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ON CRETACEOUS *STEPHANOCYATHUS* (SCLERACTINIA) FROM
THE TATRA MTS.

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A new species, *Stephanocyathus antiquus* sp. n. is described from the Albian (Lower Cretaceous) glauconitic limestones from the High-Tatric series of the Tatra Mountains, Poland. It is the oldest species of the genus *Stephanocyathus* known so far. Distichophylliid microstructure, as well as morphological features (shape, development of radial elements), make the species similar to Recent forms.

Key words: ahermatypic Scleractinia, Cretaceous, Albian, *Stephanocyathus*, Tatra Mountains, Poland.

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INTRODUCTION

The oldest *Stephanocyathus* known so far has been found in Maastrichtian (Upper Cretaceous) deposits of Greenland (Florin 1972). The purpose of this paper is to describe a new species of this genus from the Albian (Lower Cretaceous).

The specimens come from a thin condensed horizon of the Albian phosphate-bearing sequence of glauconitic limestone from the Kominy Dudowe section and from Żeleźniak gully (fig. 1). From the same deposits cropping out in another locality, Passendorfer (1930) described *Trochocyathus conulus* Phillips. The limestone overlies an Urgonian reefal complex of the Barremian to early Ajtton age, and passes upwards into basinal marly mudstone of the latest Albian to early Turonian age. The fauna described in this paper has been collected from redeposited beds, so it is hard to estimate true life conditions (bathymetry) of the species described (Krajewski 1984a, 1984b).

The specimens are housed at the Institute of Paleobiology of the Polish Academy of Sciences, Warsaw.

