

# *Columactinastraea anthonii* sp. nov. (Scleractinia, Astrocoeniina), a new coral species from the Maastrichtian (Upper Cretaceous) of The Netherlands

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Only four cerioid species of scleractinian corals have been described from the Maastrichtian in its type area; the montlivaltiid *Isastrea angulosa* (Goldfuss, 1826), and the astrocoeniids *Actinastrea goldfussi* d'Orbigny, 1849, *A. faujasi* (Quenstedt, 1881) and *Columastrea fallax* Umbgrove, 1925. A lectotype is selected for the latter species. A new cerioid species, *Columactinastraea anthonii* sp. nov., is recorded from the middle part of the Meerssen Member (Maastricht Formation) at the ENCI Quarry, Zuid Limburg, The Netherlands. It is well-preserved and differs from other *Columactinastraea* species mainly by the relatively large diameter of its lumen.

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## Introduction

Twenty seven taxa of compound corals have been described from the type area of the Maastrichtian (Upper Cretaceous) (Umbgrove, 1925). The most numerous and biggest specimens are found in the middle part of the Meerssen Member (Maastricht Formation, Upper Maastrichtian) from Zuid Limburg, The Netherlands (Leloux, 1999). Of the 27 species of compound corals described only a few are cerioid. These are “massive corals in which the walls of adjacent polygonal corallites are closely united” (Moore *et al.*, 1956, p. F246); *Actinastrea goldfussi* d'Orbigny, 1849, *A. faujasi* Quenstedt, 1881, *Columastrea fallax* (Umbgrove, 1925) and *Isastrea angulosa* (Goldfuss, 1826). On November 13th, 1999, a cerioid specimen was found that differs from these four taxa. The major part of the specimen is preserved as a steinkern. However, during cleaning a fragment broke off revealing a part with positive, though recrystallized, skeletal remains. Baron-Szabo (pers. comm., 2000, 2003) recognized it as a *Columactinastraea* and it is this specimen which made her add the Maastrichtian of The Netherlands to the stratigraphical and geographical range of that genus (Baron-Szabo, 2002). Specimens in the collection of the National Museum of Natural History, Leiden, are given the prefix RGM.

### Preservation and association

The specimen is part of a limestone block that was collected by the author at the north side of the ENCI Quarry, St. Pietersberg, south of Maastricht, The Netherlands. Geographic coordinates of this spot measured by a GPS are 50°49'45.9"N 5°41'09.5"E. This block lay on the ground, but the spot in the wall where it originally came from could be reconstructed since it fell only recently from the top of bed IV f-4 to base of IV f-5 in the middle of the Meerssen Member, Maastricht Formation (see Felder & Bosch, 1998, for lithostratigraphy of the ENCI Quarry).

The block is composed of consolidated limestone and measures 250 by 250 by 150 mm. It consists mainly of large particles such as the red alga *Lithothamnium mammilosum* Gümbel, 1871, the foraminifer *Lepidorbitoides minor* (Schlumberger, 1901), small specimens of the coral *Heterocoenia bacillaris* (Goldfuss, 1826), several species of bryozoan, moulds of bivalves and echinoderm fragments. Since all these particles, mostly larger than 5 mm, are packed against each other within a muddy matrix, the block is a packstone. The grains are roughly oriented parallel to the sedimentary layers. The porosity at the bottom of the block is very low and increases to the top. The colour of the block changes from whitish yellow at the bottom to orange yellow at the top. This is probably related to the porosity difference, whereby the iron-rich groundwater was better able to reach the top part. At the bottom there is more muddy matrix. This all suggests a high energetic environment where mud could only be trapped in the lower parts of the layer or an environment in which the water currents increased.

The top of the block contains the remains of a flat encrusting coral colony sized approximately 250 by 150 by 5-10 mm. This colony is probably autochthonous; it is large, flat, thin and apparently unbroken structure preserved in a sedimentary rock with bioclasts of a mean size of approximately 10 mm (other organic remains that are normally much bigger than 10 mm are all broken). The large particles in the sedimentary rock were probably a good substratum to settle for the colony, and the energetic environment kept it clean from sand and clay. Most of the colony is present as a mould. About ten corallites are preserved as a positive. They were covered by younger corallites, which were filled with mud and their skeletons dissolved. Probably the resulting water, rich in calcium carbonate, knitted the mud together and sealed off the corallites below. The skeletons of these ten corallites are recrystallized; small calcite crystals are visible.

### Systematic palaeontology

The classification of Baron-Szabo (2002) is followed. Only selected citations are given in the synonymies below. For a complete list of citations, see Löser (2002).

**Order Scleractinia Bourne, 1900**  
**Suborder Astrocoeniina Vaughan & Wells, 1943**  
**Family Actinastreidae Alloiteau, 1952**  
**Genus *Columactinastraea* Alloiteau, 1952**

1952 *Columactinastræa* Alloiteau, 1951 – Alloiteau, p. 603.

