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

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Thomas STEUBER 2
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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 Cénomanien inférieur de Nea Nikopoli (Kozani, Grèce ; Crétacé).- Une série marine riche en coraux d’âge Cénomanien 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 Plesiosmiliids. 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 Cénomanien et 33 se sont prolongés dans le Cénomanien moyen, mais seulement 19 ont persisté jusque dans le Turonien. La faune corallienne montre des relations paléobiogéographiques étroites avec principalement des faunes du Cénomanien 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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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 Brun (1956), under the former Turkish name Scafidi. Brun 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 Cunnilites (= 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 & Dien, 1992; Steuber & Löser, 2000; Berndt, 2004; Ayoob-Hannaa, 2011; Ayoob-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 (Elíasová, 1992, 1994, 1996a, 1997b, 2004; Löser, 1989, 1994, 2014b, 2015a). The taxonomy of Tethyan Cenomanian corals is mostly outdated (Coquand, 1862; Fromenteel, 1862-1887; Montanaro-Gallitelli, 1937; Söhle, 1897; Stoliczka, 1873), with only a few more recent revisions (Tunsek et al., 1992; Ganeel, 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 combination 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 thrusted over the mainly crystalline Pelagonian basement, forming an Eohellenic 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, Aquitanian 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).

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 formaninifers, 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 formaninifers. Two limestone beds (A4, A5) contain corals, bivalves (*Neithia*), gastropods, rudists (*Apricardia, Caprinula* and *Caprinulidae*), and fragments of echinoids. Above a fine-grained conglomerate with components of ophiolite and limestone of 2-4 mm in diametre, showing spherical weathering (A6), follow numerous beds of a nodular limestone (A7-12) that all contain (mainly colonial) corals, gastropods (mainly *Neithea*), rudists (*Apricardia, Ichthysarcolites*, *Radiolitidae*), and other bivalves, such as *Ilymatogyra africana* (LAMARCK, 1801), *Rhynchostreon suborbiculatum* (LAMARCK, 1801), *Rastellium carinatum* (LAMARCK, 1806), *Chondrodonta joanae* (CHOFFAT, 1886), *Neithia* (*Neithia*) 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.
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 southeastern 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 foraminifers. 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 (*Ichthyosarcolites, 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 (*Ichthyosarcolites, Radiolitidae*) and colonial corals (*Hydnophoridae*) 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, Hydnophorararea, Latomeandra, Thalamocae- niopsis) in live position. Bed C5 contains predominantly solitary (Aulosmilia, Tiaraspiilia) and colonial corals (Cryptocoenia, Latomeandra, Mixastrea, Parnassomeandra, Polyasteopsis, Si- lingastraea), large gastropods (Nerineidae) and rare rudists (Caprinidae and Caprinulidae, Radiolitidae). Phaceloid coral colonies (Lato- meandra) 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-
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 siliciclastics 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 Conicorbitolina 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. Batalier (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 Helladastrea 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) indicate an Early Cenomanian age. The Lower Turonian. (2011) quote a range from Upper Cenomanian to Turonian while Hondt & Dieni (1992) restrict species (1987) indicate an Early Cenomanian age. The genus Helastrea is indicated in the Cenomanian and Turonian. (Choffat, 1886), Stenzel (1971) indicates a Turonian age, Auoy-Hannaa (2011) and Auoy-Hannaa & Fürsich (2011) quote a range from Upper Cenomanian to Lower Turonian. Neithhea (Neithhea) zitelli (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 & Bengtson, 1999).

The caprinid and caprinulid rudists Caprina adversa orbigny, 1822, Caprina baylei (Gemmella-ro, 1865), Orthoptychus striatus Futterer, 1892, Schiosia sp., Sphaerucaprina sp., and Caprinula boissyi (Orbigny, 1842) support a Cenomanian age. 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 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 (Lamarrck, 1801) is a widespread species that occurred in the Cenomanian according to Ayoub-Hannaa (2011), Berndt (2004), and Marchus (1990) while Ayoub-Hannaa and Fürsich (2011) quote a range from Upper Cenomanian to Lower Turonian. Neithrea (Neithrea) zitelli (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 & Bengtson, 1999).

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% bioclasts derived from the erosion of the Eohellenic basement (Fig. 6). In section C, bioclasts 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

C. conica. 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.

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## Methods

Coral specimens were cut and polished. Thin sections in both transversal and longitudinal orientation were prepared where possible. Thin sections were scanned by passing light through them using a flatbed scanner with an optical resolution of 6,400 dpi. Scanned images were then transferred to grey scale bit maps. Their quality was amended by histogram contrast manipulation (contrast stretching) where possible. To gain more insight into the intraspecific variation of fossil corals and to obtain a better strategy for comparing species, calicular dimensions of one or two thin sections of each species were systematically measured. To achieve statistical significance, the largest number of possible measurements was taken. This number was mainly determined by the size and quality of the thin section and the size of the single corallites in relation to the size of the thin sections.
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
- \( \text{min-max} \) lowest and highest measured values
- \( \mu \) 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 Amphiasterinae, Heterochoeniina, or Rhiplogyrina. Others, such as the Archrochoeniina, 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 assignation 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.
Figure 7: Relation of former suborders and superfamilies, slightly modified after Löser (2016c).

