drawings of various rhizoclones, ×50 (Zittel, 1878a); *b,* part of elongate example having vertical rows of skeletal pores; ×1; *c,* upper surface of funnel-like example, ×0.25 (Quenstedt, 1877–1878).——FIG. 183,*1d. C. hoheneggeri* ZITTEL, Weiss Jura, Upper Jurassic, Krakau, Poland; side view of subcylindrial sponge with numerous inhalant ostia in generally longitudinal canals, ×1 (Zittel, 1878a).

Cnemopeltia POMEL, 1872, p. 82 [**Cnemidium rimulosum* GOLDFUSS, 1826, p. 15; OD] [=*Cnemidiastrum* ZITTEL, 1878b, p. 45 (type, *C. pluristellum* ZITTEL, 1878a, p. 26[10]) as understood by SCHRAMMEN, 1937, p. 84; not *Cnemidiastrum sensu* DE LAUBENFELS, 1955, p. 47]. Funnel or bowl shaped, or depressed, top shaped with shallow, central cavity or none, or discoidal, or asymmetrical; radial canals distinct locally, but replaced mainly by continuous branching and anastomosing clefts; outer (lower) surface of skeletal framework with open clefts, which radiate upwardly from base, or with corresponding series of closely spaced, small, simple or pustular skeletal pores, which open into clefts below surface; paragastral (upper) surface similar, with clefts or pore series radiating from center, or from number of points from which canal-like, tubular cavities may run down toward base; no loose spicules known. *Jurassic (Oxfordian–Kimmeridgian):* Germany, Switzerland.

C. (**Cnemopeltia**). Clefts or pore series of paragastral (upper) surface radiating from center. *Jurassic (Oxfordian–Kimmeridgian):* Germany, Switzerland.——FIG. 183,*2a–c.* **C. (C.) rimulosum* (GOLDFUSS), Weiss Jura, Kimmeridgian, Heuberg, Germany; *a,* segment of upper surface; *b,* lower surface, ×1 (Quenstedt, 1877–1878); *c,* desmas, ×20 (Schrammen, 1937).

C. (**Tremastrum**) SCHRAMMEN, 1924b, p. 129 [**Cnemidiastrum pluristellatum* ZITTEL, 1878a, p. 110; OD]. Paragastral (upper) surface with clefts radiating from a number of points, one of which is usually central, from which tubular, canal-like cavities run downwardly. [Original publication was without diagnosis but in new combination with type species. First formal diagnosis was by SCHRAMMEN, 1937, p. 84–85.] *Jurassic (Oxfordian–Kimmeridgian):* Germany, Switzerland.——FIG. 183,*3a–b.* **C. (T.) pluristellatum* (ZITTEL), Weiss Jura, Kimmeridgian, Heuberg, Germany; *a,* upper surface with clefts convergent to several oscula; *b,* lower surface with radially aligned series of inhalant ostia, ×1 (Quenstedt, 1877–1878).

Corallidium ZITTEL, 1878a, p. 110 [**Cnemidium diceratinum* QUENSTEDT, 1852, p. 675; OD]. Top to carrot shaped, with small, central cavity at summit; skeletal framework traversed vertically by numerous fine, radial fissures, between which skeleton forms thin, vertical plates that resemble septa of coral; internal structure exposed at summit, but covered on sides or under surface by dense, cortical layer resembling epitheca; no loose spicules known. *Jurassic (Kimmeridgian):* Germany.——FIG. 184,*2a–b.* **C. diceratinum* (QUENSTEDT), Weiss Jura, Aue; *a,* small, top-shaped example, seen from above; *b,* same sponge seen from side, ×1 (Quenstedt, 1877–1878).

Cucumaltina BRIMAUD & VACHARD, 1986, p. 315 [**C. placocephalus;* OD]. Elongate, stalked sponge with numerous irregular constrictions throughout its length; surface finely porous and smooth; spongocoel long and narrow with surface weakly and irregularly enlarged from base to summit, without particular relationships to exterior; inhalant canals bifurcate and arranged oblique to dermal exterior and surface of spongocoel; apex flat; osculum round and neither depressed nor jutting out, surrounded by ramified, superficial, radial canals; skeletal structure of dense, radial fibers composed uniquely of rhizoclones, which are not particularly differentiated in cortical skeleton. *Neogene (Miocene):* Spain.——FIG. 184,*1a–c.* **C. placocephalus,* Tortonian strata, upper Miocene, Pliego, southern Spain; *a,* stalked, constricted sponge with central osculum of deep spongocoel on upper face, IPM R6960, ×0.48; *b,* longitudinal section of paratype with light matrix in central spongocoel and lateral, canal system, IPM R6961, ×0.5; *c,* photomicrograph of rhizoclones in skeletal structure, IPM R6962, ×50 (Brimaud & Vachard, 1986; courtesy of *Publications Scientifiques du Muséum national d'Histoire naturelle, Paris*).

Superfamily PLATYCHONIODEA Schrammen, 1924

[*nom. transl.* REID, herein, *ex* Platychoniidae SCHRAMMEN, 1924b, p. 152]

Meshwork of skeletal framework typically semifibrous and commonly with some desmas united to form strandlike, longitudinal trains; some with internal meshwork constructed to produce an appearance of

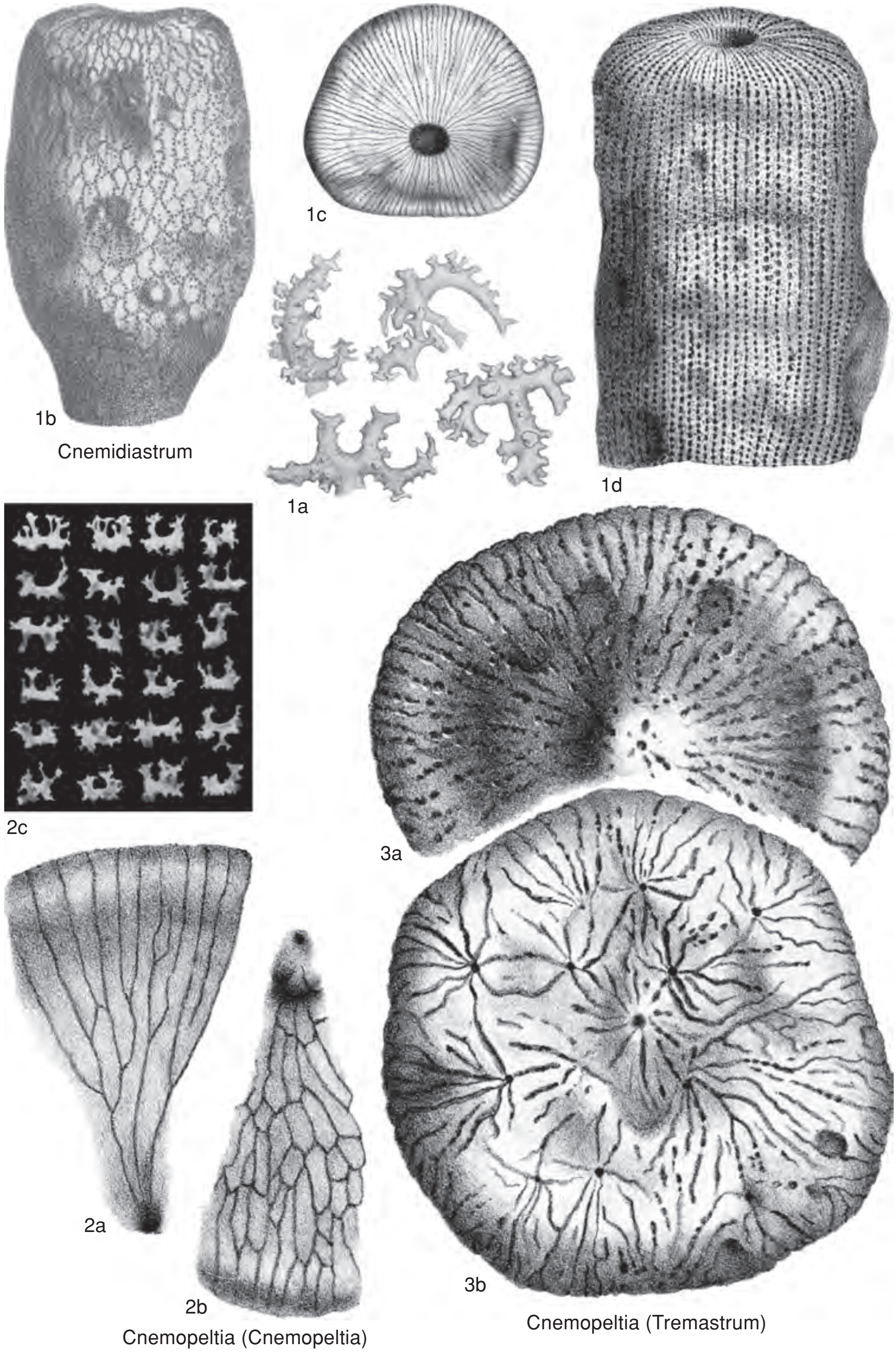

FIG. 183. Cnemidiastridae (p. 291–292).

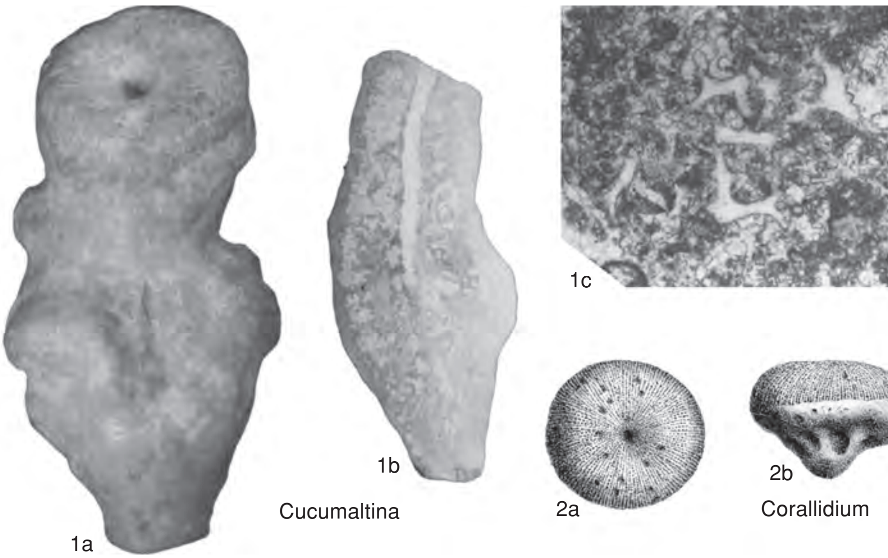

FIG. 184. Cnemidiastridae (p. 292).

fine, longitudinal canals or of radial septa; less commonly with semifibrous structure indistinctly developed or with local development of true, composite, skeletal fibers; outermost meshwork of framework may be similar to that of interior, or form a compact, skeletal cortex on either surface or both; no special ectosomal desmas; loose spicules unknown. [The superfamily comprises Rhizomorina, whose structure approached that of the typical fibrous Scleritodermatoidea (Scleritodermatidae, Seliscothonidae) but which normally lack true, composite, skeletal fibers.] *Jurassic–Holocene.*

Family PLATYCHONIIDAE Schrammen, 1924

[Platychoniidae SCHRAMMEN, 1924b, p. 152]

Plate- to funnel-like, flabellate, encrusting, or nodular sponges without distinct skeletal canals (epirhyses, aporhyses), in which surfaces of skeletal framework have numerous small, closely spaced, skeletal pores, to which larger, osculelike apertures may be added, or may be coated by dense, external, cortical meshwork without distinct skeletal pores; internal meshwork typically semifibrous, but sometimes tending to become distinctly fibrous, and with or without longitudinal, strandlike trains of desmas, between which fine, canal-like spaces may be seen, when such strands are developed; no loose spicules known. [Original publication of the family name Platychoniidae SCHRAMMEN was without diagnosis, but the type *Platychonia* ZITTEL and another recognizable genus (*Bothrolemma* SCHRAMMEN) were listed. A supposed Eocene record of *Platychonia* (CHAPMAN & CRESPIN, 1934, p. 117) is thought to be based on a sphaerocladine genus because the desmas have “4 to 7 or more radiating arms.”] *Jurassic–Holocene.*

Platychonia ZITTEL, 1878a, p. 114 [**Spongites vagans* QUENSTEDT, 1877 in 1877–1878, p. 328; SD HINDE, 1893b, p. 203; =*Scyphia schlotheimi* GOLDFUSS, 1829, p. 90, according to SCHRAMMEN, 1937, p. 95]. Plate or bowl-like, irregularly funnel-like, or flabellate, earlike to irregularly convolute; both surfaces of skeletal framework with small, closely spaced, skeletal pores that are arranged without order; internal meshwork semifibrous with distinct, longitudinal strands, between which canal-like spaces may be present, or irregularly reticulate and tending to become distinctly fibrous; no loose spicules known. *Jurassic (Sinemurian–Kimmeridgian):* England, *Sinemurian, upper Pliensbachian;* England, *Bajocian;* Germany, Switzerland, Poland, *Oxfordian–Kimmeridgian.*——FIG.

185,*3a–b.* **P. vagans* (Quenstedt), Weiss Jura, Oxfordian, Streitberg and Bosler, Germany; *a,* rhizoclone desmas, ×20 (Schrammen, 1937); *b,* side view of large, subcylindrical specimen with convolute structure, ×0.33 (Quenstedt, 1877–1878).

Amphibleptula Schmidt, 1879, p. 28 [**A. madrepora;* OD]. Platelike, rhizomorine sponges with thick, dermal layer composed of long oxeas and ectosomal desmas with more branches than in interior. *Jurassic–Holocene:* Germany, *Jurassic;* Barbados, Atlantic Ocean, *Holocene.*——Fig. 185,*2a–b. A. jurassica* Pisera, Kimmeridgian marls, Upper Jurassic, Genkingen, Germany; *a,* upper or gastral surface of platelike sponge, ZPAL Pf.VIII/133, ×0.75; *b,* transverse section through margin of holotype showing choanosomal skeleton and bundles of protruding oxeas, ZPAL Pf.VIII552, ×5 (Pisera, 1997; courtesy of *Palaeontologica Polonica*).

Bothrolemma Schrammen, 1924b, p. 133 [**Platychonia osculifera* Kolb, 1910 in 1910–1911, p. 240; OD]. Platelike, nodular, or forming crusts on other sponges; surfaces or unattached surface of skeletal framework with small pores and larger, osculelike apertures; internal meshwork as in *Platychonia* Zittel; no loose spicules known. [Original publication was without diagnosis but in new combination with established species *Platychonia osculifera* Kolb; first formal diagnosis was by Schrammen, 1937, p. 99.] *Jurassic (Oxfordian–Kimmeridgian):* Poland, *Oxfordian;* Germany, *Kimmeridgian.*——Fig. 185,*5.* **B. osculifera* (Kolb), Weiss Jura, Kimmeridgian, Heuchstetten, Germany; rhizoclone desmas, ×20 (Schrammen, 1937).