1956 *Columactinastraea* Alloiteau, 1952 – Wells, p. F370.

- 1957 *Columactinastraea* gen. nov. – Alloiteau, pp. 72-73.  
 1981b *Columactinastraea* Alloiteau, 1951 – Tchechmedjieva, pp. 35-37  
 2002 *Columactinastrea* Alloiteau, 1952 – Baron-Szabo, p. 22.

*Remarks* — Alloiteau (1952, p. 603) erected the new genus *Columactinastraea*, while referring to Alloiteau (1951 [sic]) as the first publication. In his list of references Alloiteau (1952, p. 682) only refers to “Alloiteau (J.) — Contribution à la systématique des Madréporaires. *Thèse*, Paris, 1952”. It could be that Alloiteau’s thesis was indeed awarded in 1952, but the work was first published in 1957 as two volumes. Even Alloiteau (e.g., 1958, p. 207) himself subsequently used 1957 as the date of publication. This complicates the nomenclature of the genus. Alloiteau (1952, p. 603) gave a short diagnosis of the genus *Columactinastraea*. He nominated *C. rennensis* Alloiteau, 1957, as the type species. However, in 1952 he only gave the name *C. rennensis*, its origin and a picture of its holotype (p. 648, pl. 7, fig. 4) and not a description, thus being a *nomen nudum* (International Commission on Zoological Nomenclature, 1999, art. 13). *Columactinastraea rennensis* was published in Alloiteau (1957) as a new species. Since *C. rennensis* was a *nomen nudum* in Alloiteau (1952), it cannot be a type species. Alloiteau (1952) included two other species in *Columactinastraea*, *C. formosa* (Goldfuss, 1826) and *C. dumortieri* (de Fromental, 1886). Both are available and since *C. formosa* is the first mentioned in Alloiteau (1952, p. 600), it must be considered as the valid type species of the genus. Another way of dealing with this problem would be to ignore the date of publication of Alloiteau (1957) and pretend that it predates Alloiteau (1952). Since this procedure was followed by other authors in later works, it is intended to propose this to the commission of the International Commission on Zoological Nomenclature (ICZN) (Leloux, research in progress).

*Discussion* — *Columactinastraea* is “a un polypier généralement massif; régulier ou tubéreux, comme celui d’*Actinastræa* mais possède, autour d’une columelle styli-forme, une couronne de palis également styli-formes ou substyli-formes” (Alloiteau, 1952, p. 603). Wells (1956, p. F370) restricted the genus to those having pali before the first two septal cycles in one crown. Alloiteau (1957, p. 72-73) stated that the pali were restricted to the first septal cycle. This was repeated and accepted by Beauvais (1982, p. 26) and by Baron-Szabo (2002, p. 22). Turnšek & Polšak (1978, p. 167) wrote that according to them “Alloiteau distinguished *Columactinastraea* from *Actinastraea* by its spongy columella.”

Baron-Szabo & González-Leon (1999, p. 468) wrote that “description of specimens may differ slightly from the generic concepts of some taxa proposed by Vaughan & Wells (1943), Wells (1956) and Alloiteau (1957) regarding the development of pali, paliform lobes (e.g. *Columactinastraea*, ...).” They justified this assessment on strength of the research by Foster (1986) on *Porites* and *Goniopora*, in which the number of pali within the same colony and between two colonies can vary up to 40%. However, Foster (1987, pp. 18-22) demonstrated that the number of pali in the genus *Stephanocoenia* is constant within a species. Therefore, more research is needed on the variability in development of columella and pali.

*Columactinastraea anthonii* sp. nov.

Pl. 1, figs. 1-5; Fig. 1.

*Derivatio nominis* — This species is named in memory of Antonius Gerardus Cornelis Molenschot (\*Kaatsheuvel, July 9<sup>th</sup>, 1931-†Utrecht, May 22<sup>nd</sup>, 2001). Ton was a dear friend and the father of one of the author's best friends.

*Holotype* — Flat encrusting colony on top of limestone block RGM 216001.

*Locus typicus* — ENCI Quarry, St. Pietersberg, south of Maastricht, Zuid Limburg, The Netherlands.

*Stratum typicum* — Middle part of Meerssen Member (top Bed IV f-4 to base Bed IV f-5 of Felder & Bosch, 1998), Maastricht Formation, Upper Maastrichtian (Upper Cretaceous).

*Description* — Cerioid colony consists of penta- to hexagonal corallites, grown close to and sharing their walls with each other. Wall thickness varies between 0.2 and 0.5 mm. Individual corallites 0.3-0.5 mm high and overgrown by younger corallites in some specimens. Since only hexagonal (or, if pressed by other corallites, pentagonal) corallites are visible, extratentacular budding is presumed. Most corallites preserved as steinkerns. Average diameter of corallites 4.6 mm, with a minimum of 4 mm and a maximum of 5.3 mm (25 steinkernels measured). They have 24 septa, divided into three cycles (6-6-12). First two cycles almost equal in size (respectively, 1.5 mm and 1.4 mm), third cycle much smaller (0.8 mm). Widths of septa all the same, about 0.2 mm.

