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# BARREMIAN CORALS FROM SAN ANTONIO TEXCALA, PUEBLA, MEXICO—A REVIEW OF THE TYPE MATERIAL OF FELIX 1891

Por

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## ABSTRACT

The Barremian coral fauna from San Antonio Texcala described by the German palaeontologist Johannes Felix is revised. The material is completely recrystallized; therefore, it was not possible to study the internal structures. Studies were exclusively confined to the coral surface. The original type locality of the material was not located in the field. Corals found in the outcrops at the presumed type locality area differ in their preservation and taxonomic composition. The nearby localities of the San Juan Raya Formation yielded corals different from those of San Antonio Texcala. The only material available for a revision is therefore the collection material at the Leipzig University (Germany). Forty-two species are assigned to 26 genera, six species more than described by Felix. Most species belong to the suborders Stylinina, Faviina, and Microsolenina, the most common genera are *Cryptocoenia* and *Polyphylloseris*. The suborders Archeocaeniina, Amphiastraeina, and Rhipidogyrina, which are usually common in the Early Cretaceous, are conspicuous by their complete absence from the fauna of San Antonio Texcala. Stratigraphically, the fauna shows affinities with faunas between the very Late Jurassic and the Campanian, though the closest correlation is with early Aptian associations. Palaeobiogeographic relationships are slight and exist mainly with Barremian-Aptian faunas of the central Tethys, the Caribbean, and even Asian and Boreal provinces.


Key words: Corals, Cretaceous, Puebla, Zapotitlán Formation, Barremian.

## RESUMEN

Se revisa la colección de los corales del Barremiano de San Antonio Texcala, descrita por el geólogo alemán Johannes Felix. Las muestras se encuentran mal conservadas. No fue posible examinar las estructuras internas, ya que están completamente recristalizadas. Los estudios se limitaron a la superficie de los corales. La localidad tipo original no se ha podido encontrar. Los corales encontrados en el área presumible de exposición se diferencian por su estado de preservación y su composición taxonómica. Las localidades cercanas a la Formación San Juan Raya proporcionaron corales diferentes de los de San Antonio Texcala. Las únicas muestras accesibles para una revisión son, por tanto, las de la colección de la Universidad de Leipzig (Alemania). Cuarenta y dos especies se asignan a 26 géneros, seis especies más que las descritas por Felix. La mayoría de las especies pertenece a los subórdenes Stylinina, Faviina y Microsolenina y los géneros más comunes son *Cryptocoenia* y *Polyphylloseris*. Los subórdenes Archeocaeniina, Amphiastraeina y Rhipidogyrina, que son normalmente comunes en el Cretácico Temprano, no se registró en la fauna de San Antonio Texcala. Estratigráficamente, la fauna muestra afinidades con faunas entre el Jurásico muy Tardío y el Campaniano, y una correlación muy alta con asociaciones del Aptiano temprano. Las relaciones paleobiogeográficas son débiles y se encuentran principalmente con faunas del Barremiano-Aptiano del Tethys central, la provincia Caribeña, y aun con las provincias Asiáticas y Boreales.


Palabras clave: Corales, Cretácico, Puebla, Formación Zapotitlán, Barremiano.

## INTRODUCTION

In 1891, the German palaeontologist Johannes Felix published a survey of the Neocomian coral fauna of San Antonio de las Salinas, Puebla, Mexico. Felix reported 34 species in 21 genera. In view of the exotic provenance of the material, Felix established 25 new species and one new genus. The material did not return to Mexico, but remained in his private collection which he later bestowed to the collection of the Geological-Palaeontological Institute of the Leipzig University (Germany) where he worked for more than 40 years as a university professor and researcher. Due to the Second World War and the reduction of the geological department in 1968, this collection was long inaccessible. The reactivation of the geological department in 1990 and the registration of Johannes Felix´s entire collection (Löser et al., 2002a) finally provided access to the Mexican material.

Felix restricted his illustration to drawings of the coral surface, which was normal at his time. The systematic use of sections or thin sections only became common in the second half of the 20th century. But Felix also had another reason for drawing only the coral surfaces: the corals were completely recrystallized and their inner structures almost completely destroyed (under today´s conditions material of a comparable state of preservation would probably be discarded and not taxonomically determined).

Nonetheless the species names introduced by Felix (1891)—even though the taxa are insufficiently known from antiquated descriptions and imprecise illustrations—are today widely applied to material from all over the world (Löser et al., 2002b). Therefore, it would be counter-productive to disregard the Puebla material as being poorly preserved and unsuited for modern taxonomy. This study is an attempt to clarify the taxonomy of at least those species for which it was possible to determine the genus and to provide some illustrations of the type material.

## LOCATION AND STRATIGRAPHY

The fauna was originally described from a locality near a place called San Antonio de las Salinas (today San Antonio Texcala). This small village, well known for its production of precious onyx articles, lies 8.4 km SW of the town of Tehuacán, SE Puebla (Figure 1). The outcrop area is somewhere in the Barranca Ayucingo, a large ravine running from NW to SE and crossing the National Road 125 from Tehuacán to Zapotitlán Salinas at San Antonio Texcala (for details see INEGI, 1984).

The first (and only) description of the locality is brief (Felix and Lenk, 1891, p. 123): "The limestone—which is light grey in this case—contains sometimes a larger, sometimes a smaller number of chert concretions, which on weathering stand out as nodules. It also contains varying amounts of organic matter, notably corals, which are so much intergrown with the hard rock and weathered so incompletely as to make it almost impossible to recognise any reef forms, let alone to determine them in detail. The Barranca, which runs down from Ayucingo to San Antonio de las Salinas, shows repeated changes from those limestone beds to easily weathering brown marl layers which contain an extremely rich fauna." [Die hier lichtgrauen Kalksteine sind bald mehr bald weniger reich an Hornsteinknauern, welche bei der Verwitterung beulenförmig hervortreten. In wechselndem Grade bergen sie auch organische Reste, namentlich Korallenstöcke, die mit dem harten Gestein so verwachsen sind und so unvollständig herauswittern, dass man - von einer näheren Bestimmung ganz abgesehen - kaum mit Sicherheit das Vorhandensein auch riffbildender Formen zu erkennen vermag. Die Barranca, welche von Ayucingo gegen San Antonio de las Salinas hinabzieht, erschliesst einen mehrfachen Wechsel jener Kalkbänke mit leicht verwitternden, braunen Mergelschichten, welche eine außerordentlich reiche Fauna enthalten.]. To this sequence Felix assigned a Neocomian age. It is not clear from where exactly Felix collected the corals -from the limestone or from the marl. Nor is it understandable why he sampled the corals at all, seeing that they would be hard to determine.

Fifteen years later, Aguilera (1906) established the Zapotitlán Formation, which represents a sequence of shales and marls containing rudists and conglomerates and is found "north of San Antonio" (l.c.). Aguilera (l.c.) assigned the formation to the Barremian. Its total thickness was 1,300 m. The new formation probably also comprises the Felix locality.

Among other fossils, Aguilera (1906) listed many corals, often as new species. These species have to be considered nomina nuda as Aguilera did not provide a description. The material is kept at the National Palaeontological Collection in Mexico City and was (for a small

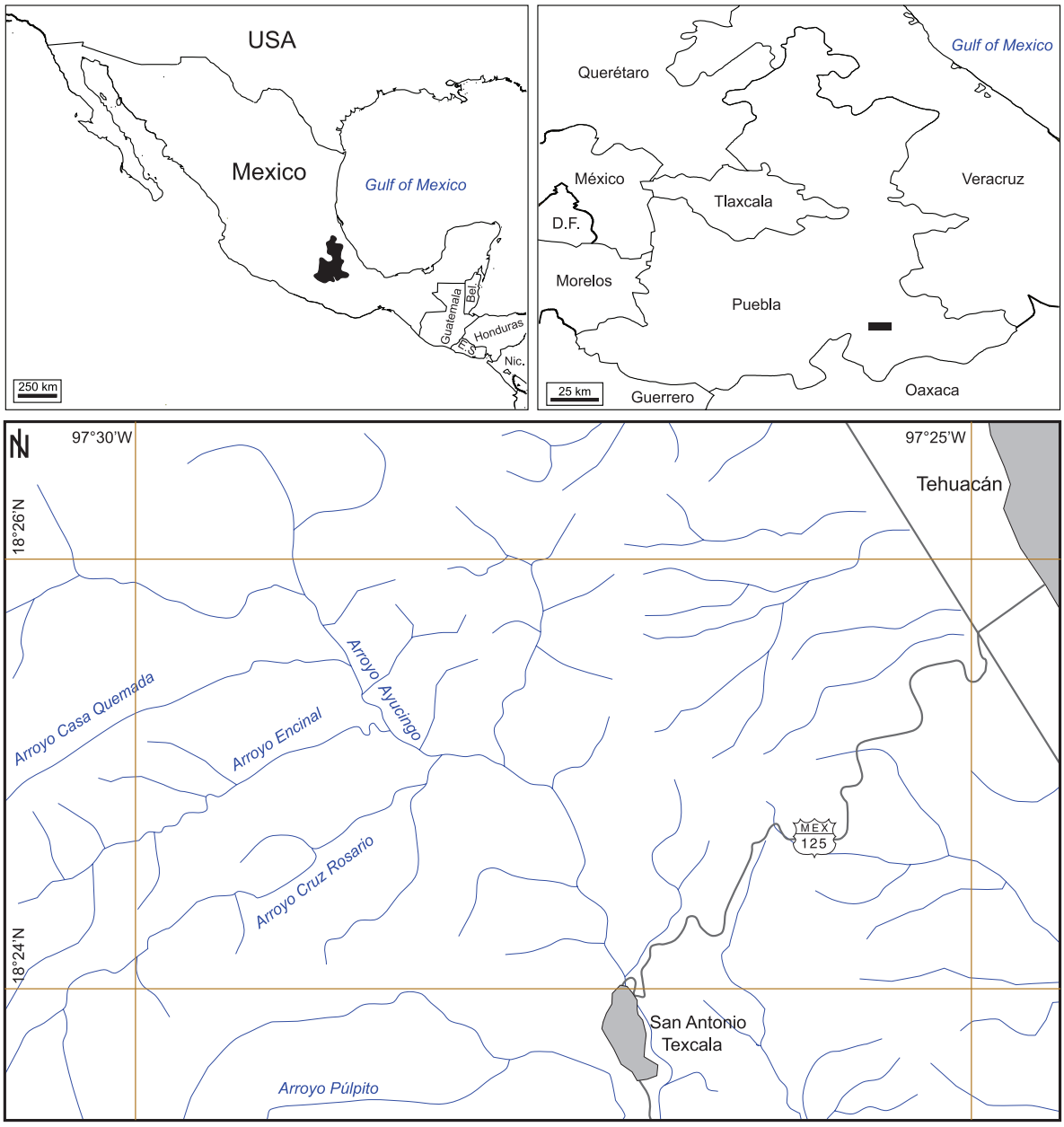



Figure 1. Study area. Drawn after topographic map sheet Tehuacán (INEGI, 1984).

part) taxonomically revised by Reyeros-Navarro (1963). Aguilera (1906) did not refer to the Felix locality. To “San Antonio” he referred only in very general terms. Most of the material collected by Aguilera comes from San Juan Raya, a locality ca. 15 km SW of San Antonio Texcala. Aguilera provided various outcrop names for his material. The lithology of the coral samples taken by Aguilera shows that they must have come from at least five different horizons. One specimen (IGM 1201) shows the same lithology as Felix´s material,

although the species was not found among the material collected by Felix. Aguilera (1906) also established the San Juan Raya Formation (overlying the Zapotitlán Formation), which should be of Aptian age.

Müllerried (1934) presented a generalised geological section of the region around San Antonio Texcala and San Juan Raya which in stratigraphic terms ranged from the Neocomian to the Aptian. The section was of a total thickness of about 800 m and consisted of marls (occasionally sandy) intercalated with thin limestone beds as well as of limestones and conglomerates. All layers yielded shallow marine invertebrates, such as rudist bivalves, nerineid gastropods and corals. The limestone beds intercalated with the basal marls contained ammonites (such as *Haploceras grasianum* d'Orbigny, *Pulchellia* ex gr. *pulchella* d'Orbigny, *Desmoceras* ex gr. *difficile* d'Orbigny, *Holcodiscus* ex gr. *camelinus* d'Orbigny, *Phylloceras* ex gr. *thetys* d'Orbigny), which according to Müllerried allowed an assignation to the early Barremian. Müllerried did not mention Felix´s material, probably because he himself did not know where it was taken from. Fossil lists provided by Müllerried are based on his own observations. He mentioned at least (l.c. p. 73) that the material described by Felix was probably of an early Barremian age.

Up to now the most complete synthesis of the studied region is given by Calderón-García (1956). He distinguished two informal members within the Zapotitlán Formation, though without providing details. The upper limit of the formation where it borders on the overlying San Juan Raya Formation is not well defined. Parts of the upper Zapotitlán Formation are probably laterally intercalated with the lower parts of the San Juan Raya Formation. The two formations are obviously difficult to distinguish on account of their similar lithology. The San Juan Raya Formation is well known as a source of shallow marine invertebrates and vertebrates. Calderón-García (1956) dated the Zapotitlán Formation as Barremian and the San Juan Raya Formation as Aptian. Newer observations on the stratigraphy are not known.

The sediments of the Zapotitlán Formation are well exposed in the Ayucingo Valley, even though tectonically disturbed, which is documented by frequent changes of strike and dip. An estimate of the overall sediment thickness is therefore difficult to give and requires first of all a systematic measurement of the whole sequence. The estimate of 800 m put forward by Müllerried (1934), encompassing both the Zapotitlán and San Juan Raya Formations, is definitely too low.

Harry Filkorn (Los Angeles), who believed having found the original locality of the Felix's material (see also Filkorn, 2003), provided detailed geographic data on the locality in the

Ayucingo Valley. The valley was recently visited by the author wishing to find the type locality of the corals described by Felix. The valley was examined between San Antonio Texcala and a spot about three kilometres northwest. The spot mentioned by Filkorn was found and yielded some coral samples which are different in lithology, in their state of preservation, and faunal composition from those described by Felix. The original Felix locality was not found, so the sampling point of his material is still unknown. The fauna was probably exposed as a result of erosion of one of the numerous marly layers in the lower part of the sections (i.e., a layer closer to San Antonio Texcala) where the marls are darker and correspond much more to the description given by Felix).

The coral material collected by Aguilera (which is kept at the National Palaeontological Collection in Mexico City) is not identical lithologically with the material collected by Felix (with one exception, as noted above).

## MATERIAL

The collection comprises 116 specimens, mainly isolated corals, which are assigned to 69 collection numbers. Some numbers therefore relate to more than one specimen. Subordinate numbers were assigned in cases where types had to be selected.

Colonial corals dominate. The surface structure of the corals is in part well preserved and shows fine ornamentation of the septal upper border and in part of the septal surfaces. The inner structures are completely destroyed; the corals are filled with a dark, coarsely crystallised calcite. There is no trace of an inner structure, not even close to the surface, except for two dendroid coral specimens. It was therefore not possible to prepare thin sections or to draw acetate peels from the samples.

Felix himself (1891) was aware of the poor state of his material (see note on *Cladophyllia miroi*, p. 153: No calice was preserved anywhere [kein Kelch war nirgends erhalten]), but this did not prevent him from establishing 25 new species and one new genus. From today´s standpoint this might seem strange, but in the 19$^{th}$ century it was usual to examine only the coral surface for taxonomic classification. At that time Felix was moreover just at the beginning of his career as a coral specialist and possibly not sufficiently experienced to consider the poor state of preservation of the coral samples.

It was not possible to obtain more material from the type locality, since its exact position remains unknown. Newly collected material from the Ayucingo Valley differs from Felix´s material in its taxonomical composition, except for one specimen from which a thin section was obtained (*Enallhelia anomalos*).

The material from San Juan Raya in the National Palaeontological Collection also differs taxonomically from Felix´s material. Only two specimens collected by Aguilera from San Juan Raya can be assigned to species established by Felix. This point remains doubtful because an examination of the corals in this collection by modern methods, such as polished sections or thin sections, was not allowed. It was not even possible to re-polish existing sections in order to take acetate peels for examination and illustration purposes.

The taxonomy of Felix´s material remains uncertain due to the poor state of preservation, but it seems to be more reasonable to describe and illustrate the material than to completely disregard it. The coral species from the San Antonio Texcala locality established by Felix are frequently found also in other Early Cretaceous coral localities, as has been reported in

the literature and verified in the present study. It is one of the most important coral faunas in North America and forms a major orientation point for palaeobiogeographic analysis.

The specimens illustrated are preferably type specimens, even if they are poorly preserved. The description is more or less detailed, depending on the quality of the material. The precision of the generic determination also depends greatly on the state of preservation. In some cases it was not possible to verify the original determination.

All of the original material is reposited at the Geological Institute of the Leipzig University, with the exception of the holotype and only specimen of *Thamnasteria crespoi*. This sample was probably taken for an exhibition and not returned to the collection, which is unfortunately the case with many specimens in this collection.

## METHODS

The examination was carried out using a binocular microscope. Because of the poor quality of the samples, only outer structures were studied and depicted. The illustrations were produced using an optical flat bed scanner (Canon DuoScan 2400) with a resolution of 2400 dpi. This type of scanner has a high depth of focus. Objects were scanned with reflecting light passing through a complicated lens system that guarantees sharp images.

More details were obtained with an Epson flat bed scanner with an optical resolution of 4,800 dpi (Perfection 4870 Photo) and a digital camera Nikon CoolPix 995 attached to a Zeiss STEMI 2000C microscope. Scanned imagines and digital photographs were transferred into grey scale bit maps. Their quality was enhanced by histogram contrast manipulation (contrast stretching).

To compare the fauna of San Antonio Texcala with other coral faunas outside the study area, a computer database of about 2,700 coral localities worldwide with coral indications was used (Löser et al., 2002b). To simplify the analysis, localities of the same age and located in the same basin, on the same continental margin or the same interoceanic platform were grouped together in one province. There are altogether 310 provinces comprising between one and 115 localities. In this way the comparison avoided any biases in favour of better explored areas such as Central Europe or the USA. Only firmly dated localities were used in the analysis. The studied locality was not included in any existing province, but rather an independent province was created for it 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 two species in common with the fauna of the studied area. The comparisons were performed by distance matrix cluster analysis of shared presence (Cheetham and Hazle, 1969) and clustering, using the agglomerative simple linkage method (Shi, 1993).