Chonellopsis Reid, *nom. nov.* herein (Schrammen, 1924b, p. 128, *nom. nud.;* Schrammen, 1936, p. 185, *nom. nud.*) [**C. striata* Schrammen, 1936, p. 185; OD]. Platelike, flabellate, or leaflike to earlike, or irregularly convolute; surfaces of skeletal framework with very small, skeletal pores, arranged without order on one surface, but in longitudinal series that radiate from base to margin on other surface; internal meshwork denser than in *Platychonia* species; no loose spicules known. [de Laubenfels (1955, p. 46) subsequently designated the type species for *Chonellopsis,* but according to *Code* Article 13.3 (ICZN, 1999), subsequent designation is admissable only for genera established prior to 1931 (see also p. xxiii, herein).] *Jurassic (Oxfordian–Kimmeridgian):* Germany.——Fig. 185,*1a–b.* **C. striata,* Weiss Jura, Gerstetten; *a,* irregularly convolute example, ×1; *b,* rhizoclone desmas, ×20 (Schrammen, 1937).

Hyaloderma Oppliger, 1921a, p. 204 [**H. porata;* M; SD de Laubenfels, 1955, p. 65]. Plate- to earlike, with central or marginal attachment; both surfaces of skeletal framework densely coated by smooth, external cortex, without distinct skeletal pores; some desmas of internal framework showing longitudinal and transverse alignments; no loose spicules known. *Jurassic (Kimmeridgian):* Switzerland.——Fig. 185,*4.* **H. porata,* Badenerschichten, Kimmeridgian, Rümikon; view from above into funnel-shaped gastral surface of thin-walled sponge, ×1 (Oppliger, 1926).

Family DISCOSTROMATIDAE Schrammen, 1924

[*nom. correct.* Reid, herein, *pro* Discostromidae Schrammen, 1924b, p. 151] [=Pyrgochoniidae Schrammen, 1924a, p. 153; Hyalotragosidae Schrammen, 1937, p. 91]

Discoidal or mushroomlike to funnel- or toplike sponges with distinct aporhyses or other skeletal canals; internal meshwork of skeletal framework compact to distinctly semifibrous, or forming radial, septalike lamellae, meshwork at surfaces compact, usually forming more or less distinct, skeletal cortex in which small, finely branched desmas may be added to others similar to those of interior; no loose spicules known. [Original publication of the family name Discostromatidae was without diagnosis, but the type genus *Discostroma* Zittel was listed. This genus is based on a species *D. intricata* (Quenstedt) whose structure is obscure in its author's original material, but is accepted as similar to *Hyalotragos* Zittel, type of Hyalotragosidae Schrammen, on Zittel's (1878a) authority.] *Upper Jurassic.*

Subfamily DISCOSTROMATINAE Schrammen, 1924

[*nom. transl. et correct.* Reid, herein, *ex* Discostromidae Schrammen, 1924a, p. 151]

Outer or lower (inhalant) skeletal surface without conspicuous pores or osculelike apertures, although small, intracortical pores may be seen under magnification; aporhyses well developed, numerous. *Upper Jurassic (Oxfordian–Kimmeridgian).*

Discostroma Zittel, 1878a, p. 112 [**Tragos intricatum* Quenstedt, 1877 in 1877–1878, p. 295; OD]. Discoidal or initially funnel-like, then expanding horizontally, with small, basal stalk and with upper surface convex around small, central cavity; lower surface with compact and concentrically wrinkled, surface meshwork; upper surface irregularly ridged and pitted; skeleton and canal system otherwise as in *Hyalotragos* Zittel, according to Zittel (1878a, p. 112). [Skeletal structure is obscure in Quenstedt's material and in topotypes obtained by Schrammen (1937, p. 94). The type species is possibly identical with *Hyalotragos patella* (Goldfuss), the type species of *Hyalotragos,* in which the upper, skeletal surface may have irregular pitting or furrowing.] *Jurassic (Kimmeridgian):* Germany.——

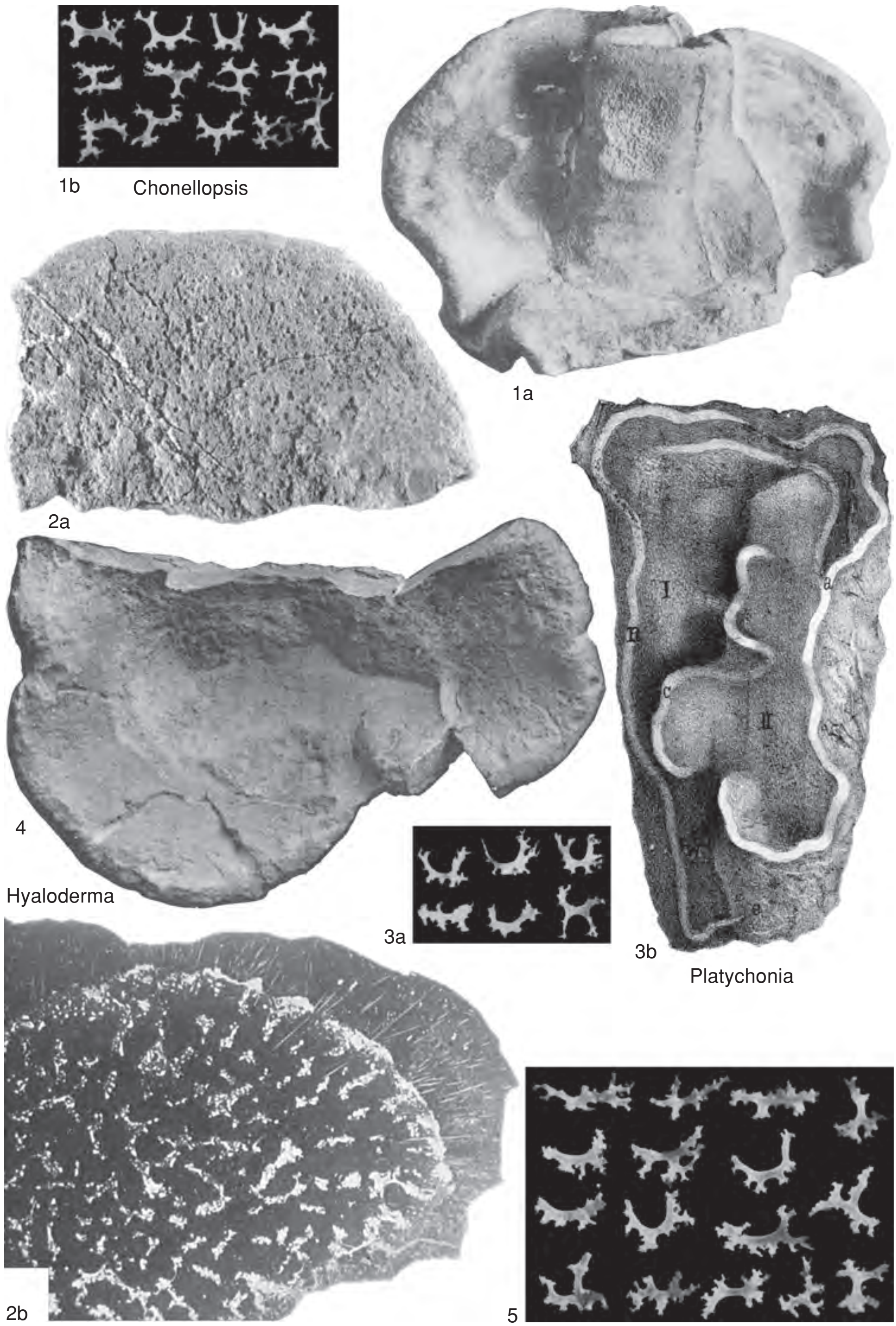

FIG. 185. Platychoniidae (p. 294–295).

FIG. 186,*2a–b*. **D. intricatum* (QUENSTEDT), Kimmeridgian marls, Upper Jurassic, Genkingen; *a,* upper surface of funnel-shaped sponge with irregular pits, ZPAL Pf.VIII/263; *b,* side view of same specimen with lower stalk to broadly obconical form, ×1 (Pisera, 1997; courtesy of *Palaeontologica Polonica*).

Hyalospongia SIEMIRADZKI, 1913, p. 181 [**Tragos infrajugosum* QUENSTEDT, 1878 in 1877–1878, p. 292; OD; ?=*Tragos rugosum* GOLDFUSS, 1829, p. 96, according to SCHRAMMEN (1937, p. 93), which was used as the type species of *Diacyparia* by POMEL, 1872, although SIEMIRADZKI (1913, p. 181) considered the two species as different and used *T. infrajugosum* as the type species of *Hyalospongia*]. Funnel- to mushroomlike, stalked, with or without shallow, central depression; meshwork of lower skeletal surface more or less compact, with or without distinct, skeletal pores; internal meshwork semifibrous, with or without distinct, longitudinal strands; upper surface with shallow, round pits, in which are postica of groups of aporhyses, and surface between which formed by dense, smooth, cortical layer; or similar but with marginated, osculelike apertures, through which aporhyses open in groups or individually; no loose spicules known. *Jurassic (Oxfordian–Kimmeridgian):* Germany, Poland, Switzerland.——FIG. 186,*3a–b*. **H. infrajugosum* (QUENSTEDT), Weiss Jura, Ulm, Germany; *a,* upper surface with round, rimmed pits of postica in smooth, cortical layer; *b,* folded lower surface with dense, dermal layer, ×0.5 (Quenstedt, 1877–1878).

Hyalotragos ZITTEL, 1878a, p. 111 [**Tragos patella* GOLDFUSS, 1826, p. 14; SD DE LAUBENFELS, 1955, p. 48] [=*Saccotragos* OPPLIGER, 1926, p. 67 (type, *S. acuminata* OPPLIGER, 1926, p. 66, SD DE LAUBENFELS, 1955, p. 107)]. Discoidal to mushroom, funnel or top shaped, with lower surface smooth or concentrically wrinkled and sometimes with wall plicated radially; meshwork of lower, skeletal surface compact, dense, with small ostia or none; internal meshwork compact to semifibrous, with longitudinal, strandlike trains of desmas spreading out toward both skeletal surfaces, or apparently traversed by fine, longitudinal canals; aporhyses well developed, vertical in axial parts, sloped or arched outwardly around them; upper surface more or less compact, smooth or irregularly furrowed with central group of postica through which axial aporhyses open, and other scattered postica around them; no loose spicules known. [Diagnosis here based on *H. patella* and similar species, not including forms of *Hyalospongia* SIEMIRADZKI and *Proseliscothon* SIEMIRADZKI as in ZITTEL's (1878a) and SCHRAMMEN's (1937) diagnoses.] *Jurassic (Oxfordian–Kimmeridgian):* Germany, Poland, Switzerland.——FIG. 186,*4a–b*. **H. patella* (GOLDFUSS), Weiss Jura, Heuberg, Germany; *a,* side view of stalked, broad sponge; *b,* view of lower, dermal surface, ×1 (Quenstedt, 1877–1878).——FIG. 186,*4c*. *H. patella* SCHRAMMEN, Weiss Jura, Oxfordian, Streitberg, Germany; rhizoclone desmas, ×20 (Schrammen, 1937).——FIG. 186,*4d*. *H. (Saccotragos) acuminata* (OPPLIGER), Badenerschichten, Kimmeridgian, Rümikon, Switzerland; side view of funnel-shaped sponge, ×0.5 (Oppliger, 1926).

Proseliscothon SIEMIRADZKI, 1913, p. 186 [**P. cracoviense;* OD]. Funnel to top shaped; lower surface of skeletal framework with small, closely spaced, skeletal pores arranged without order; internal meshwork forming thin, closely spaced, septalike, radial lamellae; upper surface coated by dense, external, cortical layer, with small, intracortical pores arranged along fine, radial ridges, corresponding with internal septa, and additional larger apertures as postica of aporhyses; internal meshes containing small, accessory desmas, which become more numerous toward upper surface and form cortical meshwork; no loose spicules known. *Jurassic (Oxfordian):* Poland.——FIG. 186,*1a–c*. **P. cracoviense; a,* upper surface; *b,* lower surface, ×1; *c,* vertical section of upper part of wall, ×30 (Siemiradzki, 1913).

Subfamily PYRGOCHONIINAE Schrammen, 1924

[*nom. transl.* REID, herein, *ex* Pyrgochoniidae SCHRAMMEN, 1924a, p. 153]

Outer or lower skeletal surface with conspicuous pores or osculelike apertures, from which shallow pits or distinct, tubular canals extend into skeletal framework; normal aporhyses well developed or absent. [Original publication of the name Pyrgochoniidae SCHRAMMEN was without diagnosis, but the type genus *Pyrgochonia* ZITTEL was listed. The subfamily is separated from the Discostromatinae because the form of the external apertures suggests development of secondary, exhalant vents on the normally inhalant surface; thus, the associated skeletal canals should then be secondary aporhyses, not epirhyses.] *Upper Jurassic.*

Pyrgochonia ZITTEL, 1878a, p. 112 [**Tragos acetabulum* GOLDFUSS, 1826, p. 13; OD] [=*Forospongia* D'ORBIGNY, 1849, p. 549, obj., *nom. oblit.*]. Bowl or funnel-like, more or less thick walled to toplike with shallow, central depression; usually stalked; outer (or lower) skeletal surface with numerous rounded, simple or marginate, osculelike apertures arranged without order, in rough, longitudinal series, or along longitudinal furrows; intervening surface formed by thin, compact, skeletal cortex, with or without distinct, small, intracortical ostia; paragastral surface similar, or with smaller and more numerous apertures; internal meshwork semifibrous; axial parts or stalk with tubular, vertical aporhyses that open at center of paragastral surface;

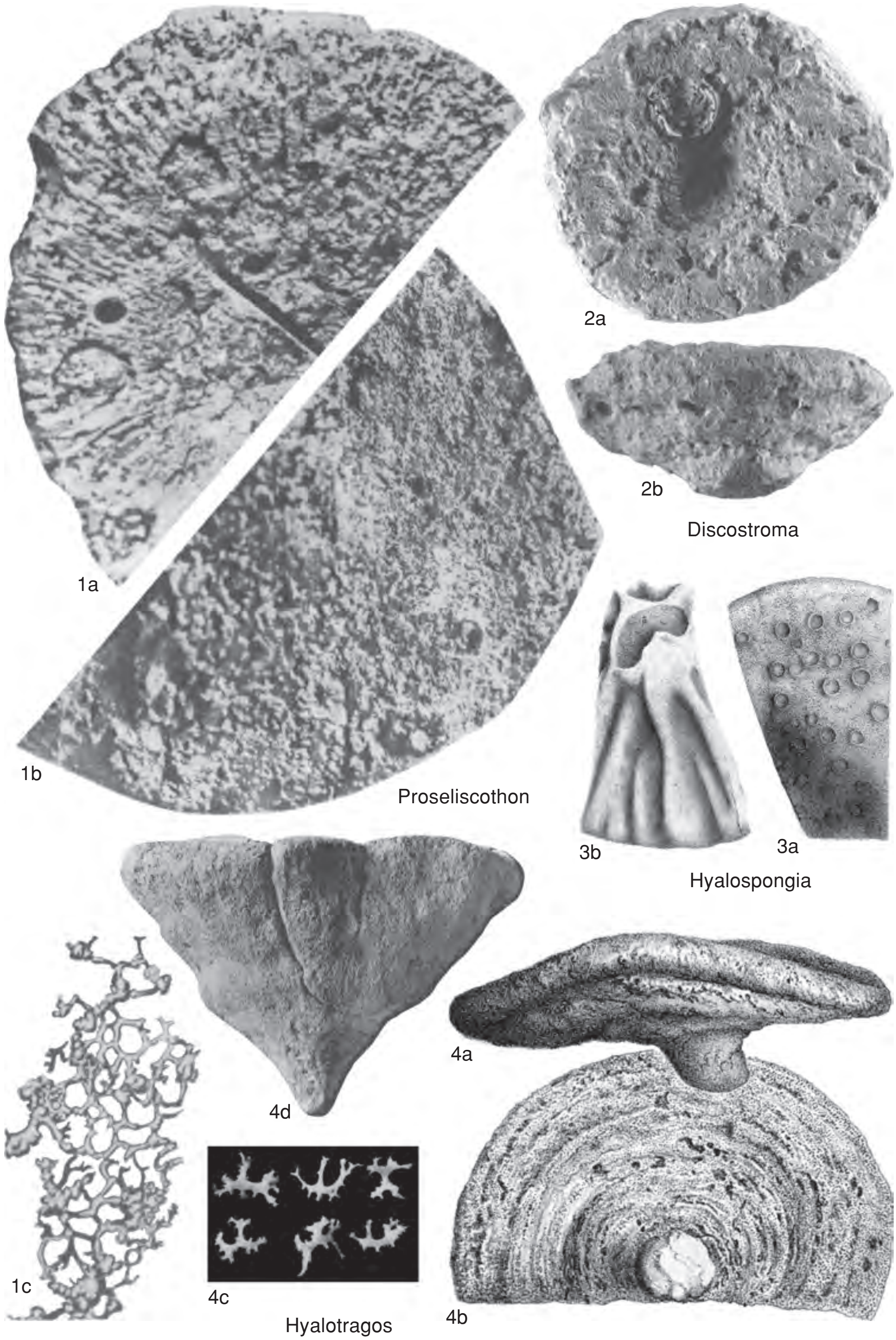

FIG. 186. Discostromatidae (p. 295–297).