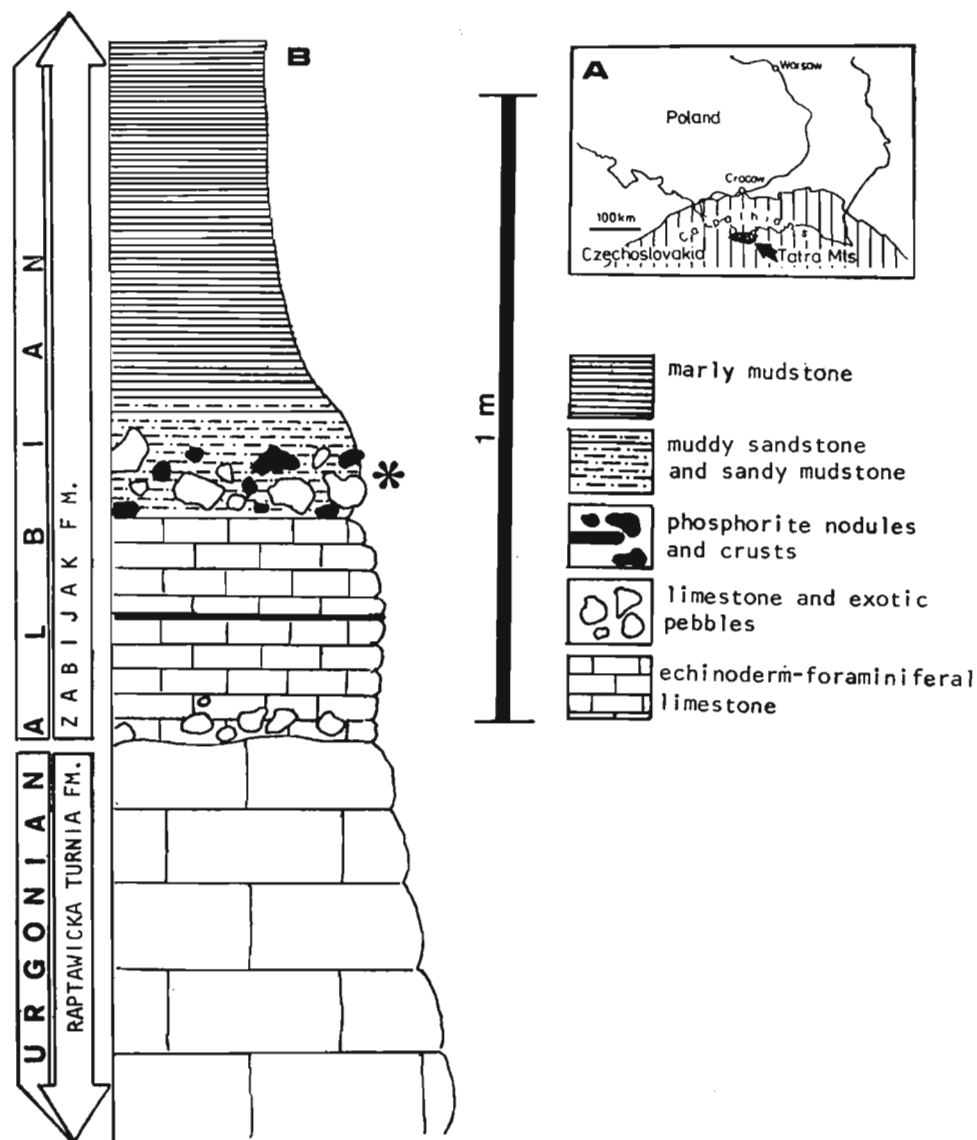


Fig. 1. Location of the Tatra Mountains in the Western Carpathians (A) and a section in the southern part of the Kominy Dudowe alp (B). The place where the holotype of *Stephanocyathus (S.) antiquus* sp. n. was found is marked by an asterisk. Adopted from Krajewski, 1984a, 1984b.

Museal acronyms:

USNM United States National Museum of Natural History, Smithsonian Institution;
ZPAL Institute of Paleobiology, Polish Academy of Sciences.

Abbreviations and symbols used in descriptions:

- S — number of radial elements (septa)
 S (1—n) — septal cycles
 C (1—n) — costal cycles
 P (1—n) — crowns of pali or paliform lobes

d	— diameter of corallum
SD	— septal density — number of septa per mm
H	— height of corallum
e.	— estimated

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The photos of Recent *Stephanocyathus* specimens have been made by Mr. Dziewiński and thin sections by Mrs. M. Nowińska.

DESCRIPTION

Family Caryophylliidae Gray, 1847 Genus *Stephanocyathus* Seguenza, 1864

Up to Floris discovery (1972) the genus was known as a taxon ranging from the Eocene to Recent (*vide* Wells 1956). Floris found it (*Stephanocyathus* (*Stephanocyathus*) sp.) in Maastrichtian (Upper Cretaceous) sediments of West Greenland. The Tatra Mountains specimens extend the range of the genus to the Albian (Lower Cretaceous).

Bathymetric range of the Recent species is 141 m to 2235 m (after Wells 1956 and Zibrowius 1980).

Stephanocyathus (*Stephanocyathus*) *antiquus* sp. n. (pl. 5: 1; pl. 7: 1–2; pl. 8: 1; fig. 2)

1984a. *Caryophyllia*: Krajewski, fig. 7a

1984. *Caryophylliid* indet.: Roniewicz, fig. 2

Holotype: ZPAL H II/1; Krajewski 1984a, fig. 7a, Roniewicz 1984, fig. 2, and herein pl. 7: 2; pl. 8: 1; fig. 2.

Paratype: ZPAL H II/3; pl. 5: 1; pl. 7: 1.

Type horizon: Albian (condensed glauconitic limestone), High-Tatric series.

Type locality: Kominy Dudowe section — Tatra Mountains, Poland.

Derivation of the name: *antiquus* (Lat.) — ancient, the oldest species of the genus *Stephanocyathus*.

Diagnosis. — Patellate. Corallite diameter up to 25 mm. Radial elements in five complete cycles. Axial part of distal edge of S1-2 septa does not reach the columella. Paliform lobes in two crowns.

