



Early Cenomanian coral faunas from Nea Nikopoli (Kozani, Greece; Cretaceous)

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Abstract: A Lower Cenomanian marine succession rich in corals is reported from the western margin of the Pelagonian zone in central Greece. The succession starts with a coarse conglomerate followed by sandstone, nodular limestone and massive limestone. Fifteen levels contain corals with the nodular limestone being the most species-rich. As a total, 78 species in 46 genera are described. They belong to 15 superfamilies. Three genera and four species are described as new. The new genera belong to the families Heterocoeniidae and Felixaraeidae, and the informal Plesiosmiliids. The record of six genera results in stratigraphical range extensions. The coral associations show more relationships to Lower than to Upper Cretaceous faunas. Thirty-nine genera already existed before the Cenomanian and 33 genera continued into the Middle Cenomanian, but only 19 genera persisted into the Turonian. The coral fauna has close palaeobiogeographic relationships with mainly Boreal or North Tethyan Cenomanian faunas such as those of the Aquitanian Basin, the Basque-Cantabrian Basin, or with faunas from the northern margin of the Rhenish Massif, but shares also species with the Upper Aptian to Lower Albian of the Bisbee Basin in North America and with faunas of the Lower to Middle Albian of the Northern Pyrenees.

Key-words:

- Corals;
- Greece;
- Cretaceous;
- Scleractinia;
- taxonomy;
- new taxa

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Résumé : *Faune corallienne d'âge Cénomanién inférieur de Nea Nikopoli (Kozani, Grèce ; Crétacé).*- Une série marine riche en coraux d'âge Cénomanién inférieur est signalée sur la marge occidentale de la zone pélagonienne en Grèce centrale. La série débute par un conglomérat grossier suivi d'un grès, d'un calcaire noduleux et d'un calcaire massif. Quinze niveaux renferment des coraux, le calcaire noduleux étant le plus riche en espèces. En tout 78 espèces réparties en 46 genres et 15 superfamilles sont décrites. Trois genres et quatre espèces sont nouveaux. Les nouveaux genres appartiennent à la famille des Heterocoeniidae et à celle des Felixaraeidae, ainsi qu'à celle informelle des Plésiosmiliidés. Les assemblages de coraux montrent plus de relations avec des faunes du Crétacé inférieur qu'avec celles du Crétacé supérieur. 39 genres existaient déjà avant le Cénomanién et 33 se sont prolongés dans le Cénomanién moyen, mais seulement 19 ont persisté jusque dans le Turonien. La faune corallienne montre des relations paléobiogéographiques étroites avec principalement des faunes du Cénomanién boréal ou nord-téthysien comme celles du Bassin d'Aquitaine, du Bassin Basco-Cantabrique, ou avec des faunes de la marge nord du Massif rhénan, mais elle partage aussi des espèces avec l'Aptien supérieur ou l'Albien inférieur du Bassin de Bisbee en Amérique du Nord ainsi qu'avec des faunes de l'Albien inférieur à moyen des Pyrénées septentrionales.

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**Mots-clefs :**

- Coraux ;
- Grèce ;
- Crétacé ;
- Scleractinia;
- taxinomie ;
- nouveaux taxons

Introduction

The Cretaceous section of Nea Nikopoli (40° 19'45"N, 21°44'15"E), about 5 km NW of Kozani, was first described by BRUNN (1956), under the former Turkish name Scafidi. BRUNN described the outcrop briefly, provided a preliminary columnar section, and listed various microfossils (mainly foraminifers, among them orbitolinids) and macrofossils (gastropods, bivalves and four coral species). Based on rudist bivalves and microfossils, he assigned the section to the Cenomanian and partly Turonian. KOLLMANN (1987) provided a comprehensive report on the gastropod fauna and restricted the age of the section to the early Late Cenomanian, based on rudists and nerineid gastropods, and reported corals of the genus *Cunnolites* (= *Cyclolites*). Both authors recognised corals only from the lower siliciclastic part of the section where solitary corals and the small circular colonies of *Aspidiscus* are abundant. However, corals are also abundant in the more calcareous part of the section, but weather out more easily in the lower, siliciclastic part, where they consequently appear to be more abundant and diverse. After a prospective visit in 1995, subsequent lithological and palaeontological studies during 1996 revealed a rich fauna not only of gastropods, but also of corals, rudists and other bivalves.

While Cenomanian bivalve faunas are relatively well known from the Tethys (PHILIP, 1978, 1998; MALCHUS, 1990; DHONDT & DIENI, 1992; STEUBER & LÖSER, 2000; BERNDT, 2004; AYOUB-HANNAA, 2011; AYOUB-HANNAA & FÜRSICH, 2011), Tethyan coral faunas of this age received only limited attention, in contrast to the Boreal Cenomanian coral faunas, which are much better known and have been recently revised (ELIÁŠOVÁ, 1992, 1994, 1996a, 1996b, 1997a, 1997b, 2004; LÖSER, 1989, 1994, 2014b, 2015a). The taxonomy of Tethyan Cenomanian corals is mostly outdated (COQUAND, 1862; FROMENTEL, 1862-1887; MONTANARO-GALLITELLI, 1937; SÖHLE, 1897; STOLICZKA, 1873), with only a few more recent revisions (TURNŠEK *et al.*, 1992; GAMEIL, 1997; LÖSER & MOHANTI, 2004; LÖSER *et al.*, 2013; Fig. 1). Other Tethyan faunas turned out to be older than originally assumed (PREVER, 1909; MARKOVIC & ANDJELKOVIC, 1953), possibly consist of a combi-

nation of corals from different ages (HACKEMESSER, 1936, 1937), or have been presented only cursorily (WILMSEN, 1996, 1997).

The fauna from Nea Nikopoli described here provides data from a hitherto less explored area. Although the relatively poor state of preservation of the corals from Nea Nikopoli considerably limits the taxonomic classification, the fauna presents numerous yet unknown taxa and improves our knowledge on the relationship between Boreal and Tethyan faunas.

Study area

The outcrop area in the West of Kozani (Fig. 2) belongs to the western margin of the Pelagonian tectonostratigraphic zone of the Hellenids. During the latest Jurassic and Early Cretaceous, the Maliakian nappes and the Eohellenic ophiolite complex were thrust over the mainly crystalline Pelagonian basement, forming an Eohellenian cordillera. This cordillera was subsequently uplifted and eroded during the Early Cretaceous. In the early Late Cretaceous the area was flooded by a shallow marine sea, resulting in the sedimentary deposits that are described in the present study. The depositional environment subsequently deepened, and the resulting basin was then filled with Upper Cretaceous calcareous and Paleogene flysch-type deposits (JACOBSHAGEN, 1985).

Sections studied

The sections studied were all measured at a hill to the West of the village of Nea Nikopoli (Fig. 3). Because of vegetation cover and faulting, it was not possible to measure one complete section. Four sections were recorded, three at the eastern slope and one at the south-eastern slope of the hill (Fig. 3). Section A is the oldest part, located on the eastern slope of the hill. Section B, also located on the eastern flank, is a very short section but can be correlated with section A (Fig. 4). Section C on the south-eastern slope is stratigraphically higher than section A, but cannot be correlated with it. The youngest part of section A may partly correspond to the lower part of section C. Section D at the eastern slope is stratigraphically lower than section C (Fig. 5).

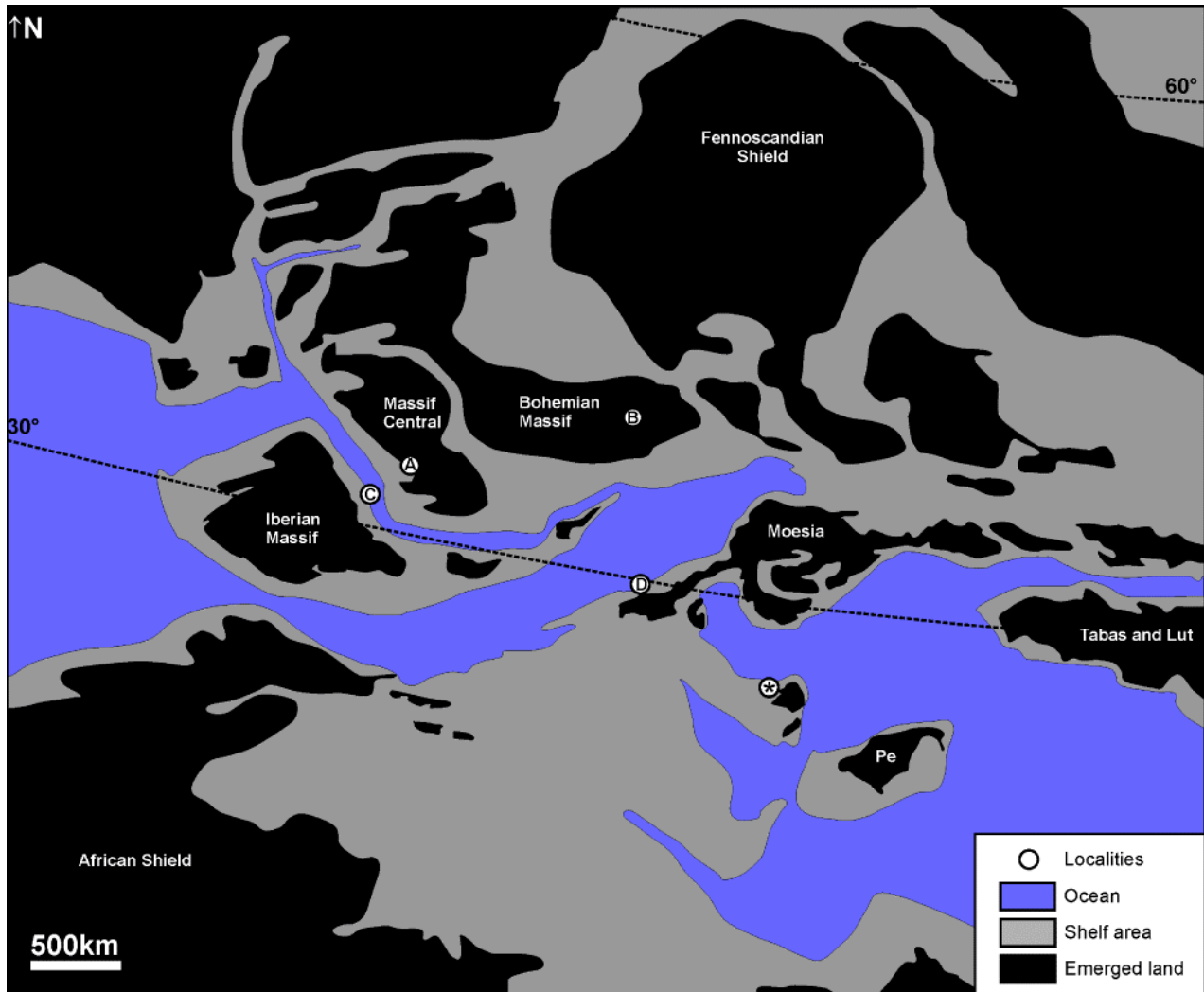


Figure 1: Palaeogeographic map of the western and central Tethys (100 ma, Late Albian, Base of the Dispar zone) with the study area and locations of important Cenomanian faunas. Tectonic units: Pe, Pelagonian. Localities (circles): *, study area, west Pelagonian zone; A, Aquitainian Basin, SW margin of the Massif Central (coral faunas in Charente-Maritime, France); B, Bohemian Massif (exposed before the late Middle Cenomanian; coral faunas in Bohemia, Czech Republic); C, Basque-Cantabrian Basin (coral faunas close to Santander, Cantabria, Spain); D, Austroalpine unit (coral fauna of the Roßsteinalm area W Kreuth in the Alps). Modified after LÖSER, WERNER & DARGA (2013). Map © Ron BLAKEY, NAU Geology (<http://cpgeosystems.com>).

The Cretaceous deposits transgressively follow above obducted ophiolitic rocks. The ophiolitic rocks themselves are not exposed, only three metres of coarse conglomerate with ophiolitic components of about 25 cm in diameter (A1) indicate the proximity of the basement. This unit does not contain any macrofossils. An unbedded silty sandstone (A2) follows, that contains gastropods (*Turritella choffati*, *Sogdianella syriaca*), bivalves, small solitary (Caryophylliidae indet., *Phyllosmilia*, *Plesiolites*) and colonial corals (*Aspidiscus*), orbitolinid foraminifers, and spines of regular echinids. Upwards follows a sandstone with nodular limestone beds (A3) with gastropods (*Turritella choffati*), solitary and colonial corals (*Aspidiscus*), and orbitolinid foraminifers. Two limestone beds (A4, A5) contain corals, bivalves (*Neithea*), gastropods, rudists (*Apricardia*, Capri-

nidae and Caprinulidae, Radiolitidae), and fragments of echinoids. Above a fine-grained conglomerate with components of ophiolite and limestone of 2-4 mm in diameter, showing spherical weathering (A6), follow numerous beds of a nodular limestone (A7-12) that all contain (mainly colonial) corals, gastropods (mainly Nerineidae), rudists (*Apricardia*, *Ichthyosarcolites*, Radiolitidae), and other bivalves, such as *Ilymatogyra africana* (LAMARCK, 1801), *Rhynchostreon* ? *suborbiculatum* (LAMARCK, 1801), *Rastellum carinatum* (LAMARCK, 1806), *Chondrodonta joannae* (CHOFFAT, 1886), *Neithea* (*Neithea*) *zitteli* (PIRONA, 1884), and *Spondylus* sp. This part of the section is not well exposed and numerous isolated records of macrofossils could not be assigned to any specific bed. The majority of the corals has been collected from beds A5-A12.

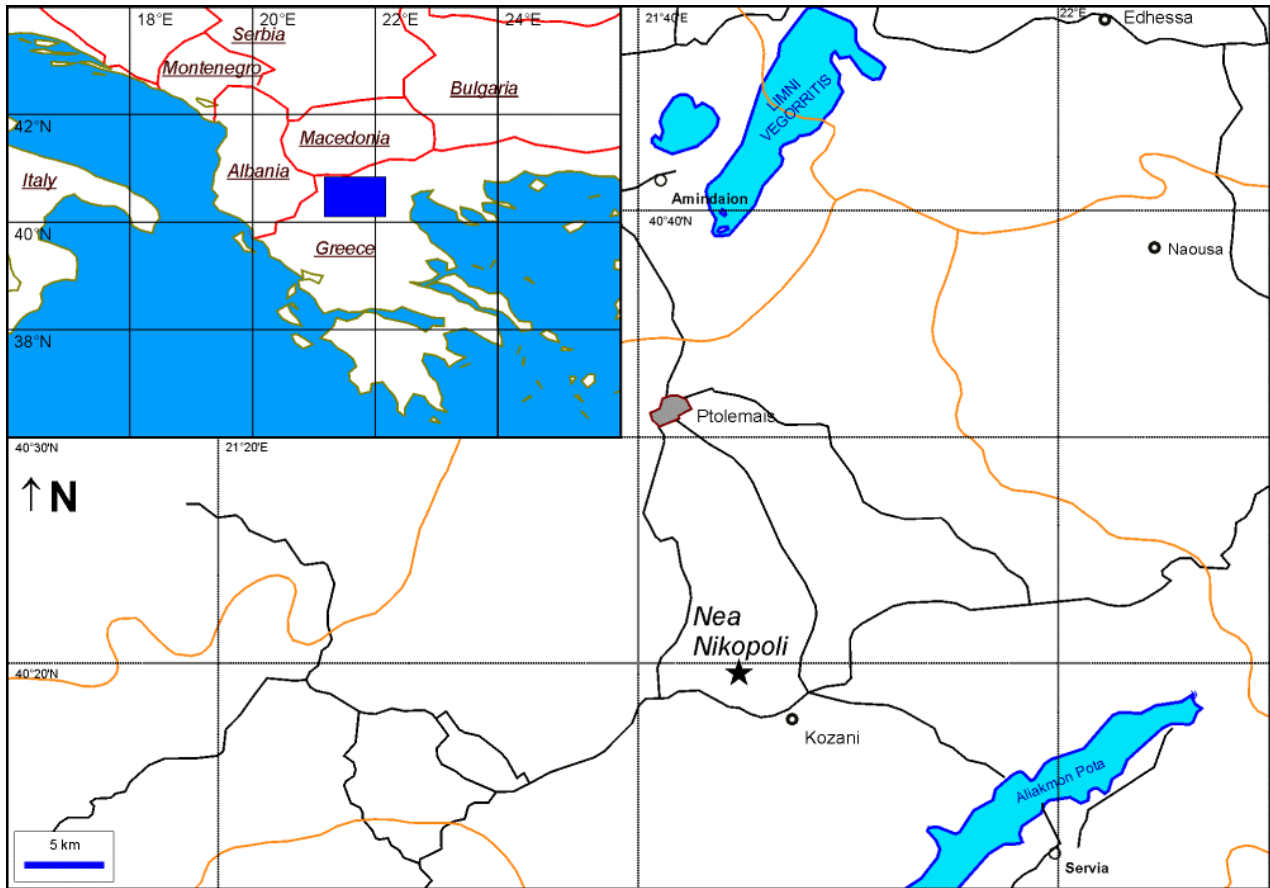


Figure 2: Location of the study area.

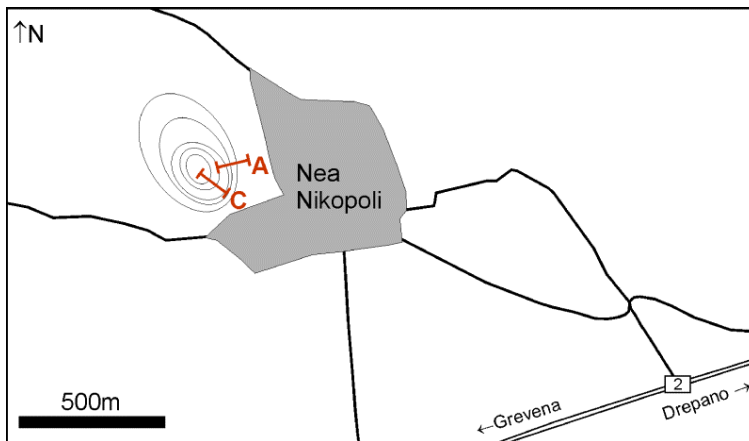


Figure 3: Outcrop situation with the locations of the sections.

Section B is located to the Southeast of section A, and consists only of one exposed bed of a coarse, immature sandstone with colonial corals (*Aspidiscus*, *Columastrea*, *Mixastrea*, *Pachygyra*), gastropods, rudists (very large Caprinidae, Radiolitidae) and other bivalves (*Neithea*).

The third section C is located on the south-eastern slope of the hill and encompasses mainly coral-rudist-limestones. The base of the section is not exposed and cannot be confidently correlated with section A. Fifty-two beds are distinguished. Beds C1 to C12 contain corals, gastropods (mainly Nerineidae), rudists, and orbitolinid forami-

fers. Non-rudist bivalves were not found. Bed C1 is a silty to sandy, impure limestone with solitary (*Aulastraeopora*, *Paramontlivaltia*) and colonial (*Brachycoenia*) corals and rudists (*Ichthyosarcollites*, Radiolitidae) in life position. Bed C2 is a coarse-grained limestone with orbitolinid foraminifers, and shell fragments. Bed C3 is a bioclastic limestone with complete rudists (*Ichthyosarcollites*, Radiolitidae) and colonial corals (*Hydnophoraraea*) which are not in life position. Bed C4 is a bioclastic limestone with rudists (small Caprinidae and Caprinulidae, Radiolitidae) and solitary (*Para-*

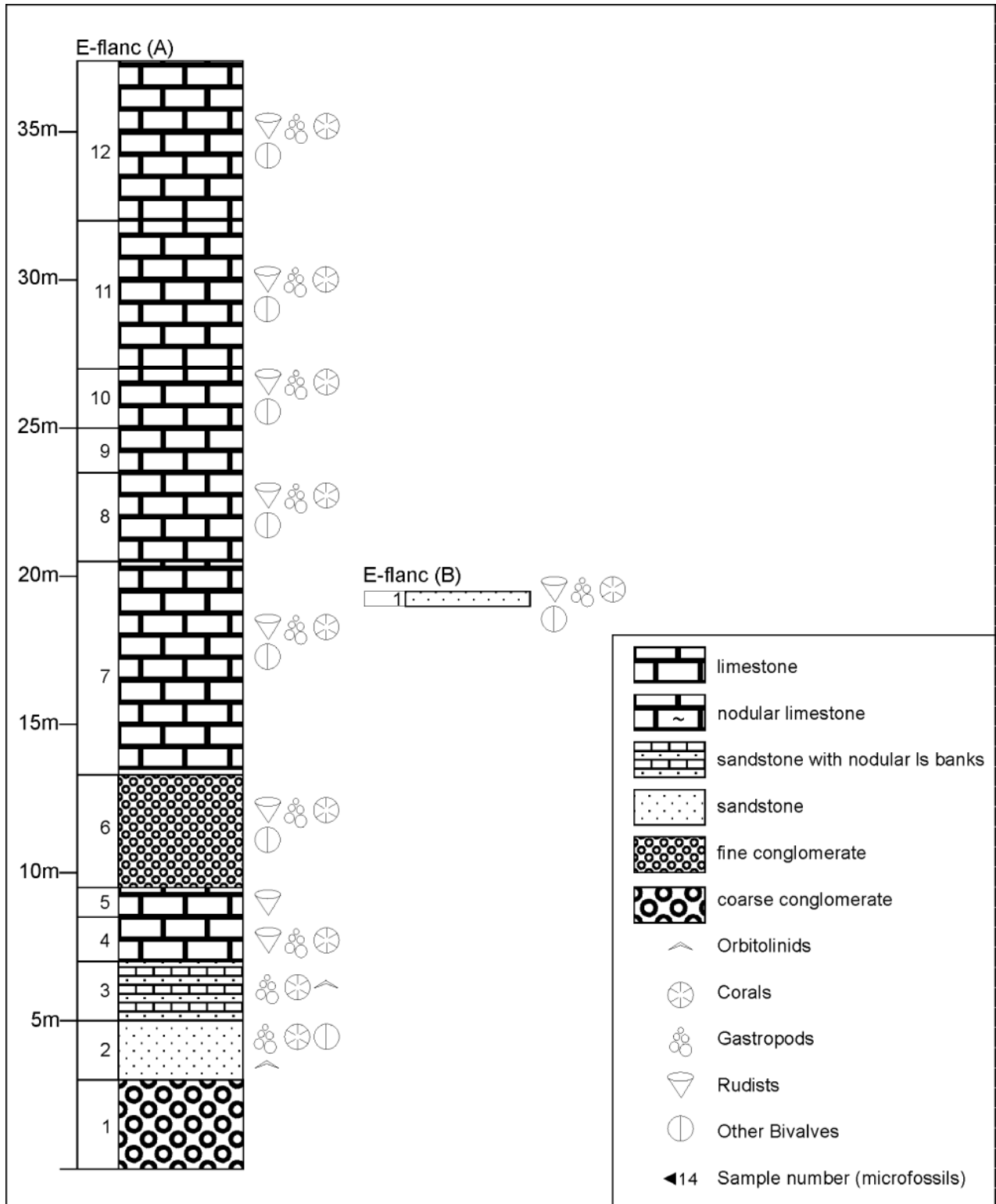
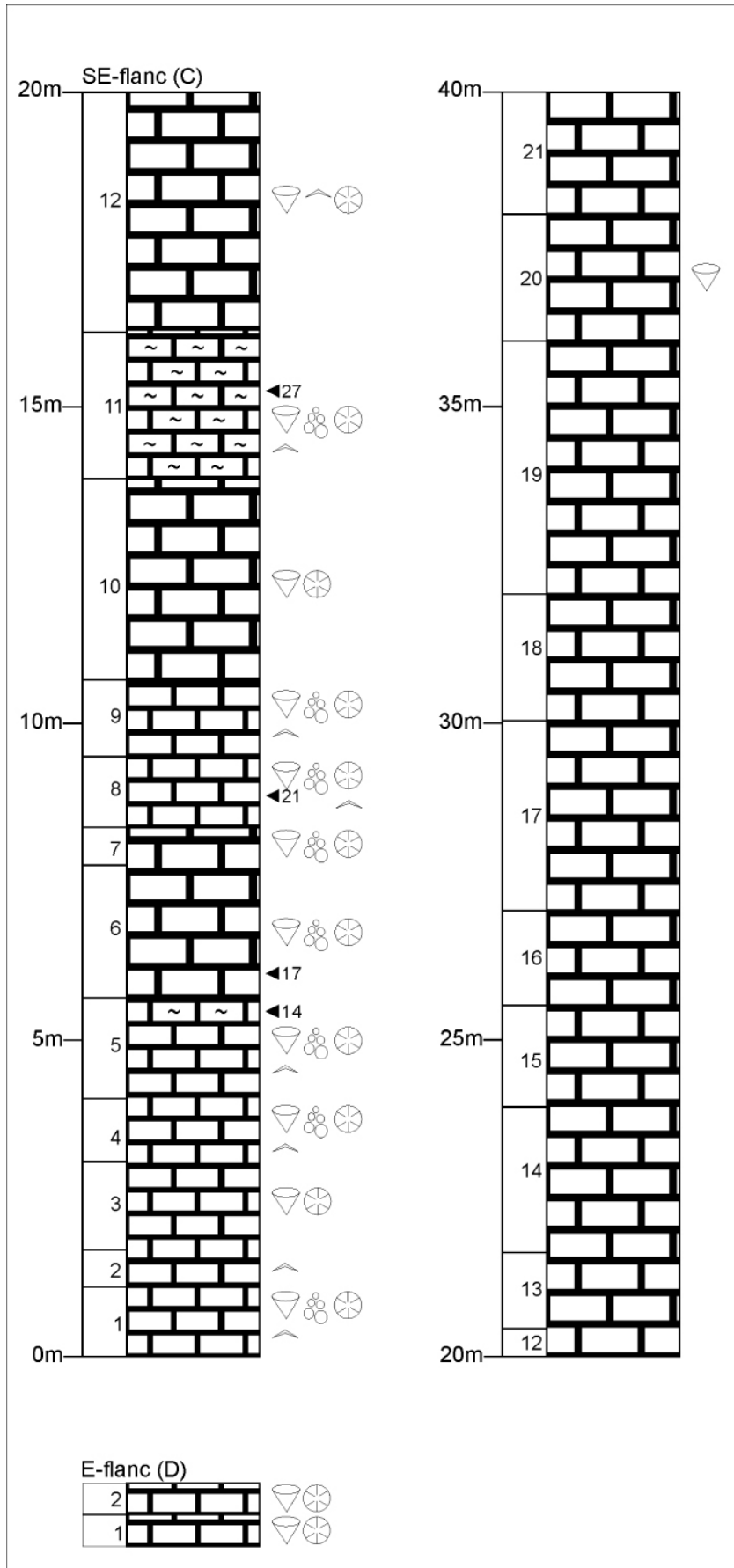


Figure 4: Sections A and B.

montlivaltia) and colonial corals (*Cryptocoenia*, *Hydnophoraraea*, *Latomeandra*, *Thalamocae-niopsis*) in live position. Bed C5 contains pre-dominantly solitary (*Aulosmilia*, *Tiarasmilia*) and colonial corals (*Cryptocoenia*, *Latomeandra*, *Mixastrea*, *Parnassomeandra*, *Polyastreopsis*, *Si-*

lingastraea), large gastropods (Nerineidae) and rare rudists (Caprinidae and Caprinulidae, Radiolitidae). Phaceloid coral colonies (*Latomeandra*) extend laterally up to 40 cm. Massive corals are comparatively large with up to 10 cm in diameter. Bed C6 is a coarse bioclastic lime-



◀ **Figure 5:** Sections C and D.

stone with large colonial corals (*Astraeofungia*, *Cryptocoenia*, *Hydnophoraraea*, *Parnassomeandra*; up to 15 cm in diameter) and rudists (Caprinidae and Caprinulidae, Radiolitidae). Bed C7 is a bioclastic limestone with large coral colonies (*Astraeofungia*, *Cryptocoenia*, *Hydnophoraraea*, *Latomeandra*), solitary corals (*Tiarasmilia*), and rudists (Caprinidae and Caprinulidae, Radiolitidae). Bed C8 has mainly gastropods, less colonial corals (*Apoplacophyllia*, *Hydnophoropsis*) and rudists (*Ichthyosarcolites*, Radiolitidae). Corals become less abundant above bed C8. In bed C9 rudists are dominating (Caprinidae and Caprinulidae, *Ichthyosarcolites*, Radiolitidae), colonial corals are rare (*Cryptocoenia*, *Parnassomeandra*). Bed C10 has the same composition of rudists, and corals (*Cryptocoenia*, *Polyastreopsis*) are rare. Bed C11 is a silty limestone with rudists (Caprinidae and Caprinulidae, *Ichthyosarcolites*, Radiolitidae) and few colonial corals (*Astraeofungia*, *Cryptocoenia*). Bed C12 is a coarse bioclastic limestone that contains only rudists (Caprinidae and Caprinulidae, Radiolitidae). Bed C13 to C21 mainly consists of coarse bioclastic limestone with very few macrofossils. Above bed C21, there are another 60 m of mainly fine-grained bioclastic limestone without macrofossils.

The very short section D is exposed about two metres below the first bed of section C and consists of two beds. Bed D1 is an impure limestone with colonial corals (*Columastrea*, *Eocomoseris*, *Helladastrea*) and rudists (Radiolitidae) in life position. Bed D2 is a sandy, impure limestone with colonial corals (*Aspidiscus*, *Polyastreopsis*) and rudists (*Ichthyosarcolites*, Radiolitidae), also in life position. The amount of siliclastics decreases upwards.

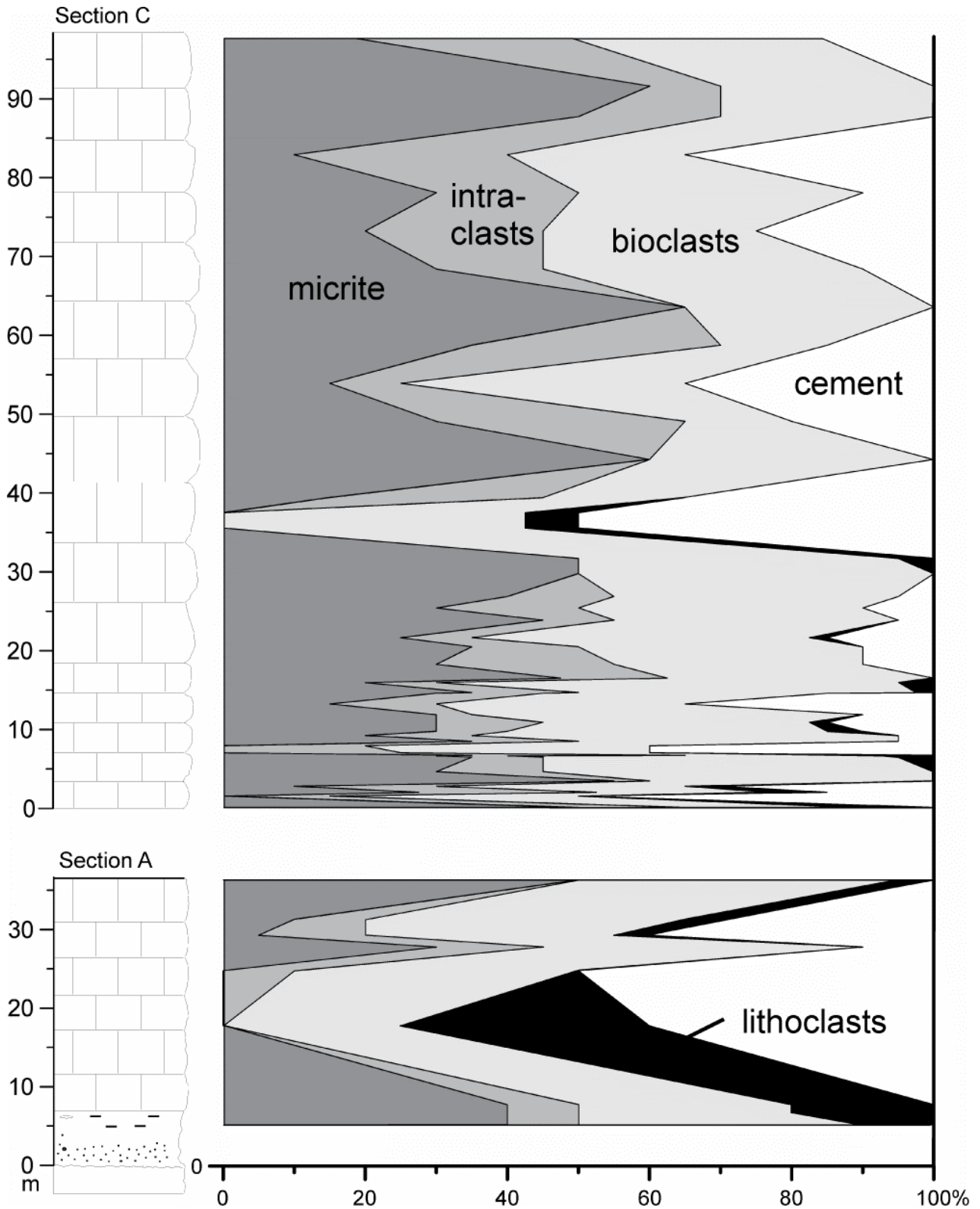


Figure 6: Lithology of sections A and C.

Stratigraphy

BRUNN (1956) reported on a Cenomanian age for the Nea Nikopoli section. KOLLMANN (1987) limited the age to early Late Cenomanian. The occurrence of the orbitolinid foraminifers *Conicor-*

bitolina corbarica (SCHROEDER & NEUMANN, 1985) in bed C5 (sample 14) would suggest a Late Albian to Early Cenomanian age, and *Conicorbitolina conica* (ARCHIAC, 1837) in bed C24 (sample 42) a Late Albian to Middle Cenomanian age.



The coral fauna exhibits only one relatively precise marker with *Aspidiscus cristatus*. The genus is generally restricted to the Cenomanian (LÖSER *et al.*, 2002), but there are some indications from the Albian. BATALLER (1949) reported *Aspidiscus cristatus* from Zufia (Spain, Navarra), and LÓPEZ-HORGUE *et al.* (1999) reported *Aspidiscus* sp. from a section of the same locality dated as middle Late Albian (Varicosum zone). Both records are without description and illustration. According to LÓPEZ-HORGUE (written communication, February 2016) the specimen mentioned in LÓPEZ-HORGUE *et al.* (1999) belongs to the genus *Helladastraea* that was for a long time considered synonymous with *Aspidiscus* (LÖSER, 2011b) but has a slightly longer stratigraphical range. Apart from this, only ABDEL-GAWAD and GAMEIL (1995) reported *Aspidiscus* sp. from the Manzour Mt. (Sinai, Egypt) with an early Middle Albian age (*Knemiceras spathi* zone).

The caprinid and caprinulid rudists *Caprina adversa* ORBIGNY, 1822, *Caprina baylei* (GEMMELLARO, 1865), *Orthoptychus striatus* FUTTERER, 1892, *Schiosia* sp., *Sphaerucaprina* sp., and *Caprinula boissyi* (ORBIGNY, 1842) support a Cenomanian age.

The non-rudist bivalves also clearly indicate a Cenomanian age. For *Chondrodonta joannae* (CHOFFAT, 1886), STENZEL (1971) indicates a Turonian age, AYOUB-HANNAA (2011) and AYOUB-HANNAA & FÜRSICH (2011) indicate both Late Cenomanian to Turonian while DHONDT & DIENI (1992) restrict this species to the Late Cenomanian. *Ilymatogyra africana* (LAMARCK, 1801) is a widespread species that occurred in the Cenomanian according to AYOUB-HANNAA (2011), BERNDT (2004), and MALCHUS (1990) while AYOUB-HANNAA and FÜRSICH (2011) quote a range from Upper Cenomanian to Lower Turonian. *Neithea (Neithea) zitteli* (PIRONA, 1884) is indicated in the Cenomanian and Turonian (DHONDT, 1973). *Rhynchostreon suborbiculatum* (LAMARCK, 1801) has its first occurrence in the Cenomanian (AYOUB-HANNAA, 2011) and may range into the Coniacian (SEELING & BENGTON, 1999).

Nerineid gastropods reported by KOLLMANN (1987) indicate an Early Cenomanian age. The species *Multioptyxis olisiponensis* (SHARPE, 1850), *Plesioplocus grandis* PCHELINTSEV, 1953, and *Haploptyxis requieni* (ORBIGNY, 1842) have their first occurrence in the Cenomanian (*Haploptyxis requieni* is a senior synonym of *Italoptygmatis geinitzi* GOLDFUSS, 1841; see KOLLMANN *et al.*, 1998). The genus *Trochactaeon* (family Acteonellidae) does not occur in the Albian (H. KOLLMANN, written communication, March 2016).

The Nerineids and non-rudist bivalves come mainly from section A in the lower part of the composite section, while the orbitolinid foraminifers occur in higher levels, particularly *C. conica*. An Early Cenomanian age is therefore most probable for the fossil-bearing part of the section (sections A, B, C1-12, and D). For the highest part of section C, a Middle Cenomanian age is possible.

Lithology

Limestones at the base of section A contain up to 30% lithoclasts derived from the erosion of the Eohellenic basement (Fig. 6). In section C, lithoclasts decrease in abundance upsection, and are not recorded above 40 m. Except for an interval of bioclastic grainstone at 36 m of section C, the calcareous deposits are dominated by packstone and floatstone with abundant bioclasts (fragments of rudists and other bivalves, echinoids, ostracods, *Bacinella-Lithocodium*, orbitolinids and other benthic foraminifers) without any trend in modal composition or abundance of certain types of bioclasts. Orbitolinids occur throughout section C. The depositional environment is interpreted as a shallow subtidal, low-energy carbonate ramp.

Coral occurrence

Corals easily weather out from all of section A, but because the section is partly covered, the corals can only rarely be assigned to a specific bed. In contrast, in section C, corals could be sampled bed by bed, but it was not possible to obtain high amounts as from section A because of the higher sampling effort required.

Material and methods

Material

All material was collected during fieldwork in 1995 and 1996. Most material was obtained from section A (Table 1) because it could easily be collected. The number of specimens that could be collected from higher parts of the section was limited by the difficulty of obtaining corals from the hard limestone. The total collection consisted of approximately 300 specimens, of which 160 could be assigned to a species. Most corals are available as isolated specimens, with almost no preserved surfaces and ornamentation of the septal upper margins. Colonial corals dominate with considerable sizes; the largest colonies reach up to 150 mm in diameter. Corals are mainly strongly recrystallized, and fine skeletal structures (microstructures) are barely preserved. The material is kept at the Bavarian State Collection of Palaeontology and Geology (Munich, Germany) under the signature 2003 XX.



Table 1: Distribution of the coral species among the various beds.

	A	A2	A4	A5-12	B	C	C1	C4	C5	C6	C7	C8	C9	D1	D2
Acrosmilium eturbensis			•	•											
Apoplacophyllia sp.												•			
Aspidiscus cristatus				•	•										•
Astraeofungia cf. barcenai									•						
Aulastraeopora harrisi							•								
Aulastraeopora schnauzeae	•														
Aulosmilium sp.				•					•						
Brachycoenia sp.							•								
Canleria clemens				•											
Canleria sp. 1				•											
Canleria sp. 2				•											
Caryophylliidae sp. indet. 1		•													
Caryophylliidae sp. indet. 2				•											
Complexastrea sp.	•														
Confusaforma weyeri				•											
Cryptocoenia cf. biedai				•						•					
Cryptocoenia corbariensis				•											
Cryptocoenia jacobi				•											
Cryptocoenia cf. miyakoensis											•			•	
Cryptocoenia sp.				•					•				•		
Diplocteniopsis sp.				•											
Elasmophyllia sp.				•											
Eocolumastrea gortanii				•	•										•
Eocolumastrea rosae				•											
Eocomoseris sp.															•
Eosiderastrea grandipora				•											
Eosiderastrea paragrandidipora				•											
Eosiderastrea stefani				•											
Eosiderastrea sp. 1				•											
Eosiderastrea sp. 2				•											
Felixigyra sp.				•											
Haplaraea gracilis				•											
Heliopora radiata				•											
Helladastrea sp.				•											•
Heterocoenia distans				•											
Hydnophoraea styriaca				•											
Hydnophoropsis sp. 1				•											
Hydnophoropsis sp. 2													•		
Kozaniastrea pachysepta				•											
Latomeandra ? plicata								•	•						
Microsolena ? interjecta				•											
Mixastraea westfalica						•									
Mixastrea aff. danubica				•	•										
Negoporites spissus				•											
Pachygyra sp.					•										



For each type of measurement (calicular diameter and distance, width and distance of calicular row), in one thin section, the following values were obtained:

n	number of measurements
min-max	lowest and highest measured values
μ	arithmetic mean (average)
s	standard deviation
v	coefficient of variation according to K. PEARSON
$\mu \pm s$	first interval

Thin sections were measured and values were calculated using the Palaeontological Database System PaleoTax, module PaleoTax/Measure (<http://www.paleotax.de/measure>); for details on the mathematical background, see LÖSER (2012). Characters visible on the fossils were compared against those on specimens in worldwide fossil coral collections, and an associated image database (ca. 25,400 specimens, ca. 12,500 illustrated, located in the Estación Regional de Noroeste (ERNO), Sonora, Mexico). Data storage and processing were carried out using the PaleoTax database program (LÖSER, 2004).