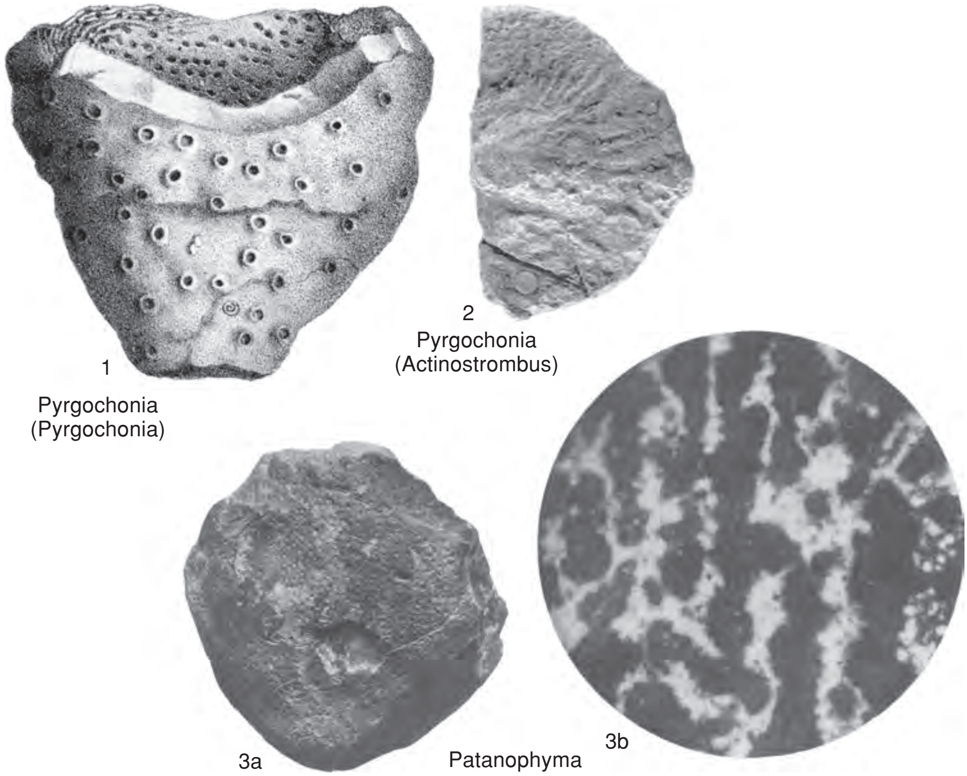

FIG. 187. Discostromatidae (p. 299).

lateral parts with oblique or meandering canals that may open through apertures of either surface; no loose spicules known. *Upper Jurassic*.

P. (**Pyrgochonia**). External apertures marginated, not in longitudinal series or furrows, and may be larger than those of interior. *Upper Jurassic:* Europe.——FIG. 187,*1*. **P. (P.) acetabulum* (GOLDFUSS), Weiss Jura, Kimmeridgian, Heuberg; side view of bowl-shaped sponge with rimmed, inhalant ostia on dermal surface and unrimmed, exhalant ostia on gastral surface, ×1 (Quenstedt, 1877–1878).

P. (**Actinostrombus**) SCHRAMMEN, 1924b, p. 129 [**Tragos radiatum* GOLDFUSS, 1829, p. 96; OD]. External apertures not marginated, arranged in longitudinal series or along longitudinal furrows on lower surface. [Original publication was without diagnosis but in new combination with type species. First formal diagnosis was by SCHRAMMEN, 1937, p. 98.] *Jurassic (Kimmeridgian):* Germany.——FIG. 187,*2*. **P. (A.) radiata* (GOLDFUSS), Kimmeridgian marl, Bärenthal; dermal or lower surface with radial furrows, ZPAL Pf. VIII/212, ×0.5 (Pisera, 1997; courtesy of *Palaeontologica Polonica*).

?Patanophyma OPPLIGER, 1915, p. 74 [**P. polypora;* OD]. Bowl shaped, stalked; lower skeletal surface with dense, external cortex, pierced by apertures of canals that may extend to near upper, skeletal surface; internal meshwork semifibrous, with some desmas in strandlike, longitudinal trains; upper surface finely porous, without apertures of canals; no loose spicules known. [Allocation of the genus to this family is uncertain, and it could belong with the Platychoniidae; external apertures here are assumed to correspond with those of *Pyrgochonia* ZITTEL.] *Jurassic (Kimmeridgian):* Switzerland.——FIG. 187,*3a–b*. **P. polypora,* Birmensdorfer beds, Olten; *a,* side view with coarse ostia in dermal layers, ×0.5; *b,* photomicrograph showing small, rhizoclone spicules and aligned, skeletal pores, scale not given, approximately ×30 (Oppliger, 1915).

Family ARETOTRAGOSIDAE Malecki, 1996

[Aretotragosidae MALECKI, 1996, p. 4]

Moderately thick-walled, funnel- or top-shaped, rhizomorine sponges with moderately closely spaced, small ostia and irregularly arranged postica groups on gastral surface; postica clusters may form rosettes on summits of papillae or in shallow or deep grooves; dermal skeleton made of more or less branched rhizoclones. *Jurassic:* Poland.

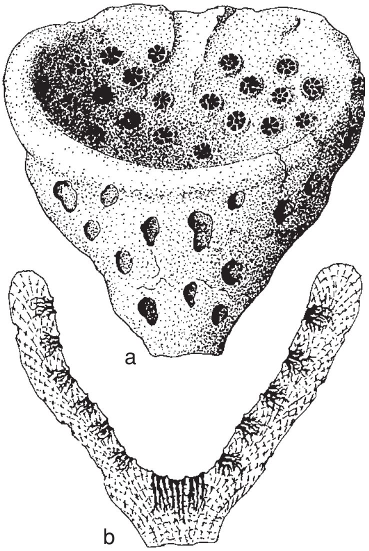

FIG. 188. Aretotragosidae (p. 300).

Aretotragos MALECKI, 1996, p. 4 [**A. jaraczi;* OD]. Sponges funnel, broad basin, or top shaped, with thick walls marked on curved, dermal surface with very small prosopores in shallow depressions; gastral surface with clusters of postica that form rosettes 1 to 4 mm across and irregularly 1 to 8 mm apart; main skeleton of rhizoclones with upwardly and outwardly divergent structure. *Jurassic:* Poland.——FIG. 188*a–b*. **A. jaraczi,* Transversarius beds, Weiss Jura, Krakow; *a,* side view of funnel-like sponge with prosopores in small, dermal depressions and exhalant ostia in rosettes on gastral surface; *b,* vertical section showing skeletal structure and nature of exhalant, canal clusters, ×0.5 (Malecki, 1996).

Superfamily SCLERITODERMATOIDEA Sollas, 1888

[*nom. transl. et correct.* REID, herein, *ex* Scleritodermidae SOLLAS, 1888, p. clvii]

Skeletal framework typically composed of three-dimensional network of composite, skeletal fibers, in which desmas are matted together side by side; with or without compact, cortical meshwork, which masks fibrous interior but outlines skeletal pores or oscules when present; some with special cortical desmas that are smaller and more finely branched than those forming internal framework; a few with fibrous structure indistinctly developed or absent, or with fibers constructed from zygomes of bipolar rhizoclones, arranged transversely between adjacent fibers; modern forms with sigmaspires, additional microrhabds, or no microscleres. *Jurassic (Callovian)–Holocene.*

Scleritodermatidae in SOLLAS's original sense (1888) are distinguished by possession of sigmaspire microscleres, without reference to skeletal structure. Sigmaspires occur in the three living genera *Scleritoderma* SCHMIDT, *Microscleroderma* KIRKPATRICK, and *Taprobane* DENDY, of which only *Scleritoderma* was known to SOLLAS (1888). Use of the translated name Scleritodermatoidea for forms distinguished by fibrous, skeletal structure is based on the writer's observation of this type of structure in a specimen of *S. paccardi* SCHMIDT, type species of *Scleritoderma,* and in the holotypes of *M. hirsuta* KIRKPATRICK and *T. herdmanni* DENDY, sole species of these genera. A condition in which fibrous structure is not distinctly developed was seen in *S. flabelliforme* SOLLAS, in which sigmaspires are present. Fibrous structure also occurs in the living "*Seliscothon*" *chonelloides* DOEDERLEIN, here regarded as a scleritodermatid without sigmaspires (*Neoseliscothon* REID).

Fossil genera, in which nothing is known of the microscleres, are identified as Scleritodermatidae if similar to the cited living genera in skeletal structure and habit. Others are placed in families Seliscothonidae SCHRAMMEN (if similar but with conspicuous longitudinal skeletal fibers) and Jereicidae SCHRAMMEN (if jereiform in habit).

Family SCLERITODERMATIDAE Sollas, 1888

[*nom. correct.* VON LENDENFELD, 1904c, p. 141, *pro* Scleritodermidae SOLLAS, 1888, p. clvii] [=Amphichondriidae SCHRAMMEN, 1924a, p. 83; Heterothelionidae SCHRAMMEN, 1924a, p. 83; Verruculinidae SCHRAMMEN, 1924a, p. 83; Taprobaneidae DE LAUBENFELS, 1936, p. 74, *partim;* Amphibleptulidae DE LAUBENFELS, 1936, p. 102, *partim*]

Typically cup- to funnel-like, flabellate, or irregularly convolute sponges in which paragastral surface has conspicuous, marginated oscules, or similar features present on both surfaces; skeletal framework usually clearly fibrous internally, but without conspicuous, longitudinal fibers; internal fibrous structure exposed at skeletal surfaces, or masked by dense, external cortex with perforating, skeletal pores on paragastral surface or both surfaces; desmas of cortical meshwork similar to those of interior or smaller and more finely branched; skeletal pores minute, punctiform and large and pustular or papilliform; some with distinct, internal aporhyses; supplemental oxeas or styles in some species; modern examples with sigmaspire microscleres only, additional microrhabds, or no microscleres. *Jurassic (Oxfordian)–Holocene.*

This family is interpreted as including the three living scleritodermatids *Scleritoderma* SCHMIDT, *Microscleroderma* KIRKPATRICK, and *Taprobane* DENDY, in which sigmaspires are present, and all fossil and modern Rhizomorina that resemble them in general habit and skeletal structure.

Systematic treatment by SCHRAMMEN (1924a) of some forms included here requires comment. The nominal genera *Verruculina* ZITTEL, 1878a and *Amphithelion* ZITTEL, 1878a were regarded by ZITTEL (1878b) as perhaps only distinct subgenerically, but were united by HINDE (1884a) as a single genus *Verruculina.* This practice was followed initially by SCHRAMMEN (1910), but he later (1924a) divided forms referable to this genus *s.l.* into eight genera (*Verruculina* ZITTEL, *Amphithelion* ZITTEL; *Amphichondrium* SCHRAMMEN, *Heterothelion* SCHRAMMEN, *Sporadothelion* SCHRAMMEN, *Amphistomium* SCHRAMMEN, *Seliscothon* SCHRAMMEN, *Cryptothelion* SCHRAMMEN), which were placed in five families (Leidorellidae SCHRAMMEN, Amphichondriidae SCHRAMMEN, Amphithelionidae SCHRAMMEN, Heterothelionidae SCHRAMMEN, Verruculinidae SCHRAMMEN). DE LAUBENFELS (1955) listed all eight genera, but recognized only the Leiodorellidae of SCHRAMMEN's families and treated three genera (*Cryptothelion, Heterothelion, Sporadothelion*) as family Uncertain (DE LAUBENFELS, 1955, p. 48–50). LAGNEAU-HÉRENGER (1962) recognized only *Verruculina,* placed in SCHRAMMEN's Verruculinidae, in part because criteria used by SCHRAMMEN are difficult to apply to poor material.

The genera distinguished by SCHRAMMEN (1924a) seem to have no characters that justify their reference to more than one family, and most are not separable except as subgenera. The principal difference among them is occurrence of two main types of desmas; these are used herein to distinguish ZITTEL's genera, although not in his original sense. SCHRAMMEN's Leiodorellidae and Amphithelionidae are adopted as subfamilies for various reasons.

Subfamily SCLERITODERMATINAE Sollas, 1888

[*nom. transl. et correct.* REID, herein, *ex* Scleritodermidae SOLLAS, 1888, p. clvii]

Cup- to funnel-like, flabellate, or irregularly convolute sponges, with more or less prominent oscules on paragastral surface; sigmaspire microscleres, to which normal or irregular microrhabds may be added; skeletal framework vaguely or clearly fibrous with layer of dense, cortical meshwork at paragastral surface, or no cortical meshwork; supplemental oxeas may occur within interfibrous meshes or project from skeletal surfaces. [There is no certain fossil record of the subfamily. Diagnosis above is based on limited material, but cortical meshwork is restricted to the paragastral surface in type material of *Scleritoderma flabelliforme* SOLLAS and absent in types of *Microscleroderma hirsuta* KIRKPATRICK and *Taprobane herdmanni* DENDY.] *?Cretaceous, Holocene.*

Scleritoderma SCHMIDT, 1879, p. 28 [**S. paccardi;* OD]. Cuplike or flabellate, with prominent oscules on paragastral surface but no corresponding, external features; skeletal framework vaguely or clearly fibrous, with paragastral cortex or none; supplemental oxeas may occur; microscleres sigmaspires and simple, crooked or irregular microrhabds, latter packing ectosome and lining internal canals. [The range was given as Cretaceous–Holocene by DE LAUBENFELS (1955, p. 49), but no fossil record has been traced; possibly represented by *Pleurophymia* POMEL (Miocene, Northern Africa), herein listed under the subfamily Uncertain.]