Structures that are apparent include a styliform columella about 0.50 by 0.23 mm in cross section. Border of septa of first two cycles show three lobes with each three to five smaller teeth. Third cycle shows four to five toothed lobes. On the sides of septa small spines are irregularly placed. Number of trabeculae can only be estimated on the basis of the number of spines on the septal margin, nine to fifteen per septum. Inner lobes of septa interpreted as paliform (see Fig. 1 for a schematic view). Lobes generally about 0.5 mm long, teeth about 0.1 mm. Calical cavity gently U-shaped.

*Remarks* — Since only one specimen is known, it has not been damaged for making SEM samples or thin sections. *Columactinastraea anthonii* sp. nov. differs from other *Columactinastraea* species by its larger diameter of the lumen. A comparison of lumen diameter, calice diameter and number of septa of *Columactinastraea* spp. is presented in Figure 2. A small literature study of the other *Columactinastraea* species is

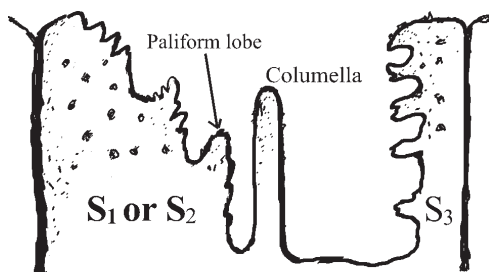


Fig. 1. Schematic view on a corallite of *Columactinastraea anthonii* sp. nov.

presented below. Only the holotype of *C. formosa* (Goldfuss, 1826) and *C. rennensis* specimen Cr<sub>2</sub> 242 from the Upper Campanian outcrop north of Gârlo, Bulgaria, has yet been studied by the author.

### *Columactinastraea dumortieri* (de Fromentel, 1886)

- 1886 *Stephanastræa Dumartieri* – De Fromentel, pp. 608-609, pl.180, fig. 2, pl. 181, fig. 1.  
1952 *Columactinastræa Dumortieri* de From. – Alloiteau, p. 624, pl. 4, fig. 1.  
1957 *Columactinastraea Dumortieri* de From. – Alloiteau, pl. 3, fig. 19.

*Type material* — De Fromentel (1886) described specimens from the Turonian of Martignen and of Bausset, France. Alloiteau (1952) depicted a specimen from the Upper Santonian of Bausset, dep. Var, France as holotype. The latter can probably be regarded as a lectotype selection. None of these authors stated where their specimens are deposited.

*Remarks* — This taxon was named after Eugène Dumortier (1802-1873), a French palaeontologist. Fromentel (1886) was inconsistent in spelling of the species name as well as in referring to the numbers of the figures. The first time the name is mentioned (p. 608) it is spelt “Dumartier,i” and pls. 180, fig. 2, and 181, fig. 2 are indicated. On the next page and on the plates the spelling “*Dumortieri*” was used. On p. 609 the author referred to pl. 181, figs. 1 and 2a, yet on the plates only figures 1 and 1a are named *S. dumortieri*. Alloiteau (1952, pl. 4, fig. 1) depicted the holotype enlarged five times. This picture suggests that diameters of calices are about 1 to 2 mm and up to 30 septa are included. This is in contrast to the original description of De Fromentel, who stated “On ne compte pas plus de vingt cloisons par calice.”

### *Columactinastraea formosa* (Goldfuss, 1826)

- 1826 *Astrea formosa nobis* – Goldfuss, p. 111, pl. 22, figs. 1b-c, and pl. 38 fig. 9.  
1952 *Columactinastræa formosa* (Goldf.) – Alloiteau, p. 600, pl. 1, fig. 2.  
1954 *Stephanocoenia formosa* (Goldfuss) 1826 – Kolosvary, p. 112, pl. 13, figs. 8-9.  
1982 *Columactinastraea formosa* (Goldfuss, 1826) – Beauvais, pp. 26-29, pl. 1, figs. 6-7.  
1995 *Columactinastraea formosa* (Goldfuss, 1826) – Tchechmedjieva, p. 28, pl. 2, fig. 1.  
2002 *Columastrea formosa* (Goldfuss, 1829) – Löser, p. 20.

*Holotype* — Goldfuss Coll. 295, Bonn from Abtenau in Salzburg, Austria (according to Goldfuss, 1826, p. 111) or from Gosau (according to the labels stored with the holotype), exact stratigraphical position unknown, but is considered to be in the Gosau Group (Turonian-Campanian).