Data recording and analysis, compilation of synonymy lists and correlating procedures were carried out with the aid of the palaeontologic database management system PaleoTax (Löser, 2004; http://www.paleotax.de). Charts and cluster diagrams were created using PaleoTax/Graph.

## TAXONOMY

Systematic taxonomic work is difficult, on one hand, by the changes that have occurred in coral systematics in the past 60 years and, on the other, by the absence of a well founded illustrated and commented compilation of all Mesozoic coral genera due to insufficient knowledge of type material.

The systematics used here is mainly based on the traditional scheme first introduced by Alloiteau (1952, 1957) and later improved by, among others, Roniewicz (1976) and Morycowa and Roniewicz (1995). Many genera are only insufficiently known on account of the scarcity of revised type material of Cretaceous corals, including most types of type species. Many taxonomic units, such as families (Cyathophoridae, Latomeandridae, Synastraeidae) are poorly defined because the type of the type species of the name-giving genus is either poorly preserved, unknown, or incompatible with the family concept. The author´s studies of type material in the past 20 years with a view to verifying the genera and species at least in part (see Löser, 2005 for details) cannot replace a systematic revision.

A direct comparison of samples with the type material is therefore recommended in this study. The distribution data, as reflected in the synonymy lists, are based on material that was studied or is well known from good descriptions and illustrations. Material just mentioned in the literature or material not available for study or insufficiently described and illustrated in the literature has not been taken into account. To obtain a better insight into the distribution patterns of the coral fauna of San Antonio Texcala, additional unpublished material—indicated by a collection acronym and specimen number in parentheses—has been included.

Felix established 25 new coral species in the material from Puebla. Holotypes were unknown at his time and therefore not designated. His new species were in part based on various syntypes which in some cases are now determined to represent different species. Illustrated material was preferred for the lectotypes selected herein.

The following institutional abbreviations are used: BSP, Bayerische Staatssammlung für Paläontologie und Geologie, München, Germany; CGS, Ĉeska geologická sluzba, Praha, Czech Republic; ERNO, Universidad Nacional Autónoma de México, Instituto de Geología, Estación Regional del Noroeste, Hermosillo, Mexico; FSL, Université Claude Bernard, Institut de Géologie, Lyon, France; GPS, Geologische und Paläontologische Sammlung der Universität Leipzig, Leipzig, Germany; IGM, Universidad Nacional Autónoma de México, Instituto de Geología, Ciudad de México, Mexico (= Colección Nacional de Paleontología);

IRScNB, Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium; MB., Museum für Naturkunde der Humboldt-Universität, Berlin, Germany; MHNG, Muséum d'Histoire Naturelle de la Ville de Genève, Genève, Switzerland; MHNN, Muséum d'Histoire Naturelle de Neuchâtel, Neuchâtel, Switzerland; MNHN, Muséum National d'Histoire Naturelle Paris, Paris (France); MPUR, Museo di Paleontologia, Roma, Italy; NHM, The Natural History Museum, London, United Kingdom; NHMW, Naturhistorisches Museum Wien, Wien, Austria; OKSB, Coll. O. Karousek, Stara Boleslav, Czech Republic; PIW, Institut für Paläontologie der Universität Würzburg, Würzburg, Germany; SLD, Coll. Löser, Dresden, Germany (being transferred to the BSP); TMM, Texas Memorial Museum, Austin, Tex., USA; UP, Université de Provence, Coll.Masse, Marseille, France; ZSH, Zumsteinhaus, Kempten, Germany.

The following abbreviations are used to indicate the dimensions of the corals: c, calicular diameter; ccd, distance between calicular centres; cdw, distance between calicular centres within calicular series; ci, calicular diameter (isolated calice); cl, calicular diameter (calicular pit); col, calicular diameter (oval calice, length); cow, calicular diameter (oval calice, width); crd, distance of calicular series; crl, length of calicular series; crw, width of calicular series; s, number of radial elements in adult calices; sc, number of costae; sd, density of radial elements; sdc, density of costae; sdt, density of trabeculae; si, number of septa in the isolated calice; sp, primary septa; tbd, density of tubes. Type species of the genera and the mode of designation are not repeated since they are published (Löser et al., 2002b).

Suborder Stylinina Alloiteau, 1952
Family Cyathophoridae Vaughan and Wells, 1943
*Cryptocoenia* d'Orbigny, 1849
***Cryptocoenia antiqua* d'Orbigny, 1850**

**Material**. FLX 1994, Lectotype of *Cyathophora atempa*, herein designated.

**Synonymy**

| | | |
|---|---|---|
| * | 1850 | *Cryptocoenia antiqua* - d'Orbigny, (2), p. 92 |
| non | 1857 | *Cyathophora antiqua* - de Fromentel, p. 42 [= *Cryptocoenia picteti*] |
| ? | 1884 | *Cryptocoenia antiqua* - de Fromentel, p. 543, pl. 148: 1 [= *?Cryptocoenia regularis*] |
| v p | 1891 | *Cyathophora atempa* - Felix, p. 155, pl. 25: 7, 8 |
| | 1954 | *Cryptocoenia antiqua* De From. 1884 - Wery, p. 43 |
| non | 1960 | *Cyathophora antiqua* Fromentel - Kuzmicheva, p. 134, pl. 3: 3 |

**Dimensions**. cl 1.6 - 1.9 mm; ccd 2.0 - 2.7 mm; s 12 - 24; sc 12.

**Description**. Small plocoid colony. Intercalicinal space narrow. Calices round. Septa in six systems and two to three cycles. The septa of the first cycle are strong, slightly elevated but reaching in length only up to 10% of the calicular diameter. Those of the second cycle are much shorter and form only short septal ridges. The third cycle seems to be always incomplete and its septa are as short as those of the second cycle. No columella. Endotheca unknown.

**Remarks**. *Cryptocoenia antiqua* is poorly defined; the holotype is lost and it is uncertain whether the material described by de Fromentel (1857, 1884) belongs to this species. *C. antiqua* is used here in the sense of Wery (1954, p. 43), who claimed to have the holotype. This information is doubtful because he indicated that the type was from the de Fromentel collection, whereas it should be part of the d'Orbigny collection. The material observed by Wery (l.c.) might therefore belong to *C. atempa.* The present material may differ from *C. antiqua* on account of the incomplete third cycle.

**Occurrence elsewhere**. Early Hauterivian (Radiatus zone): France (Haute-Marne) Saint Dizier; France (Yonne) Chenay; Fontenoy; Venoy. Early Aptian: Greece (Viotía) Arachova (SLD 5497). Late Aptian: Spain (Cataluña, Tarragona) Com. Baix Penedès, Masarbones (SLD 6026); Mexico (Sonora) Municipio Opodepe, Rancho El Pimiento (ERNO L-4420).

### *Cryptocoenia bulgarica* (Toula, 1884)

**Material**. FLX 2105, Paralectotype of *Cyathophora atempa*.

**Synonymy**

| | | |
|---|---|---|
| *v | 1884 | *Astrocoenia bulgarica* nov. sp. - Toula, p. 1317, pl. 6: 4 |
| v | 1889 | *Cryptocoenia ramosa* nov. spec. - Toula, p. 83, pl. 5: 10, 11 |
| v p | 1891 | *Cyathophora atempa* - Felix, p. 155 |
| | 1944 | *Cyathophora hedbergi* Wells, n. sp. - Wells, p. 434, pl. 69: 7, 8 |
| v | 1964 | *Adelocoenia biedai* n.sp. - Morycowa, p. 26, text ill. 2, pl. 4: 2, pl. 5: 5 |
| | 1981 | *Cyathophora steinmanni* Fritzsche 1924 - Turnšek and Mihajlović, p. 18, pl. 13: 3, 4 |
| | 1993 | *Pseudocoenia beskidena* Eliášová 1981 - Baron-Szabo, p. 155, text ill. 3, pl. 2: 1 |
| v | 1995 | *Procyathophora biedai* (Morycowa 1964) - Löser and Raeder, p. 43 |
| v | 1996 | *Pentacoenia tombecki* Fromentel, 1857 - Baron-Szabo and Steuber, p. 9, pl. 2: 5 |

**Dimensions**. cl 1.6 - 2.0 mm; ccd 2.2 - 3.0 mm; s 12.

**Description**. Plocoid colony. Calices round and regular. Septa in six systems and two cycles. The septa of the first cycle reach in length up to 40% of the calicular diameter. Those of the second cycle are shorter and form only short septal ridges. No columella. Endotheca unknown.

**Remarks**. When established, the species has been assigned to *Astrocoenia*. The study of the type material revealed that the species belongs to the genus *Cryptocoenia*. The holotype (NHMW 1999z0036/0000) has the following dimensions: cl 1.7 - 2.2 mm; ccd 2.4 - 3.0 mm; s 6 s1 + 6 s2; sc 24. *C. bulgarica* is a common species.

**Occurrence elsewhere**. Early Hauterivian (Radiatus zone): France (Yonne) Fontenoy, Les Merles (SLD 5154). Late Barremian: Poland (Malopolskie, Tarnów) Tarnów, Trzemesna. Early Aptian: France (Aude) Les Corbières, Bugarach, Le Mas (NHM R. 34224); Greece (Viotía) Arachova; Perachorion; Serbia and Montenegro (East Serbia) Pirot, Bela Palanka; Zljebine; Venezuela (Sucre) Cumaná, Las Cinco Ceibas. Late Aptian: Spain (Cataluña, Barcelona) Com. Alt Penedès, Castellvi de la Marca, Can Pascual (SLD 6299); Spain (Cataluña, Tarragona)

Com. Baix Penedès, Masarbones (SLD 6028); Mun. Montmell, Marmellà, Can Xuec (SLD 6223). Latest Aptian to early Albian: Spain (Vascongadas, Vizcaya) Gamecho, Playa de Laga. Early Albian: Mexico (Sonora) Municipio Cucurpe, La Mesa (ERNO L-4829). Early Albian (Mammillatum zone): France (Aude) Padern, Le Crès (SLD 4529). Middle Albian: Greece (Viotía) Aliartos, Korónia (SLD 1893), late Albian: United Kingdom (Devonshire) Exeter, Haldon Hill (NHM R. 23570). Cenomanian: Germany (Bayern) Rosstein-Alm (BSP 1955 XIX 28). Late Cenomanian (Guerangeri zone): Czech Republic (Central Bohemian region) Korycany, Netreba (CGS HF 1481).

### *Cryptocoenia corbariensis* (Alloiteau, 1948)

Figure 2A

**Material**. FLX 2090.

**Synonymy**

*v 1948 *Cyathophora corbariensis* nov. sp. - Alloiteau, p. 721, text ill. 9, pl. 26: 8, pl. 27: 3

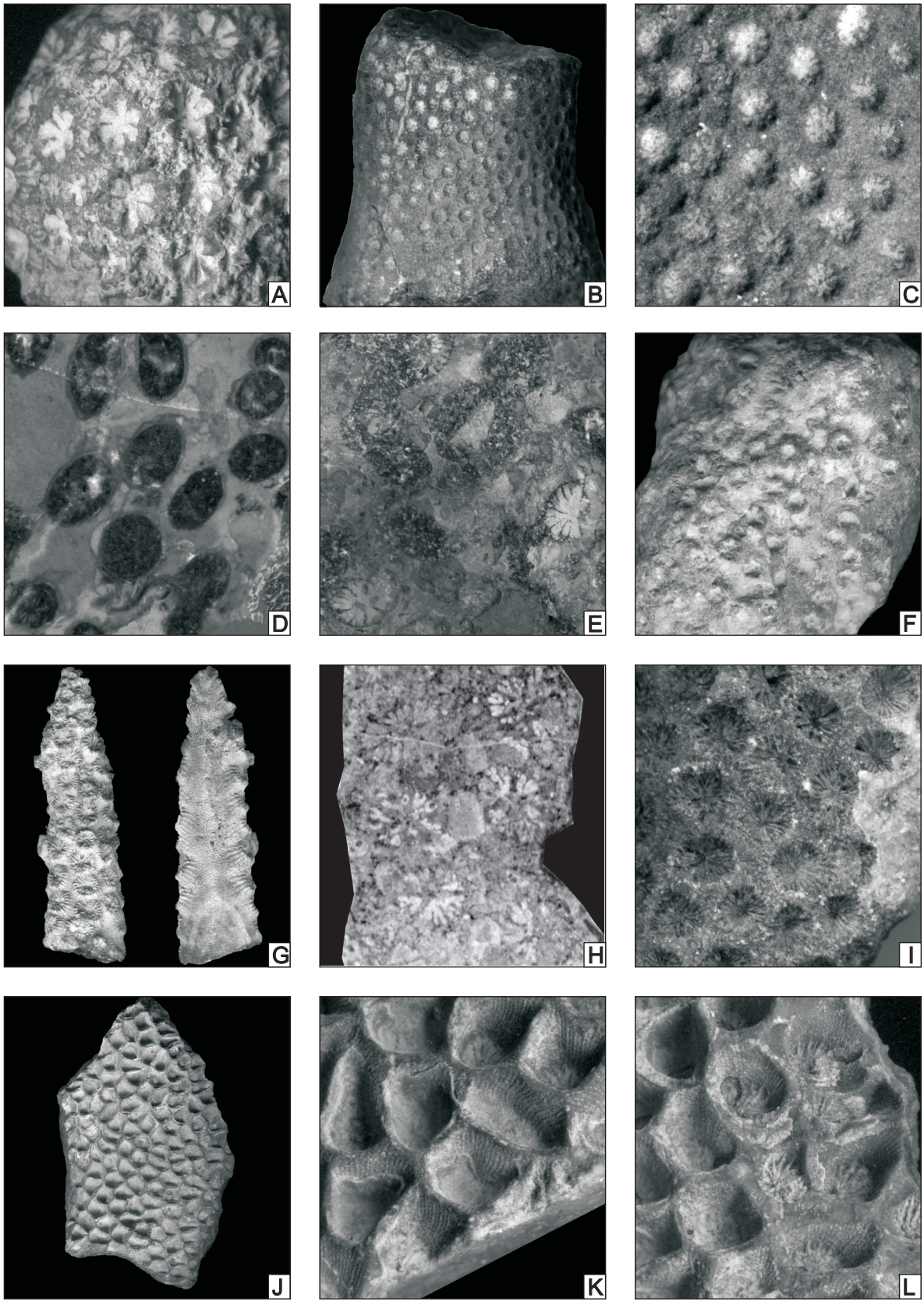
**Dimensions**. c 3.0 -3.5 mm; ccd 4.0 - 5.0 mm; s 12.

**Description**. Small plocoid colony. Intercalicinal space narrow. Calices round. Septa in six systems and two cycles. The septa of the first cycle are strong, slightly raised and reach almost up to the centre of the calice. No auriculae present. Those of the second cycle are shorter and form only short septal ridges. Coenoesteum consisting of up to 24 costae. No columella. Endotheca unknown.

**Remarks**. The specimen was labeled *Phyllocoenia exculpta*, coming from the Gosau area in Austria. But its lithology was identical with that of the other samples from the San Antonio Texcala locality. The incorrect label was probably not due to Felix, but caused by one of the various transports of the Felix collection within the Leipzig University building (Löser et al., 2002a).

**Occurrence elsewhere**. Early Albian (Mammillatum zone): France (Aude) Padern. Early Cenomanian: France (Charente-Maritime) Fouras (SLD 5592); Greece (Kozani) Kozani, Nea Nikopolis (SLD 5867).

Figure 2. **A**: *Cryptocoenia corbariensis* (Alloiteau, 1948), GPS FLX 2090, coral surface, 3x. **B**: *Pseudocoenia micrommatos* (Felix, 1891), Holotype of *Cryptocoenia micrommatos*, GPS FLX 2102, coral surface, 2x. **C***:* detail, 6x. **D**: *Cladophyllia miroi* Felix, 1891, Lectotype of *Cladophyllia miroi*, GPS FLX 4749, polished coral surface, 4x. **E**: *Goniocora* sp., Paralectotype of *Calamophyllia sandbergeri*, GPS FLX 2746, coral surface, 2x. **F**: *Heterocoenia pusilla* Reig Oriol, 1992, Paralectotype of *Stylophora tehuacanensis*, GPS FLX 4667, coral surface, 3x. **G**: *Enallhelia anomalos* (Felix, 1891), Holotype of *Prohelia anomalos*, GPS FLX 4668, coral surface from both sides, 2x. **H**: ERNO L-4867, transversal thin section, 8x. **I**: ?*Diploastrea cyclops* (Felix, 1891), Lectotype of *Phyllocoenia cyclops*, GPS FLX 2050, coral surface, 3x. **J**: *Latusastrea* sp., GPS FLX 1623, coral surface, 0.8x. **K, L**: detail, 4x.