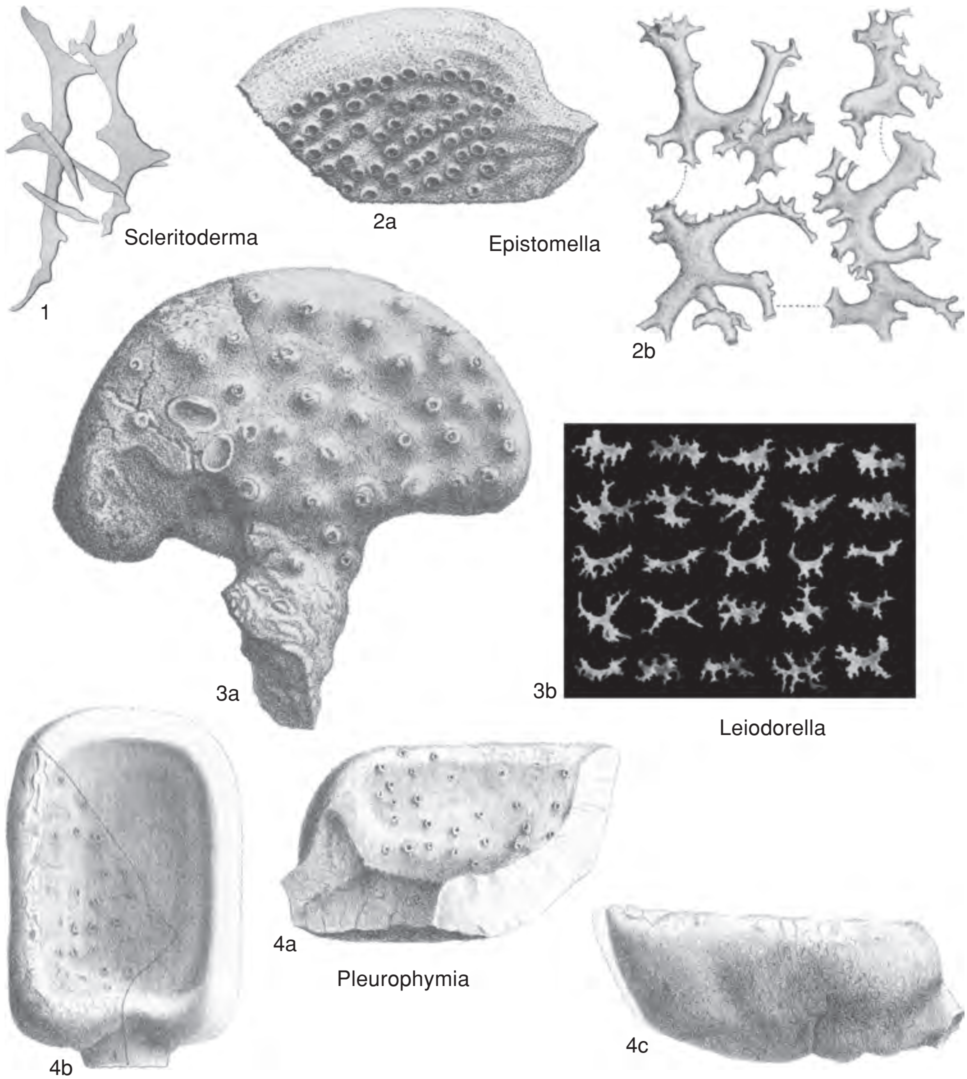

FIG. 189. Scleritodermatidae (p. 301–307).

?Cretaceous, Holocene: West Indies, East Indies.——FIG. 189,*1*. **S. paccardi,* Holocene, West Indies; isolated, monaxial desmas showing ranges in size and irregular form, ×100 (Schmidt, 1879).

Subfamily LEIODORELLINAE Schrammen, 1924

[*nom. transl.* REID, herein, *ex* Leiodorellidae SCHRAMMEN, 1924a, p. 82]

Flabellate sponges with dense, skeletal cortex and large, osculelike, skeletal pores on one or both surfaces of skeletal framework; internal meshwork more or less compact; no loose spicules known. [The subfamily comprises two isolated genera, resembling later (Cretaceous–Holocene) Scleritodermatidae but not related clearly to them. These sponges may belong with the Platychoniidae but are placed here because desmas are more similar to those of the Cretaceous Amphithelioninae, and the genus *Epistomella* ZITTEL resembles living *Scleritoderma flabelliforme* SOLLAS.] *Upper Jurassic (Oxfordian–Kimmeridgian).*

Leiodorella Zittel, 1878a, p. 113 [**L. expansa;* SD de Laubenfels, 1955, p. 48] [=*Amphisyringium* Schrammen, 1924a, p. 114, obj.; *?Amphihamma* Schrammen, 1924b, p. 128, *nom. nud.* (type, *A. pustulosa,* ?=*Leiodorella pustulosa* Schrammen, 1937, p. 100)]. Flabellate, flat or concavoconvex; both skeletal surfaces with dense, skeletal cortex and large, marginated or pustular, osculelike pores; internal meshwork more or less compact; no loose spicules known. *Jurassic (Oxfordian–Kimmeridgian):* Germany, Switzerland, Poland.——Fig. 189,*3a.* **L. expansa,* Krakau, Poland; side view of flabellate form with dermal surface marked by oscular-like, rimmed pore, ×1 (Zittel, 1878a).——Fig. 189,*3b. L. tubata* (Quenstedt), Weiss Jura, Kimmeridgian, Sontheim, Germany; rhizoclone desmas, ×20 (Schrammen, 1937).

Epistomella Zittel, 1878a, p. 113 [**Spongites clivosus* Quenstedt, 1877 in 1877–1878, p. 321; OD] [?=*Verruculinopsis* Schrammen, 1924a, p. 132, *nom. nud.* (type, *V. aurita* Schrammen, 1924a, p. 132, *nom. nud.,* ?=*Epistomella aurita* Schrammen, 1937, p. 101)]. Similar to *Leiodorella* Zittel, but with skeletal cortex and large, pustular, skeletal pores on one surface only; other skeletal surface finely porous. *Jurassic (Kimmeridgian):* Germany.——Fig. 189,*2a–b.* **E. clivosa* (Quenstedt), Weiss Jura, Sozenhausen; *a,* small fragment with pustular, skeletal pores on one surface, ×1; *b,* desmas identified with species by Zittel (1878a), ×50 (Zittel, 1878a).

Subfamily AMPHITHELIONINAE Schrammen, 1924

[*nom. transl.* Reid, herein, *ex* Amphithelionidae Schrammen, 1924a, p. 82]

Mainly funnel-like, flabellate, or irregularly convolute sponges with internally fibrous, skeletal frameworks that typically have more or less dense, skeletal cortex on both sides of skeletal framework, and commonly with marginated, pustular, or papilliform skeletal pores on both surfaces; some examples with variant habits irregularly lobate, roughly toplike, forming secondary funnels through union of enrolled and apposed, skeletal margins, or forming composite growths; skeletal pores (postica) of paragastral surface small, marginated to large, elongate papilliform; pores of external surface minute punctiform to large pustular and commonly smaller and more numerous than postica; internal framework frequently uncanalized, but some with distinct aporhyses or with canals that run inwardly from pores of external surface; cortical meshwork formed from desmas similar to those of interior or partly from smaller, flattened and strongly branching desmas; supplemental oxeas may occur; no microscleres known. [Skeletal pores of the external surface are not called ostia here because their commonly pustular form suggests an exhalant function. Amphithelioninae resemble *Leiodorella* Zittel (Upper Jurassic) when pustular pores are present on both surfaces; but the commonly small size of external pores and their punctiform character in some species suggest an independent, parallel development.] *Cretaceous–Neogene (Miocene).*

Amphithelion Zittel, 1878a, p. 123 [**Verrucospongia macrommata* F. A. Roemer, 1864, p. 45; SD Schrammen, 1924a, p. 117; ?=*A. reussi* (McCoy), cf. Schrammen, 1910, p. 140, synonymy] [=*Cladostelgis* Pomel, 1872, p. 150 (type, *Verrucospongia damaecornis* F. A. Roemer, 1864, p. 45, OD); *Pleurostelgis* Pomel, 1872, p. 150, *nom. oblit.; Heterothelion* Schrammen, 1924a, p. 118 (type, *Verruculina cupula* Schrammen, 1910, p. 142); *Sporadothelion* Schrammen, 1924a, p. 120 (type, *S. dissipatum* Schrammen, 1924a, p. 122)]. Usually flabellate, stalked or not, taking leaf-, ear-, fan-, or bladelike shapes, or forming an incomplete funnel or secondary funnel; but may also be regularly plate-, bowl-, or funnel-like, or roughly top shaped; external, skeletal pores punctiform to pustular, usually small, closely spaced, and always more numerous and smaller than postica; postica marginated to elongate, papilliform, often large; distinct aporhyses present or absent; desmas typically stout, arched, or branching, with arched forms often predominant; special, cortical desmas unknown; some with supplemental oxeas; microscleres unknown. [Distinction from *Verruculina* Zittel is here based on the form of the desmas and absence of special, cortical desmas, not on the form of the external pores, as suggested by Zittel, 1878a. *Pleurostelgis* (Pomel, 1872, p. 150) was equated by de Laubenfels (1955, p. 107) with *Stelgis* Pomel (=*Ventriculites* Mantell, 1822, p. 167, class Hexactinellida), but the type species is *Amphithelion miliare* of Zittel, 1878a, and *Sporadothelion miliare* of Schrammen, 1924a (=*A. miliare* herein). *Upper Cretaceous (Cenomanian–Campanian):* Europe.

A. (**Amphithelion**). Aporhyses present or absent and radial or branching but not longitudinal when present. *Cretaceous (Cenomanian–Santonian):* Czech Republic, Slovakia, *Cenomanian;* England, Germany, *Turonian–Campanian;* France, *Coniacian–Santonian.*——Fig. 190,*2a.* **A. (A.) macrommata* (F. A. Roemer), Mukronatenkreide, Campanian, Misburg, Germany; characteristic rhizoclone desmas, ×20 (Schrammen, 1924a; courtesy of E.

Schweizerbart'sche Verlagsbuchhandlung).——FIG. 190,*2b–c. A. (A.) reussi* (MCCOY), Upper Chalk, ?Campanian, Flamborough, Yorkshire, England; *b,* complete example with elongate, papilliform postica on paragastral surface, ×0.5; *c,* part of external surface showing smaller external pores, ×1 (Hinde, 1884b).——FIG. 190,*2d. A. (A.) cupula* (SCHRAMMEN), Mukronatenkreide, Campanian, Misburg, Germany; rhizoclone desmas, ×20 (Schrammen, 1924a; courtesy of E. Schweizerbart'sche Verlagsbuchhandlung).——FIG. 190,*2e. A. (A.) dissipatum* (SCHRAMMEN), Quadratenkreide, Campanian, Höver, Germany; rhizoclone desmas, ×20 (Schrammen, 1924a; courtesy of E. Schweizerbart'sche Verlagsbuchhandlung).——FIG. 190,*2f–g. A. (A.) miliare* (REUSS), Upper Chalk, Upper Cretaceous, Flamborough, Yorkshire, England; *f,* general view showing paragastral surface and stump of broken stalk, long in this species; *g,* part of external surface showing small, external pores, sole *Amphithelion* species for which ZITTEL (1878a) studied another author's original material, ×1 (Hinde, 1884b).

A. (**Amphistomium**) SCHRAMMEN, 1924a, p. 114 [**A. aequibile* SCHRAMMEN, 1924a, p. 115; OD]. Funnel-like or flabellate; both skeletal surfaces with numerous large, pustular, skeletal pores; external pores similar in size to those of paragastral surface, although rather more numerous; desmas slender, mainly linear in interior, finely branching in cortical layers; no loose spicules known. [Here thought to be similar to *Verruculina* ZITTEL; the relationship to *Leiodorella* ZITTEL of Upper Jurassic, claimed by SCHRAMMEN (1924a, p. 114), is uncertain.] *Cretaceous (Campanian):* Germany.——FIG. 190,*1a–b.* **A. (A.) aequibile; a,* external surface seen from below, ×0.75; *b,* characteristic rhizoclone desmas, ×20 (Schrammen, 1924a; courtesy of E. Schweizerbart'sche Verlagsbuchhandlung).

A. (**Cryptothelion**) SCHRAMMEN, 1924a, p. 122 [**C. geminum;* OD]. Aporhyses present, usually simple, and traversing skeletal framework longitudinally from postica toward basal parts; may form composite, flabellate growths by lateral budding. *Cretaceous (Campanian):* England, *?Campanian;* Germany, *Campanian.*——FIG. 191,*2a.* **A. (C.) geminum,* Quadratenkreide, Campanian, Höver, Germany; rhizoclone desmas, ×20 (Schrammen, 1924a; courtesy of E. Schweizerbart'sche Verlagsbuchhandlung).——FIG. 191,*2b–c. A. (C.) papillata* (HINDE), Upper Chalk, Campanian, Flamborough, Yorkshire, England; *b,* incomplete example with margin broken in part, showing paragastral surface and postica, where skeletal cortex is broken away near base, and internal meshwork is locally not preserved, aporhyses are seen in section; *c,* part of external surface, ×1 (Hinde, 1884a).

?Cladostelgis POMEL, 1872, p. 150, *nom. oblit.* [**Verrucospongia damaecornis* F. A. ROEMER, 1864, p. 45; OD]. Flabellate, of distinctive, digitate, staghorn shaped, but without other special features. [Equated incorrectly by DE LAUBENFELS (1955, p. 107) with *Stelgis* POMEL (1872, p. 149, type, *Ventriculites radiatus* MANTELL, 1822, p. 168), =*Ventriculites* MANTELL (1822, p. 168) of class Hexactinellida, order Lychniscosa.] *Cretaceous:* Europe.——FIG. 191,*1.* **C. damaecornis* (F. A. ROEMER), Cuvieri beds, Turonian, Windmuhlenberges near Salzgitter, Germany; side view of staghorn-shaped sponge with pronounced but small, exhalant ostia, ×1 (Roemer, 1864).

Scythophymia POMEL, 1872, p. 131 [**S. crassa* POMEL, 1872, p. 132; SD DE LAUBENFELS, 1955, p. 48] [=*Scytophymia* MORET, 1924, p. 15, *nom. null.*]. Cup to mushroomlike, thick walled; both surfaces of skeletal framework with smooth, dense, skeletal cortex; paragastral surface with large, widely spaced, punctiform or marginated postica; external (or lower) surface apparently without skeletal pores; further details unknown. [Position strictly unknown, but interpreted by MORET (1924, p. 15) as based on forms of *Verruculina* ZITTEL (*s.l.*); absence of external pores is distinctive, if genuine.] *Neogene (Miocene):* Algeria.——FIG. 191,*3a–b.* **S. crassa,* Djebel Djambeida; *a,* side view of thick-walled, mushroomlike sponge with prominent, broad, upper depression; *b,* view from above into summit area with marginated postica on gastral surface, ×0.5 (Pomel, 1872).