Material. — Two specimens from the condensed glauconitic limestone from the High-Tatric series of the Tatra Mountains: with two transverse thin-sections (ZPAL H II/1 from Kominy Dudowe section and ZPAL H II/3 from Żeleźniak gully); a series of peels with transverse sections (pl. 5: 1–2).

Dimensions (in mm):

	d	S	H	SD/10 mm *
ZPAL H II/1	25	96	?	15
ZPAL H II/3	e. 16	e. 96	1.86	18
<i>S. laevifundus</i> (USNM 46382)	32	96	7.5	11 (15**)
<i>S. diadema</i> (USNM 46343)	46	96	12.5	8 (15**)

* — septal density measured at preserved calicular edge

** — septal density measured in *S. diadema* and *S. laevifundus* at diameter equal to that of ZPAL H II/1. S5 at this diameter in *S. diadema* are rudimentary.

Description. — Solitary, patellate with proximal side slightly convex. Septa hexamerally arranged in five complete cycles, S1-2 septa are almost equal in length and thickness and represent the thickest radial elements of corallum. Their septal blades are straight and become gradually thinner axialwards (similarly to septal blades of other cycles). S1-2 septa do not have distinctly developed paliform lobes. Axial parts of their distal edges do not reach columella (pl. 5: 1f). S1 are mainly independent though, sometimes, blade-like connections with septa of higher cycles appear in their axial zone (e.g. S1 connected with S3 — pl. 5: 1f). S3 straight, half as thin as S1—2 septa. S3 have paliform lobes (P3), each of which is separated from its corresponding septum by a broad indentation (pl. 5: 1f; fig. 2). Distal part of P3 seems to be thicker than the remaining part of septal blade S3 (pl. 5: 1g—h). S4 approximately half as thin as S3 and slightly sinuous. At about one-third of corallum radius from the axis, S4 are joined to paliform lobes P3 by the inner edges of their paliform lobes P4 (pl. 5: 1g; fig. 2). P4 are separated from S4 by an indentation. P3 and P4 paliform lobes occur in two crowns. S5 short, about half as long as S4. Occasionally, they fuse with S4 at about half way from the axial edge of S4 septa (pl. 5: 1c). Septal density about 15 per 10 mm. Faces covered with fine, blunt granules. Costal part of radial elements well developed, particularly C1—2.

Columella poorly developed, formed of slightly thickened axial parts of radial elements (pl. 5: 1d—f) joined by solidly fused mass.

The wall is septothecal (pl. 5: 1a; fig. 2).

Microstructure. — As a result of diagenetical processes, aragonitic microstructure is not preserved. Nevertheless, in the central part of the septal blade (ZPAL H II/1), vestiges of very fine trabeculae (10—30 μ m in diameter — measured between centers of vestiges — m.b.c.v.) can be seen. The vestiges are arranged in a pattern typical of caryophylliids — straight or zigzag "chainlet" in mid-septal zone. In S1—2 they form a zigzag chain (20—30 μ m m.b.c.v.) and in higher cycles they are arranged in straight or slightly sinuous pattern (10—20 μ m m.b.c.v.). Such microstructure has been called distichophylliid (Cuif 1975; Roniewicz 1984) to emphasize similarity to the microstructure of the Triassic scleractinian family Reimaniphylliidae Melnikowa, 1975 (= Distichophylliidae Cuif, 1977). Paliform lobes also demonstrate traces of trabecular structure. Granulation visible on the surface of septa mainly has trabecular foundations (Jell's (1969) secondary trabeculae; pl. 8: 1b).

Stephanocyathus shows microstructural traits of caryophylliids, that has been revealed in Recent deep-water species: e.g., in *S. diadema* (Moseley, 1876) by Sorauf and Podoff (1977) and in *S. laevifundus* Cairns, 1977 — herein pl. 7: 3.