A
B
C
D
E
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K
L

### *Cryptocoenia neocomiensis* d'Orbigny, 1850

**Material**. FLX 2084.

**Synonymy**

| | | |
|---|---|---|
| *v | 1850 | *Cryptocoenia neocomiensis* - d'Orbigny, (2), p. 92 |
| non | 1857 | *Cyathophora neocomiensis* - de Fromentel, p. 41, pl. 5: 11, 12 [= *Cryptocoenia icaunensis*] |
| | 1884 | *Cyathophora* (*Cyathocoenia*) *neocomiensis* - de Fromentel, p. 541, pl. 126: 2 |
| | 1884 | *Cryptocoenia neocomiensis* - de Fromentel, p. 544, pl. 148: 2-2a |
| v | 1884 | *Cyathophora* (*Cyathocoenia*) *icaunensis* - de Fromentel, p. 539, pl. 147: 3 |
| v | 1891 | *Cryptocoenia neocomiensis* - Felix, p. 154 |
| v non | 1896 | *Cyathophora neocomiensis* - Koby, p. 28, pl. 4: 6, 6a [= *Stylina* sp.] |
| non | 1903 | *Cryptocoenia neocomiensis* - Volz, p. 23 [= *Cryptocoenia excavata*] |
| v | 1964 | *Adelocoenia annae* (Volz, 1903) - Morycowa, p. 27, pl. 11: 2 |
| non | 1964 | *Cryptocoenia neocomiensis* d'Orbigny, 1847 - Morycowa, p. 29, pl. 5: 7 [= *Cryptocoenia aguilerai*] |
| v | 1971 | *Pseudocoenia annae* (Volz, 1903) - Morycowa, p. 42 |
| v | 1995 | *Adelocoenia* cf. *neocomiensis* (d'Orbigny 1850) - Abdel-Gawad and Gameil, p. 9, pl. 12: 7, 8 |
| v non | 1998 | *Adelocoenia neocomiensis* (d'Orbigny 1850) - Schöllhorn, p. 74, fig. 35, pl. 19: 7, 10, pl. 28: 3 [= *Cryptocoenia aguilerai*] |
| v | 2001 | *Adelocoenia neocomiensis* (d'Orbigny 1850) - Löser, 2001, p. 42, pl. 1: 6 |

**Dimensions**. cl 2.8 - 3.3 mm; ccd 4.5 - 5.0 mm; s 12; sc 24; sdc 2 / 1 mm.

**Description**. Small plocoid colony. Intercalicinal space rather wide. Calices round and regular. Septa in six systems and two cycles. The septa of the first cycle are strong, reaching almost to the centre of the calice. Auriculae do not exist. Those of the second cycle are shorter and form only short septal ridges. Coenosteum consists of up to 24 costae. No columella. Endotheca unknown.

**Remarks**. In the collection of the MNHN (Paris) exists one specimen (M03706) which is considered the holotype of *C. neocomiensis*. It has no number of the Coll. d'Orbigny making this designation doubtful. The specimen is not well preserved and has the following dimensions: cl 2.7 - 3.3 mm; ccd 3.5 - 4.5 mm; s 6 s1 + 6 s2; sdc 2 / 1 mm.

**Occurrence elsewhere**. Early Hauterivian (Radiatus zone): France (Aube) Troyes, Vallières; France (Haute-Marne) Saint Dizier; France (Yonne) Fontenoy, Les Merles (SLD 5127); Gy-l'Evêque; Leugny, Les Cassines (SLD 5103). Barremian to early Aptian: Romania (Suceava) Pojorîta area, Cîmpulung-Moldovenesc, Rarau Mt. Early Aptian: Greece (Viotía) Levadia, Perachorion; Poland (Malopolskie, Wadowice) Lanckorona, Jastrzebia. Late Aptian: Algeria (Constantine) Sidi R'Gheiss (UP M 6291). Early Cenomanian: Greece (Kozani) Kozani, Nea Nikopolis (SLD 5873).

### *Cryptocoenia regularis* (de Fromentel, 1884)

**Material**. FLX 1975, Paralectotype of *Cyathophora atempa*.

**Synonymy**

| | | |
|---|---|---|
| * | 1884 | *Cyathophora* (*Cyathocoenia*) *regularis* - de Fromentel, p. 540, pl. 149: 2 |
| v p | 1891 | *Cyathophora atempa* - Felix, p. 155, pl. 25: 7, 8 |
| v non | 1897 | *Cyathophora regularis* - Koby, p. 29, pl. 9: 5 [= *Confusaforma* sp.] |
| v | 1909 | *Cyathophora turonensis* - Prever, p. 124, pl. 5: 12, pl. 13: 20 |
| v | 1932 | *Cyathophora haysensis* Wells, n. sp. - Wells, p. 237, pl. 30: 4, pl. 32: 5 |
| | 1992 | *Cyathophora regularis* Fromentel, 1875 - Eliášová, p. 402, pl. 2: 2, 3, pl. 8: 8 |
| v | 1997 | *Cyathophora miyakoensis* Eguchi, 1936 - Baron-Szabo, p. 40, pl. 3: 5, 6 |
| v | 2001 | *Adelocoenia regularis* (de Fromentel 1884) - Löser, p. 42, pl. 1: 3 |

**Dimensions**. cl 2.0 - 2.5 mm; s 12; ccd 2.5 - 3.0 mm.

**Description**. Plocoid colony. Calices round. Septa in six systems and two cycles. The septa of the first cycle reach in length up to 30% of the calicular diameter. Those of the second cycle are shorter and reduced to ridges. No columella. Endotheca unknown.

**Remarks**. The holotype could not be found in the collections of the MNHN (Paris) and new material could not be collected since the type locality does not yield fossils anymore. The assignation of material to this species is based on the dimensions provided by de Fromentel (1884).

**Occurrence elsewhere**. Early Hauterivian (Radiatus zone): France (Aube) Troyes, Vallières; France (Haute-Marne) Morancourt; France (Yonne) Fontenoy, Les Merles (SLD 5027); Gy-l'Evêque. Early Aptian (Lenticularis zone): Germany (Bayern) Allgäuer Helvetikum,

Brandalpe. Late Aptian: Italy (Abruzzi, L'Aquila) Monti d'Ocre, Fossa Agnese. Early Albian (Tardefurcata zone): USA (Texas) Hays County, Blanco River, Pleasant Valley Crossing. Early Albian: Spain (Castilla la Vieja, Santander) Cabo de Ajo (SLD 4680). Middle Cenomanian (Mantelli - Rhotomagense zone): Belgium (Hainaut) Tournai (IRScNB I. G. 3354 / LOE 14). Late Cenomanian: Czech Republic (Central Bohemian region) Kolín, Planany. Late Cenomanian (Guerangeri zone): Czech Republic (Central Bohemian region) Korycany; Netreba. Late Cenomanian (Geslinianum zone): Czech Republic (Central Bohemian region) Chvateruby. Czech Republic (Hradec Králové region) Horice, Podnorní Ujezd.

*Pseudocoenia* d'Orbigny, 1850

***Pseudocoenia micrommatos* (Felix, 1891)**

Figure 2B, C

**Material**. FLX 2102, Holotype of *Cryptocoenia micrommatos*, by monotypy.

**Synonymy**

| | | |
|---|---|---|
| *v | 1891 | *Cryptocoenia micrommatos* - Felix, p. 154, pl. 24: 5, 5 a-b |
| v | 1963 | *Procyathophora poblana* n.sp. - Reyeros Navarro, p. 9, pl. 3: 4 |
| v | 1989 | *Cryptocoenia micrommatos* Felix - Perrilliat, p. 91, fig. 31a |

**Dimensions**. c 1.1 - 1.3 mm; ccd 1.7 - 2.0 mm; s 16.

**Description**. Small plocoid colony. Calices very regular, round, at a certain distance from each other. Septa short, in eight systems and two cycles. Those of the first cycle reach in length about 20% of the calicular diameter, those of the second remain very short and are reduced to ridges. No costae observed. No columella. Wall and endotheca unknown.

**Remarks**. *Pseudocoenia* is used herein in the sense of d'Orbigny, not according to the lectotype designated by Wells (1936). See also Löser (in review). *Pseudocoenia* is a *Cryptocoenia* (hexameral septal symmetry) with an octomeral septal symmetry. In the Cretaceous, the genus is rare.

**Occurrence elsewhere**. Aptian: Mexico (Puebla) San Juan Raya.

Family Stylinidae d'Orbigny, 1851

*Cladophyllia* Milne-Edwards and Haime, 1851

***Cladophyllia miroi* Felix, 1891**

Figure 2D

**Material**. FLX 4749, Lectotype of *Cladophyllia miroi*, herein designated; FLX 4745, Paralectotype of *Cladophyllia miroi*; FLX 4757, Paralectotype of *Cladophyllia miroi*.

**Synonymy**

| | | |
|---|---|---|
| *v | 1891 | *Cladophyllia miroi* - Felix, p. 153, pl. 25: 10, 10a |
| v | 1989 | *Cladophyllia miroi* Felix - Perrilliat, p. 91, fig. 30g |
| v ? | 1999 | *Cladophyllia mexicana* n. sp. - Baron-Szabo and González-León, p. 477, fig. 3h, k |

**Dimensions**. c 2.0 - 2.5 mm; cl 1.7 - 1.8 mm; ccd 3.0 - 4.0 mm; s 24.

**Description**. Dendroid colony with round calices. Septa compact, thin and in part connected to each other in the calicular centre. Septa in six systems and three cycles. Wall probably paraseptothecal. Columella and endotheca unknown.

**Remarks**. *Cladophyllia mexicana* is probably a junior synonym. This can only be confirmed by the aid of new and hopefully better preserved material from the type area of *Cladophyllia miroi*.

**Occurrence elsewhere**. Early Hauterivian (Radiatus zone): France (Yonne) Fontenoy, Les Merles (SLD 5253); Gy-l'Evêque (SLD 6532). Early Aptian (Lenticularis zone): Greece (Viotía) Levadia, roadcut near Perachorion NW Levadia (SLD 5727). Latest Aptian to early Albian: Mexico (Sonora) Municipio San Pedro de la Cueva, Lampazos area. Early Albian: Mexico (Sonora) Municipio Opodepe, Tuape, Cerro de la Espina (ERNO L-4439).

*Enallhelia* Milne-Edwards and Haime, 1849

***Enallhelia anomalos* (Felix, 1891)**

Figure 2G, H

**Material**. FLX 4668, Holotype of *Prohelia anomalos*, by monotypy; ERNO L-4867.

**Synonymy**

*v 1891 *Prohelia anomalos* - Felix, p. 162, pl. 23: 4, 4a-c
v 1989 *Prohelia anomalos* Felix - Perrilliat, p. 99, fig. 34b

**Dimensions**. cl 1.1 - 1.5 mm; ccd 2.0 - 2.5 mm; s 24; sc 48.

**Description**. Small branch bearing only on one side densely packed, in part alternating small calices. Its reverse side is finely granulated. The calices are round and raised. Septa occur in six systems and three cycles. The septa of the first cycle are large and reach almost the columella.The septa of the second cycle are thinner than those of the first cycle but not much shorter. The septa of the third cycle are much thinner and reach only half the length of those of the first cycle. All septa bear auriculae on their inner margin. They are free and not connected to the columella. The costae are regular and granulated. The wall is parathecal. The columella is styliform and oval.

**Remarks**. The small specimen is the best preserved of all, even if its inner structures are completely destroyed. It is moreover the only species recently found in the type area in a much better state of preservation than others and helps to improve our knowledge of this species. The genus *Prohelia* is a junior synonym of *Stylangia* (Löser, 2005). *Stylangia* is an incrusting *Stylina*, whereas *Enallhelia* forms small erected branches which bear calices only on one side.

*Goniocora* Milne-Edwards and Haime, 1851
***Goniocora* sp.**
Figure 2E

**Material**. FLX 2746, Paralectotype of *Calamophyllia sandbergeri*.

**Synonymy**

v p 1891 *Calamophyllia Sandbergeri* - Felix, p. 153, pl. 22: 9

**Dimensions**. c 5 - 5 * 10 mm; cl 3.8 mm; s 24.

**Description**. Dendroid colony with round or oval branches. Septa thin, compact, free and in six septal systems. They are regularly arranged in three cycles. No auriculae observed,

probably on account of the poor state of conservation. The columella is small and styliform and not present in all calices.

**Remarks**. The genus *Goniocora* is relatively unknown since the type material (or topotypical material) has never been depicted in detail except for a very recent publication (Helm, 2005). *Goniocora* is a stylinid genus with septa bearing small auriculae, a small styliform columella which may also be absent and be connected to a septum. The present material shows a very close affinity to *Goniocora* though the existence of auriculae is doubtful due to the poor state of preservation of the sample.

Suborder Heterocoeniina Beauvais, 1974
Family Heterocoeniidae Oppenheim, 1930
*Heterocoenia* Milne-Edwards and Haime, 1848
***Heterocoenia pusilla* Reig Oriol, 1992**
Figure 2F

**Material**. FLX 4667, Paralectotype of *Stylophora tehuacanensis*.

**Synonymy**

| | | |
|---|---|---|
| v p | 1891 | *Stylophora tehuacanensis* nov. sp. - Felix, p. 161, pl. 22: 2, 8 |
| v | 1905 | *Heterocoenia verrucosa* - d'Angelis d'Ossat, p. 23, pl. 1: 15, 16 |
| * | 1992 | *Heterocoenia pusilla* n. sp. - Reig Oriol, p. 34, pl. 7: 4 |
| | 1994 | *Heterocoenia rosi* n. sp. - Reig Oriol, p. 12, pl. 1: 4, pl. 2: 9 |

**Dimensions**. cl 0.9 - 1.1 mm; ccd 1.3 - 2.5 mm; s 6.

**Description**. Small plocoid colony. Calices small, widely separated from each other and slightly raised. Six septa in three systems and two cycles can be distinguished. They are short and their peripherical part is broad. The septa of the first cycle are slightly larger than the others. No columella. Endotheca unknown. The coenosteum is smooth.

**Remarks**. The material was labeled *Stylophora tehuacanensis* by Felix but it does not belong to this species (*S. tehuacanensis* was reassigned to *Polytremacis*). Compared with all other *Heterocoenia* species, *H. pusilla* is characterised by its small calicular diameter.

**Occurrence elsewhere**. ?Early Cretaceous: Italy (Campania, Napoli) Isle of Capri, Venassino (MPUR i. 409). Late Cenomanian: Czech Republic (Central Bohemian region) Kolín, Planany (OKSB n/n L7567). Campanian: Spain (Cataluña, Lérida) Com. Pallars Jussà, Mun. Pallars Jussà, Pobla de Segur, Torallola.

### *Latusastrea* d'Orbigny, 1849

**Remarks**. *Latusastrea* is a problematic genus. It is based on a Late Jurassic type species with large calices in a cerioid calicular arrangement and a thin wall. The Cretaceous species are characterised by small calices, arranged in the typical swallow-nest like form with thick walls. It might be useful to apply the generic name *Pleurocoenia* to the material with small calices, but the type of the type species of this genus is not available at the collection of the MNHN (Paris) and moreover, it comes from Uchaux (Vaucluse, France), a locality which yielded only material of a very poor state of preservation. Another problem is, that the types of many hypothetical *Pleurocoenia* species are lost (*Pleurocoenia exigua* de Fromentel, 1862, *Pleurocoenia provincialis* d'Orbigny, 1849), not revised (*Stereopsammia inflexa* Eichwald, 1865/68, *Heliopora aprutina* Prever, 1909, *Heliopora decipiens* Prever, 1909) or poorly preserved (*Pleurocoenia polygonalis* de Fromentel, 1862). The genus *Latusastrea* is in need for revision.

### *Latusastrea* sp.

Figure 2J–L

**Material**. FLX 1580, 1584, 1619, 1623.

**Synonymy**

v 1891 *Latusastraea* cf. *polygonalis* - Felix, p. 157, pl. 24: 1, 1a-b

**Dimensions**. cow 1.5 - 2.5 mm; col 3.0 - 4.0 mm; ccd 3.0 - 5.0 mm; s 19 - 21; sp 5 - 6.

**Description**. Cerioid colony with polygonal, slightly elongated and very deep calices. Three types of septa can be distinguished: about five to six primary septa, 13 to 16 shorter secondary septa and a large number of septal ridges which are clearly visible on the calicular inner margin. The primary septa are long and grow only from one side of the calice to the other. They may reach 80% in length of the smaller calicular diameter. In elongated calices the primary septa are always found on the longer side. The septa of the second generation are

shorter and may reach about 25% of the smaller calicular diameter. They are found between the primary septa and the other side. Both septal types meet in a calicular centre which is not in the geometric centre of the calice but somewhat closer to the margin. The septa of the third type are very short and only visible in the upper part of the calice where the septa of the first two types can also be traced. The endotheca probably consists of thin dissepiments. A columella does not exist. Budding is probably intracalcinal (marginal).

**Remarks**. This material corresponds to the type species of *Latusastrea*. Material like this was considered by Kolodziej (1995) as belonging to *Thecidiosmilia* (which is considered a younger synonym of *Latusastrea*). The other known *Latusastrea* species with large calices (*L. alveolata, L. valvata, L. morycowae*) as well as the present material show comparable dimensions but differ in the number of larger primary septa. The proposal of Birenheide (1969) that *Thecidiosmilia* should be made a junior synonym of *Latusastrea* is accepted herein, since the type species of both genera differ only slightly.

*Latusastrea polygonalis* has much smaller dimensions and belongs to the group of forms with small calices. The holotype (MNHN R10920), a poorly conserved specimen from Uchaux (Vaucluse, France) shows the following calicular dimensions: cl 1.0 - 1.5 x 1.0 - 1.75 mm; ccd 3.0 - 4.0 mm. Number of the septa is unknown.

### *Latusastrea provincialis* (d'Orbigny, 1849)

**Material**. FLX 1602, 1611.

**Synonymy**

| | | |
|---|---|---|
| * | 1850 | *Pleurocoenia provincialis* - d'Orbigny, (2), p. 209 |
| v p | 1891 | *Latusastraea provincialis* - Felix, p. 158, pl. 25: 16 |
| v | 1964 | *Latusastraea provincialis* (d'Orbigny, 1850) - Morycowa, p. 70, pl. 19: 3, pl. 20: 4 |
| non | 1980 | *Latusastraea provincialis* (Orbigny, 1850) - Kuzmicheva, p. 99, pl. 36: 5 [= *L. polygonalis*] |
| non | 1987 | *Latusastraea provincialis* (Orbigny, 1850) - Kuzmicheva, p. 228, pl. 2: 2 [= *L. polygonalis*] |
| | 1993 | *Latusastraea provincialis* (d'Orbigny 1850) - Baron-Szabo, p. 157, text ill. 4, pl. 2: 3 |
| *v | 1994 | *Latusastrea xigazeensis* (sp. nov.) - Liao and Xia, p. 67, 221, pl. 5: 5, 6 |

| | | |
|---|---|---|
| | 1995 | *Latusastraea exiguis* (Fromentel, 1862) - Morycowa and Roniewicz, p. 18, fig. 1, 2, 3 a-f |
| v | 1996 | *Latusastrea provencialis* (d'Orbigny, 1850) - Baron-Szabo and Steuber, p. 18, pl. 7: 6 |
| v | 1997 | *Latusastrea provincialis* (d'Orbigny, 1849) - Baron-Szabo, p. 46, pl. 2: 5, 6 |
| v | 1998 | cf. *Latusastrea* aff. *exiguis* (Fromentel, 1862) - Schöllhorn, p. 79, pl. 20: 4, 5 |
| non | 1999 | *Latusastrea provencialis* d'Orbigny, 1849 - Baron-Szabo and González-León, p. 482, fig. 4 d [= *L. irregularis*] |
| non | 2002 | *Latusastraea provincialis* (d'Orbigny, 1850) - Kuzmicheva, p. 127, pl. 8: 4 [= *L. polygonalis*] |
| v non | 2003 | *Latusastrea provencialis* (d'Orbigny, 1849) - Baron-Szabo and González-León, p. 206, fig. 7G [= *L. irregularis*] |
| v | 2006 | *Latusastrea provencialis* (d'Orbigny, 1849) - Löser and Ferry, p. 480, fig. 4.3 |

**Dimensions**. FLX 1611: cow 0.6 - 0.8 mm; col 1.3 - 1.5 mm; ccd 2.5 - 3.0 mm. FLX 1602: cow 0.7 - 1.0 mm; col 1.3 - 1.4 mm; ccd 2.2 - 2.5 mm.