Institutional abbreviations: BSPG, Bayerische Staatsammlung für Paläontologie und Geologie, München, Germany; CGS, Ceská 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, México City, Mexico; LFU, Landesamt für Umwelt, München, Germany; MB, Museum für Naturkunde der Humboldt-Universität, Berlin, Germany; MGB, Museo Geológico del Seminario de Barcelona, Spain; MHE, Coll. M. Heinrich, Eckental, Germany; MNHN, Muséum d'Histoire naturelle de Neuchâtel, Switzerland; NMNH, National Museum of Natural History, 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; UMNH, National Museum of Natural History, Washington, D.C., USA; UPS, Université Paul Sabatier, Laboratoire de Géologie Sédimentaire et Paléontologie, Toulouse, France; WCM, Worcester City Museum and Art Gallery, UK; ZSH, Zumsteinhaus, Kempen, 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; cmx, larger outer calicular diameter; cmn, smaller outer calicular diameter; cn, calicular diameter (inner corallite in amphistaedae); crd, distance of calicular series; crw, width of calicular series; h, height of a solitary coral; md, distance between monticule in a hydnophoroid colony; ml, length of monticules in hydnophoroid 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 Archeocaeniina 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 Archeocaeniina 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]

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Other occurrences: Tithonian of France (Doubis) 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 (Arcêde) St.Remêze, 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 (Viotia) Levadia, Perachoron; Mexico (Puebla) Tehuacán, La Compañía (ERNO L-R10908). Upper Aptian of Algeria (Constantine) Sidi R'Gheiss (UP M 6313); Greece (Viotia) Aliartos, Chiamrena. Uppermost Aptian of Japan (Iwate-ken) Shimohi-gun, Tanohata-mura, Haie, northern cliff; Shimohi-gun, Taroch, Todana. Lowermost Albian (Tardefurcata zone) of Spain (Cataluña, Tarragona) Com. Baix Penedès, Mun. Maslorenç, Masarbonés, 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 (Mantell zone) of Germany (Nordrhein-Westfalen) Mülheim/Ruhr, Kassenberg. Lower Cenomanian (Dixoni zone) of Germany (Sachsen) Meißen-Zscheila, Trinitatis church.

Superfamily Caryophyllioidea Dana, 1846

Remarks: The superfamily corresponds to the suborder Caryophylliliina 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.
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**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:**

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**Remarks:** The material cannot be compared to any existing genus because all Cretaceous Caryophyllioida 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 EDWARDS & HAIMÉ, 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 nomenclatorical problems, the name-giving genus *Favia* is undefined (see LÖSER & SKLENAR, 2016, for further explanation), and so the suborder. The suborder Astrapoidea ALLOITEAU, 1952, is considered by various authors a junior synonym of the Faviina. This suborder is based on *Astraea* LAMARCK, 1801, a genus that was never the object of any detailed investigation.

**Family Columastraeidae 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. 4, 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. niongalensis* 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 ksiazkiewiczii bucovinensis* n. subsp. - MORYCOWA, p. 96, Figs. 30.c-d, Pl. 24, figs. 2-3; Pl. 25, fig. 1

v 1981 *Columnocoenia ksiazkiewiczii bucovinensis* MORYCOWA, 1971 - TURNŠEK & MIHAJLOVIĆ, p. 20, Pl. 16, figs. 1-2

v 1991 *Styliina 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
**Carnets Geol. 18 (3)**

**Dimensions:**

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**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 hexameral. 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 tabulæ. Wall compact, septothecal. Coenosteum narrow (approx. 20% c), consists of costae and exothecal dissepiments. Budding extracalcinal.

**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 Sopalmo (MGSB 73674); Egypt (Sheb Gezi- rat Sena) Maghara Mt, SE Mansour (GSUB 5874); Italy (Abruzzi, L’Aquila) Monti d’Ocre, Fossa Cerasetti; Venezuela (Anzoátegui) Guanta coast, La Borrrach Island. Lower Aptian (Lenticularis zone) of Romania (Suceava) Pojirota area, Cimpulung-Moldovenes, Valea Izvorul Alb. Aptian to Cenomanian of Greece (Fokida) Mariolada, Kria Vrissi, Kokrissi Vrissi springs. Upper Aptian of Spain (Valencia, Castellón) Benicasim, 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 [= Moraviatoor]. Lower Cenomanian (Dixoni zone) of Germany (Sachsen) Meißen-Zscheila, Trinitatis church.

**Eocolumastrea rosea** (*PREVER, 1909*)

(Pl. 1, figs. 10-12)

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

**Synonymy:**

* v ? 1873 **Holocoeonia 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 **Columnocoeenia ksiazkiewiczi bucovinensis** MORYCOWA, 1971 - BARON-SZABO & STEUBER, p. 12, Pl. 5, figs. 1, 5

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**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 hexameral. 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 tabulæ. Wall compact, septothecal. Coenosteum narrow (approx. 20% c), consists of costae and exothecal dissepiments. Budding extracalcinal.

**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 Lower Aptian of Spain (Cataluña, Lérida) Com. Alt Urgell, Buerco section (BSPG 2003 XX 5336). Uppermost Aptian of Japan (Iwate-ken) Miyako-shi, Sakai- ma, Hideshima (TUM 39740). Lower Albian of Mexico (Sonora) Municipio Ures, Cerro de Oro (ERNO L-4841). Upper 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, Lam pazos 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 [= Moravatoor]; Tunisia, Oum-Ali Mt (FSL).

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

**Diplocoeniids, informal group**

**Sakalavastraea ALLOTTEAU, 1958**

**Type species:** *Sakalavastraea collignoni* ALLOTTEAU, 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 Stephanastera 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

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**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.

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**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:

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


Superfamily Cyclolitoidea
Milne Edwards & Haime, 1849

Remarks: This superfamily corresponds to the suborder Microsolenina Morycowa & Roniewicz, 1995. The name-giving genus *Microsolena* 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

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

Other occurrences: Cretaceous of Greece (Fokida) Kiona massif, Panourgias. Cenomanian of Bahrain, Drilling; Germany (Bayern) Ruhpolding, Urschlauf; Algeria (Batna) Aurès Mts; Algeria (Constantine) Commune Ain Smara, Chettabah Mt; Algeria (Khencela) Commune Ouled Amar, Ouled Amar; Commune Tamza, Taafist Mt;
Astraeofungia (Michelin, 1841, by original designation).