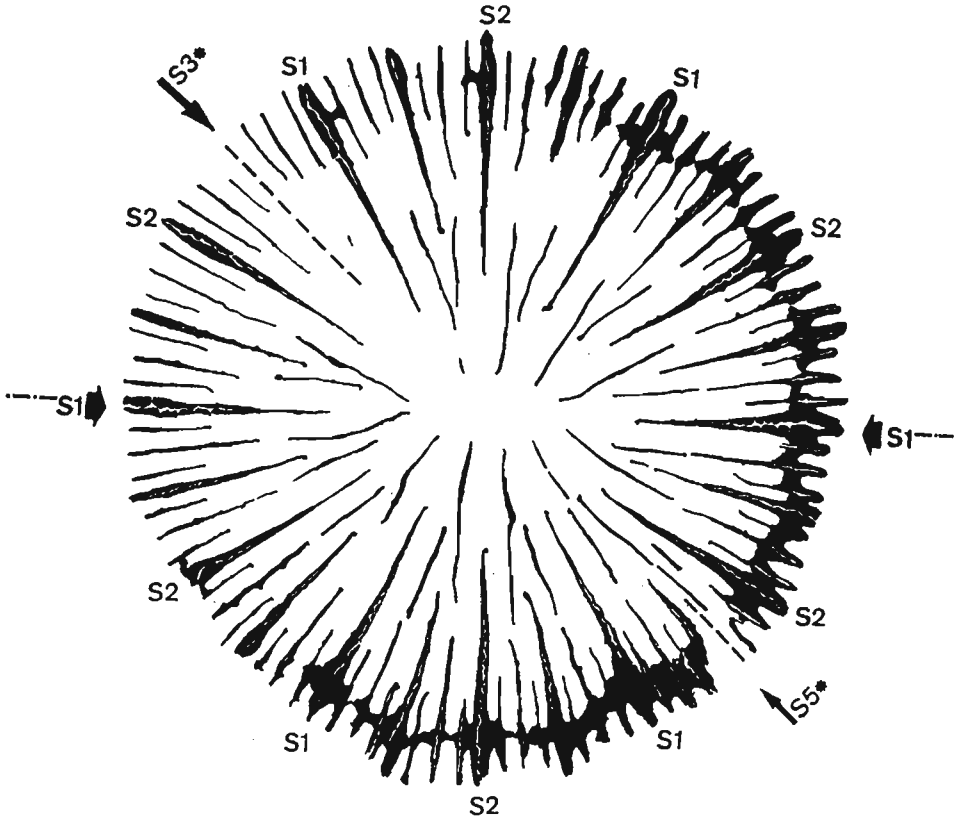


Fig. 2. *Stephanocyathus (Stephanocyathus) antiquus* sp. n.: holotype, ZPAL H II/1 transverse thin section. The plane of bilateral symmetry is indicated by two opposing S1 (principal septa) marked with thick arrows. Two damaged septa, one S3 and one S5 (dashed lines) are marked with thinner arrows.

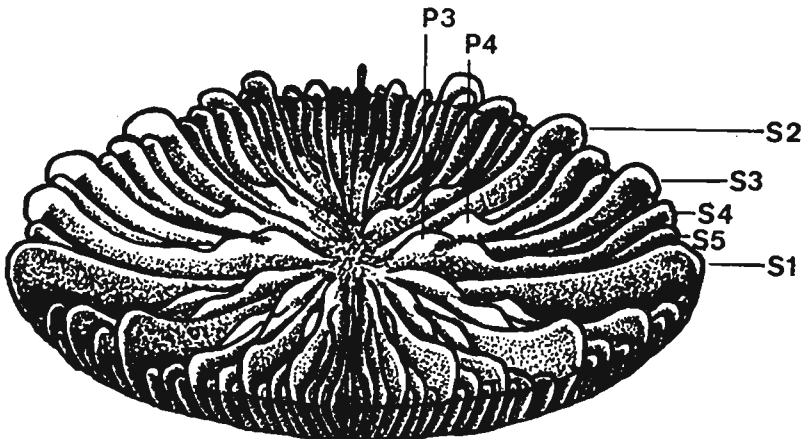


Fig. 3. Simplified reconstruction of *Stephanocyathus (S.) antiquus* sp. n.

