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Systematic Descriptions of the Scleractinia
Family Rhizangiidae

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PART F, REVISED, VOLUME 2, CHAPTER 10: SYSTEMATIC DESCRIPTIONS OF THE SCLERACTINIA FAMILY RHIZANGIIDAE

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INTRODUCTION

The majority of the rhizangiid genera occurred during the Cenozoic, especially the interval Eocene to Pliocene. Only the genera *Astrangia* (*Coenangia*), *Arctangia*, *Astrangia*, and *Rhizangia* have been reported from Cretaceous strata. Species of these genera lived mainly during the late Cretaceous in central Europe, North America, and the Caribbean (BARON-SZABO, 2002, 2006, 2014). Post-Cretaceous forms have predominantly been described from the Eocene to Pliocene of Europe. This chapter gives an overview of the taxonomy, stratigraphy, and geography of the genera currently included in the family Rhizangiidae. The diagnosis of the family is followed by the description of its nominate genus, and then descriptions of the other genera in alphabetical order. Table 1 (p. 4) provides a synopsis of rhizangiid genera, including key characteristics and stratigraphic ranges.

Family RHIZANGIIDAE d'Orbigny, 1851

[Rhizangiidae D'ORBIGNY, 1851, p. 173] [=Astrangiidae VERRILL, 1870, p. 514]

Colonial or solitary, usually colonial, forming colonies mainly by extracalicular budding from stolon-like expansions from edge zone; corallites may or may not remain organically connected; extant forms azooxanthellate, mainly occurring in shallow water; colonies commonly consist of scattered corallites with no apparent connection, or united basally by vesicular or solid coenosteum, or

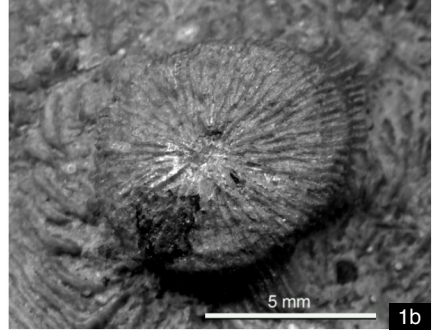
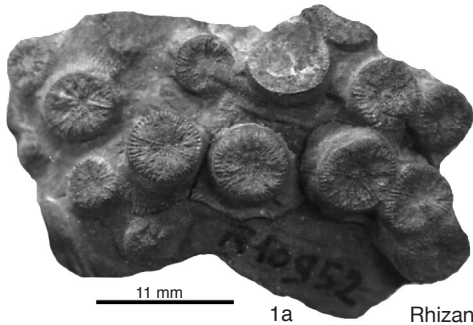
forming compact masses; septa composed of one fan system of simple or compound trabeculae, resulting in appearance of slightly dentate marginal and axial edges; irregular divergence of trabecular branching axes produces scattered lateral granulations; septal porosity absent or irregular, present mainly in septa of higher cycles; costae present, often reduced; stereome present or absent; paliform lobes (and ?pali) absent or present, possibly indistinguishably intermingled with columella; columella trabecular, variably shaped solid-trabecular (e.g., styliiform, sublamellar, made of a varying number of segments), or absent; corallite wall a complete or incomplete septotheca, septoparatheca, synapticulotheca, synapticuloparatheca, or epitheca (*sensu lato*); endothecal dissepiments thin; synapticalae absent or present (description adapted from VAUGHAN & WELLS, 1943, p. 175; WELLS, 1956, p. 408; and BARON-SZABO, 2006, p. 63; new). *Lower Cretaceous (Valanginian)–Holocene.*

Rhizangia MILNE EDWARDS & HAIME, 1848a, p. 496 [**Astrea brevissima* DESHAYES in LADOUCKETTE, 1834, p. 565, pl. 13, 13–14; M]. Colonial, tympanoid, reptoid; budding extracalicular; costosepta compact, strongly dentate laterally; denticles on lateral flanks of septa generally less than 100 µm in size; joining septa present; columella parietal-papillose and often fused into a single papilla; synapticalae present; endothecal dissepiments sparse or absent; wall synapticulothecal. [The original type specimen was lost; BARTA-CALMUS (1973, p. 521) selected a neotype, which is, however, invalid according to ICZN Article 75.3, 4th Edition. The species *R. aotearoa* SQUIRES, 1962, is grouped with the genus *Astrangia* below.] *Upper Cretaceous (Turonian)–Miocene.* Caribbean, eastern