**Description**. Plocoid colony with widely separated oval calices. A main septum is visible in places, but the material is generally very poorly preserved. The coenosteum is finely granulated.

**Remarks**. Baron-Szabo (1997) and Baron-Szabo and González-León (1999) included *L. exigua* in the synonymy of *Latusastrea provincialis*. *Latusastrea exigua* is indeed an unknown species. It has never been depicted and its holotype is probably lost. The name of this species should therefore not be used. The dimensions of much of the material assigned to *L. exigua* are larger and cannot be easily transferred to *L. provincialis*. To solve the problem, topotypical material needs to be recollected from the type locality of *L. exigua* (Sault, Vaucluse, France).

*Latusastrea provincialis* itself is quite an unknown species. The type material (from Uchaux, Vaucluse, France) is not available at the MNHN (Paris) and there exists no illustration of the material from the type locality at all.

**Occurrence elsewhere**. Middle Berriasian: France (Haute-Savoie) Mont Salève (MB. K 1001). Late Barremian: France (Ardèche) St.Remèze, Belvédère du Serre-de-Tourre; Poland (Malopolskie, Tarnów) Tarnów, Trzemesna. Late Barremian to early Aptian: Switzerland (Bern) Rawil pass. Early Aptian: Greece (Viotía) Arachova; Perachorion (SLD 5775);

Poland (Malopolskie, Wadowice) Lanckorona, Jastrzebia. Early Aptian (Lenticularis zone): Germany (Bayern) Allgäuer Helvetikum. Early late Aptian: Spain (Cataluña, Lérida) Com. Alt Urgell, Mun. Coll de Nargó, Sta. Fé, Font Bordonera. Late Aptian: Algeria (Constantine) Sidi R'Gheiss (UP M 6313). Latest Aptian to early Albian: Spain (Vascongadas, Vizcaya) Gamecho, Playa de Laga. Early Albian: Mexico (Sonora) Municipio Opodepe, Tuape, Cerro de la Espina (ERNO L-4459). Early Cenomanian: China (Xizang [= Tibet] Autonomous Region) Xigaze county, Donggar district, suburb of Donggar. Upper Turonian: France (Vaucluse) Orange, Uchaux.

### *Latusastrea irregularis* (Toula, 1884)

**Material**. FLX 1606.

**Synonymy**

| | | |
|---|---|---|
| *v | 1884 | *Pleurocoenia irregularis* nov. spec. - Toula, p. 1318, pl. 6: 6 |
| v p | 1891 | *Latusastraea provincialis* - Felix, p. 158, pl. 25: 16 |
| v | 1905 | *Heterocoenia verrucosa* - d'Angelis d'Ossat, p. 23, pl. 1: 15, 16 |
| v | 1909 | *Heliopora decipiens* - Prever, p. 65, pl. 1: 18, 18 a, 23, pl. 2: 1, 1a, 2 |
| v | 1964 | *Latusastraea decipiens* (Prever, 1909) - Morycowa, p. 71, pl. 20: 1, 2 |
| v | 1974 | *Latusastrea decipiens* (Prever) - Turnšek and Buser, p. 16, 34, pl. 6: 3 |
| | 1981 | *Latusastrea decipiens* (Prever) 1909 - Turnšek and Mihajlović., p. 19, pl. 13: 7, 8 |
| v | 1984 | ?*Polytremacis* cf. *urgoniensis* Koby, 1897 - Scholz, 1984, p. 475 |
| | 1993 | *Latusastraea provincialis* (d'Orbigny 1850) - Baron-Szabo, p. 157, text ill. 4, pl. 2: 3 |
| v | 1999 | *Latusastrea* provincialis d'Orbigny, 1849 - Baron-Szabo and González-León, p. 482, fig. 4 d |
| v | 2003 | *Latusastrea provencialis* (d'Orbigny, 1849) - Baron-Szabo and González-León, p. 206, fig. 7G |
| v | 2005 | *Latusastrea provencialis* (d'Orbigny, 1849) - Götz et al., p. 874, fig. 8B |
| v ? | 2006 | *Latusastrea* cf. *provencialis* (d'Orbigny, 1849) - Löser and Ferry, p. 480, fig. 4.6-7 |

**Dimensions**. cow 0.4 - 0.5 mm; col 0.8 - 1.0 mm; ccd 0.8 - 1.3 mm.

**Description**. Plocoid colony with oval calices which are not widely separated. In some places there is a broader, finely granulated peritheca. The main septum is visible in some calices, but no finer structures have been preserved.

**Remarks**. *Latusastrea irregularis* is a quite unknown species. The holotype (NHMW 1965/634a/1) is poorly preserved. It has the following dimensions: cl 0.5 - 0.7 x 0.9 - 1.1 mm; ccd 1.5 - 2.0 mm.

**Occurrence elsewhere**. ?Early Cretaceous: Italy (Campania, Napoli) Isle of Capri, Venassino. Hauterivian: Spain (Valencia, Castellón) La Avellà, Catí. Lower Barremian: France (Drôme) Vercors Mts, Archiane. Late Barremian: France (Ardèche) St.Remèze, Belvedere du Gaud; Poland (Malopolskie, Tarnów) Tarnów, Trzemesna. Early Aptian (Tuarkyricus - Weissi zone): France (Vaucluse) Sault (FSL). Early Aptian: Greece (Viotía) Arachova (SLD 5515); Poland (Malopolskie, Wadowice) Lanckorona, Jastrzebia; Slovenia (West Slovenia) Banskja Planota, Osojnica; Serbia and Montenegro (East Serbia) Pirot, Bela Palanka; Zljebine. Early Aptian (Lenticularis zone): Germany (Bayern) Allgäuer Helvetikum, Mahdtal (BSP 1997 V 42); Untere Gundalpe (ZSH H-KU 741). Early late Aptian: Algeria (Tebessa) Commune Ouenza, Ouenza Mt (UP M 5133). Late Aptian: Tanzania (Tanganyika, Mtwara) Nambawala plateau, Kikomolela, Likwaja (MB. K 1366); Italy (Abruzzi, L'Aquila) Monti d'Ocre. Latest Aptian to early Albian: Spain (Vascongadas, Vizcaya) Gamecho, Playa de Laga; Greece (Viotía) Aliartos, Chiarmena (SLD 6214). Early Albian: Mexico (Baja California Norte) El Progreso, Los Torotes section (ERNO L-4390); Mexico (Sonora) Municipio Opodepe, Tuape, Cerro de la Espina (ERNO L-4220).

Suborder Faviina Vaughan and Wells, 1943
Family Faviidae Milne-Edwards, 1857
*Eugyra* de Fromentel, 1857
***Eugyra affinis* Prever, 1909**

**Material**. FLX 1705.

**Synonymy**

| | | |
|---|---|---|
| v | 1857 | *Eugyra neocomiensis* - de Fromentel, p. 31, pl. 3: 6, 7 |
| v | 1889 | *Eugyra* spec. Ähnlich *Eugyra neocomiensis* E. de From. - Toula, p. 84 |
| v p | 1891 | *Eugyra neocomiensis* - Felix, p. 159 |
| v p non | 1909 | *Eugyra affinis* - Prever, pl. 11: 6 [= *Myriophyllia* sp.] |
| *v p | 1909 | *Eugyra affinis* - Prever, pl. 11: 7 |
| | 1981 | *Eugyra cotteaui* Fromentel 1857 - Turnšek and Mihajlović, p. 17, pl. 11: 3, 4 |

**Dimensions**. crd 2.0 - 2.5 mm; crw 1.6 - 1.8 mm; sd 4.5 / 2 mm.

**Description**. Meandroid colony with regular calicular rows which are almost straight and not bent. Septa are free and compact, in places alternating in length. A columella does not exist. Wall and endotheca unknown.

**Remarks**. The type material of Prever (1909) consists of four syntypes (PU 17999, 18000, 18001, 18002) belonging to different species of the genera *Eugyra* and *Myriophyllia*. Most of them are small fragments and hardly recognisable. The best preserved specimen (18002) is selected as the lectotype. Specimens PU 17999, 18000 and 18001 become paralectotypes. No preference is given to the illustrated specimens (PU 17999 and PU 18000) because they are so poorly preserved that an adequate definition of the species was not possible. Lectotype 18002 comes from the late Aptian of the Monti d'Ocre, Fosso Cerasetti. *Eugyra neocomiensis* cannot be a senior synonym as the species was established by d'Orbigny (1850), not by de Fromentel (1857). The material is not available and a neotype has not yet been fixed.

**Occurrence elsewhere**. Early Hauterivian (Radiatus zone): France (Yonne) Gy-l'Evêque. Barremian to Aptian: Bulgaria (Veliko Tarnovska oblast) Veliko Tarnovo, Arbanasi, Lyaskovets Monastir Sv.Peter. Early Aptian (Tuarkyricus - Weissi zone): France (Vaucluse) Sault (FSL). Early Aptian: Greece (Viotía) Arachova (SLD 5503); Serbia and Montenegro (East Serbia) Zljebine. Early late Aptian: Spain (Cataluña, Lérida) Com. Alt Urgell, Buerco section (SLD 5337). Late Aptian: Italy (Abruzzi, L'Aquila) Monti d'Ocre, Fosso Cerasetti. Early Albian: Mexico (Sonora) Municipio Opodepe, Tuape, Cerro de la Espina (ERNO L-4302); Municipio Ures, Cerro de Oro (ERNO L-4375); USA (Arizona) Douglas, Paul Spur Ridge (SLD 4783).

*Pseudomyriophyllia* Morycowa, 1971

***Pseudomyriophyllia* cf. *carpathica* Morycowa, 1971**

**Material**. FLX 1694.

**Synonymy**

v 1891 *Eugyra Cotteaui* - Felix, p. 159

**Dimensions**. crd 2.5 - 3.0 mm; crw 2.0 mm; sd 5.0 / 2 mm.

**Description**. Meandroid colony with regular calicular rows which are almost straight and not bent. Septa are free and compact, in places alternating in length. The columella is styliform. Wall and endotheca unknown.

**Remarks**. The dimensions of the material are slightly larger than those of *P. carpathica*.

***Pseudomyriophyllia* sp.**

**Material**. FLX 1692.

**Synonymy**

v p 1891 *Eugyra neocomiensis* - Felix, p. 159
v 1999 *Myriophyllia propria* Sikharulidze, 1979 - Baron-Szabo and González-León, p. 469, fig. 2b

**Dimensions**. crd 1.3 - 1.7 mm; crw 1.0 - 1.4 mm; sd 5.0 / 2 mm.

**Description**. Meandroid colony with regular calicular rows, which are slightly bent. Septa are free and compact, often alternating in length. The columella is styliform. Wall and endotheca unknown.

**Remarks**. It might be that among species originally assigned to *Eugyra* species of *Pseudomyriophyllia* can be found. Many *Eugyra* species are still unrevised. The present material could not be assigned to any of the few existing *Pseudomyriophyllia* species.

**Occurrence elsewhere**. Early Hauterivian (Radiatus zone): France (Yonne) Fontenoy, Les Merles (SLD 6085). Latest Aptian: Spain (Cataluña, Lérida) Com. Alt Urgell, Mun. Coll de Nargó, Set Comelles, El Caso section (SLD 5355). Early Albian: Mexico (Sonora) Municipio Opodepe, Tuape, Cerro de la Espina.

*Diploastrea* Matthai, 1914
**?*Diploastrea cyclops* (Felix, 1891)**
Figure 2I

**Material**. FLX 2050, Lectotype of *Phyllocoenia cyclops*, herein designated.

**Synonymy**

*v p 1891 *Phyllocoenia cyclops* - Felix, p. 155, pl. 23: 3, 3a, 5
v non 1963 *Complexastrea cyclops* (Felix) - Reyeros Navarro, p. 16, pl. 5: 1, 2, 5 [= *Ovalastrea recki*]

v non 1974 *Montastrea cyclops* (Felix) - Reyeros de Castillo, p. 19
v 1989 *Phyllocoenia cyclops* Felix - Perrilliat, p. 97, fig. 33d

**Dimensions**. cl 2.5 - 3.0 mm; ccd 2.5 - 4.5 mm; s 32; sdc 3.0 / 1 mm.

**Description**. Plocoid colony with slightly depressed calices. Septa are compact, straight, and connected to each other in the centre of the calice in a regular pattern. Septa of the first cycle are connected to each other and form a pseudocolumella. They are confluent to non-confluent. Septa probably in an octameral system. The wall is probably parathecal. Endotheca unknown.

**Remarks**. *Diploastrea* is only a very tentative determination. The material closely resembles that described by Wells (1932) as *Diploastrea harrisi*, except that the dimensions are smaller. *Phyllocoenia* is a Cenozoic or even extant genus: the type species *P. irradians* is considered *Orbicella* (Vaughan, 1919). *Orbicella* is considered a junior synonym of *Montastrea* (e.g., Chevalier and Beauvais, 1987).

Family Montlivaltiidae Felix, 1900
*Comophyllastraea* Alloiteau, 1957
***Comophyllastraea wollheimi* (Felix, 1891)**
Figure 3C

**Material**. FLX 5020, Holotype of *Hydnophyllia wollheimi*, by monotypy.

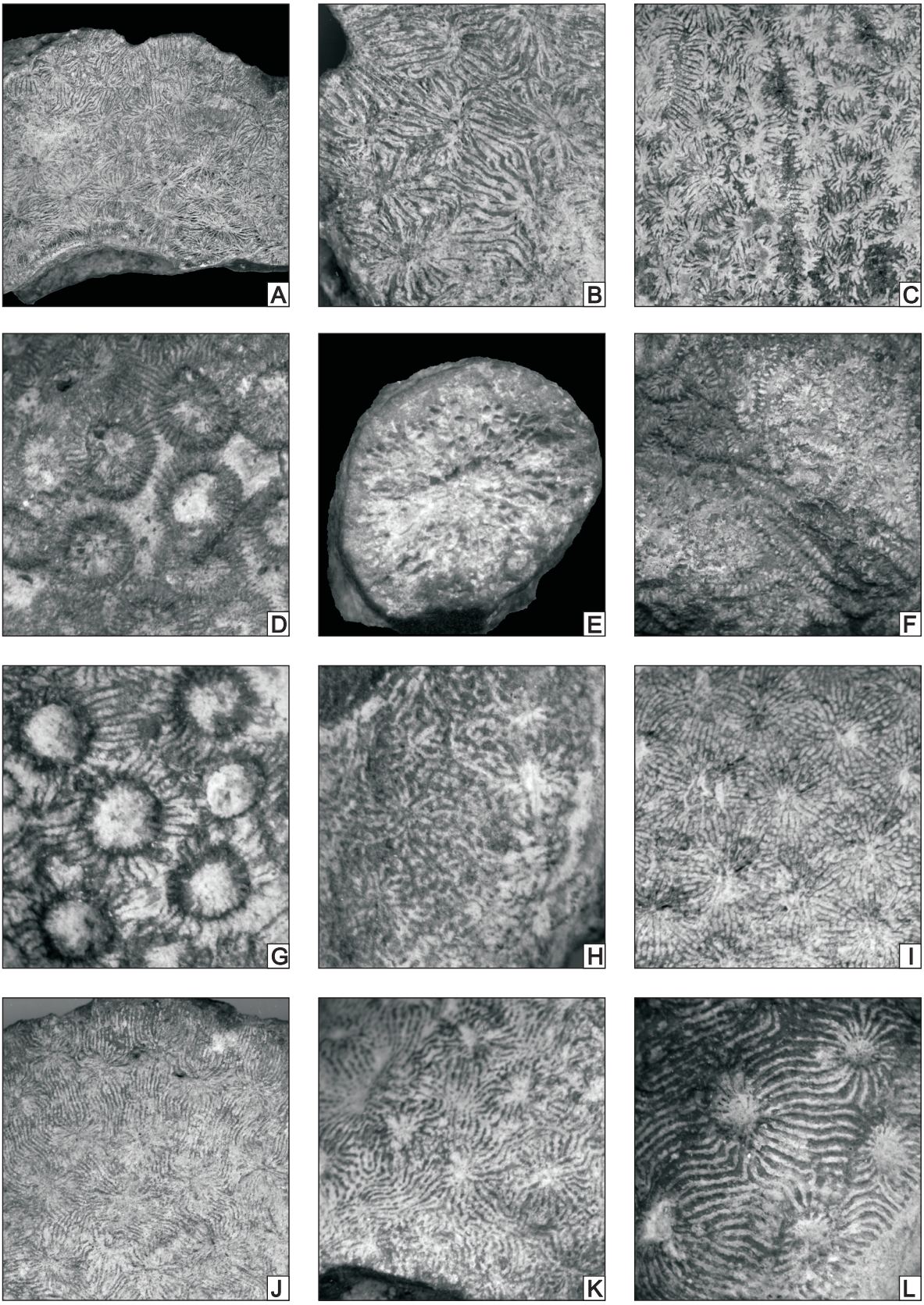
**Synonymy**

*v 1891 *Hydnophyllia Wollheimi* - Felix, p. 153, pl. 22: 13
v 1989 *Hydnophyllia wollheimi* Felix - Perrilliat, p. 93, fig. 32d

**Dimensions**. ccd 5-6; s 48-56; sd 4.0 / 2 mm.

**Description**. Thamnasterioid, rarely meandrinoid colony with isolated collines as in *Comoseris*. The calicular arrangement is comparable to that in *Dimorphocoenia*, except that the calices are not arranged in regular rows and form short series as in *Brachyseris*. The septa are compact with regular ornamentation of the distal margin. Septa are confluent to sub-confluent and of alternating thickness (as in *Dimorphocoenia*). A columella does not exist. No wall has been noticed. The endotheca is well developed.