*Remarks* — This is a massive cerioid colony, 21 by 33 mm. The lumens are between 0.84 and 1.42 mm in diameter (author’s measurements of 10 lumens of the holotype). Beauvais (1982, p. 27) measured the calices of the holotype between 1.8 and 2.2 mm. (Beauvais measured the outside diameter of the calice, whereas the present author measured the internal diameter of the lumen. The latter was done for a better comparison with the moulds of the lumens of the cerioid species from the type Maastricht-

ian.) Tchechmedjieva (1995, p. 28) gave the diameter of the calice for her material (one colony from the Upper Campanian north of Gârlo, Bulgaria) between 1.6 and 2.2 mm. Like *C. rennensis*, *C. formosa* it has two octomeral cycles and a crown of eight pali before the first cycle. Tchechmedjieva also stated that sometimes a few septa of the

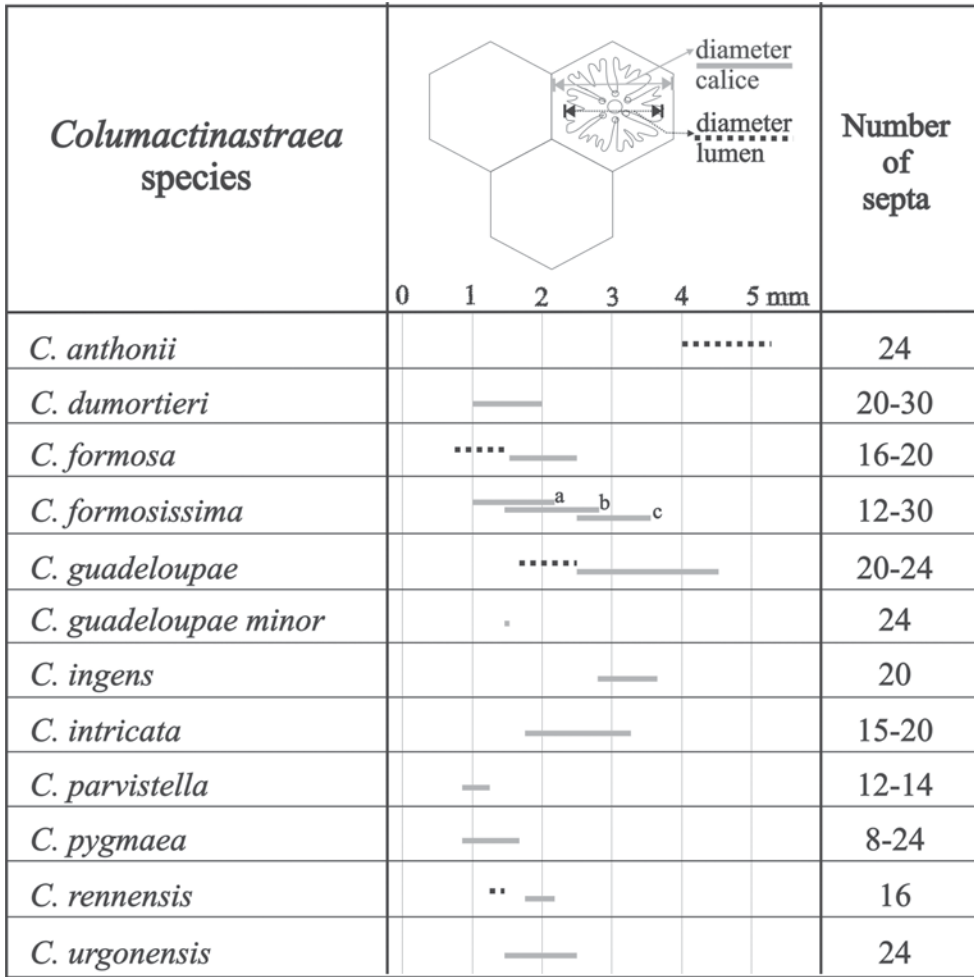


Fig. 2. Comparison of diameters of lumens, calices and number of septa between the treated species. The diameters of the lumens are always shorter than those of the calices. In the case of *Columactinastraea anthonii* sp. nov., the diameters of the calices are only a fraction larger than those of the lumen. The latter are measured because the main fraction of corallites in this fossil are present as moulds of the lumen. The lumen diameters of *C. formosa* (holotype) and *C. rennensis* (Bulgarian specimen) were measured by the author. *Columactinastraea guadeloupaie* (Wells, 1932) and *C. guadeloupaie minor* (Wells, 1946) were reclassified as *Columastrea* d'Orbigny, 1849, by Baron-Szabo (2002) and are not treated in the text; they are only incorporated into this figure for completeness. Explanation for symbols at *C. formosissima*; a = Santonian of Gosau area, Austria (Oppenheim, 1930; Baron-Szabo, 1999), b = Campanian of Torallola, Lleida, Spain (Baron-Szabo, 1998), c = holotype of Sowerby (1832) from Gosau area (Turonian to Campanian).

third cycle occur. Kolosvary (1954, p. 112) noted that the number of septa was between 16 and 20 for lower to middle Senonian specimens of Nékézseny, Jöcsös Vally, Hungary. Beauvais (1982) stated that *C. rennensis* and *C. formosa* are clearly distinguished by the different diameters of their calices.