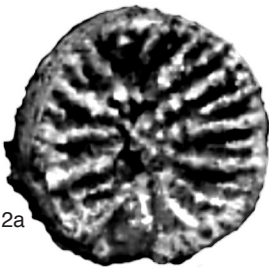
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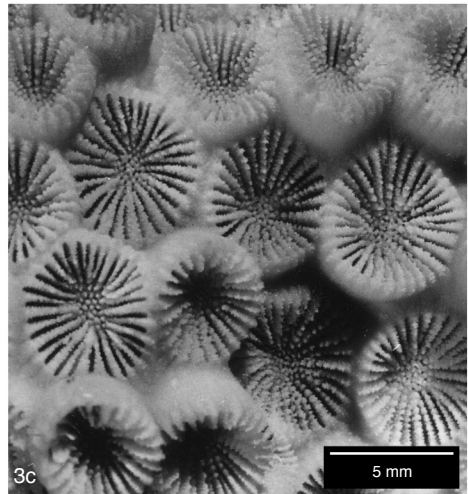
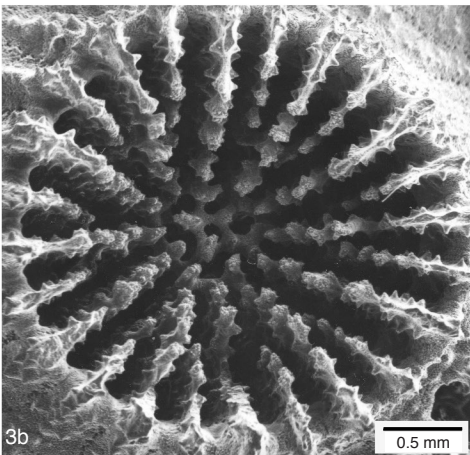
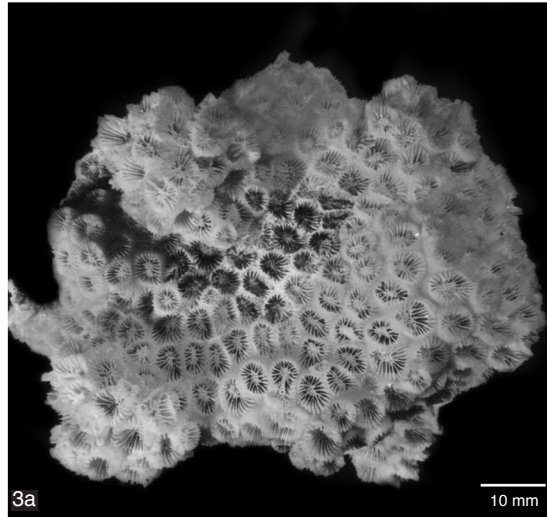
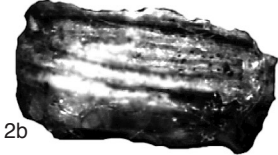
- Europe, western Europe, *Upper Cretaceous*; southern Europe, *Paleocene–Oligocene*; Southeast Asia, *Eocene*; Central America, *Eocene*; western Europe, *Eocene–Miocene*.—FIG. 1, 1*a*. **R. brevisima* (DESHAYES in LADOUCKETTE), MNHN R.10952, topotype, upper surface of colony, Eocene (Bartonian), France (Baron-Szabo, new).—FIG. 1, 1*b*. *R. sedgwicki* REUSS, 1854, ?syntype, NHMW 1864/0040/1414, upper surface of colony, Turonian–Campanian, Gosau Group, Austria (Baron-Szabo, 2014, pl. 33, 6).
- Arctangia** WELLS, 1937*b*, p. 247 [**Thecocyathus nathorsti* LINDSTRÖM, 1900, p. 9; OD; emend., BARON-SZABO, 2005, p. 481; ?syntype, NRM-PZ Cn 2]. Solitary, corallum turbinate to subturbinate, fixed by small base; costosepta compact to subcompact; septal perforations occur irregularly, lateral flanks of septa covered by rounded and spiniform granulae, rounded granulae 30–120 µm, spiniform granulae around 100 µm in height; endothecal dissepiments thin and vesicular, sparse; paliform structures irregularly present, mainly before S1–S3; wall septoparathecal and synapticuloparathecal; costae weakly developed, generally incorporated by thickened inner layers of epithecal stereome (mature epitheca, *sensu* RONIEWICZ & STOLARSKI, 1999); epitheca *sensu lato* multilamellar, wrinkled (corresponding to type, pattern C, *sensu* RONIEWICZ & STOLARSKI, 1999). [It is assumed that the type specimen for *A. nathorsti*, ?syntype NRM-PZ Cn 2, was collected by LINDSTRÖM (personal communication, CHRISTINA FRANZÉN-BENGTSON, 2004), but because confirming documents do not exist, it remains unclear when and by whom the specimen was collected. This specimen is the only available representative of this genus; for discussion see BARON-SZABO, 2005, p. 479–480.] *Lower Cretaceous (Valanginian–Hauterivian)*: northern Europe.—FIG. 1, 2*a–b*. **A. nathorsti* (LINDSTRÖM, 1900), ?syntype, NRM-PZ Cn 2, Svalbard, Spitzbergen, King Charles Land, Arctic, Norway; 2*a*, upper surface of corallum, cross view (Baron-Szabo, new); 2*b*, upper surface of corallum, lateral view (Baron-Szabo, 2005, p. 480, fig. 1H).
- Astrangia** MILNE EDWARDS & HAIME, 1848*a*, p. 496 [**A. michelini* MILNE EDWARDS & HAIME, 1848*b*, p. 320; SD; original type lost; =*A. poculata* ELLIS & SOLANDER, 1786, obj.] [= *Gombertangia* OPPENHEIM, 1899, p. 223 (type, *G. felixi*; M)]. Colonial, encrusting, ramose, with plocoid to subplocoid, or subfasciculate corallite integration; budding extracalicular from edge zone; corallites united basally by thin coenosteum; septa compact to subcompact, irregularly perforated; lateral flanks and axial ends of septa dentate; costae granular, often reduced; paliform lobes (and ?pali) present or absent; columella papillose; endothecal dissepiments thin; corallite wall paraseptothecal, incomplete. [The species *Rhizangia aotearoa* SQUIRES, 1962, from the Duntroonian–Waitakian (Oligocene) of New Zealand, differs from *Rhizangia* in forming an encrusting-plocoid to subfasciculate (not reptoid-tympanoid) corallum, but it corresponds to *Astrangia* cf. *A. expansa* VAUGHAN, 1900, and is, therefore, included here. For information and discussion regarding problems of some Upper Cretaceous material from North America, see BARON-SZABO, 2006, p. 64.] *Upper Cretaceous (Cenomanian)–Holocene*: Australasia, *Upper Cretaceous*; North America, *Upper Cretaceous–Pleistocene*; Central America, northern Europe, *Paleocene*; southern Europe, *Eocene–Oligocene*; Southeast Asia, *Eocene*; Australasia, South Asia, western Europe, *Oligocene*; sub-Saharan Africa, *middle Miocene*; Central America, Southeast Asia, *Pleistocene*; eastern Pacific Ocean, northeastern Atlantic Ocean, southwestern Pacific Ocean, western Atlantic Ocean (including off southern South America), southeastern Indian Ocean, 0–263 m depth, *Holocene*. FIG. 1, 3*a–c*. **A. poculata* (ELLIS & SOLANDER, 1786); 3*a*, neotype, USNM 80350, upper surface of colony, Atlantic Ocean (off Atlantic City), New Jersey, USA (Peters & others, 1988, p. 236, fig. 1); 3*b*, USNM 78507, close view of corallite, 27°19' N, 80°0' W, at 38–59 m depth, R/V Gerda station 1002, Florida, USA (Peters & others, 1988, p. 236, fig. 6); 3*c*, USNM 78509, upper surface of colony, Atlantic Ocean (off Jacksonville, at 15 m depth), Florida, USA (Peters & others, 1988, p. 236, fig. 3).
- A. (Coenangia)** VERRILL, 1870, p. 530 [**C. conferta* VERRILL, 1870, p. 530; SD VAUGHAN & WELLS, 1943, p. 177; lectotype YPM 4492 (DURHAM, 1947, p. 30, pl. 6, 1–2)]. Having skeletal features of *Astrangia*, but corallites in cerioid integration. [The type species is described by DURHAM and BARNARD, 1952, p. 77.] *Upper Cretaceous (Cenomanian)–Holocene*: North America, *Upper Cretaceous–Paleocene*; Central America, Southeast Asia, *Pleistocene*; Australasia, *Middle Pleistocene*; tropical northeastern Pacific Ocean (9–33 m depth), *Holocene*.—FIG. 2, 1*a–b*. **A. (C.) conferta*, topotype, USNM 83470, *Holocene*, Magdalena Bay, Baja California, Mexico, shallow water; 1*a*, upper surface of colony; 1*b*, close-up of 1*a* (Cairns, new).—FIG. 2, 1*c*. *A. (C.) lamarensis* WELLS, 1947, holotype, USNM 104171, upper surface, Cenomanian, Woodbine Formation, Lamar County, Red River, Texas, USA (Baron-Szabo, new).
- Bathangia** KEFERSTEIN, 1859, p. 375 [**Madreporites sessilis* SCHLOTHEIM, 1820, p. 356; OD; emend. BARON-SZABO, 2009, p. 394–397; holotype, MB.K.4397]. Solitary (tympanoid) and colonial (subdendroid to subfasciculate-subreptoid) coral; individual corallites can remain solitary up to diameter of 6.5 mm; budding extracalicular; corallites cup-shaped, embedded in thick, dense vesicular coenosteum in lower part of corallum; may possess short costae; endothecal dissepiments vesicular, thin, present throughout the whole corallum, but mainly found in peripheral areas of corallites; septa finely granulated laterally and dentate axially and marginally; ?pali or paliform lobes of multiple paliform teeth occur irregularly before some S2 and younger (higher) cycles; columella spongy or made of one or small number of solid-trabecular segments. *Eocene–*