Verruculina ZITTEL, 1878a, p. 122 [**Chenendopora aurita* F. A. ROEMER, 1864, p. 43; SD SCHRAMMEN, 1924a, p. 124; not *Manon micrommata* F. A. ROEMER, 1840 in 1840–1841, p. 3, *des.* DE LAUBENFELS, 1955, p. 48] [=*Chondriophyllum* SCHRAMMEN, 1924a, p. 126 (type, *Manon tenue* ROEMER, 1840 in 1840–1841, p. 3)]. Bowl- to funnel-like or flabellate, stalked or not, some flabellate examples enrolled to form secondary funnels or irregularly convolute; external, skeletal pores punctiform, minute, to pustular, small, always numerous; postica nearly always pustular, and usually larger but less numerous than external pores; size and spacing of postica greatest in thick-walled and least in thin-walled species; desmas of interior typically slender and predominantly branching, although simple, arched forms also occur; most species with special, flattened, and finely branching desmas in cortical meshwork; supplemental oxeas in some; no microscleres known. [*Chondriophyllum* SCHRAMMEN (type, *Manon tenue* F. A. ROEMER, 1841 in 1840–1841, p. 3) includes species in which thickness of the skeletal wall is typically not more than about 0.5 cm, and special cortical desmas are present.] *Cretaceous (Aptian)–Neogene (Miocene).*

V. (**Verruculina**). Special cortical desmas present; wall thick or thin; size of postica varied correspondingly. *Cretaceous (Aptian)–Neogene (Miocene):* Spain, *Aptian;* Czech Republic, Slovakia,

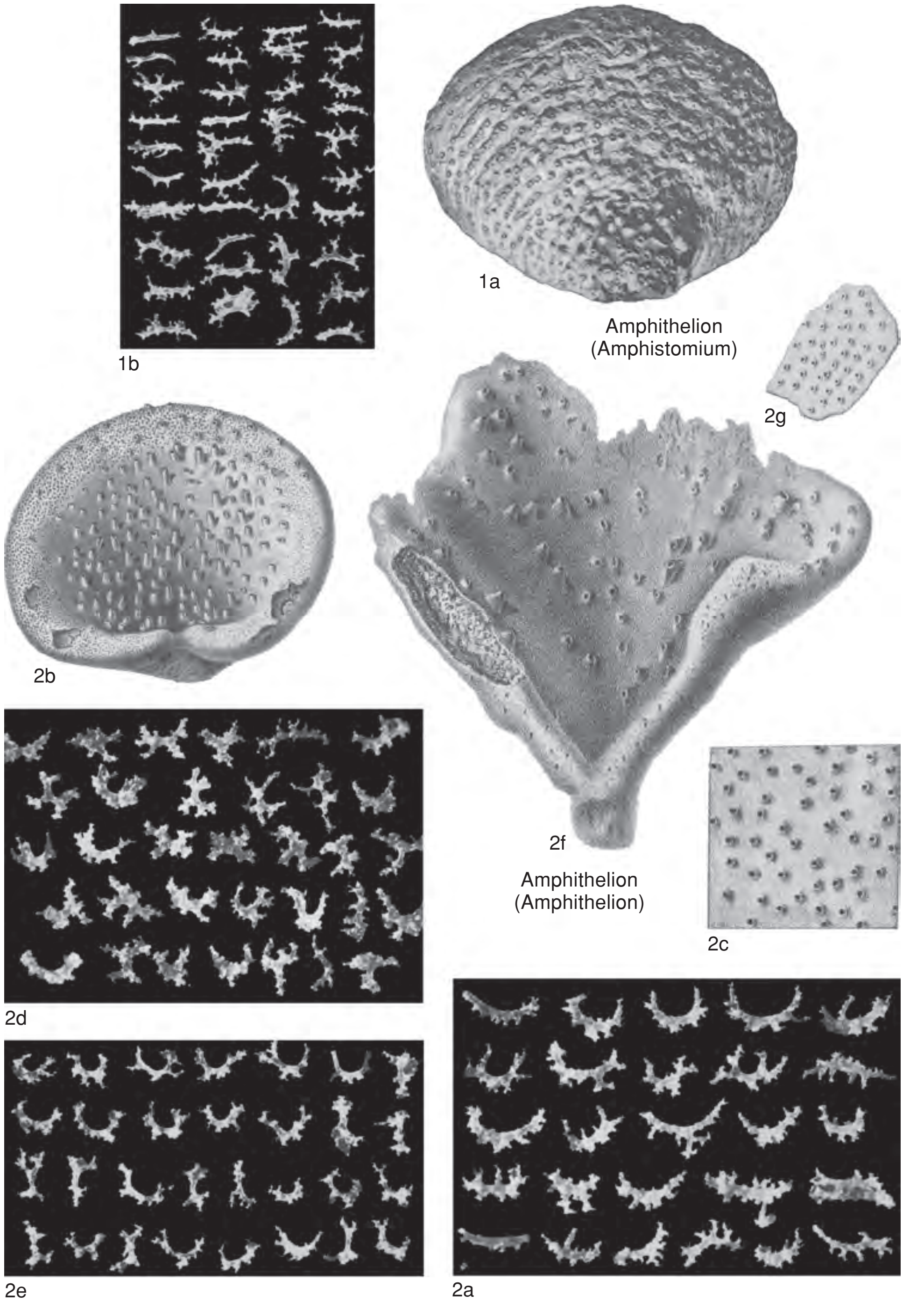

FIG. 190. Scleritodermatidae (p. 303–304).

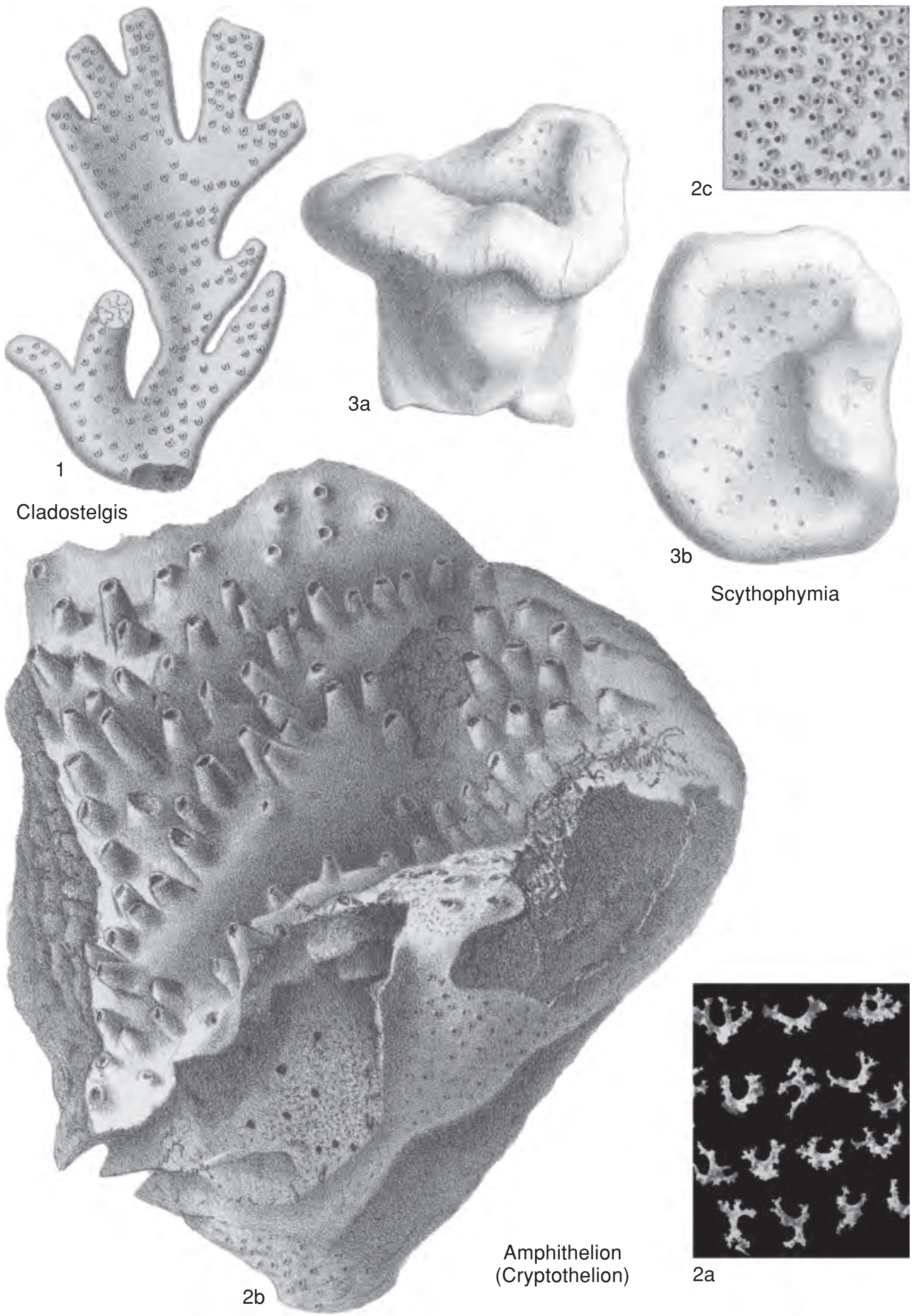

FIG. 191. Scleritodermatidae (p. 304).

Cenomanian; England, *Santonian–Campanian;* France, *Santonian;* Germany, *Turonian–Campanian;* Western Australia, *Eocene;* Algeria, *Miocene.*——FIG. 192*a–b.* **V. (V.) aurita* (ROEMER), Mukronatenkreide, Campanian, Misburg, Germany; *a,* side view of funnel-shaped holotype, ×1 (Roemer, 1864); *b,* characteristic desmas, ×22 (Schrammen, 1924a; courtesy of E. Schweizerbart'sche Verlagsbuchhandlung).——FIG. 192*c. V. (V.) seriatopora* (F. A. ROEMER), Quadratenkreide, Campanian, Oberg, Germany; paragastral surface of flabellate specimen showing postica. [This species is identical with *V. aurita* according to SCHRAMMEN, 1910, p. 141, but not 1924a, p. 124; may be same species, but with cortex incompletely developed], ×1 (Schrammen, 1910).——FIG. 192*d–e. V. (V.) tenuis* (F. A. ROEMER), Upper Chalk, ?Campanian, Flamborough, Yorkshire, England, type species of *Chondriophyllum* SCHRAMMEN, 1924a, figured by HINDE, 1884a as *V. pustulosa* HINDE; *d,* general view showing paragastral surface and thin wall of funnel-shaped sponge; *e,* part of external surface, ×1 (Hinde, 1884a).

V. (**Amphichondrium**) SCHRAMMEN, 1924a, p. 127 [**Spongia convoluta* QUENSTEDT, 1877 in 1877–1878, p. 368; OD]. Special cortical desmas (said to be) absent; wall typically thin; external pores and postica both minute, about equally numerous, punctiform to pustular. *Cretaceous (upper Turonian–Campanian):* Germany, *upper Turonian–Campanian;* England, *Campanian.*——FIG. 193*a–d.* **V. (A.) convoluta* (QUENSTEDT), Campanian; *a,* funnel-shaped sponge, Upper Chalk, Flamborough, Yorkshire, England, ×0.5; *b–c,* paragastral surface with small, exhalant pores, external surface with minute, inhalant pores, Upper Chalk, Flamborough, Yorkshire, England, ×4 (Hinde, 1884a); *d,* characteristic rhizoclone desmas, Mukronatenkreide, Misburg, Germany, ×20 (Schrammen, 1924a; courtesy of E. Schweizerbart'sche Verlagsbuchhandlung).

Subfamily UNCERTAIN

Pleurophymia POMEL, 1872, p. 135 [**P. cotyle;* SD DE LAUBENFELS, 1955, p. 48; =*P. sessilis* POMEL, 1872, p. 138]. Irregularly cuplike or flabellate, thick walled, may be stalked; paragastral surface of skeletal framework with skeletal cortex and large, widely spaced, marginated to papilliform postica; external surface finely rugose, with small pores along irregular furrows, and apparently no cortex; interior with branching, skeletal canals that begin from postica and run to pores of external surface; further details unknown. [Spicular structure of type species unknown, but all nominal species are probably identical, and one (*P. ambigua* POMEL, 1872, p. 137) referred by MORET (1924, p. 15) to *Verruculina* ZITTEL (*s.l.*); herein thought likely to be more similar to living Scleritodermatinae because of seeming absence of an external cortex, if POMEL's descriptions are correct.] *Neogene (Miocene):* Algeria.——FIG. 189,*4a–c.* **P. cotyle,* Djebel Djambeida; *a,* incomplete specimen from above, showing postica; *b,* same from below, restored where detail absent; *c,* lateral view showing lateral point of attachment, with internal canals exposed along fracture, ×0.5 (Pomel, 1872).

Family JEREICIDAE Schrammen, 1924

[Jereicidae SCHRAMMEN, 1924a, p. 81] [=Jereopsidae DE LAUBENFELS, 1955, p. 48]

Globular to club-shaped or cylindrical sponges without distinct, paragastral cavities, although terminal depression may be present, but with axial group of vertical aporhyses whose apertures (postica) are at summit; additional epirhyses present or absent; skeletal framework vaguely to distinctly fibrous internally, and with or without distinct, longitudinal, skeletal fibers that radiate upwardly from axial parts when present; surface meshwork usually forming compact, skeletal cortex, with perforating ostia outside area where aporhyses open; supplemental monaxons in some; no microscleres known. [Change of the family name from Jereicidae to Jereopsidae, if *Jereica* ZITTEL is regarded as a synonym of *Jereopsis* POMEL, as by DE LAUBENFELS (1955, p. 48), is not required nor permitted by the *Code* (ICZN, 1999).] *Jurassic (Callovian)–Holocene.*

Jereica ZITTEL, 1878a, p. 126 [**Jerea polystoma* F. A. ROEMER, 1864, p. 34; SD MORET, 1926b, p. 87]. Globular, pyriform, top to club shaped or cylindrical, often stalked, with or without shallow, terminal depression; skeletal surface typically formed by dense, external cortex with numerous small, closely spaced, perforating ostia, except in terminal area where aporhyses open; skeletal framework clearly fibrous internally, with axial part traversed by bundle of vertical, tubular aporhyses that extend to near base, and with radiating, skeletal fibers and fine, radial epirhyses in lateral parts around them; no radial aporhyses in lateral parts; postica several to many times larger than ostia, simple or slightly marginated, and located in terminal depression when present; cortical desmas may be smaller than those of internal fibers; supplemental oxeas may occur; no microscleres known. *Jurassic (Oxfordian)–Upper Cretaceous:* Poland, *Oxfordian;* Europe, *Upper Cretaceous;* England, *Cenomanian, Campanian;* France, *Turonian–Santonian;* Germany, *Santonian–Campanian.*——FIG. 194,*3a–b.* **J. polystoma* (F. A. ROEMER), Coniacian, Paris basin, France; *a–b,*