Zigzag mid-septal zone and secondary trabeculae also occur in *Stephanocyathus spinosus* (Osasco, 1897: Chevalier 1961). Floris (1972) has found a dark mid-line in the studied specimens of his *Stephanocyathus* (*Stephanocyathus*) sp.

Within recrystallized septal blades (ZPAL H II/3) borings of endolithic algae have been recognized (pl. 7: 3).

Remarks.—On the proximal side of the specimen ZPAL H II/3 (pl. 7: 1b), damages are visible mainly on the C1—2. These costae were presumably more exsert than the others and therefore were more vulnerable. The theca is almost completely damaged (preserved remains — pl. 5: 1a). Because of the absence of any costal modifications as stout spines, the described species is included to subgenus *Stephanocyathus* (*Stephanocyathus*).

The slightly oblique thin section ZPAL H II/1 shows that distal margin of theca is in the highest position near S1—2, together with the nearest S5. This suggests a similar nature of septal exsertion and corresponding "elevation" of the wall side profile to those in Recent forms (pl. 6: 1a, 2a).

It is possible that in the specimen ZPAL H II/3 a depression developed (pl 5: 1a; pl. 7: 1b) in the center of its proximal side just as in the Recent specimen of *S. laevifundus* Cairns, 1977 (pl. 6: 1d).

Relatively well preserved specimen ZPAL H II/1 shows a bilateral symmetry of the corallum, which exists in many of the Recent species of *Stephanocyathus* (see Cairns 1977, Zibrowius 1980, and pl 6: 2c). The plane of symmetry is defined by two opposing S1 (fig. 2). Paliform lobes (mainly P3) adhering to septa lying in the plane of symmetry bend toward this plane.

The newly established species, *S. antiquus* sp. n. reveals a number of features that exist in Recent species of *Stephanocyathus*. The species is similar to *S. laevifundus* in number of radial elements, relatively small diameter, and in development of paliform lobes. It differs, however, from *S. laevifundus* in many features: it has better developed costal part of radial elements, the distal parts of S1—2 septa do not reach columella, and P1—2 paliform lobes are absent. The here described species differs from the Recent *S. crassus* (Jourdan, 1895) and *S. nobilis* (Moseley, 1873) in having a complete S5 cycle. From *S. nobilis* it also differs in its patellate corallum.

Stephanocyathus (*S.*) sp. described by Floris (1972) from Maastrichtian of Greenland is too poorly preserved for a detailed comparison with other species of *Stephanocyathus*. However, pali or paliform lobes in front of S2 (and S3) and lack of lobes in front of S4 distinguish the Greenland form from *S. antiquus* sp. n.

It seems that microstructural and morphological similarities to Recent forms evidence a low evolutionary rate in the genus *Stephanocyathus*.

Distribution.—In the Tatra Mts—Albian of the High-Tatric series (glauconitic limestones—Kominy Dudowe and Żeleźniak gully sections).

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KREDOWY *STEPHANOCYATHUS* (SCLERACTINIA) Z TATR

Streszczenie

W pracy opisałem nowy gatunek koralowca osobniczego *Stephanocyathus* (*Stephanocyathus*) *antiquus* sp. n. z wapieni glaukonitowych albu (kreda dolna) Tatr (pl. 5—8; fig. 2). Została przez to rozszerzona dolna granica zasięgu stratygraficznego rodzaju *Stephanocyathus* dotychczas znanego od mastrychtu (kreda górna) do dziś (Floris 1972).