### ***Columactinastraea formosissima* (Sowerby, 1832)**

- 1832 *Astrea formosissima* – Sowerby, p. 417, pl. 37, fig. 6.  
1930 *Stephanocoenia formosissima* Sowerby sp. – Oppenheim, pp. 474-476, pl. 36, figs. 9-9b.  
1998 *Columactinastraea formosissima* (Sowerby, 1831 [sic]) – Baron-Szabo, pp. 129-130, pl. 1, fig. 3.  
2002 *Columactionastrea formosissima* (Sowerby, 1832) – Baron-Szabo, pl. 4, fig. 2,4.

*Type material* — The Natural History Museum, London, specimen R. 11609 from Gosau, Turonian to Campanian.

*Remarks* — Sowerby (1832) proposed this name in combination with only an illustration. According to the International Commission on Zoological Nomenclature (1999, art. 12.2.7), *Astrea formosissima* Sowerby, 1832, is available. No magnification factor was given to the illustration. Supposing that the magnification factor is one, the calices of this specimen are about 2.5 to 3.5 mm. The specimen shows intratentacular budding and no pali or paliform lobes can be seen, although the detailed illustration suggests a teathed margin of the septa. This illustration also suggests a septal formula of 6-6-12. Baron-Szabo (2002, pl. 4, fig. 2) depicted the holotype, confirming the details of Sowerby's illustration. The intratentacular budding is in contrast to the description of *Columactinastraea*. According to Oppenheim (1930), "Das Hauptmerkmal für sie liegt in ihren weit größeren Kelchen" (up to 3 mm). However, his illustrated specimen from Zimmergraben shows calice diameters about 1.0-1.5 mm and, indeed, one of 3 mm, but that is a splitting corallite associated with intratentacular budding. That specimen has a crown of pali around its columella. Baron-Szabo (1998) presented calice diameters of 1.5-2.8 mm for material from Torallola (Lleida, Spain) and 1.2-2.2 mm from Weisenbachalm, Austria (Baron-Szabo, 1999).

### ***Columactinastraea ingens* Reig Oriol, 1997**

- 1997 *Columactinastraea ingens* n. sp. – Reig Oriol, pp. 13-14, pl. 2, fig. 2.

*Holotype* — Museo Geológico del Seminario de Barcelona n° 60191 from Campanian of Toralla, Pobra de Segur (Lleida, Spain).

### ***Columactinastraea intricata* (Quenstedt, 1881)**

- 1881 *Astraea intricata* – Quenstedt, pp. 896-897, pl. 178, fig. 20.  
1982 *Columactinastraea intricata* (Quenstedt) 1881 – Beauvais, 1982, p. 29, pl. 2, figs. 2a-b.

*Type material* — Quenstedt (1881, p. 897) stated that "Sie liegt in unserer Sammlung zwar bei den Gosauern, aber ihres röthlichen Kalkmergels wegen scheint sie von Hallthurm zwischen Reichenthal und Berchtesgaden zu stammen." Apparently,

this is the holotype by monotypy (Beauvais, 1982) and is still in the Quenstedt collection (Tübingen).

*Remarks* — The original description and figures of Quenstedt (1881) suggest a massive compound coral. It has approximately 16 granulated septa, a columella and a crown of pali. Beauvais (1982) stated that diameters of the calices varied between 1.8-2.0 mm and 3.0-3.25 mm, and the number of septa varying between 15 and 20 per calice for the holotype.

### *Columactinastraea parvistella* Reig Oriol, 1992

1992 *Columactinastrea parvistella* n. sp. – Reig Oriol, pp. 32-33, pl. 7, figs. 2-3.

*Type material* — Museo Geológico del Seminario de Barcelona, Campanian of Torallola (Lleida, Spain).

*Remarks* — The diameter of the calices is between 0.9 and 1.2 mm, and it has a hexamerous, sometimes septamerous, septal pattern. The columella is styliform, there are two cycles of septa and the first cycle of septa has paliform lobes.

### *Columactinastraea? pygmaea* (Felix, 1903)

1903 *Astrocoenia pygmaea* n. sp. – Felix, p. 54, pl. 3, figs. 4-5.

1975 *Actinastraea pygmaea* (Felix 1903) – Beauvais *et al.*, p. 44, pl. 4, fig. 1a-b.

1978 *Columactinastrea pygmaea* (Felix 1903) – Turnšek & Polšak, p.147, pl. 3, figs. 1-4.

*Type material* — Original type series consists of three specimens from Azinhaga do Pinhal-do-Loura. Beauvais *et al.* (1975) designated coll. P. Choffat n° 3530 as holotype. It can be considered as a lectotype selection.