Rhizangia



Arctangia

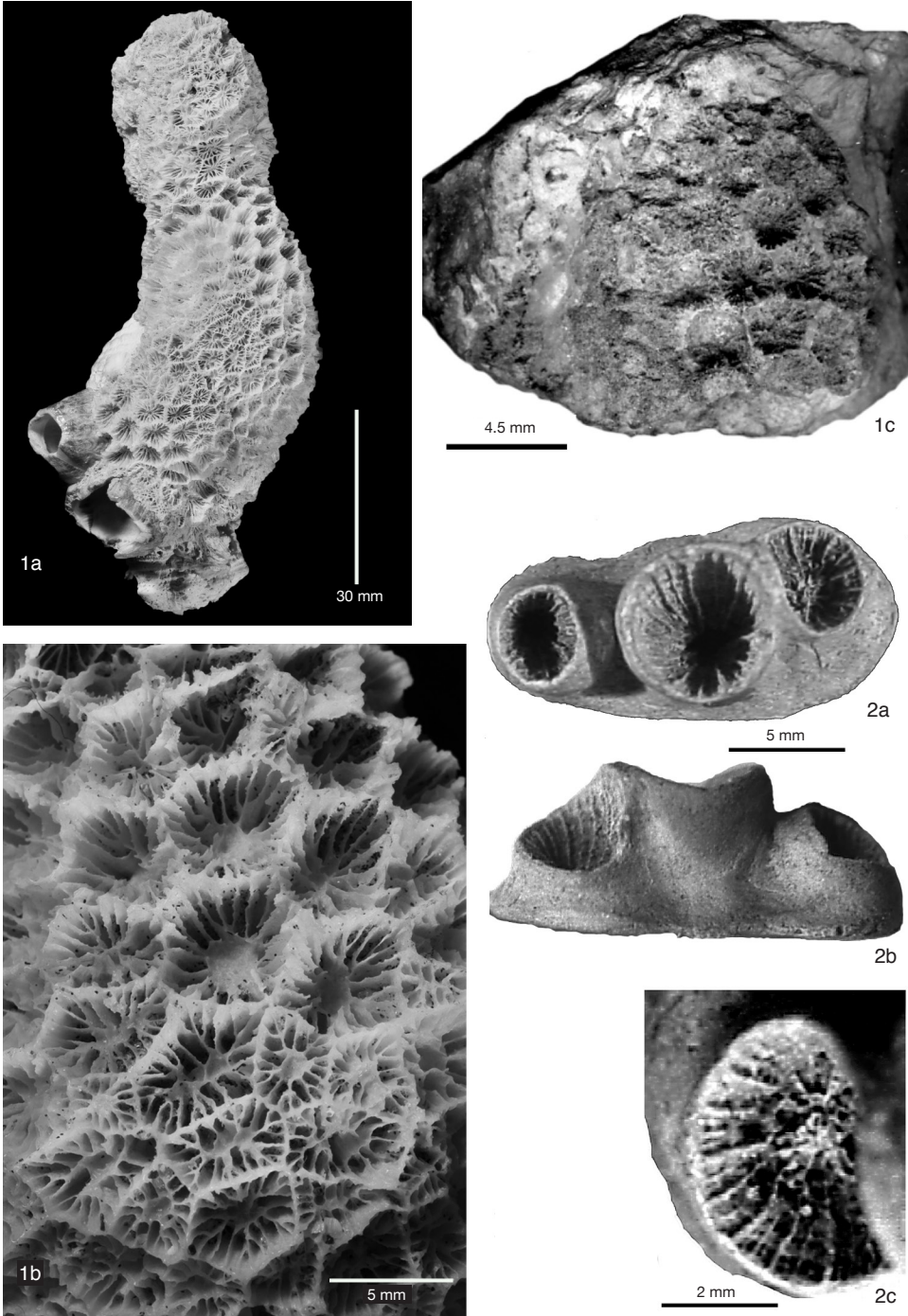


Astrangia

FIG. 1. Rhizangiidae (p. 1-2).

TABLE 1. Synopsis of rhizangiid genera, including key characteristics and stratigraphic ranges.