Porównałem cechy morfologiczne i mikrostrukturalne nowo opisanego gatunku z analogicznymi cechami kilku współczesnych gatunków rodzaju *Stephanocyathus*. Nowy gatunek badałem w szlifach seryjnych i w płytkach cienkich. Stwierdzony już wcześniej dla okazu ZPAL H II/1 distichophylliidowy typ mikrostruktury (Roniewicz 1984) mający filogenetyczną kontynuację w mikrostrukturach współczesnych przed-

stawicieli rodziny Caryophyllidae, między innymi u współczesnych gatunków rodzaju *Stephanocyathus* (patrz Sorauf i Podoff 1977, oraz pl. 7: 4), uzupełnia morfologiczne cechy pozwalające zaliczyć posiadane kopalne okazy do rodzaju *Stephanocyathus*.

EXPLANATION OF PLATES 5—8

Plate 5

Stephanocyathus (Stephanocyathus) antiquus sp. n. ZPAL H II/3 paratype, scale bar 0.5 cm

1. *a—h*: a series of transverse sections from proximal part (*a*) to distal part (*h*) of the corallum. In lower-right corners cumulative distances (in mm) are given. The same pair of S1 septa is indicated in all photographs. The specimen is partly damaged and in some sections only some radial elements are visible—particularly S5 are poorly marked. In 1c note joining between S5 and S4 (arrow) and “blistered” extensions (B) on the axial margin of the S3 septum comparable to paliform teeth in *Stephanocyathus (S.) laevifundus* Cairns, 1977 (see pl. 6: 1b—c).

Plate 6

Recent representatives of *Stephanocyathus*

Stephanocyathus (Stephanocyathus) laevifundus Cairns, 1977

1. USNM 46382 (13°21'N, 61°03'W; 576—842 m): *a* lateral view; *b* oblique distal view: note paliform lobes; *c* distal view: note small paliform teeth on the axial margin of the S1—S2—S3 septa; *d* proximal view.

Stephanocyathus (Stephanocyathus) diadema (Moseley, 1876)

2. USNM 46343 (23°49'N, 75°49'W; 1853 m): *a* lateral view; *b* oblique distal view; *c* distal view: the principal septa are marked; *d* proximal view: note strong C1—2 in comparison with C1—2 in *Stephanocyathus (S.) laevifundus* Cairns, 1977 (see pl. 6: 1d).

All specimens \times ca. 1.5

Plate 7

Stephanocyathus (Stephanocyathus) antiquus sp. n.

1. ZPAL H II/3 paratype: *a* transverse section, \times ca. 1.5; *b* proximal view: costal part of S1—2 septa are damaged (two of them arrowed), \times ca. 1.5; *c* lateral

view, \times ca. 1.5; *d* enlargement of recrystallized septum with marked borings of endolithic algae (EA), \times ca. 140. See also pl. 5: 1 a—h.

2. ZPAL H II/1 holotype: transverse thin section. S1 septa marked on pl. 8, fig. 1a are arrowed. See also fig. 2 and pl. 8: 1 a—c.

Stephanocyathus (Stephanocyathus) laevifundus Cairns, 1977

3. USNM 46382 (13°21'N, 61°03'W; 576—842 m): transverse thin section through the S1 septum showing mid-septal zone forming zigzag line composed of small trabeculae, \times ca. 75.

Plate 8

Stephanocyathus (Stephanocyathus) antiquus sp. n.

1. ZPAL H II/1 holotype: a thin section, *a* fragment with S1 arrowed in pl. 7: 2. Two fragments (B and C) are enlarged in fig. 1b and fig. 1c; *b* enlargement of S4 showing mid-septal zone composed of closely spaced vestiges of trabeculae, about 10—20 μ m in diameter (measured between centers of vestiges); *c* enlargement of S1 showing mid-septal zone in form of a dark, zigzag line with poorly distinguished vestiges of trabeculae and secondary trabeculae (arrowed). See also pl. 7: 2.

