

# *Podoseris* – a poorly known solitary coral from the Albian of England (Scleractinia)

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## Abstract

The late Early Cretaceous coral genus *Podoseris* has been revised on the basis of the type material of its type species and topotypical material from the type locality. *Podoseris* is a small solitary cupulate to tympanoid coral, which is endemic to the Hunstanton Red Chalk in Norfolk, England. The genus is characterised by almost compact pennular septa. It is therefore assigned to the family Synastraeidae. *Podoseris* counts with eight species, which are considered synonymous, with the exception of the Jurassic species, which does not belong to this genus.

**Key words:** Corals, England, Cretaceous, taxonomy, Scleractinia.

## Zusammenfassung

Die Korallengattung *Podoseris* der späten Unterkreide wurde auf der Basis von Typusmaterial der Typusart und topotypischen Materials von der Typuslokalität revidiert. *Podoseris* ist eine kleine cupulate bis tympanoide Koralle, die ihr endemisches Vorkommen im Hunstanton Red Chalk in Norfolk (England) hat. Die Gattung ist durch pennuläre und fast kompakte Septen gekennzeichnet und wird daher der Familie Synastraeidae zugewiesen. *Podoseris* besitzt acht Arten, die als synonym verstanden werden, mit Ausnahme der aus dem Jura beschriebenen Art, die nicht zu dieser Gattung gehört.

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## 1. Introduction

The small solitary coral *Podoseris* DUNCAN, 1869 is a genus endemic to the Hunstanton Red Chalk (Middle to Late Albian) of Norfolk, England. It was first briefly described and illustrated by DUNCAN (1869) and later (DUNCAN 1889) considered in great detail. A new family was established by DUNCAN (1884) on the basis of this genus. Although the genus was well illustrated by DUNCAN (1889), it remained poorly known and was compared to Rhizangiid corals. The present study includes a re-examination of the type material and more detailed studies based on thin sections obtained from the topotypical material.

## Acknowledgements

I am grateful to JILL DARRELL (Natural History Museum London, England) who provided the topotypical material and allowed the preparation of thin sections. The study of the collection material was assisted by a UNAM/DGAPA PASPA programme. The insightful comments given by BERNARD LATHUILLIÈRE (Nancy) helped to improve the manuscript. English text correction by edit-age.com.

## 2. Material and methods

The studied material comes entirely from the Hunstanton Red Chalk of the Hunstanton Cliff near Hunstanton in Norfolk, England. The Hunstanton Red Chalk has a Middle to Late Albian age, comprising the Dentatus to Inflatum ammonite zones (OWEN 1995). The observed material (about 30 samples) is kept at the Natural History Museum (NHM; London, England) and the Sedgwick Museum of Earth Sciences (CAMSM; Cambridge, England). From selected specimens, thin sections were obtained in transverse and longitudinal directions. Microphotographs for illustration purposes were obtained using a transparency scanner Epson Perfection V750-M Pro with an optical resolution of 6400 dots per inch. The scanned images were then transferred to greyscale bitmaps. Their quality was amended by histogram contrast manipulation (contrast stretching), where possible.

### 3. Systematic palaeontology

Order Scleractinia BOURNE, 1900

Suborder Microsolenina MORYCOWA & RONIEWICZ, 1995

Family Synastraeidae ALLOITEAU, 1952

Genus *Podoseris* DUNCAN, 1869

Type species: *Podoseris mammiliformis* DUNCAN, 1869 by subsequent designation in DUNCAN (1889: 28).

Diagnosis. – Solitary cupolate to tympanoid coral. Calicular outline circular. Calice with a diameter of 10–15 mm. Septa exsert and compact. Microstructure of septa very probably of large trabeculae (230–280  $\mu\text{m}$ ), growing vertically in central parts of the septum and are more inclined towards the other margin. Septa in cross section externally slightly thicker, and getting slightly thinner towards the centre. Septal maximum thickness 500  $\mu\text{m}$ , minimum thickness 70  $\mu\text{m}$ . Width of pennulae oscillates between 330 and 450  $\mu\text{m}$ . Symmetry of septa irregularly radial. Cycles of septa irregular, but generations can be distinguished. Number of septa ranges between 80 and 120. Septal generations differ in length and thickness. First septal generation reaches to the centre of the calice, further generations are subsequently shorter. Septa of younger cycles connected to septa of older ones in places. Septal upper border with large regular granules. Septal lateral face with pennulae, often as mi-pennulae, inner margin smooth. Pali or paliform lobes absent. Costae present, with granules on their surface. Synapticulae present, rare. Columella consisting of a group of isolated trabeculae or a small solid element. Endotheca with dissepiments. Wall present, compact, septothecal, with synapticulae, in cupolate forms as pennular envelope. Epitheca present.