To compare the studied fauna with other coral faunas outside the study area, a computer database of about 2,700 worldwide coral localities with coral indications was used (LÖSER *et al.*, 2002, 2005). To simplify the analysis, localities of the same age, located in the same basin, on the same continental margin or the same interoceanic platform, were grouped together into one palaeo-province (a type of large faunule, sensu JOHNSON, 2007). Altogether, this produced 310 provinces. Only firmly dated localities were assigned to a province to ensure that the following analysis is valid, and the studied locality was not included in any existing province. For the study area, an independent province was created to allow a clear comparison between the existing provinces and the new material. Interregional comparisons were carried out between the new province and existing provinces having at least three species in common with the fauna of the studied area. For details, see also LÖSER (2008) and LÖSER & MINOR (2007).

Systematic palaeontology

The constantly growing number of genera and the improving examination methods in Mesozoic corals question traditional classification systems (VAUGHAN & WELLS, 1943; ALLOITEAU, 1952). The current classification system of the order Scleractinia is the application of suborders and families. The use of suborders is not practical for various reasons. Not all suborders are well-defined

and/or limited to a relatively small group of genera. Well defined are, as in, for instance, the suborders Amphistraeina, Heterocoeniina, or Rhipidogrina. Others, such as the Archeoceniina, Faviina, or the Meandrinina, are defined using a conceptual idea or are undefined. When suborders are applied strictly, many families would remain without a suborder. These families would require the creation of new suborders. To avoid too much confusion, a preliminary classification system introduced in LÖSER (2016c) does not apply suborders, but superfamilies that group families together. Practically, suborders are for the moment replaced by superfamilies. So 27 superfamilies with 56 families (or informal groups) are distinguished that have a range in the Cretaceous. In contrary to the former classification system based on suborders, the superfamilies may constitute monophyletic groups. The basic characteristics for the distinction of the superfamilies is the relative size of the trabeculae, in the ratio to the septa. Further distinction is made based on the presence or absence of synapticulae and the septal perforation. The former classification system using suborders and the new system can be compared (Fig. 7). Note that the suborders just reflect, where the families were formerly assigned. It would not be a good decision to apply these suborders to collect the newly introduced superfamilies because the superfamilies distinguish in the same way as suborders did before. The table is just to give the reader some orientation. More explanation is given under the superfamilies.

The distribution data (as reflected in the synonymy lists) are almost entirely based on well-examined material. Material only mentioned in the literature and material not available or insufficiently described and illustrated in the literature were not taken into account. To obtain better insight into the distribution patterns of the coral fauna of Greece, additional unpublished material - indicated by a collection acronym and sample number in parenthesis - has been included. Therefore, distribution data indicated under 'Other occurrences' are also provided for species remaining in open nomenclature.

The abbreviations used in the synonymy lists follow MATTHEWS (1973): *: earliest valid publication of the species name; ?: the assignment of this description to the species is doubtful (so marked quotations are not reflected in the stratigraphic and palaeobiogeographic distribution); p: the described material belongs only in part to the species concerned; v: the specimen was observed by the author. A year in italics indicates that the quotation is provided with neither a description nor an illustration.



Former suborder	Superfamily	Family	Former suborder	Superfamily	Family	
Amphiastraeina	Amphiastraeoidea	Amphiastraeidae	Fungiina	Agaricioidea	Agariciidae	
		Donacosmiliidae		Fungioidea	Asteroseriidae	
		Opisthophyllidae			Fungiidae	
Archeocaeniina	Acroporoidea	Acroporidae		Felixaraeoidea	Felixaraeidae	
	Actinastraeoidea	Actinastraeidae			Lamellofungiidae	
Astraeoidea	Misistelloidea	Misistellidae		Haplaraeoidea	Haplaraeidae	
		plesiosmiliids		holocoenioids	holocoeniids	
Astrocoeniina	Haimesastraeoidea	Haimesastraeidae		Meandrophyllioidea	Meandrophylliidae	
	Stylophoroidea	Stylophoridae		Micrabacioidea	Micrabaciidae	
Caryophylliina	Caryophyllioidea	Caryophyllidae		Thamnasterioidea	Cyclastraeidae	
		Turbinoliidae	Siderastraeidae			
Dendrophylliina	Dendrophyllioidea	Dendrophylliidae	Thamnasteriidae			
Faviina	Cladocoroidea	Cladocoridae	Heterocoeniina	Heterocoenioidae	Agatheliidae	
		Columastraeidae			Carolastraeidae	
		diplocoeniids			Heterocoeniidae	
		placophorids			Paronastraeidae	
	Eugyroidea	Cladophylliidae			triphylocoeniids	
		Eugyridae			Trochoidomeandriidae	
		Felixigyrids	Meandrinina	Ficariastraeoidea	Ficariastraeidae	
		Solenocoeniidae		Phyllosmilioidea	Phyllosmiliidae	
	Madreporoidea	Madreporidae	Microsolenina	Cyclolitoidea	Cyclolitidae	
	Montastraeoidea	Hemiporitidae			Leptophylliidae	
		Montastraeidae			Microsolenidae	
		Placocoeniidae			Negoporitidae	
Montlivaltioidea	Lasmogyridae	Synastraeidae				
	Montlivaltiidae	Poritina	Poritoidea	Actinacididae		
					Poritidae	
		Rhipidogyrina			Stylinoidea	Aulastraeoporidae
		Stylinina				Rhipidogyridae
				Stylinidae		

Figure 7: Relation of former suborders and superfamilies, slightly modified after LÖSER (2016c).

Institutional abbreviations: BSPG, Bayerische Staatssammlung für Paläontologie und Geologie, München, Germany; CGS, Česká geologická služba, Praha, Czech Republic; ERNO, Universidad Nacional Autónoma de México, Instituto de Geología, Estación Regional de Noroeste, Hermosillo, Mexico; FGUB, Facultad de Geología de la Universidad de Barcelona, Spain FSL, Université Claude Bernard, Institut de Géologie, Lyon, France; GLAHM, Hunterian Museum, Glasgow, UK; GPSL, Geologische und Paläontologische Sammlung der Universität Leipzig, Germany; GSUB, Geologisch-Paläontologisches Institut Bremen, Germany; IGM, Instituto de Geología, Mexico City, Mexico; LFU, Landesamt für Umwelt, München, Germany; MB, Museum für Naturkunde der Humboldt-Universität, Berlin, Germany; MGSB, Museo Geológico del Seminario de Barcelona, Spain; MHE, Coll. M. Heinrich, Eckental, Germany; MHNN, Muséum d'Histoire naturelle de Neuchâtel, Switzerland; MNHN, Muséum National d'Histoire Naturelle, Paris, France; MV, Vinseum, Vilafranca del Penedès, Spain; NHM, The Natural

History Museum, London, UK; NHMW, Naturhistorisches Museum, Wien, Austria; NMNH, National Museum of Natural History, Washington, D.C., USA; PIUEN, Paläontologisches Institut, Erlangen, Germany; RLM, Ruhrlandmuseum, Essen, Germany; SAZU, Paleontoloski institut Ivana Rakovca, Ljubljana, Slovenia; SMF, Senckenbergmuseum, Frankfurt/M., Germany; SNSD-MMG, Senckenberg Naturhistorische Sammlungen Dresden, Museum für Mineralogie und Geologie, Germany; TUM, The Tohoku University Museum, Sendai, Japan; UJ, Jagiellonian University, Instytut Nauk Geologicznych, Kraków, Poland; UNAM-FI, UNAM, Facultad de Ingeniería, Mexico City, Mexico; UP, Université de Provence, Coll. Masse, Marseille, France; UPS, Université Paul Sabatier, Laboratoire de Géologie Sédimentaire et Paléontologie, Toulouse, France; WCM, Worcester City Museum and Art Gallery, UK; ZSH, Zumsteinhaus, Kempten, Germany.

Abbreviations of measurements: c, calicular diameter (outer diameter); ccd, distance between calicular centres; cl, calicular diameter (lu-



men, calicular pit); clmax, large lumen; clmin, small lumen; cmax, larger outer calicular diameter; cmin, smaller outer calicular diameter; cn, calicular diameter (inner corallite in amphistroidae); crd, distance of calicular series; crw, width of calicular series; h, height of a solitary coral; md, distance between monticule in a hydno-phoroid colony; ml, length of monticules in hydno-phoroid colony; mw, monticule width; s, number of septa in the adult corallite; sap, number of lonsdaloid septa (without septa); sd, density of septa; sk, number of septa which reach the columella; sl, length of septa; tb, density of tubes.

Order Scleractinia BOURNE, 1900

Superfamily Actinastraeoidea ALLOITEAU, 1952

Remarks: The families of this superfamily were formerly assigned to the suborder Archeocae-niina ALLOITEAU, 1952. The suborder has no reference to any family or genus, and is therefore undefined. It should encompass corals with septa made of few 'simple' trabeculae without a divergence system. The suborder Archeocae-niina is not identical with the suborder Astrocoeniina VAUGHAN & WELLS, 1943, that is based on the genus *Astrocoenia*, a genus that is characterised by very small trabeculae.

Family Actinastraeidae ALLOITEAU, 1952

Stelidioseris TOMES, 1893

Type species: *Stelidioseris gibbosa* TOMES, 1893, by original designation.

Stelidioseris japonica (EGUCHI, 1951)

(Pl. 1, figs. 1-3)

Material: BSPG 2003 XX 5826, 5838; 2 thin sections.

Synonymy:

- *v 1951 *Astrocoenia japonica* EGUCHI, p. 17, Pl. 8, figs. 7-8; Pl. 10, figs. 4-5
- v 2013b *Stelidioseris japonica* (EGUCHI, 1951) - LÖSER, p. 84, Fig. 2.d-f [= here detailed synonymy]

Dimensions:

(5838)	n	min-max	μ	s	v	$\mu \pm s$
clmin	40	1.19-1.77	1.46	0.15	10.7	1.31-1.62
clmax	40	1.58-2.68	2.07	0.27	13.2	1.79-2.34
ccd	40	1.43-2.29	1.89	0.25	12.9	1.64-2.13
s	24					
sk	6					

Description: Plocoid colony. Calicular outline polygonal. Septa compact, consist of few (8-10) large trabeculae, in cross section externally slightly thicker, then equally in thickness. Symmetry of septa radial and regularly hexameral.

Cycles of septa subregular. Septal cycles differ in length. Septa of the second cycle occasionally attached to those of the first cycle. Septal distal margin unknown, lateral face with thorns. Pali absent. All septa of the first cycle are attached to the columella. Costae hardly present. Synapticulae absent. Columella styliform. Endotheca consists of a few dissepiments. Wall compact, septothecal. Coenosteum made by costae. Budding intracalicular.

Occurrence: Bed A5-12 (BSPG 2003 XX 5838).

Other occurrences: Tithonian of France (Doubs) Gilley (MNHN BeauG212). Cretaceous of Serbia (East Serbia) Planinica. Lower Hauterivian (Radiatus zone) of France (Yonne) Fontenoy, field S the junction to Les Merles (BSPG 2003 XX 5064); Gy-l'Evêque, fields SW Gy-l'Evêque (BSPG 2003 XX 6535); Leugny, Les Cassines 4 km E Leugny (BSPG 2003 XX 5175). Upper Barremian of France (Ardèche) St.Remèze, Belvedere du Gaud. Aptian of Japan (Kochi-ken) Kami-gun, Birafu-mura, at the former Iwakai Primary School (TUM 65366). Lower Aptian of Spain (Murcia) Sierra de la Muela; Greece (Viotía) Levidia, Pera-chorion; Mexico (Puebla) Tehuacán, La Compañía (ERNO L-R10908). Upper Aptian of Algeria (Constantine) Sidi R'Gheiss (UP M 6313); Greece (Viotía) Aliartos, Chiarmena. Uppermost Aptian of Japan (Iwate-ken) Shimohei-gun, Tanohata-mura, Haipe, northern cliff; Shimohei-gun, Taro-cho, Todana. Lowermost Albian (Tardefurcata zone) of Spain (Cataluña, Tarragona) Com. Baix Penedès, Mun. Masllorenç, Masarbones, field N (ERNO L-6010). Lower Albian of Mexico (Baja California) Eréndira, Punto San Isidro (ERNO L-120402); Mexico (Sonora) Municipio Agua Prieta, E San Bernardino Valley, Cordon Caloso; Municipio Arizpe, Arizpe, Cerro La Ceja; Municipio Arizpe, El Salmón; Municipio Opodepe, Tuape, Cerro de la Espina; Municipio Santa Ana, Santa Ana; Municipio Ures, Cerro de Oro. Lower Cenomanian (Mantelli zone) of Germany (Nordrhein/Westfalen) Mülheim/Ruhr, Kassenberg. Lower Cenomanian (Dixon zone) of Germany (Sachsen) Meißenzscheila, Trinitatis church.

Superfamily Caryophylliioidea DANA, 1846

Remarks: The superfamily corresponds to the suborder Caryophylliina VAUGHAN & WELLS, 1943.

Family Caryophylliidae DANA, 1846

Caryophylliidae sp. indet. 1

(Pl. 1, fig. 4)

Material: BSPG 2003 XX 7468, 7474-7477; 5 thin sections.

**Dimensions:**

(7468)	
c	10mm
s	48
(7576)	
c	8x9 4mm
s	48

Description: Solitary turbinate coral. Calicular outline circular, pit depressed. Septa compact. Microstructure of small-sized trabeculae, septa with a median dark line. Septa in cross section thick close to the wall, thinner towards the centre. Symmetry of septa radial and regularly hexamer. Cycles of septa regular. Septal cycles differ in length and thickness. Septa occasionally connected to each other close to the calicular centre. Septal lateral face with fine thorns. Pali absent. Costae present but short. Synapticulae absent. Columella lamellar. Endotheca absent. Wall compact, septothecal.

Remarks: The material cannot be compared to any existing genus because all Cretaceous Caryophyllioida are very poorly documented and most genera are not known by the means of thin sections.

Occurrence: Bed A2 (BSPG 2003 XX 7468, 7474-7477).

Caryophylliidae sp. indet. 2

(Pl. 1, fig. 5)

Material: BSPG 2003 XX 7448; 2 thin sections.

Dimensions:

(7448)	
c	5.7x8.5mm
s	48

Description: Solitary turbinate coral. Calicular outline elliptical, pit depressed. Septa compact. Microstructure of small-sized trabeculae, septa with a median dark line. Septa in cross section medium thick close to the wall, thicker towards the centre. Symmetry of septa radial and regularly hexamer. Cycles of septa regular. Septal cycles differ in length and thickness. Septa occasionally connected to each other close to the calicular centre. Septal lateral face with thorns. Pali absent. Costae and synapticulae absent. Columella lamellar. Endotheca absent. Wall compact, septothecal.

Remarks: The material cannot be compared to any existing genus because all Cretaceous Caryophylliina are very poorly documented and most genera are not known through thin sections. Comparing to the literature, the present material is comparable to *Amblocyathus*, an Upper Albian to Cenomanian genus, but the type of its type species (*Cyathina bowerbanki* MILNE ED-

WARDS & HAIME, 1848) is not available.

Occurrence: Bed A5-12 (BSPG 2003 XX 7448).

Superfamily Cladocoroidea
MILNE EDWARDS, 1857

Remarks: The families of this superfamily were formerly assigned to the suborder Faviina VAUGHAN & WELLS, 1943. Because of nomenclatorial problems, the name-giving genus *Favia* is undefined (see LÖSER & SKLENAR, 2016, for further explanation), and so the suborder. The suborder *Astraeoidea* ALLOITEAU, 1952, is considered by various authors a junior synonym of the Faviina. This suborder is based on *Astrea* LAMARCK, 1801, a genus that was never the object of any detailed investigation.

Family Columastraedae ALLOITEAU, 1952***Eocolumastrea* LÖSER & ZELL, 2015**

Type species: *Columnocoenia bucovinensis* MORYCOWA, 1971, by original designation.

***Eocolumastrea gortanii* (PREVER, 1909)**

(Pl. 1, figs. 7-9)

Material: BSPG 2003 XX 5850, 5872, 5874, 5876, 5878; 6 thin sections.

Synonymy:

- v? 1873 *Holocoenia ramosa*, STOLICZKA - STOLICZKA, p. 24, Pl. 4, figs. 4-5
- *v 1909 *Ulastraea Gortanii* PREVER, p. 91, Pl. 5, figs. 6-7
- v 1909 *Ulastraea Octaviae* - PREVER, p. 91, Pl. 5, fig. 5
- v 1909 *Leptastraea Cremai* n.f. - PREVER, p. 93, Pl. 6, figs. 6-7
- v 1909 *Leptastraea Cremai* var. *aquilana* n.f. - PREVER, p. 94, Pl. 6, figs. 4-5
- v 1909 *Leptastraea parva* n.f. - PREVER, p. 95, Pl. 6, fig. 9
- v 1932 *Stephanocoenia* (?) *guadalupae* WELLS, n.sp. - WELLS, p. 235, Pl. 32, figs. 8-9; Pl. 39, fig. 3
- v 1937 *Placocoenia* ex. aff. *niogalensis* DIETR. 1926 - HACKEMESSER, p. 52, Pl. 1, figs. 3-4
- v 1944 *Stephanocoenia guadalupae* WELLS, 1932 - WELLS, p. 433, Pl. 69, figs. 3-4
- v 1971 *Columnocoenia ksiazkiewiczzi bucovinensis* n. subsp. - MORYCOWA, p. 96, Figs. 30.c-d, Pl. 24, figs. 2-3; Pl. 25, fig. 1
- v 1981 *Columnocoenia ksiazkiewiczzi bucovinensis* MORYCOWA, 1971 - TURNŠEK & MIHAJLOVIC, p. 20, Pl. 16, figs. 1-2
- v 1991 *Stylina wintoni* (WELLS, 1933) - PRINZ, p. 195, Fig. 29, Pl. 8, fig. 5
- v 2008 *Columnocoenia aragonensis* (ALLOITEAU, 1946-1947) - LÖSER & SALDAÑA-SZABO, Pl. 17, figs. 3-4
- v 2015 *Eocolumastrea bucovinensis* (MORYCOWA, 1971) - LÖSER & ZELL, p. 160, Fig. 5.1-3

**Dimensions:**

(5878)	n	min-max	μ	s	v	$\mu \pm s$
clmin	25	1.74-2.21	2.00	0.15	7.6	1.84-2.15
clmax	25	1.94-2.81	2.37	0.19	8.3	2.17-2.56
ccd	25	2.01-3.31	2.66	0.37	14.1	2.28-3.04
s	24					

Description: Plocoid colony. Calicular outline circular to slightly elliptical. Septa compact, septa and costae in cross section in the wall thick, thinner toward the centre. Symmetry of septa radial and regularly hexamer. Cycles of septa regular. Septal cycles differ in length and thickness. Septa of the first two cycles in places connected to each other in the calicular centre, and those of the third cycle to those of older cycles. Septal distal margin unknown, lateral face with fine thorns, inner margin slightly swollen in places. Pali irregularly on the first cycle. Some septa may be attached to the columella. Costae present, sub-confluent to non-confluent. Synapticulae absent. Columella small, styliform to lamellar. Endotheca consists of tabulae. Wall compact, septothecal. Coenosteum narrow (approx. 20% c), consists of costae and exothecal dissepiments. Budding extracalicular.

Occurrence: Bed A (BSPG 2003 XX 5872); A5-12 (BSPG 2003 XX 5878); B (BSPG 2003 XX 5874); D1 (BSPG 2003 XX 5876).

Other occurrences: Cretaceous of Serbia (East Serbia) Planinica. Barremian of Chile (Antofagasta) El Way. Upper Barremian to Lower Aptian (Sartousi - Weissi zones) of Germany (Bayern) Allgäuer Helvetikum, Falkenberg (ZSH H-KU 793). Upper Barremian to Lower Aptian (Lenticularis zone) of Mexico (Sonora) Municipio Ures, Cerro de Oro (ERNO L-4321). Aptian of Mexico (Puebla) San Juan Raya (IGM 9236). Lower Aptian of Spain (Murcia) Jumilla, Solano del Sopalm (MGSB 73674); Egypt (Shebh Gezirat Sena) Maghara Mt, SE Mansour (GSUB SM01); Greece (Viotía) Arachova (BSPG 2003 XX 5483); Italy (Abruzzi, L'Aquila) Monti d'Ocre, Fossa Cerasetti; Venezuela (Anzoátegui) Guanta coast, La Borracha Island. Lower Aptian (Lenticularis zone) of Romania (Suceava) Pojorîta area, Cîmpulung-Moldovenesc, Valea Izvorul Alb. Aptian to Cenomanian of Greece (Fokída) Mario-lada, Kria Vrissi, Kokkino Vrissi springs. Upper Aptian of Spain (Valencia, Castellón) Benicasin, La Venta (MGSB 73710); Poland (Malopolskie, Zakopane) Tatry Mts, Wysoka Turnia (BSPG 2003 XX 5423). Upper Aptian (Jacobi zone) of USA (Texas) Comal County, Guadalupe River, Demijohn Bend. Lower Albian of Mexico (Baja California) Santo Tomás, Arroyo de la Cueva (ERNO L-134604); Mexico (Sonora) Municipio Opodepe, Rancho El Pimiento (ERNO L-4420); Municipio Ures, Cerro de Oro (ERNO L-4927). Upper Lower

Albian (Mammillatum zone) of France (Aude) Padern, SE Le Crès, 1.45 km WWS Padern (SMF 75655). Middle Albian of Mexico (Sonora) Municipio San Pedro de la Cueva, Tepache, Lampazos area (ERNO 2189); Municipio San Pedro de la Cueva, Tepache, Lampazos area, Espinazo de Diablo (ERNO L-120524). Upper Albian of India (Tamil Nadu [= Madras]) Maruvattur [= Moravia-toor]. Lower Cenomanian (Dixoni zone) of Germany (Sachsen) Meißen-Zscheila, Trinitatis church.

***Eocolumastrea rosae* (PREVER, 1909)**

(Pl. 1, figs. 10-12)

Material: BSPG 2003 XX 5813, 5825, 5895; 3 thin sections.

Synonymy:

- v ? 1873 *Holocoenia ramosa*, STOLICZKA - STOLICZKA, p. 24, Pl. 4, figs. 4-5
- *v 1909 *Ulastraea Rosae* PREVER, p. 90, Pl. 5, figs. 9-11
- v 1909 *Favia Felixi* - PREVER, p. 84, Pl. 4, figs. 1-2
- v 1909 *Phyllocoenia plana* - PREVER, p. 131, Pl. 14, fig. 15
- v 1930 *Phyllocoenia polluciformis* n. sp. - GREGORY, p. 201, Pl. 18, fig. 7
- v 1933 *Orbicella edwardsensis* n.sp. - WELLS, p. 85, Pl. 2, figs. 9-10
- v 1996 *Columnocoenia ksiazkiewiczzi bucovinensis* MORYCOWA, 1971 - BARON-SZABO & STEUBER, p. 12, Pl. 5, figs. 1, 5

Dimensions:

(5895)	n	min-max	μ	s	v	$\mu \pm s$
clmin	30	1.43-1.81	1.61	0.10	6.5	1.51-1.72
clmax	30	1.55-1.93	1.72	0.09	5.4	1.62-1.81
ccd	30	1.70-2.66	2.12	0.24	11.6	1.87-2.37
s	24					

Description: Plocoid colony. Calicular outline circular. Septa compact, septa and costae in cross section in the wall thick, thinner toward the centre. Symmetry of septa radial and regularly hexamer. Cycles of septa regular. Septal cycles differ in length and thickness. Septa of the first two cycles in places connected to each other in the calicular centre, and those of the third cycle rarely to those of older cycles. Septal distal margin unknown, lateral face with fine thorns, inner margin slightly swollen in places. Pali irregularly on the first cycle. Some septa may be attached to the columella. Costae present, sub-confluent to non-confluent. Synapticulae absent. Columella small, styliform to lamellar. Endotheca consists of tabulae. Wall compact, septothecal. Coenosteum narrow (approx. 20% c), consists of costae and exothecal dissepiments. Budding extracalicular.

Occurrence: Bed A5-12 (BSPG 2003 XX 5895).



Other occurrences: Barremian of Mexico (Puebla) Tehuacán, San Antonio Texcala (ERNO L-4419). Barremian to Lower Aptian of Kenya (Coast) Frere Town, Malindi road. Lower Aptian of Greece (Viotía) Arachova; Italy (Abruzzi, L'Aquila) Monti d'Ocre, Fossa Cerasetti; Monti d'Ocre, Fossa Mezza Spada. Lower Upper Aptian of Spain (Cataluña, Lérida) Com. Alt Urgell, Buerco section (BSPG 2003 XX 5336). Uppermost Aptian of Japan (Iwate-ken) Miyako-shi, Sakiyama, Hideshima (TUM 39740). Lower Albian of Mexico (Sonora) Municipio Ures, Cerro de Oro (ERNO L-4841). Upper Lower Albian (Mammillatum zone) of Spain (Cantabria, Santander) Cala de Islares, playa (ERNO L-133104); France (Aude) Padern, SE Le Crès, 1.45 km WWS Padern (SMF 75584). Middle Albian of Mexico (Sonora) Municipio San Pedro de la Cueva, Tepache, Lampazos area, Espinazo de Diablo (ERNO L-120521). Middle Albian (Lautus zone) of USA (Texas) Kerr County, Kerrville, Hiram Hall Ranch. Upper Albian of UK (Devonshire) Exeter, Haldon Hill (WCM); India (Tamil Nadu [= Madras]) Maruvattur [= Moraviatoor]; Tunisia, Oum-Ali Mt (FSL).

Diplocoeniids, informal group

Remarks: The informal group encompasses five cerioid genera of the Lower Cretaceous and Cenomanian.

Sakalavastraea ALLOITEAU, 1958

Type species: *Sakalavastraea collignoni* ALLOITEAU, 1958, by original designation.

Sakalavastraea clementi L. BEAUVAIS, 1972

(Pl. 2, figs. 1-2)

Material: BSPG 2003 XX 5858; 2 thin sections.

Synonymy:

- *v 1972 *Sakalavastraea clementi* nov. sp. - L. BEAUVAIS, p. 96, Pl. 11, fig. 1
- v 1989 *Stephanastraea* sp. - LÖSER, p. 99, Figs. 4-5
- v 2014b "*Glenarea*" sp. 1 - LÖSER, p. 23, Fig. 2.g
- v 2014b "*Glenarea*" sp. 2 - LÖSER, p. 23, Fig. 2.h

Dimensions:

(5858)	n	min-max	μ	s	v	$\mu \pm s$
clmin	20	1.51-2.10	1.80	0.18	9.9	1.62-1.98
clmax	20	2.10-3.03	2.51	0.29	11.6	2.21-2.80
ccd	20	1.77-2.31	2.05	0.15	7.5	1.89-2.20
s	10	14-23	19.10	2.84	14.9	16-22

Description: Cerioid colony. Calicular outline polygonal, pit depressed. Septa compact, in cross section slightly thicker close to the wall, becoming slightly thinner towards the centre. Symmetry of septa radial and regularly hexamerall. Cycles of septa subregular. Septal cycles differ in length, but hardly at all in thickness. Septa of the second cycle rarely attached to those of the first cycle. Septal distal margin unknown, lateral face occasionally with medium-size thorns, inner margin swollen in places. Pali, costae, and synapticalae absent. Columella formed by septal fusion in the calicular centre. Endotheca unknown. Wall compact, septothecal. Coenosteum absent. Budding intracalicular and extracalicular.

Occurrence: Bed A5-12 (BSPG 2003 XX 5858).

Other occurrences: Lower Cretaceous of Greece (Viotía) Aliartos, Korónia, road cut. Upper Cenomanian (Plenus zone) of Germany (Sachsen) Dresden-Plauen, Ratssteinbruch, southern quarry.

Sakalavastraea sp. 1

(Pl. 2, figs. 7-9)

Material: BSPG 2003 XX 5811; 2 thin sections.

Dimensions:

(5811)	n	min-max	μ	s	v	$\mu \pm s$
clmin	20	1.48-2.30	1.83	0.19	10.4	1.64-2.02
clmax	20	1.89-2.63	2.27	0.21	9.4	2.05-2.48
ccd	20	1.63-2.53	2.14	0.24	11.3	1.89-2.38
s	10	12-18	14.10	1.96	13.9	12-16

Description:

Cerioid colony. Calicular outline polygonal, pit depressed. Septa compact, in cross section slightly thicker close to the wall, becoming slightly thinner towards the centre. Symmetry of septa radial and regularly hexamerall. Cycles of septa subregular. Septal cycles differ in length, but hardly at all in thickness. Septa of the second cycle occasionally attached to those of the first cycle. Septal distal margin unknown, lateral face occasionally with medium-size thorns. Pali, costae, and synapticalae absent. Columella formed by septal fusion in the calicular centre. Endotheca consists of numerous thin tabulae. Wall compact, septothecal. Coenosteum absent. Budding intracalicular and extracalicular.

Occurrence: Bed A (BSPG 2003 XX 5811).

Other occurrences: Upper Cenomanian (Guerangeri zone) of Czech Republic (Central Bohemian region) Korycany, Netreba, Kopec (CGS HF 1704).



Sakalavastraea sp. 2

(Pl. 2, figs. 3-4)

Material: BSPG 2003 XX 5869; 1 thin section.

Dimensions:

(5869)	n	min-max	μ	s	v	μ±s
clmin	25	1.06-1.61	1.33	0.16	12.3	1.16-1.49
clmax	16	1.22-2.33	1.82	0.30	16.7	1.51-2.12
ccd	25	1.39-2.36	1.80	0.32	17.7	1.48-2.12
s	10	15-23	19.30	2.66	13.8	17-22

Description: Cerioid colony. Calicular outline polygonal, pit depressed. Septa compact, in cross section slightly thicker close to the wall, becoming slightly thinner towards the centre. Symmetry of septa radial and regularly hexamerall. Cycles of septa subregular. Septal cycles differ in length, but hardly at all in thickness. Septa of the second cycle rarely attached to those of the first cycle. Septal distal margin unknown, lateral face occasionally with medium-size thorns. Pali, costae, and synapticalae absent. Columella formed by septal fusion in the calicular centre. Endotheca unknown. Wall compact, septothecal. Coenosteum absent. Budding intracalicular and extracalicular.

Remarks: Specimen 5869 is poorly preserved. The wall is thickened and septa of the third cycle are only partly recognisable.

Occurrence: Bed A5-12 (BSPG 2003 XX 5869).

**Superfamily Cyclolitoidea
MILNE EDWARDS & HAIME, 1849**

Remarks: This superfamily corresponds to the suborder Microsolenina MORYCOWA & RONIEWICZ, 1995. The name-giving genus *Microsolenia* itself is poorly defined; the type material of the type species is not available.

Family Leptophylliidae VAUGHAN, 1905

***Aspidiscus* KOENIG, 1825**

Type species: *Aspidiscus shawi* KOENIG, 1825, by monotypy.

***Aspidiscus cristatus* (LAMARCK, 1801)**

(Pl. 2, figs. 10-12)

Material: BSPG 2003 XX 5963, 7444, 7451, 7453, 7456, 7457, 7458, 7463, 7470; 3 thin sections.

Synonymy:

- * 1801 *Cyclolites cristata* LAMARCK, p. 369
- 1851 *Aspidiscus cristatus* - BRONN, p. 155, Pl. 29.5, fig. 6
- 1857 *Aspidiscus cristatus* - PICTET, (6), p. 407, Pl. 105, fig. 7
- 1862 *Aspidiscus cristatus* MILNE EDWARDS & HAIME - COQUAND, p. 259, Pl. 28, figs. 17-21

- 1877 *Aspidiscus cristatus* - FROMENTEL, p. 466, Pl. 114, figs. 1-5
- 1885 *Cyclolites cristatus* - QUENSTEDT, p. 1016, Fig. 384
- 1897 *Aspidiscus cristatus* - SÖHLE, p. 43, Pl. 5, figs. 5, 5.a
- 1918 *Aspidiscus cristatus* (LAMARCK) - FOSSA-MANCINI, p. 135, Pl. 14, figs. 1- 2, 4-9
- v 1930 *Aspidiscus cristatus* Lamarck sp. 1801 - RENZ, p. 8, Pl. 2, fig. 1
- 1932 *Aspidiscus cristatus* LAMARCK sp. - LLUECA, p. 347, Pl. 1, figs. 5-6
- 1937 *Aspidiscus cristatus* LAMARCK sp. 1801 - BATALLER, p. 172, text-fig.
- 1952 *Cyclolites cristata* LAMARCK 1801 - ALLOI-TEAU, p. 663, Pl. 9, fig. 12
- v 1957 *Aspidiscus cristatus* (LAMARCK) - THOMAS & OMARA, p. 152, Pls. 4-5
- 1987 *Aspidiscus cristatus* - GILL & LAFUSTE, p. 926, Figs. 1-2, 3 a, 5-8, Pls. 1-2
- 1991 *Aspidiscus cristatus* (LAMARCK) - GILL & CHIKHI, p. 349, Figs. 1-2
- 1995 *Aspidiscus cristatus* (LAMARCK 1801) - ABDEL-GAWAD & GAMEIL, p. 23, Pl. 9, fig. 6
- 2014 *Aspidiscus cristatus* - WILSON, VINN & PALMER, p. 244, Figs. 2-3

Dimensions:

(7458)	n	min-max	μ	s	v	μ±s
mw	8	3.70-4.83	4.45	0.35	7.9	4.10-4.81
sd	10/5mm					

Description: Hydnochoroid colony with circular outline. Monticules polygonal, long or short and straight. Corallites indistinct. Septa irregularly perforated, more common at their inner margin. Microstructure of large trabeculae. Septa in cross section equal in thickness throughout the whole septum. No septal cycles. Septa rarely connected to each other. Septal distal margin granulated, lateral face with pennulae, inner margin smooth. Pali und costae absent. Synapticalae present. Columella difficult to separate from the perforated septal inner margins, probably consists of isolated trabecules or short lamellae. Endotheca consists of numerous dissepiments. Coenosteum absent. Budding unknown.

Occurrence: Beds A5-12 (BSPG 2003 XX 7470); B (BSPG 2003 XX 7453); D2 (BSPG 2003 XX 7451).

Other occurrences: Cretaceous of Greece (Fokída) Kiona massif, Panourgias. Cenomanian of Bahrain, Drilling; Germany (Bayern) Ruhpolding, Urschlau; Algeria (Batna) Aurès Mts; Algeria (Constantine) Commune Aïn Smara, Chettabah Mt; Algeria (Khenchela) Commune Ouled Amar, Ouled Amar; Commune Tamza, Taafist Mt;



Algeria (Tebessa) Commune Tebessa, Tebessa Mts, Col de Tenoukla; Spain (Cataluña, Barcelona) Com. Berguedà, Mun. La Pobla de Lillet, Serra de Falgars; Egypt (Shebh Gezirat Sena) El-Minshera Mt; Nezzazat Mt; Themed area; Tunisia, Gafsa, Ben Younes Mt. Lower Cenomanian (Mantelli zone) of Germany (Bayern) Ettal, Lichtenstättgraben. Lower Cenomanian of Israel (Southern district) Hebron, W Dead Sea coast, Ein Gedi; Nahal Neqarot. Cenomanian to Turonian of France (Saône-et-Loire) Cuiseaux; Italy (Abruzzi, Chieti) La Maiella; Tunisia, Ruins of Suffetula. Middle Cenomanian of Algeria (M'sila) Commune Benzouh, Ouled Nails, Bou Saada, Benzouh. Middle to Upper Cenomanian of Algeria (Batna) Moussa el Ayati. Middle Cenomanian (Rhotomagensis zone) of Algeria (Batna) Commune Azzab, Azeb Mt; Commune Batna, Koudiat Bou Zorane.

***Astraeofungia* ALLOITEAU, 1952**

Type species: *Astrea decipiens* MICHELIN, 1841, by original designation.

***Astraeofungia* cf. *barcenai* (FELIX, 1891)** (Pl. 2, figs. 5-6)

Material: BSPG 2003 XX 5888; 1 thin section.

Synonymy:

v 2013 *Astraeofungia* sp. - LÖSER, CASTRO & NIETO, p. 23, Pl. 7, figs. 7-9

Dimensions:

(5888)	n	min-max	μ	s	v	$\mu \pm s$
cdd	8	6.11-11.95	8.79	2.03	23.1	6.75-10.82
d	42-58					
sd	10/5mm					

Description: Thamnasterioid colony. Calicular centres slightly depressed. Septa perforated at their inner margin. Septa in cross section externally thicker, thinner towards the centre. Symmetry of septa irregular. No septal generations. Septa occasionally connected to each other close to the calicular centre. Septal distal margin coarsely granulated, lateral face with pennulae, inner margin smooth. Pali absent. Costae present, confluent. Synapticulae present, occasional, mainly in the space between corallites. Columella composed of isolated trabeculae or one more solid element. Endotheca unknown. No wall. Coenosteum poorly defined because of the type of the calicular arrangement. Budding extracalicular.

Remarks: The present specimen differs from *A. barcenai* by larger dimensions.

Occurrence: Bed C5 (BSPG 2003 XX 5888).

Other occurrences: Aptian of Mexico (Pue-

bla) San Juan Raya (IGM L-R10270). Lower Aptian (Tuarkyricus - Weissi zones) of UK (Isle of Wight) Atherfield (NHM R00273). Lower Upper Albian (Inflatum zone) of Spain (Valencia, Alicante) Sierra de Llorençá. Lower Cenomanian (Dixon zone) of Germany (Sachsen) Meißen-Zscheila, Trinitatis church (SNSD-MMG SaKL561). Uppermost Cenomanian (Juddi zone) of France (Aude) Les Corbières, Col de Escudiés (UPS HL 005).

***Helladastraea* AVNIMELECH, 1948**

Type species: *Aspidiscus felixi* RENZ, 1930, by original definition.

***Helladastraea* sp.**

(Pl. 3, figs. 1-3)

Material: BSPG 2003 XX 7452, 7454; 2 thin sections.

Dimensions:

(7454)	n	min-max	μ	s	v	$\mu \pm s$
ml	10	1.30-3.56	2.17	0.66	30.6	1.51-2.84
md	10	4.47-5.68	5.22	0.37	7.0	4.85-5.59
s	50-60					
sd	8/2mm					

Description: Hydnoformoid colony with circular outline. Monticules conical with small centres. Septa irregularly perforated, more common at their inner margin. Microstructure of large trabeculae. Septa in cross section equal in thickness throughout the whole septum. No regular septal generations. Septa not connected to each other. Septal distal margin unknown, lateral face with pennulae and thorns, inner margin smooth. Pali, and costae absent. Synapticulae rare. Columella difficult to separate from the perforated septal inner margins, probably consists of isolated trabeculae. Endotheca consists of numerous dissepiments. Coenosteum absent. Budding extracalicular.

Occurrence: Beds A5-12 (BSPG 2003 XX 7454); D1 (BSPG 2003 XX 7452).

Latomeandra

MILNE EDWARDS & HAIME, 1849

Type species: *Lithodendron plicata* GOLDFUSS, 1826, by subsequent definition in MILNE EDWARDS & HAIME (1851a).

***Latomeandra* ? *plicata* (GOLDFUSS, 1826)**

(Pl. 3, figs. 4-6)

Material: BSPG 2003 XX 5884, 5889, 5946; 11 thin sections.