Figure 3. **A**: *Dimorphocoenia xipei* (Felix, 1891), Holotype of *Thamnasteria xipei*, GPS FLX 5670, coral surface, 0.75x. **B**: detail, 2x. **C**: *Comophyllastraea wollheimi* (Felix, 1891), Holotype of *Hydnophyllia wollheimi*, GPS FLX 5020, coral surface, 1.5x. **D***: Ovalastrea* sp., Paralectotype of *Phyllocoenia cyclops*, GPS FLX 2028, coral surface, 3x. **E**: *Thecosmilia sandbergeri* (Felix, 1891), Lectotype of *Calamophyllia sandbergeri*, GPS FLX 6278-1, coral surface, 6x. **F**: ?*Meandroria mariscali* (Felix, 1891), Holotype of *Dendrogyra mariscali*, GPS FLX 1745, coral surface, 1.5x. **G**: *Pachyphyllia nannodes* (Felix, 1891), Lectotype of *Phyllocoenia nannodes*, GPS FLX 2036, coral surface, 4x. **H**: *Kobyastraea holmoides* (Felix, 1891), Holotype of ?*Thamnaraea holmoides*, GPS FLX 1390, coral surface, 4x. **I**: ?*Siderofungia zitteli* Felix, 1891, Holotype of *Siderofungia zitteli*, GPS FLX 5021, coral surface, 4x. **J**: *Astraeofungia barcenai* (Felix, 1891), Lectotype of *Thamnasteria barcenai*, GPS FLX 5667, coral surface, 1.5x. **K**: *Astraeofungia tenochi* (Felix, 1891), Lectotype of *Thamnasteria tenochi*, GPS FLX 5663, coral surface, 3x. **L**: *Dimorphastrea petalophyes* (Felix, 1891), Holotype of *Cyathoseris petalophyes*, GPS FLX 1468, coral surface, 3x.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**Remarks**. *Comophyllastraea* differs from *Dimorphocoenia* by its collines and the formation of short calicular series. *Hydnophyllia* is considered junior synonym of *Colpophyllia* (e.g., Wells, 1956) which is a meandrinoid coral.

*Dimorphocoenia* de Fromentel, 1857
***Dimorphocoenia xipei* (Felix, 1891)**
Figure 3A, B

**Material**. FLX 5670, Holotype of *Thamnasteria xipei*.

**Synonymy**

| | | |
|---|---|---|
| *v | 1891 | *Thamnastraea Xipei* - Felix, p. 144, pl. 24: 6 |
| v non | 1983 | *Thamnasteria xipei* (Felix, 1891) - Reyeros de Castillo, p. 14, pl. 1: 2 [= *Clausastrea* sp.] |
| v | 1989 | *Thamnastraea xipei* Felix - Perrilliat, p. 100, fig. 35e |

**Dimensions**. crd 8.0 mm; cdw 7.5 - 8.0 mm; s 40 - 46; sd 11.0 / 5 mm.

**Description**. A large thamnasterioid colony with a plain surface. Calicular rows are irregular. Septa are compact and free, slightly curved, in places bent. Their upper border is regularly granulated. Between two thick septa is a thin septum. There is no wall and no columella. Endotheca unknown.

**Remark**. The sample is clearly not *Thamnasteria* since it has compact septa and the typical montlivaltiid ornamentation. The absence of a columella and the alternating septa clearly assigns the material to *Dimorphocoenia*.

**Occurrence elsewhere**. Early Aptian (Tuarkyricus - Weissi zone): France (Vaucluse) Sault (FSL). Early Aptian: France (Vaucluse) Vaucluse Mts., Rustrel (UP 215).

*Ovalastrea* d'Orbigny, 1849
***Ovalastrea* sp.**
Figure 3D

**Material**. FLX 2028, 2040, both Paralectotypes of *Phyllocoenia cyclops*.

**Synonymy**

v p 1891 *Phyllocoenia cyclops* - Felix, p. 155, pl. 23: 3, 3a, 5
v 1983 *Baryphyllia confusa* (D'Orbigny, 1850) - Reyeros de Castillo, p. 20, pl. 7: 1, 2, pl. 8: 1

**Dimensions**. ci 3.0 - 4.5 mm; cow 3.5 - 4.0 mm; col 4.5 - 5.0 mm; ccd 5.5 - 7.0 mm; s 50 - 60; sdc 3 / 1 mm.

**Description**. Plocoid colony with a wide coenosteum. Calices round or slightly oval. Septa straight and compact. Their upper border may be regularly ornamented. The septa are often connected with each other in the centre of the calice. The costae are confluent to sub-confluent. A columella may exist, but is not clearly visible. Wall unknown.

**Remarks**. The genus is used in the sense of the type of the type species: it is a plocoid colony with a montlivaltiid septal ornamentation. It is not latomeandriid genus.

**Occurrence elsewhere**. Aptian: Mexico (Oaxaca) Boquerón de San Juan Reyes. Lower Upper Campanian: USA (Texas) Travis County, Pilot Knob, north rim (TMM G-1450 TX).

*Thecosmilia* Milne-Edwards and Haime, 1848
***Thecosmilia sandbergeri* (Felix, 1891)**
Figure 3E

**Material**. FLX 6278-1, Lectotype of *Calamophyllia sandbergeri*, herein designated. FLX 2746, Paralectotype of *Calamophyllia sandbergeri*.

**Synonymy**

*v p 1891 *Calamophyllia Sandbergeri* - Felix, p. 153, pl. 22: 9
v p 1926 *Favia tangenticostata* n. sp. - Dietrich, p. 76, pl. 6: 7, pl. 8: 7
non 1944 *Calamophyllia sandbergeri* Felix 1891 - Wells, p. 438, pl. 71: 2, 3, pl. 74: 1, 5
non 1948 *Calamophyllia sandbergeri* (Felix) - Wells, p. 612, pl. 89: 3a, pl. 90: 1, 2 [= *Calamophylliopsis* sp.]
non 1982 *Calamophyllia sandbergeri* Felix, 1891 - Kuzmicheva, p. 108, pl. 2: 5
v non 1983 *Calamophyllia sandbergeri* Felix 1891 - Reyeros de Castillo, p. 19, pl. 6: 2
v 1989 *Calamophyllia sandbergeri* Felix - Perrilliat, p. 89, fig. 30b
non 1990 *Calamophylliopsis sandbergeri* (Felix) - He and Xiao, pl. 17: 2

**Dimensions**. c 7.0 - 9.0 mm; cl 6.0 - 7.0 mm; s 70.

**Description**. A small fragment of a dendroid colony is available. Some remains of the inner structure are visible on its broken lower part. The septa are thin, free and compact. The endotheca is well developed and consists of numerous thin dissepiments. There is no columella.

**Remarks**. Only specimen 6278-1 allows determination, the other material labeled as *C. sandbergeri* (6278-2, 6278-3) is so poorly preserved that it cannot be identified. *Favia tangenticostata* Dietrich, 1926 is not a junior synonym of this species; there are three syntypes, a lectotype has not yet been designated. Only one syntype corresponds to *Thecosmilia sandbergeri*. *Calamophyllia* is a poorly defined genus. The type material of the type species is lost and new material has not been collected. The present material shows compact septa, a well developed endotheca which corresponds to the montlivaltiid genus *Thecosmilia*.

**Occurrence elsewhere.** Late Oxfordian to early Kimmeridgian: Tanzania (Tanganyika, Mtwara) Tingutinguti river.

Suborder Meandriina Alloiteau, 1952
Family Dendrogyridae Alloiteau, 1952
*Meandroria* Alloiteau, 1952
**?*Meandroria mariscali* (Felix, 1891)**
Figure 3F

**Material**. FLX 1745, Holotype of *Dendrogyra mariscali*, by monotypy.

**Synonymy**

| | | |
|---|---|---|
| *v | 1891 | *Dendrogyra Mariscali* - Felix, p. 161, pl. 24: 4, 4a |
| v | 1989 | *Dendrogyra mariscali* Felix - Perrilliat, p. 93, fig. 31i |

**Dimensions**. crd 3.0 - 4.0 mm; sd 3 / 2 mm; crw 2.5 mm.

**Description**. Meandroid colony with short and curved calicular rows. The rows are shallow. There are isolated calices. The calices within the rows are difficult to distinguish from each other. Septa strong and compact. Different generations are rarely observed. Columella lamellar, continuous. Wall probably septothecal. Endotheca unknown.

**Remarks**. The generic assignment is problematic because normally a section would be needed to determine the fine structure of the septa.

Family Smilotrochidae Alloiteau, 1952
*Pachyphyllia* Alloiteau, 1957
***Pachyphyllia nannodes* (Felix, 1891)**
Figure 3G

**Material**. FLX 2036, Lectotype of *Phyllocoenia nannodes*, herein designated.

**Synonymy**

| | | |
|---|---|---|
| *v | 1891 | *Phyllocoenia nannodes* - Felix, p. 156, pl. 23: 8, 10 |
| v | 1974 | *Phyllocoenia cotteaui* Fromentel - Turnšek and Buser, p. 19, 36, pl. 6: 4 |
| v | 1989 | *Phyllocoenia nannodes* Felix - Perrilliat, p. 97, fig. 33b |

**Dimensions**. cl 2.2 - 2.8 mm; ccd 4.0 - 6.0 mm; s 32; sc 40; sdc 3.0 / 1 mm.

**Description**. Plocoid colony. Calices round to oval. Septa thin and compact, generally non-confluent, but in places sub-confluent. They occur in eight or 10 septal systems. Since the calicular centre is covered in all calices, the nature of the septal insertion and the columella is unknown. The wall is parathecal. Endotheca unknown.

**Remarks**. The specimens 2064 and 2043, which are labeled *Phyllocoenia nannodes* by Felix, cannot be assigned to this genus. Instead of the poorly defined genus *Phyllocoenia, P. nannodes* is assigned here to *Pachyphyllia*. This genus might correspond the concept of Cretaceous '*Phyllocoenia'*, a genus which did not exist in the Mesozoic (see comments on *Diploastrea cyclops*).

**Occurrence elsewhere**. Early Aptian: Greece (Viotía) Levadia, Perachorion (SLD 5731); Slovenia (West Slovenia) Banskja Planota, Osojnica.

Suborder Fungiina Duncan, 1884
Family Haplaraeidae Vaughan and Wells, 1943
*Kobyastraea* Roniewicz, 1970
**?*Kobyastraea holmoides* (Felix, 1891)**
Figure 3H

**Material**. FLX 1390, Holotype of *Thamnaraea holmoides*, by monotypy.

**Synonymy**

*v 1891 *Thamnaraea holmoides* - Felix, p. 143, pl. 22: 1, 1a

**Dimensions**. ccd 3.0-4.0 mm; s ca. 24; sd 3.0 / 1 mm.

**Description**. Thamnasterioid colonial coral. Septa confluent or sub-confluent among the calices. Septa thin, slightly perforated, often connected to each other in the calicular centre. Septal upper border granulated, trabecule probably large. No pennulae were found. Wall synapticulothecate, but incomplete.

**Remarks**. Determination is only tentative as the material is very poorly preserved.

Family Siderastraeidae Vaughan and Wells, 1943
Siderofungia Reis, 1889
**?*Siderofungia zitteli* Felix, 1891**
Figure 3I

**Material**. FLX 5021, Holotype of *Siderofungia zitteli*, by monotypy.

**Synonymy**

*v 1891 *Siderofungia Zitteli* - Felix, p. 150, pl. 23: 6, 6a
non 1961 *Siderofungia zitteli* Felix - Bendukidze, p. 30, pl. 3: 4
v 1989 *Siderofungia zitteli* Felix - Perrilliat, p. 99, fig. 34h
v non 1994 *Siderofungia zitteli* Felix 1891 - Löser, p. 61, text ill. 49, pl. 7: 1, 2, pl. 10: 5

**Dimensions**. c 4.0 - 4.5 mm; ccd 4.5 - 5.0 mm; s 40 - 45; sd 4 / 1.0 mm.

**Description**. Thamnasterioid colony. Calices with small calicular pits. Septa thin, compact, sometimes connected to each other in the calicular centre. Septal faces and septal upper border (?) smooth. Wall incomplete (probably parathecal). Dissepiments numerous. No columella, no synapticulae. Budding extracalicinal.

**Remarks**. Thin sections are badly needed to specify the systematic position of this species, which at present is still unclear.

Suborder Microsolenina Morycowa and Roniewicz, 1995
Family Microsolenidae Koby, 1889
*Meandraraea* Etallon, 1859
***Meandraraea sauteri* (Felix, 1891)**
Figure 4B, C

**Material**. FLX 369, Holotype of *Latomeandra sauteri*, by monotypy; FLX 382, Holotype of *Latomeandra montezumae*, by monotypy; FLX 5814, Paralectotype of *Latomeandra steini*.

**Synonymy**

| | | |
|---|---|---|
| v | 1891 | *Latimaeandra Montezumae* - Felix, p. 148, pl. 22: 10 |
| *v | 1891 | *Latimaeandra Sauteri* - Felix, p. 148, pl. 23: 2 |
| v p | 1891 | *Latimaeandra Steini* - Felix, p. 147 [non pl. 23: 1, 1b] |
| v p | 1926 | *Latimaeandraraea oolitotithonica* n. sp. - Dietrich, p. 81, pl. 8: 4, pl. 10: 1, pl. 13: 1 |
| v | 1989 | *Latimaeandra sauteri* Felix - Perrilliat, p. 93, fig. 32e |

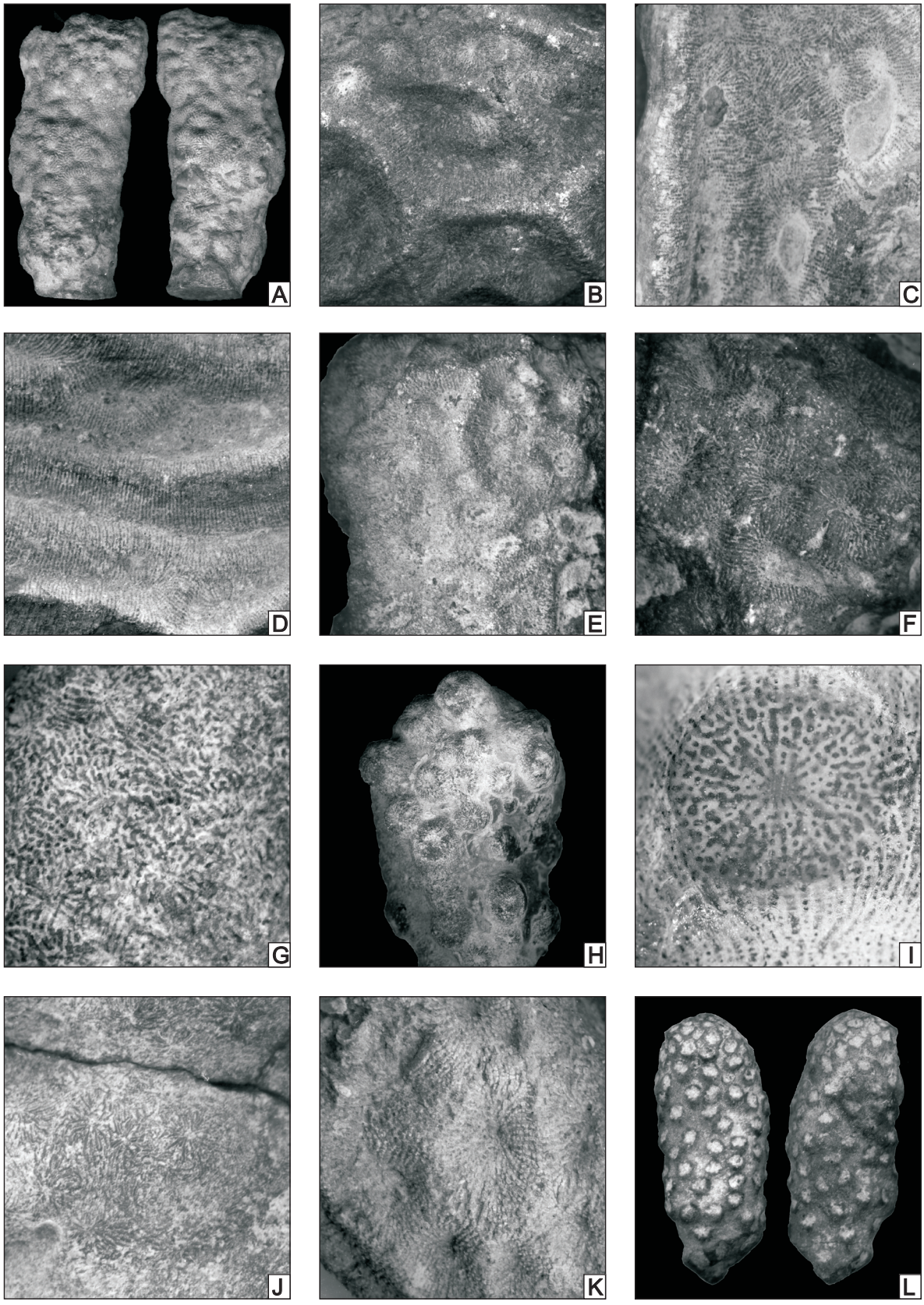
**Dimensions**. FLX 369 (Holotype of *L. sauteri*): crd 7.0 - 9.0 mm; cdw 5.0 - 6.0 mm; s 30 - 40; sd 5.5 / 2 mm. FLX 382 (Holotype of *L. montezumae*): crd 7.0 mm; cdw 4.5 - 5.0 mm; s 30 - 40; si 80; sd 4.0 / 2 mm; sdt 5 / 2 mm.