**Type species:** *Astrea decipiens* (Michelin, 1841).

**Astraeofungia cf. barcenai** (Felix, 1891)

*(Pl. 2, figs. 5-6)*

**Material:** BSPG 2003 XX 5888; 1 thin section.

**Synonymy:**

- *Astraeofungia sp*. - Löser, Castro & Nieto, p. 23, Pl. 7, figs. 7-9

**Dimensions:**

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**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 extracalicial.

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

**Occurrence:** Bed C5 (BSPG 2003 XX 5888).

**Other occurrences:** Aptian of Mexico (Puebla) 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 Llorenç. Lower Cenomanian (Dixoni zone) of Germany (Sachsen) Meißen-Zscheila, Trinitatis church (SNSD-MMG SaKL561). Uppermost Cenomanian (Judii 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:**

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**Description:** Hydnophoroid 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 trabecules. Endotheca consists of numerous dissepiments. Coenosteum absent. Budding extracalicial.

**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:

- 2007 *Montlivaltia caryophyllata* Lamouroux, 1821 - P. Andey, Fürsch & Baron-Szabo, p. 22, figs. 2-3, 5, 7, 9
- 2009 *Latomeandra minor* Reig Oriol, 1975 - Morycowa & Masse, p. 130, Fig. 21.f-g

Dimensions:

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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 (Tuarkyrichus - 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, Luña 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:

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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 trabecules. Endotheca consists of thin tabulae. Wall compact to subcompact, synapticulotheical, partly septothecal. Coenosteum absent. Budding extracalicial.

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:**

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**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 extracalicinal.  

**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. - ALLOITEAU, p. 22, Pl. 1, figs. 18-19  
v 1989 Acrosmilia patellata (MICHELIN, 1845) - LÖSER, p. 131, Fig. 34, Pl. 26, fig. 1  

**Dimensions:**

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**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) Etal, 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 ALLOTTEAU, 1957**

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

**Polyastropsis arnaudi ALLOTTEAU, 1957**  
(Pl. 4, figs. 4-6)

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

**Synonymy:**
- v 1889 *Prionastrea* spec. - TOULA, p. 85, Pl. 6, fig. 6
- *v* 1957 Polyastropsis Arnaudi ALLOTTEAU, p. 219, Figs. 163, 283, Pl. 1, figs. 3, 16
- v 1994 *Thamnoseras? 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:**

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**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 extracalicial.

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


**Polyastropsis subplana (PREVER, 1909)**  
(Pl. 1, fig. 6)

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

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

**Dimensions:**

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</table>

**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 extracalicial.

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

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).


**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:**

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**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:**

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Description: Ceroid 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-

**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, Luña 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:**

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**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. Synapticalae fairly common. Columella styliform. Endotheca absent. Coenosteum narrow (approx. 20% c), consists of costae. Budding extracalinal.

**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, 1889**

**Type species:** *Negoporites 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:

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Description: Astroid 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. Septal lateral face with pennulae, inner margin smooth. Pali irregularly present. Septa are not attached to the columella. Costae present, non-confluent. Synapticulae present, occasional, mainly in the space between corallites. Columella composed of isolated trabeculae or one more solid element. Budding extracalicinal.


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

Family Synastreidae ALLOITEAU, 1952

*Brachycoenia* M. BEAUVAIL, 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:

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</tbody>
</table>

Description: Thamnasterioid colony. Coralites 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 extracalicinal.

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:

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<tbody>
<tr>
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<td></td>
<td></td>
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<tr>
<td>s</td>
<td>15</td>
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<tr>
<td></td>
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<tr>
<td>sd</td>
<td>10/5mm</td>
</tr>
</tbody>
</table>
**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 extracalinal.

**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 (Viotía) 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 TURNIŠEK & MINAJOVIĆ, 1981.

**Family Eugyridae ACHIARDI, 1875**

**Hydnophorarea Oppenheim, 1930**

**Type species:** Monticularia styriaca MICHELIN, 1847.

**Hydnophorarea 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 Hydnophorarea styriaca - OPPENHEIM, p. 224, Pl. 14, fig. 4; Pl. 18, figs. 1, 6

**Dimensions:**

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**Description:** Hydnophoroid colony. Monticules elevated, conical, with small centres. Coralites 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 intracalinal.

**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 & MARCOPOLOU-DIACANTONI, 2002**

**Type species:** Parnassomeandra diacantoniae MORYCOWA & MARCOPOLOU-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
**Confusaforma LÖSER, 1987**

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

**Confusaforma weyeri** LÖSER, 1987

**Material:** BSPG 2003 XX 5827; 2 thin sections.

**Synonymy:**

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<th>Reference</th>
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<td>1987</td>
<td>LÖSER</td>
<td>p. 234, Pl. 1, figs. 1-3</td>
<td>Confusaforma weyeri</td>
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<td>1987</td>
<td>LÖSER</td>
<td>p. 104, Figs. 10-13, Pl. 22, figs. 1-5</td>
<td>Confusaforma weyeri</td>
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<tr>
<td>2003</td>
<td>LÖSER</td>
<td>p. 234, Pl. 1, figs. 1-3</td>
<td>Confusaforma weyeri</td>
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<tr>
<td>2013</td>
<td>LÖSER</td>
<td>p. 64, Pl. 9, figs. 2-3</td>
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<td>0.23</td>
<td>15.3</td>
<td>1.29-1.76</td>
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</tbody>
</table>

**Description:** Ceroid 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 extracalicinal.

**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) Banska Planota, Osojnica (SAZU P-525). Lower Albain of Mexico (Sonora) Municipio Opodepe, Tuape, Cerro de la Espina. Lower Cenomanian (Dixoni zone) of Spain (Cantabria, Santander) Cobreces, Luarna 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)