Rhizangiid genus	Key characteristics	Stratigraphic ranges	Remarks
<i>Rhizangia</i> Milne Edwards & Haime, 1848a p. 496 [* <i>Astrea brevissima</i> Deshayes in Ladoucette, 1834, p. 565, pl. 13, figs. 13, 14; M]	colonial; tympanoid, reptoid; compact costosepta; parietal-papillose columella often fused into a single papilla	Turonian–Miocene	together with <i>Astrangia</i> , this genus has the largest stratigraphic range of the rhizangiid genera
<i>Arcangia</i> Wells, 1937b, p. 247 [* <i>Thecocyathus nathorsti</i> Lindström, 1900, p. 9; SD]	solitary; turbinate; complex wall, including septoparatheca, synapticuloparatheca, and epithecal stereome	Valanginian–Hauterivian	this genus was recently re-described by Baron-Szabo (2005)
<i>Astrangia</i> Milne Edwards & Haime, 1848a, p. 496 [* <i>A. michelini</i> Milne Edwards & Haime, 1848b, p. 320; SD]	colonial; plocoid, subplocoid, ramose; wall paraseptothecal, incomplete	Cenomanian–Holocene	neotype described in Peters & others (1988), type material lost according to Chevalier (1966); contains the junior synonym <i>Gombertangia</i> Oppenheim, 1899; includes subgenus <i>Coenangia</i> Verrill, 1870 [* <i>C. conferta</i> Verrill, 1870, p. 530; SD]; Skeletal elements as in <i>Astrangia</i> but cerioid
<i>Bathangia</i> Keferstein, 1859, p. 375 [* <i>Madreporites sessilis</i> Schlotheim, 1820, p. 356; M]	colonial; dendroid to subfasciculate-subreptoid, paliform lobes or ?pali before 2nd cycle septa	Eocene–Oligocene	this genus was recently re-described by Baron-Szabo (2009)
<i>Cladangia</i> Milne Edwards & Haime, 1851, p. 119 [* <i>Astrea semispherica</i> DeFrance, 1826, p. 380; M]	colonial; massive or subramose, plocoid; columella papillose	Eocene–Pleistocene	similar to <i>Astrangia</i> but corallum often massive with plocoid polyp integration; contains subgenus <i>Reussangia</i> Wells, 1937a [* <i>Sylangia elegans</i> Reuss, 1874, Vol. 3, p. 11; OD; non de Fromentel, 1867]; Skeletal elements as in <i>Cladangia</i> but columella formed by a single nodule; information regarding lost original material provided by Chevalier (1962)
<i>Cryptangia</i> Milne Edwards & Haime, 1848a, p. 496 [* <i>C. woodii</i> Milne Edwards & Haime, 1848a, p. 496; M]	colonial; reptoid; solitary; trochoid to subcylindrical; paliform structures ?absent	Miocene–Pliocene	Chevalier (1962, 1970) gave additional information on the genus
<i>Culicia</i> Dana, 1846, p. 376, [* <i>C. stellata</i> Dana, 1846, p. 377; SD Wells 1936, p. 105]	colonial; reptoid, sometimes stoloniferous; very elaborately developed axial region of corallite, including lobate, dentate, and laciniate axial edges, and papillose columella; strongly epithecate	Oligocene–Holocene	contains the junior synonyms <i>Angia</i> Milne Edwards & Haime, 1848a, p. 496, and <i>Cyclia</i> Milne Edwards & Haime, 1851, p. 116; type species of <i>Culicia</i> well described by Cairns & Zibrowius (1997)
<i>Oulangia</i> Milne Edwards & Haime, 1848a, p. 497 [* <i>O. stokesi</i> Milne Edwards & Haime, 1848a, pl. 7, fig. 4; SD Milne Edwards & Haime, 1850, p. xlv]	solitary or reptoid; paliform lobes present; no endotheca	Miocene–Holocene	contains the junior synonym <i>Ulangia</i> Milne Edwards, 1857, p. 617; further information on the genus by Chevalier (1962) and Yabe & Eguchi (1932)
<i>Sclerangia</i> Baron-Szabo & Cairns, 2015, p. 2 [* <i>S. floridana</i> Baron-Szabo & Cairns, 2015, p. 2; OD]	colonial; encrusting, plocoid to subcerioid, corallites variably cylindrical to tympanoid; generally no endotheca	Miocene	colony always encrusts dead gastropod shells that are inhabited by sipunculids



Astrangia (Coenangia)

Bathangia

FIG. 2. Rhizangiidae (p. 2-6).