**Description**. Meandroid colony where calicular rows are short and broad. In the process of dividing calicular rows, two adjacent calices may be united in one row.There are also isolated calices. The collines are tholiform, and valleys between them may be deep. Septa are regularly perforated and bear pennulae. They do not differ in thickness and length. There is no wall between calices in the same row. Between rows, synapticulae seem to be more abundant. Calicular centre and endotheca are unknown.

**Remarks**. *Latimaeandra* (= *Latomeandra*) is an unknown genus. The type of the type species has never been examined in detail. The present material corresponds clearly to the concept of *Meandraraea*: meandroid calicular arrangement, regular perforated septa and the presence of pennulae.

**Occurrence elsewhere**. Upper Kimmeridgian to lower Tithonian: Tanzania (Tanganyika, Mtwara) Mahokondo valley, Kikomeo. Lower Valanginian: Switzerland (Vaud) Arzier, La Violette quarries (MHNG). Early Albian (Tardefurcata zone): USA (Texas) Hays County, Blanco River, Pleasant Valley Crossing (SLD 4791). Early Albian (Mammillatum zone): France (Aude) Padern, Le Crès (SLD 4525).

Figure 4. **A**: ?*Thamnoseris arborescens* Felix, 1891, Lectotype of *Thamnoseris arborescens*, GPS FLX 595-1, coral surface, both sides of the colony, 2x. **B**: *Meandraraea sauteri* (Felix, 1891), Holotype of *Latomeandra sauteri*, GPS FLX 369, coral surface, 1.5x. **C**: *Meandraraea sauteri* (Felix, 1891), paralectotype of *Latomeandra steini*, GPS FLX 5814, coral surface, 2x. **D**: *Meandraraea steini* (Felix, 1891), Lectotype of *Latomeandra steini*, GPS FLX 506, coral surface, 2x. **E**: *Meandraraea tulae* (Felix, 1891), Lectotype of *Latomeandra tulae*, GPS FLX 378, coral surface, 2x. **F**: *Meandraraea* cf. *tulae* (Felix, 1891), Paralectotype of *Latomeandra tulae*, GPS FLX 377, coral surface, 3x. **G**: *Microsolena* sp., Paralectotype of *Thamnasteria tenochi*, GPS FLX 5674, coral surface, 4x. **H**: *Polyphylloseris conophora* (Felix, 1891), Lectotype of *Mastophyllia conophora*, GPS FLX 5571, coral surface, 1.2x. **I**: IGM 7331, polished section, 8.6x. **J***: Polyphylloseris polymorpha* (Felix, 1891), Lectotype of *Polyphyllastrea polymorpha*, GPS FLX 5582, coral surface, 3x. **K**: *Synastrea* cf. *agaricites* (Goldfuss, 1826), GPS FLX 374, coral surface, 3x. **L**: *Polytremacis tehuacanensis* (Felix, 1891), Lectotype of *Stylophora tehuacanensis*, GPS FLX 5912-2, coral surface, from both sides, 2.5x.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### ***Meandraraea steini* (Felix, 1891)**

Figure 4D

**Material**. FLX 506, Lectotype of *Latomeandra steini*, designated herein.

**Synonymy**

| | | |
|---|---|---|
| *v p | 1891 | *Latimaeandra Steini* - Felix, p. 147, pl. 23: 1, 1 b |
| v | 1989 | *Latimaeandra steini* Felix - Perrilliat, p. 95, fig. 32i |

**Dimensions**. crd 9.0 - 11.0 mm; cdw 5.0 - 6.5 mm; crl 30.0 - 80.0 mm; s 24 - 30; sd 6.0 / 2 mm.

**Description**. Meandroid colony where calicular rows are very long. The rows are very regular and adjacent calices are not united. There are no isolated calices. The collines are tholiform, and valleys between them are deep. Calices are difficult to distinguish from each other. Septa are regularly perforated and bear pennulae. They do not differ in thickness and length. There is no wall between calices in the same row. Between rows synapticulae seem to be more abundant. No columella was found. An endotheca is unknown.

**Remarks**. See also *M. sauteri*. The present material corresponds to the concept of *Meandraraea*: meandroid calicular arrangement, regular perforated septa and the presence of pennulae.

**Occurrence elsewhere**. Late Cenomanian: Jordan, East of Ras En Naqb (PIW).

### ***Meandraraea tulae* (Felix, 1891)**

Figure 4E

**Material**. FLX 378, Lectotype of *Latomeandra tulae*, herein designated.

**Synonymy**

| | | |
|---|---|---|
| *v p | 1891 | *Latimaeandra Tulae* - Felix, p. 149, pl. 24: 3, 3a |
| | 1932 | *Meandraraea* sp. cf. *tulae* (Felix) - Wells, p. 252, pl. 37: 3 |
| v | 1989 | *Latimaeandra tulae* Felix - Perrilliat, p. 95, fig. 32h |
| v | 2003 | *Meandraraea meandroides* Koby, 1898 - Baron-Szabo and González-León, p. 217, fig. 9C |

**Dimensions**. crd 4.0 mm; cdw 2.5 - 3.0 mm; s 24 - 32; si 40-50; sd 3.0 / 1 mm.

**Description**. Meandroid colony where calicular rows are very short. Isolated calices are numerous. The collines are tholiform, and valleys between them are deep. Calices are easy to distinguish from each other. Septa are regularly perforated and bear pennulae. They do not differ in thickness and length. There is no wall between calices in the same row. Between rows, synapticulae seem to be more abundant. Columella and endotheca are unknown.

**Remarks**. See also *M. sauteri*. The present material corresponds to the concept of *Meandraraea*: meandroid calicular arrangement, regular perforated septa and the presense of pennulae.

**Occurrence elsewhere**. Early Albian (Tardefurcata zone): USA (Texas) Hays County, Blanco River, Pleasant Valley Crossing; early Albian: Mexico (Sonora) Municipio Ures, Cerro de Oro.

### *Meandraraea* cf. *tulae* (Felix, 1891)

Figure 4F

**Material**. FLX 377, Paralectotype of *Latomeandra tulae*.

**Synonymy**

| | | |
|---|---|---|
| v p | 1891 | *Latimaeandra Tulae* - Felix, p. 149 [non pl. 24: 3] |
| v | 1999 | *Meandraraea meandroides* Koby, 1898 - Baron-Szabo and González-León, p. 487, fig. 5 c, h |

**Dimensions**. crd 4.0 - 5.5 mm; cdw 2.5 - 3.0 mm; s 35 - 40; sd 7.0 / 2 mm; si 80-90.

**Description**. Meandroid colony where calicular rows are very short and isolated calices are numerous. The collines are tholiform, and valleys between them are not very deep. Calices are easy to distinguish from each other. Septa are regularly perforated, and bear pennulae. They do not differ in thickness and length. There is no wall between calices in the same row. Between rows, synapticulae seem to be more abundant. Columella and endotheca are unknown.

**Remarks**. The material differs from *M. tulae* in that the dimensions are slightly larger and the septa more numerous. It may represent a new yet undescribed species (together with the material collected in the synonymy list), but taking into account the high amount of yet unrevised '*Latimaeandra'* species, the creation of a new species does not seem very useful. The four described species differ in the distance of calicular series, as well as in number and density of septa.

**Occurrence elsewhere**. Early Albian: Mexico (Sonora) Municipio Opodepe, Tuape, Cerro de la Espina (ERNO L-4229); Mexico (Sonora) Municipio Ures, Cerro de Oro.

*Microsolena* Lamouroux, 1821

***Microsolena* sp.**

Figure 4G

**Material**. FLX 5674, Paralectotype of *Thamnasteria tenochi*.

**Synonymy**

v p 1891 *Thamnastraea Tenochi* - Felix, p. 145, pl. 22: 7, 7a

**Dimensions**. ccd 2.5 - 3.0 mm; s 22 - 30; sd 6.0 / 1 mm; sdt 5.0 / 1 mm.

**Description**. Thamnasterioid colony. Septa thick, in places curved, regularly perforated, with pennulae. Trabeculae large. No wall between calices. Columella and endotheca unknown.

**Remarks**. The material cannot be assigned to *Thamnasteria*. This genus collected in the past various thamnasterioid coral types which are now considered different genera. The present material is characterised by regularly perforated septa and the presence of pennulae and can be easily identified as *Microsolena*.

**Occurrence elsewhere**. Barremian: France (Doubs) Morteau (MHNN 26727). Early Cenomanian: France (Charente-Maritime) Fouras (SLD 5605).

*Polyphylloseris* de Fromentel, 1857

***Polyphylloseris conophora* (Felix, 1891)**

Figures 4H, I

**Material**. FLX 5571, Lectotype of *Mastophyllia conophora*, herein designated.

**Synonymy**

| | | |
|---|---|---|
| *v | 1891 | *Mastophyllia conophora* - Felix, p. 146, pl. 23: 9, 9a |
| | 1900 | *Polyphylloseris robusta* n. sp. - Weissermel, p. 11, pl. 23: 1, 2 |
| non | 1932 | *Mastophyllia conophora* Felix - Ackermann, p. 12 |
| v non | 1963 | *Polyphylloseris conophora* (Felix) - Reyeros-Navarro, p. 15, pl. 4: 1 |
| v | 1963 | *Polyphylloseris conophora* (Felix) - Reyeros-Navarro, p. 15, pl. 4: 2 |
| v non | 1963 | *Polyphylloseris conophora* (Felix) - Reyeros-Navarro, p. 15, pl. 4: 6 [= *Polyphylloseris mammillata*] |
| v | 1982 | *Astraraea ngariensis* Liao (sp. nov.) - Liao, p. 163, pl. 10: 4, pl. 11: 2-4 |
| v | 1989 | *Mastophyllia conophora* Felix - Perrilliat, p. 95, fig. 32b |
| v | 2003 | *Mixastraea westfalica* Löser, 1993 - Baron-Szabo and González-León, p. 221, fig. 9a |

**Dimensions**. c 6.0 - 9.0 mm; ccd 5.5 - 7.0 mm; s 60 - 80; sd 5.0 / 1 mm; sdt 5.0 / 1 mm.

**Description**. Thamnasterioid-plocoid colony. Calices well distinguishable and in many cases highly raised. Septa are regularly perforated and bear pennulae. They are sub-confluent to confluent. A columella was not observed in the material from San Juan Raya (Reyeros-Navarro, 1963). There is no wall. No endothecal elements were found in the material from San Juan Raya (l.c.).

**Remarks**. The species is the type species of the genus *Mastophyllia* Felix, 1891. Felix kept the description short and did not compare the new genus with *Polyphylloseris*. There are no general differences in morphology between *Polyphylloseris convexa*, the type species of *Polyphylloseris*, and *Mastophyllia conophora*, except for calicular distance and septal number which makes them just different species.

**Occurrence elsewhere**. Lower Cretaceous: Tanzania (Tanganyika, Mtwara) Likonde Kitali plateau. Late Barremian to early Aptian (Lenticularis zone): China (Xizang [= Tibet] Autonomous Region) Rutog county, Risum district, Jaggang, Shangqulongbeigou. Aptian: Mexico (Puebla) San Juan Raya. Aptian to early Albian: Japan (Iwate-ken) Miyako-shi, Sakiyama, Hideshima. Early Albian: Mexico (Sonora) Municipio Ures, Cerro de Oro.

### ***Polyphylloseris convexa* (d'Orbigny, 1850)**

**Material**. FLX 5565, Paralectotype of *Polyphylloseris polymorpha*.

**Synonymy**

| | | |
|---|---|---|
| *v | 1850 | *Polyphyllastrea convexa* - d'Orbigny, (2), p. 94 |
| | 1857 | *Polyphylloseris convexa* - de Fromentel, p. 68, pl. 10: 11-13 |
| v p | 1891 | *Polyphylloseris polymorpha* - Felix, p. 143, pl. 22: 4, 6, 6a |
| v non | 1898 | *Polyphylloseris convexa* - Koby, p. 84, pl. 21: 3, 4 [= *Polyphyllastrea* aff. *convexa*] |
| v | 1935 | *Polyphyllastrea convexa* d'Orb. - Cottreau, p. 41, pl. 75: 14, 15 |
| v non | 1943 | *Polyphylloseris convexa* d'Orbigny 1849 - Vaughan and Wells, p. 149, pl. 21: 4 [= *Polyphylloseris* aff. *convexa*] |
| non | 1960 | *Polyphylloseris convexa* Fromentel - Kuzmicheva, p. 139, pl. 7: 4 |
| v non | 1971 | *Polyphylloseris convexa* de From., 1857 - Morycowa, p. 118, pl. 32: 1 [= *Polyphylloseris* aff. *convexa*] |
| v non | 1974 | *Ovalastraea turbinata* (Fromentel) - Turnšek and Buser, p. 22, 37, pl. 11: 3 [= *Polyphylloseris mammillata*] |
| non | 1981 | *Polyphylloseris convexa* Fromentel 1857 - Turnšek and Mihajlović., p. 36, pl. 42: 1-4 |
| non | 1985 | *Polyphylloseris convexa* (Orbigny, 1850) - Sikharulidze, p. 46, pl. 20: 4, pl. 21: 1 [= *Polyphylloseris* cf. *conophora*] |
| non | 1988 | *Polyphylloseris convexa* de Ordigny, 1850 - Kuzmicheva and Aliev, p. 172, pl. 7: 2 |
| v non | 1995 | *Polyphylloseris convexa* Fromentel 1857 - Abdel-Gawad and Gameil, p. 25, pl. 12: 1, 2 |
| v non | 1997 | *Polyphylloseris convexa* (d'Orbigny) 1850 - Turnšek, p. 157 [= *Polyphylloseris mammillata*] |
| v | 2001 | *Polyphylloseris convexa* (d'Orbigny 1850) - Löser, p. 47 |

**Dimensions**. c 6.0 mm; ccd 7.8 - 9.2 mm; s 80 - 120; sd 6.0 / 1 mm; sdt 8.0 / 1 mm.

**Description**. Thamnasterioid-plocoid colony. Calices are large, well distinguishable and raised. Septa are regularly perforated and bear pennulae. They are thin, numerous, sub-confluent to confluent. The columella is probably marked with a small single papilla. There is no wall. The endotheca is unknown.

**Remarks**. *P. convexa* is often cited in the literature, but the species is actually very rare. Compared with the other species of the genus, *P. convexa* is the species with the largest calicular distance and most numerous septa. *P. mammillata* has smaller dimensions than *P.*

*convexa*. The unique available paratype of *P. convexa* (TUM 56596) shows the following dimensions: ccd 4.0 - 5.5 mm, s 70 - 80.

**Occurrence elsewhere**. Early Hauterivian (Radiatus zone): France (Aube) Troyes, Vallières; France (Yonne) Chenay; Fontenoy; Gy-l'Evêque.

### ***Polyphylloseris iwateensis* Eguchi, 1951**

**Material**. FLX 5590, Paralectotype of *Polyphylloseris polymorpha*.

**Synonymy**

v p 1891 *Polyphylloseris polymorpha* - Felix, p. 143, pl. 22: 4, 6, 6a
*v 1951 *Polyphylloseris iwateensis* Eguchi, n. sp. - Eguchi, p. 40, pl. 11: 1-4

**Dimensions**. c 5.0 - 6.0 mm; ccd 6.0 - 8.0 mm; s 100 - 110; sd 6.0 / 1 mm; sdt 6.0 / 1 mm.

**Description**. Thamnasterioid-plocoid colony. Calices well distinguishable and hardly raised. Septa are regularly perforated and bear pennulae. They are sub-confluent to confluent. There is no wall. The columella and endotheca are unknown.

**Remarks**. *Polyphylloseris iwateensis* is an unknown species. The dimensions of its holotype (TUM 65269) are as follows: c 4.0 - 5.0 mm; ccd 6.0 -8.0 mm; s 80 - 100; sd 9.0 / 2 mm; sdt 8.0 / 2 mm. The present material has a slightly larger number of septa which results also in a higher septal density.

**Occurrence elsewhere**. Early Aptian: Greece (Viotía) Arachova (SLD 5533); Aptian to early Albian: Japan (Iwate-ken) Miyako-shi, Sakiyama, Hideshima.

### ***Polyphylloseris polymorpha* Felix, 1891**

Figure 4J

**Material**. FLX 5582, Lectotype of *Polyphylloseris polymorpha*, herein designated.

**Synonymy**

*v p 1891 *Polyphylloseris polymorpha* - Felix, p. 143, pl. 22: 4, 6, 6a
v 1989 *Polyphylloseris polymorpha* Felix - Perrilliat, p. 97, fig. 34k

**Dimensions**. c 2.5 - 3.5 mm; ccd 4.0 mm; s 50 - 55; sd 5.5 / 1 mm; sdt 6.0 / 1 mm.

**Description**. Thamnasterioid-plocoid colony. Calices well distinguishable and slightly raised in places. Septa are regularly perforated and bear pennulae. They are sub-confluent to confluent. The columella is probably marked with a small single papilla. There is no wall. The endotheca is unknown.

**Remarks**. This species is characterised by its small dimensions and low number of septa, compared to other species of the genus.

Family Latomeandridae de Fromentel, 1861
*Astraeofungia* Alloiteau, 1952
***Astraeofungia crespoi* (Felix, 1891)**

**Synonymy**

* 1891 *Thamnastraea Crespoi* - Felix, 1891, p. 146, pl. 22: 5

**Remarks**. The figured specimen is lost. No additional material was found in the collection of the GPS. *Astraeofungia tendagurensis* (Dietrich, 1926) is probably a junior synonym.