Synonymy:

- v 2007 *Montlivaltia caryophyllata* LAMOUREUX, 1821 - PANDEY, FÜRSICH & BARON-SZABO, p. 22, Pl. 5, figs. 2-3, 5, 7, 9
- v 2009 *Latomeandra minor* REIG ORIOL, 1975 - MORYCOWA & MASSE, p. 130, Fig. 21.f-g

Dimensions:

(5946)	n	min-max	μ	s	v	μ±s
clmin	10	3.30-4.12	3.57	0.30	8.4	3.27-3.87
clmax	10	3.64-4.99	4.10	0.43	10.6	3.67-4.54
cmin	10	3.95-4.84	4.44	0.29	6.6	4.14-4.73
cmax	10	4.55-6.11	5.05	0.51	10.1	4.54-5.57
ccd	15	4.20-7.09	5.60	0.93	16.7	4.66-6.53
s	50-60					
sd	6/2mm					

Description: Phaceloid colony. Calicular outline circular to elliptical. Septa perforated at their inner margin, in cross section slightly thicker close to the wall, becoming slightly thinner towards the centre. Symmetry of septa irregularly radial. Cycles of septa irregular, but size orders can be distinguished. Septal cycles (generations) differ in length and thickness. Septa of younger generations in places attached to those of preceding generations. Septal distal margin unknown, lateral face with pennulae, inner margin smooth. Pali and costae absent. Synapticulae rare. Columella difficult to separate from the perforated septal inner margins, probably consists of isolated trabecules. Endotheca absent. Wall compact, very thin, probably epithelial. Budding intracalicular.

Remarks: The genus name is here applied in the conceptual sense of the genus: a phaceloid pennular coral with a rather large diameter (in contrast to *Latohelia*, which has a very small diameter and more compact septa). The material cannot be clearly compared to *L. plicata* because of the poor state of preservation of the type of the latter species.

Occurrence: Beds A (BSPG 2003 XX 5946); C4 (BSPG 2003 XX 5884); C5 (BSPG 2003 XX 5889).

Other occurrences: Lower Aptian (Tuarkyricus - Weissi zones) of France (Vaucluse) Vaucluse Mts, Lagnes. Upper Aptian to Lower Albian of Iran, Koppeh Dagh, Mashad. Lower Cenomanian (Dixoni zone) of Spain (Cantabria, Santander) Cobreces, Luaña playa (BSPG 2007 V 049).

Mixastraea RONIEWICZ, 1976

Type species: *Mixastraea danubica* RONIEWICZ, 1976, by original designation.

**Mixastraea aff. danubica
RONIEWICZ, 1976**

(Pl. 3, figs. 10-12)

Material: BSPG 2003 XX 5890, 5894, 6146; 4 thin sections.

Dimensions:

(5894)	n	min-max	μ	s	v	μ±s
clmin	25	3.233-8.106	6.027	1.400	23.2	4.62-7.42
clmax	23	4.780-10.301	7.456	1.508	20.2	5.94-8.96
ccd	25	4.423-9.791	7.110	1.584	22.2	5.52-8.69
s	70-130					
sd	16/5mm					

(6146)	n	min-max	μ	s	v	μ±s
clmin	12	5.217-9.251	7.166	1.396	19.4	5.77-8.56
clmax	12	5.817-12.074	9.270	1.981	21.3	7.28-11.25
ccd	22	5.188-10.669	7.840	1.428	18.2	6.41-9.26
s	90					
sd	16/5mm					

Description: Cerioid-astreoid colony. Calicular outline polygonal to circular. Septa perforated at their inner margin, in cross section equal in thickness throughout the whole septum. Symmetry of septa irregular. Cycles of septa irregular, but size orders can be distinguished. Septal generations differ in length, but hardly at all in thickness. Septa of younger generations in places connected to the septa of preceding ones. Septal distal margin unknown, lateral face with pennulae, inner margin smooth. Pali absent. Costae present, non-confluent to confluent. Synapticulae present, occasional, mainly in the space between corallites. Columella composed of a group of isolated trabeculae. Endotheca consists of thin tabulae. Wall compact to subcompact, synapticulothecal, partly septothecal. Coenosteum absent. Budding extracalicular.

Remarks: The present material has larger dimensions and higher septal counts than *M. danubica*.

Occurrence: Beds A5-12 (BSPG 2003 XX 5894); B (BSPG 2003 XX 5890).

**Mixastraea westfalica LÖSER, 1993**

(Pl. 3, figs. 7-9)

Material: BSPG 2003 XX 5880; 2 thin sections.**Synonymy:**

- *v 1993 *Mixastraea westfalica* LÖSER, p. 104, Figs. 1-2, Pl. 1, figs. 2-3
- v 1994 *Mixastraea westfalica* LÖSER, 1993 - LÖSER, p. 40, Figs. 28-32, Pl. 7, fig. 3; Pl. 12, fig. 12

Dimensions:

(5880)	n	min-max	μ	s	v	$\mu \pm s$
ccd	16	5.09-11.23	8.02	1.95	24.4	6.06-9.98
s	6	48-59	55	3.8	6.8	
sd	13/5mm					

Description: Cerioid-astreoid colony. Calicular outline polygonal to circular. Septa perforated at their inner margin, in cross section equal in thickness throughout the whole septum. Symmetry of septa irregular. Cycles of septa irregular, but size orders can be distinguished. Septal generations differ in length, but hardly at all in thickness. Septa of younger generations often connected to the septa of preceding ones. Septal distal margin unknown, lateral face with pennulae, inner margin smooth. Pali absent. Costae present, non-confluent to confluent. Synapticulae present, occasional, mainly in the space between corallites. Columella composed of a group of isolated trabeculae. Endotheca consists of thin tabulae. Wall subcompact, synapticulothecal. Coenosteum absent. Budding extracalicular.

Occurrence: Bed C (BSPG 2003 XX 5880).

Other occurrences: Lower Cenomanian (Mantelli zone) of Germany (Nordrhein/Westfalen) Mülheim/Ruhr, Kassenberg.

Placoseris FROMENTEL, 1863

Type species: *Placoseris patella* FROMENTEL, 1863, by subsequent definition in VAUGHAN (1905).

Remarks: *Placoseris* is here applied for material that would traditionally be assigned to *Acrosmilia*. *Placoseris* has thinner septa and the septa are more frequently attached to each other whereas *Acrosmilia* has the typical thick septa of the Synastraeidae family, with septa, that are rarely connected to each other. When *Acrosmilia* will be assigned to the Synastraeidae family, consequently the family taxon Leptophylliidae could not longer applied as it is now. *Placoseris* has a range from the Callovian to Cenomanian.

Placoseris eturbensis (FROMENTEL, 1857)

(Pl. 4, figs. 1-3)

Material: BSPG 2003 XX 5892, 7438; 4 thin sections.**Synonymy:**

- *v 1857 *Trochoseris Eturbensis* FROMENTEL, p. 19, Pl. 1, fig. 8
- v 1863b *Leptophyllia Eturbensis* - FROMENTEL, p. 301, Pl. 50, fig. 2
- v 1897 *Leptophyllia patellata* - SÖHLE, p. 44, Pl. 6, fig. 5
- v 1941 *Thecoseris cenomanensis* n.sp. - ALLOI-TEAU, p. 22, Pl. 1, figs. 18-19
- v 1989 *Acrosmilia patellata* (MICHELIN, 1845) - LÖSER, p. 131, Fig. 34, Pl. 26, fig. 1

Dimensions:

(5892)	
c	21x36
cl	20x34
s	210
(7438)	
c	25.6x28.2
s	170

Description: Solitary cylindrical coral. Calicular outline elliptical, calicular pit depressed. Septa irregularly perforated. Microstructure of large trabeculae. Septa in cross section slightly thicker close to the wall, becoming slightly thinner towards the centre. Symmetry of septa irregular. Cycles of septa irregular, but size orders can be distinguished. Septal generations differ in length and thickness. Lateral face with pennulae. Costae present but short. Synapticulae present. Columella composed of a group of isolated trabeculae. Endotheca consists of numerous small dissepiments. Wall compact, structure unknown.

Occurrence: Bed A4 (BSPG 2003 XX 5892); A5-12 (BSPG 2003 XX 7438).

Other occurrences: Lower Hauterivian (Radiatus zone) of France (Haute-Marne) Saint Dizier. Aptian of Mexico (Puebla) San Juan Raya (IGM 9244). Lower Cenomanian (Mantelli zone) of Germany (Bayern) Ettal, Lichtenstättgraben; Germany (Nordrhein/Westfalen) Mülheim/Ruhr, Kassenberg (RLM RE 551.763.310 A 7051/1-2). Middle Cenomanian of Germany (Bayern) Roßstein-Almen (LFU 8336SG015085). Middle to Upper Cenomanian (Rhotomagense - Naviculare zone) of France (Sarthe) Le Mans. Upper Cenomanian (Plenus zone) of Germany (Sachsen) Dresden-Plauen, Ratssteinbruch, southern quarry.

**Polyastropsis ALLOITEAU, 1957**

Type species: *Polyastropsis arnaudi* ALLOITEAU, 1957, by original designation.

***Polyastropsis arnaudi* ALLOITEAU, 1957**

(Pl. 4, figs. 4-6)

Material: BSPG 2003 XX 5823, 5845, 6990; 5 thin sections.

Synonymy:

- v 1889 *Prionastraea* spec. - TOULA, p. 85, Pl. 6, fig. 6
- *v 1957 *Polyastropsis Arnaudi* ALLOITEAU, p. 219, Figs. 163, 283, Pl. 1, figs. 3, 16
- v 1994 *Thamnoseris* ? *delorenzoi* PREVER, 1909 - LÖSER, p. 44, Figs. 33-37, Pl. 7, figs. 4-6; Pl. 11, fig. 7
- v 1996 *Latiastrea* cf. *kaufmanni* (KOBY, 1897) - BARON & STEUBER, p. 25, Pl. 15, figs. 1-2

Dimensions:

(5823)	n	min-max	μ	s	v	$\mu \pm s$
clmin	30	2.50-4.06	3.21	0.43	13.4	2.77-3.64
clmax	30	3.32-4.87	4.13	0.43	10.6	3.69-4.57
ccd	30	2.76-4.59	3.60	0.51	14.2	3.09-4.12
s	10	24-34	30.40	2.79	9.2	28-33

Description: Cerioid colony. Calicular outline irregularly polygonal. Septa perforated at their inner margin, in cross section externally slightly thicker, then equally in thickness. Symmetry of septa irregular. Septa occasionally connected to each other. Septal lateral face with pennulae. Pali absent. Costae present, confluent. Synapticulae present, occasional, mainly in the space between corallites. Columella absent or as some small elements, presumably trabecular extensions of septal inner margins. Endotheca absent. Wall not compact, synapticulothecal. Coenosteum absent. Budding extracalicular.

Occurrence: Beds A (BSPG 2003 XX 6990); A5-12 (BSPG 2003 XX 5823, 5845).

Other occurrences: Barremian to Lower Aptian of Kenya (Coast) Frere Town, Malindi road (GLAHM C4072). Barremian to Aptian of Bulgaria (Veliko Tarnovska oblast) Veliko Tarnovo, Arbanski, Lyaskovets Monastir Sv.Peter. Upper Barremian of France (Ardèche) St.Remèze, Pont de Laval (BSPG 2003 XX 5221). Upper Barremian to Lower Aptian (Lenticularis zone) of Mexico (Sonora) Municipio Ures, Cerro de Oro (ERNO L-4332). Aptian of Mexico (Puebla) San Juan Raya, Lomo de los Gatos (ERNO L-R11706). Lower Aptian (Tuarkyricus - Weissi zones) of UK (Isle of Wight) Atherfield (NHM R06505). Lower Aptian of Spain (Murcia) Sierra de la Muela (BSPG 2003 XX 4700); Greece (Viotía) Arachova; Levadia, Perachorion (BSPG 2003 XX 5802). Lower Aptian

(Lenticularis zone) of Greece (Viotía) Levadia, roadcut near Perachorion NW Levadia (BSPG 2003 XX 5787). Lower Aptian (Weissi - Furcata zones) of Tanzania (Tanganyika, Mtwara) Nambawala plateau, Pilepile (MB K1311). Lower Upper Aptian of Algeria (Tebessa) Commune Ouenza, Ouenza Mt (UP M 5139). Uppermost Aptian of Spain (Cataluña, Lérida) Com. Alt Urgell, Mun. Coll de Nargó, Set Comelles, El Caso section (BSPG 2003 XX 5351). Lowermost Albian (Tardefurcata zone) of Spain (Cataluña, Tarragona) Com. Baix Penedès, Mun. Masllorç, Masarboines, field N (BSPG 2003 XX 6023). Lower Albian of Mexico (Baja California) El Progreso, Los Torotes section (ERNO L-4394); Mexico (Sonora) Municipio Agua Prieta, E San Bernardino Valley, Cordon Caloso (ERNO L-4210); Municipio Naco, Naco, Sierra San Jose (ERNO L-4409); Municipio Ures, Cerro de Oro (ERNO L-4946). Lower Cenomanian (Mantelli zone) of Germany (Nordrhein/Westfalen) Mülheim/Ruhr, Kassenberg. Lower Cenomanian of France (Charente-Maritime) Rochefort, Cadoret (MHE F013); Rochefort, sondage de l'Hôpital. Middle to Upper Cenomanian of Greece (Argolída) Nea Epidavros, road to the relais station (BSPG 2003 XX 5392).

***Polyastropsis subplana* (PREVER, 1909)**

(Pl. 1, fig. 6)

Material: BSPG 2003 XX 5833, 5871, 5877; 2 thin sections.

Synonymy:

- *v 1909 *Thamnoseris subplana* PREVER, p. 75, Pl. 3, fig. 2
- v 1995 *Thamnoseris* sp.1 - LÖSER & RAEDER, p. 50
- v 1998 *Thamnoseris* sp. - SCHÖLLHORN, p. 97, Pl. 22, figs. 6-7, 10; Pl. 24, figs. 1-2; Pl. 29, fig. 2

Dimensions:

(5833)	n	min-max	μ	s	v	$\mu \pm s$
ccd	25	3.07-5.84	4.42	0.83	18.9	3.58-5.25
s	40-50					
sd	14/5mm					

(5871)	n	min-max	μ	s	v	$\mu \pm s$
ccd	30	3.70-5.54	4.64	0.48	10.4	4.15-5.13
s	40-50					
sd	5/2mm					

Description: Cerioid colony. Calicular outline irregularly polygonal. Septa perforated at their inner margin, in cross section externally slightly thicker, then equally in thickness. Symmetry of septa irregular. Septa occasionally connected to



each other. Septal lateral face with pennulae. Pali absent. Costae present, confluent. Synapticulae present, occasional, mainly in the space between corallites. Columella absent or as some small elements, presumably trabecular extensions of septal inner margins. Endotheca unknown. Wall not compact, synapticulothecal. Coenosteum absent. Budding extracalical.

Remarks: All specimens are small and poorly preserved. Longitudinal thin sections could not be obtained.

Occurrence: Beds A (BSPG 2003 XX 5871); A5-12 (BSPG 2003 XX 5833); D2 (BSPG 2003 XX 5877).

Other occurrences: Barremian of France (Doubs) Morteau (MHNN 26751). Aptian of Mexico (Puebla) San Juan Raya, Lomo de los Gatos (ERNO L-R10966). Lower Aptian of Greece (Viotía) Levadia, Perachorion; Italy (Abruzzi, L'Aquila) Monti d'Ocre, Fossa Cerasetti. Lower Upper Aptian of Spain (Cataluña, Lérida) Com. La Noguera, Mun. Vilanova de Meià, Montsec de Rubies, section NW La Cabrua quarry (BSPG 2003 XX 6335). Uppermost Aptian of Spain (Cataluña, Lérida) Com. Alt Urgell, Mun. Coll de Nargó, Set Comelles, El Caso section. Lower Albian of Mexico (Sonora) Municipio Opodepe, Tuape, Cerro de la Espina (ERNO 2202). Lower Cenomanian (Mantelli zone) of Germany (Nordrhein/Westfalen) Mülheim/Ruhr, Kassenberg (BSPG 2003 XX 1135).

***Thalamocaeniopsis* ALLOITEAU, 1954**

Type species: *Thalamocaeniopsis ouenzensis* ALLOITEAU, 1954, by original designation.

***Thalamocaeniopsis explanata* (REIG ORIOL, 1994)**

(Pl. 4, figs. 7-9)

Material: BSPG 2003 XX 5814, 5865; 2 thin sections.

Synonymy:

*v 1994 *Microsolena explanata* n. sp. - REIG ORIOL, p. 33, Pl. 4, fig. 8; Pl. 5, fig. 1

Dimensions:

(5814)	n	min-max	μ	s	v	μ±s
clmin	20	2.67-4.61	3.55	0.59	16.5	2.95-4.13
clmax	20	4.14-6.15	5.14	0.58	11.3	4.55-5.72
ccd	20	2.68-4.88	3.73	0.56	14.9	3.17-4.29
s	10	48-62	55.3	5.2	9.3	50-61
sd	7/2mm					

Description: Cerioid colony. Calicular outline polygonal. Septa perforated at their inner margin. Microstructure of large trabeculae. Septa in cross

section externally slightly thicker, then equally in thickness. Symmetry of septa irregular. Cycles of septa irregular, but size orders can be distinguished. Septal generations differ in length. Septa of younger generations often connected to the septa of preceding ones. Septal distal margin unknown, lateral face with pennulae and thorns, inner margin smooth. Pali absent. Costae absent. Synapticulae occasional, mainly in the space between corallites. Columella composed of isolated trabeculae or one more solid element. Endotheca consists of tabulae. Wall compact, synapticulothecal. Coenosteum absent. Budding extracalical.

Occurrence: Bed A5-12 (BSPG 2003 XX 5814, 5865).

Other occurrences: Lower Valanginian of Spain (Andalucía, Jaén) Sierra de Cazorla, Cabañas, Puerto Llano section (ERNO L-1217007). Upper Barremian to Lower Aptian of Poland, Malopolskie (UJ nn). Lower Aptian of Greece (Viotía) Levadia, Perachorion (BSPG 2003 XX 5723). Aptian to Albian of Greece (Fokída) Mariolada, S spring Kria Vrissi, trail section (BSPG 2009 XV 21). Upper Aptian of Spain (Valencia, Castellón) Benicasin, La Venta (FGUB LV-31). Upper Aptian (Nolani zone) of Spain (Cataluña, Barcelona) Com. Garraf, Mun. Vilanova i la Geltrú, Las Mesquites.

***Thalamocaeniopsis* sp.**

(Pl. 4, figs. 10-11)

Material: BSPG 2003 XX 5885; 2 thin sections.

Synonymy:

v 2004 *Isastrea minima* PREVER, 1909 - LÖSER & MOHANTI, p. 583, Fig. 2.c

Dimensions:

(5885)	n	min-max	μ	s	v	μ±s
clmin	4	4.76-6.16	5.63	0.61	10.8	5.02-6.24
clmax	3	6.16-8.04	7.26	0.98	13.5	6.28-8.25
ccd	13	5.45-7.59	6.28	0.72	11.4	5.56-7.00
s	3	48-62	45.0	4.58	10.1	40.4-49.6
sd	12/5mm					

Description: Cerioid colony. Calicular outline polygonal. Septa perforated at their inner margin. Microstructure of large trabeculae. Septa in cross section externally slightly thicker, then equally in thickness. Symmetry of septa irregular. Cycles of septa irregular, but size orders can be distinguished. Septal generations differ in length. Septa of younger generations often connected to the septa of preceding ones. Septal distal margin un-



known, lateral face with pennulae and thorns, inner margin smooth. Pali absent. Costae absent. Synapticulae occasional, mainly in the space between corallites. Columella composed of isolated trabeculae. Endotheca unknown. Wall compact, synapticulothecal. Coenosteum absent. Budding extracalicular.

Occurrence: Bed C4 (BSPG 2003 XX 5885).

Other occurrences: Cenomanian of India (Tamil Nadu [= Madras]) Kunnam. Lower Cenomanian (Dixoni zone) of Spain (Cantabria, Santander) Cobreces, Luaña playa (BSPG 2007 V 104).

Family Microsolenidae Koby, 1889

Eocomoseris MELNIKOVA *et al.*, 1993

Type species: *Eocomoseris gurumdyensis* RONIEWICZ, 2011, nom. nov. pro *Eocomoseris ramosa* MELNIKOVA *et al.*, 1993, by original designation.

Eocomoseris sp.

(Pl. 5, figs. 1-3)

Material: BSPG 2003 XX 5891; 3 thin sections.

Dimensions:

(5891)	n	min-max	μ	s	v	$\mu \pm s$
clmin	7	2.25-3.01	2.62	0.27	10.5	2.34-2.90
clmax	8	2.19-3.04	2.70	0.34	12.6	2.36-3.05
ccd	9	2.01-3.16	2.61	0.39	15.1	2.21-3.00
s	4	18-21	19.25	1.25	6.5	
sd	6/2mm					

Description: Astreoid colony. Septa irregularly perforated. Microstructure of large trabeculae. Septa in cross section equal in thickness throughout the whole septum. Symmetry of septa irregular, but two size orders can be distinguished. Septal generations differ in length. Septa occasionally connected to each other. Septal distal margin unknown, lateral face with pennulae, inner margin smooth. Pali absent. Some septa may be attached to the columella. Costae present, sub-confluent to non-confluent. Synapticulae fairly common. Columella styliform. Endotheca absent. Coenosteum narrow (approx. 20% c), consists of costae. Budding extracalicular.

Occurrence: Bed D1 (BSPG 2003 XX 5891).

Microsolena LAMOUROUX, 1821

Type species: *Microsolena porosa* LAMOUROUX, 1821, by monotypy.

Microsolena ? interjecta ALLOITEAU, 1958

(Pl. 5, figs. 4-6)

Material: BSPG 2003 XX 5832; 3 thin sections.

Dimensions:

(5832)	n	min-max	μ	s	v	$\mu \pm s$
ccd	20	2.18-3.57	2.74	0.44	16.2	2.30-3.19
s	10	32-40	36.10	2.84	7.8	33-39
sd	5/1mm					
sdt	6/1mm					

Description: Thamnasterioid colony. Septa regularly perforated. Microstructure of large trabeculae. Septa in cross section equal in thickness throughout the whole septum. No septal symmetry. Septa not connected to each other. Septal distal margin with large regular granules, lateral face with pennulae, inner margin unknown. Pali absent. Costae present, confluent. Synapticulae present, abundant. Columella poorly defined, probably some isolated trabeculae. Endotheca absent. Budding extracalicular.

Remarks: *M. interjecta* is a Jurassic species, but no other name was available for the present specimen.

Occurrence: Bed A5-12 (BSPG 2003 XX 5832).

Other occurrences: Lower Cenomanian of France (Charente-Maritime) Fouras (BSPG 2003 XX 5599). Upper Cenomanian of France (Bouches-du-Rhône) Martigues, trench along road between Martigues and La Couronne (BSPG 2003 XX 5399).

Family Negoporitidae ELIÁŠOVÁ, 1995

Negoporites ELIÁŠOVÁ, 1989

Type species: *Porites michelini* REUSS, 1846, by original designation.

Negoporites spissus (POČTA, 1887)

(Pl. 5, figs. 7-9)

Material: BSPG 2003 XX 5834, 5856, 5863, 5866; 4 thin sections.



Synonymy:

- v 1887 *Porites spissus* POČTA, p. 28, Pl. 1, fig. 5.a-b
- v 1989 *Goniopora michelini* (REUSS, 1845) - LÖSER, p. 145, Figs. 47-49, Pl. 27, fig. 7
- v 1989 *Mesomorpha* cf. *ornata* MORYCOWA, 1971 - LÖSER, p. 120, Fig. 24
- v 2014 *Negoporites spissus* (POČTA, 1887) - LÖSER, p. 41, Fig. 6.k

Dimensions:

(5834)	n	min-max	μ	s	v	μ±s
clmin	20	1.21-1.66	1.43	0.11	7.9	1.31-1.54
ccd	20	1.42-2.11	1.79	0.22	12.4	1.56-2.01
s	24					
sd	6/1mm					

Description: Astreoid colony. Calicular outline circular to slightly elliptical. Coral surface plain. Septa irregularly perforated, in cross section thick close to the wall, thinner towards the centre. Symmetry of septa bilateral. Cycles of septa sub-regular. Septal cycles differ in length, but hardly at all in thickness. Septa of younger cycles often and regularly connected to the septa of preceding ones. Septal lateral face with pennulae, inner margin smooth. Pali irregularly present. Septa are not attached to the columella. Costae present, non-confluent. Synapticulae present, fairly common, mainly in the wall area. Columella small, substyliform. Endotheca consists of numerous thin tabulae. Wall practically not existent. Coenosteum medium broad, consists of trabeculae and tabulae. Budding extracalicular.

Occurrence: Bed A5-12 (BSPG 2003 XX 5834).

Other occurrences: Lower Cenomanian (Dixon zone) of Spain (Cantabria, Santander) Cobreces, Luaña playa (BSPG 2007 V 086). Upper Cenomanian (Guerangeri zone) of Czech Republic (Central Bohemian region) Korycany [= Koritzan]; Korycany, Netreba (CGS HF 1558). Upper Cenomanian (Plenus zone) of Germany (Sachsen) Dohna, Kahlbusch, western part; Dresden-Plauen, Ratssteinbruch, southern quarry.

Family Synastreaeidae ALLOITEAU, 1952

***Brachycoenia* M. BEAUVAIS, 1982**

Type species: *Adelastrea leptophylla* REUSS, 1854, by original designation.

***Brachycoenia* sp.**

(Pl. 5, figs. 10-12)

Material: BSPG 2003 XX 5949; 2 thin sections.

Dimensions:

(5949)	n	min-max	μ	s	v	μ±s
clmin	15	4.67-6.81	5.41	0.62	11.6	4.78-6.04
clmax	15	4.81-7.04	5.78	0.68	11.8	5.09-6.46
ccd	30	6.64-9.92	8.51	1.11	13.0	7.40-9.63
s	5	44-57	49.20	4.96	10.1	
sd	15/5mm					

Description: Thamnasterioid colony. Corallites slightly elevated over the colony surface. Septa compact. Microstructure of large trabeculae. Septa in cross section thick close to the wall, thinner towards the centre. Symmetry of septa irregular. No septal generations. Septa occasionally connected to each other close to the calicular centre. Septal distal margin coarsely granulated, lateral face with pennulae. Pali absent. Costae present, confluent or sub-confluent. Synapticulae present, occasional, mainly in the space between corallites. Columella composed of isolated trabeculae or one more solid element. Endotheca absent. Coenosteum poorly defined because of the type of the calicular arrangement. Budding extracalicular.

Occurrence: Bed C1 (BSPG 2003 XX 5949).

Other occurrences: Upper Aptian of Greece (Viotia) Aliartos, Chiarmena (BSPG 2003 XX 6182). Santonian of Austria (Salzburg) Rußbach, Zimmergraben (MHE A1222).

***Synastrea* MILNE EDWARDS & HAIME, 1848**

Type species: *Astrea agaricites* GOLDFUSS, 1826, by monotypy.

***Synastrea* sp.**

(Pl. 6, figs. 1-3)

Material: BSPG 2003 XX 5817, 5879, 5930, 5969; 2 thin sections.

Dimensions:

(5832)	n	min-max	μ	s	v	μ±s
ccd	30	3.82-6.79	5.2	0.81	15.5	4.39-6.01
s	15	26-38	29.9	4.0	13.4	26-34
sd	10/5mm					



Description: Thamnasterioid colony. Calicular centres slightly depressed. Septa compact. Microstructure of large trabeculae. Septa in cross section externally thicker, thinner toward the centre. Symmetry of septa irregular. No septal generations. Septa occasionally connected to each other close to the calicular centre. Septal distal margin coarsely granulated, lateral face with pennulae, inner margin smooth. Pali absent. Costae present, confluent or sub-confluent. Synapticulae present, occasional, mainly in the space between corallites. Columella unknown. Endotheca absent. Coenosteum poorly defined because of the type of the calicular arrangement. Budding extracalicular.

Occurrence: Beds A5-12 (BSPG 2003 XX 5817); C5 (BSPG 2003 XX 5969); C6 (BSPG 2003 XX 5879, 5930).

Other occurrences: Lower Aptian of Greece (Viotia) Arachova (BSPG 2003 XX 5563). Santonian of Austria (Oberösterreich) Russbach, Pass Gschütt area (MHE A0624); Austria (Salzburg) Rußbach, Randobach (MHE A0841). Campanian to Maastrichtian of Jamaica (St. James) Catadupa (NMNH #442).

Superfamily Eugyroidea ACHIARDI, 1875

Remarks: The families of this superfamily were formerly assigned to different suborders. The family Eugyridae was assigned to the suborder Faviina, that is, as explained above, poorly defined. The family Solenocoeniidae was without systematic position when established. It corresponds to the family Cyathophoridae VAUGHAN & WELLS, 1943. This family cannot be applied because the lectotype of the type species of the genus *Cyathophora* MICHELIN, 1842, does not show the characteristics ascribed to it. The genera of the informal group of the genus *Felixigyra* were assigned to the families Eugyridae and Trochoidomeandridae TURNŠEK & MIHAJLOVIC, 1981.

Family Eugyridae ACHIARDI, 1875

Hydnophoraraea OPPENHEIM, 1930

Type species: *Monticularia styriaca* MICHELIN, 1847.

Hydnophoraraea styriaca (MICHELIN, 1847)

(Pl. 6, figs. 4-6)

Material: BSPG 2003 XX 5899; 2 thin sections.

Synonymy:

- * 1847 *Monticularia styriaca* MICHELIN, p. 295, Pl. 68, fig. 2
- 1930 *Hydnophoraraea styriaca* - OPPENHEIM, p. 224, Pl. 14, fig. 4; Pl. 18, figs. 1, 6

Dimensions:

(5899)	n	min-max	μ	s	v	$\mu \pm s$
ml	30	0.92-1.56	1.19	0.17	14.4	11.01-1.36
md	30	1.66-2.41	2.02	0.21	10.5	1.81-2.23
s	20	9-18	13.7	2.4	17.5	11.3-16.1
sl	0.3-0.4mm					
sd	3/1mm					

Description: Hydorphoroid colony. Monticules elevated, conical, with small centres. Corallites indistinct. Septa compact, in cross section equal in thickness throughout the whole septum. Symmetry of septa irregularly radial. Cycles of septa irregular, but size orders can be distinguished. Septal generations differ in length. Septa occasionally connected to each other, by means of their swollen inner margins. Septal lateral face with thorns, inner margin T-shaped in places. Pali, costae, and synapticulae absent. Columella absent or as some small elements, presumably trabecular extensions of septal inner margins. Endotheca consists of tabulae. Coenosteum absent. Budding intracalicular.

Occurrence: Bed A5-12 (BSPG 2003 XX 5899).

Other occurrences: Lower Cenomanian (Dixoni zone) of Spain (Cantabria, Santander) Cobreces, Luaña playa (BSPG 2007 V 316). Middle Cenomanian of Germany (Bayern) Roßstein-Almen (LFU 8336SG015012#1). Santonian of Austria (Oberösterreich) Russbach, Pass Gschütt area (MHE A0346); Austria (Salzburg) Rußbach, Randobach (MHE A0608).

Parnassomeandra

MORYCOWA & MARCOPOULOU-DIACANTONI, 2002

Type species: *Parnassomeandra diacantoniae* MORYCOWA & MARCOPOULOU-DIACANTONI, 2002, by original designation.

Parnassomeandra steuberi LÖSER, 2013 (Pl. 6, figs. 7-9)

Material: BSPG 2003 XX 5893, 5927, 5928; 3 thin sections.

Synonymy:

- *v 2013a *Parnassomeandra steuberi* LÖSER, p. 14, Figs. 5.f-i



Dimensions:

(5928)	n	min-max	μ	s	v	μ±s
cl	15	2.85-3.48	3.12	0.19	6.0	2.93-3.31
c	15	4.08-4.99	4.59	0.27	5.7	4.32-4.85
sd	7/5mm					

Remarks: A detailed description of the species was given in LÖSER (2013a).

Occurrence: Beds C5 (BSPG 2003 XX 5893); C6 (BSPG 2003 XX 5928); C9 (BSPG 2003 XX 5927).

Other occurrences: Upper Lower Albian (Mammillatum zone) of France (Aude) Padern, SE Le Crès, 1.45 km WWS Padern.

Family Solenocoeniidae RONIEWICZ, 2008

Confusaforma LÖSER, 1987

Type species: *Confusaforma weyeri* LÖSER, 1987, by original designation.

***Confusaforma weyeri* LÖSER, 1987**

(Pl. 6, figs. 10-12)

Material: BSPG 2003 XX 5827; 2 thin sections.

Synonymy:

- vp 1909 *Polytremacis glomerata* - PREVER, p. 69, Pl. 27, fig. 2
- *v 1987 *Confusaforma weyeri* LÖSER, p. 234, Pl. 1, figs. 1-3
- v 1989 *Confusaforma weyeri* LÖSER, 1987 - LÖSER, p. 104, Figs. 10-13, Pl. 22, figs. 1-5
- v 2003 *Confusaforma weyeri* LÖSER, 1987 - BARON-SZABO & GONZÁLEZ LEÓN, p. 207, Fig. 7.B
- v 2014b *Confusaforma weyeri* LÖSER, 1987 - LÖSER, p. 46, Fig. 7.g
- v 2015b *Confusaforma weyeri* LÖSER, 1987 - LÖSER, p. 16, Fig. 1.A-C

Dimensions:

(5827)	n	min-max	μ	s	v	μ±s
clmin	15	0.40-0.73	0.57	0.08	14.5	0.48-0.65
clmax	15	0.57-1.03	0.74	0.14	18.5	0.60-0.87
ccd	15	1.16-2.02	1.53	0.23	15.3	1.29-1.76
s	3-6					

Description: Cerioid colony. Calicular outline irregular. Septa compact. Septa in cross section thick close to the wall and of triangular outline. Symmetry of septa irregular. Septa very short, reduced to ridges, not connected to each other. Septal lateral face smooth, inner margin smooth. Pali absent. Costae, synapticulae, and columella

absent. Endotheca consists of numerous and regular tabulae. Wall compact, structure unknown. Budding extracalicular.

Occurrence: Bed A5-12 (BSPG 2003 XX 5827).

Other occurrences: Lower Aptian of Italy (Abruzzi, L'Aquila) Monti d'Ocre, Fossa Mezza Spada; Slovenia (West Slovenia) Banskja Planota, Osojnica (SAZU P-525). Lower Albian of Mexico (Sonora) Municipio Opodepe, Tuape, Cerro de la Espina. Lower Cenomanian (Dixoni zone) of Spain (Cantabria, Santander) Cobreces, Luaña playa (BSPG 2007 V 230). Upper Cenomanian of Czech Republic (Central Bohemian region) Kolín, Planany (CGS HF 2476). Upper Cenomanian (Pleenus zone) of Germany (Sachsen) Dresden-Plauen, Ratssteinbruch, former quarries; Dresden-Plauen, Ratssteinbruch, southern quarry.

***Cryptocoenia* ORBIGNY, 1849**

Type species: *Astrea alveolata* GOLDFUSS, 1826, by monotypy.

***Cryptocoenia* cf. *biedai* (MORYCOWA, 1964)**

(Pl. 7, figs. 1-3)

Material: BSPG 2003 XX 5848, 5881; 4 thin sections.

Synonymy:

- vp 1884 *Astrocoenia bulgarica* nov. sp. - TOULA, p. 1317, Pl. 6, fig. 4
- vp 1889 *Cryptocoenia ramosa* nov. spec. - TOULA, p. 83, Pl. 5, figs. 10-11
- vp 1891 *Cyathophora atempa* - FELIX, p. 155, Pl. 25, figs. 7-8
- v 1981 *Cyathophora steinmanni* FRITZSCHE, 1924 - TURNŠEK & MIHAJLOVIC, p. 18, Pl. 13, figs. 3-4
- 1993 *Pseudocoenia beskidena* ELIÁŠOVÁ, 1981 - BARON-SZABO & STEUBER, p. 8, Pl. 3, fig. 3
- v 2013 *Cryptocoenia bulgarica* (TOULA, 1884) - LÖSER, WERNER & DARGA, p. 64, Pl. 9, figs. 2-3
- v 2015b *Cryptocoenia biedai* (MORYCOWA, 1964) - LÖSER, p. 19, Fig. 2.D-F

Dimensions:

(5881)	n	min-max	μ	s	v	μ±s
clmin	30	1.54-1.99	1.80	0.13	7.5	1.66-1.93
clmax	20	1.80-2.53	2.19	0.22	10.1	1.97-2.41
ccd	30	1.80-2.76	2.24	0.27	12.1	1.97-2.52
s	6-12					

Description: Plocoid colony. Calicular outline elliptical. Septa compact. Symmetry of septa radial and regularly hexamerous. Cycles of septa subregular. Septal cycles differ in length. Septa very short, often hardly visible. Septa not con-



nected to each other. Septal lateral face smooth, inner margin smooth. Pali absent. Costae present, confluent or sub-confluent. Synapticulae and columella absent. Endotheca of numerous regular tabulae. Wall compact, probably parathecal. Coenosteum very narrow (approx. 10% c). Budding extracalicular.

Remarks: The present material differs from *C. biedai* by slightly larger calicular dimensions.

Occurrence: Beds A5-12 (BSPG 2003 XX 5848, 5855); C6 (BSPG 2003 XX 5881).

Other occurrences: Barremian of Mexico (Puebla) Tehuacán, San Antonio Texcala. Barremian (Moutoniceras - Giraudi zone) of France (Drôme) Serre de Bleyton (NHMW 2008z0096/19). Upper Barremian of Poland (Malopolskie, Tarnów) Tarnów, Trzemesna. Lower Aptian of Greece (Viotía) Arachova; Serbia (East Serbia) Pirot; Zljebine. Upper Aptian of Spain (Vascongadas, Vizc5855, aya) Gamecho, Playa de Laga. Lower Albian of Spain (Cantabria, Santander) Cabo de Ajo (ERNO L-4706); Mexico (Sonora) Municipio Opodepe, Tuape, Cerro de la Espina. Upper Lower Albian (Mammillatum zone) of France (Aude) Padern, SE Le Crès, 1.45 km WWS Padern (SMF 75633). Middle Albian of Greece (Viotía) Aliartos, Korónia. Upper Albian of UK (Devonshire) Exeter, Haldon Hill (NHM R23570). Middle Cenomanian of Germany (Bayern) Roßstein-Almen. Upper Cenomanian (Guerangeri zone) of Czech Republic (Central Bohemian region) Korycany, Natreba (CGS HF 1481).

***Cryptocoenia corbariensis*
(ALLOITEAU, 1948)**

(Pl. 4, fig. 12)

Material: BSPG 2003 XX 5841, 5897; 1 thin section.

Synonymy:

- 1857 *Cyathophora icaunensis* - FROMENTEL, p. 41
- *v 1948 *Cyathophora corbariensis* ALLOITEAU, p. 721, Fig. 9, Pl. 26, fig. 8; Pl. 27, fig. 3
- v 2013 *Cryptocoenia corbariensis* (ALLOITEAU, 1948) - LÖSER, p. 34, Fig. 11.j-l

Dimensions:

(5897)	n	min-max	μ	s	v	μ±s
clmin	15	2.75-3.64	3.09	0.25	8.2	2.84-3.35
clmax	15	3.12-3.91	3.45	0.21	6.2	3.23-3.66
ccd	15	3.04-4.97	3.97	0.68	17.1	3.28-4.65
s	12					

Description: Plocoid colony. Calicular outline elliptical. Septa compact. Symmetry of septa radial and regularly hexamerall. Cycles of septa regular. Septal cycles differ in length. Septa not connected to each other. Septal lateral face smooth (probably due to preservation), inner margin smooth. Pali absent. Costae present, confluent or sub-confluent. Synapticulae and columella absent. Endotheca unknown. Wall compact, probably parathecal. Coenosteum very narrow (approx. 10% c). Budding extracalicular.

Occurrence: Bed A5-12 (BSPG 2003 XX 5841, 5897).

Other occurrences: Lower Hauterivian (Radiatus zone) of France (Yonne) Gy-l'Evêque. Upper Lower Albian (Mammillatum zone) of France (Aude) Padern; Padern, SE Le Crès, 1.45 km WWS Padern. Lower Cenomanian of France (Charente-Maritime) Fouras (BSPG 2003 XX 5592).