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

**Synonymy:**

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<th>Reference</th>
<th>Title</th>
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<td>TOULA</td>
<td>p. 1317, Pl. 6, fig. 4</td>
<td>Astrocoenia bulgarica nov. sp.</td>
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<tr>
<td>1889</td>
<td>TOULA</td>
<td>p. 83, Pl. 5, figs. 10-11</td>
<td>Cryptocoenia ramosa nov. spec.</td>
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<td>1981</td>
<td>FELIX</td>
<td>p. 155, Pl. 25, figs. 7-8</td>
<td>Cyathophora atemphata</td>
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<tr>
<td>1981</td>
<td>TURNŠEK &amp; MIHAJLOVIC</td>
<td>p. 18, Pl. 13, figs. 3-4</td>
<td>Cyathophora steinmanni</td>
</tr>
<tr>
<td>1993</td>
<td>BARON-SZABO &amp; STEUBER</td>
<td>p. 8, Pl. 3, fig. 3</td>
<td>Pseudocoenia beskidena</td>
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<td>LÖSER, WERNER &amp; DARGA</td>
<td>p. 64, Pl. 9, figs. 2-3</td>
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<td>p. 19, Fig. 2.D-F</td>
<td>Cryptocoenia biedai</td>
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**Dimensions:**

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<td>1.97-2.52</td>
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<td>s</td>
<td>6-12</td>
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</table>

**Description:** Plocoid colony. Calicular outline elliptical. Septa compact. Symmetry of septa radial and regularly hexameral. Cycles of septa subregular. Septal cycles differ in length. Septa very short, 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.

**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).


**Cryptocoenia corbariensis** (ALLOITEAU, 1948)

(Pl. 4, fig. 12)

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

**Synonymy:**

1857 *Cyathophora iscaunensis* - FROMENTEL, p. 41

*v* 1948 *Cyathophora corbariensis* ALLOITEAU, p. 721, figs. 9, Pl. 26, fig. 3; Pl. 27, fig. 3

*v* 2013 *Cryptocoenia corbariensis* (ALLOITEAU, 1948) - LÖSER, p. 34, Figs. 11.f-g [here detailed synonymy]

**Dimensions:**

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<td>3.45 0.21</td>
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<tr>
<td>ccd</td>
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<tr>
<td>s</td>
<td>12</td>
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<td></td>
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</tbody>
</table>


**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 jacobi** (ALLOITEAU, 1948)

(Pl. 7, figs. 4-6)

**Material:** BSPG 2003 XX 5860; 2 thin sections.

**Synonymy:**

*v* 1948 *Cyathophora Jacobi* ALLOITEAU, p. 722, Pl. 27, figs. 1, 7-8

*v* 1963 *Plesiastraea sulcatis-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 jacobi* (ALLOITEAU, 1948) - LÖSER, p. 35, Figs. 11.f-g [here detailed synonymy]

**Dimensions:**

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<td>3.45 0.24</td>
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<td>8.4 3.74-4.43</td>
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<td>s</td>
<td>12-24</td>
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**Description:** Plocoid colony. Calicular outline elliptical. Septa compact. Symmetry of septa radial and regularly hexameral. Cycles of septa regular. 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.


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
| cmin | 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   |           |      |      |      |          |


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 (Viota) Levadia, Perachorion (BSPG 2003 XX 5768). Aptian to Lower Albian of Japan (Iwate-ken) 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-ope, Tuape, Cerro de la Espina.

Cryptocoenia sp. (Pl. 7, figs. 10-12)

Material: BSPG 2003 XX 5835, 5862, 5924, 5926, 5928; 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   |           |      |      |      |          |


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 (Viota) 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:

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

Rhipidomeandra MORYCOWA & MASSE, 1998

Type species: Rhipidomeandra bugrovae Morycowa & Massé, 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:

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


Superfamily Felixarceaidea

M. BEAUVAS, 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 Asteroseriidae. All other families cannot remain in this suborder. Some families were already separated into the suborder Microsolenina (see above).

Family Lamellofungiidae

ALLOITEAU, 1952

Kozaniaestrea new genus

Origin of the name: After the region.

Type species: Kozaniaestrea pachysepta n. sp.

Species: Only the type species.

Diagnosis: Ceroid colony with very thick compact septa in a subregular hexameral symmetry. Without columella, pali and synapticulae. Endotheca well developed. Wall septothecal. Budding intracalicinal, septal.
Comparison: From the only comparable genus Lamellofungia the new genus differs by the much more irregular septal insertion.


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:

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<tr>
<td>s</td>
<td>25</td>
<td>9-16</td>
<td>12.2</td>
<td>1.5</td>
<td>12.0</td>
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</table>

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:

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<tr>
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<td>17-19mm</td>
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<td>15</td>
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<tr>
<td>s</td>
<td>ca. 120</td>
<td></td>
<td>80-90</td>
<td></td>
</tr>
<tr>
<td>sd</td>
<td>5/2mm</td>
<td></td>
<td>4/2mm</td>
<td></td>
</tr>
</tbody>
</table>

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 intracalicinal.

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

Other occurrences: Cretaceous of Greece (Fokida) Kiona massif, Panourgias.
Superfamily Heterocoenioidea
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-defined and assigned.

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 hexameral. 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, synapticulae and colu-
mella absent. Endotheca unknown. Wall compact, consists of horizontal trabeculae. Coenosteum medium broad (approx. 30% c), consists of dissepiments and trabeculae. Budding extracali-
cinal.

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


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 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).


Family Heterocoeniidae
OPPENHEIM, 1930

Styloheterocoeniiidae 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, hexameral), 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 extracalicinal.

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 helenensis* n. sp.  
(Pl. 11, figs. 1-4)

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

Holotype: BSPG 2003 XX 5849 with two thin sections.

Material studied: Holotype and 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. helenensis* by smaller calicular dimensions and a lower number of septa.

Dimensions:

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>min-max</th>
<th>μ</th>
<th>s</th>
<th>v</th>
<th>μ±s</th>
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<tbody>
<tr>
<td>clmin</td>
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<td>1.67-2.99</td>
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<td>18.7</td>
<td>1.84-2.68</td>
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<tr>
<td>clmax</td>
<td>12</td>
<td>1.98-3.47</td>
<td>2.76</td>
<td>0.49</td>
<td>17.9</td>
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<tr>
<td>ccd</td>
<td>12</td>
<td>4.11-5.87</td>
<td>5.12</td>
<td>0.60</td>
<td>11.8</td>
<td>4.51-5.73</td>
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<tr>
<td>sys</td>
<td>3</td>
<td>6-12</td>
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*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.