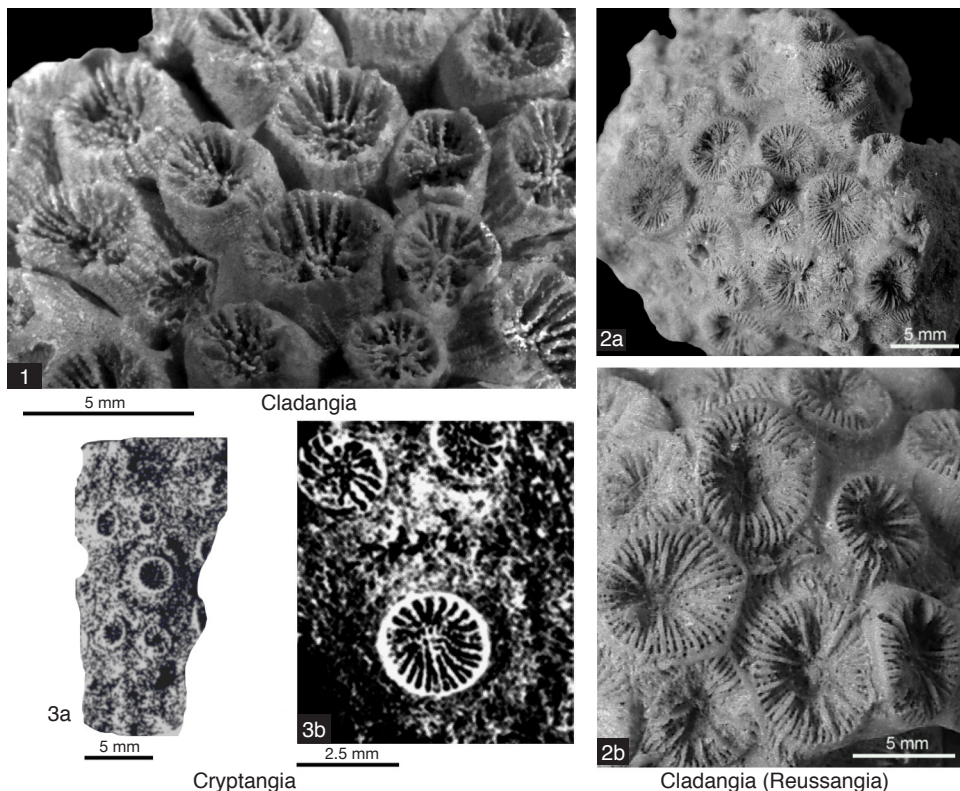


FIG. 3. Rhizangiidae (p. 6–7).

Oligocene: western Europe, *middle Eocene–lower Oligocene*.—FIG. 2, 2a–c. **B. sessilis* (SCHLOTHEIM, 1820), holotype, MB.K.4397, middle Eocene (Lutetian), Courtagnon, France; 2a, upper surface of colony, cross view (Baron-Szabo, 2009, fig. 1A); 2b, upper surface of colony, lateral view (Baron-Szabo, 2009, fig. 1F); 2c, upper surface of colony, cross view, close-up of 2a (Baron-Szabo, 2009, p. 395, fig. 1G).

Cladangia MILNE EDWARDS & HAIME, 1851, p. 119 [**Astraea semispherica* DEFANCE, 1826, p. 380; M (now lost)]. Colonial, massive or subramose, plocoid to fasciculate; budding extracalicular and intracalicular (for intracalicular budding, see CHEVALIER, 1970, p. 20–28, pl. 2, 1–2); corallites united basally by striate or spinose coenosteum; costosepta irregularly perforated, dentate laterally and marginally; costae generally weakly developed; columella generally papillose, irregularly spongy-papillose in some forms; intercalicular dissepiments thin; wall septothecal and septoparathecal; perithecal wall striate or spinose. *Eocene–Pleistocene*: southern Europe, *Eocene–Miocene*; western Europe, *Oligocene–Miocene*; Australasia, Central America, eastern Europe, North Africa, *Miocene*; sub-Saharan Africa, *Pleistocene*; Indian Ocean (exact locality unknown), southwestern Pacific, 20 m depth,

Holocene.—FIG. 3, 1, *C. conferta* (REUSS, 1847 [revised and expanded, REUSS, 1872, p. 247–248]), syntype, NHMW 1872/0012/0068, upper surface of colony, Miocene, Vienna Basin, Austrian–Czech Republic border region, collected at Bischofswart/Hlohovec, Mähren (Moravia), Czech Republic, (Baron-Szabo, new).

C. (Reussangia) WELLS, 1937a, p. 75 [**Stylangia elegans* REUSS, 1874, Vol. 3, p. 11, non DE FROMENTEL, 1867; OD; holotype, GBA 1874/003/0017]. Having the skeletal features of *Cladangia*, but columella made of a single, styliform-like nodule. *Eocene*: southern Europe, *middle Eocene*.—FIG. 3, 2a–b, *C. (R.) elegans* (REUSS, 1874), holotype, GBA 1874/003/0017, middle Eocene (Lutetian), San Giovanni Ilarione, Italy; 2a, upper surface of colony; 2b, close-up of 2a. (Baron-Szabo, new).

Cryptangia MILNE EDWARDS & HAIME, 1848a, p. 496 [**C. woodii*; M; lectotype, MNHN M01157]. Corallum reptoid (individual corallites have been reported as solitary, subcylindrical, subtrochoid, and trochoid, see WELLS, 1956, p. 408; KÜHN, 1965, p. 41); budding extracalicular from stolons; costosepta dentate distally and axially, lateral surfaces of septa granulate; endotheca weakly developed; costae short; wall septothecal and parathecal;