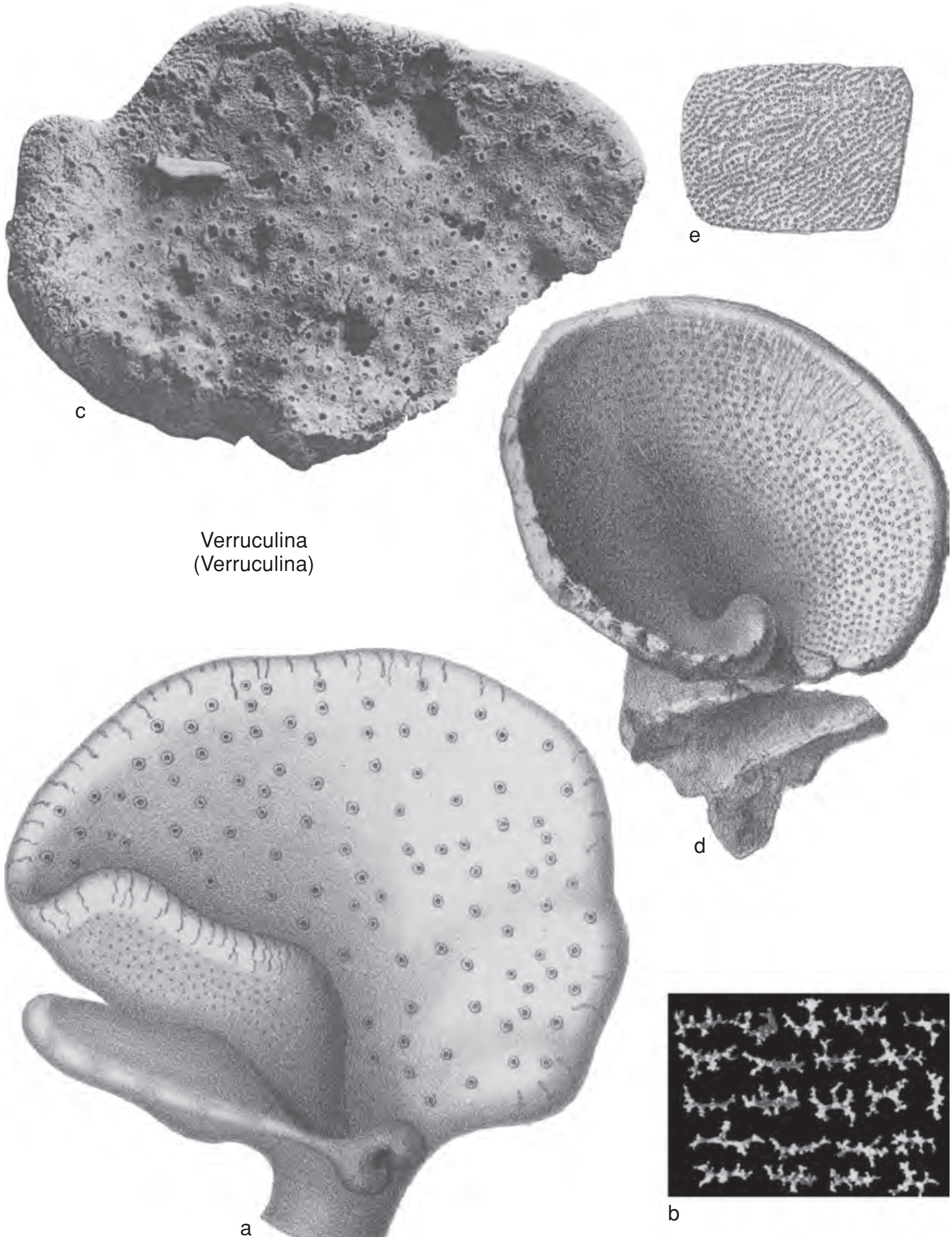

FIG. 192. Scleritodermatidae (p. 304–307).

diagrams showing structure: *a,* external appearance and *b,* vertical section; *ip,* inhalant pores (ostia); *c,* cortex, removed in part; *ep,* exhalant pores (postica); *f,* fibers of interior, seen where cortex is removed (view *a*); *f,* fibrous lateral part of skeletal framework (view *b*); *ic,* supposed inhalant canals (spaces between radial fibers); *ec,* exhalant canals (aporhyses) (Moret, 1926b).——FIG. 194,*3c. J. punctata* (GOLDFUSS), Santonian, Saint-Cyr, France; skeletal surface with cortex and pores present at

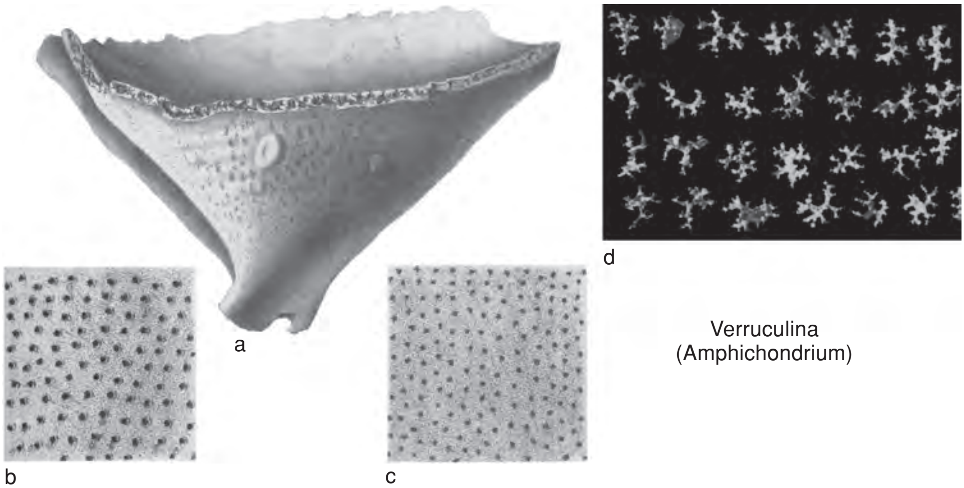

FIG. 193. Scleritodermatidae (p. 307).

right and fibrous interior exposed at left, ×20 (Moret, 1926b; courtesy of Société Géologique de France).

Jereopsis POMEL, 1872, p. 177 [**J. inaequalis;* SD DE LAUBENFELS, 1955, p. 48; =*Jerea clavaeformis* POMEL, 1872, p. 162, *non* SCHMIDT, 1879; for synonymy of *J. clavaeformis* see MORET, 1924, p. 12–13] [=*Jereopsidea* POMEL, 1872, p. 188 (type, *Jereopsis aberrans* POMEL, 1872, p. 187, SD DE LAUBENFELS, 1955, p. 48)]. Globular to short-cylindrical or elongate pyriform, or forms compound growths in which two or more sponges are united; individuals always with shallow, bowl-like, terminal depression, in which aporhyses open, and some with depression surrounded by flattened and radially furrowed surface; sides with ostia that perforate dense, external cortex; underlying surface of internal, skeletal framework with sinuous, anastomosing furrows that run downwardly from summit; interior fibrous but without distinct, radial fibers, traversed vertically by bundle of axial aporhyses and with additional radial aporhyses that arch outwardly and downwardly in lateral parts, and in some instances open into furrows at external surface of framework; postica little larger than ostia; no loose spicules known. *Neogene (Miocene):* Algeria, Spain.——FIG. 194,*2a–c.* **J. inaequalis,* Djebel Djambeida, Algeria; *a,* side view of subcylindrical form, ×0.5; *b,* view from above of shallow spongocoel depression with exhalant ostia and surrounding, radial canals, ×1; *c,* side view of compound example (=*Jerea sobolifera* POMEL), ×1 (Pomel, 1872).

Moretispongia BREISTROFFER, 1949, p. 103 [**Epeudea praegnans* DUMORTIER, 1871, p. 53; OD; type genus is not *Meta pyriformis* POMEL, as cited in LAGNEAU-HÉRENGER, 1962, p. 182] [=*Marisca* POMEL, 1872, p. 192 (type, *M. pyriformis,* M), *non* GRAY, 1840]. Pyriform to irregularly cylindrical with shallow, terminal depression in which aporhyses open; sides with skeletal cortex pierced by widely spaced, marginated ostia that are similar to postica in size or larger; underlying surface of internal framework may be furrowed; internal meshwork fibrous; some desmas may resemble spiny tetraclones or sphaeroclones; no loose spicules known. *Middle Jurassic (Callovian)–Neogene (Miocene):* France, *Callovian;* Europe, *Upper Jurassic–Lower Cretaceous;* Spain, *Aptian;* Northern Africa, *Miocene.*——FIG. 194,*1a. M. pyriformis* (POMEL), Miocene, Benibou Mileuk, Algeria; side view showing cylindrical form with nodose, inhalant ostia on sides and furrows of small, exhalant ostia on summit, slightly reduced (Moret, 1924; courtesy of Société Géologique de France).——FIG. 194,*1b–c. M. micropora* LAGNEAU-HÉRENGER, Aptian, Can Casanyas Castellet, Catalogne, Spain; characteristic spicules including desmas of interior, some resembling spiny sphaeroclones, and normal rhizoclones, ×25 (Lagneau-Hérenger, 1962).

Pomelia ZITTEL, 1878a, p. 126 [**P. schmidti;* OD]. Club shaped to subcylindrical with arched summit marked by shallow grooves around summit cluster of small oscula of deep, exhalant canals; dermal surface with regular, fine, inhalant ostia; endosomal skeleton of rhizoclones united with short, thick, ray tips and dermal rhizoclones more nodose. [Included in the family with some question.] *Neogene (?Miocene), Holocene:* North Africa, *?Miocene;* USA (Florida), *Holocene.*——FIG. 195,*2a–b.* **P. schmidti,* Holocene, Florida; *a,* side view of small, club-shaped sponge with short stalk and oscular cluster at summit, ×1; *b,* spicule relationships in endosomal skeleton, ×40 (Zittel, 1878a).

Stichophyma POMEL, 1872, p. 188 [**Manon turbinatum* F. A. ROEMER, 1840 in 1840–1841, p. 3; SD DE LAUBENFELS, 1955, p. 48; *M. turbinatum*

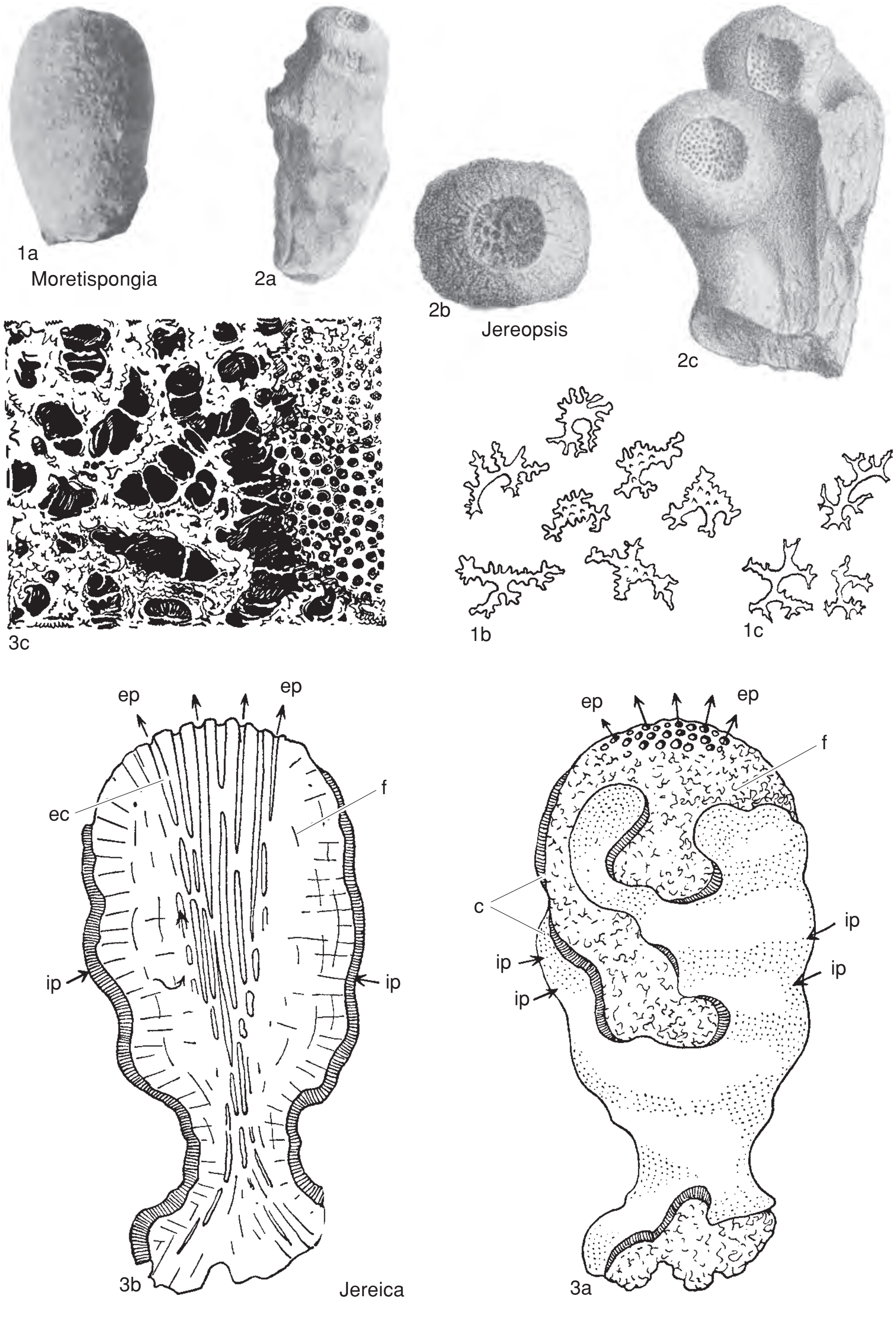

FIG. 194. Jereicidae (p. 307–309).

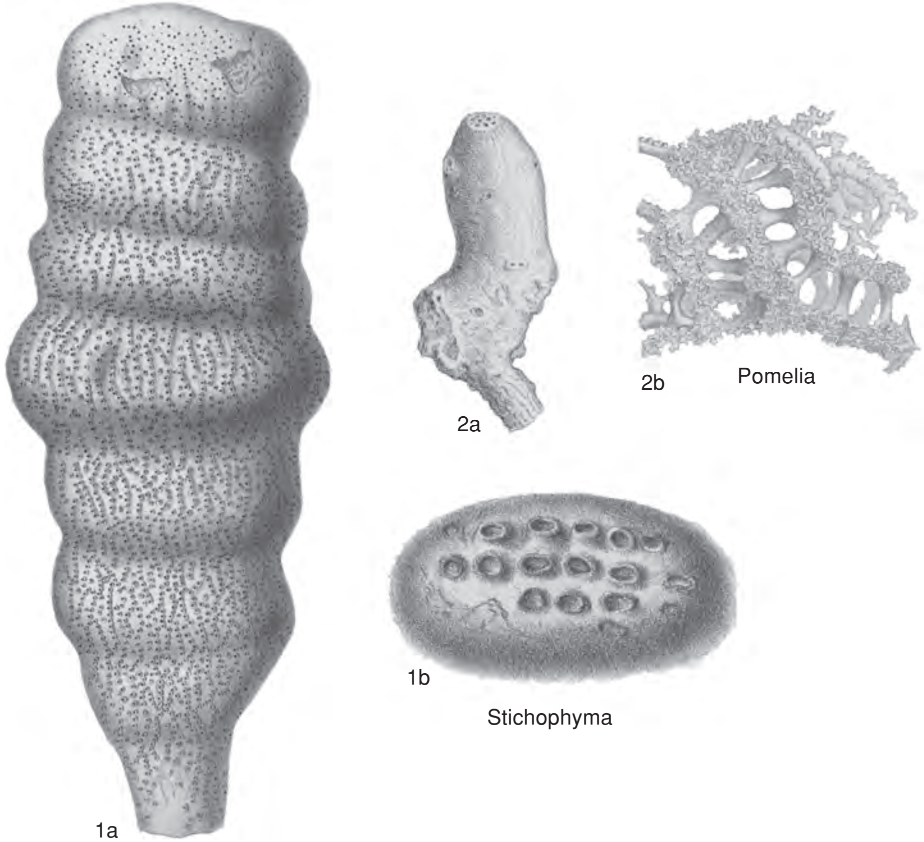

FIG. 195. Jereicidae (p. 309–311).

only mentioned, not designated, by RAUFF, 1893, p. 96, to whom DE LAUBENFELS (1955) ascribed designation] [=*Stychophyma* VOSMAER, 1885, p. 291, *nom. null.; Sticophyma* MORET, 1924, p. 13, *nom. null.; Meta* POMEL, 1872, p. 188, obj., *non* KOCH, 1835]. Pyriform to top or club shaped, cylindrical, or irregularly nodular, with rounded or flattened summit but no terminal depression; some elongate examples also branched or with transverse constrictions; skeletal surface formed by dense, external cortex pierced at summit by group of large, simple or marginated postica, and on sides by numerous smaller pores that are typically pustular; internal framework fibrous with an axial group of vertical aporhyses that extend to base, and with radiating fibers and fine, radial epirhyses in lateral parts but no radial aporhyses; no loose spicules known. *Upper Cretaceous–Neogene (Miocene):* Europe, *Upper Cretaceous;* Czech Republic, Slovakia, *Cenomanian;* France, *Santonian;* England, *Campanian;* Germany, Poland, *Turonian–Campanian;* Algeria, *Miocene.* ——FIG. 195,*1a–b. S. tumida* HINDE, Upper Chalk, Campanian, Flamborough, England; *a,* large, club-shaped example with transverse constrictions and numerous pustular, inhalant pores in dense, dermal layer, ×0.5; *b,* summit of another specimen from above showing large, marginated postica, ×1 (Hinde, 1884a).