***Cryptocoenia jacobii* (ALLOITEAU, 1948)**

(Pl. 7, figs. 4-6)

Material: BSPG 2003 XX 5860; 2 thin sections.

Synonymy:

- *v 1948 *Cyathophora Jacobii* ALLOITEAU, p. 722, Pl. 27, figs. 1, 7-8
- v 1963 *Plesiastraea sulcati-lamellosa* FROMENTEL - REYEROS NAVARRO, p. 18, Pl. 1, fig. 2
- v 1995 *Adelocoenia neocomiensis* (ORBIGNY, 1850) - LÖSER & RAEDER, p. 42
- v 1998 *Adelocoenia neocomiensis* (ORBIGNY, 1850) - SCHÖLLHORN, p. 74, Fig. 35, Pl. 19, figs. 7, 10; Pl. 28, fig. 3
- v 2013a *Cryptocoenia jacobii* (ALLOITEAU, 1948) - LÖSER, p. 35, Figs. 11.f-g [= here detailed synonymy]

Dimensions:

(5860)	n	min-max	μ	s	v	μ±s
clmin	25	2.90-3.59	3.20	0.19	6.2	3.00-3.40
clmax	25	2.97-3.78	3.45	0.24	7.1	3.20-3.69
ccd	30	3.6-4.74	4.09	0.34	8.4	3.74-4.43
s	12-24					

Description: Plocoid colony. Calicular outline elliptical. Septa compact. Symmetry of septa radial and regularly hexamerall. Cycles of septa subregular. Septal cycles differ in length. Septa not connected to each other. Septal lateral face smooth, inner margin smooth. Pali absent. Costae present, confluent or sub-confluent.



Synapticulae and columella absent. Endotheca of numerous regular tabulae. Wall compact, probably parathecal. Coenosteum very narrow (approx. 10% c). Budding extracalicular.

Occurrence: Bed A5-12 (BSPG 2003 XX 5860).

Other occurrences: Lower Hauterivian (Radiatus zone) of France (Yonne) Fontenoy, field S the junction to Les Merles (BSPG 2003 XX 5407); Gy-l'Evêque, fields SW Gy-l'Evêque (BSPG 2003 XX 6408). Aptian of Mexico (Puebla) San Juan Raya; San Juan Raya, Lomo de los Gatos (ERNO L-7239). Lower Aptian of Greece (Viotía) Levadia, Perachorion. Lower Upper Aptian of Spain (Cataluña, Lérida) Com. Alt Urgell, Mun. Cabó, Senyús section. Upper Aptian to Albian of Iran (Esfahan) Esfahan Basin, Dizlu (PIUEN b35). Uppermost Aptian of Spain (Cataluña, Lérida) Com. Alt Urgell, Mun. Coll de Nargó, Set Comelles, El Caso section. Lower to Middle Albian of Spain (Valencia, Alicante) Sierra de Seguilí. Upper Lower Albian (Mammillatum zone) of France (Aude) Padern. Lower Upper Albian (Inflatum zone) of Spain (Valencia, Alicante) Sierra de Llorençá. Upper Albian of UK (Devonshire) Exeter, Haldon Hill (NHM R06502). Cenomanian of India (Tamil Nadu [= Madras]) Kunnam.

Cryptocoenia* cf. *miyakoensis
(EGUCHI, 1936)

(Pl. 7, figs. 7-9)

Material:

BSPG 2003 XX 5883, 5923; 2 thin sections.

Synonymy:

- v 2015b *Cryptocoenia* cf. *miyakoensis* (EGUCHI, 1936) - LÖSER, p. 20, Figs. 4.A-B

Dimensions:

(5883)	n	min-max	μ	s	v	μ±s
clmin	10	1.10-1.74	1.32	0.19	14.5	1.13-1.52
ccd	5	1.90-2.12	2.04	0.08	4.0	1.96-2.13
s	6					

Description: Plocoid colony. Calicular outline irregular circular. Septa compact. Microstructure of septa unknown. Symmetry of septa radial and hexamerous. Cycles of septa subregular. Septal cycles differ in length. Septa very short, reduced to ridges, not connected to each other. Septal lateral face smooth, inner margin smooth. Pali absent. Costae unknown. Synapticulae and columella absent. Endotheca consists of numerous tabulae. Wall compact, probably parathecal. Coenosteum very narrow. Budding extracalicular.

Remarks: The only specimen is poorly preserved and only few measurements were possible. The material, which probably represents a new and yet undescribed species, is distinguished from *C. miyakoensis* by larger calicular dimensions.

Occurrence: Beds C7 (BSPG 2003 XX 5923); C9 (BSPG 2003 XX 5883).

Other occurrences: Lower Aptian of Greece (Viotía) Levadia, Perachorion (BSPG 2003 XX 5768). Aptian to Lower Albian of Japan (Iwateken) Miyako-shi, Sakiyama, Hideshima (TUM L-NN-10). Upper Aptian of Japan (Miyagi-ken) (TUM L-NN-9). Lower Albian of Mexico (Sonora) Municipio Cucurpe, Cucurpe, La Mesa; Municipio Opo-depe, Tuape, Cerro de la Espina.

***Cryptocoenia* sp.**

(Pl. 7, figs. 10-12)

Material: BSPG 2003 XX 5835, 5862, 5924, 5926, 5966; 3 thin sections.

Synonymy:

- 1993 *Pentacoenia pulchella* ORBIGNY, 1850 - BARON-SZABO & STEUBER, p. 18
- v 2015 *Cryptocoenia* sp. - LÖSER, ARIAS & VILAS, p. 58, Fig. 8.d-f

Dimensions:

(5835)	n	min-max	μ	s	v	μ±s
clmin	20	1.31-1.81	1.54	0.14	9.3	1.39-1.68
clmax	20	1.69-2.25	1.92	0.15	8.1	1.76-2.07
ccd	30	1.74-2.72	2.15	0.27	12.3	1.88-2.41
s	6					

Description: Plocoid colony. Calicular outline irregular circular. Septa compact. Microstructure of septa unknown. Symmetry of septa radial and hexamerous. Cycles of septa subregular. Septal cycles differ in length. Septa very short, reduced to ridges, not connected to each other. Septal lateral face smooth, inner margin smooth. Pali absent. Costae present, confluent or sub-confluent, surface unknown. Synapticulae and columella absent. Endotheca consists of numerous tabulae. Wall compact, probably parathecal. Coenosteum narrow, consists of costae and tabulae. Budding extracalicular.

Occurrence: Beds A5-12 (BSPG 2003 XX 5835, 5862); C5 (BSPG 2003 XX 5966); C9 (BSPG 2003 XX 5924, 5926).

Other occurrences: Lower Aptian of Greece (Viotía) Arachova. Upper Aptian of Spain (Vascongadas, Vizcaya) Gamecho, Playa de Laga. Upper Albian of Spain (Murcia) Jumilla, Sierra del Carche.



Felixigyrids, informal group

Remarks: The informal group encompasses two genera of the Lower Cretaceous and Lower Cenomanian. For details compare to LÖSER (2013d).

Felixigyra PREVER, 1909

Type species: *Felixigyra deangelisi* PREVER, 1909, by subsequent definition in WELLS (1936).

Felixigyra sp.
(Pl. 8, figs. 1-3)

Material: BSPG 2003 XX 5816; 3 thin sections.

Synonymy:

v 2010a *Felixigyra* sp. - LÖSER, p. 195, Fig. 7

Dimensions:

(5816)	n	min-max	μ	s	v	μ±s
crw	15	0.82-1.37	1.13	0.17	14.8	0.96-1.29
md	10	1.37-1.97	1.67	0.24	14.4	1.42-1.90

sd 7/2mm

Description: Hydrophoroid colony. Monticules conical, but thick. Corallites distinct. Septa compact. Septa in cross section thick throughout the whole septum. No septal symmetry, only two irregular size orders. Septal lateral face occasionally with thorns, inner margin T-shaped and swollen. Pali, costae, synapticulae, and columella absent. Endotheca consists of dissepiments. Wall compact, septothecal. Coenosteum absent. Budding intracalicular, polystomodeal.

Occurrence: Bed A5-12 (BSPG 2003 XX 5816).

Other occurrences: Lower Albian of Mexico (Sonora) Municipio Ures, Cerro de Oro (ERNO 3142).

Rhipidomeandra MORYCOWA & MASSE, 1998

Type species: *Rhipidomeandra bugrovae* MORYCOWA & MASSE, 1998, by original designation.

Rhipidomeandra sp.
(Pl. 8, figs. 4-6)

Material: BSPG 2003 XX 5818, 7443; 3 thin sections.

Synonymy:

v 2013d *Rhipidomeandra* sp. 2 - LÖSER, p. 14, Fig. 1

Dimensions:

(5818)	n	min-max	μ	s	v	μ±s
crw	25	0.55-0.85	0.7	0.08	11.5	0.61-0.77
crd	20	1.16-1.87	1.55	0.19	12.4	1.35-1.74

sd 7/2mm

Description: Meandroid-hydrophoroid colony. Calicular rows long and straight. Corallites partly distinct. No neighbouring corallites in one row. Valley septa absent. Septa compact, in cross section thick throughout the whole septum. Symmetry of septa irregular, but two size orders can be distinguished. Cycles of septa subregular. Septal generations differ in length and thickness. Septa not connected to each other. Septal lateral face smooth (probably due to preservation), inner margin T-shaped and swollen. Pali, costae, synapticulae, and columella absent. Endotheca consists of tabulae. Wall compact, structure unknown. Collines tectiform. Coenosteum absent. Budding intracalicular, polystomodeal.

Remarks: This species was discussed in detail in LÖSER (2013d).

Occurrence: Bed A5-12 (BSPG 2003 XX 5818).

Superfamily Felixaraeoidea M. BEAUVAIS, 1982

Remarks: The families of this superfamily were formerly assigned to the suborder Fungiina VERRILL, 1865. The suborder was applied by ALLOITEAU (1952) and subsequent authors in a very broad sense for any coral with perforate septa and/or synapticulae (except Dendrophylliina). The suborder collected numerous families that vary considerably in their septal microstructure. Fungiina sensu stricto are corals with fulturae, e.g., only the Fungiidae, and perhaps the Astero-seriidae. All other families cannot remain in this suborder. Some families were already separated into the suborder Microsolenina (see above).

Family Lamellofungiidae ALLOITEAU, 1952

Kozaniastrea new genus

Origin of the name: After the region.

Type species: *Kozaniastrea pachysepta* n. sp.

Species: Only the type species.

Diagnosis: Cerioid colony with very thick compact septa in a subregular hexamerall symmetry. Without columella, pali and synapticulae. Endotheca well developed. Wall septothecal. Budding intracalicular, septal.



Comparison: From the only comparable genus *Lamellofungia* the new genus differs by the much more irregular septal insertion.

Description: Cerioid colony. Calicular outline irregularly polygonal, with a small diameter. Coral surface plane. Septa compact. Microstructure of septa unknown. Septa in cross section thick close to the wall, thinner towards the centre. Symmetry of septa radial and irregularly hexamerous. Cycles of septa subregular. Septal cycles differ in length and thickness. First septal cycle extends close to the calicular centre, later cycles are subsequently shorter. Septa not connected to each other. Septal distal margin unknown, lateral face with large granules, inner margin swollen. Pali absent. Costae hardly present, confluent. Synapticulae and columella absent. Endotheca consists of numerous tabulae. Wall subcompact, septothecal. Coenosteum absent. Budding intracalicular, septal.

Systematic position: Because of the lack of septal microstructures the systematic position is somewhat unsure. The outline of the septa, and their thickness suggest a position in the family Lamellofungiidae.

***Kozaniastrea pachysepta* n. sp.**

(Pl. 9, figs. 1-5)

Origin of the name: Because of the thick septa.

Holotype: BSPG 2009 XX 7449.

Material studied: Holotype BSPG 2003 XX 7449; 3 thin sections.

Type locality: Greece, Kozani, Nea Nikopoli, section A, bed 5-12.

Type level: Cretaceous, Lower Cenomanian.

Diagnosis: *Kozaniastrea* with a calicular diameter of 2-3mm and 11-14 septa.

Description: As for the genus.

Dimensions:

(7449)	n	min-max	μ	s	v	$\mu \pm s$
clmin	25	1.76-2.82	2.31	0.30	12.9	2.01-2.61
clmax	25	2.30-4.04	3.10	0.49	15.9	2.61-3.60
ccd	35	2.42-3.84	3.01	0.42	14.1	2.58-3.44
s	25	9-16	12.2	1.5	12.0	10.69-13.62

**Superfamily Haplaraeoidea
VAUGHAN & WELLS, 1943**

Remarks: The families of this superfamily were formerly assigned to the suborder Fungiina VERRILL, 1865. See above for explanations.

**Family Haplaraeidae
VAUGHAN & WELLS, 1943**

***Haplaraea* MILASCHEWITSCH, 1876**

Type species: *Haplaraea elegans* MILASCHEWITSCH, 1876, by monotypy.

***Haplaraea gracilis* (HACKEMESSER, 1936)**

(Pl. 8, figs. 7-9)

Material: BSPG 2003 XX 5854, 5958, 5960; 4 thin sections.

Synonymy:

v* 1936 *Elasmophyllia gracilis* HACKEMESSER, p. 34, Pl. 4, Figs. 8-9

Dimensions:

(5830)	
cl	17-19mm
s	ca. 120
sd	5/2mm
(5960)	
cl	15
s	80-90
sd	4/2mm

Description: Phaceloid colony. Calicular outline circular to elliptical. Septa perforated at their inner margin, in cross section slightly thicker close to the wall, becoming slightly thinner towards the centre. Symmetry of septa irregularly radial. Cycles of septa irregular, but size orders can be distinguished. Septal generations differ in length and thickness. Septa of younger generations in places attached to those of preceding generations. Septal distal margin unknown, lateral face with thorns, inner margin smooth. Pali and costae absent. Synapticulae rare. Columella difficult to separate from the perforated septal inner margins, probably consists of isolated trabecules. Endotheca with tabulae. Wall absent. Budding intracalicular.

Occurrence: Bed A5-12 (BSPG 2003 XX 5854, 5958, 5960).

Other occurrences: Cretaceous of Greece (Fokída) Kiona massif, Panourgias.



Superfamily Heterocoeniioidea
OPPENHEIM, 1930

Remarks: Most families of this superfamily were formerly assigned to the suborder Heterocoeniina M. BEAUVAIS, 1974. This suborder, based on a family originally assigned to the suborder Stylinina, was relatively well-limited and defined.

Family Agatheliidae
L. BEAUVAIS & M. BEAUVAIS, 1975

***Canleria* ELIÁŠOVÁ, 1996**

Type species: *Canleria clemens* ELIÁŠOVÁ, 1996, by original designation.

***Canleria clemens* ELIÁŠOVÁ, 1996**
(Pl. 8, figs. 10-12)

Material: BSPG 2003 XX 5852, 5859, 5951; 4 thin sections.

Synonymy:

- v* 1996 *Canleria clemens* ELIÁŠOVÁ, p. 255, Pl. 1, figs. 1-2; Pl. 2, figs. 1-4
v 2014a *Canleria clemens* ELIÁŠOVÁ, 1996 - LÖSER, p. 312, Figs. 7.1-3

Dimensions:

(5951)	n	min-max	μ	s	v	μ±s
clmin	25	1.16-1.69	1.43	0.12	8.6	1.30-1.55
clmax	25	1.33-1.89	1.58	0.13	8.6	1.44-1.72
c	30	2.02-3.50	2.79	0.38	13.6	2.41-3.17
ccd	30	1.94-3.93	2.79	0.49	17.7	2.30-3.29
s	6+6					

Description: Plocoid colony. Calicular outline circular to slightly elliptical. Septa compact, in cross section thick close to the wall, then equally very thin. Symmetry of septa radial and regularly hexamerall. Cycles of septa regular. Septal cycles differ in length and thickness. Septa not connected to each other. Septal lateral face with apophysal septa and thorns, inner margin rarely branching. Pali, costae, synapticalae and columella absent. Endotheca unknown. Wall compact, consists of horizontal trabeculae. Coenosteum medium broad (approx. 30% c), consists of dissepiments and trabeculae. Budding extracalicular.

Remarks: The species has just recently (LÖSER, 2014a) been revised.

Occurrence: Bed A5-12 (BSPG 2003 XX 5852, 5859, 5951).

Other occurrences: Upper Cenomanian of Czech Republic (Central Bohemian region) Kolín, Planany.

***Canleria* sp. 1**

(Pl. 9, figs. 6-8)

Material: BSPG 2003 XX 6149; 2 thin sections.

Synonymy:

- v 2014a *Canleria* sp. 1 - LÖSER, p. 314, Figs. 7.7-9

Dimensions:

(6149)	n	min-max	μ	s	v	μ±s
clmin	20	1.96-2.69	2.33	0.23	10.1	2.09-2.57
clmax	20	2.17-3.24	2.61	0.29	11.1	2.32-2.90
c min	20	3.85-5.16	4.29	0.39	9.2	3.90-4.69
ccd	20	3.29-5.71	4.23	0.71	16.6	3.53-4.95
s	6+6					

Remarks: A detailed description of the material was given in LÖSER (2014a).

Occurrence: Bed A5-12 (BSPG 2003 XX 6149).

Other occurrences: Lower Cenomanian of France (Charente-Maritime) Fouras.

***Canleria* sp. 2**

(Pl. 10, figs. 1-3)

Material: BSPG 2003 XX 5867; 3 thin sections.

Synonymy:

- v 2014a *Canleria* sp. 3 - LÖSER, p. 314, Figs. 8.1-3

Dimensions:

(5867)	n	min-max	μ	s	v	μ±s
clmin	4	3.77-4.59	4.29	0.38	8.8	3.91-4.67
clmax	4	4.38-5.25	4.82	0.38	7.8	4.44-5.20
c	4	6.04-7.66	6.74	0.80	11.8	5.94-7.54
ccd	4	8.71-9.43	9.06	0.34	3.7	8.72-9.40
s	12-15					

Remarks: A detailed description of the material was provided in LÖSER (2014a).

Occurrence: Bed A5-12 (BSPG 2003 XX 5867).

Family Heterocoeniidae
OPPENHEIM, 1930

***Styloheterocoenia* new genus**

Origin of the name: In relation to the genus *Heterocoenia* and (Latin) Stylus for bar or rod, referring to the pali originating from the costae.

Type species: *Styloheterocoenia hellenensis* n. sp.



Species: Type species and *S. brunni* n. sp.

Diagnosis: A member of the family Heterocoeniidae with external pali (costal pali; LÖSER, 2016c: 33) originating from the costae. Septa thick, compact, in a regular septal symmetry in various systems (trimeral, tetrameral, hexamer- al), finely ornamented at their later faces. Wall subcompact, septothecal. Endotheca well developed. Columella and synapticulae absent.

Description: Plocoid colony. Calicular outline irregular circular. Septa compact. Microstructure of small-sized trabeculae, septa with a median dark line. Septa in cross section thick close to the wall, thinner towards the centre. Symmetry of septa radial and regularly trimeral (in the type species). Cycles of septa regular. Septal cycles differ in length. First septal cycle extends close to the calicular centre, later cycles are subsequently shorter. Septa not connected to each other. Septal distal margin unknown, lateral face with fine thorns, inner margin slightly swollen in places. Pali absent. Costae present, non-confluent, with pali-like outgrowths, called costal pali. Synapticulae and columella absent. Endotheca consists of numerous and regular tabulae. Wall present, subcompact, septothecal. Coenosteum medium broad (approx. 50% c), consists of tabulae and costal pali. Budding extracalicular.

Comparison: The new genus compares well to *Heterocoenia*, but differs by pali-like upward-growing extensions of the costae that appear in the coenosteum as large isolated trabeculae.

Remarks: The genus is rather common in the Upper Albian to Cenomanian from the Western and Central Tethys, but rarely reported in the literature. It was found in Bavaria (Germany), Cantabria (Spain), Charente-Maritime (France), in the Kiona Massif (Greece), and in the Prebetic zone (Spain).

***Styloheterocoenia hellenensis* n. sp.**

(Pl. 11, figs. 1-4)

Origin of the name: In relation to the type area.

Holotype: BSPG 2009 XX 5837.

Material studied: Holotype with three thin sections.

Type locality: Greece, Kozani, Nea Nikopoli, section A, bed 5-12.

Type level: Cretaceous, Lower Cenomanian.

Diagnosis: *Styloheterocoenia* mit a trimeral septal symmetry, 12 septa, and a smaller inner calicular diameter of 4-5 mm.

Dimensions:

(5837)	n	min-max	μ	s	v	$\mu \pm s$
clmin	4	3.73-5.30	4.62	0.66	14.4	3.95-5.29
clmax	5	4.20-5.65	5.03	0.60	12.0	4.42-5.64
ccd	4	4.58-9.47	7.25	2.04	28.1	5.20-9.29
s	3+3+6					

***Styloheterocoenia brunni* n. sp.**

(Pl. 10, figs. 7-9)

Origin of the name: After J.H. BRUNN who was the first to describe the type locality.

Holotype: BSPG 2003 XX 5849 with two thin sections.

Paratype: BSPG 2003 XX 5847.

Material studied: Holotype, paratype.

Type locality: Greece, Kozani, Nea Nikopoli, section A, bed 5-12.

Type level: Cretaceous, Lower Cenomanian.

Diagnosis: *Styloheterocoenia* with a calicular diameter of 2-3 mm, a trimeral septal symmetry, and 6 to 12 septa.

Description: As for the genus.

Comparison: The species differs from *S. hellenensis* by smaller calicular dimensions and a lower number of septa.

Dimensions:

(5849)	n	min-max	μ	s	v	$\mu \pm s$
clmin	12	1.67-2.99	2.26	0.42	18.7	1.84-2.68
clmax	12	1.98-3.47	2.76	0.49	17.9	2.26-3.25
ccd	12	4.11-5.87	5.12	0.60	11.8	4.51-5.73
sys	3					
s	6-12					

***Styloheterocoenia* sp.**

(Pl. 12, figs. 1-3)

Material: BSPG 2003 XX 5937; 2 thin sections.

Dimensions:

(5837)	n	min-max	μ	s	v	$\mu \pm s$
cl	20	1.65-2.38	2.04	0.20	10.2	1.83-2.25
ccd	25	2.84-5.08	3.94	0.64	16.3	3.30-4.59
s	4+4					

Description: As for the genus.

Remarks: The only specimen is too poorly preserved to be used to establish a new species for it.

Occurrence: Bed A (BSPG 2003 XX 5937).

***Heterocoenia*****MILNE EDWARDS & HAIME, 1848**

Type species: *Lithodendron exigua* MICHELIN, 1847, subsequent definition in MILNE EDWARDS & HAIME (1851a).

Heterocoenia distans**(MILNE EDWARDS & HAIME, 1848)**

(Pl. 10, figs. 4-6)

Material:

BSPG 2003 XX 5819, 5840, 5864, 5873; 10 thin sections.

Synonymy:

*v 1848c *Dichocoenia ? distans* MILNE EDWARDS & HAIME, p. 308

Dimensions:

(5819)	n	min-max	μ	s	v	$\mu \pm s$
clmin	25	2.54-3.32	2.91	0.22	7.6	2.69-3.13
clmax	25	2.92-3.99	3.35	0.28	8.4	3.07-3.64
ccd	20	3.10-5.89	4.66	0.88	18.9	3.78-5.55
s	6+6					

Description: Plocoid colony. Calicular outline irregular circular. Septa compact, in cross section thick close to the wall and of triangular outline. Symmetry of septa radial and regularly hexamer. Cycles of septa subregular. Septal cycles differ in length and thickness. Septa not connected to each other. Septal distal margin unknown, lateral face with fine thorns, inner margin branching in places. No main septum. Pali absent. Costae present but short, non-confluent, rarely sub-confluent. Synapticulae and columella absent. Endotheca well developed, consists of tabulae and dissepiments. Wall compact, thin in places, paraseptothecal. Coenosteum narrow (approx. 25% c), consisting of dissepiments. Budding extracalicular.

Occurrence: Bed A (BSPG 2003 XX 5873); A5-12 (BSPG 2003 XX 5819, 5840, 5864).

Other occurrences: Lower Cenomanian of France (Charente-Maritime) Ile d'Aix. Santonian of Austria (Oberösterreich) Russbach, Pass Gschütt area (BSPG 2003 XX 6778); Austria (Salzburg) Rußbach, Randobach (MHE A0593); Rußbach, Zimmergraben (MHE A1054). Lower Upper Campanian of Spain (Cataluña, Lérida) Com. Pallars Jussà, Mun. Pallars Jussà, Pobla de Segur, Torallola (BSPG 2006 II 8).

Family Paronastreaeidae**M. BEAUVAIS, 1974*****Tiarasmilia* WELLS, 1932**

Type species: *Tiarasmilia casteri* WELLS, 1932, by original designation.

***Tiarasmilia* cf. *casteri* WELLS, 1932**

(Pl. 11, figs. 5-6)

Material: BSPG 2003 XX 5953, 5965; 3 thin sections.

Dimensions:

(5953)	
c	12
cl	9
s	24
(5965)	
c	20
cl	18
s	24

Description: Solitary turbinate coral. Calicular outline circular. Septa compact, in cross section thick close to the wall, thinner towards the centre. Symmetry of septa radial and regularly hexamer. Cycles of septa regular. Septal cycles differ in length and thickness. Septa not connected to each other. Septal lateral face with apophysal septa, inner margin branching. Pali absent. Costae present but short. Synapticulae and columella absent. Endotheca unknown. Wall compact, structure unknown.

Remarks: The material differs from *T. casteri* by a different septal ornamentation. In *Tiarasmilia* the apophysal septa are directed to the calicular centre whereas in the present material the apophysal septa grow in a rectangular angle from the septa.

Occurrence: Beds A5-12 (BSPG 2003 XX 5953); C5 (BSPG 2003 XX 5965).

***Tiarasmilia* sp.**

(Pl. 13, fig. 4)

Material: BSPG 2003 XX 5921; 2 thin sections.

Synonymy:

- 1997 *Trochoidomeandra* cf. *problematica* MORRYCOWA, 1971 - BARON-SZABO & FERNÁNDEZ MENDIOLA, p. 48, Fig. 5.e
- v 2010a *Tiarasmilia* sp. 1 - LÖSER, p. 162, Figs. 2.9, 3.1, 3.2
- v 2013a *Tiarasmilia* sp. - LÖSER, p. 18, Fig. 6.l

**Dimensions:**

(5921)	
c	10
cl	8
s	12

Description: Solitary turbinate coral. Calicular outline circular. Septa compact, in cross section thick close to the wall, thinner towards the centre. Symmetry of septa radial and regularly hexamer. Cycles of septa regular. Septal cycles differ in length and thickness. Septa not connected to each other. Septal lateral face with fine apophysal septa, inner margin swollen. Pali absent. Costae unknown. Synapticulae and columella absent. Endotheca unknown. Wall unknown.

Occurrence: Bed C7 (BSPG 2003 XX 5921).

Other occurrences: Upper Barremian of Mexico (Puebla) Tehuacán, La Compañía (IGM 9263). Aptian to Albian of Greece (Fokída) Kiona massif, Panourgias [= Dremisa] (BSPG 2003 XX 5901). Lower Albian of Spain (Cantabria, Santander) Cabo de Ajo; Mexico (Sonora) Municipio Cucurpe, Cucurpe, La Mesa. Upper Lower Albian (Mammillatum zone) of France (Aude) Padern, SE Le Crès, 1.45 km WWS Padern. Middle Cenomanian (Mantelli - Rhotomagense zone) of Belgium (Hainaut) Tournai-Chercq (MNHN M00283).

Superfamily Misistelloidea**ELIÁŠOVÁ, 1976**

Remarks: The family and informal group of this superfamily were formerly assigned to the suborders *Astraeoidea* ALLOITEAU, 1952, and *Meandrinina* ALLOITEAU, 1952. The suborder *Astraeoidea* is poorly defined as explained above. The definition of the suborder *Meandrinina* was rather conceptual when it was established. No data were provided on the septal microstructure. Subsequently, a large amount of material with very small trabeculae was assigned to this suborder. The name-giving genus *Meandrina* LAMARCK, 1801, possesses rather large trabeculae, and is therefore much closer allied to the suborder *Faviina* in its traditional understanding.

Plesiosmiliids, informal group***Plesiolites* new genus**

Origin of the name: Formed from the genus names *Plesiosmilia* and *Cyclolites*.

Type species: *Plesiolites winnii* n. sp.

Species: Only the type species.

Diagnosis: Cyclolite coral with compact septa, in a regular symmetry and a large lamellar columella.

Comparison: Among the genera of the *Plesiosmilia* informal group, there is no cyclolite genus. Other known cyclolite genera have perforate septa.

Description: Solitary cupolate ('cyclolite') coral. Calicular outline circular to slightly elliptical, calicular pit slightly depressed. Septa compact. Septa in cross section thick in the middle, thinner externally and toward the centre. Symmetry of septa radial and regularly hexamer. Cycles of septa subregular. Septal cycles differ in length and thickness. Septa not connected to each other. Septal distal margin smooth, lateral face smooth (probably due to preservation), inner margin smooth. Pali absent. Two opposite septa of the first cycle are sometimes attached to the columella. Costae and synapticulae absent. Columella lamellar. Endotheca consists of numerous dissepiments. Wall present, compact, structure unknown. Epitheca present.

Systematic position: Because of the lack of septal microstructure the systematic position of the genus is somewhat unsure. The outline of the septa, their regular symmetry, the poorly ornamented lateral faces, and the well-developed endotheca would suggest a position close to the genus *Plesiosmilia*.

***Plesiolites winnii* n. sp.**

(Pl. 12, figs. 4-8)

Origin of the name: In honour of Winfried ('Winni') WERNER, former deputy director of the Bayerische Staatssammlungen für Geologie und Paläontologie in Munich (Germany), good friend and colleague.

Holotype: BSPG 2009 XX 7469.

Paratypes: BSPG 2009 XX 7464, 7465, 7466.

Material studied: Holotype, paratypes, another six specimens (BSPG 2003 XX 7460, 7461, 7462, 7471, 7472, 7473); 5 thin sections.

Type locality: Greece, Kozani, Nea Nikopoli, section A, bed 5-12.

Type level: Cretaceous, Lower Cenomanian.

Diagnosis: *Plesiolites* with a diameter of about 30mm and 80 to 124 septa.

Description: As for the genus.

Dimensions:

(7464)	
c	29.5x33
s	110
(7465)	
c	25.5x28.7
s	80



(7466)	
c	28x32
s	124
(7469)	
c	29x31
s	110

***Plesiosmilia* MILASCHEWITSCH, 1876**

Type species: *Plesiosmilia turbinata* MILASCHEWITSCH, 1876, by subsequent designation in WELLS (1936).

***Plesiosmilia vaughani* (ANGELIS d'OSSAT, 1905)**

(Pl. 13, figs. 1-3)

Material: BSPG 2003 XX 5964; 2 thin sections.**Synonymy:**

- *v 1905 *Pleurosmilia Vaughani* ANGELIS d'OSSAT, p. 234, Pl. 16, fig. 3
- v 1905 *Peplosmilia Coquandi* - ANGELIS d'OSSAT, p. 239, Pl. 17, fig. 2.a-b
- v 1905 *Peplosmilia Iberica* - ANGELIS d'OSSAT, p. 240, Pl. 17, fig. 4.a-c
- v 1905 *Peplosmilia Casañasi* - ANGELIS d'OSSAT, p. 241, Pl. 17, fig. 5.a-d
- v 1933 *Pleurosmilia whitneyi* n.sp. - WELLS, p. 62, Pl. 2, fig. 20; Pl. 5, fig. 5

Dimensions:

(5964)	
c	29x36
s	96
sdc	5/4mm

Description: Solitary turbinate coral. Calicular outline elliptical, pit depressed. Septa compact, in cross section centrally thicker. Symmetry of septa radial and regularly hexamerall. Cycles of septa subregular. Septal cycles differ in length and thickness. Septa not connected to each other. Septal lateral face smooth (probably due to preservation), inner margin smooth. Pali absent. Two opposite septa of the first cycle are attached to the columella. Costae present. Synapticulae absent. Columella lamellar. Endotheca consists of numerous dissepiments. Wall absent.

Occurrence: Bed A4b (BSPG 2003 XX 5964).

Other occurrences: Lower Hauterivian (Radium zone) of France (Yonne) Gy-l'Evêque, fields SW Gy-l'Evêque (BSPG 2003 XX 6506). Upper Aptian (Nolani zone) of Spain (Cataluña, Barcelona) Com. Garraf, Mun. Vilanova i la Geltrú, Las Mesquites. Lowermost Albian (Tardifurcata zone) of Spain (Cataluña, Barcelona)

Com. Alt Penedés, Mun. Castellví de la Marca; Com. Alt Penedès, Castellvi de la Marca, Can Pascual (ERNO L-6827). Lower Albian of Mexico (Sonora) Municipio Arizpe, El Salmón (ERNO L-4967); Municipio Cucurpe, Cucurpe, La Mesa (ERNO L-4360). Middle Albian of Mexico (Sonora) Municipio San Pedro de la Cueva, Tepache, Lampazos area, Espinazo de Diablo (ERNO L-120515). Lower Cenomanian (Mantelli zone) of USA (Texas) Travis County, Manchaca, first creek.

***Trochophyllia* ALLOITEAU, 1952**

Type species: *Montlivaltia melania* FROMENTEL, 1861, by original designation.

Remarks: *Trochophyllia* is here applied as a *Plesiosmilia* without columella and replaces *Paramontlivaltia*. *Paramontlivaltia* itself is a problematic genus. There is only one possible syntype of *Montlivaltia charcennensis*, the type species of *Paramontlivaltia*, available. This is the holotype of *Montlivaltia perornata* nom. nud. as declared by ALLOITEAU (1956b). But this specimen was not illustrated by its author (FROMENTEL, 1863a; FROMENTEL & FERRY, 1869) and belongs to the genus *Montlivaltia*. In contrast, the material illustrated by ALLOITEAU (1956a) that corresponds to the illustrated syntypes of *Montlivaltia charcennensis* could not be found anymore. The two type specimens are not identical as suggested by the online catalogue of the MNHN. The name *Paramontlivaltia* is therefore a nomen dubium. Another possible candidate for comparable material is the genus *Ellipsosmilia* ORBIGNY, 1849, but the type material of the type species is silicified and sections or thin sections do not exist.

***Trochophyllia ogilvieae* (ANGELIS d'OSSAT, 1905)**

(Pl. 13, fig. 5)

Material: BSPG 2003 XX 5947; 2 thin sections.**Synonymy:**

- v 1905 *Epismilia Ogilviei* - ANGELIS d'OSSAT, p. 229, Pl. 15, fig. 10.a-b
- v 2014b *Paramontlivaltia frechi* (ANGELIS d'OSSAT, 1905) - LÖSER, p. 34, Fig. 5.b

Dimensions:

(5947)	
c	25-36
s	120

Description: Solitary cylindrical coral. Calicular outline elliptical, pit depressed. Septa compact, in cross section slightly thicker close to the wall, becoming slightly thinner towards the centre. Symmetry of septa radial but systems are not recognisable. Septal generations differ in length and thickness. Septa not connected to each



other. Septal lateral face with granules, inner margin slightly swollen in places. Pali absent. Costae present but short, smooth on their surface. Synapticulae absent. Columella absent. Endotheca consists of numerous dissepiments.

Occurrence: Bed A5-12 (BSPG 2003 XX 5954).

Other occurrences: Lowermost Albian (Tardefurcata zone) of Spain (Cataluña, Barcelona) Com. Alt Penedès, Mun. Castellví de la Marca, Can Pascual.

Trochophyllia rara (PREVER, 1909)

(Pl. 13, figs. 6-7)

Material: BSPG 2003 XX 5931; 2 thin sections.

Synonymy:

- v* 1909 *Trochosmilia rara* PREVER, p. 107, Fig. 11, Pl. 10, fig. 29
- v 1909 *Trochosmilia communis* - PREVER, p. 106, Figs. 8-10, Pl. 10, fig. 4
- v 1909 *Trochosmilia polymorpha* - PREVER, p. 108, Figs. 12-13, Pl. 10, figs. 5-23
- v 1994 ? *Paramontlivaltia inaequalis* (MICHELIN, 1845) - LÖSER, p. 21, Figs. 12-13, Pl. 6, fig. 2; Pl. 12, figs. 4-5; Pl. 14, fig. 1
- v 2007 *Montlivaltia* sp. - PANDEY, FÜRSICH & BARON-SZABO, p. 26, Pl. 6, fig. 2

Dimensions:

(5931)	
c	14x21
s	48

Description: Solitary cylindric coral. Calicular outline elliptical, pit depressed. Septa compact, in cross section slightly thicker close to the wall, becoming slightly thinner towards the centre. Septal microstructure with small trabeculae marked as a dark line. Symmetry of septa radial but systems are not recognisable. Septal generations differ in length and thickness. Septa not connected to each other, or rarely by means of dissepiments. Septal lateral face with granules, inner margin slightly swollen in places. Pali absent. Costae present but short, smooth on their surface. Synapticulae absent. Columella absent. Endotheca consists of dissepiments.

Occurrence: Bed C4 (BSPG 2003 XX 5931).

Other occurrences: Aptian of Mexico (Puebla) San Juan Raya (IGM Museum GA 9-3). Lower Aptian of Italy (Abruzzi, L'Aquila) Monti d'Ocre; Monti d'Ocre, Fossa Agnese; Monti d'Ocre, Fossa Cerasetti; Monti d'Ocre, Fossa Mezza Spada. Upper Aptian to Lower Albian of Iran, Koppeh Dag, Mashad. Lower Cenomanian (Mantelli zone) of Germany (Nordrhein/Westfalen) Mülheim/Ruhr, Kassenberg.

Trochophyllia tourtiensis (BÖLSCHE, 1871)

(Pl. 13, fig. 8)

Material: BSPG 2003 XX 5941; 2 thin sections.

Synonymy:

- v* 1871 *Montlivaultia ? Tourtiensis* BÖLSCHE, p. 46, Pl. 11, fig. 1
- v 1989 *Montlivaltia ? tourtiensis* BÖLSCHE, 1871 - LÖSER, p. 112, Fig. 19, Pl. 24, figs. 1-2

Dimensions:

(5941)	
c	17-21
s	120

Description: Solitary cylindric coral. Calicular outline elliptical, pit depressed. Septa compact, in cross section slightly thicker close to the wall, becoming slightly thinner towards the centre. Septal microstructure with small trabeculae marked as a dark line. Symmetry of septa radial but systems are not recognisable. Septal generations differ in length and thickness. Septa not connected to each other. Septal lateral face with granules, inner margin slightly swollen in places. Pali absent. Costae present but short, smooth on their surface. Synapticulae and columella absent. Endotheca consists of dissepiments.

Occurrence: Bed C1 (BSPG 2003 XX 5941).

Other occurrences: Upper Cenomanian (Plenus zone) of Germany (Sachsen) Dresden-Plauen.

Trochophyllia sp.

(Pl. 13, figs. 10-12)

Material: BSPG 2003 XX 5955, 5956, 5957, 5959, 5962; 11 thin sections.

Synonymy:

- v 2000 *Trochocyathus microphytes* FELIX, 1903 - BARON-SZABO, p. 126, Pl. 10, figs. 5, 7; Pl. 12, fig. 3

Dimensions:

(5955)	
c	21-25
s	140

Description: Solitary cylindric coral. Calicular outline elliptical, pit depressed. Septa compact, in cross section slightly thicker close to the wall, becoming slightly thinner towards the centre. Symmetry of septa radial but systems are not recognisable. Septal generations differ in length and thickness. Septa not connected to each other. Septal lateral face with granules, inner margin smooth. Pali absent. Costae present but short, smooth on their surface. Synapticulae and



columella absent. Endotheca consists of numerous dissepiments.

Occurrence: Bed A5-12 (BSPG 2003 XX 5955, 5956, 5957, 5959, 5962).

Other occurrences: Lower Hauterivian (Radiatus zone) of France (Aube) Troyes, Vallières (CF 862). Upper Campanian to Lower Maastrichtian of United Arab Emirates (Al Ain) Al Ain, Huwayyah Mt, SW corner.

**Superfamily Montastraeoidea
YABE & SUGIYAMA, 1941**

Remarks: The families of this superfamily were formerly assigned to the suborder Faviina that is poorly defined as explained above.

Family Placocoeniidae ALLOITEAU, 1952

Placocoenia ORBIGNY, 1849

Type species: *Astrea macrophthalma* GOLDFUSS, 1826, by monotypy.