- epithelial *sensu lato* wall wrinkled; paliform structures ?absent; columella papillose. [According to MILNE EDWARDS & HAIME (1848a, p. 496), symbiosis with bryozoans is a characteristic feature of this genus. CHEVALIER (1962, p. 244) and KÜHN (1965, p. 41) disagree with this statement, referring to their own observations of specimens showing all skeletal features of *Cryptangia* but lacking connections with bryozoans. CHEVALIER (1962, p. 245) questioned that the material described by ZUFFARDI-COMERCI (1932) from the Miocene of Italy belonged to *Cryptangia*.] *Miocene–Pliocene*: western Europe, *Miocene–Pliocene*; southern Europe, *Miocene*.—FIG. 3, 3a–b. **C. woodii* MILNE EDWARDS & HAIME, 1848a, lectotype, MNHN M01157, Pliocene, Ramsholt, UK; 3a, upper surface of colony (adapted from Chevalier, 1962, pl. 11, 14); 3b, close-up of 3a (adapted from Chevalier, 1962, pl. 16, 5).
- Culicia** DANA, 1846, p. 376 [**C. stellata* DANA, 1846, p. 377, pl. 28, 5a–d; SD WELLS, 1936, p. 105; holotype USNM 185] [= *Angia* MILNE EDWARDS & HAIME, 1848a, p. 496 (type, *Dendrophyllia rubeola* QUOY & GAIMARD, 1833, p. 197, OD (now lost); = *Cylicia* MILNE EDWARDS & HAIME, 1851, p. 116, *nom. van.*]. Corallum reptoid; budding extracalicular from basal coenosteum, sometimes stoloniferous; corallites strongly epithecate; epitheca *sensu lato* extends beyond upper outer edges of septa as a continuous rim; axial edges of S1 lobate, inner edges of septa of remaining cycles dentate to lacinate; paliform lobes often present; columella papillose. *Oligocene–Holocene*: western Europe, *Oligocene–Pliocene*; southern Europe, *Miocene–Pliocene*; East Asia, Australasia, *Pleistocene–Holocene*; central, southeastern, and western Pacific Ocean, northwestern Indian Ocean (Red Sea), southeastern Indian Ocean (off Australia), southwestern Indian Ocean, warm temperate South Africa, 0–378 m depth. *Holocene*.—FIG. 4, 1a. **C. stellata* DANA, 1846, USNM 80029, upper surface of corallite, cross view, Holocene, 9°36.5'N, 123°55'E, Alpha Helix station 79 M140, Philippines, 14–20 m depth (Cairns & Zibrowius, 1997, p. 211, fig. 3a).—FIG. 4, 1b. *C. rubeola* (QUOY & GAIMARD, 1833), USNM 95000, Holocene, 44°36'S, 167°49.4'E, 30 m depth, NZOI station M793, New Zealand (Cairns, 1995, p. 171, fig. 5b).
- Oulangia** MILNE EDWARDS & HAIME, 1848a, p. 497 [**O. stokesiana* MILNE EDWARDS & HAIME, 1848b, p. 319, pl. 7, 4; SD MILNE EDWARDS & HAIME, 1850, p. xlv; holotype, NHMUK 1855.12.27.1] [= *Ulangia* MILNE EDWARDS, 1857, p. 617, *nom. van.*]. Corallum solitary or forming small reptoid colonies, corallites united by thin coenosteum; costosepta granulate laterally, especially in vicinity of the axial region; axial edges of septa finely dentate and possess small number of pores; pali absent, but paliform lobes present (CHEVALIER [1962, p. 243] reported the presence of elongate paliform lobes); columella papillose; wall septothecal, thin; endotheca and epitheca *sensu lato* absent. [See MILNE EDWARDS & HAIME, 1849, p. 183 for expanded type description.] *Miocene–Holocene*: southern Europe, western Europe, *Miocene*; East Asia, *Pleistocene*; Southeast Asia, central, eastern, and northwestern Pacific Ocean, southeastern Indian Ocean, 0–64 m depth, *Holocene*.—FIG. 4, 2a–b. **O. stokesiana* MILNE EDWARDS & HAIME, 1848b, WAM 152-83, Holocene, Black Rocks, Derby, King Sound, Western Australia; 2a, upper surface of corallite, oral view (Cairns, 1988, p. 373, fig. 1e); 2b, lateral view of corallum (Cairns, 1988, p. 373, fig. 1d).
- Sclerangia** BARON-SZABO & CAIRNS, 2015, p. 2 [**S. floridana*; OD; holotype, USNM I171263; five paratypes USNM I171258–I171262]. Corallum colonial, plocoid to subcerioid; budding extracalicular; colonies always encrust shells of dead gastropods that are inhabited by sipunculids; corallites cylindrical to subcylindrical or tympanoid; costosepta have spiniform and rounded granules laterally, developed as in *Arctangia*, *Astrangia*, and *Cladangia*; axial edges of all septa coarsely dentate; costae short or absent; columella spongy-papillose or formed by irregularly shaped trabecular segments; paliform structures irregularly present before all septa; endotheca generally absent or made of very small number of vesicular dissepiments; wall parathecal and septoparathecal. *Miocene*: USA (only known from Florida).—FIG. 4, 3. **S. floridana* BARON-SZABO & CAIRNS, 2015, holotype, USNM I171263, Chipola Formation, Calhoun County, Florida, USA (Baron-Szabo & Cairns, 2015, p. 2, fig. 1, 1).