*Remarks* — Felix (1903, p. 54) wrote; “Die Columella ist nur sehr schwach entwickelt, im Kelchgrunde wird sie durch einige ganz feine Körnchen angedeutet und da sie auch einer angeschliffenen Querfläche in dieser Form in Erscheinung tritt, so ergibt sich, dass sie keinen compacten Griffel darstellt, sondern aus mehreren mit einander verbundenen feinen Bälkchen gebildet wird. In dieser Beziehung schliesst sich diese portugiesische Art an die mit einer spongiösen Columella versehene *Astrocoenia konincki* an, von welcher sie sich in der durch die viel geringere Grösse der Kelche genügend unterscheidet.” Beauvais *et al.* (1975) re-studied the type specimen (Coll. P. Choffat, nr. 3530) and noted no pali, but a small styliform columella, and therefore they placed it in *Actinastrea*. The specimens in Croatia were described by Turnšek & Polšak (1978, p. 147) as having a spongy papillose columella and placed the species in *Columactinastraea*. They did not know of the revision of Beauvais *et al.* (1975) and they used a different diagnosis (spongy columella instead of a styliform columella with a crown of (sub-) styliform pali or paliform lobes). It seems obvious to accept the interpretation of Beauvais *et al.* (1975) and place this species in *Actinastrea*. However, Baron-Szabo (pers. comm, 2003) stated that the picture in Beauvais *et al.* (1975, pl. 4 fig. 1a-b) resembles more a *Columactinastraea* than an *Actinastrea*.



### *Columactinastraea rennensis* Alloiteau, 1957

- 1952 *C. rennensis* All.– Alloiteau, p. 603, pl. 7, fig. 3 [*nomen nudum*].  
1957 *Columactinastraea rennensis* sp. nov. – Alloiteau, p. 73, fig. 18, pl. 3 fig. 2.  
1981a *Columactinastraea rennensis* Alloiteau, 1951 – Tchechmedjieva, p. 29, pl. 5, figs. 2-2a.  
1992 *Columactinastraea rennensis* Alloiteau, 1952 – Reig Oriol, pp. 31-32, pl. 7, fig. 1.

*Holotype* — MNHN (Paris): R10928\*, Upper Santonian from “la Bastide de Camps”, Aude, France.

*Studied material* — Specimen Cr<sub>2</sub> 242 (University of Sofia “Kliment Ohridski”, Faculty of Geology and Geography), Lower Campanian (Swinburne *et al.*, 1992), north of Gârlo, Bulgaria.

*Remarks* — The lumens of specimen Cr<sub>2</sub> 242 have diameters between 1.2 and 1.4 mm. According to Alloiteau (1957, p. 73), *C. rennensis* has two cycles, each of eight septa, and an average diameter of the calices is 2 mm. Tchechmedjieva (1981a, p. 29) stated that this diameter is smaller than the one of *C. dumortieri*. Reig Oriol (1992, p. 32) doubted if *C. rennensis* and *C. formosa* were different species.

### *Columactinastraea urgonensis* Sikharulidze, 1977

- 1977 *Columactinastraea urgonensis* sp. nov. – Sikharulidze, p. 73, pl. 11, fig. 1a-d.

*Holotype* — N.° 217/77, GIN AN GSSR, Ali (Eastern Georgia), Lower Barremian.

*Remarks* — According to Sikharulidze (1977), the diameter of the calices is between 1.5 and 2.5 mm. They have 24 septa and pali in the first two cycles. It was distinguished from *C. rennensis* by having 24 instead of 16 septa and larger calices.

### *Columactinastraea* sp.

- 1999 *Columactinastraea* sp. – Baron-Szabo & González-León, p. 469, fig. 2a.

*Locality and horizon* — Barremian-Aptian from Sonora, Mexico.

*Remarks* — Baron-Szabo & González-León (1999) were not able to establish the species because the preservation was too poor. Distance between calice centres is between 1.5-3.4 mm, and the number of septa between 14 and 20. Their figure shows a hexamerl septal pattern and relatively thick walls.

### Comparison with other published cerioid coral fossils

The comparison with other cerioid coral species is restricted to two categories. The first consists of only those species described from the Upper Cretaceous in the type area of the Maastrichtian. The second category of treated species belong to *Plesiosiderastraea* from the Campanian of Bulgaria. The latter is included since a resem-

blance between these species as depicted in Tchechmedjjeva (1975, pl. 1, figs. 1-2) was one of the reasons the author went to Bulgaria to study their type specimens.

**Suborder Astrocoeniina Vaughan & Wells, 1943**

**Family Actinastreaidae Alloiteau, 1952**

***Actinastrea* d'Orbigny, 1849**

Fig. 3.

*Remarks* — *Actinastrea goldfussi* d'Orbigny, 1849, and *Actinastrea faujasi* (Quenstedt, 1881) have smaller calices (approximately 1 to 1.5 mm in diameter) and fewer septa (12 and 12 to 16, respectively) than *Columactinastraea anthonii*. The wall thickness is also relatively larger (0.2-0.5 mm). *Actinastrea* does not have pali or paliform lobes. There are holes in the wall parallel to the calice, the so-called 'lacune murale' of Alloiteau (1957) and 'tekalin lakooni' of Tchechmedjjeva (1981a), a characteristic feature for *Actinastrea*. See Figure 3 for a drawing of a thin section.