Material studied: Holotype and 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. helenensis* by smaller calicular dimensions and a lower number of septa.

Dimensions:

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>min-max</th>
<th>μ</th>
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<th>μ±s</th>
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<td>12.0</td>
<td>4.42-5.64</td>
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<tr>
<td>ccd</td>
<td>4</td>
<td>4.58-9.47</td>
<td>7.25</td>
<td>2.04</td>
<td>28.1</td>
<td>5.20-9.29</td>
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<tr>
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*Styloheterocoenia* sp.  
(Pl. 12, figs. 1-3)

Material: BSPG 2003 XX 5937; 2 thin sections.

Dimensions:

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<th>μ</th>
<th>s</th>
<th>v</th>
<th>μ±s</th>
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<tbody>
<tr>
<td>cl</td>
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<td>1.65-2.38</td>
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<td>0.20</td>
<td>10.2</td>
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<td>16.3</td>
<td>3.30-4.59</td>
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</table>
**Heterocoenia**

**MILNE EDWARDS & HAI ME, 1848**

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

**Heterocoenia distans**

**(MILNE EDWARDS & HAI ME, 1848)**

(Pl. 10, figs. 4-6)

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

**Synonymy:**
*v* 1848c *Dichocoenia* ? *distans* MILNE EDWARDS & HAI ME, p. 308

**Dimensions:**

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<tr>
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**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 Jussá, Mun. Pallars Jussá, Pobla de Segur, Torallola (BSPG 2006 II 8).

**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:**

<table>
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<td>cl</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>s</td>
<td>24</td>
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</tr>
</tbody>
</table>


**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* MORYCOWA, 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:

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<tr>
<td>d</td>
<td>8</td>
</tr>
<tr>
<td>s</td>
<td>12</td>
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</tbody>
</table>


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 Astraeoida Alloiteau, 1952, and Meandrinina Alloiteau, 1952. The suborder Astraeoida 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 Favinita in its traditional understanding.

**Plesiosmilids, informal group**

**Plesiostoliths new genus**

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

Type species: *Plesiostoliths winnii* n. sp.

Species: Only the type species.

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

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

**Description:** Solitary cupolate (’cyclolytid’) 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 hexameral. 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 *Plesiostonia*.

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

Description: As for the genus.

Dimensions:

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<tr>
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<table>
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<th>7465</th>
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<tbody>
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<td>25.5x28.7</td>
</tr>
<tr>
<td>s</td>
<td>80</td>
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</table>
Plesiosmilia MILASCHEWITSCH, 1876

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

Plesiosmilia vaughani
(ANGELIS d’OSSAT, 1905)

Material: BSPG 2003 XX 5964; 2 thin sections.

Synonymy:

\*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:

\[
\begin{array}{|c|c|}
\hline
& c & 29x36 \\
\hline
s & 96 \\
\hline
\end{array}
\]


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)

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:

\[
\begin{array}{|c|c|}
\hline
& c & 25-36 \\
\hline
s & 120 \\
\hline
\end{array}
\]


**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:**
- **1909** Trochosmilia rara **PREVER,** p. 107, Fig. 11, Pl. 10, fig. 29
- **1909** Trochosmilia communis - **PREVER,** p. 106, Figs. 8-10, Pl. 10, fig. 4
- **1909** Trochosmilia polymorpha - **PREVER,** p. 108, Figs. 12-13, Pl. 10, figs. 5-23
- **1994** ? Paramontlivaltia inaequalis (MICHELIN, 1845) - **LÖSER,** p. 21, Figs. 12-13, Pl. 6, fig. 2; Pl. 12, figs. 4-5; Pl. 14, fig. 1
- **2007** Montlivaltia sp. - **PANDEY, FÜRSICH & BARON-SZABO,** p. 26, Pl. 6, Pl. 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 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 Dagh, Mashad. Lower Cenomanian (Mantei zone) of Germany (Nordrhein/Westfalen) Mühlheim/Ruhr, Kassenberg.

### Trochophyllia tourtiensis (BÖLSCHE, 1871)

**(Pl. 13, fig. 8)**

**Material:** BSPG 2003 XX 5941; 2 thin sections.

**Synonymy:**
- **1871** Montlivaultia ? Tourtiensis **BÖLSCHE,** p. 46, Pl. 11, fig. 1
- **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 (Pleius 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:**
- **2000** Trochocytus microphyes **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, Valleryes (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* GOLD-FUSS, 1826, by monotypy.

**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 toward the centre. Symmetry of septa radial and irregularly hexameral. Cycles of septa subregular. Septal generations differ in length and thickness. First septal generation reaches 35% of the (shorter) 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 extracalcalinal.

**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

**Silingastrea LIAO, 1982**

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

**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 columnella. Costae present, non-confluent. Synapticulae absent. Columella lamellar. Endotheca unknown. Wall absent. Coenosteum narrow. Budding extracalcalinal.

**Occurrence:** Bed C5 (BSPG 2003 XX 5887).

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

---

**Table 1: Dimensions**

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<th>Material</th>
<th>Dimensions</th>
</tr>
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<tr>
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**Table 2: Dimensions**

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<th>Dimensions</th>
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<td>ccd</td>
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</table>
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:

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<td>7.9</td>
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<td>22-27</td>
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<td>4/3mm</td>
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Description: Astreoid colony. Calicular outline elliptical. Septa compact. 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. 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. Endotheca consists of numerous and regular tabulae. Wall absent. Coenosteum narrow, consists of costae and tabulae. Budding extracalinal.