***Astraeofungia barcenai* (Felix, 1891)**
Figure 3J

**Material**. FLX 5667, Lectotype of *Thamnasteria barcenai*, herein designated.

**Synonymy**

| | | |
|---|---|---|
| *v | 1891 | *Thamnastraea Barcenai* - Felix, pl. 22: 3 |
| v non | 1891 | *Thamnastraea Barcenai* - Felix, pl. 23: 7 [=*Dimorphastrea petalophyes*] |
| non | 1932 | *Dimorpharaea* sp. cf. *D. barcenai* (Felix) - Wells, p. 253, pl. 37: 4 |
| non | 1985 | *Dimorpharaea* cf. *barcenai* (Felix, 1891) - Sikharulidze, p. 44, pl. 20: 3 |
| v | 1989 | *Thamnastraea barcenai* Felix - Perrilliat, p. 100, fig. 35i |
| v | 1994 | *Dimorphastrea parallela* (Reuss, 1846) - Eliášová, p. 1, pl. 1: 1-3 |
| non | 1996 | *Dimorpharaea barcenai* (Felix, 1891) - Császár and Turnšek, p. 434, fig. 9 |
| v | 1998 | *Astraeofungia* sp. - Schöllhorn, p. 95, fig. 41, pl. 24: 4, pl. 28: 1 |

**Dimensions**. ccd 7.5 - 8.0 mm; s 45 - 55; sd 4.0 / 3 mm.

**Description**. Thamnasterioid colony with a certain trend towards forming calicular rows. But this occurs only occasionally and is not a regular feature as in *Dimorphastrea*. Septa are free, straight or curved, generally very regular in size and length. They bear pennulae and are probably slightly perforated on their inner margins. Their upper border is granulated. Columella and endotheca unknown.

**Remarks**. This species is probably a junior synonym of *Astraeofungia parallela* (Reuss, 1846). Eliášová (1994, p. 1) designated a neotype and paratype for *Astraea parallela*, not taking into account that the IRZN valid at that time (Ride et al., 1985) only allowed the designation of neotypes under 'exceptional circumstances' (l.c., p. 157), which did not apply to *Astraea parallela*. The material described by Eliášová is closely related to *A. barcenai*.

**Occurrence elsewhere**. Early Aptian: Greece (Viotía) Arachova (SLD 5471). Early late Aptian: Spain (Cataluña, Lérida) Com. Alt Urgell, Mun. Cabó, Senyús section; Mun. Coll de Nargó, Sta. Fé, Font Bordonera. Late Cenomanian: Czech Republic (Central Bohemian region) Kutná Hora, Kamajka.

### *Astraeofungia tenochi* (Felix, 1891)

Figure 3K

**Material**. FLX 5663, Lectotype of *Thamnasteria tenochi*, herein designated.

**Synonymy**

| | | |
|---|---|---|
| *v | 1891 | *Thamnastraea Tenochi* - Felix, p. 145, pl. 22: 7, 7a |
| v | 1989 | *Thamnastraea tenochi* Felix - Perrilliat, p. 100, fig. 35h |

**Dimensions**. ccd 4.5-5.5 mm; s 28 - 32 (40); sd 5 / 2 mm; sdt 4 / 2 mm.

**Description**. Thamnasterioid colony. Colony surface generally smooth, but the calicular centres may be slightly raised. Calices are arranged in rows, but this is a regular arrangement only in places. Septa may also run to neighbouring calices (this is not the case with *Dimorphastrea*). The septa are thick and consist of large trabeculae. They are almost compact; there may be some pores on the inner margins. Pennulae present. Septa confluent, in places sub-confluent. Calicular centre unknown. There is no wall. Endotheca unknown.

**Remarks**. This species is closely related to *Astraeofungia siva* (Stoliczka, 1873), but the raised calices and very strong septa make assignation to *Astraeofungia* doubtful.

*Dimorphastrea* d'Orbigny, 1850

***Dimorphastrea petalophyes* (Felix, 1891)**

Figure 3L

**Material**. FLX 1468, Holotype of *Cyathoseris petalophyes*, by monotypy; FLX 5666, Paralectotype of *Thamnasteria barcenai*.

**Synonymy**

| | | |
|---|---|---|
| *v | 1891 | *Cyathoseris petalophyes* - Felix, p. 149, pl. 24: 2, 2a |
| v p | 1891 | *Thamnastraea Barcenai* - Felix, pl. 23: 7 |
| v | 1898 | *Thamnastraea Golliezi* - Koby, p. 76, pl. 19: 2 |
| v | 1989 | *Cyathoseris petalophyes* Felix - Perrilliat, p. 91, fig. 31c |

**Dimensions**. FLX 1468 (Holotype of *C. petalophyes*): crd 9.0 mm; cdw 6.5 - 8.5 mm; s 24 - 32; sd 5.0 / 7 mm. FLX 5666 (Paralectotype of *T. barcenai*): crd 5.5 - 10.0 mm; cdw 5.0 - 7.5 mm; s 32 - 36; sd 7.0 / 2 mm.

**Description**. Thamnasterioid colony with irregular calicular arrangement. Because the septa are 'combed' in one direction (comparable to Late Cretaceous species of the genus), the material was assigned to *Dimorphastrea* and not to *Astraeofungia*. The calicular rows are not very regular. The septa are all identical: thick, compact (perhaps not in the calicular centre) and they bear pennulae. The columella is parietal. Endotheca unknown.

**Remarks**. *Cyathoseris* is an agariciid Cenozoic genus which did not occur in the Cretaceous. Because of the presence of pennulae and its rare pores, the present material can be clearly assigned to the Latomeandridae and because of its calicular arrangement to *Dimorphastrea*.

**Occurrence elsewhere**. Early Hauterivian (Radiatus zone): France (Yonne) Gy-l'Evêque (MB. LOE 8). Barremian: France (Doubs) Morteau. Middle Cenomanian (Mantelli - Rhotomagense zone): Belgium (Hainaut) Tournai (IRScNB I. G. 10511 / LOE 8).

*Thamnoseris* de Fromentel, 1861

***Thamnoseris irregularis* (Felix, 1891)**

**Material**. FLX 494, Holotype of *Siderofungia irregularis*, by monotypy.

**Synonymy**

| | | |
|---|---|---|
| *v | 1891 | *Siderofungia irregularis* - Felix, p. 151, pl. 22: 12, 12a |
| v | 1932 | *Complexastrea* (?) *glenrosensis* Wells, n.sp. - Wells, p. 246, pl. 35: 6, pl. 38: 4 |
| non | 1932 | *Siderofungia irregularis* Felix - Wells, p. 250, pl. 35: 3, pl. 39: 2 |
| non | 1944 | *Periseris irregularis* (Felix) 1891 - Wells, p. 439, pl. 71: 4 |
| non | 1956 | *Periseris irregularis* (Felix) - Wells, p. 380, fig. 269.5 |
| non | 1957 | *Periseris irregularis* (Felix), 1891 - Von der Osten, p. 576, pl. 63: 11, 14 |
| non | 1961 | *Siderofungia irregularis* Felix - Bendukidze, p. 31, pl. 3: 5 |
| ?v | 1976 | *Thamnoseris morchella* (Reuss 1854) - Turnšek and Buser, p. 25, 46, pl. 19: 1-3 |
| non | 1981 | *Siderastraea* (*Siderofungia*) *irregularis* Felix 1891 - Turnšek and Mihajlović, p. 34, pl. 39: 3, 4 |
| non | 1982 | *Siderofungia irregularis* Felix, 1891 - Kuzmicheva, p. 107, pl. 2: 3 |
| v | 1989 | *Siderofungia irregularis* Felix - Perrilliat, p. 99, fig. 34f |
| non | 1996 | *Siderofungia irregularis* Felix 1891 - Császár and Turnšek, p. 434, fig. 14 |
| non | 1996 | *Siderofungia irregularis* Felix, 1891 - Baron-Szabo and Steuber, p. 27, pl. 16: 5 [= *Brachyseris* sp.] |
| non | 1997 | *Siderastrea irregularis* (Felix, 1891) - Bugrova, p. 32, pl. 8: 1-3 |

**Dimensions**. c 2.5 - 4.0 mm; ccd 4.5 - 6.0 mm; s 40 - 45; sd 4.0 / 1 mm.

**Description**. Thamnasterioid-cerioid colony with slightly depressed calices. Septa are thin, bear pennulae and may be connected to each other in the calicular centre. The wall is probably incomplete and synapticulothecate. Columella and endotheca unknown.

**Remarks**. After recording the collection data, the collection was moved within the large attic of the Leipzig Geological Institute. Later on the specimen had disappeared and it was therefore not possible to take a photograph.

**Occurrence elsewhere**. Cretaceous: Slovenia (West Slovenia) Banjska planota, Kanalski Lom. Early Hauterivian (Radiatus zone): France (Yonne) Leugny, Les Cassines (SLD 5143). Early Aptian: Greece (Viotía) Levadia, Perachorion (SLD 5722). Early Albian (Tardefurcata zone): USA (Texas) Hays County, Blanco River, Pleasant Valley Crossing.

### ?*Thamnoseris arborescens* Felix, 1891

Figure 4A

**Material**. FLX 595-1, Lectotype of *Thamnoseris arborescens*, herein designated; FLX 595-2, Paralectotype of *Thamnoseris arborescens*; FLX 587, Paralectotype of *Thamnoseris arborescens*.

**Synonymy**

| | | |
|---|---|---|
| *v | 1891 | *Thamnoseris arborescens* - Felix, p. 152, pl. 25: 11, 15 |
| v non | 1944 | *Actinaraea arborescens* (Felix) 1891 - Wells, p. 440, pl. 72: 1-5, pl. 74: 1 [= *Actinaraea* sp.] |
| v | 1989 | *Thamnoseris arborescens* Felix - Perrilliat, p. 100, fig. 35f |
| non | 1997 | *Thamnoseris arborescens* Felix 1891 - Sanders and Baron-Szabo, p. 74, pl. 21: 2 |
| non | 1997 | *Thamnoseris arborescens* Felix, 1891 - Baron-Szabo, p. 88, pl. 16: 2, 4 |
| non | 1998 | *Thamnoseris arborescens* Felix, 1891 - Baron-Szabo, p. 148, pl. 8: 2 |
| non | 2001 | *Thamnoseris arborescens* Felix, 1891 - Baron-Szabo, p. 266, fig. 3C |
| non | 2002 | *Thamnoseris arborescens* Felix, 1890-91 - Kuzmicheva, p. 188, pl. 30: 3 |

**Dimensions**. c 2 - 2.5 mm; ccd 2 - 2.8 mm; s 30 - 40; sd 4.0 / 1 mm.

**Description**. Small branching colony. Calices in a thamnasterioid-cerioid arrangement. Calices well separated, with a deep calicular pit. Septa strong, straight, confluent to sub-confluent. Upper border with large granulae corresponding to trabeculae. Pennulae present. Septa seem to be compact. The wall is incomplete and probably consists of synapticulae.

**Remarks**. Deep calices, thick, straight and almost compact septa are more typical of Synastraeidae, but in view of the lack of sections, the material should better remain at present with *Thamnoseris*. *Thamnoseris carpathica* Morycowa, 1971 was assigned to *T. arborescens* by Baron-Szabo (1998). This is not possible as *T. carpathica* has fewer septa (20–24). It is probably a junior synonym of *T. ankotrofotsyensis* Alloiteau, 1958.

Family Synastraeidae Alloiteau, 1952

*Synastrea* Milne-Edwards and Haime, 1848

### ***Synastrea* cf. *agaricites* (Goldfuss, 1826)**

Figure 4K

**Material**. FLX 374 (not described by Felix).

**Dimensions**. ccd 5.5 - 7.0 mm; s 60 - 80; sd 7.0 / 2 mm; sdt 5.0 / 2 mm.

**Description**. Thamnasterioid colony with deep calices. Septa very thick, consisting of large square trabeculae. The septa bear pennulae and seem to be completely compact, but may have also a few pores. They are fully confluent. A wall is marked, but probably does not exist. Calicular centre unknown.

**Remarks**. The material differs from *Synastrea agaricites* by a septal number larger than that of the holotype of *Synastrea agaricites*, which is about 50 septa. This sample was not described by Felix, but he obviously collected and labeled it *Synastrea* sp.

Suborder Coenothecalia
Family Helioporidae Moseley, 1876
*Polytremacis* d'Orbigny, 1849
***Polytremacis tehuacanensis* (Felix, 1891)**
Figure 4L

**Material**. FLX 5912-2, Lectotype of *Stylophora tehuacanensis*, herein designated; FLX 5912-1, Paralectotype of *Stylophora tehuacanensis.*

**Synonymy**

| | | |
|---|---|---|
| *v p | 1891 | *Stylophora tehuacanensis* nov. sp. - Felix, p. 161, pl. 22: 2, 8 |
| v | 1893 | *Polytremacis chalmasi* Thomas et Peron - Péron, p. 375, pl. 31: 18-23 |
| v non | 1983 | *Stylina tehuacanensis* (Felix, 1891) - Reyeros de Castillo, p. 17, pl. 4: 2, pl. 5: 1 [= *Acanthocoenia* sp.] |

**Dimensions**. c 0.9 - 1.0 mm; ccd 1.5 - 1.8 mm; s 8; tbd 5 / 1 mm.

**Description**. Small ramose, plocoid colonies. Calices dense, raised, almost forming small upward-growing tubes. The calices are round to oval. The colony looks like a *Latusastrea* in places. Septa very short. Coenosteum cellular, the tips of the trabeculae are slightly raised. There is no columella.

**Remarks**. Collection number 5912 comprises two figured specimens of the same species. The smaller specimen 5912-2 is selected as the lectotype because it is better preserved. Felix assigned the same name to the three samples under number 4667 which belong to *Heterocoenia*

*pusilla*. Indeed the samples look much like *Heterocoenia* because of the erected calices, but this is the case also in other *Polytremacis* species.

The specimens from San Antonio Texcala are completely identical with material from the Cenomanian of Tunisia which was found in the collection of the Lyon Geological Institute (FSL) labeled as *Polytremacis chalmasi*. These specimens very probably belong to the collection of Peron (Péron, 1893) and are the type material from Tunisia which has never been revised.

**Occurrence elsewhere**. Late Cenomanian: Tunisia, Cehela Mt.; El Agïeïcha; Kef Nador, Taferma Mt.; Oum-Debban Mt.

## RESULTS

Table 1 summarises the material from San Antonio Texcala with old and new names, collection numbers and types. In his publication Felix distinguished 34 species (partly in open nomenclature), whereas 42 species are described here. Specimens that were found impossible to determine have been omitted. The number of species described herein is larger because in some cases Felix lumped species together (his *Stylophora tehuacanensis* corresponds to *Heterocoenia pusilla* and *Polytremacis tehuacanensis*; the two *Polyphylloseris* species he described have been subdivided into four species). The faunal composition is conservative: it contains more species of genera originating in the Jurassic and very Early Cretaceous (Berriasian) than species of genera originating in the Cretaceous (such as *Eugyra*, *Comophyllastraea*, *Diploastrea*, *Pseudomyriophyllia*; Löser, 2005). The names of most species remained, i.e. they did not turn out to be synonyms. This is partly due to difficulties in comparing Felix´s material with other species, and partly to the fact that they really are new species. Most generic assignments changed due to changes in the systematics of corals and the importance attributed to the various morphological elements. In the 19$^{th}$ century, pennulae, auriculae, and the microarchitecture expressed in septal upper-border and septal flank ornamentation were unknown or not taken into account, but became much more important after 1950. Many genera originally used by Felix (such as *Latomeandra* or *Thamnasteria*) were later restricted to limited material closer to the type species, did not occur in the Cretaceous (such as *Dendrogyra*, *Hydnophyllia*, *Porites*), or are simply poorly defined (*Calamophyllia*).

At the genus level, the fauna lacks typical Cretaceous elements (such as Actinastraeidae or the genus *Columnocoenia*) but also Late Jurassic/Early Cretaceous families such as the Amphiastraeidae and Rhipidogyridae. At the species level, the fauna shows the greatest affinity to early Aptian faunas (74 %; Löser, 2002). Only 28 out of 42 species were found in other localities (Figure 5). This is not only due to the faunal composition, but also to the poor state of conservation, which makes correct determination difficult. These 28 species occur predominantly in the Aptian, not in the Barremian, as would probably be expected. This is due to two reasons. On one hand, many more coral faunas are known from the Aptian (predominantly the early Aptian) than from the Barremian. On the other, Barremian coral faunas are much less known than Aptian faunas (cf. Löser and Ferry, 2006). There are no great faunal differences between Hauterivian and Aptian faunas. Eleven species from San Antonio Texcala are therefore also known from Hauterivian sediments, mainly from the early Hauterivian (Radiatus zone) of the Paris Basin. After the Aptian the number of joint species dropped slightly because of Oceanic Anoxic Events (e.g. Erba, 2004) in the Central Tethys,

Table 1. Original name (or name given by Felix to the collection material if not published), name assigned in this study, collection number (if there is more than one specimen, the number is given in parenthesis), figure in Felix (1891) and remarks, mainly on the type status of the material concerned. The table is arranged according to original names, and within a species according to collection numbers. Abbreviations: HT, holotype; LT, lectotype; PT, paratype; PLT, paralectotype.