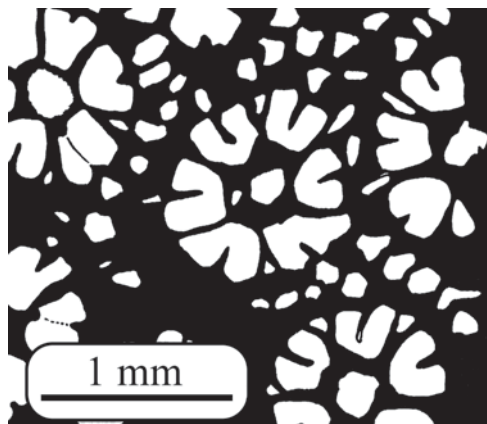


Fig. 3. Drawing of a thin section of *Actinastrea goldfussi* from the Upper Maastrichtian of the St. Pietersberg (Zuid Limburg, The Netherlands) showing the open spaces between the corallites. RGM thin section M38, Coll. Umbgrove.

**Suborder Faviina Vaughan & Wells, 1943**

**Family Isastreidae Alloiteau, 1952**

**Genus *Isastrea* Milne Edwards & Haime, 1851**

***Isastrea angulosa* (Goldfuss, 1826)**

1826 *Astrea angulosa* nobis – Goldfuss, p. 69, pl. 23, fig. 7a, b.

*Holotype* — Rheinische Friedrich Wilhelm Universität Goldfuss collection no. 232, Bonn. From the Upper Maastrichtian of St. Pietersberg, Zuid Limburg, The Netherlands.

*Other material* — Six specimens from middle of Meerssen Member, Maarstricht Formation, ENCI Quarry, Limburg, The Netherlands, RGM \*\*\*\*\*\_\*\*\*\*\*.

*Diagnosis* — Small, massive colonies with convex to strongly convex surface, cerioid, with quadri-, penta- to hexagonal corallites (diameter 2-6 mm) with four cycles of septa; fourth cycle can be incomplete. Massive circular columella. No traces of pali or paliform lobes.

*Remarks* — A large variety of sizes in corallites occurs in these fossils as seen in the type area of the Maastrichtian. The dimensions of skeletal elements within a colony do not vary much. It is possible that more taxa will eventually be distinguishable within this group of fossils.

**Family Columastridae Alloiteau, 1952**  
**Genus *Columastrea* d'Orbigny, 1849**  
***Columastrea fallax* Umbgrove, 1925**

- 1925 *Columnastraea fallax* sp. nov. — Umbgrove, p.119, pl. 8 fig. 1; pl. 10, fig. 11.  
1999 *Columastrea fallax* — Leloux, p. 193.

*Lectotype* — RGM 29074, as depicted by Umbgrove (1925, pl. 8, fig. 1).

*Lectoparatypes* — RGM 29067, RGM 29068, RGM 33987, RGM 76618 and RGM 76703.

*Type locality and horizon* — Middle of the Meerssen Member, Upper Maastrichtian of St. Pietersberg, Zuid Limburg, The Netherlands.

*Remarks* — Umbgrove (1925, pl. 10, fig. 11) depicted a cast of the holotype. The 'bundles of pillars' (moulds of the lumens) are funnel shaped. On top of the funnel a hemispherical depression is visible. This indicates a 'V-shaped' lumen with a low circular columella. It has only 12 septa per corallite and the calices are approximately 1.5 mm in diameter. Normally, the 'bundles of pillars' are somewhat separated from each other. There is no evidence for costae. In some specimens the calices are so near to each other that they become polygonal instead of rounded. Umbgrove (1925, p. 119) assumed the presence of six pali. However, the material does not show clear prints of these pali. Umbgrove, although having doubts about the structures being impressions of original skeletal structures, thought the characteristics of this fossil species fitted best with *Columastrea* d'Orbigny, 1849. Since the observation of the impressions of the pali is doubtful, the generic assignation of this species remains dubious.

**Suborder Fungiina Verrill, 1865**  
**Family Siderastridae Vaughan & Wells, 1943**  
**Genus *Plesiosiderastraea* Tchechmedjjeva, 1975**

*Remark* — *Plesiosiderastraea* can be distinguished from *Columactinastraea anthonii* in having a spongy columella.

***Plesiosiderastraea garloica* Tchechmedjjeva, 1975**  
Fig. 4.

- 1975 *Plesiosiderastraea garloica* gen. et sp. n. – Tchechmedjjeva, pp. 33-36, pl. 1, figs. 1-2.  
1986 *Plesiosiderastraea garloica* – Tchechmedjjeva, p. 67, fig. 9.  
1986 *P. tzankovi* – Tchechmedjjeva, p. 67, fig. 9.  
1988 *Plesiosiderastraea tzankovi* sp. n. – Tchechmedjjeva, p. 239, pl. 1, fig. 5-6.