Family SELISCOTHONIDAE Schrammen, 1924

[Seliscothonidae SCHRAMMEN, 1924a, p. 81]

Hollow, cylindrical, funnel- to mushroomlike or flabellate sponges with fibrous, skeletal frameworks, in which radially spreading, longitudinal, skeletal fibers are conspicuous; skeletal canalization typically either absent or restricted to development of ostia or postica; some also with vertical aporhyses in axial parts only; longitudinal fibers arranged without special order, or so as to form more or less regular, radial lamellae;

skeletal surfaces may expose internal structure or be formed by skeletal cortex in which desmas are similar to those of interior or smaller and more finely branched; supplemental oxeas may occur within internal meshes, at surfaces, or enclosed within longitudinal fibers; microscleres unknown. [Living "*Seliscothon*" *chonelloides* DOEDERLEIN is not referred to this family because longitudinal skeletal fibers appear to be absent.] *Cretaceous (Aptian)–Holocene.*

Seliscothon ZITTEL, 1878a, p. 117 [**Spongia plana* PHILLIPS, 1835 in 1828–1836, p. 177; SD DE LAUBENFELS, 1955, p. 45] [=*Trachydictya* POMEL, 1872, p. 107, *nom. oblit.*]. Usually funnel- or mushroomlike, but may be hollow cylindrical or flabellate; interior of skeletal framework with radial lamellae or not, or with more or less regular lamellae in parts but not others; external (lower) surface of framework with thin, fibrous, skeletal cortex, in which branching and anastomosing fibers are aligned longitudinally, and may be finer than those of interior; this surface commonly striated longitudinally, striations corresponding with skeletal fibers, but in some with fibrous cortex coated by very thin, dense, external cortex, formed by small, finely branching, flattened desmas, and without skeletal pores; paragastral (upper) surface usually with more or less compact, skeletal cortex and closely spaced postica, but exposing internal structure if cortex is developed incompletely or absent; interior usually not canalized, but mushroomlike specimens may have central group of vertical aporhyses that extend into stalk; supplemental oxeas may occur in interfibrous meshes, at surfaces, or incorporated into longitudinal fibers; microscleres unknown. [Lamellar internal structure is often treated as extensively developed in this genus, but it occurs only locally or is absent in the type species *S. plana,* in which fine, longitudinal striation of the external surface does not represent internal structure.] *Cretaceous (Aptian)–Neogene (Miocene):* Spain, *Aptian;* Czech Republic, Slovakia, *Cenomanian;* France, *Cenomanian–Campanian;* Germany, Poland, *Santonian–Campanian;* England, *Santonian–Maastrichtian;* Spain, Algeria, *Miocene.*——FIG. 196,*2a–c.* **S. planum* (PHILLIPS); *a,* small example with funnel-like shape seen from above, Upper Chalk, ?Campanian, Flamborough, Yorkshire, England; *b,* same seen from side, inverted, Upper Chalk, ?Campanian, Flamborough, Yorkshire, England, ×1 (Hinde, 1884a); *c,* rhizoclone desmas and oxeas, Mukronatenkreide, Campanian, Misburg, Germany, ×20 (Schrammen, 1924a; courtesy of E. Schweizerbart'sche Verlagsbuchhandlung).

Histiodia POMEL, 1872, p. 144 [**H. undulata;* SD DE LAUBENFELS, 1955, p. 45] [=*Histodia* MORET, 1924, p. 16, *nom. null.*]. Only known from fragments but apparently flabellate, forming thin-walled, undulating plates; both surfaces of skeletal framework with fine, closely spaced, and more or less sinuous, longitudinal furrows, along which are regular series of skeletal pores; when complete, furrows roofed by thin, smooth, external cortex, pierced by skeletal pores corresponding with those of underlying framework, and with roofed furrows forming longitudinal, subcortical channels; interior fibrous but not lamellar; further details unknown. [The genus is regarded as being essentially identical with *Seliscothon* ZITTEL and MORET (1924, p. 16), but distinguished by characters of the skeletal surfaces.] *Neogene (Miocene):* Algeria.——FIG. 196,*3a–b.* **H. undulata; a,* fragment of skeletal framework, showing external furrows, Beni bou Mileuk, slightly reduced (Moret, 1924; courtesy of Société Géologique de France); *b,* skeletal surface as seen with cortex present (right) and absent (left), Djebel Djambeida, slightly enlarged (Pomel, 1872).

Kaliapsis BOWERBANK, 1869, p. 337 [**K. cidaris;* OD]. Sponges a thin coating, parasitic, spicules phyllotriaenes, rhizoclad desmas, and acanthostyles. *Holocene:* Indian and Pacific Oceans.——FIG. 196,*4a–b.* **K. cidaris,* South Seas; *a,* section normal to surface, showing vertical shift from fibers with canals at base, to those strongly branched at surface, ×150; *b,* associated small phyllotriaene, ×175 (Bowerbank, 1869).

?Laosciadia POMEL, 1872, p. 148 [**L. fungiformis;* OD]. Class uncertain; equated with *Seliscothon* ZITTEL by DE LAUBENFELS (1955, p. 45) but not MORET (1924, 1926b) or LAGNEAU-HÉRENGER (1962); type species resembles a *Seliscothon* from POMEL's description, but not figured; skeleton thought to be calcareous by POMEL; and no specimens known; belongs with order Pharetronida, class Calcarea, if the skeleton were calcareous. *Upper Cretaceous:* England.

Pachyselis SCHRAMMEN, 1924a, p. 93 [**Achilleum auriforme* F. A. ROEMER, 1840 in 1840–1841, p. 2; OD]. Flabellate, ear- or leaflike, or irregularly lobate to convolute; skeletal framework fibrous internally but not lamellar; one surface with fine, longitudinal striations or small, skeletal pores; the other coated by dense, external cortex with small, round pores; cortical meshwork formed from small, flattened, strongly branching desmas; loose oxeas may occur; microscleres unknown. [The type species was formerly known as *Chonella auriformis* (see ZITTEL, 1878a; SCHRAMMEN, 1910; MORET, 1926b) and regarded as nonfibrous by MORET; some specimens identified under this name by SCHRAMMEN also nonfibrous and clearly azoricids; but fibrous structure present in others and mentioned by ROEMER (1864, p. 51); the name *C. auriformis* hence thought herein to have been used for two different species.] *Cretaceous (Turonian–Campanian):* Germany.——FIG. 196,*1a–b.* **P. auriformis* (F. A. ROEMER); *a,* small example with surface meshwork poorly developed, showing fibrous structure of interior, Scaphiten-Planer, upper Turonian, Nettlingen, ×1 (Schrammen, 1910);

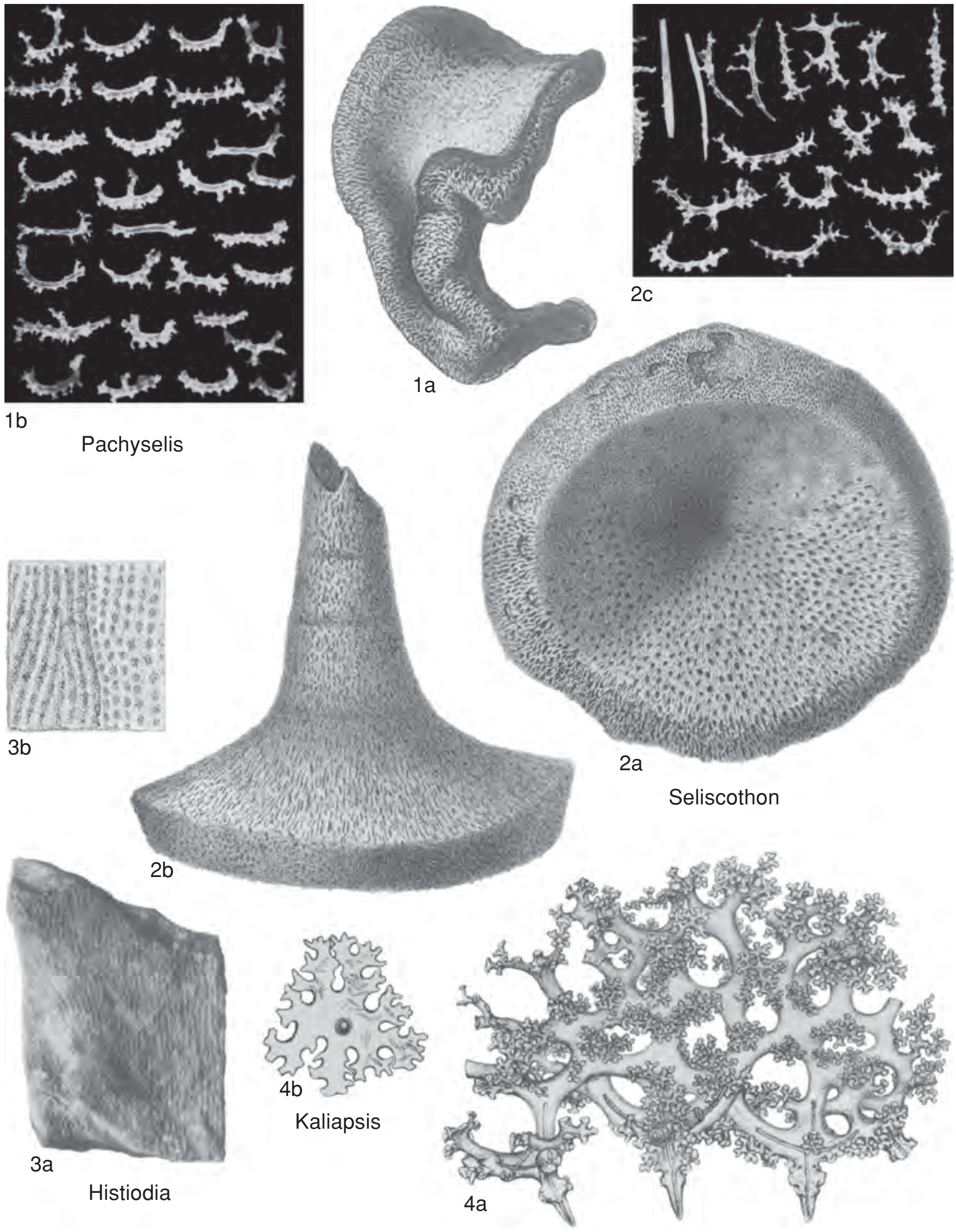

FIG. 196. Seliscothonidae (p. 312–313).

b, rhizoclone desmas of internal meshwork, Mukronatenkreide, Campanian, Misburg, Germany, ×20 (Schrammen, 1924a; courtesy of E. Schweizerbart'sche Verlagsbuchhandlung).

Phlyctia POMEL, 1872, p. 235 [**P. expansa;* SD DE LAUBENFELS, 1955, p. 47]. Initially funnel-like, becoming flabellate or expanding horizontally; skeletal framework fibrous but not lamellar, with longitudinal fibers spreading out toward both surfaces; external (or lower) surface with no cortex, exposing internal structure; paragastral surface similar or locally with round postica; no loose spicules known. *Neogene (Miocene):* Algeria.——FIG. 197,*1a–c.* **P. expansa,* Djebel Djambeida; *a,* dermal surface; *b,*

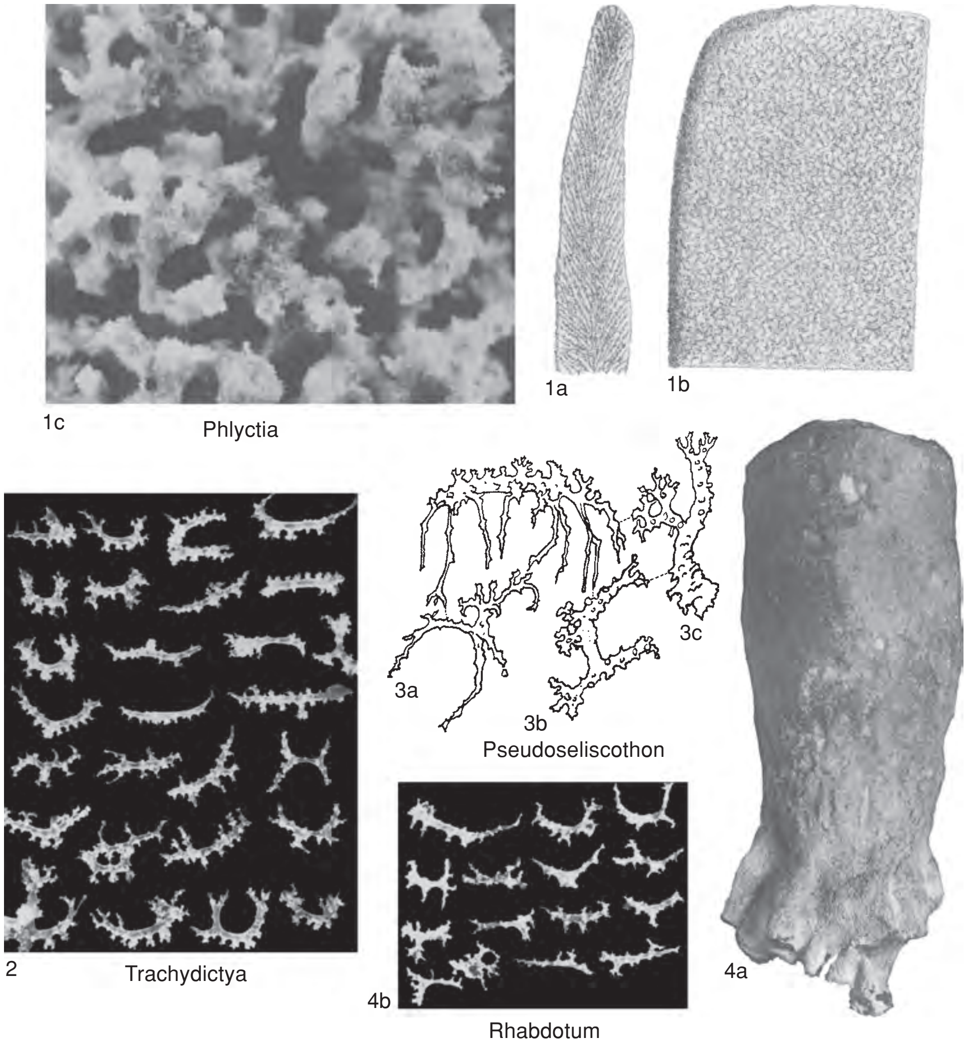

FIG. 197. Seliscothonidae (p. 313–315).

section through bladelike fragment showing divergent, skeletal structure, ×1 (Pomel, 1872); *c,* photomicrograph of skeletal surface, ×10 (Moret, 1924; courtesy of Société Géologique de France).