| Collection name / Felix (1891) | Coll. no. | Figure | In this study | Remarks |
|---|---|---|---|---|
| | 2090 | | *Cryptocoenia corbariensis* | |
| *Calamophyllia sandbergeri* Felix | 2746 | | *Goniocora* sp. | PLT of *C. sandbergeri* |
| *Calamophyllia sandbergeri* Felix | 6278-1 | Pl. 22: 9 | *Thecosmilia sandbergeri* | LT of *C. sandbergeri* |
| *Calamophyllia sandbergeri* Felix | 6278-2 | | *Thecosmilia sandbergeri* | PLT of *C. sandbergeri* |
| *Calamophyllia sandbergeri* Felix | 6278-3 | | *Thecosmilia sandbergeri* | PLT of *C. sandbergeri* |
| *Cladophyllia miroi* Felix | 4745 | | n/a | PLT of *C. miroi* |
| *Cladophyllia miroi* Felix | 4749 | Pl. 25: 10 | *Cladophyllia miroi* | LT of *C. miroi* |
| *Cladophyllia miroi* Felix | 4757 | | n/a | PLT of *C. miroi* |
| *Cryptocoenia micrommatos* Felix | 2102 | Pl. 24: 5 | *Pseudocoenia micrommatos* | HT of *C. micrommatos* |
| *Cryptocoenia neocomiensis* Orbigny | 2084 | | *Cryptocoenia neocomiensis* | |
| *Cyathophora atempa* Felix | 1975 | | n/a | PLT of *C. atempa* |
| *Cyathophora atempa* Felix | 1994 | Pl. 25: 8 | *Cryptocoenia antiqua* | LT of *C. atempa* |
| *Cyathophora atempa* Felix | 2105 (6) | | *Cryptocoenia bulgarica* | PLT of *C. atempa* |
| *Cyathoseris petalophyes* Felix | 1468 | Pl. 24: 2 | *Dimorphastrea petalophyes* | HT of *C. petalophyes* |
| *Dendrogyra mariscali* Felix | 1745 | Pl. 24: 4 | *Meandroria mariscali* | HT of *D. mariscali* |
| *Eugyra cotteaui* Orbigny | 1682 (5) | | n/a | |
| *Eugyra cotteaui* Orbigny | 1686 (3) | | n/a | |
| *Eugyra cotteaui* Orbigny | 1688 (6) | | n/a | |
| *Eugyra cotteaui* Orbigny | 1694 (8) | | *Pseudomyriophyllia carpathica* | |
| *Eugyra cotteaui* Orbigny | 1750 | | n/a | |
| *Eugyra neocomiensis* Orbigny | 1692 (9) | | n/a | |
| *Eugyra neocomiensis* Orbigny | 1701 (3) | | n/a | |
| *Eugyra neocomiensis* Orbigny | 1705 (3) | | *Eugyra affinis* | |
| *Eugyra* sp. | 1698 | | n/a | |
| *Hydnophyllia wollheimi* Felix | 5020 | Pl. 22: 13 | *Comophyllastraea wollheimi* | HT of *H. wollheimi* |
| *Latomeandra montezumae* Felix | 382 | Pl. 22: 10 | *Meandraraea sauteri* | HT of *L. montezumae* |
| *Latomeandra sauteri* Felix | 369 | Pl. 23: 2 | *Meandraraea sauteri* | HT of *L. sauteri* |
| *Latomeandra* sp. | 381 | Pl. 22: 11 | *Astraeofungia tenochi* | |
| *Latomeandra steini* Felix | 506 | Pl. 23: 1, 1b | *Meandraraea steini* | LT of *L. steini* |
| *Latomeandra steini* Felix | 5814 | | *Meandraraea sauteri* | PLT of *L. steini* |
| *Latomeandra tulae* Felix | 377 | | *Meandraraea* cf. *tulae* | PLT of *L. tulae* |
| *Latomeandra tulae* Felix | 378 | Pl. 24: 3 | *Meandraraea tulae* | LT of *L. tulae* |
| *Latusastrea polygonalis* Fromentel | 1580 | Pl. 24: 1 | *Latusastrea* sp. | |
| *Latusastrea polygonalis* Fromentel | 1584 | | *Latusastrea* sp. | |
| *Latusastrea polygonalis* Fromentel | 1619 | | *Latusastrea* sp. | |
| *Latusastrea polygonalis* Fromentel | 1623 (3) | | *Latusastrea* sp. | |
| *Latusastrea provencialis* Orbigny | 1602 | Pl. 25: 16 | *Latusastrea provincialis* | |

Table 1. Original name (or name given by Felix to the collection material if not published), name assigned in this study, collection number (if there is more than one specimen, the number is given in parenthesis), figure in Felix (1891) and remarks, mainly on the type status of the material concerned. The table is arranged according to original names, and within a species according to collection numbers. Abbreviations: HT, holotype; LT, lectotype; PT, paratype; PLT, paralectotype. (Continued)

| **Collection name / Felix (1891)** | **Coll. no.** | **Figure** | In this study | Remarks |
|---|---|---|---|---|
| *Latusastrea provencialis* Orbigny | 1606 | | *Latusastrea irregularis* | |
| *Latusastrea provencialis* Orbigny | 1611 | | *Latusastrea provincialis* | |
| *Latusastrea provencialis* Orbigny | 2388 | | n/a | |
| *Mastophyllia conophora* Felix | 5571 | Pl. 23: 9 | *Polyphylloseris conophora* | LT of *M. conophora* |
| *Mastophyllia conophora* Felix | 5586 | | *Polyphylloseris conophora* | PLT of *M. conophora* |
| *Montlivaltia dumortieri* Fromentel | 2465 | | n/a (juvenile *Dimorpharaea* or *Dimorphastrea)* | |
| *Phyllocoenia cyclops* Felix | 2028 | Pl. 23: 3 | *Ovalastrea* sp. | PLT of *P. cyclops* |
| *Phyllocoenia cyclops* Felix | 2040 | | *Ovalastrea* sp. | PLT of *P. cyclops* |
| *Phyllocoenia cyclops* Felix | 2050 | Pl. 23: 5 | *?Diploastrea cyclops* | LT of *P. cyclops* |
| *Phyllocoenia nannodes* Felix | 2036 | Pl. 23: 10 | *Pachyphyllia nannodes* | LT of *P. nannodes* |
| *Phyllocoenia nannodes* Felix | 2043 | Pl. 23: 8 | n/a | PLT of *P. nannodes* |
| *Phyllocoenia nannodes* Felix | 2064 (3) | | n/a | PLT of *P. nannodes* |
| *Polyphyllastrea polymorpha* Felix | 5565 (2) | | *Polyphylloseris convexa* | PLT of *P. polymorpha* |
| *Polyphyllastrea polymorpha* Felix | 5582 | Pl. 22: 4 | *Polyphylloseris polymorpha* | LT of *P. polymorpha* |
| *Polyphyllastrea polymorpha* Felix | 5590 | Pl. 22: 6 | *Polyphylloseris iwateensis* | PLT of *P. polymorpha* |
| *Porites* sp. | 888 | | n/a | |
| *Prohelia anomalos* Felix | 4668 | Pl. 23: 4 | *Enallhelia anomalos* | HT of *P. anomalos* |
| *Rhabdophyllia* sp. | 5535 | | n/a | |
| *Siderofungia irregularis* Felix | 494 | Pl. 22: 12 | *Thamnoseris irregularis* | HT of *S. irregularis* |
| *Siderofungia zitteli* Felix | 5021 | Pl. 23: 6 | *?Siderofungia zitteli* | HT of *S. zitteli* |
| *Stylina tehuacanensis* Felix | 4667 (3) | | *Heterocoenia pusilla* | PLT of *S. tehuacanensis* |
| *Stylina tehuacanensis* Felix | 5912-1 | Pl. 22: 2 | *Polytremacis tehuacanensis* | PLT of *S. tehuacanensis* |
| *Stylina tehuacanensis* Felix | 5912-2 | Pl. 22: 8, 8a | *Polytremacis tehuacanensis* | LT of *S. tehuacanensis* |
| *Synastrea* sp. | 374 | | *Synastrea* cf. *agaricites* | |
| *Thamnaraea holmoides* Felix | 1390 | Pl. 22: 1 | *Kobyastraea holmoides* | HT of *T. holmoides* |
| *Thamnasteria barcenai* Felix | 5666 | Pl. 23: 7 | *Dimorphastrea petalophyes* | PLT of *T. barcenai* |
| *Thamnasteria barcenai* Felix | 5667 | Pl. 22: 3 | *Astraeofungia barcenai* | LT of *T. barcenai* |
| *Thamnasteria stricta* Fromentel | 5677 | | n/a | |
| *Thamnasteria tenochi* Felix | 5663 | Pl. 22: 7 | *Astraeofungia tenochi* | LT of *T. tenochi* |
| *Thamnasteria tenochi* Felix | 5674 (2) | | *Microsolena* sp. | PLT of *T. tenochi* |
| *Thamnasteria xipei* Felix | 5670 | Pl. 24: 6 | *Dimorphocoenia xipei* | HT of *T. xipei* |
| *Thamnastraea crespoi* Felix | n/a | Pl. 22: 5 | *Astraeofungia crespoi* | specimen is lost |
| *Thamnoseris arborescens* Felix | 587 | Pl. 25: 11 | *Thamnoseris arborescens* | PLT of *T. arborescens* |
| *Thamnoseris arborescens* Felix | 595-1 | Pl. 25: 15 | *Thamnoseris arborescens* | LT of *T. arborescens* |
| *Thamnoseris arborescens* Felix | 595-2 | | *Thamnoseris arborescens* | PLT of *T. arborescens* |

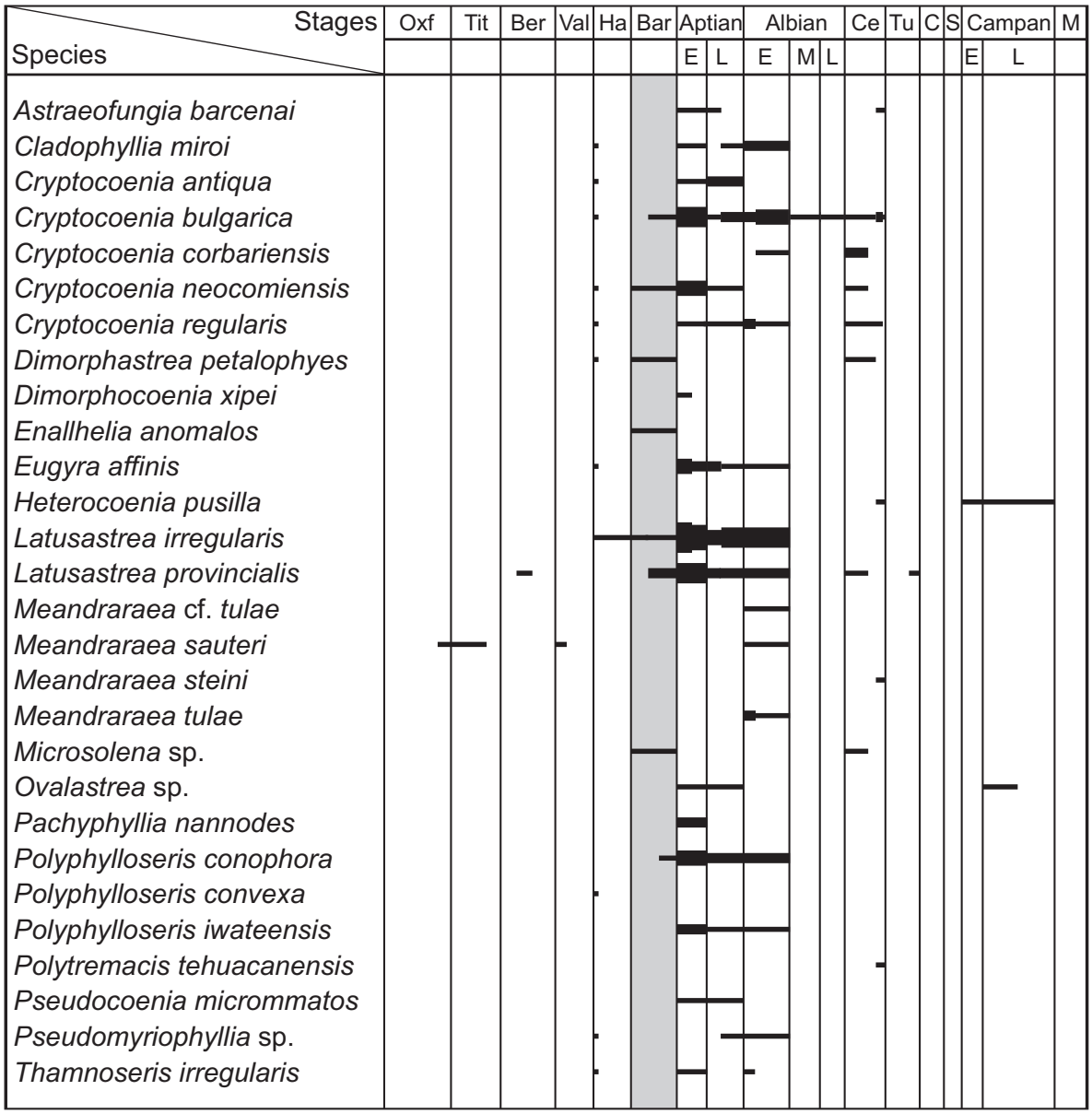


Figure 5**.** Stratigraphic distribution of the coral species found in the San Antonio Texcala area. The bars indicate the known distribution. Their thickness corresponds to the number of indications in the various provinces. Species only known from the San Antonio Texcala area are not displayed. Oxf: Oxfordian, Tit: Tithonian, Ber: Berriasian, Val: Valanginian, Ha: Hauterivian, Bar: Barremian, Ce: Cenomanian, Tu: Turonian, C: Coniacian, S: Santonian, Campan: Campanian, Ma: Maastrichtian, E: Early, M: Middle, L: Late.

but it remained moderately high until the end of the Cenomanian, when Oceanic Anoxic Event 2 and a sea-level highstand (Haq et al., 1988) caused an extinction event in corals (Löser, 1998, p. 1479).

Figure 6 is a correlation chart which compares about 300 regions with varying time slices with the studied locality. As the number of joint species is unequal and generally low, the regions with more species form one cluster with the locality and the regions with few species form another. The San Antonio Texcala locality generally takes an off position, which indicates that its faunal composition is poor compared with other faunas. Several species from San Antonio Texcala also occur in other regions, but not together. The fauna from San Antonio Texcala is not a typical association. All the faunas in the second, lower cluster have the same number of joint species with each other as they have with the examined locality. This can partly be explained by the very conservative character of the San Antonio Texcala fauna, as stated

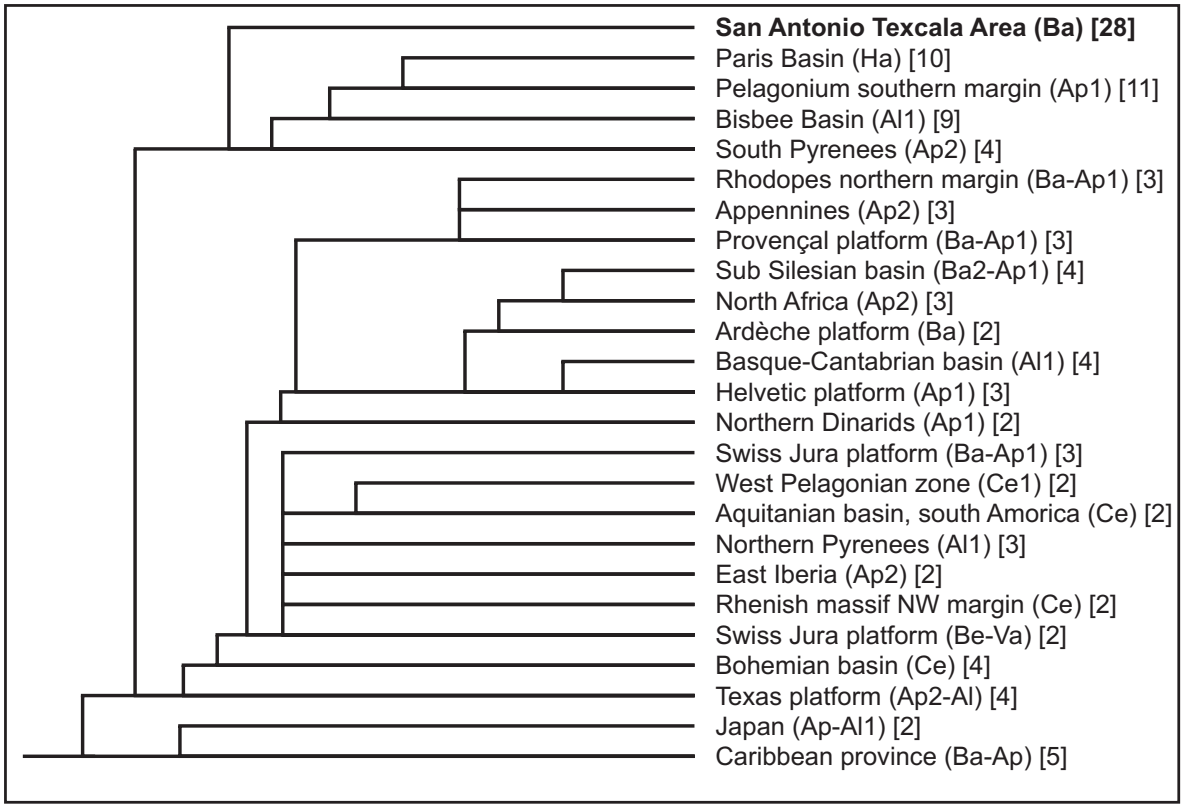


Figure 6**.** Correlation of provinces with the studied locality. Provinces with only one species excluded from the analyses. Jaccard correlation coefficient was applied. Scale is logarithmic. Be: Berriasian, Va: Valanginian, Ha: Hauterivian, Ba: Barremian, Ap: Aptian, Al: Albian, Ce: Cenomanian, 1: Early, 2: Late. Number of correlating species in brackets.

above. The examined coral fauna shows a large number of endemic species (33%), probably due to the large number of poorly recognisable species. It contains various species which are hardly known from other areas, but also some cosmopolitan species. However, a reliable interpretation of the taxonomic data is limited by the conservation problems of the material. If all species that are not clearly recognisable (such as ?*Diploastrea cyclops*, *Goniocora* sp., ?*Kobyastraea holmoides*, ?*Meandroria mariscali*, *Ovalastrea* sp., *Pachyphyllia nannodes*, ?*Siderofungia zitteli*, ?*Thamnoseris arborescens*) were to be removed, the endemism of the fauna would drop to 20%, which is a normal value for the Early Cretaceous.

Stratigraphically, most relationships are found with Barremian to Aptian provinces. Geographical relations exist with the whole central Tethys realm, even with Asia and the Boreal, but also with the closer Caribbean province. Within the Caribbean province, species of San Antonio Texcala are found in the nearby San Juan Raya area and in Venezuela. San Antonio Texcala shares a large number of species with the species-rich Mural Limestone (early Albian) in Sonora (Mexico) and Arizona (USA) but none with the late Barremian to early Aptian Cerro de Oro Formation of the Bisbee Basin in Sonora (Mexico).

## CONCLUSIONS

The Barremian coral fauna of San Antonio Texcala (Puebla, Mexico) originally described by Johannes Felix (1891) is revised on the basis of the original material. The poor state of conservation of the material limits the taxonomic revision and thus the interpretation. Because the fauna is unique in North America, a more intensive investigation of the studied area is needed. This includes a detailed—bed by bed—registration of the Zapotitlán Formation in the Ayucingo Valley, the systematic collection of index fossils (such as ammonites and microfossils) as well as other fossil groups which will be helpful in dating (such as rudist bivalves). More intensive work in the study area will probably also yield more coral samples and, hopefully, also species which were once established by Felix.

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