Remarks. – *Podoseris* may occur as a cupolate or tympanoid solitary coral. In any case, it is attached to the sediment. In cupolate forms, there is no wall; the costae reach directly to the basal plates as in *Micrabacia*. Tympanoid specimens have a cylindrical form; the corals are still attached with their basal plate to the sediment. In these forms, there exists a wall, which is often covered with an epitheca. Between the cupolate and tympanoid growth types, all transitional forms exist. Septal insertion is irregular, but at least four generations can be clearly distinguished. Perforations, if present, are restricted to the inner septal margin. The pennulae are very large and pronounced, as well as the ornamentation of the septal upper margin. The columella is difficult to distinguish from the perforate septal inner margins.

Systematic position. – The genus was originally assigned to the subfamily Lophoserinae, family Fungiidae. This position was confirmed by DUNCAN (1889) with the additional note that the genus has no affinities to

the genus *Rhizangia* MILNE EDWARDS & HAIME, 1848, because TOMES (1885) had synonymised *Podoseris* with this genus. Nevertheless, it was assigned by VAUGHAN & WELLS (1943) (as a questionable genus) to the Astrangiidae MILNE EDWARDS, 1857, which was later considered synonymous with the Rhizangiidae D'ORBIGNY, 1851 (WELLS 1956). ALLOITEAU (1952) assigned *Podoseris* to the Astrangiidae and mentioned as distribution also France. WELLS (1956) transferred *Podoseris* (with the members of the Astrangiidae) into the Rhizangiidae. Although *Rhizangia* was later found to belong to the Siderastraeidae VAUGHAN, 1943 (CHEVALIER 1961, BARTA-CALMUS 1973), the family Rhizangiidae remained in use within the suborder Faviina (BARON-SZABO 2006, 2009; KUZMICHEVA 2002). The status and systematic position of *Rhizangia* and the Rhizangiidae cannot be clarified; the type of the type species of *Rhizangia*, *Astrea brevissima* DESHAYES, 1820 is lost, and an unjustified neotype established by BARTA-CALMUS (1973) is not available at the former Sorbonne collection in Paris (now at the Université Pierre et Marie Curie and the Museum National d'Histoire Naturelle, Paris).

DUNCAN (1869, 1889) was aware of the presence of synapticulae in *Podoseris*, and the position of the genus within the Fungiidae was, at the time, correct. GILL (1967) did not include the genus in the list of pennular coral genera, although pennulae are clearly shown in the illustration provided by DUNCAN (1889, pl. 5, fig. 14), taking into account the low angle of the trabecular growth direction towards the external margin. The presence of pennulae and the compact strong septa classify *Podoseris* as a member of the Synastraeidae ALLOITEAU, 1952. It is closely related to *Synhelia*. The family name Podoseriidae DUNCAN, 1884 cannot be applied in place of Synastraeidae, because it is a nomen oblitum. The members of the family Leptophylliidae have much more perforated septa.

The family Synastraeidae evolved in the Early Cretaceous. The first *Synastrea* species were found in the Early Hauterivian in the Paris Basin (*S. neocomiensis* D'ORBIGNY, 1850; *Thamnasteria pediculata* DE FROMENTEL, 1857). The *Synastrea* species that are older than Hauterivian may belong to other genera such as *Astraeofungia*. Many genera of the family appeared during the Albian (*Podoseris*), Cenomanian (*Leptophyllaraea* ALLOITEAU, 1952; *Synhelia* MILNE EDWARDS & HAIME, 1849), and from the Late Turonian (*Felixastraea* OPPENHEIM, 1930; *Gyroseris* REUSS, 1854; *Hydnophorastraea* BEAUVAIS, 1982; *Pseudoseris* ALLOITEAU, 1952). This family ecologically replaced the Microsoleniidae, which disappeared almost completely after the Cenomanian/Turonian boundary. Synastroid corals have thick and almost no perforated septa, and as Microsolenids have very well developed pennulae, that are understood as an indication of heterotrophic feeding mode under low light conditions (TOMÁS et al. 2008).