Pseudoseliscothon MORET, 1926b, p. 81 [**P. cazioti;* OD]. Hollow, cylindrical or trumpetlike, thick walled; external surface of skeletal framework formed by skeletal cortex with numerous minute, closely spaced, intracortical ostia; interior fibrous, but not lamellar; character of paragastral surface unknown; desmas large, some finely tuberculate, others with very long spines that give desmas spiderlike appearance; no other spicules known. *Cretaceous (Santonian):* France.——FIG. 197,*3a–c.* **P. cazioti,* Saint-Cyr; characteristic desmas including tuberculate desmas from internal fibers, cortical desma, and spiderlike desma from interior, ×25 (Moret, 1926b; courtesy of Société Géologique de France).

Rhabdotum SCHRAMMEN, 1924a, p. 95 [**R. columna;* OD]. Cylindrical or club shaped, short stalked, with deep, tubular, paragastral cavity; external surface of skeletal framework with fibrous structure, or coated locally by very thin, dense, external cortex with round ostia; distinct postica absent; external cortex formed from small, finely branching, flattened desmas; no other spicules known. *Cretaceous (Campanian):* Germany.——FIG. 197,*4a–b.* **R. columna,* Quadratenkreide, Höver; *a,* cylindrical sponge with lower root tufts, ×0.75; *b,*

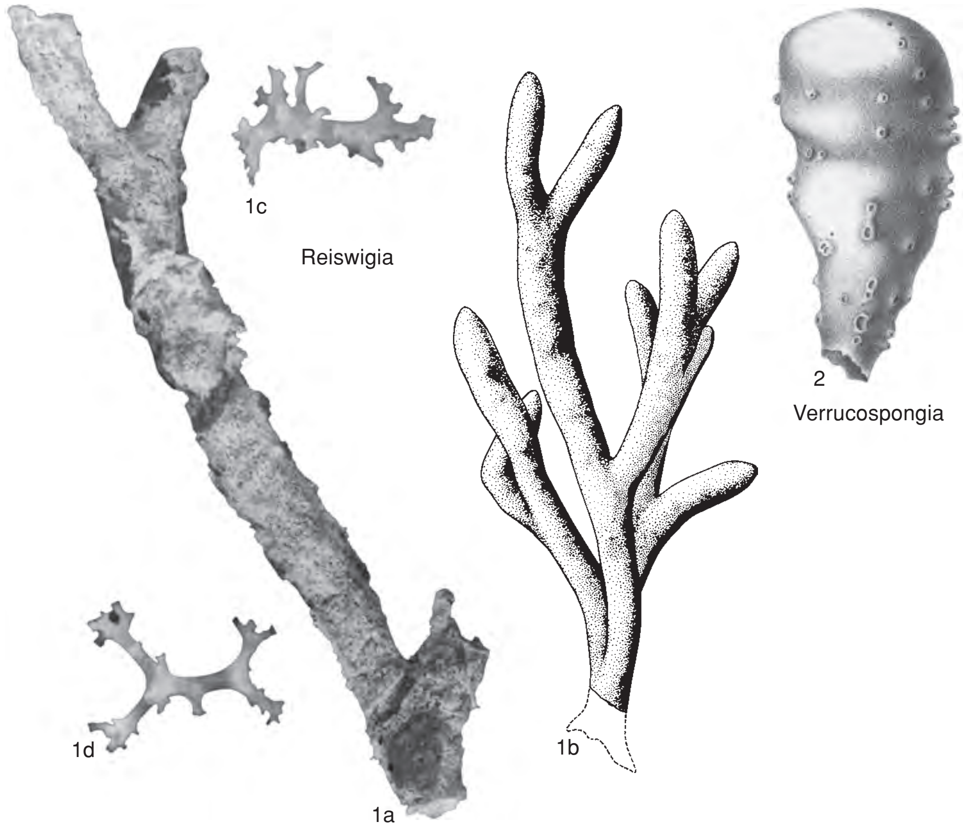

FIG. 198. Uncertain (p. 315–316).

rhizoclone desmas, ×20 (Schrammen, 1924a; courtesy of E. Schweizerbart'sche Verlagsbuchhandlung).

Trachydictya POMEL, 1872, p. 107 [**Scyphia mantelli* GOLDFUSS, 1831, p. 219; OD]. Based on a funnel-like species with finely lamellar structure and smaller postica than *S. plana,* but not otherwise distinctive. *Cretaceous (Campanian):* Germany.——FIG. 197,*2.* **T. mantelli* (GOLDFUSS), Mukronatenkreide, Misburg; desmas, ×20 (Schrammen, 1924a; courtesy of E. Schweizerbart'sche Verlagsbuchhandlung).

Family UNCERTAIN

Orecyta DE LAUBENFELS, 1955, p. 49, *nom. nov. pro Cytorea* POMEL, 1872, p. 225, *non* LAPORTE, 1849 [**Limnorea nobilis* ROEMER, 1864, p. 37; OD]. *Cretaceous:* Europe.

Perimera POMEL, 1872, p. 200 [**Polystoma boletiformis* COURTILLER, 1861, p. 127; OD]. *Cretaceous:* Europe.

Plococonia POMEL, 1872, p. 248 [**Spongia contortilobata* MICHELIN, 1847 in 1840–1847, p. 144; OD]. *Cretaceous:* Europe.

Pocillospongia COURTILLER, 1861, p. 125 [**P. pyriformis;* SD DE LAUBENFELS, 1955, p. 49] [=*Poecilospongia* POMEL, 1872, p. 117, *nom. null.*]. *Cretaceous:* Europe.

Reiswigia TRAMMER, 1979, p. 40 [**R. ramosa* TRAMMER, 1979, p. 41; OD]. Branching sponge without a spongocoel and distinct canal system but with small pores scattered over dermal surface; skeleton of rhizoclones covered with sharp-ended processes. *Jurassic (Oxfordian):* Poland.——FIG. 198,*1a–d.* **R. ramosa,* Lower Oxfordian deposits, Polish Jura Chain; *a,* holotype fragment, ×1; *b,* restoration showing branched habit, ×0.5; *c–d,* isolated rhizoclones, ×50 (Trammer, 1979).

Verrucospongia D'ORBIGNY, 1849, p. 549 [**Manon sparsum* REUSS, 1844, p. 170; SD DE LAUBENFELS, 1955, p. 49]. Subcylindrical or steeply to irregularly obconical sponge with rounder upper end; numerous variously sized, perforated, wartlike projections around possible inhalant ostia irregularly distributed over polymorphic dermal surface; dermal layer a thick web of anastomosing fibers. *Upper Cretaceous:* Europe.——FIG. 198,*2.* **V. sparsa* (REUSS), Lower Plänerkalk, near Bilin, Germany; side view

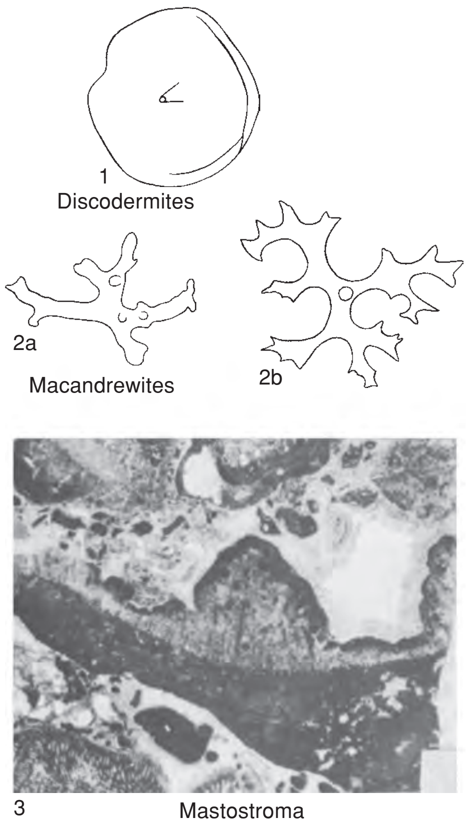

FIG. 199. Uncertain (p. 316).

of steeply obconical, slightly annulate sponge with wartlike projections around possible inhalant ostia irregularly distributed over dermal surface, ×1 (Reuss, 1845–1846).

Suborder UNCERTAIN

Bothrochlaenia POMEL, 1872, p. 72 [**B. pavonia;* OD]. *Upper Jurassic:* ?Europe.

Chlaenia POMEL, 1872, p. 72 [**Chenendopora complanata* D'ORBIGNY, 1850, vol. 1, p. 391; SD ENGESER & MEHL, 1993, p. 186] [=*Cymbochlaenia* POMEL, 1872, p. 72, obj.]. *Cretaceous:* Europe.

Cladilithosia POMEL, 1872, p. 252 [no species]. *Cretaceous:* Europe.

Cupulina COURTILLER, 1861, pl. 20, 39 [**C. pocillum;* SD DE LAUBENFELS, 1955, p. 65]. *Upper Cretaceous:* France.

Diacyparia POMEL, 1872, p. 90 [**Tragos rugosum* GOLDFUSS, 1829, p. 96 (*teste* SCHRAMMEN, 1937, p. 93); =*Chenendopora rugosa* D'ORBIGNY, 1850, vol. 1, p. 391, SD DE LAUBENFELS, 1955, p. 65]. *Cretaceous:* Europe.

Discodermites SOLLAS, 1880d, p. 386 [**D. cretaceus;* OD]. Isolated spicule with circular, discoidal head and conical shaft with smooth, cylindrical arms and botryoidal apophyses. *Cretaceous:* Europe.——FIG. 199,*1*. **D. cretaceus,* Trimmingham Chalk, Maastrichtian, Norfolk, England; isolated type spicule with discoidal head and conical shaft, scale unknown (Sollas, 1880d).

Elasmalimus POMEL, 1872, p. 203 [**Dimorpha prolifera* COURTILLER, 1861, p. 124; SD DE LAUBENFELS, 1955, p. 65] [=*Elasmolimus* DE LAUBENFELS, 1955, p. 65, *nom. null.*]. *Cretaceous:* Europe.

Hypothyra POMEL, 1872, p. 116 [**Scyphia trilobata* MICHELIN, 1847 in 1840–1847, p. 141; OD]. *Cretaceous*: Europe.

Ishadia POMEL, 1872, p. 210 [**I. typica;* OD]. *Paleogene–Neogene:* North Africa.

Macandrewites SOLLAS, 1880d, p. 389 [**Dactylocalycites vicaryi* CARTER, 1871, p. 123; OD]. *Cretaceous:* Europe.——FIG. 199,*2a–b*. **M. vicaryi* (CARTER), Trimmingham Chalk, Maastrichtian, Norfolk, England; type with tetraclone spicules (Sollas, 1880d).

Mastostroma WU, 1991, p. 93 [**M. punctiformis;* OD]. Sheetlike with mounds on upper surface, pierced by larger, horizontal tubes and smaller, vertical ones; lithistid skeleton of so-called knots and shafts where spherical knots formed by fusion of ray tips. *Permian (Guadalupian):* China.——FIG. 199,*3*. **M. punctiformis,* Reef of Xiangbo, Maokou Stage, Longlin, Guangxi; vertical section of holotype showing form with mounds and horizontal and vertical canals, IGC xb36-1-2, ×2 (Wu, 1991).

Ocellaria RAMOND DE CARBONNIÈRE, 1801, p. 177 [**O. nuda;* SD POMEL, 1872, p. 87]. [=*Ocellarioscyphia* FROMENTEL, 1860, p. 40 (intended but unjustified emendation of genus; subsequent designation of *Ventriculites radiatus* MANTELL, 1822, by DE LAUBENFELS (1955, p. 106) as the type species is therefore invalid).] *Upper Cretaceous:* Europe.

Orosphecion POMEL, 1872, p. 222 [**Manon pulvinarium* GOLDFUSS, 1826, p. 2; OD]. *Cretaceous:* Europe.

Ortmannispongia DE LAUBENFELS, 1955, p. 65, *nom. nov. pro Ortmannia* SCHRAMMEN, 1924a, p. 74, *non* RATHRUN, 1902 [**Ortmannia colligens* SCHRAMMEN, 1924a, p. 74; OD]. [DE LAUBENFELS (1955, p. 65) cited the genus as renamed by SCHRAMMEN (1936), but the reference where that change was made has not been found.] *Cretaceous:* Europe.

Pachypsechia POMEL, 1872, p. 154 [**P. subannulata;* OD]. *Jurassic:* North Africa.

Physocalpia POMEL, 1872, p. 117 [**Scyphia mamillata* COURTILLER, 1861, p. 122; OD]. *Cretaceous:* France.

Placojerea POMEL, 1872, p. 193 [**Jerea desnoyersii* MICHELIN, 1847 in 1840–1847, p. 135; OD]. *Cretaceous:* France.

Platispongia COURTILLER, 1861, p. 139 [**P. speculum;* SD DE LAUBENFELS, 1955, p. 65]. *Upper Cretaceous:* France.

Plethosiphonia POMEL, 1872, p. 127 [**P. oroides;* OD] [=*Pliobunia* POMEL, 1872, p. 206 (type, *P. oroides,* OD)]. *Paleogene–Neogene:* North Africa.

Podapsis SOLLAS, 1880d, p. 388 [**P. cretacea;* SD DE LAUBENFELS, 1955, p. 65]. Spicules relatively small but with curious, footlike shape of articular surface at end of unbranched rays. *Cretaceous:* Europe.

Polysiphoneudea FROMENTEL, 1860a, p. 30 [**Siphonia arbuscula* MICHELIN, 1847 in 1840–1847, p. 139; OD] [=*Polysiphonia* POMEL, 1872, p. 127, obj.]. *Upper Cretaceous:* Europe.

Polystomiella REID, herein, *nom. nov. pro Polystoma* COURTILLER, 1861, p. 126, *non* ZEDER, 1800, *nec* ZEDER, 1803, *nec* DE LAROCHE, 1811, *nec* KUHL & HASSELT, 1822, *nec* STEPHENS, 1835 [**Polystoma irregulare* COURTILLER, 1861, p. 126; OD] [?=*Perimera* POMEL, 1872, p. 200 (type, *Polystoma boletiformis* COURTILLER, 1861, p. 126, OD]. *Upper Cretaceous:* France.

Polythyra POMEL, 1872, p. 116 [**Scyphia perforata* COURTILLER, 1861, p. 121; OD]. *Cretaceous:* Europe.

Pterocalpia POMEL, 1872, p. 117 [**Scyphia alata* COURTILLER, 1861, p. 123; OD] [=*Petrocalpia* RAUFF, 1893, p. 68, *nom. null.*]. *Cretaceous:* Europe.

Rhizostele POMEL, 1872, p. 158 [**Rhizospongia clavata* COURTILLER, 1861, p. 119; OD]. *Cretaceous:* Europe.

Siphonocoelia FROMENTEL, 1860a, p. 31 [**Scyphia elegans* GOLDFUSS, 1826, p. 5; OD]. *Upper Jurassic (Oxfordian):* Europe.