ABBREVIATIONS FOR MUSEUM REPOSITORIES

- BMNH: The Natural History Museum, London, UK
 GBA: Geologische Bundesanstalt Vienna, Austria
 MB: Museum für Naturkunde, Berlin, Germany
 MNHN: Institut de Paléontologie du Muséum d'Histoire Naturelle de Paris, France
 NHMUK: Natural History Museum, London, UK
 NHMW: Naturhistorisches Museum, Vienna, Austria
 NRM: Naturhistoriska Riksmuseet, Stockholm, Sweden
 NMNH: National Museum of Natural History, Smithsonian Institution, Washington, DC (formerly USNM)
 USNM: now NMNH
 WAM: Western Australian Museum, Perth, Australia
 YPM: Yale Peabody Museum, New Haven, USA

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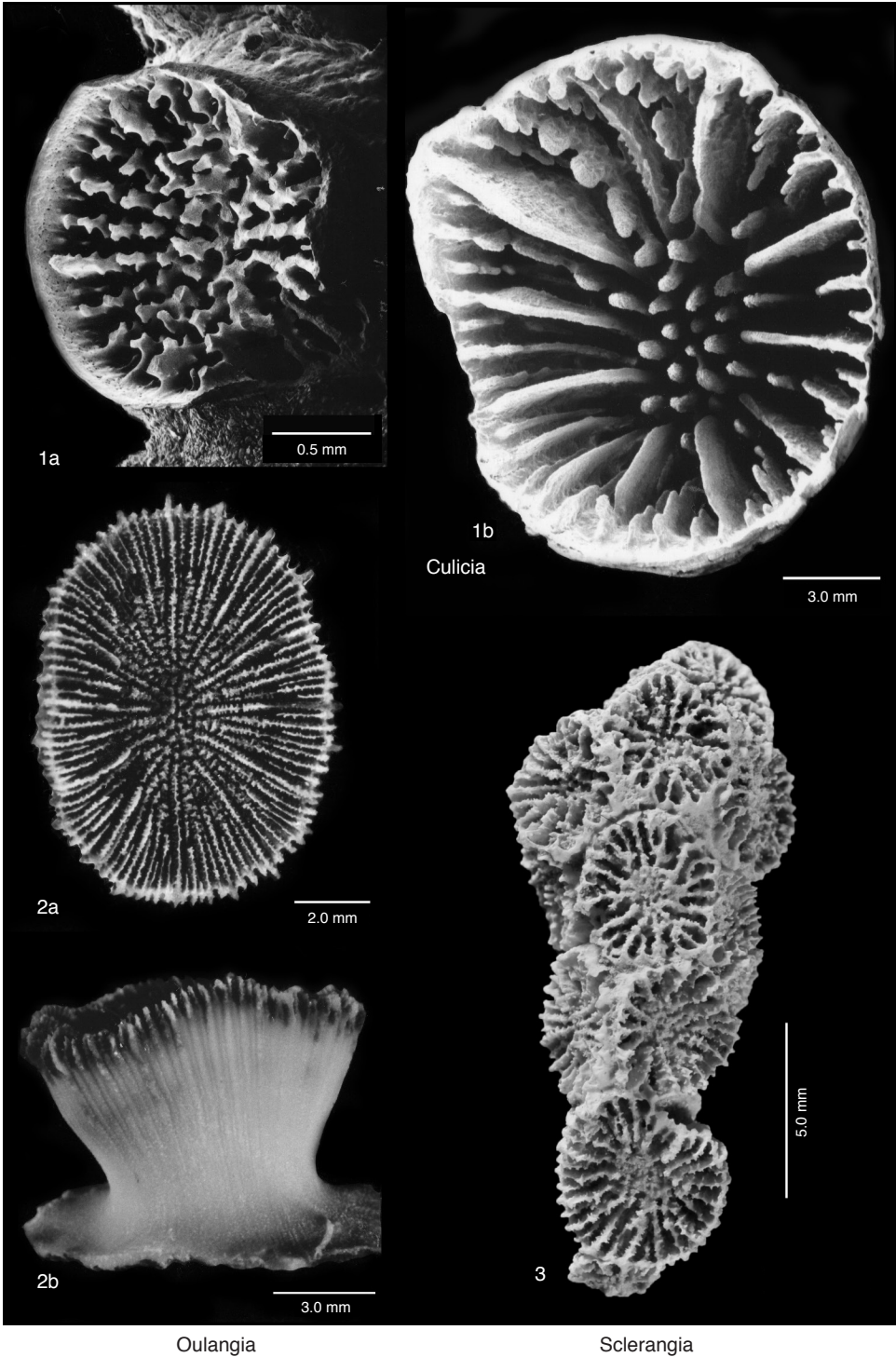


FIG. 4. Rhizangiidae (p. 7).

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