Placocoenia sp.

(Pl. 14, figs. 1-3)

Material: BSPG 2003 XX 5875; 3 thin sections.

Dimensions:

(5875)	n	min-max	μ	s	v	$\mu \pm s$
clmin	8	6.98-8.88	7.93	0.73	9.2	7.20-8.66
clmax	7	7.85-9.83	8.88	0.63	7.1	8.25-9.51
ccd	10	12.35-16.56	14.01	1.22	8.7	12.78-15.23
s	6+6+12+24					

Description: Plocoid colony. Calicular outline elliptical. Corallites elevated over the colony surface. Septa compact. Microstructure of large trabeculae. Septa (and costae) in cross section in the wall thick, thinner towards the centre. Symmetry of septa radial and irregularly hexamerous. Cycles of septa regular. Septal cycles differ in length and thickness. Septa only rarely connected to each other in the calicular centre. Septal distal margin unknown, lateral face occasionally with medium-size thorns, inner margin slightly swollen in places. Pali absent. Some septa of the first cycle are rarely attached to the columella. Costae present, confluent, with granulae on their surface. Synapticulae absent. Columella lamellar. Endotheca consists of thin tabulae. Wall subcompact, paraseptothecal. Coenosteum broad (approx. 75% c), consists of costae. Budding extracalicular.

Remarks: The specimen cannot be compared to any existing species because of its large dimensions.

Occurrence: Bed A (BSPG 2003 XX 5875).

**Superfamily Montlivaltioidea
FELIX, 1900**

Remarks: The families of this superfamily were formerly assigned to the suborder Faviina that is poorly defined as explained above.

**Family Lasmogyridae
VAUGHAN & WELLS, 1943**

Silingastraea LIAO, 1982

Type species: *Silingastraea xainzaensis* LIAO, 1982, by original designation.

Silingastraea japonica (EGUCHI, 1951)

(Pl. 16, figs. 4-5)

Material: BSPG 2003 XX 5887; 1 thin section.

Synonymy:

- *v 1951 *Placocoenia japonica* EGUCHI, p. 27, Pl. 4, figs. 3-5
- v 1982 *Silingastraea xainzaensis* LIAO (gen. et sp. nov.) - LIAO, p. 173, Pl. 21, figs. 1-2; Pl. 22, fig. 1
- v 1994 *Silingastraea xainzaensis* LIAO - LIAO & XIA, p. 170, 234, Pl. 49, figs. 1-2; Pl. 50, figs. 6-7

Dimensions:

(5887)	n	min-max	μ	s	v	$\mu \pm s$
cmin	6	10.05-12.57	10.69	0.97	9.1	9.72-11.67
cmax	6	11.05-13.07	12.12	0.84	6.9	11.27-12.96
ccd	7	10.31-12.97	11.72	0.92	7.8	10.80-12.65
s	4	25-29	27.0	1.82	6.7	

Description: Astreoid colony. Calicular outline elliptical. Septa compact. Septa in cross section slightly thicker close to the wall, becoming slightly thinner toward the centre. Symmetry of septa irregular, but two size orders can be distinguished. Cycles of septa subregular. Septal generations differ in length and thickness. First septal generation reaches 35% of the (shorter) calicular diameter, later generations are shorter. Septa not connected to each other. Septal distal margin unknown, lateral face and inner margin smooth. Pali absent. Septa are not attached to the columella. Costae present, non-confluent. Synapticulae absent. Columella lamellar. Endotheca unknown. Wall absent. Coenosteum narrow. Budding extracalicular.

Occurrence: Bed C5 (BSPG 2003 XX 5887).

Other occurrences: Aptian of China (Xizang [= Tibet] Autonomous Region) Rutog county, Rishum district, Jaggang, Qiekan. Uppermost Aptian of Japan (Iwate-ken) Shimohei-gun, Iwaizumi-cho, Moshi, Matsushima.



***Silingastraea shimoheiensis*
(EGUCHI, 1951)**

(Pl. 14, figs. 4-6)

Material: BSPG 2003 XX 5828, 5853, 5898; 3 thin sections.

Synonymy:

*v 1951 *Thigmastrea* ? *shimoheiensis* EGUCHI, p. 14, Pl. 4, figs. 1-2

Dimensions:

(5828)	n	min-max	μ	s	v	μ±s
clmin	20	3.85-4.99	4.40	0.32	7.3	4.08-4.73
clmax	20	4.00-6.27	4.78	0.53	11.1	4.25-5.31
ccd	25	6.14-8.19	7.17	0.57	7.9	6.59-7.73
s	10	21-28	24.20	2.52	10.4	22-27
sd	4/3mm					

Description: Astreoid colony. Calicular outline elliptical. Septa compact. Septa in cross section slightly thicker close to the wall, becoming slightly thinner toward the centre. Symmetry of septa irregular, but three size orders can be distinguished. Cycles of septa subregular. Septal generations differ in length and thickness. First septal generation reaches 35% of the (shorter) calicular diameter, later generations are shorter. Septa not connected to each other. Septal distal margin unknown, lateral face smooth, inner margin smooth. Pali absent. Some septa are attached to the columella. Costae present, non-confluent. Synapticulae absent. Columella lamellar, strong. Endotheca consists of numerous and regular tabulae. Wall absent. Coenosteum narrow, consists of costae and tabulae. Budding extracalicular.

Occurrence: Bed A5-12 (BSPG 2003 XX 5828, 5853, 5898).

Other occurrences: Lower Aptian of Greece (Viotía) Arachova (MB K624). Uppermost Aptian of Japan (Iwate-ken) Shimohei-gun, Taro-cho, Todana.

***Silingastraea* sp. 1**

(Pl. 14, figs. 7-9)

Material: BSPG 2003 XX 5815; 2 thin sections.

Dimensions:

(5815)	n	min-max	μ	s	v	μ±s
cmin	7	9.27-11.06	10.20	0.72	7.0	9.48-10.93
cmax	6	10.66-13.03	11.75	0.92	7.8	10.82-12.67
ccd	6	9.57-11.26	10.49	0.64	6.1	9.85-11.13
s	24					
sd	6/5mm					

Description: Astreoid colony. Calicular outline elliptical. Septa compact. Septa in cross section slightly thicker close to the wall, becoming slightly thinner toward the centre. Symmetry of septa irregular, but size orders can be distinguished. Cycles of septa subregular. Septal generations differ in length and thickness. First septal generation reaches 35% of the (shorter) calicular diameter, later generations are shorter. Septa not connected to each other. Septal distal margin unknown, lateral face and inner margin smooth. Pali absent. Some septa are attached to the columella. Costae present, non-confluent. Synapticulae absent. Columella lamellar. Endotheca consists of numerous subregular tabulae. Wall absent. Coenosteum narrow, consists of costae and tabulae. Budding extracalicular.

Occurrence: Bed A5-12 (BSPG 2003 XX 5815).

***Silingastraea* sp. 2**

(Pl. 14, figs. 10-12)

Material:

BSPG 2003 XX 5831, 5844; 4 thin sections.

Synonymy:

- v 2010 *Lamnastrea* sp. - LÖSER, CASTRO & NIETO, p. 321, Figs. 3.7-9
- v 2015 *Silingastraea shimoheiensis* (EGUCHI, 1951) - LÖSER, ARIAS & VILAS, p. 50, Fig. 4.g-i

Dimensions:

(5844)	n	min-max	μ	s	v	μ±s
clmin	9	4.45-6.79	5.83	0.78	13.4	5.04-6.61
clmax	9	6.28-9.40	8.13	1.02	12.5	7.11-9.15
ccd	10	7.25-8.96	8.27	0.60	7.2	7.67-8.87
s	5	21-35	30.4	5.41	17.8	25-36



Description: Astreoid colony. Calicular outline elliptical. Septa compact. Microstructure of large trabeculae. Septa in cross section slightly thicker close to the wall, becoming slightly thinner toward the centre. Symmetry of septa irregular, but three size orders can be distinguished. Cycles of septa subregular. Septal generations differ in length and thickness. First septal generation reaches 35% of the (shorter) calicular diameter, later generations are shorter. Septa not connected to each other. Septal distal margin and lateral face unknown, inner margin smooth. Pali absent. Some septa rarely attached to the columella. Costae present, non-confluent. Synapticulae absent. Columella lamellar, rather strong. Endotheca consists of numerous and regular tabulae. Wall absent. Coenosteum medium broad, consists of costae and tabulae. Budding extracalicular.

Occurrence: Bed A5-12 (BSPG 2003 XX 5831, 5844).

Other occurrences: Lower to Middle Albian of Spain (Valencia, Alicante) Sierra de Seguí. Upper Albian of Spain (Murcia) Jumilla, Sierra del Carche.

Silingastraea sp. 3

(Pl. 15, figs. 1-3)

Material: BSPG 2003 XX 5824, 5886; 3 thin sections.

Dimensions:

(5824)	n	min-max	μ	s	v	μ±s
cl	11	6.404-8.837	7.564	0.858	11.3	6.70-8.42
ccd	10	10.880-13.784	12.194	0.950	7.7	11.24-13.14
s	24-30					
(5886)	n	min-max	μ	s	v	μ±s
cmin	4	10.109-11.899	11.235	0.796	7.0	10.43-12.03
ccd	6	10.398-12.639	11.742	0.740	6.3	11.00-12.48
sy	8					
s	32					

Description: Astreoid colony. Calicular outline elliptical. Septa compact. Septa in cross section thicker close to the wall, becoming thinner toward the centre. Symmetry of septa irregular, but size orders can be distinguished. Cycles of septa subregular. Septal generations differ in length and thickness. First septal generation reaches

35% of the (shorter) calicular diameter, later generations are shorter. Septa not connected to each other. Septal distal margin unknown, lateral face and inner margin smooth. Pali absent. Some septa are rarely attached to the columella. Costae present, non-confluent or subconfluent. Synapticulae absent. Columella lamellar, thin. Endotheca consists of numerous tabulae. Wall absent. Coenosteum narrow, consists of costae and tabulae. Budding extracalicular.

Occurrence: Beds A5-12 (BSPG 2003 XX 5824); C5 (BSPG 2003 XX 5886).

Family Montlivaltiidae FELIX, 1900

Complexastrea ORBIGNY, 1849

Type species: *Confusastrea subburgundiae* ORBIGNY, 1850, by monotypy.

Complexastrea sp.

(Pl. 15, figs. 4-6)

Material: BSPG 2003 XX 5936; 2 thin sections.

Synonymy:

v 2012 *Complexastrea* sp. - BOVER ARNAL et al., p. 56, Fig. 10.P

Dimensions:

(5936)	
ccd	11-13mm
s	60
sd	11/10mm

Description: Astreoid colony. Calicular outline elliptical. Septa compact, in cross section slightly thicker close to the wall, becoming slightly thinner towards the centre. Symmetry of septa irregular, but two size orders can be distinguished. Septal generations differ in length, but hardly at all in thickness. Septa not connected to each other. Septal lateral face smooth (probably due to preservation), inner margin smooth. Pali absent. Costae present, non-confluent. Synapticulae and columella absent. Endotheca consists of numerous small dissepiments. Coenosteum narrow (approx. 20% c), consists of costae and exothecal dissepiments. Budding extracalicular.

Occurrence: Bed A (BSPG 2003 XX 5936).

Other occurrences: Lower Aptian of Mexico (Puebla) Tehuacán, La Compañía (UNAM-FI CIA-40/1). Upper Aptian (Martinoïdes zone) of Spain (Aragón, Teruel) Mun. Miravete de la Sierra, Com. Maestrazgo, Barranco de las Corralizas. Lower Cenomanian (Dixon zone) of Spain (Cantabria, Santander) Cobreces, Luaña playa (BSPG 2007 V 161).

**Thecosmilia****MILNE EDWARDS & HAIME, 1848****Type species:** *Lithodendron trichotoma* GOLDFUSS, 1826, by monotypy.***Thecosmilia densa* FROMENTEL, 1870**

(Pl. 15, figs. 7-9)

Material: BSPG 2003 XX 5842; 2 thin sections.**Synonymy:**

- *v 1870 *Thecosmilia densa* FROMENTEL, p. 411, Pl. 92, fig. 3
- v 1897 *Thecosmilia Tobleri* - KOPY, p. 38, Pl. 13, figs. 1-4
- v 1974 *Thecosmilia trichotoma* (GOLDFUSS) - MORYCOWA, p. 467, Fig. 5, Pl. 5, fig. 2; Pl. 10, fig. 1

Dimensions:

(5842)	
c	15-18
cl	10-16
ccd	17-23
s	60-80
sdc	3/2mm

Description: Phaceloid colony. Calicular outline elliptical. Septa compact, in cross section centrally thicker. Symmetry of septa irregularly radial. Cycles of septa irregular, but size orders can be distinguished. Septal generations differ in length and thickness. Septa occasionally connected, only by means of dissepiments. Pali absent. Costae present. Synapticulae and columella absent. Endotheca consists of thin tabulae. Budding unknown.

Occurrence: Bed A5-12 (BSPG 2003 XX 5842).

Other occurrences: Lower Upper Tithon of Poland (Malopolskie, Wadowice) Wadowice, Wozniki. Berriasian of Switzerland (Nidwalden) Urirothstock massif, Bannalp. Lower Hauterivian (Radiatus zone) of France (Haute-Marne) Moran-court. Lower Aptian of Greece (Viotía) Arachova (BSPG 2003 XX 5545).

Superfamily Phyllosmilioidea
FELIX, 1903

Remarks: The families of this superfamily were formerly assigned to the suborder Meandrina. The characteristics of the name-giving genus *Meandrina* do not correspond to that ascribed to the suborder as explained above.

Family Phyllosmiliidae FELIX, 1903***Aulosmilia* ALLOITEAU, 1952****Type species:** *Trochosmilia archiaci* FROMENTEL, 1863, by original designation.***Aulosmilia* sp.**

(Pl. 15, figs. 10-12)

Material: BSPG 2003 XX 5967, 7441; 2 thin sections.**Dimensions:**

(5967)	
c	14x25mm
s	48
(7441)	
c	16x28mm
s	48
sdc	6/5mm

Description: Solitary turbinate coral. Calicular outline elliptical, pit depressed. Septa compact. Microstructure of small-sized trabeculae, septa with a median dark zigzag line. Septa in cross section slightly thicker close to the wall, becoming slightly thinner towards the centre. Symmetry of septa radial and regularly hexamer. Cycles of septa regular. Septal cycles differ in length and thickness. Septa not connected to each other. Septal lateral face smooth (probably due to preservation), inner margin T-shaped, swollen or bent. Pali absent. Some septa may be attached to the columella. Costae present but short, smooth on their surface. Synapticulae absent. Columella lamellar, discontinuous, very deep in the corallite. Endotheca consists of a few dissepiments. Wall compact, paraseptothecal. Epitheca present.

Remarks: The specimens differ from all other known species by their low number of septa. They may be juvenile specimens. A columella is present, but it is very deep in the corallite. In 2003 XX 7441, the septa are regularly bent at the inner margin.

Occurrence: Beds A5-12 (BSPG 2003 XX 7441); C5 (BSPG 2003 XX 5967).

Other occurrences: Uppermost Cenomanian (Juddi zone) of France (Aude) Les Corbières, Sougraigne, Prat-Périé (BSPG 2011 XXVI 25).



Diplocteniopsis ZLATARSKI, 1968

Type species: *Diplocteniopsis curvicalix* ZLATARSKI, 1968, by original designation.

Diplocteniopsis sp.

(Pl. 16, figs. 1-3)

Material: BSPG 2003 XX 5938, 7436; 5 thin sections.

Dimensions:

(5938)	
c	11x55
s	150
sd	7/5mm
(7436)	
c	11x26.4
s	95
sd	8/5mm

Description: Solitary flabelloid coral. Calicular outline elongated. Septa compact, in cross section slightly thicker close to the wall, becoming slightly thinner towards the centre. Symmetry of septa irregular, but two size orders can be distinguished. Cycles of septa subregular. Septal cycles (generations) differ in length and thickness. Septa not connected to each other. Septal lateral face with thorns, inner margin T-shaped or swollen. Pali absent. Costae present but short. Synapticulae absent. Columella lamellar, vertically discontinuous. Endotheca consists of tabulae. Wall subcompact, parathecal.

Remarks: *Diplocteniopsis* is one of the oldest members of the Phyllosmiliidae. The family Diplocteniopsidae ZLATARSKI, 1968, is considered synonymous with the Phyllosmiliidae. The Diplocteniopsidae do not belong to the Faviina suborder (Astraeoidea auctt.) as proposed by ZLATARSKI (1968) because the material has small trabeculae. *Diplocteniopsis* was originally described from the Aptian of Bulgaria. Later, the locality turned out to be latest Barremian in age (B. KOŁODZIEJ, pers. comm.). The present material extends the range of the genus into the Lower Cenomanian.

Occurrence: Bed A5-12 (BSPG 2003 XX 7436).

Elasmophyllia FROMENTEL, 1873

Type species: *Thecosmilia deformis* REUSS, 1854, by subsequent monotypy.

Elasmophyllia sp.

(Pl. 16, figs. 6-7)

Material: BSPG 2003 XX 5961; 4 thin sections.

Dimensions:

(5961)	
crw	8-9mm
ccd	7-8mm
s	12-14
sd	6/5mm

Description: Flabelloid colony. Calicular pit depressed. Corallites distinct. Septa compact. Microstructure of small-sized trabeculae, septa with a median dark line. Septa in cross section slightly thicker close to the wall, becoming slightly thinner towards the centre. Symmetry of septa irregular, but three size orders can be distinguished. Cycles of septa subregular. Septal generations differ in length and thickness. Septa of younger generations rarely connected to the septa of preceding ones. Septal lateral face with thorns, inner margin T-shaped in places. Pali absent. Costae present but short. Synapticulae and columella absent. Endotheca consists of tabulae. Wall absent. Budding intracalicular.

Remarks: The specimen marks the first occurrence of the genus.

Occurrence: Bed A5-12 (BSPG 2003 XX 5961).

Hydnophoropsis SÖHLE, 1899

Type species: *Hydnophoropsis thecalis* SÖHLE, 1899, by monotypy.

Hydnophoropsis sp. 1

(Pl. 16, figs. 8-10)

Material: BSPG 2003 XX 5836; 2 thin sections.

Synonymy:

v 2013c *Hydnophoropsis* sp. 4 - LÖSER, p. 33, Pl. 4, figs. 7-9

Dimensions:

(5836)	n	min-max	μ	s	v	μ±s
Clmin	20	2.96-3.79	3.44	0.22	6.5	3.22-3.67
Clmax	20	3.26-4.88	4.14	0.47	11.4	3.66-4.62
Ccd	30	4.59-7.98	6.40	1.05	16.4	5.34-7.45
S	10	23-30	24.60	1.95	7.9	23-27



Description: Plocoid colony. Calicular outline circular to elliptical. Septa compact. Microstructure of septa unknown. Septa (and costae) in cross section in the wall thick, thinner toward the centre. Symmetry of septa radial and regularly hexamer. Cycles of septa subregular. Septal cycles differ in length and thickness. First septal cycle reaches 40% of the (shorter) calicular diameter, later cycles are shorter. Septa of the first cycle occasionally connected to each other in the centre of the corallite. Septal distal margin unknown, lateral face occasionally with medium size thorns, inner margin slightly swollen in places. Pali absent. Some septa of the first cycle are rarely attached to the columella. Costae present, non-confluent, with trabecular extensions. Synapticulae absent. Columella small, lamellar. Endotheca consists of tabulae. Wall compact, septothecal. Coenosteum medium broad, consists of costae, trabecular extensions and exothecal dissepiments. Budding extracalicular

Occurrence: Bed A5-12 (BSPG 2003 XX 5836).

Hydnophoropsis sp. 2

(Pl. 17, figs. 1-3)

Material: BSPG 2003 XX 5882; 2 thin sections.

Synonymy:

- v 2013c *Hydnophoropsis* sp. 2 - LÖSER, p. 32, Pl. 4, figs. 4-6

Dimensions:

(5882)	n	min-max	μ	s	v	$\mu \pm s$
clmin	12	4.40-5.41	4.91	0.34	6.9	4.57-5.25
clmax	7	3.51-6.17	5.01	0.91	18.3	4.10-5.93
ccd	17	5.75-10.03	7.89	1.44	18.2	6.45-9.33
s	24					

Description: Plocoid colony. Calicular outline circular to elliptical. Septa compact. Microstructure of septa unknown. Septa (and costae) in cross section in the wall thick, thinner toward the centre. Symmetry of septa radial and regularly hexamer. Cycles of septa subregular. Septal cycles differ in length and thickness. First septal cycle reaches 40% of the (shorter) calicular diameter, later cycles are shorter. Septa of the first cycle rarely connected to each other in the centre of the corallite. Septal distal margin unknown, lateral face occasionally with medium size thorns, inner margin slightly swollen in places. Pali absent. Some septa of the first cycle are rarely attached to the columella. Costae present, non-confluent, with trabecular extensions. Synapticulae absent. Columella thin, lamellar. Endotheca consists of tabulae. Wall compact, septothecal. Coenosteum broad, consists of costae, trabecular extensions and exothecal dissepiments. Budding extracalicular.

Occurrence: Bed C8 (BSPG 2003 XX 5882).

Pachygyra

MILNE EDWARDS & HAIME, 1848

Type species: *Lobophyllia labyrinthica* MICHELIN, 1847, by monotypy.

Pachygyra sp.

(Pl. 17, figs. 4-6)

Material: BSPG 2003 XX 7442; 4 thin sections.

Dimensions:

(7442)	
crw	2.4-3.0
sd	6/2mm

Description: Meandroid colony. Calicular centres slightly depressed, margins very elevated, rows long and curved. Corallites indistinct. No neighbouring corallites in one row. Valley septa absent. Septa compact, in cross section close to the wall thick, thinner towards the centre, first generation disproportionately thicker than other generations. Symmetry of septa irregular. Cycles of septa irregular, but size orders can be distinguished. Septal generations differ in length and thickness. Septa not connected to each other. Septal distal margin smooth (probably due to preservation), lateral face with fine thorns, inner margin T-shaped. Pali absent. Costae present, non-confluent. Synapticulae absent. Columella lamellar. Endotheca consists of numerous dissepiments. Wall compact, septothecal. Collines depressed. Coenosteum medium broad (approx. 50% c), consists of costae and exothecal dissepiments. Budding intracalicular.

Remarks: *Pachygyra bellula* has comparable dimensions but differs by a higher density of septa. The present specimen is poorly preserved.

Occurrence: Bed B (BSPG 2003 XX 7442).

Phyllosmia FROMENTEL, 1862

Type species: *Turbinolia basochesi* DEFRANCE, 1828, subsequent designation by FELIX (1925).

Phyllosmia cf. *basochesi*

(DEFRANCE, 1828)

(Pl. 17, figs. 7-10)

Material: BSPG 2003 XX 5952, 7433, 7434, 7435, 7437, 7472; 8 thin sections.

Dimensions:

(7432)	
c	6.6x26.4
s	ca. 160
sd	6/2mm



(7433)	
c	6.3x27.3
s	ca. 160
sd	6/2mm
(7437)	
c	6.1x29.7
s	ca. 180
sd	6/2mm

Description: Solitary flabelloid coral. Calicular outline very elongated, pit depressed. Septa compact. Septa in cross section slightly thicker close to the wall, becoming slightly thinner towards the centre. Symmetry of septa radial but systems are not recognizable. Cycles of septa subregular. Septal generations differ in length and thickness. Septa not connected to each other. Septal distal margin unknown, lateral face with numerous fine thorns, inner margin swollen. Pali absent. Some septa may be attached to the columella. Costae present but short, with granulae on their surface. Synapticulae absent. Columella lamellar, discontinuous. Endotheca absent. Wall compact, septothecal.

Remarks: The material differs from *Ph. Basochesi* by a much higher density of septa.

Occurrence: Bed A5-12 (BSPG 2003 XX 5952, 7433, 7434, 7435, 7437, 7472).

Other occurrences: Santonian of Austria (Oberösterreich) Gosau basin (MNHN nn); France (Bouches-du-Rhône) Marseille (GPSL FLX 8033). Upper Santonian of France (Bouches-du-Rhône) Marseille, Figuière (MNHN nn). Lower Upper Campanian of Spain (Cataluña, Lérida) Com. Pallars Jussà, Mun. Pallars Jussà, Pobla de Segur, Toralola, south of (MB K1148#1).

Superfamily Styliinoidea ORBIGNY, 1851

Remarks: The families of this superfamily were formerly assigned to the suborders Rhipidogrina RONIEWICZ, 1976, and Stylinina ALLOITEAU, 1952. The suborder Rhipidogrina is well defined but considered synonymous with the suborder Stylinina. The suborder Stylinina is based on the conceptual genus *Stylinina* LAMARCK, 1816; type material of the type species is not available.

Family Aulastraeoporidae ALLOITEAU, 1957

Apoplacophyllia MORYCOWA & MARCOPOULOU-DIACANTONI, 2002

Type species: *Apoplacophyllia hackemesseri* MORYCOWA & MARCOPOULOU-DIACANTONI, 2002, by original designation.

Apoplacophyllia sp.

(Pl. 18, figs. 1-3)

Material: BSPG 2003 XX 5935; 2 thin sections.

Dimensions:

(5935)	n	min-max	μ	s	v	$\mu \pm s$
clmin	17	2.46-4.87	3.40	0.77	22.7	2.62-4.17
clmax	17	3.09-4.97	3.89	0.56	14.5	3.33-4.46
cmin	17	3.53-6.12	4.53	0.75	16.7	3.78-5.29
cmax	17	3.91-6.32	5.12	0.63	12.3	4.49-5.75
s	24					

Description: Phaceloid colony. Calicular outline circular. Septa compact, in cross section externally thick, thinner toward the centre. Symmetry of septa radial and regularly hexamerall. Cycles of septa regular. Septal cycles differ in length and thickness. Septa not connected to each other. Septal distal margin unknown, lateral face with fine thorns, inner margin with auriculae in places, branched or swollen. Pali absent. Costae present but short. Synapticulae and columella absent. Endotheca consists of central tabulae and lateral large dissepiments. Wall and coenosteum absent. Budding unknown.

Occurrence: Bed C8 (BSPG 2003 XX 5935).

Aulastraeopora PREVER, 1909

Type species:

Aulastraeopora deangelisi PREVER, 1909, by subsequent designation in WELLS (1936).

Aulastraeopora harrisi (WELLS, 1932)

(Pl. 13, fig. 9)

Material: BSPG 2003 XX 5940; 2 thin sections.

Synonymy:

- *v 1932 *Blothrocyathus harrisi* WELLS, p. 242, Pl. 30, figs. 6, 6.a, 7; Pl. 31, figs. 3-4
- v 2013 *Aulastraeopora harrisi* (WELLS, 1932) - LÖSER, CASTRO & NIETO, p. 28, Pl. 9, fig. 7 [= detailed synonymy here]

Dimensions:

(5940)	
c	18x22
s	24

Description: Solitary cylindrical coral. Calicular outline elliptical. Septa compact, in cross section slightly thicker close to the wall, becoming slightly thinner towards the centre. Symmetry of septa radial and regularly hexamerall. Cycles of septa regular. Septal cycles differ in length and thickness. Septa not connected to each other. Septal distal margin unknown, lateral face smooth (probably due to preservation). Pali, costae, synapticulae, and columella absent. Endotheca consists



of central tabulae and lateral large dissepiments. Wall compact, has the same structure as septa.

Occurrence: Bed C1 (BSPG 2003 XX 5940).

Other occurrences: Upper Barremian to Lower Aptian (Lenticularis zone) of Mexico (Sonora) Municipio Ures, Cerro de Oro (ERNO L-4499). Aptian of Mexico (Puebla) San Juan Raya (IGM 9206). Lower Aptian of Greece (Viotía) Arachova; Italy (Abruzzi, L'Aquila) Monti d'Ocre, Fossa Agnese (BSPG 2003 XX 5400); Monti d'Ocre, Margine N di Fossa Mezza Spada. Upper Aptian of Spain (Valencia) Chera, Pico Ropé (BSPG 2014 XVIII 4). Albian of China (Xizang [= Tibet] Autonomous Region) Gerze county, Dongco district, Lopu, Xiakangjiang. Lowermost Albian (Tardefurcata zone) of Spain (Cataluña, Tarragona) Com. Baix Penedés, Mun. Olivella, Can Grau (MV 12872); USA (Texas) Hays County, Blanco River, Pleasant Valley Crossing. Lower Albian of Mexico (Baja California) Santo Tomás, Arroyo de la Cueva (ERNO L-1347052); Mexico (Sonora) Municipio Arizpe, Arizpe, Cerro La Ceja (ERNO L-4264); Municipio Cucurpe, Cucurpe, La Mesa (ERNO L-4289); Municipio Opodepe, Tuape, Cerro de la Espina (ERNO L-4252). Upper Lower Albian (Mammillatum zone) of France (Aude) Padern, SE Le Crès, 1.45 km WWS Padern. Lower Upper Albian (Inflatum zone) of Spain (Valencia, Alicante) Sierra de Llorençá. Cenomanian of Greece (Fokída) Kiona massif, Panourgias [= Dremisa] (BSPG 2003 XX 5905).

***Aulastraeopora schnauzeae* LÖSER, 1998**

(Pl. 18, figs. 4-6)

Material: SNSD-MMG GrK2; 2 thin sections.

Synonymy:

- v 1936 cf. *Montlivaultia pauciradiata* FROM./
Dasmiopsis OPP. - HACKMESSER, p. 34
- *v 1998 *Aulastraeopora schnauzeae* LÖSER, p. 66,
Pl. 1, figs. 3-4; Pl. 2, figs. 1-2; Pl. 3, fig. 2

Dimensions:

(SNSD-MMG GrK2)	
h	105
c	85
cn	37
sy	4
s	16
sap	256

Remarks: The species was described in detail in LÖSER (1998). The position of the species within the genus *Aulastraeopora* is preliminary. This genus does not have such thick septa.

Occurrence: Bed A (SNSD-MMG GrK2).

Other occurrences: Cenomanian of Greece (Fokída) Kiona massif, Panourgias [= Dremisa].

***Preverastraea* L. BEAUVAIS, 1976**

Type species: *Aulastraeopora chelussii* PREVER, 1909, by original designation.

***Preverastraea infundibuliformis*
(WELLS, 1932)**

(Pl. 18, figs. 10-12)

Material: BSPG 2003 XX 6170; 2 thin sections.

Synonymy:

- *v 1932 *Connectastrea* (?) *infundibuliformis* WELLS,
p. 236, Pl. 33, figs. 6-7
- v 2007 *Preverastraea* sp. - LÖSER, p. 13, Pl. 3, figs.
7-8

Dimensions:

(6170)	n	min-max	μ	s	v	$\mu \pm s$
ccd	45	2.90-5.48	4.24	0.68	16.0	3.56-4.92
cn	20	1.94-2.55	2.21	0.18	8.5	2.02-2.40
s	24					

Description: Astreoid colony. Calicular outline circular. Septa compact, in cross section equal in thickness in the whole septum. Symmetry of septa regular hexamer. Septal generations differ in length. Septa not connected to each other. Septal distal margin unknown. Pali, and synapticulae absent. Costae short. Columella absent. Endotheca consists of tabulae and dissepiments. The incomplete wall has the same structure as the septa. Coenosteum narrow. Budding extracalicular.

Remarks: The only specimen is poorly preserved.

Occurrence: Bed A5-12 (BSPG 2003 XX 6170).

Other occurrences: Lower Albian of Mexico (Sonora) Municipio Arizpe, Arizpe, Cerro La Ceja (ERNO L-4273); Municipio Opodepe, Tuape, Cerro de la Espina (ERNO L-4235). Middle Albian (Dentatus zone) of USA (Texas) Comal County, New Braunfels-Crane's Mill road.

***Preverastraea* aff. *stellata*
(STOLICZKA, 1873)**

(Pl. 18, figs. 7-9)

Material: BSPG 2003 XX 5839; 7 thin sections.

Dimensions:

(5839)	n	min-max	μ	s	v	$\mu \pm s$
ccd	25	4.07-7.67	5.76	1.07	18.5	4.69-6.83
s	10	10-16	13.5	2.0	14.9	11.5-15.5

Description: Astreoid colony. Calicular outline circular. Septa compact, in cross section equal in thickness in the whole septum. Symmetry of septa irregular. No regular septal generations. Septal generations do not differ. Septa not connected to



each other. Septal distal margin unknown. Pali and synapticalae absent. Costae short. Columella absent. Endotheca consists of tabulae and dissepiments. The incomplete wall has the same structure as the septa. Coenosteum narrow. Budding extracalicular.

Remarks: The taxonomic position of this specimen is unsure. It is closest to the type specimen of *Mycetophyllia stellata* STOLICZKA, 1871, but differs in much smaller dimensions (ccd 10-12 in the holotype of *Mycetophyllia stellata*) and a slightly higher number of septa (6-8 in the type). Also, the assignation to *Preverastraea* is tentative. The only specimen is not well preserved and although many thin sections were prepared, the complex morphology could not be completely recognised.

Occurrence: Bed A5-12 (BSPG 2003 XX 5839).

Superfamily Stylophoroidea MILNE EDWARDS, 1857

Remarks: The families of this superfamily were formerly assigned to the suborder Astrocoeniina VAUGHAN & WELLS, 1943.

Family Stylophoridae MILNE EDWARDS, 1857

Stephanomorpha VAUGHAN, 1900

Type species: *Stephanocoenia monticuliformis* VAUGHAN, 1900, by original designation.

Stephanomorpha ? sp. (Pl. 19, figs. 1-3)

Material: BSPG 2003 XX 5822, 5861; 6 thin sections.

Dimensions:

(5822)	n	min-max	μ	s	v	μ±s
clmin	35	1.39-2.04	1.72	0.15	9.2	1.56-1.88
clmax	35	1.79-2.38	2.07	0.15	7.4	1.91-2.22
ccd	40	1.75-3.06	2.36	0.29	12.4	2.07-2.65
s	24					

Description: Plocoid colony. Calicular outline circular to elliptical, centres depressed. Septa compact, (and costae) in cross section in the wall thick, thinner toward the centre. Microstructure of small trabeculae, marked by a dark line. Symmetry of septa radial and hexamerous. Cycles of septa subregular. Septal cycles differ in length and thickness. Septa of the third cycle in plates attached to those of the second cycle, septa of older cycles often connected to each other in the centre of the corallite. Septal distal margin unknown, lateral face with few thorns. Pali probably present. Some septa may be attached to the columella. Costae present, thick, sub-confluent to non-confluent. Synapticalae absent. Columella

styliiform to lamellar. Endotheca consists of tabulae. Wall compact, septothecal. Coenosteum very narrow (approx. 10% c), consists of costae. Budding extracalicular.

Remarks: The generic assignment is tentative. No fine septal structures of *Stephanomorpha* are known.

Occurrence: Bed A5-12 (BSPG 2003 XX 5822, 5861).

Superfamily Thamnasterioidea REUSS, 1864

Remarks: The families of this superfamily were formerly assigned to the suborder Fungiina VERRILL, 1865, but differ in many aspects from the name-giving genus *Fungia*.

Family Siderastraeidae VAUGHAN & WELLS, 1943

Eosiderastrea LÖSER, 2016

Type species: *Siderastrea cuyleri* WELLS, 1932, by original designation.

Eosiderastrea grandipora (ORBIGNY, 1850) (Pl. 19, figs. 4-6)

Material: BSPG 2003 XX 5900; 2 thin sections.

Synonymy:

*v	1850	<i>Stephanocoenia grandipora</i> ORBIGNY, (2), p. 182
	1851	<i>Stephanocoenia grandipora</i> - MILNE EDWARDS & HAIME, p. 66
	1857	<i>Stephanocoenia grandipora</i> - MILNE EDWARDS, (2), p. 269
	1884	<i>Stephanocoenia Grandipora</i> - FROMENTEL, p. 538
vp	1994	<i>Baryphyllia haimej</i> FROMENTEL, 1857 - LÖSER, p. 38, Figs. 26-27, Pl. 8, fig. 1; Pl. 12, figs. 10-11
v	2016b	<i>Eosiderastrea grandipora</i> (ORBIGNY, 1850) - LÖSER, p. 391, Pl. 3, figs. 1-2

Dimensions:

(5900)	n	min-max	μ	s	v	μ±s
cmin	14	5.77-7.37	6.67	0.54	8.1	6.13-7.22
cmax	12	7.41-11.82	9.28	1.29	13.9	7.99-10.57
ccd	20	6.23-9.27	7.62	0.92	12.0	6.70-8.55
s	5	50-61	53.80	4.26	7.9	

Description: Astreoid colony. Calicular outline circular to polygonal. Septa compact, in cross section externally thick, thinner towards the centre. Symmetry of septa radial and irregularly hexamerous. Cycles of septa subregular. Septal



cycles differ in length, but hardly at all in thickness. Septa of the fourth cycle often attached to those of the third cycle. Septal distal margin unknown, lateral face with numerous fine thorns. Pali absent. Costae present, sub-confluent to non-confluent. Synapticulae present, fairly common. Columella by septal fusion. Endotheca consists of numerous thin tabulae. Wall absent. Coenosteum absent. Budding extracalicular.

Occurrence: Bed A5-12 (BSPG 2003 XX 5900).

Other occurrences: Middle Albian (Lautus zone) of USA (Texas) Bell County, Santa Fe Railroad quarry. Lower Cenomanian (Mantelli zone) of Germany (Nordrhein/Westfalen) Mülheim/Ruhr, Kassenberg. Lower Cenomanian of France (Charente-Maritime) Ile d'Aix. Lower Cenomanian (Dixoni zone) of Spain (Cantabria, Santander) Cobreces, Luaña playa (BSPG 2007 V 199).

Eosiderastrea paragrandidipora
LÖSER, 2016

(Pl. 19, figs. 7-9)

Material: BSPG 2003 XX 5812, 5868; 4 thin sections.

Synonymy:

vp 1994 *Baryphyllia haimeii* FROMENTEL, 1857 - LÖSER, p. 38, Figs. 26-27, Pl. 8, fig. 1; Pl. 12, figs. 10-11

*v 2016b *Eosiderastrea paragrandidipora* LÖSER, p. 393, Pl. 4, figs. 7-9

Dimensions:

(5812)	n	min-max	μ	s	v	$\mu \pm s$
clmin	10	3.81-4.64	4.20	0.29	7.0	3.90-4.49
clmax	20	3.86-5.70	4.60	0.48	10.5	4.11-5.09
c min	15	4.66-6.21	5.50	0.43	7.9	5.06-5.94
ccd	20	3.92-6.91	5.40	0.86	16.0	4.53-6.27
s	7	42-44	42.85	0.69	1.6	

Description: Astreoid-ceroid colony. Calicular outline circular to polygonal. Septa with few perforations, in cross section externally thicker, slightly thinner towards the centre. Symmetry of septa radial and irregularly hexamerous. Cycles of septa subregular. Septal cycles differ in length, but hardly at all in thickness. Septa of the fourth cycle often attached to those of the third cycle. Septal distal margin unknown, lateral face with numerous fine thorns. Pali absent. Costae hardly present, sub-confluent to non-confluent. Synapticulae present, fairly common. Columella small, by septal fusion. Endotheca consists of numerous thin tabulae. Wall present, subcompact, made by synapticulae. Coenosteum absent. Budding extracalicular.

Occurrence: Bed A5-12 (BSPG 2003 XX 5812, 5868).

Other occurrences: Lower Cenomanian (Mantelli zone) of Germany (Nordrhein/Westfalen) Mülheim/Ruhr, Kassenberg. Lower Cenomanian (Dixoni zone) of Spain (Cantabria, Santander) Cobreces, Luaña playa (BSPG 2007 V 329). Uppermost Cenomanian (Juddi zone) of France (Aude) Les Corbières, Sougraigne, Prat-Périé (BSPG 2011 XXVI 46).

***Eosiderastrea* sp. 1**

(Pl. 20, figs. 1-3)

Material: BSPG 2003 XX 5829; 2 thin sections.