*Holotype* — Cr<sub>2</sub> 278 by monotypy, from the Lower Campanian (Swinburne *et al.*, 1992), outcrop north of the village Garlo, Breznik, southwest Bulgaria. It is stored at University of Sofia “Kliment Ohridski,” Faculty of Geology and Geography.

*Remarks* — Tchechmedjieva (1988, p. 239) appointed specimen K<sub>2</sub> 1407 as holotype for *P. tzankovi*. She mentioned also another colony (K<sub>2</sub> 1408). However, that specimen could not be found during the author’s visit to Bulgaria. Based on direct comparison between the holotypes of *P. garloica* and *P. tzankovi*, the latter taxon is considered a subjective junior synonym of the first (Fig. 4). Both are somewhat recrystallized, particularly the holotype of *P. tzankovi*, resulting in thicker walls. The branching of the S3 from S1 and S2 is a feature visible on both. The author counted 5 septa per 2.75 mm on both specimens. The slight difference in average diameter of the calices per colony is not regarded as a characteristic on which to distinguish two species, when there are only two specimens.

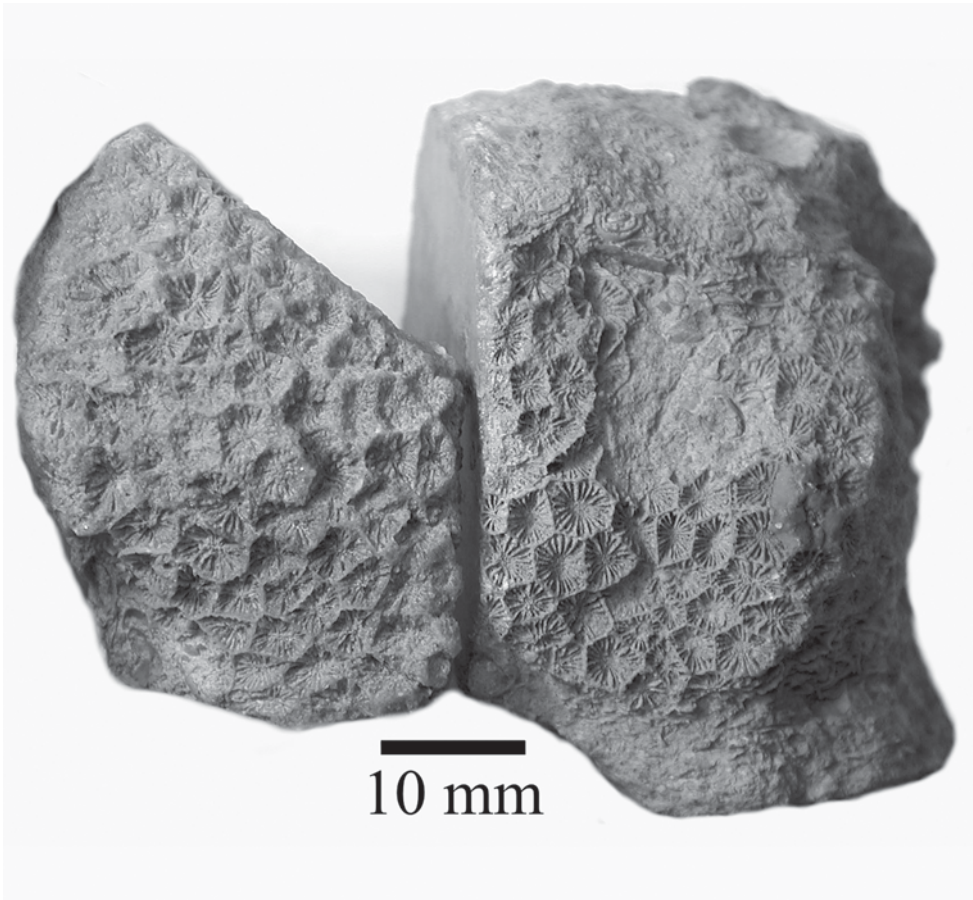


Fig. 4. The holotypes of *Plesiosiderastraea tzankovi* (left) and *P. garloica* placed side by side.

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**Plate 1**

*Columactinastraea anthonii* sp. nov., RGM 216001, holotype, from the Upper Maastrichtian Meersen Member, Maastricht Formation, ENCI Quarry, St. Pietersberg, Zuid Limburg, The Netherlands.

Fig. 1. Overview of upper surface of limestone block RGM 216001 with positions of figures 2, 3. "a" marks a *Lithothamnium mammosum*.

Fig. 2. (a) Position of several well-preserved corallites of *Columactinastraea anthonii*. A mould of a *Heterocoenia bacillaris* colony, a small fanshaped colony with four corallites, occurs middle right. Scale in mm.

Fig. 3. Steinkerns of *Columactinastraea anthonii* (centre). (b) The benthic foraminifer *Lepidorbitoides minor*. Scale in mm.

Figs. 4, 5. Details of the corallites shown in Figure 2a, of *Columactinastraea anthonii*.