**Species.** – DUNCAN (1869) established the genus with two species – *P. mammiliformis* and *P. elongata* – and later added five other species in DUNCAN (1889). In DUNCAN (1872), another species, *P. constricta*, from the Late Jurassic was created. The Cretaceous material comes exclusively from one locality, and considering the available type material, all these species are synonymous. All the examined samples present the same calicular diameter and a comparable septal number. The Jurassic species *P. constricta* shows thin septa that are poorly ornamented and are without pennulae. It does not belong to *Podoseris*. *Podoseris* is, therefore, a monospecific genus. The genus can be confounded with the very early stages of any colonial corals of the family Synastraeidae. From the type locality of *Podoseris mammiliformis*, no other corals are known so that it can be excluded that *Podoseris* represents just early stages of colonial corals.

**Distribution.** – The genus is endemic to the Middle to Late Albian of South East England.

**Palaeoecology.** – According to OWEN (1995), the Hunstanton Chalk was formed in a relatively shallow marine environment, in which periods of sedimentation and periods of non-deposition alternated. Water energy is considered low. During periods of non-deposition, iron-oxide indurated hardgrounds were formed. The low water energy made the environment unfavorable for other, e. g., colonial corals.

*Podoseris mammiliformis* DUNCAN, 1869  
Pl. 1, Figs. 1–6

- \* v 1869 *Podoseris mammiliformis*. – DUNCAN, p. 25, pl. 9, figs. 2–15.
- 1869 *Podoseris elongata*. – DUNCAN, p. 26, pl. 9, figs. 16, 17.
- v 1885 *Rhizangia mammiliformis*. – TOMES, p. 548, pl. 14, figs. 7–9.
- 1886 *Podoseris mammiliformis*. – DUNCAN, p. 53.
- 1886 *Podoseris elongata*. – DUNCAN, p. 53.
- 1889 *Podoseris elongata*, DUNC. – DUNCAN, p. 25, pl. 5, figs. 11, 14–16.
- v 1889 *Podoseris anomala*. – DUNCAN, p. 26, pl. 5, figs. 3, 4.
- v 1889 *Podoseris Jesson*. – DUNCAN, p. 26, pl. 5, figs. 5, 6.
- v 1889 *Podoseris brevis*. – DUNCAN, p. 28, pl. 5, figs. 7, 8.
- v 1889 *Podoseris mamilliformis*, DUNC. – DUNCAN, p. 28, pl. 5, fig. 9.
- v 1889 *Podoseris dubia*. – DUNCAN, p. 31, pl. 5, figs. 12, 13.
- 1889 *Podoseris affinis*. – DUNCAN, p. 26, pl. 5, figs. 1, 2.
- 1899 *Rhizangia mammiliformis*, DUNC., sp. – TOMES, p. 306.
- 2002 *Podoseris mammiliformis* DUNCAN 1869. – LÖSER et al., p. 573. [here complete synonymy]

**Types:**

- Podoseris anomala* DUNCAN, 1889: NHM R25086 (marked as holotype)
- Podoseris brevis* DUNCAN, 1889: NHM R25088 (marked as holotype)

*Podoseris dubia* DUNCAN, 1889: NHM R25090 (marked as holotype)

*Podoseris jessoni* DUNCAN, 1889: NHM R25087 (marked as holotype)

*Podoseris mammiliformis* DUNCAN, 1889: NHM R25089 (marked as holotype)

*Podoseris mammiliformis* DUNCAN, 1869: CAMSM B41560 to B41566 (marked as paratypes).

All the types are very probably syntypes because DUNCAN did not fix any type. The type material of *P. affinis* DUNCAN, 1889 and *P. elongata* DUNCAN, 1869 was not found.

**Type locality:** Hunstanton Cliff near Hunstanton, Norfolk, England.

**Type horizon and age:** The Hunstanton Red Chalk, Middle to Late Albian, *Dentatus* to *Inflatum* ammonite zones (OWEN 1995).

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Manuscript received: 7 February 2012, accepted: 19 March 2012.

**Plate 1**

*Podoseris mammiliformis* DUNCAN, 1869; Hunstanton Red Chalk, Middle to Late Albian; Hunstanton Cliff near Hunstanton in Norfolk, England.

**Fig. 1.** Oral view of NHM R50247.

**Fig. 2.** Oral view of NHM R25089 (syntype).

**Figs. 3–4.** Transverse thin sections from NHM R50247.

**Fig. 5.** Lateral view of NHM R50247.

**Fig. 6.** Longitudinal thin sections from NHM R30210.

Scales: 1 mm.