Synonymy:

v 2013 *Diploastrea* ? sp. - LÖSER, WERNER & DARGA, p. 48, Pl. 1, figs. 5-6

v 2016b *Eosiderastrea* sp. 5 - LÖSER, p. 397, Pl. 7, figs. 1-3

Dimensions:

(5829)	n	min-max	μ	s	v	$\mu \pm s$
c min	6	5.82-7.82	6.77	0.86	12.8	5.90-7.64
c max	6	6.28-11.48	8.39	1.86	22.2	6.52-10.25
ccd	12	6.05-8.37	7.09	0.84	11.9	6.24-7.93
s	5	51-63	57.80	5.80	10.0	
sd	14/5mm					

Description: Astreoid colony. Calicular outline circular to polygonal. Septa with few perforations, septa in cross section externally thicker, slightly thinner towards the centre. Symmetry of septa radial and irregularly decamerous. Cycles of septa subregular. Septal cycles differ in length, but hardly at all in thickness. Septa of the fourth cycle in places attached to those of the third cycle. Septal distal margin unknown, lateral face with numerous fine thorns. Pali absent. Costae hardly present, sub-confluent to non-confluent. Synapticulae present, fairly common. Columella small, by septal fusion. Endotheca absent. Wall present, subcompact, made by synapticulae. Coenosteum absent. Budding extracalicular.

Occurrence: Bed A5-12 (BSPG 2003 XX 5829).

Other occurrences: Middle Cenomanian of Germany (Bayern) Roßstein-Almen.

***Eosiderastrea* sp. 2**

(Pl. 20, figs. 4-6)

Material: BSPG 2003 XX 5846; 2 thin sections.

Synonymy:

v 2016b *Eosiderastrea* sp. 4 - LÖSER, p. 396, Pl. 6, figs. 10-12



Dimensions:

(5846)	n	min-max	μ	s	v	μ±s
clmin	20	3.80-5.55	4.77	0.44	9.3	4.32-5.21
clmax	15	4.99-6.43	5.62	0.37	6.6	5.24-5.99
c min	15	5.91-8.04	6.96	0.64	9.2	6.32-7.61
c max	15	7.08-8.84	8.07	0.50	6.2	7.57-8.58
ccd	20	5.11-7.71	6.55	0.85	12.9	5.70-7.40
s	12	39-47	41.83	2.40	5.7	39-44
sd	4/2mm					

Description: Astreoid-plocoid colony. Calicular outline circular. Septa with few pores, in cross section externally thick, thinner towards the centre. Symmetry of septa radial and irregularly decamerall. Cycles of septa subregular. Septal cycles differ in length, but hardly at all in thickness. Septa of the third cycle in places attached to those of the second cycle. Septal distal margin unknown, lateral face with numerous fine thorns. Pali absent. Costae present, non-confluent. Synapticulae present, fairly common. Columella by septal fusion. Endotheca consists of numerous thin tabulae. Wall almost not present, in the wall region some more synapticulae can be observed. Coenosteum very narrow. Budding extracalicular.

Occurrence: Bed A5-12 (BSPG 2003 XX 5846).

Other occurrences: Uppermost Aptian of Spain (Cataluña, Lérida) Com. Alt Urgell, Mun. Coll de Nargó, Set Comelles, El Caso section (BSPG 2003 XX 4027). Middle Albian of Mexico (Sonora) Municipio San Pedro de la Cueva, Tepache, Lampazos area, Espinazo de Diablo (ERNO L-130206). Lower Cenomanian of France (Charente-Maritime) Fouras (ERNO L-5601). Uppermost Cenomanian (Juddi zone) of France (Aude) Les Corbières, Col de Escudiés (UPS HL 025).

***Eosiderastrea stefani* LÖSER, 2016**

(Pl. 19, figs. 10-11)

Material: BSPG 2003 XX 6145; 1 thin section.

Synonymy:

- v 2013 *Diploastrea* ? *tanohataensis* (EGUCHI, 1951) - LÖSER, WERNER & DARGA, p. 46, Pl. 2, figs. 7-9
- v 2015 "*Diploastrea*" *tanohataensis* (EGUCHI, 1951) - LÖSER, p. 281, Fig. B
- *v 2016b *Eosiderastrea stefani* LÖSER, p. 394, Pl. 2, figs. 7-9

Dimensions:

(6145)	n
clmax	3.5-5.4
clmin	5.1-6.0
ccd	4.7-6.5
s	45

Description: Astreoid colony. Calicular outline circular to polygonal. Septa with few perforations, in cross section externally thicker, slightly thinner towards the centre. Symmetry of septa radial and irregularly decamerall. Cycles of septa subregular. Septal cycles differ in length, but hardly at all in thickness. Septa of the fourth third often attached to those of the second cycle. Septal distal margin unknown, lateral face with numerous fine thorns. Pali absent. Costae present, sub-confluent to non-confluent. Synapticulae present, fairly common. Columella by septal fusion. Endotheca unknown. Wall absent. Coenosteum very narrow. Budding extracalicular.

Occurrence: Bed A5-12 (BSPG 2003 XX 6145).

Other occurrences: Lower Cretaceous of Israel, Mulergat Well (NHM R43455). Lower Cenomanian of France (Charente-Maritime) Fouras (ERNO L-5614). Lower Cenomanian (Dixoni zone) of Spain (Cantabria, Santander) Cobreces, Luaña playa (BSPG 2007 V 061). Middle Cenomanian of Germany (Bayern) Roßstein-Almen. Middle to Upper Cenomanian (Rhotomagense - Naviculare zone) of France (Sarthe) Le Mans.

Order Helioporacea Bock, 1938

Family Helioporidae MOSELEY, 1876

***Heliopora* BLAINVILLE, 1830**

Type species: *Millepora coeruleae* PALLAS, 1766.

***Heliopora radiata* (ORBIGNY, 1850)**

(Pl. 20, figs. 7-9)

Material: BSPG 2003 XX 5821; 2 thin sections.

Synonymy:

- *v 1850 *Centrastrea radiata* ORBIGNY, (2), p. 207
- v 1873 *Heliopora Edwardsana*, STOLICZKA - STOLICZKA, p. 53, Pl. 11, fig. 11
- v 2000 *Polytremacis blainvilleana* (MICHELIN, 1841) - BARON-SZABO, p. 128, Pl. 13, figs. 3-4
- v 2013 *Polytremacis vermiculata* (FELIX, 1903) - LÖSER, WERNER & DARGA, p. 67, Pl. 10, figs. 7-9

**Dimensions:**

(5821)	n	min-max	μ	s	v	$\mu \pm s$
clmin	50	0.91-1.27	1.10	0.08	8.1	1.01-1.19
clmax	50	0.98-1.44	1.18	0.11	9.6	1.06-1.29
ccd	50	1.48-2.69	2.09	0.317	15.1	1.77-2.40
s	25	16-22	19.56	1.68	8.6	18-21
tb	6-9/25mm ²					

Description: Plocoid colony. Calicular outline circular to slightly elliptical, centres depressed. Pseudosepta compact, in cross section slightly thicker close to the wall, becoming slightly thinner toward the centre. No septal symmetry, or regular septal generations. Inner margin of pseudosepta smooth. Pali absent. Endotheca consists of few tabulae. Wall compact. Coenosteum broad, consists of tubes. Budding extracalicular.

Occurrence: Bed A5-12 (BSPG 2003 XX 5821).

Other occurrences: Uppermost Aptian of Spain (Cataluña, Lérida) Com. Alt Urgell, Mun. Coll de Nargó, Set Comelles, El Caso section (BSPG 2003 XX 4105). Upper Albian of India (Tamil Nadu [= Madras]) Karai [=Kauray], east of. Lower Cenomanian of France (Charente-Maritime) Chateaufneuf-sur-Charente (MNHN nn); Fouras (BSPG 2003 XX 1707); Ile d'Aix (MNHN nn). Middle Cenomanian of Germany (Bayern) Roßstein-Almen. Upper Coniacian of France (Aude) Les Corbières, Soulatge. Santonian of Austria (Salzburg) Rußbach, Randobach (MHE A0968); Rußbach, Zimmergraben (MHE A0745). Upper Santonian of France (Aude) Les Corbières, Sougraigne, La Jouane (MNHN nn). Maastrichtian of United Arab Emirates (Al Ain) Al Madam, Buhays Mt, east face of northern hill.

Discussion**Distribution in the section**

The corals are unequally distributed in the section (Table 1). The diversity is low in the lower part of the clastic section A (A1-A4), very high in the middle part of section A (A5-A12), and relatively low in the carbonatic part of the section (section C). The latter is probably due to sample bias; it was difficult to obtain specimens from the harder and more compact limestones, and the state of preservation of the corals is slightly better in the lower clastic part. Nevertheless, field observations have shown that the faunal diversity in the carbonatic part of the section is lower. The lower clastic part represents a higher number of taxa. However, an original faunal composition cannot be claimed for this part of the section; it is possible that the corals of this part were brought together from a wider area by transport processes.

The correlation of the various beds based on their coral content (Fig. 8) shows three major groups. Bed A4 (yellow area in Fig. 8) is very poor in species and therefore shows low correlation with the other beds. Beds of the short sections B and D, and samples of section A that cannot be assigned to any bed (green area in Fig. 8) are also low in species. Beds A5-A12 exhibit the richest coral fauna of the section which shows a positive correlation with the limestone complex (C; blue area) that follows upwards. In complex C, coral distribution gradually changed with the beds.

A more detailed taxonomic differentiation within the section is not possible because there are very few species that do not occur in beds A5-A12, and their absence in higher beds of the section may also be a result of sample or conservation bias. It also has to be noted that total diversity is relatively high; about 160 specimens resulted in 78 species - clearly a very low number of specimens per species. Whereas a few species (*Aspidiscus cristatus*, Caryophylliidae sp. indet. 1, *Cryptocoenia* sp., *Eocolumastrea gortanii*, *Heterocoenia distans*, *Negoporites spissus*, *Trochophyllia* sp., *Phyllosmilia* cf. *basochesi*, *Plesiolithes winnii*, *Synastrea* sp.) are represented by more than three specimens, the remaining species are mostly represented by only one (43 species), two (15 species) or three specimens (10 species). Of course, more than 300 specimens were collected, but many of them were poorly preserved and did not allow specific assignment.

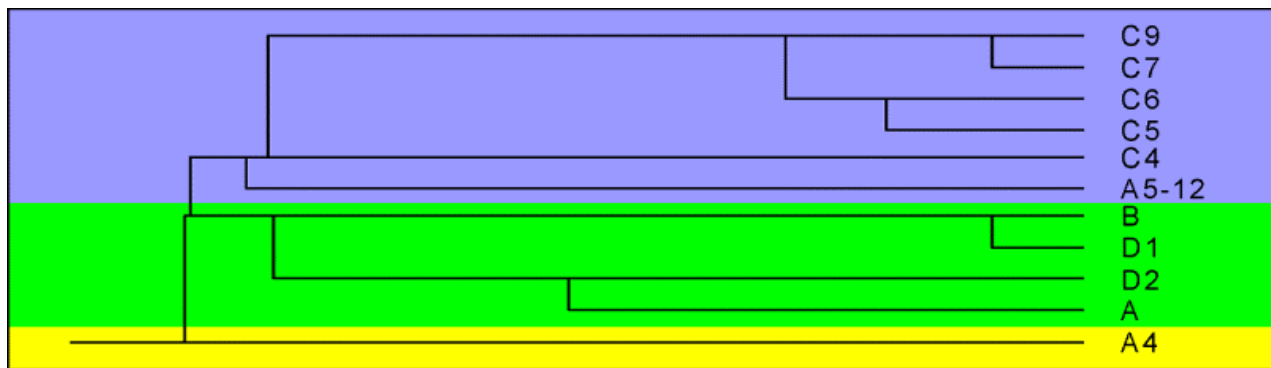


Figure 8: Correlation of the various beds with corals based on the coral taxonomy. The Correlation Ratio coefficient was applied.

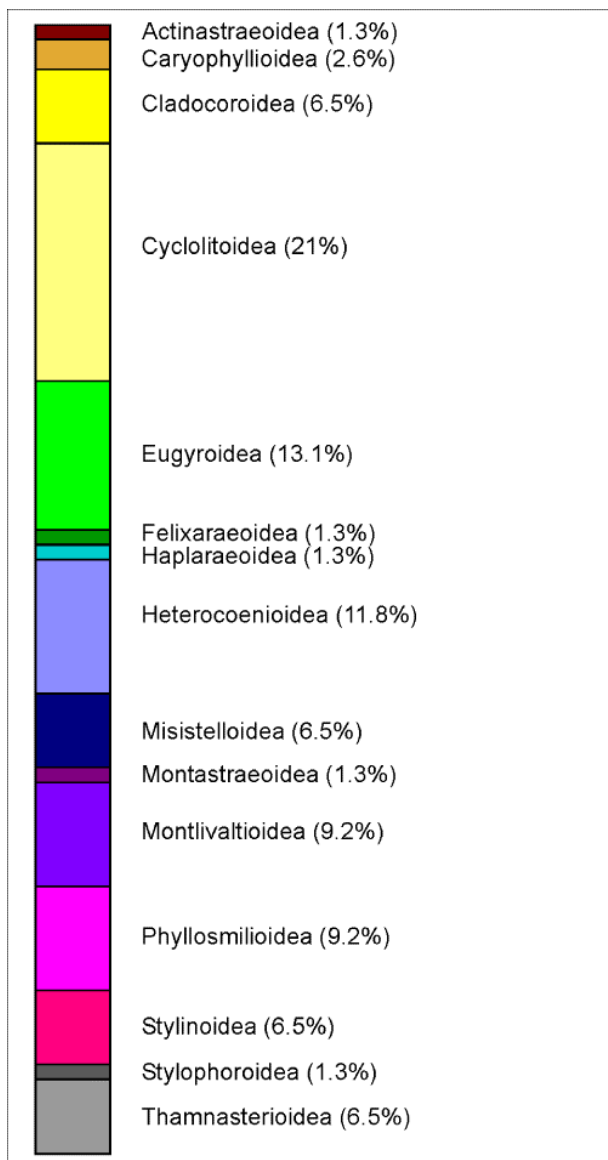


Figure 9: Species distribution in superfamilies for the study area.

Faunal composition

Superfamilies are not a very good measure for comparing the faunal composition, because they encompass different numbers of genera (for instance, the Cyclolitoidea have far more genera than the Stylophoroidea). The overall distribution patterns in the present fauna (Fig. 9) compare well to upper Lower Cretaceous coral faunas.

The superfamilies Cyclolitoidea, Eugyroidea, and Heterocoenoidea are very rich in species and together they constitute almost half of all coral species. All three are superfamilies that can be found in the entire Cretaceous, with the exception of the Eugyroidea, which has far more genera in the Lower Cretaceous. The next species-rich superfamilies, Montlivaltioidea (family Lasmogyridae) and Phyllosmilioidea with almost 20% of all species, are more diverse in the Upper Cretaceous. The remaining ten superfamilies comprise the remaining 35% of species.

According to LÖSER (2016c), 20 superfamilies occur in the Lower Cenomanian and 14 of these are indicated in the study area. For the superfamily Felixaraeidea, the range could be extended, even if the systematic position of the genus *Kozaniastrea* is preliminary.

Palaeogeographic distribution

A comparison of palaeobiogeographic units for the time span Albian to Cenomanian (Fig. 10) of the 53 species from the study area that were also indicated in other areas, seems to be very difficult. Although the overall number of shared species is high, the number of species shared with other faunules is relatively low. Except for the Upper Aptian to Lower Albian coral fauna from the Bisbee Basin (see below), the highest number (9) is represented by the faunas of the Basque-Cantabrian Basin at the Cantabrian coast (WILMSEN, 1997; the coral fauna is under investigation)

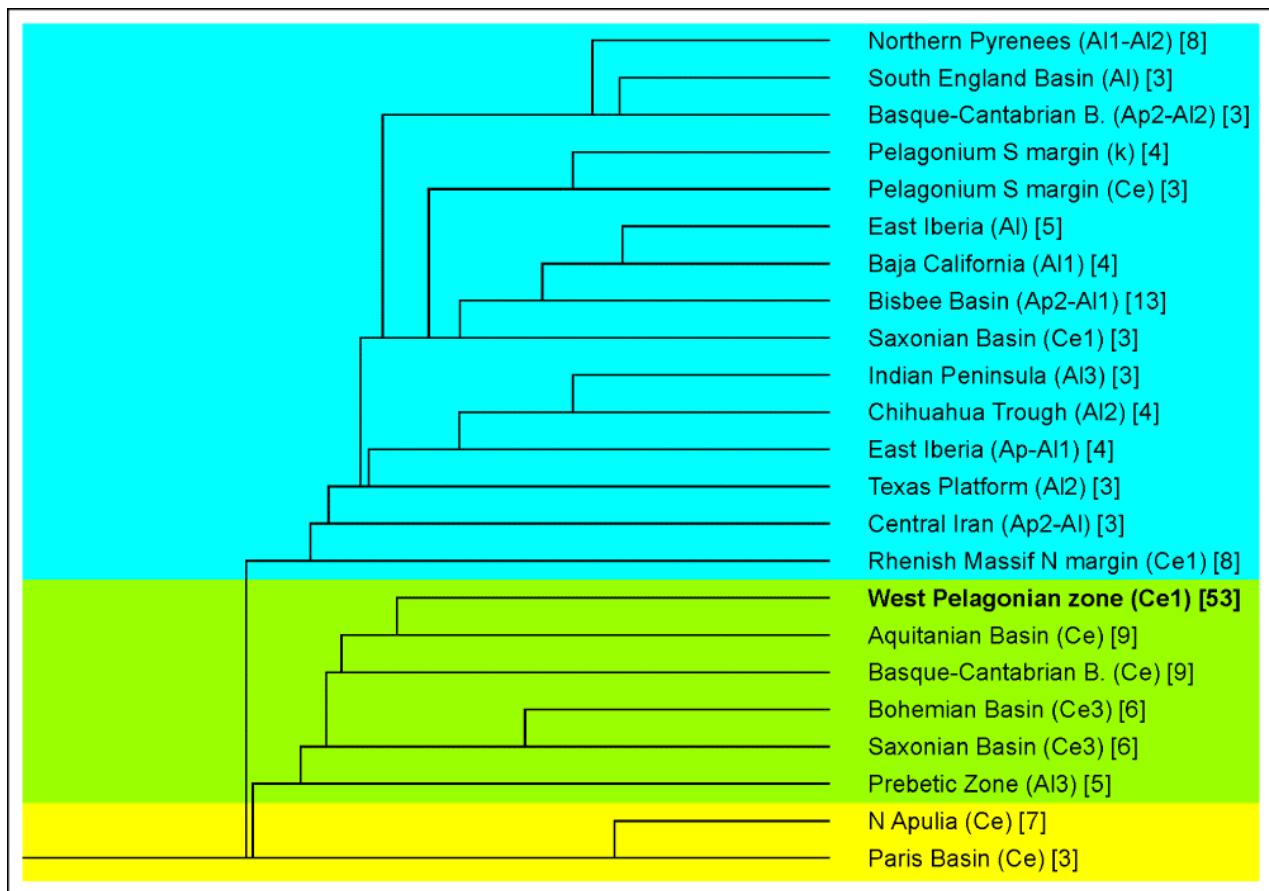


Figure 10: Correlation of provinces with joint species of the study area. Provinces with less than three joint species are suppressed, and only provinces of a Albian and Cenomanian age are shown. The Correlation Ratio coefficient was applied, the graph is logarithmic.

and by faunas of the Aquitanian Basin at the Atlantic coast mainly in the French department Charente-Maritime (BELTREMIEUX, 1866; the fauna is unrevised). The next most closely related faunules are the Boreal faunula from the Saxon Cretaceous Basin (LÖSER, 2014b) and the transitional fauna of the Bohemian Basin (ELIÁŠOVÁ, 2004, and publications cited within), and the Late Albian faunula of the Prebetic zone (LÖSER, CASTRO & NIETO, 2013). These faunules are grouped in one cluster (Fig. 10, light green area). Another small cluster (Fig. 10, yellow area) is represented by the North Apulian faunula from the Alp Mountains (LÖSER) and the Paris Basin, which is mainly represented by the poorly investigated coral fauna from the French Sarthe department (LÖSER *in* MOREL, 2015). A high number of remaining faunules give no clear pattern (Fig. 10, turquoise area) because of the low number of shared species. Although the Upper Aptian to Lower Albian coral fauna of the Bisbee Basin (LÖSER, 2011a) has the highest number of shared species with the studied fauna, it is not among the other areas

with high scores, simply because these Mexican faunas are more related to mainly Albian faunules from different areas.

Twenty-five species have no occurrence in other localities (Table 2). Most of these species are new. Only a small number of them are also formally established here. The other part of species remains in open nomenclature because the corresponding specimens are either very small or poorly preserved (*Canleria* sp. 2, *Diplocteniopsis* sp., *Elasmophyllia* sp., *Eocomoseris* sp., *Mixastrea* aff. *danubica*, *Preverastraea* aff. *stellata*, *Sakalavastraea* sp. 2, *Styloheterocoenia* sp.), the family they belong to is poorly investigated (Caryophylliidae sp. indet.), species of the genus still exist unrevised under other names (*Apoplacophyllia* sp., *Hydnophoropsis* sp., *Silingastraea* sp.), the type material of other existing species is not available (*Helladastrea* sp., *Pachygyra* sp., *Placocoenia* sp.), or the generic assignment is questionable (?*Stephanomorpha* sp., *Tiarasmilia* cf. *casteri*).

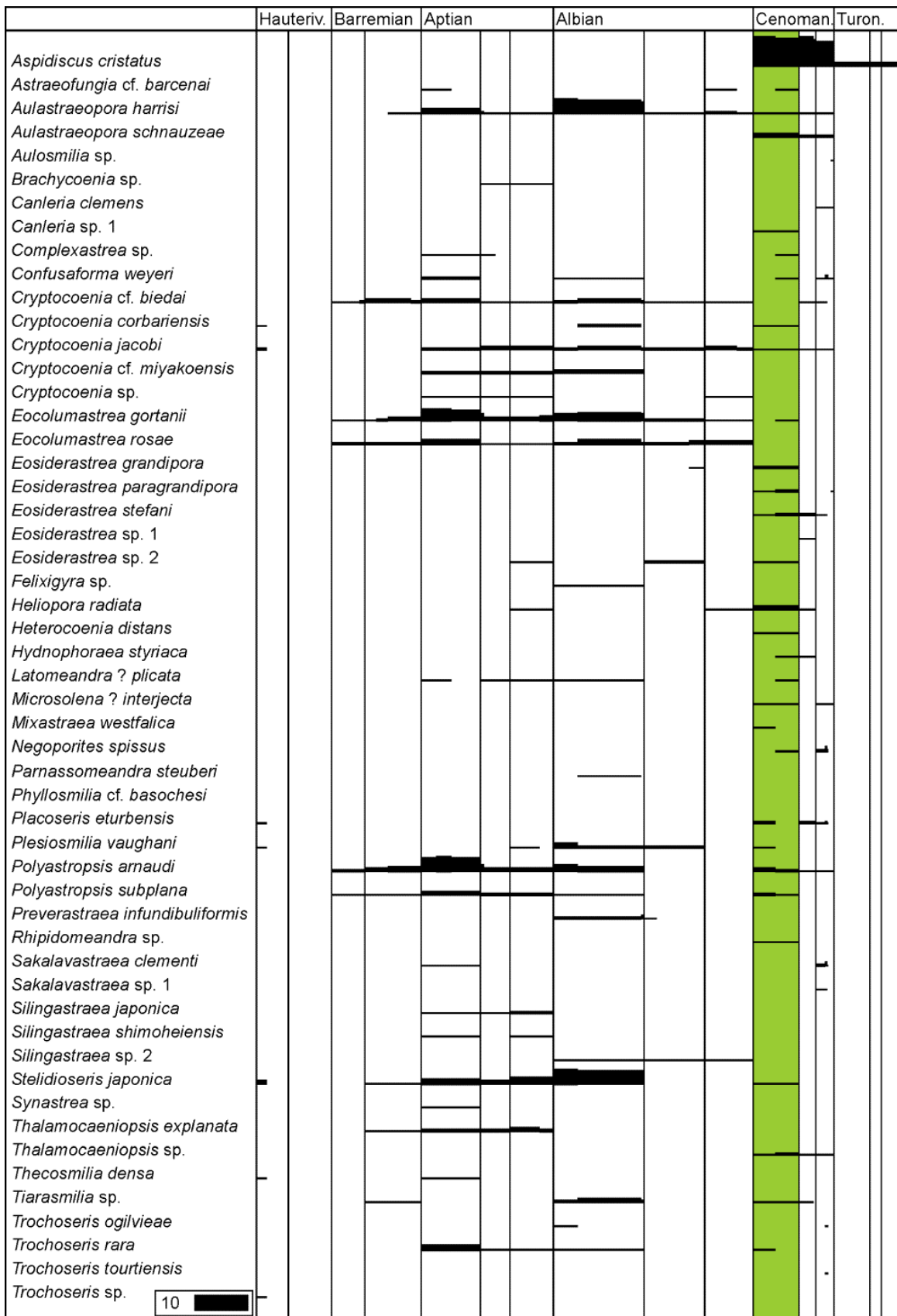


Figure 11: Stratigraphic distribution and commonness of species. The thickness of the bars indicates the number of localities (multiple localities within the same lithostratigraphic unit are counted as one) in which the concerned species was found. The green bar indicates the age of the study area.



Figure 12: Summarized distribution and commonness of species. The green bar indicates the age of the study area.

Table 2: List of species only known from the study area.

<i>Apoplacophyllia</i> sp.	<i>Canleria</i> sp. 2
<i>Caryophylliidae</i> sp. indet. 1	<i>Caryophylliidae</i> sp. indet. 2
<i>Diploctenopsis</i> sp.	<i>Elasmophyllia</i> sp.
<i>Eocomoseris</i> sp.	<i>Helladastraea</i> sp.
<i>Hydnophoropsis</i> sp. 1	<i>Hydnophoropsis</i> sp. 2
<i>Kozaniastrea pachysepta</i>	<i>Mixastrea</i> aff. <i>danubica</i>
<i>Pachygyra</i> sp.	<i>Placocoenia</i> sp.
<i>Plesiolites winnii</i>	<i>Preverastraea</i> aff. <i>stellata</i>
<i>Rhipidomeandra</i> sp.	<i>Sakalavastraea</i> sp. 2
<i>Silingastraea</i> sp. 1	<i>Silingastraea</i> sp. 3
? <i>Stephanomorpha</i> sp.	<i>Styloheterocoenia brunni</i>
<i>Styloheterocoenia hellenensis</i>	<i>Styloheterocoenia</i> sp.
<i>Tiarasmilia</i> cf. <i>casteri</i>	

Stratigraphic distribution

The distribution of the species found in the studied section shows a strong relationship to Lower Cretaceous coral faunas, mainly Lower Aptian and Lower Albian (Fig. 11). Of the 53 species indicated in other areas, 38 were indicated in the Cenomanian. This is a high value when taking into account that Tethyan Cenomanian coral faunas have been poorly studied in the past. There are 16 species that were only found in the Cenomanian or in slightly younger sediments. For instance, in the genus *Eosiderastrea*, of the five species indicated in the present coral fauna, three occur only in the Cenomanian, one occurs in the Middle Albian, and one species occurs from the Upper Aptian onwards. The summarised distribution of the species of the study area shows diversity peaks during the Early Aptian, Early Albian and Early Cenomanian (Fig. 12), a pattern that corresponds to the general distribution pattern of corals in the Cretaceous (LÖSER, 2016c, Fig. 6.1.1).

The generic composition of the studied faunas (Fig. 13) shows that the time interval from the Late Albian to Cenomanian was a time of a faunal turnover. There are several genera that have their last occurrence in the Lower Cenomanian (such as *Apoplacophyllia*, *Aulastraeopora*, *Felixigyra*, *Haplaraea*, *Latomeandra*, *Mixastraea*, *Paranassomeandra*, *Rhipidomeandra*, *Thecosmilia*,

and *Tiarasmilia*), and there are genera that have their first occurrence in the Cenomanian (*Elasmophyllia*, *Hydnophoraraea*, *Negoporites*, *Phyllosmilia*). The Lower Cenomanian has still more elements of Lower Cretaceous faunas. The poorly documented Middle Cenomanian shows the same amount of Lower and Upper Cretaceous genera (LÖSER, WERNER & DARGA, 2013), a trend that continues with the Upper Cenomanian, where Upper Cretaceous elements increased further.

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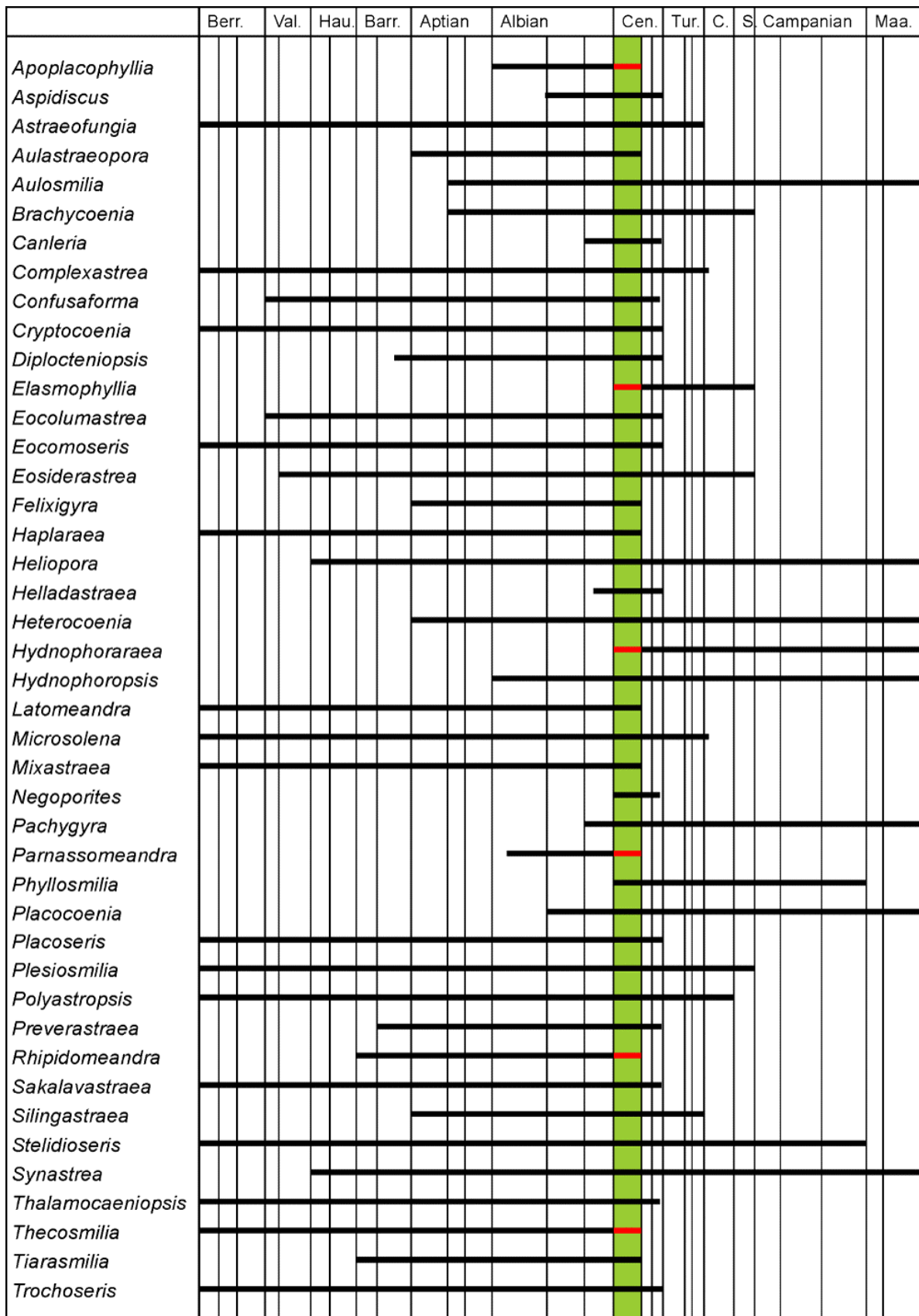


Figure 13: Stratigraphical ranges of the genera of the study area. The green bar indicates the age of the study area. Red lines indicate range extensions.



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Plates

Plate 1:

- 1-3) *Stelidioseris japonica* EGUCHI, 1951, BSPG 2003 XX 5838; 1) transversal thin section; 2) transversal thin section, detail; 3) longitudinal thin section;
- 4) Caryophylliidae indet. sp. 1, BSPG 2003 XX 7468; transversal thin section;
- 5) Caryophylliidae indet. sp. 2, BSPG 2003 XX 7448; transversal thin section;
- 6) *Polyastropsis subplana* (PREVER, 1909), BSPG 2003 XX 5833; transversal thin section;
- 7-9) *Eocolumastrea gortanii* PREVER, 1909, BSPG 2003 XX 5878; 7) transversal thin section; 8) transversal thin section, detail; 9) longitudinal thin section;
- 10-12) *Eocolumastrea rosae* PREVER, 1909, BSPG 2003 XX 5895; 10) transversal thin section; 11) transversal thin section, detail; 12) longitudinal thin section.

[Scale bar 1mm]

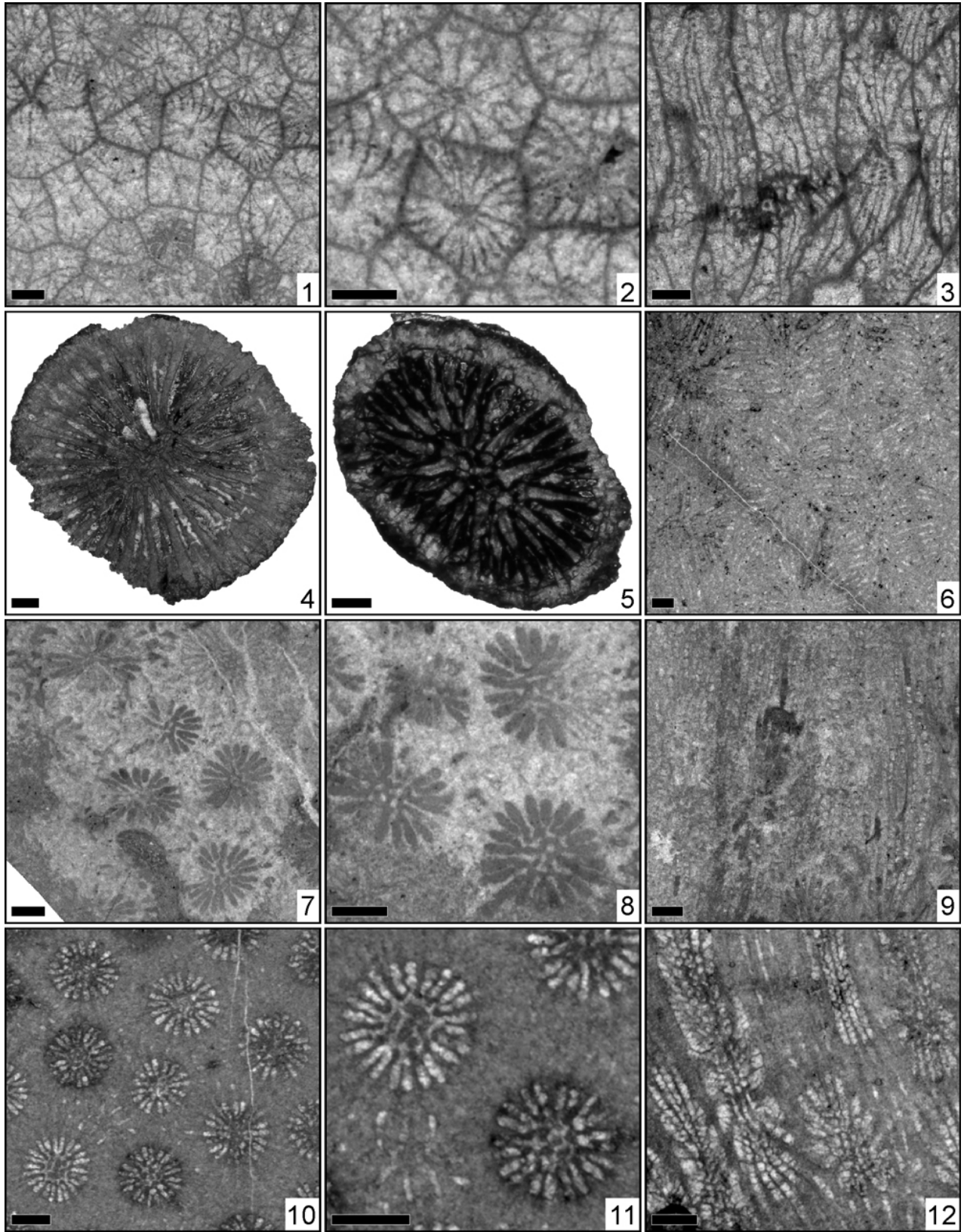




Plate 2:

1-2) *Sakalavastraea clementi* BEAUVAIS, 1972, BSPG 2003 XX 5858; 1) transversal thin section; 2) transversal thin section, detail;

3-4) *Sakalavastraea* sp. 2, BSPG 2003 XX 5869; 3) transversal thin section; 4) transversal thin section, detail;

5-6) *Astraeofungia* cf. *barcenai* (FELIX, 1891), BSPG 2003 XX 5888; 5) transversal thin section; 6) transversal thin section, detail;

7-9) *Sakalavastraea* sp. 1, BSPG 2003 XX 5811; 7) transversal thin section; 8) transversal thin section, detail; 9) longitudinal thin section;

10-12) *Aspidiscus cristatus* LAMARCK, 1801, BSPG 2003 XX 7458; 10) transversal thin section; 11) transversal thin section, detail; 12) oblique thin section.

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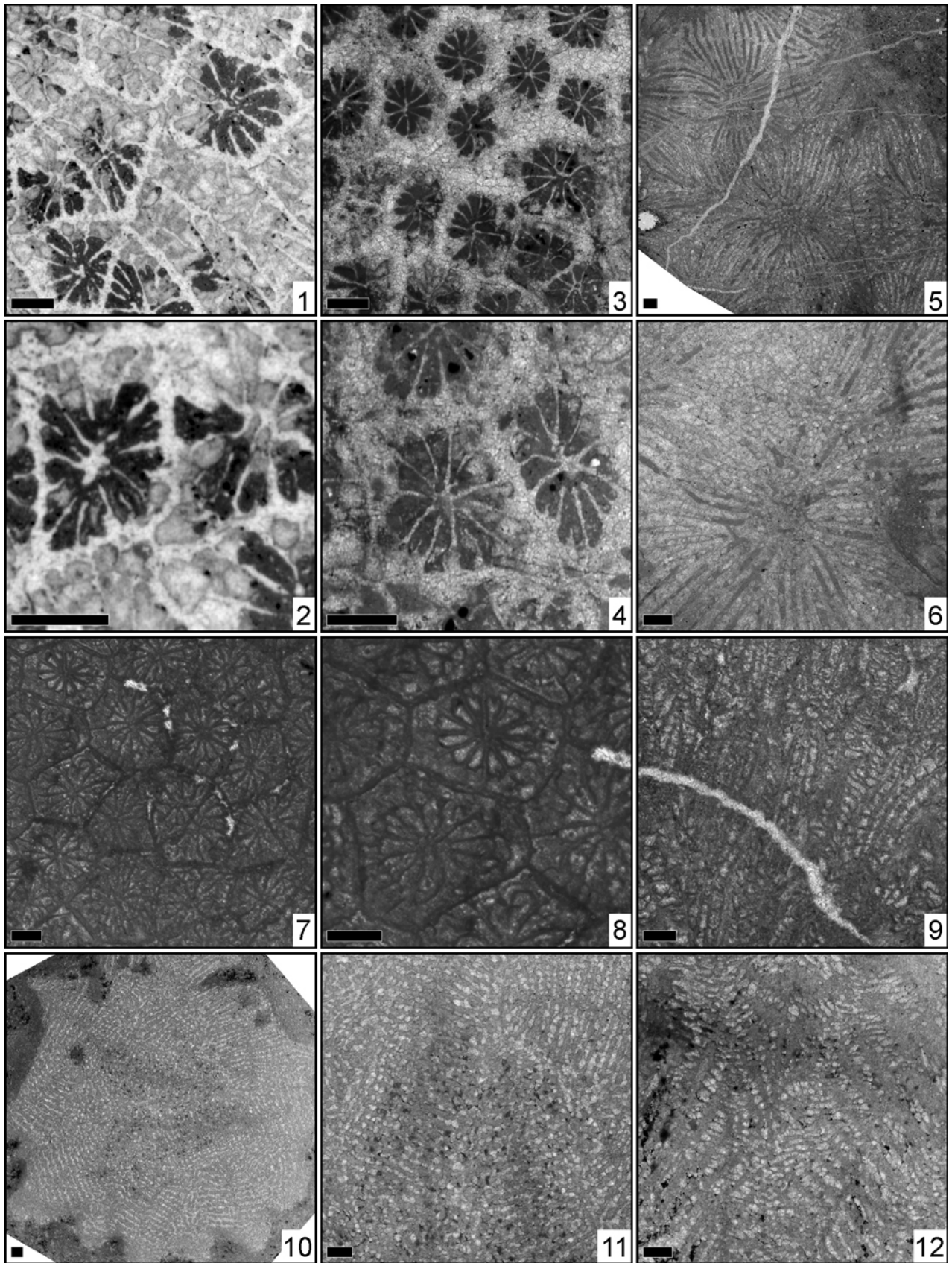




Plate 3:

1-3) *Helladastraea* sp., BSPG 2003 XX 7454; 1) transversal thin section; 2) transversal thin section, detail; 3) longitudinal thin section;

4-6) *Latomeandra ? plicata* GOLDFUSS, 1826, BSPG 2003 XX 5884; 4) transversal thin section; 5) transversal thin section, detail; 6) longitudinal thin section;

7-9) *Mixastraea westfalica* LÖSER, 1993, BSPG 2003 XX 5880; 7) transversal thin section; 8) transversal thin section, detail; 9) longitudinal thin section;

10-12) *Mixastraea* aff. *danubica* RONEWICZ, 1976, BSPG 2003 XX 5894; 10) transversal thin section; 11) transversal thin section, detail; 12) longitudinal thin section.