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:

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**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, thin. Endotheca consists of numerous and regular tabulae. Wall absent. Coenosteum narrow, consists of costae and tabulae. Budding extracalicinal.

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

**Complexastrea Orbigny, 1849**

*Complexastrea sp.*

(Pl. 15, figs. 4-6)

**Material:** BSPG 2003 XX 5936; 2 thin sections.

**Synonymy:**

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

**Dimensions:**

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<th>ccd</th>
<th>11-13mm</th>
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<tbody>
<tr>
<td>s</td>
<td>60</td>
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</table>

**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. 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 exothe cal dissepiments. Budding extracalicinal.

**Occurrence:** Bed A (BSPG 2003 XX 5936).

**Other occurrences:** Lower Aptian of Mexico (Puebla) Tehuacán, La Compañía (UNAM-FI CIA-40/1). Upper Aptian (Martinoides zone) of Spain (Aragón, Teruel) Mun. Miravete de la Sierra, Com. Maestrazgo, Barranco de las Corralizas. Lower Cenomanian (Dixoni zone) of Spain (Cantabria, Santander) Cobreces, Luaña playa (BSPG 2007 V 161).
Thecosmilia
MILNE EDWARDS & HAIMÉ, 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 - KÖBY, p. 38, Pl. 13, figs. 1-4
v 1974 Thecosmilia trichotoma (GOLDFUSS) - MORY-COWA, p. 467, Fig. 5, Pl. 5, fig. 2; Pl. 10, fig. 1

Dimensions:

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Superfamily Phyllosmilioidea
FELIX, 1903

Remarks: The families of this superfamily were formerly assigned to the suborder Meandrinina. 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:

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<td>s</td>
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<td>(7441)</td>
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<td>c</td>
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<td>sdc</td>
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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 hexameral. 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 diseipiments. 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:**

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<td>11x55</td>
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<tr>
<td>s</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>sd</td>
<td>7/5mm</td>
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</table>

|        | (7436) |
|--------|
| c      | 11x26.4|
| s      | 95     |
| sd     | 8/5mm  |

**Description:** Solitary flabelliform 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 Phyllosmiiliidae. The family Diplocteniopsidae Zlatarski, 1968, is considered synonymous with the Phyllosmiliidae. The Diplocteniopsidae do not belong to the Faviina suborder (Astreaoida 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:**

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<td>ccd</td>
<td>7-8mm</td>
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<td>12-14</td>
</tr>
<tr>
<td>sd</td>
<td>6/5mm</td>
</tr>
</tbody>
</table>


**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:**

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<th>s</th>
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<td>23-27</td>
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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 hexameral. 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 extracalicinal.


Hydnophoropsis sp. 2

Material: BSPG 2003 XX 5882; 2 thin sections.

Synonymy:

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.

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<td>6/2mm</td>
</tr>
</tbody>
</table>

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 hexameral. 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 thin, lamellar. Endotheca consists of tabulae. Wall compact, septothecal. Coenosteum broad, consists of costae, trabecular extensions and exothecal dissepiments. Budding extracalicinal.

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


Phyllosmilia FROMENTEL, 1862

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

Phyllosmilia cf. basochesi

(DFRANCE, 1828)

(Pl. 17, figs. 7-10)

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

Dimensions:

<table>
<thead>
<tr>
<th></th>
<th>(7432)</th>
</tr>
</thead>
<tbody>
<tr>
<td>c</td>
<td>6.6x26.4</td>
</tr>
<tr>
<td>s</td>
<td>ca. 160</td>
</tr>
<tr>
<td>sd</td>
<td>6/2mm</td>
</tr>
</tbody>
</table>


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

Occurrence: Bed C8 (BSPG 2003 XX 5882).
**Apoplacophyllia sp.**

(Pl. 18, figs. 1-3)

**Material:** BSPG 2003 XX 5935; 2 thin sections.

**Dimensions:**

<table>
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<th>n</th>
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<th>μ</th>
<th>s</th>
<th>v</th>
<th>μ±s</th>
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<tbody>
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<td>22.7</td>
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<td>clmax</td>
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<td>3.33-4.46</td>
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<tr>
<td>cmin</td>
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<td>3.53-6.12</td>
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<td>16.7</td>
<td>3.78-5.29</td>
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<tr>
<td>cmax</td>
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<td>3.91-6.32</td>
<td>5.12</td>
<td>0.63</td>
<td>12.3</td>
<td>4.49-5.75</td>
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<tr>
<td>s</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


**Occurrence:** Bed C8 (BSPG 2003 XX 5935).

**Aulastreaopora PREVER, 1909**

**Type species:**

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

**Aulastreaopora harrisi** (WELLS, 1932) (Pl. 13, fig. 9)

**Material:** BSPG 2003 XX 5940; 2 thin sections.

**Synonymy:**

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

**Dimensions:**

<table>
<thead>
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<th></th>
<th>(5940)</th>
</tr>
</thead>
<tbody>
<tr>
<td>c</td>
<td>18x22</td>
</tr>
<tr>
<td>s</td>
<td>24</td>
</tr>
</tbody>
</table>

**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 hexameral. 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 Rayà (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 Ropè (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 Penedès, 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 Llorenç. 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./ Dasmiospis Opp. - HAKEMESSER, p. 34  
*v 1998 Aulastraeopora schnauzeae LÖSER, p. 66, Pl. 1, figs. 3-4; Pl. 2, figs. 1-2; Pl. 3, fig. 2

**Dimensions:**  

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<th>µ±s</th>
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<tr>
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<td>1.94-2.55</td>
<td>2.21 0.18 8.5 2.02-2.40</td>
</tr>
<tr>
<td>cn</td>
<td>37</td>
<td>4.07-7.67</td>
<td>5.76 1.07 18.5 4.69-6.83</td>
</tr>
<tr>
<td>sy</td>
<td>4</td>
<td>10-16</td>
<td>13.5 2.0 14.9 11.5-15.5</td>
</tr>
<tr>
<td>s</td>
<td>16</td>
<td>25</td>
<td>4.07-7.67</td>
</tr>
</tbody>
</table>