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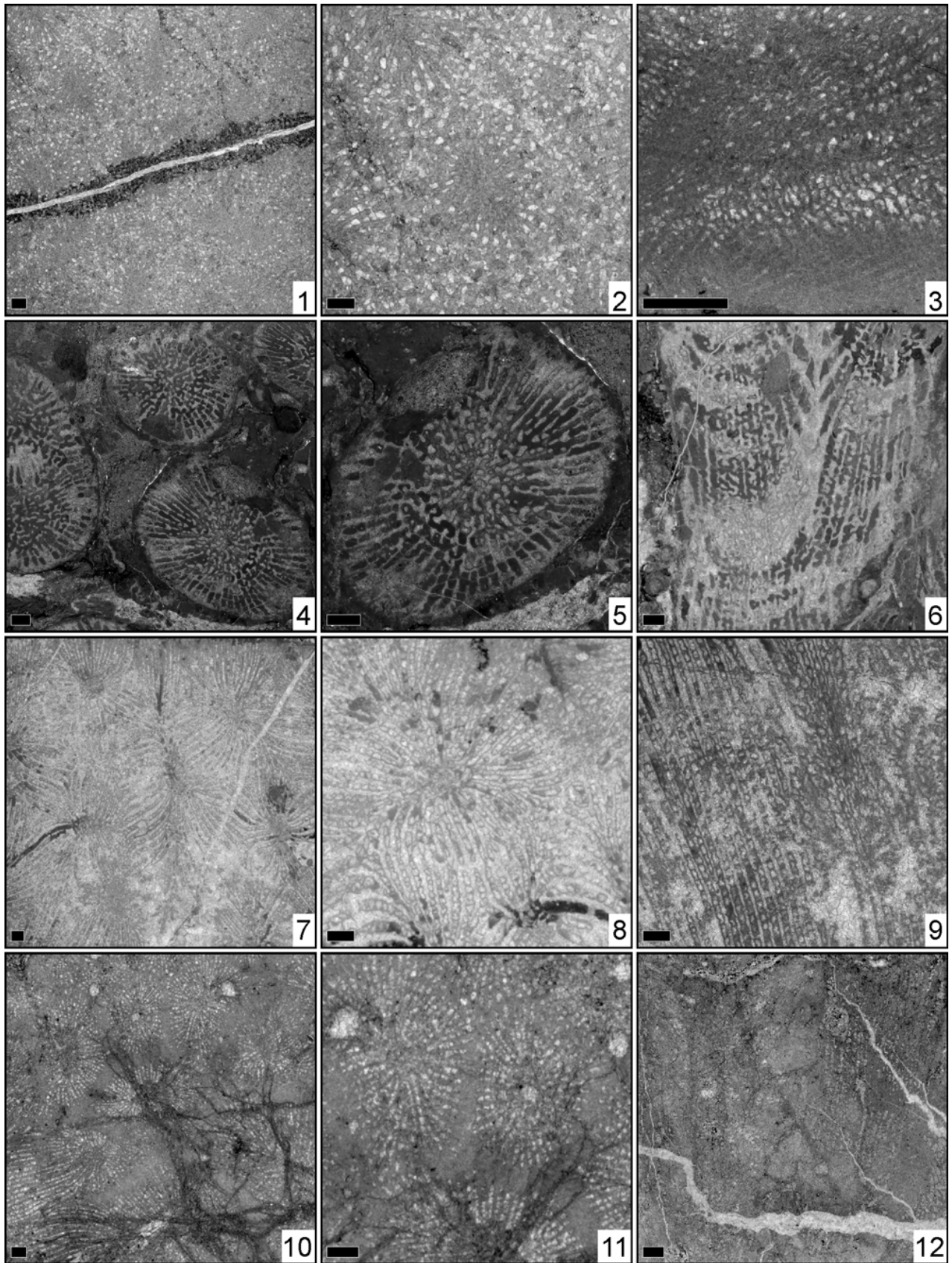




Plate 4:

1-3) *Placoseris eturbensis* (FROMENTEL, 1857), BSPG 2003 XX 7438; 1) transversal thin section; 2) transversal thin section, detail; 3) longitudinal thin section;

4-6) *Polyastropsis arnaudi* (ALLOITEAU, 1957), BSPG 2003 XX 5823; 4) transversal thin section; 5) transversal thin section, detail; 6) longitudinal thin section;

7-9) *Thalamocaeniopsis explanata* (REIG ORIOL, 1994), BSPG 2003 XX 5814; 7) transversal thin section; 8) transversal thin section, detail; 9) longitudinal thin section;

10-11) *Thalamocaeniopsis* sp., BSPG 2003 XX 5885; 10) transversal thin section; 11) transversal thin section, detail;

12) *Cryptocoenia corbariensis* ALLOITEAU, 1948, BSPG 2003 XX 5897; transversal thin section.

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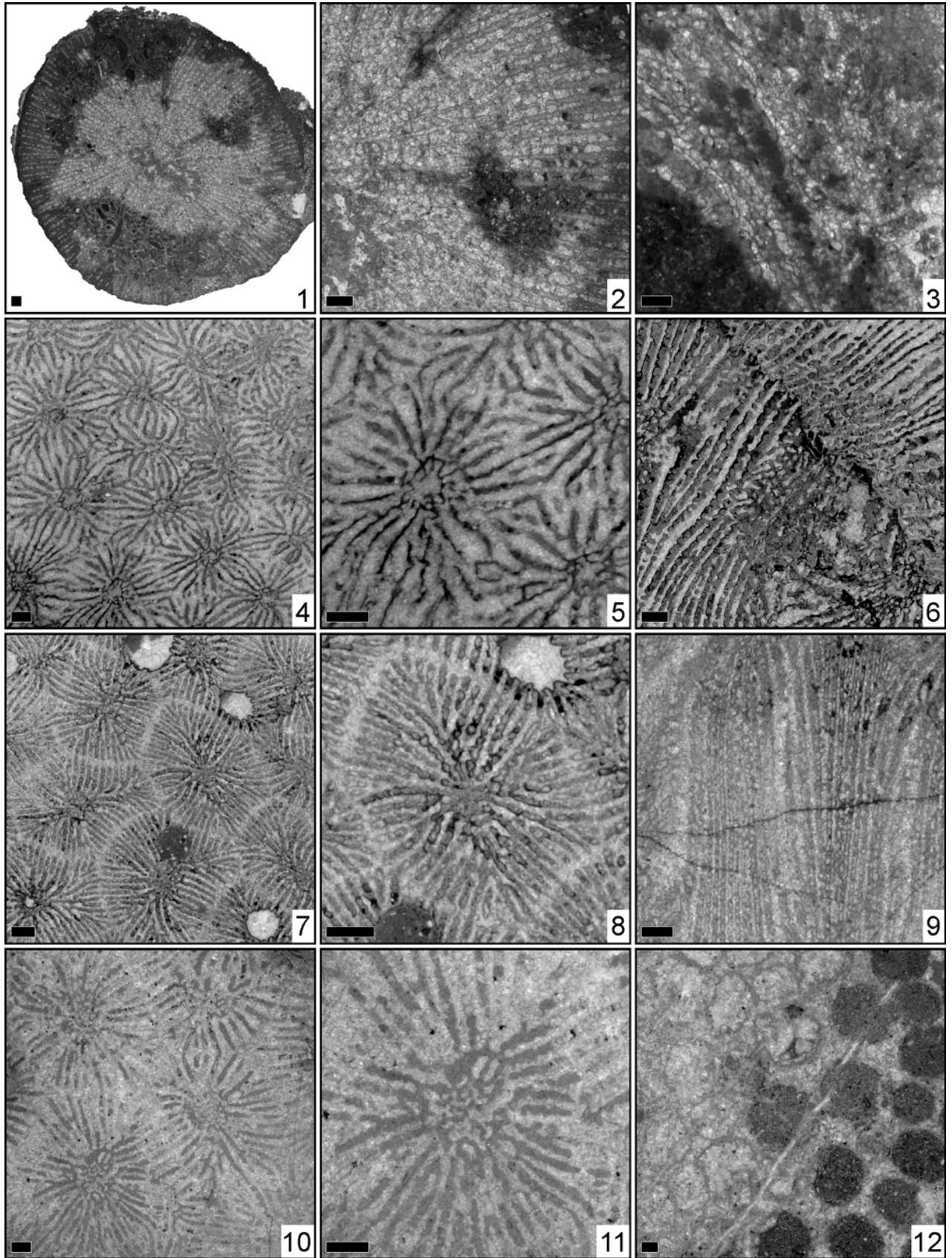




Plate 5:

1-3) *Eocomoseris* sp., BSPG 2003 XX 5891; 1) transversal thin section; 2) transversal thin section, detail; 3) longitudinal thin section;

4-6) *Microsolena ? interjecta* ALLOITEAU, 1958, BSPG 2003 XX 5832; 4) transversal thin section; 5) transversal thin section, detail; 6) longitudinal thin section;

7-9) *Negoporites spissus* POČTA, 1887, BSPG 2003 XX 5834; 7) transversal thin section; 8) transversal thin section, detail; 9) longitudinal thin section;

10-12) *Brachycoenia* sp., BSPG 2003 XX 5949; 10) transversal thin section; 11) transversal thin section, detail; 12) longitudinal thin section.

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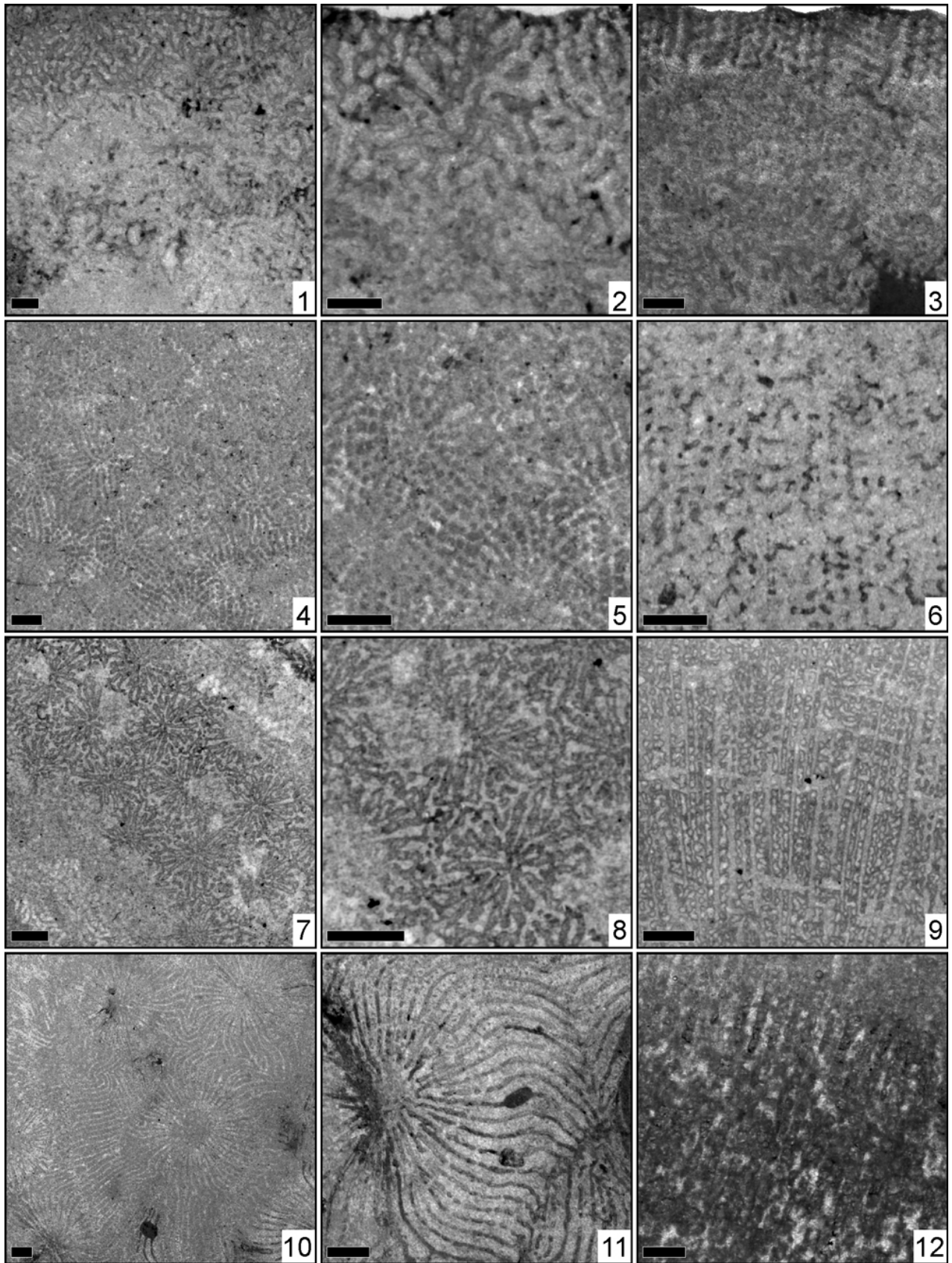




Plate 6:

1-3) *Synastrea* sp., BSPG 2003 XX 5817; 1) transversal thin section; 2) transversal thin section, detail; 3) longitudinal thin section;

4-6) *Hydnophoraraea styriaca* MICHELIN, 1847, BSPG 2003 XX 5899; 4) transversal thin section; 5) transversal thin section, detail; 6) longitudinal thin section;

7-9) *Parnassomeandra steuberi* LÖSER, 2013, BSPG 2003 XX 5928; 7) transversal thin section; 8) transversal thin section, detail; 9) longitudinal thin section;

10-12) *Confusaforma weyeri* LÖSER, 1987, BSPG 2003 XX 5827; 10) transversal thin section; 11) transversal thin section, detail; 12) longitudinal thin section.

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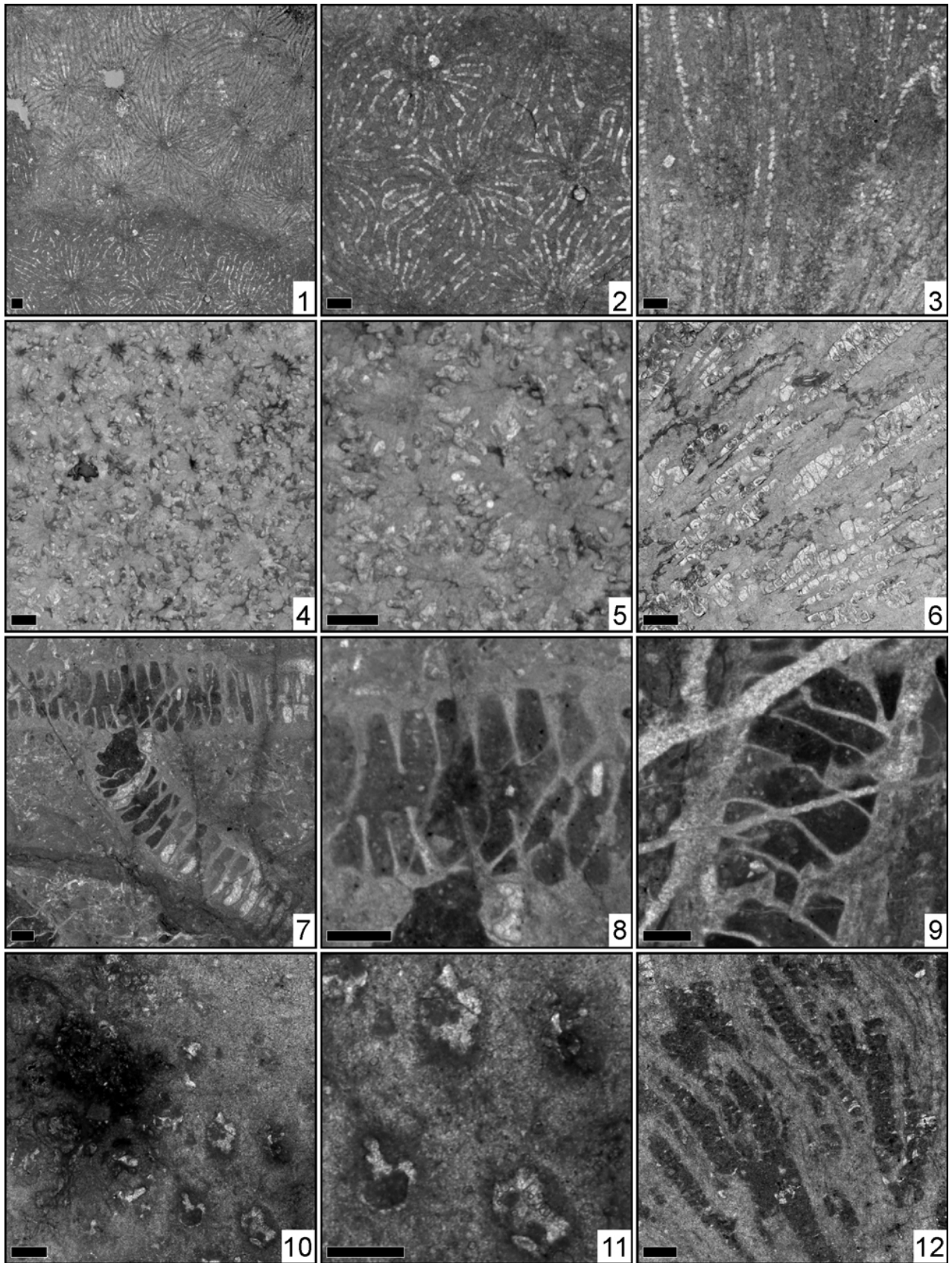




Plate 7:

1-3) *Cryptocoenia* cf. *biedai* MORYCOWA, 1964, BSPG 2003 XX 5881; 1) transversal thin section; 2) transversal thin section, detail; 3) longitudinal thin section;

4-6) *Cryptocoenia jacobi* ALLOITEAU, 1948, BSPG 2003 XX 5860; 4) transversal thin section; 5) transversal thin section, detail; 6) longitudinal thin section;

7-9) *Cryptocoenia* cf. *miyakoensis* EGUCHI, 1936, BSPG 2003 XX 5883; 7) transversal thin section; 8) transversal thin section, detail; 9) longitudinal thin section;

10-12) *Cryptocoenia* sp., BSPG 2003 XX 5835; 10) transversal thin section; 11) transversal thin section, detail; 12) longitudinal thin section.

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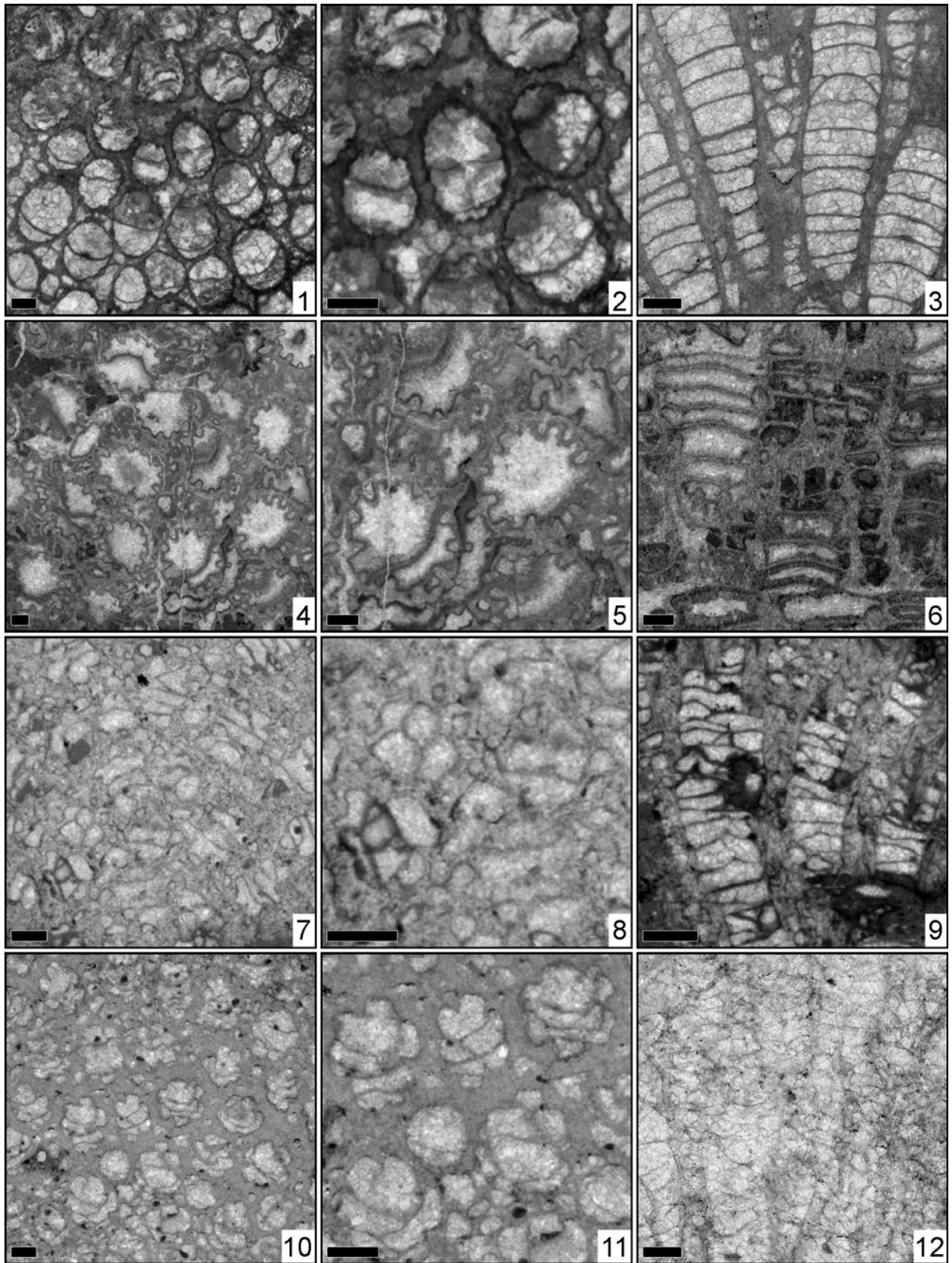




Plate 8:

1-3) *Felixigyra* sp., BSPG 2003 XX 5816; 1) transversal thin section; 2) transversal thin section, detail; 3) longitudinal thin section;

4-6) *Rhipidomeandra* sp., BSPG 2003 XX 5818; 4) transversal thin section; 5) transversal thin section, detail; 6) longitudinal thin section;

7-9) *Haplaraea gracilis* (HACKEMESSER, 1936), BSPG 2003 XX 5960; 7) transversal thin section; 8) transversal thin section, detail; 9) longitudinal thin section;

10-12) *Canleria clemens* ELIÁŠOVÁ, 1996, BSPG 2003 XX 5951; 10) transversal thin section; 11) transversal thin section, detail; 12) transversal thin section, detail with remaining septal microstructure.

[Scale bar 1mm]

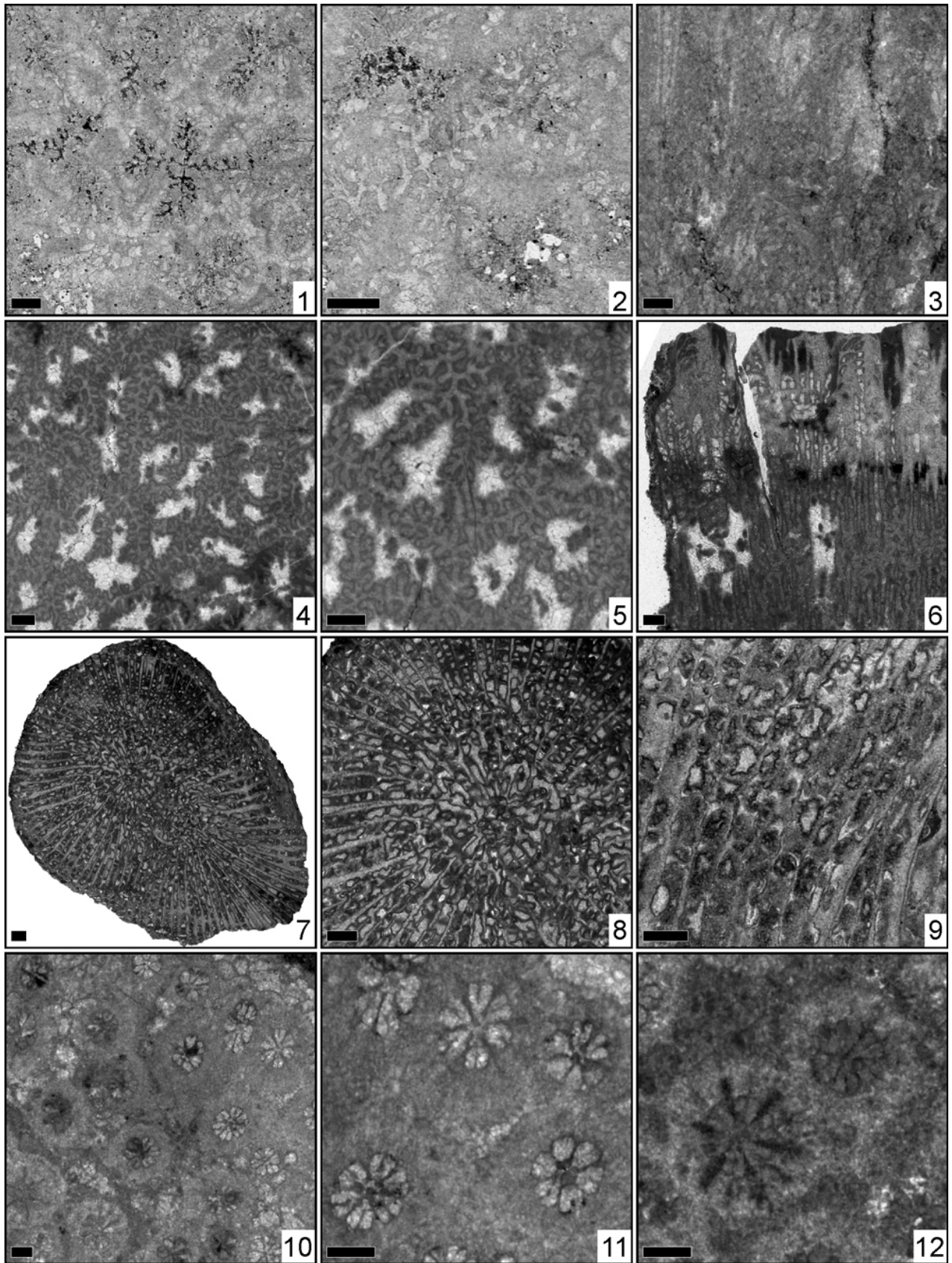




Plate 9:

1-5) *Kozaniastrea pachysepta* n. gen. n. sp., holotype BSPG 2003 XX 7449; 1) transversal thin section; 2) transversal thin section; 3) transversal thin section; 4) longitudinal thin section; 5) longitudinal thin section, detail;
6-8) *Canleria* sp. 1, BSPG 2003 XX 6149; 6) transversal thin section; 7) transversal thin section, detail; 8) longitudinal thin section.

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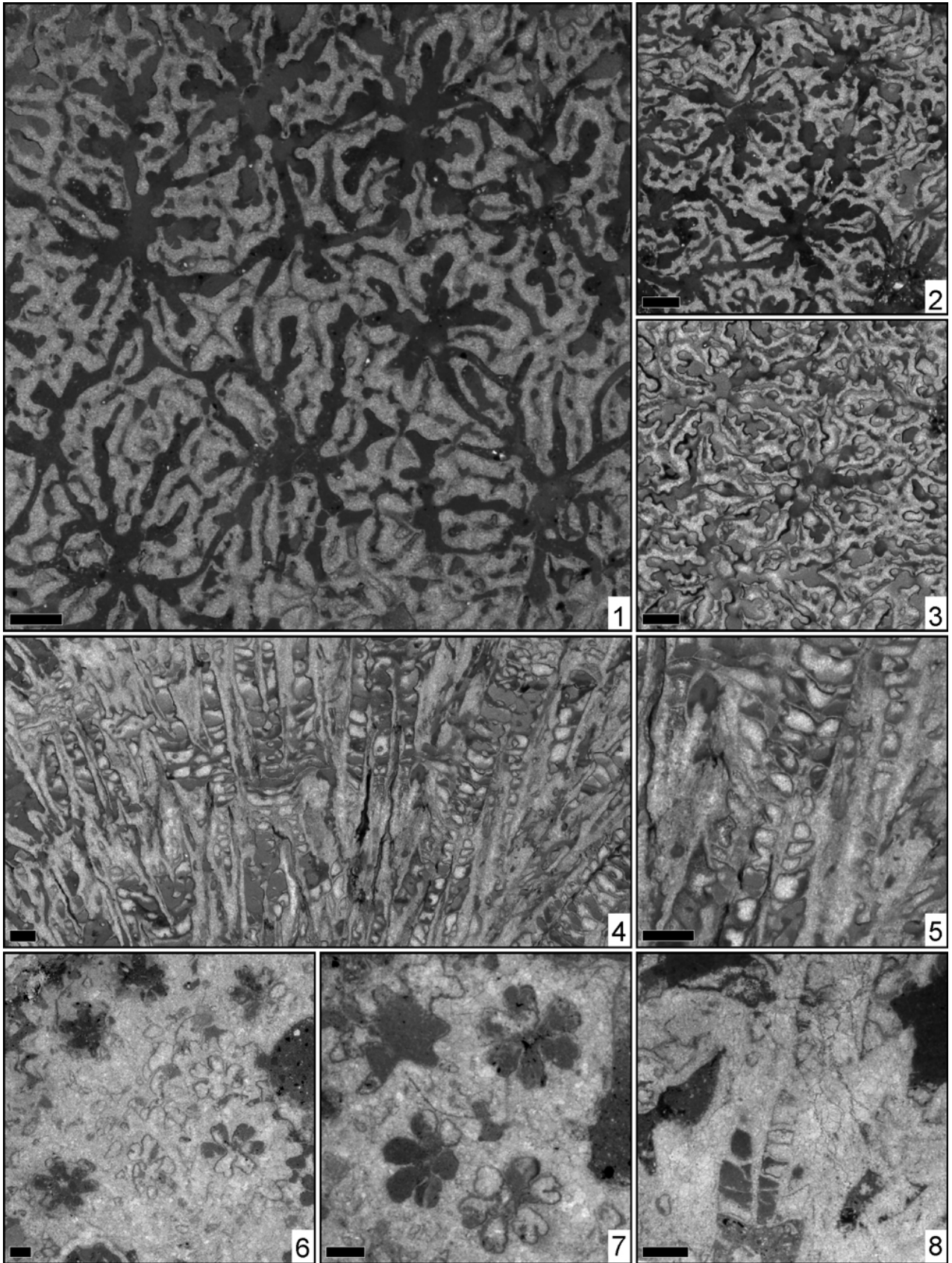




Plate 10:

1-3) *Canleria* sp. 2, BSPG 2003 XX 5867; 1) transversal thin section; 2) transversal thin section, detail; 3) longitudinal thin section;

4-6) *Heterocoenia distans* MILNE EDWARDS & HAIME, 1848, BSPG 2003 XX 5819; 4) transversal thin section; 5) transversal thin section, detail; 6) longitudinal thin section;

7-9) *Styloheterocoenia brunni* n. gen. n. sp., holotype BSPG 2003 XX 5849; 7) transversal thin section; 8) transversal thin section, detail; 9) longitudinal thin section.

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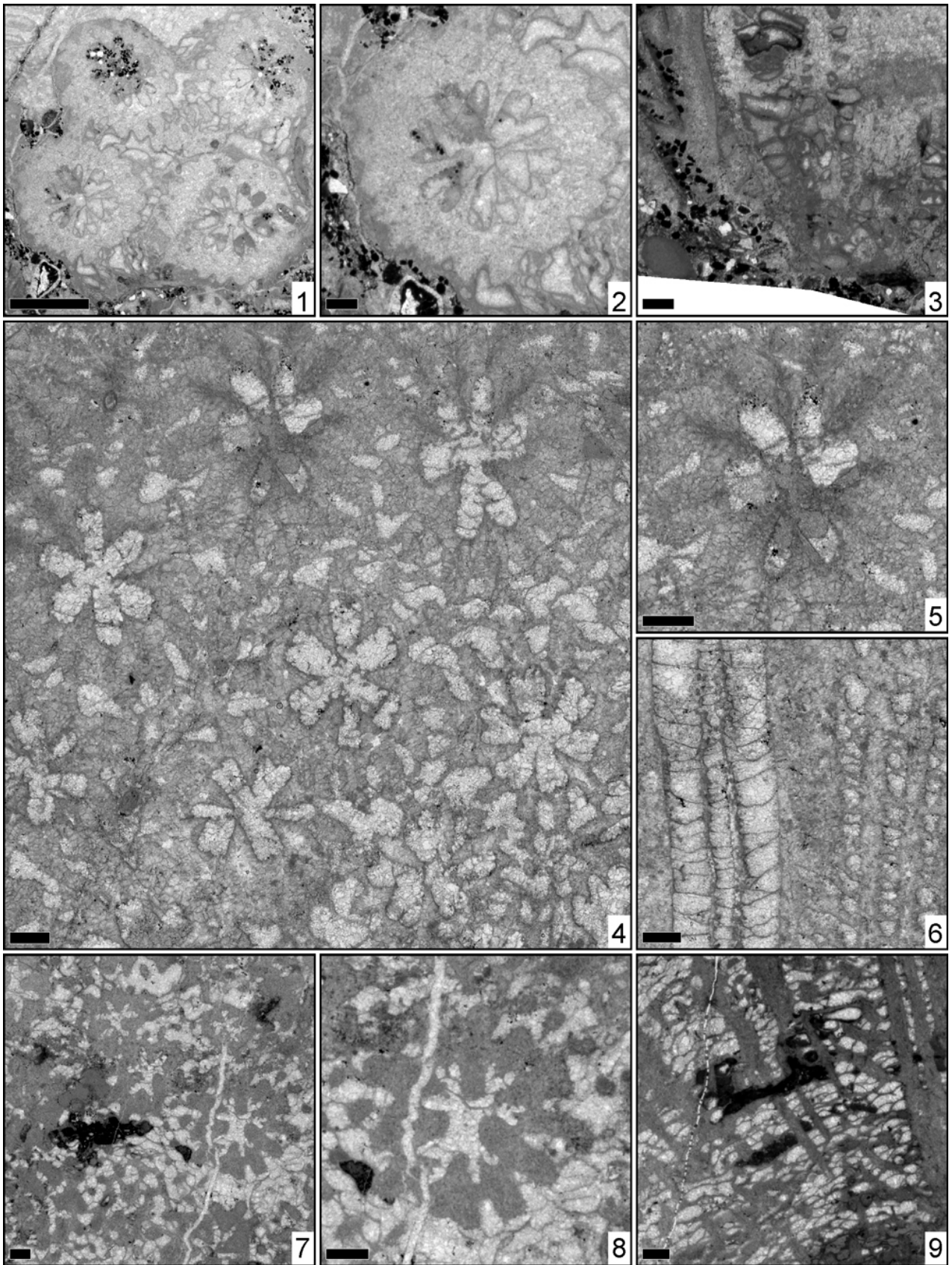




Plate 11:

1-4) *Styloheterocoenia hellenensis* n. gen. n. sp., holotype BSPG 2003 XX 5837; 1) transversal thin section; 2) transversal thin section, detail; 3) longitudinal thin section, detail; 4) longitudinal thin section;

5-6) *Tiarasmilia* cf. *casteri* WELLS, 1932, BSPG 2003 XX 5953; 5) transversal thin section; 6) transversal thin section, detail.