**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 (Fokida) Kiona massif, Panourgias [= Dremisa].

**Preverastraea aff. stellata** (STOLICZKA, 1873)  
(Pl. 18, figs. 7-9)

**Material:** BSPG 2003 XX 5839; 7 thin sections.

**Dimensions:**  

<table>
<thead>
<tr>
<th>Material: BSPG 2003 XX 5839</th>
<th>n</th>
<th>min-max</th>
<th>µ±s</th>
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</thead>
<tbody>
<tr>
<td>ccd</td>
<td>25</td>
<td>5.76</td>
<td>1.07 18.5 4.69-6.83</td>
</tr>
<tr>
<td>s</td>
<td>10</td>
<td>10-16</td>
<td>13.5 2.0 14.9 11.5-15.5</td>
</tr>
</tbody>
</table>


**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-4252). Middle Albian (Dentatus zone) of USA (Texas) Comal County, New Braunfels-Crane’s Mill road.

**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:**  

<table>
<thead>
<tr>
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<tbody>
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<tr>
<td>cn</td>
<td>20</td>
<td>1.94-2.55</td>
<td>2.21 0.18 8.5 2.02-2.40</td>
</tr>
<tr>
<td>s</td>
<td>24</td>
<td>25</td>
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</tbody>
</table>


**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-4252). 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:**  

<table>
<thead>
<tr>
<th>Material: BSPG 2003 XX 5839</th>
<th>n</th>
<th>min-max</th>
<th>µ±s</th>
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<tbody>
<tr>
<td>ccd</td>
<td>25</td>
<td>5.76</td>
<td>1.07 18.5 4.69-6.83</td>
</tr>
<tr>
<td>s</td>
<td>10</td>
<td>10-16</td>
<td>13.5 2.0 14.9 11.5-15.5</td>
</tr>
</tbody>
</table>

**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

Remarks: The taxonomic position of this specimen is unsure. It is closest to the type specimen of *Mycetophyllia stellata* Stöliczka, 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 assignment 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.


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:

<table>
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<th>(5822)</th>
<th>n</th>
<th>min-max</th>
<th>µ</th>
<th>s</th>
<th>v</th>
<th>µ±s</th>
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<tbody>
<tr>
<td>cmin</td>
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<td>1.79-2.38</td>
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<td>7.4</td>
<td>1.91-2.22</td>
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<tr>
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<td>1.75-3.06</td>
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<td>0.29</td>
<td>12.4</td>
<td>2.07-2.65</td>
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<tr>
<td>s</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 hexameral. Cycles of septa subregular. Septal cycles differ in length and thickness. Septa of the third cycle in plaves 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. Synapticulae absent. Columella styliform to lamellar. Endotheca consists of tabulae. Wall compact, septothecal. Coenosteum very narrow (approx. 10% c), consists of costae. Budding extracalicinal.

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


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

Dimensions:

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<tr>
<td>s</td>
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<td>53.80</td>
<td>4.26</td>
<td>7.9</td>
<td></td>
</tr>
</tbody>
</table>

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 hexameral. Cycles of septa subregular. Septal

**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 (Dixoni zone) of Spain (Cantabria, Santander) Cobreces, Luaña playa (BSPG 2007 V 199).

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**Eosiderastrea paragrandipora**

LÖSER, 2016

(Pl. 19, figs. 7-9)

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

**Synonymy:**

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

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

**Dimensions:**

<table>
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<th>s</th>
<th>v</th>
<th>µ±s</th>
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<td>4.20</td>
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<td>7.0</td>
<td>3.90-4.49</td>
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<td>7.9</td>
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<td>1.6</td>
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</table>


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

---

**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:**

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<th>µ±s</th>
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<td>6.28-11.48</td>
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<td>6.05-8.37</td>
<td>7.09</td>
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<td>11.9</td>
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<td>10.0</td>
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</table>


**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
**Eosiderastrea stefani** LÖSER, 2016
*(Pl. 19, figs. 10-11)*

**Material:** BSPG 2003 XX 6145; 1 thin section.

**Synonymy:**

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<th>Reference</th>
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<tbody>
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<td>Diplostrea ? tanohataensis (EGUCHI, 1951) - LÖSER, WERNER &amp; DARGA, p. 46, Pl. 2, figs. 7-9</td>
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<tr>
<td>2015</td>
<td>Diplostrea ? tanohataensis (EGUCHI, 1951) - LÖSER, p. 281, Fig. B</td>
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<tr>
<td>2016b</td>
<td>Eosiderastrea stefani LÖSER, p. 394, Pl. 2, figs. 7-9</td>
</tr>
</tbody>
</table>


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

**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, Tepaché, Lampazos area, Espinazo de Diablo (ERNO L-5614). Lower 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 coerulae PALLAS, 1766.

**Heliopora radiata** (ORBIGNY, 1850)
*(Pl. 20, figs. 7-9)*

**Material:** BSPG 2003 XX 5821; 2 thin sections.

**Synonymy:**

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</tr>
<tr>
<td>1873</td>
<td>Heliopora Edwardsana, STOLICZKA - STOLICZKA, p. 53, Pl. 11, fig. 11</td>
</tr>
<tr>
<td>1841</td>
<td>Polytrema blainvileiana (MICHELIN, 1841) - BARON-SZABÓ, p. 128, Pl. 13, figs. 3-4</td>
</tr>
<tr>
<td>1903</td>
<td>Polytrema vermiculata (FELIX, 1903) - LÖSER, WERNER &amp; DARGA, p. 67, Pl. 10, figs. 7-9</td>
</tr>
</tbody>
</table>
Dimensions:

<table>
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<tr>
<th></th>
<th></th>
<th>min-max</th>
<th>µ</th>
<th>s</th>
<th>v</th>
<th>µ±s</th>
</tr>
</thead>
<tbody>
<tr>
<td>clmin</td>
<td>50</td>
<td>0.91-1.27</td>
<td>1.10</td>
<td>0.08</td>
<td>8.1</td>
<td>1.01-1.19</td>
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<tr>
<td>clmax</td>
<td>50</td>
<td>0.98-1.44</td>
<td>1.18</td>
<td>0.11</td>
<td>9.6</td>
<td>1.06-1.29</td>
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<tr>
<td>ccd</td>
<td>50</td>
<td>1.48-2.69</td>
<td>2.09</td>
<td>0.317</td>
<td>15.1</td>
<td>1.77-2.40</td>
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<tr>
<td>s</td>
<td>25</td>
<td>16-22</td>
<td>19.56</td>
<td>1.68</td>
<td>8.6</td>
<td>18-21</td>
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<tr>
<td>tb</td>
<td>6-9/25mm²</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**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 extracalicial.

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


**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 crisatus*, Caryophylliidae sp. indet. 1, *Cryptocoenia sp.*, *Eocolumastrea gortanii*, *Heterocoenia distans*, *Negoporites spissus*, *Trochohyphila sp.*, *Phyllosmilia cf. basochesi*, *Plesioliites 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.
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 Styloinoidea). The overall distribution patterns in the present fauna (Fig. 9) compare well to upper Lower Cretaceous coral faunas.

The superfamilies Cyclolitoidea, Eugyroidea, and Heterocoenioidea 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 Lasmogryidae) 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 Felixaraoidea, 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 (Wilmersen, 1997; the coral fauna is under investigation)
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 faunula 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., Placocoaenia 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.

<table>
<thead>
<tr>
<th>Species</th>
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<tbody>
<tr>
<td>Apoplacophyllia sp.</td>
</tr>
<tr>
<td>Canleria sp. 2</td>
</tr>
<tr>
<td>Caryophylliidae sp. indet. 1</td>
</tr>
<tr>
<td>Caryophylliidae sp. indet. 2</td>
</tr>
<tr>
<td>Diplocteniopsis sp.</td>
</tr>
<tr>
<td>Elasmophyllia sp.</td>
</tr>
<tr>
<td>Eocomoseris sp.</td>
</tr>
<tr>
<td>Helladastrea sp.</td>
</tr>
<tr>
<td>Hydnophoropsis sp. 1</td>
</tr>
<tr>
<td>Hydrophoropsis sp. 2</td>
</tr>
<tr>
<td>Kozaniastrea pachysepta</td>
</tr>
<tr>
<td>Mixastrea aff. danubica</td>
</tr>
<tr>
<td>Pachygyna sp.</td>
</tr>
<tr>
<td>Placoconeia sp.</td>
</tr>
<tr>
<td>Plesiolites winnii</td>
</tr>
<tr>
<td>Preverastraea aff. stellata</td>
</tr>
<tr>
<td>Rhipidomeandra sp.</td>
</tr>
<tr>
<td>Sakalavastraea sp. 2</td>
</tr>
<tr>
<td>Silingastrea sp. 1</td>
</tr>
<tr>
<td>Silingastrea sp. 3</td>
</tr>
<tr>
<td>?Stephanomorpha sp.</td>
</tr>
<tr>
<td>Styloheterocenina brunni</td>
</tr>
<tr>
<td>Styloheterocenina hellenensis</td>
</tr>
<tr>
<td>Tiarasmilia cf. casteri</td>
</tr>
</tbody>
</table>

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, Felixigya, Haplaraea, Latomeandra, Mixastraea, Parannsomeandra, Rhipidomeandra, Thecosmilia, and Tiarasmilia), and there are genera that have their first occurrence in the Cenomanian (Elasmophyllia, Hydrophorararea, 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.

Acknowledgements

We are grateful to Danielle DECREUZE (Geneva) for determining the orbitolinid foraminifers, and Heinz KOLLMANN (Vienna) for commenting on the stratigraphic value of the nerineid gastropods from the outcrop area. We wish to thank numerous colleagues who allowed us to examine coral (type) material of their collections. Fieldwork and the preparation of thin sections were financed by DFG project FL42-73. Further funds for preparing thin sections were kindly provided by PAPIIT-DGAPA project IN101111 (UNAM, Mexico). Additional thin sections were carefully prepared by Aimée ORCI (Hermosillo). English language correction (Material and methods, Systematic part, Discussion) by Proof-Reading-Service (Letchworth Garden City, UK). Comments by an anonymous reviewer are acknowledged.

Bibliographic references

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.


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* BEAUVAS, 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.

[Scale bar 1mm]
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* RONIEWICZ, 1976, BSPG 2003 XX 5894; 10) transversal thin section; 11) transversal thin section, detail; 12) longitudinal thin section.

[Scale bar 1mm]
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.

[Scale bar 1mm]
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.

[Scale bar 1mm]
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) *Confusafoma weyeri* LÖSER, 1987, BSPG 2003 XX 5827; 10) transversal thin section; 11) transversal thin section, detail; 12) longitudinal thin section.

[Scale bar 1mm]
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.

[Scale bar 1mm]
**Plate 8:**

1-3) *Felixigrya* 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) *Haplarea 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.

[Scale bar 1mm]
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.

[Scale bar 1mm]
Plate 11:

1-4) *Stylo heterocoenia 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.

[Scale bar 1mm]
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.

[Scale bar 1mm]
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) *Aulastreaopora 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.

[Scale bar 1mm]
Plate 14:

1-3) Placocenia 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.

[Scale bar 1mm]
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;

[Scale bar 1mm]
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) *Silingastrea 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.

[Scale bar 1mm]
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.

[Scale bar 1mm]
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.

[Scale bar 1mm]
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 paragrandipora* Löser, 2016, BSPG 2003 XX 5812; 7) transversal thin section; 8) transversal thin section, detail; 9) longitudinal thin section;


[Scale bar 1mm]
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.

[Scale bar 1mm]