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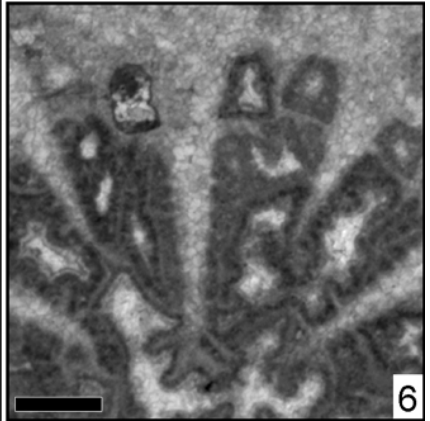
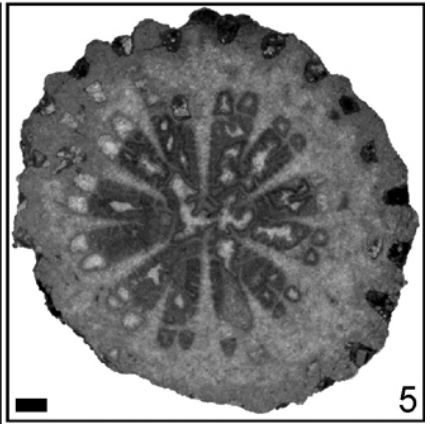
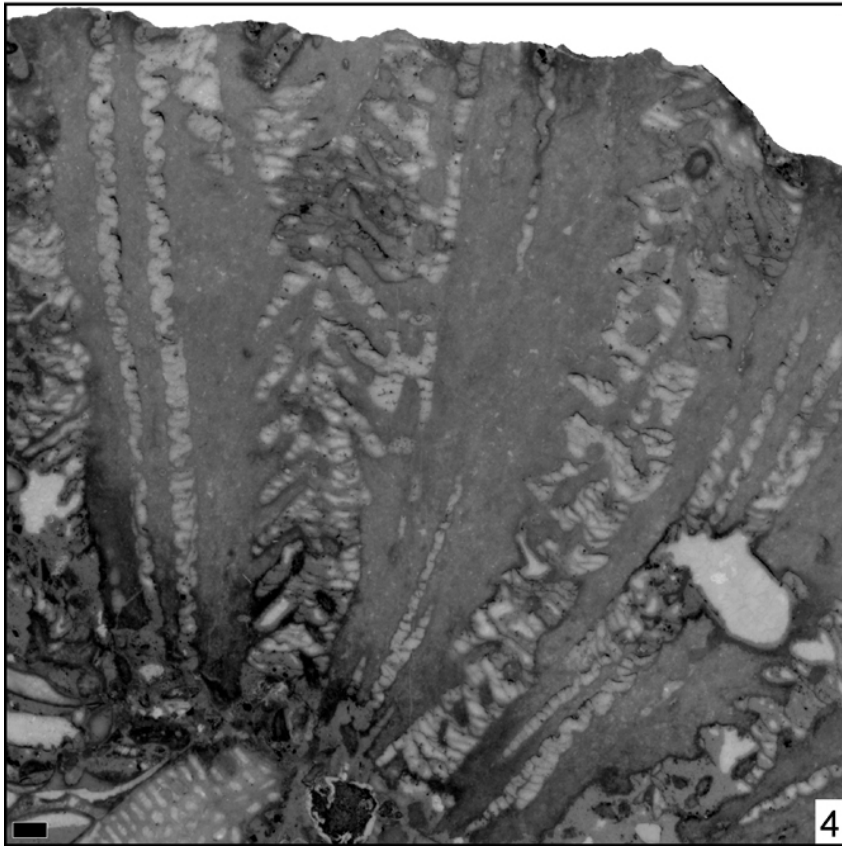
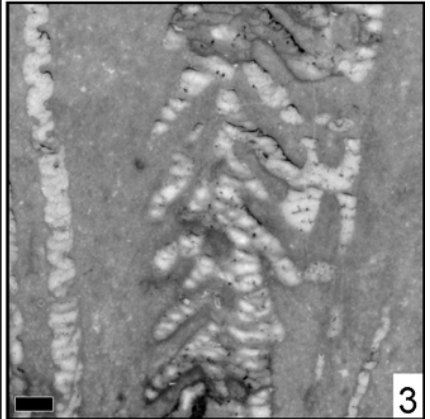
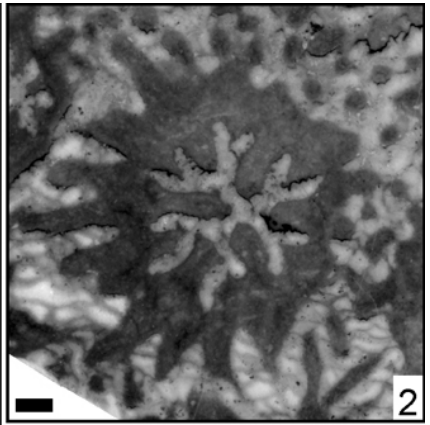
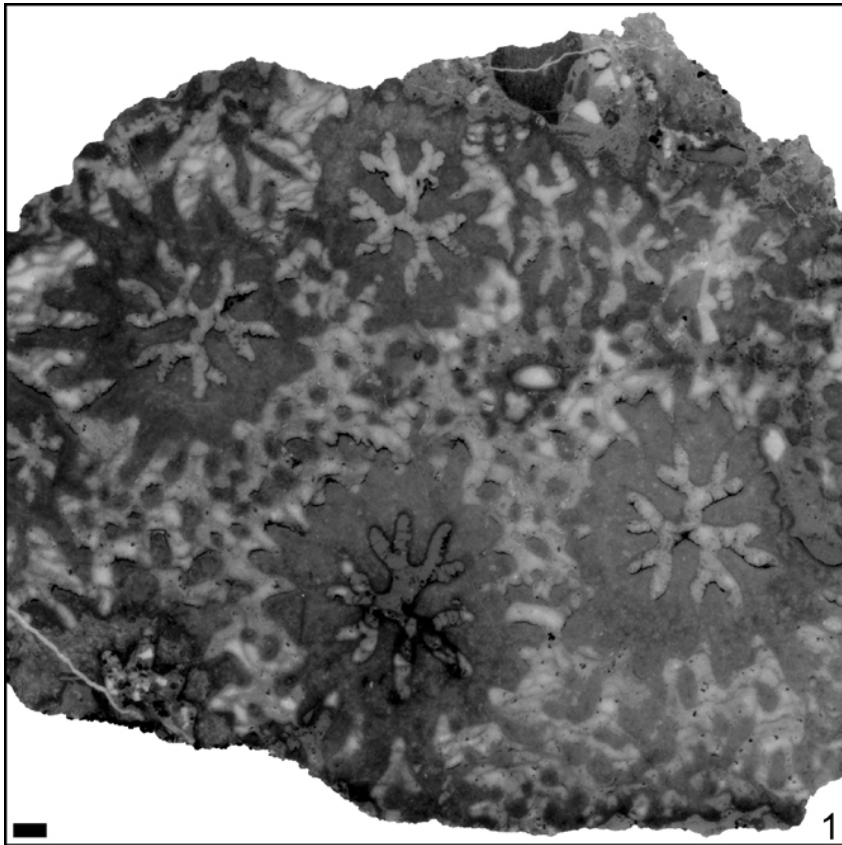




Plate 12:

1-3) *Styloheterocoenia* sp., BSPG 2003 XX 5937; 1) transversal thin section; 2) transversal thin section, detail; 3) longitudinal thin section;

4-8) *Plesiolites winnii* n. gen. n. sp., holotype BSPG 2003 XX 7469; 4) transversal thin section; 5) transversal thin section, detail; 6) paratype BSPG 2003 XX 7464; transversal thin section; 7) holotype BSPG 2003 XX 7469; longitudinal thin section; 8) paratype BSPG 2003 XX 7466; transversal thin section.

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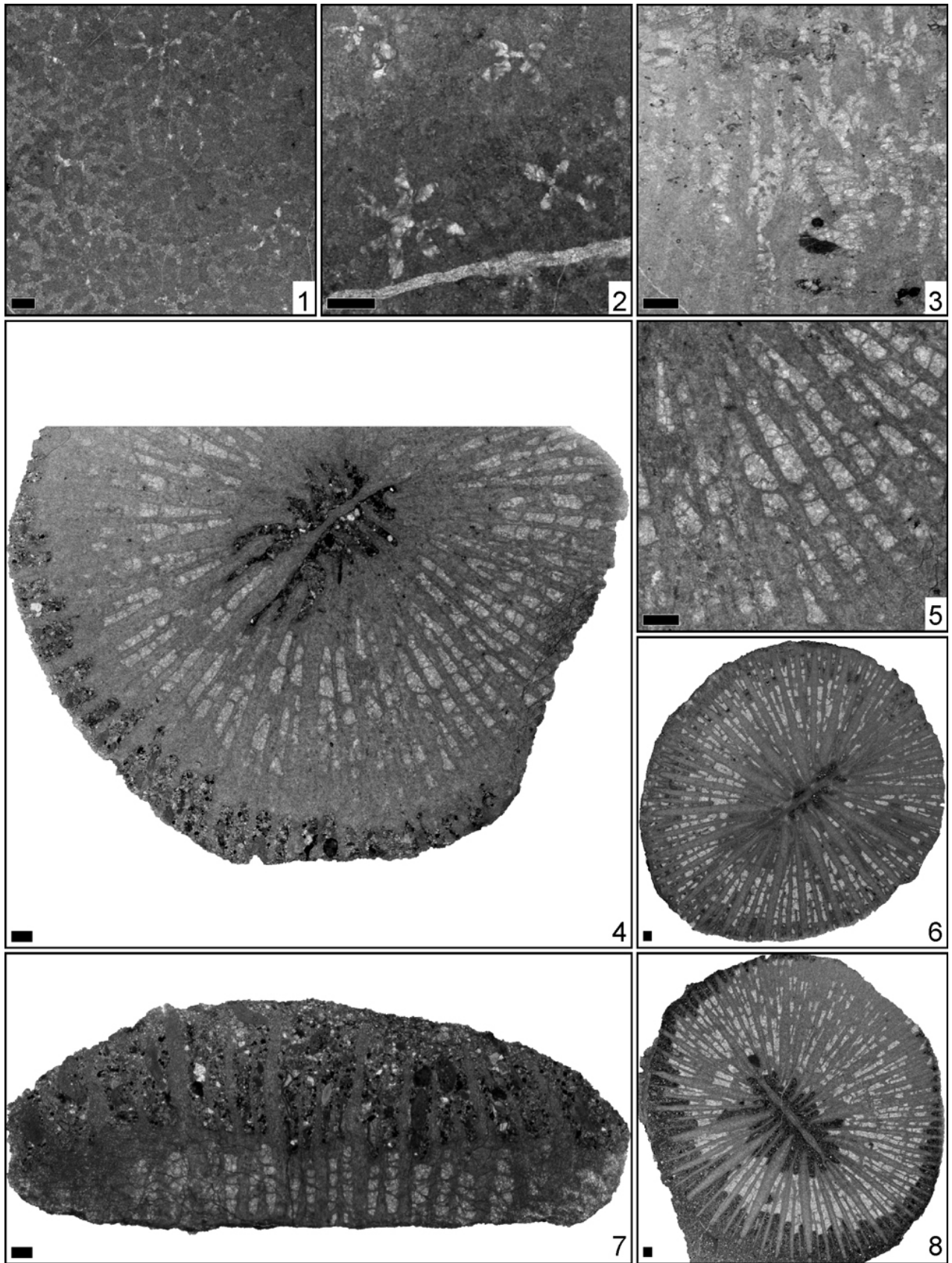




Plate 13:

1-3) *Plesiosmilia vaughani* (ANGELIS d'OSSAT, 1905), BSPG 2003 XX 5964; 1) transversal thin section; 2) transversal thin section, detail; 3) longitudinal thin section;

4) *Tiarasmilia* sp., BSPG 2003 XX 5921; transversal thin section;

5) *Trochophyllia ogilvieae* (ANGELIS d'OSSAT, 1905), BSPG 2003 XX 5947; transversal thin section;

6-7) *Trochophyllia rara* (PREVER, 1909), BSPG 2003 XX 5931; 6) transversal thin section; 7) transversal thin section, detail;

8) *Trochophyllia tourtiensis* (BÖLSCHE, 1871), BSPG 2003 XX 5941; transversal thin section;

9) *Aulastraeopora harrisi* WELLS, 1932, BSPG 2003 XX 5940; transversal thin section;

10-12) *Trochophyllia* sp., BSPG 2003 XX 5955; 10) transversal thin section; 11) transversal thin section, detail; 12) longitudinal thin section.

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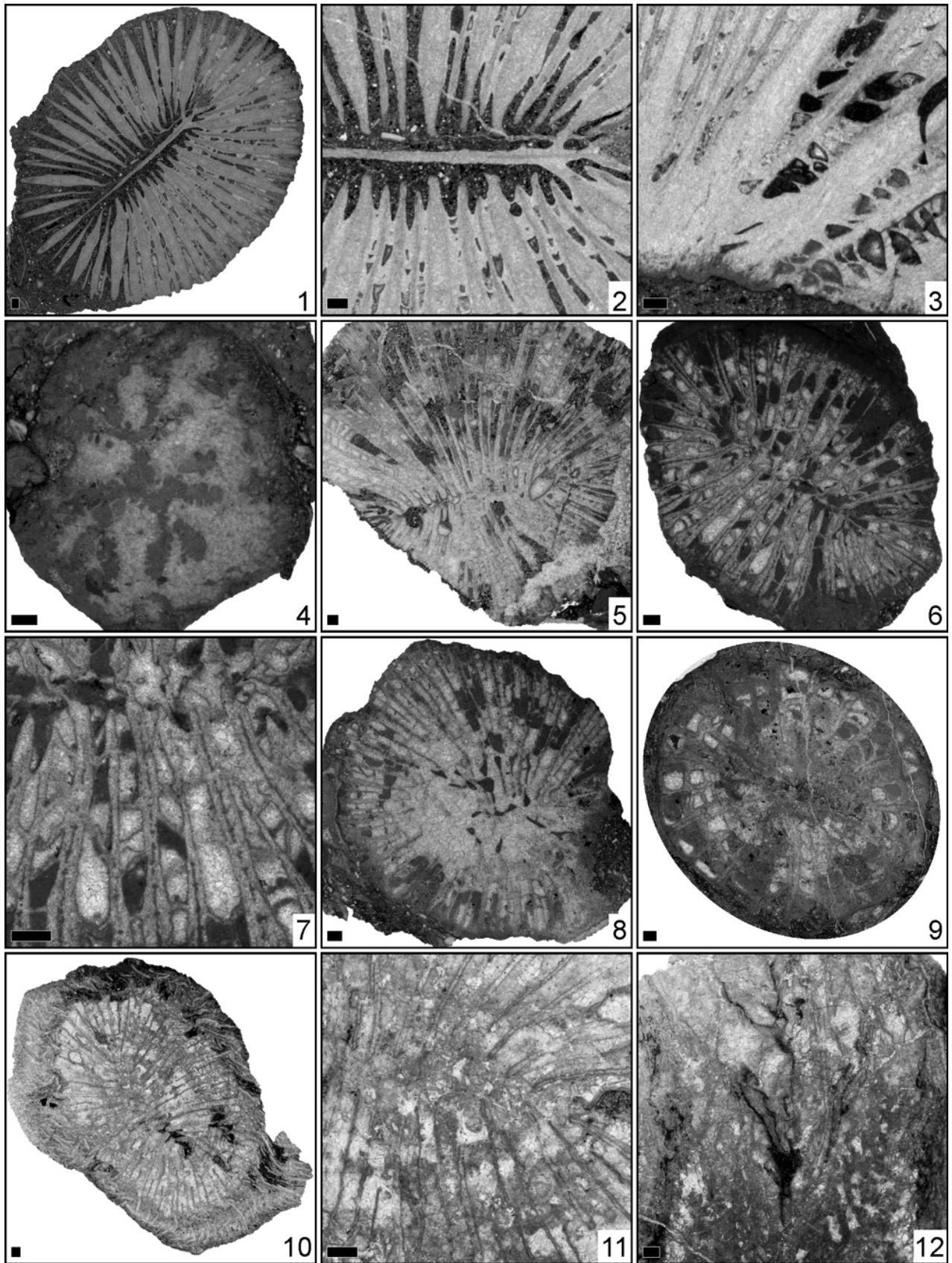




Plate 14:

1-3) *Placocoenia* sp., BSPG 2003 XX 5875; 1) transversal thin section; 2) transversal thin section, detail; 3) longitudinal thin section;

4-6) *Silingastraea shimoheiensis* EGUCHI, 1951, BSPG 2003 XX 5828; 4) transversal thin section; 5) transversal thin section, detail; 6) longitudinal thin section;

7-9) *Silingastraea* sp. 1, BSPG 2003 XX 5815; 7) transversal thin section; 8) transversal thin section, detail; 9) longitudinal thin section;

10-12) *Silingastraea* sp. 2, BSPG 2003 XX 5844; 10) transversal thin section; 11) transversal thin section, detail; 12) longitudinal thin section.

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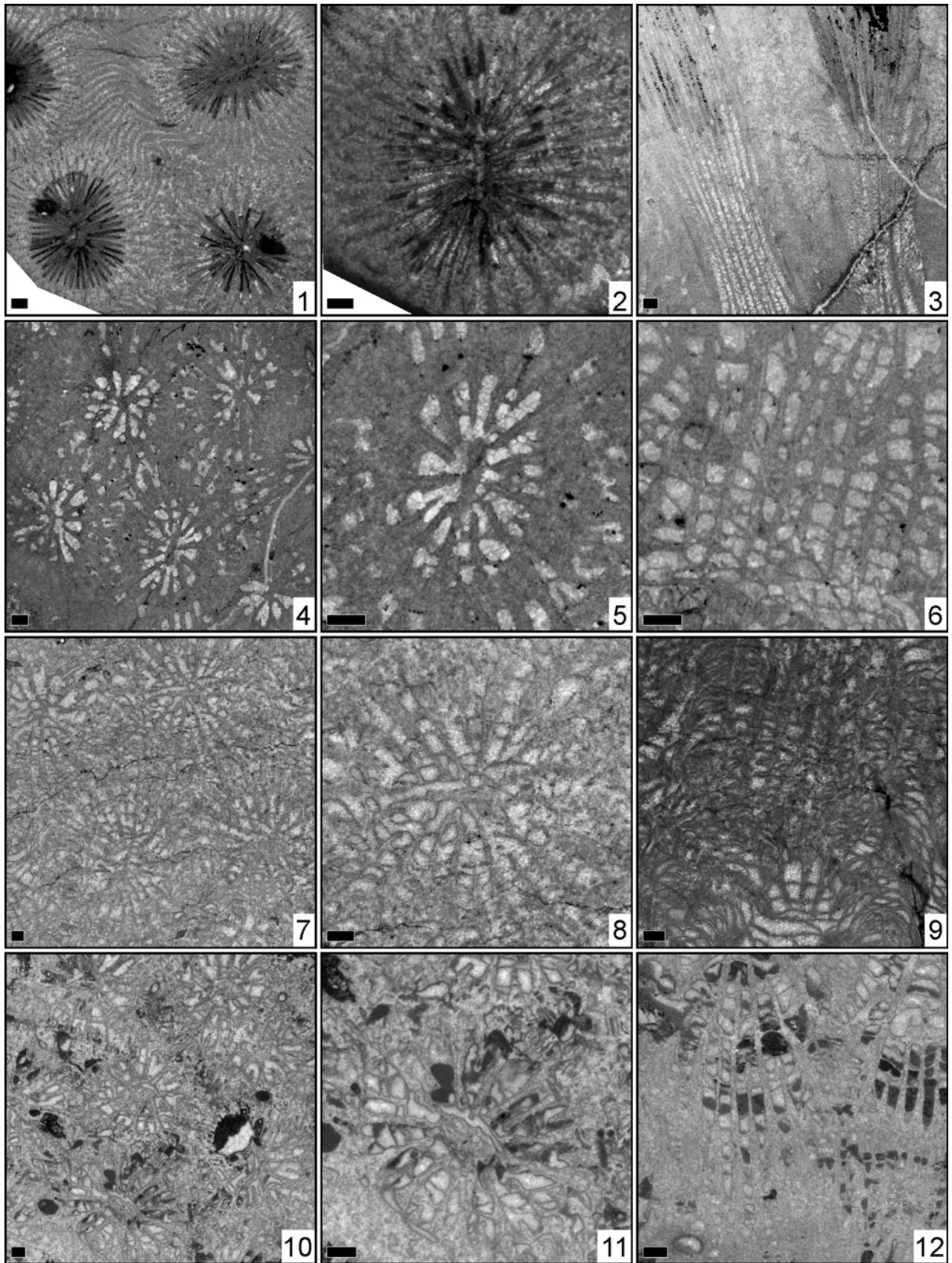




Plate 15:

1-3) *Silingastraea* sp. 3, BSPG 2003 XX 5824; 1) transversal thin section; 2) transversal thin section, detail; 3) longitudinal thin section;

4-6) *Complexastrea* sp., BSPG 2003 XX 5936; 4) transversal thin section; 5) transversal thin section, detail; 6) longitudinal thin section;

7-9) *Thecosmilia densa* FROMENTEL, 1870, BSPG 2003 XX 5842; 7) transversal thin section; 8) transversal thin section, detail; 9) oblique thin section;

10-12) *Aulosmilia* sp., BSPG 2003 XX 5967; 10) transversal thin section; 11) transversal thin section, detail; 12) BSPG 2003 XX 7441; transversal thin section;

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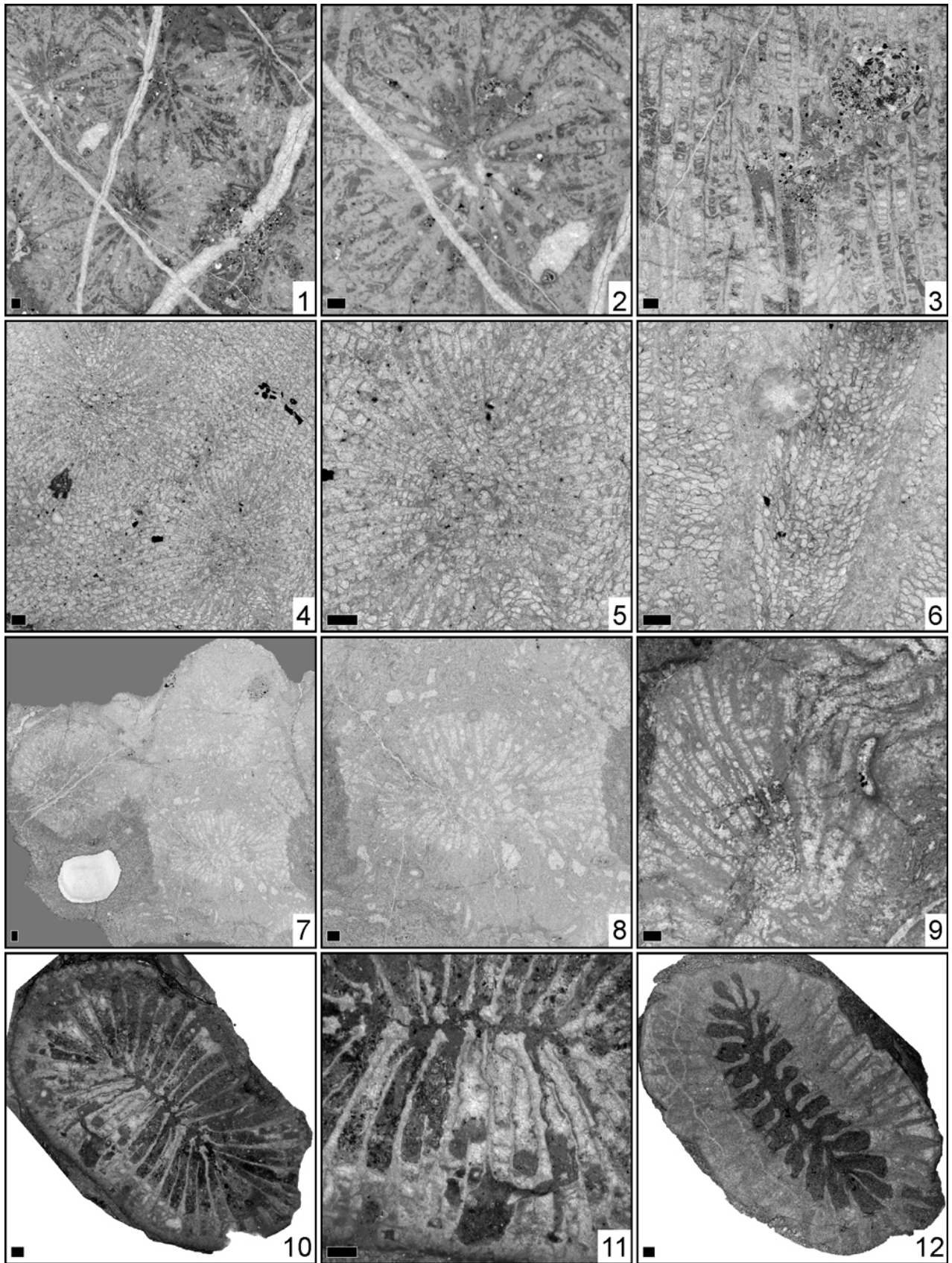




Plate 16:

1-3) *Diplocteniopsis* sp., BSPG 2003 XX 5938; 1) transversal thin section; 2) transversal thin section, detail; 3) longitudinal thin section;

4-5) *Silingastraea japonica* EGUCHI, 1951, BSPG 2003 XX 5887; 4) transversal thin section; 5) transversal thin section, detail;

6-7) *Elasmophyllia* sp., BSPG 2003 XX 5961; 6) transversal thin section; 7) transversal thin section, detail;

8-10) *Hydnophoropsis* sp. 1, BSPG 2003 XX 5836; 8) transversal thin section; 9) transversal thin section, detail; 10) longitudinal thin section.

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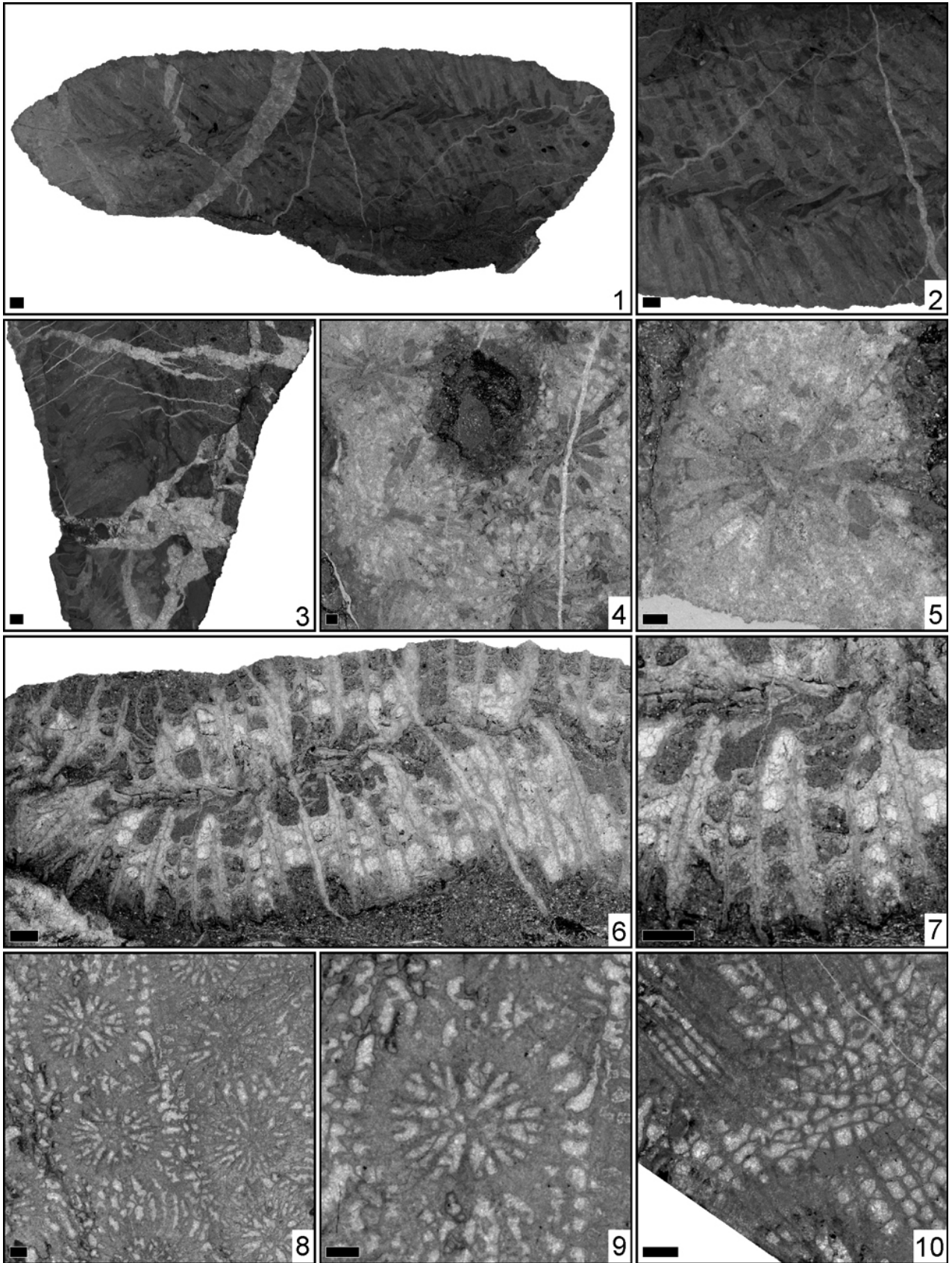




Plate 17:

1-3) *Hydnophoropsis* sp. 2, BSPG 2003 XX 5882; 1) transversal thin section; 2) transversal thin section, detail; 3) longitudinal thin section;

4-6) *Pachygyra* sp., BSPG 2003 XX 7442; 4) transversal thin section; 5) transversal thin section, detail; 6) longitudinal thin section;

7-10) *Phyllosmilia* cf. *basochesi* DEFRANCE, 1828, BSPG 2003 XX 7433; 7) transversal thin section; 8) transversal thin section, detail; 9) BSPG 2003 XX 7437; transversal thin section, detail; 10) BSPG 2003 XX 7433; longitudinal thin section.

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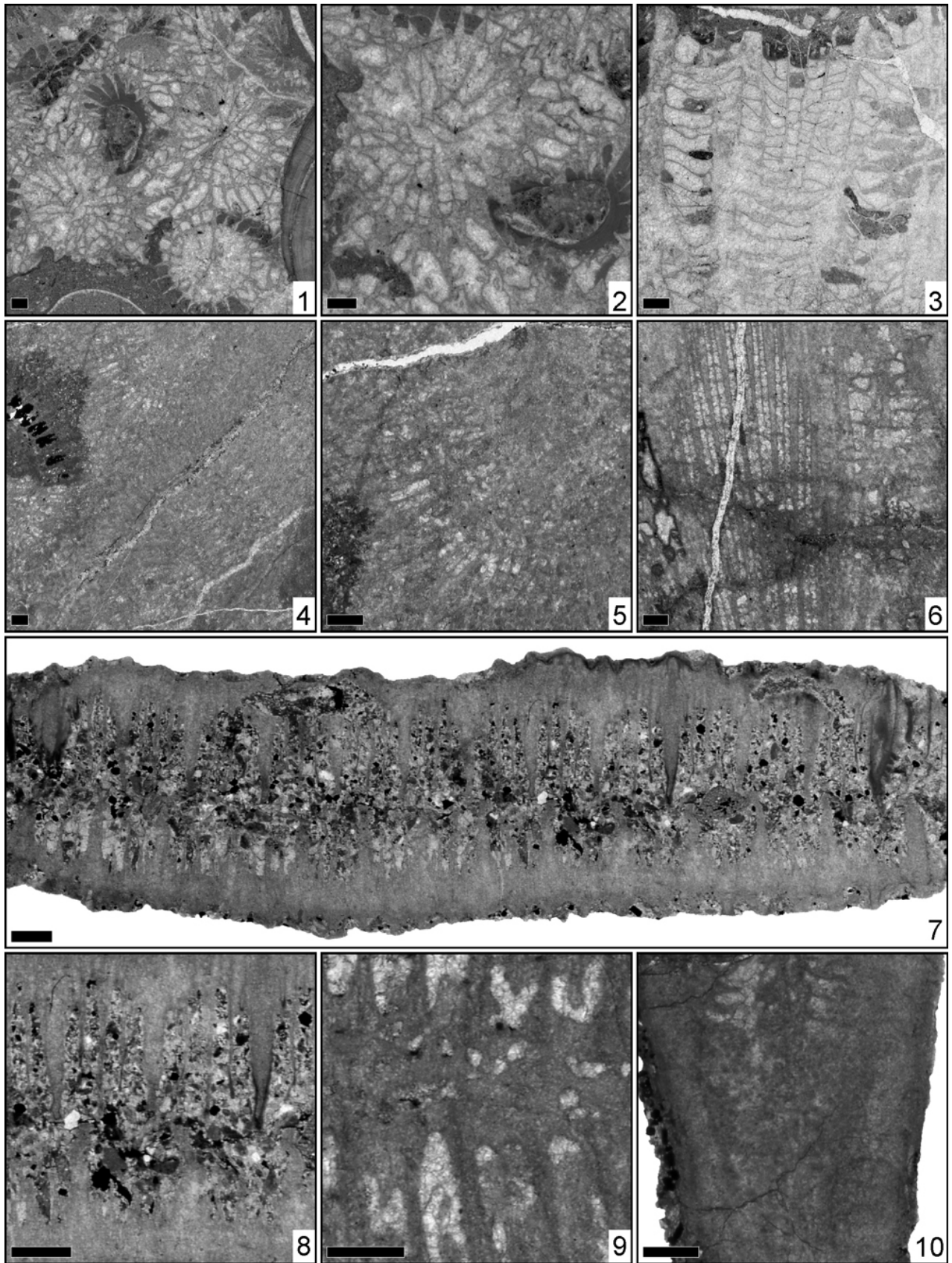




Plate 18:

1-3) *Apoplacophyllia* sp., BSPG 2003 XX 5935; 1) transversal thin section; 2) transversal thin section, detail; 3) longitudinal thin section;

4-6) *Aulastraeopora schnauzeae* LÖSER, 1998, SNSD-MMG GrK2; 4) transversal thin section; 5) transversal thin section, detail; 6) longitudinal thin section;

7-9) *Preverastraea* aff. *stellata* STOLICZKA, 1873, BSPG 2003 XX 5839; 7) transversal thin section; 8) transversal thin section, detail; 9) longitudinal thin section;

10-12) *Preverastraea infundibuliformis* (WELLS, 1932), BSPG 2003 XX 6170; 10) transversal thin section; 11) transversal thin section, detail; 12) longitudinal thin section.

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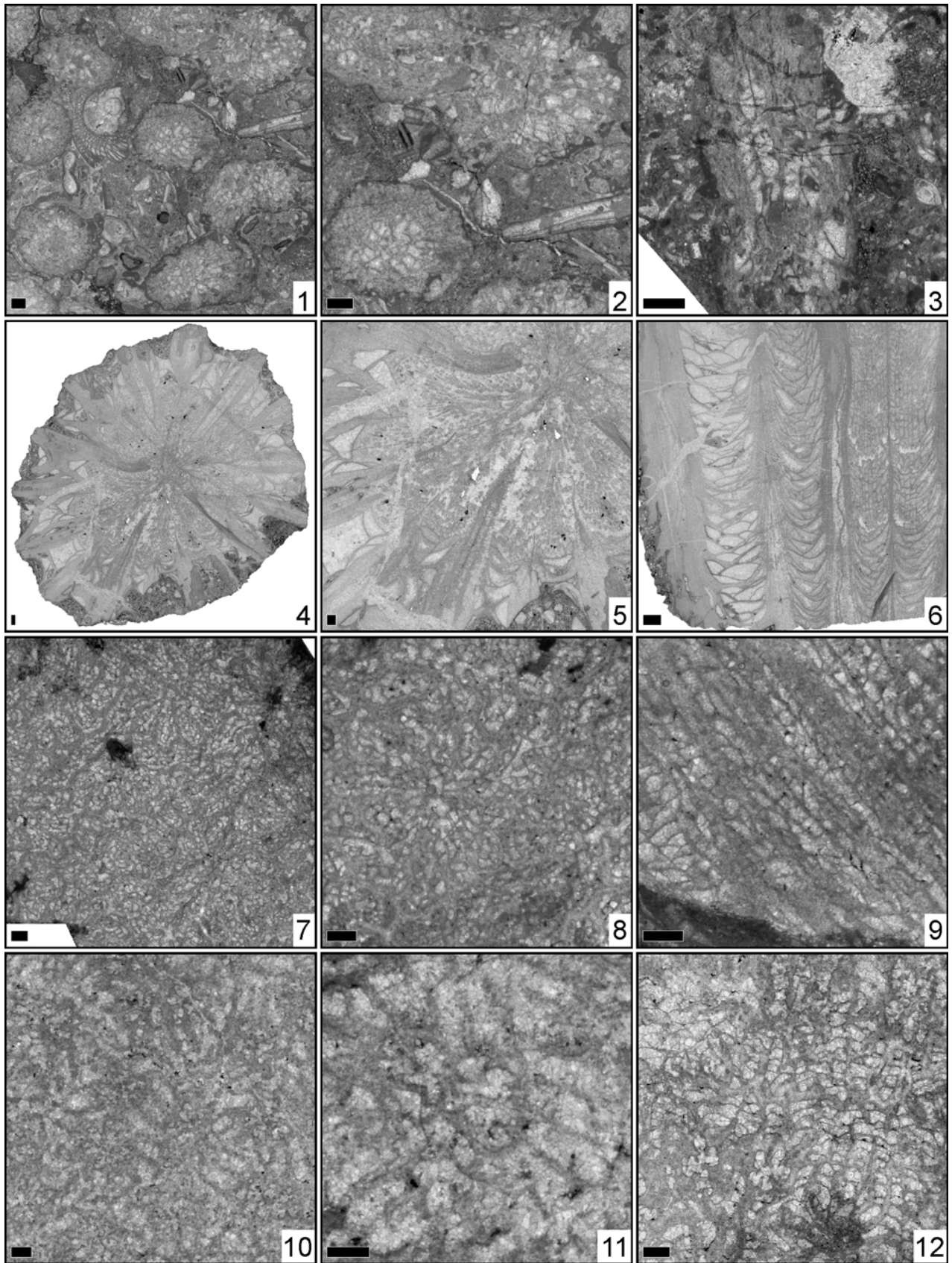




Plate 19:

1-3) ?*Stephanomorpha* sp., BSPG 2003 XX 5822; 1) transversal thin section; 2) transversal thin section, detail; 3) longitudinal thin section;

4-6) *Eosiderastrea grandipora* ORBIGNY, 1850, BSPG 2003 XX 5900; 4) transversal thin section; 5) transversal thin section, detail; 6) longitudinal thin section;

7-9) *Eosiderastrea paragrandidipora* LÖSER, 2016, BSPG 2003 XX 5812; 7) transversal thin section; 8) transversal thin section, detail; 9) longitudinal thin section;

10-11) *Eosiderastrea stefani* LÖSER, 2016, BSPG 2003 XX 6145; 10) oblique thin section; 11) transversal thin section, detail.

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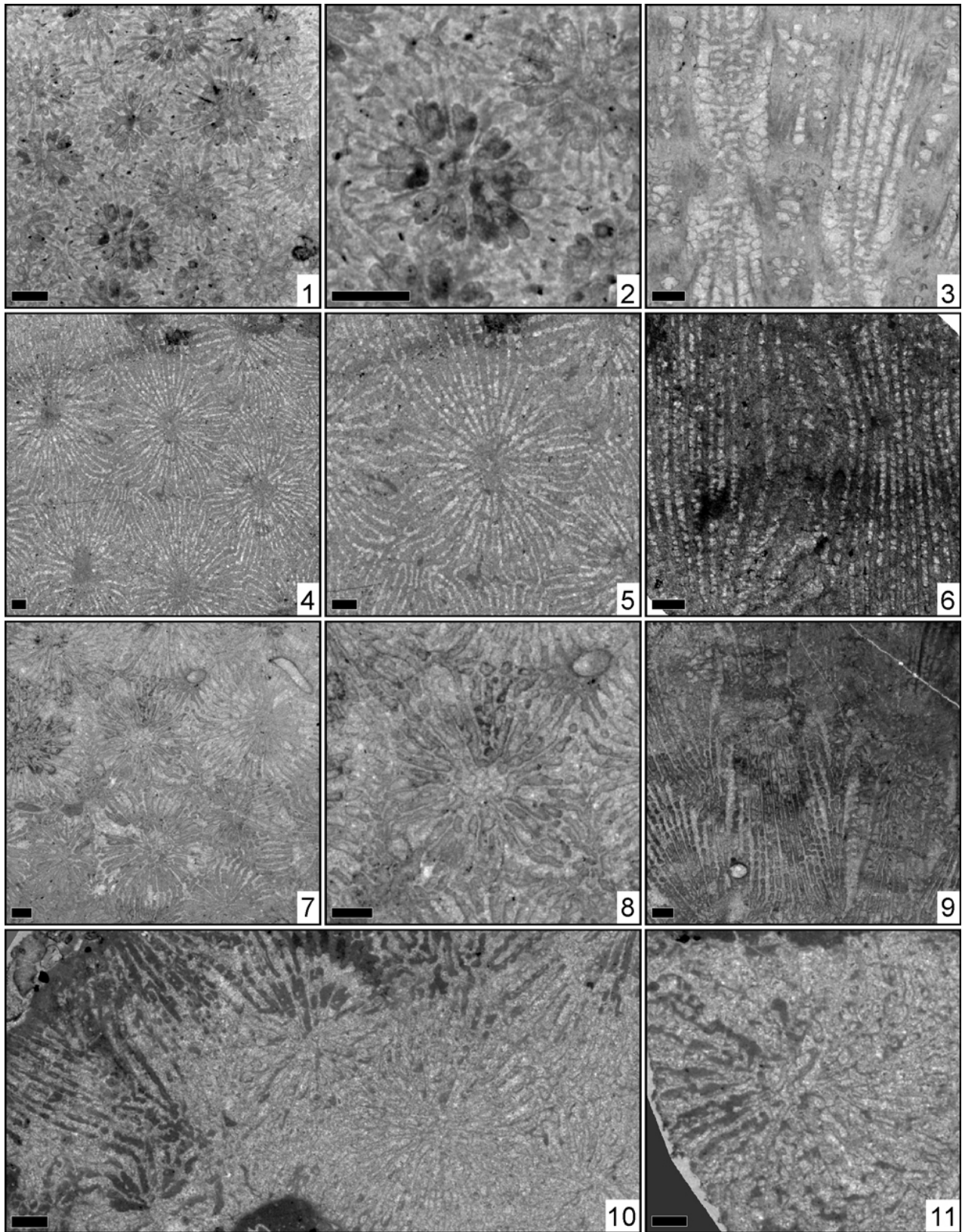




Plate 20:

1-3) *Eosiderastrea* sp. 1, BSPG 2003 XX 5829; 1) transversal thin section; 2) transversal thin section, detail; 3) longitudinal thin section;

4-6) *Eosiderastrea* sp. 2, BSPG 2003 XX 5846; 4) transversal thin section; 5) transversal thin section, detail; 6) longitudinal thin section;

7-9) *Heliopora radiata* (ORBIGNY, 1850), BSPG 2003 XX 5821; 7) transversal thin section; 8) transversal thin section, detail; 9) longitudinal thin section.

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