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ON A NEW RHIPIDOGYRIN GENUS, *DIPLOCOENIELLA* (SCLERACTINIA, LOWER CRETACEOUS)

Elżbieta MORYCOWA

Institute of Geological Sciences, Jagiellonian University, ul. Oleandry 2a, 30-063 Kraków, Poland

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Abstract: *Diplocoeniella* gen. n. is newly described from the Barremian and Lower Aptian of the Polish Outer Carpathians. This genus includes cerioid colonies, plocoid in appearance, characterized by intracalicular budding, septoparathecal wall of corallites, costosepta consisting of branching trabeculae, typical of rhipidogyrin corals, styliform columella, extended, tabuloid dissepiments. One new species of this genus, *Diplocoeniella gerochi* sp. n. is described herein.

Abstrakt: Koralowce *Diplocoeniella* gen. n. pochodzą z utworów barremu i dolnego aptu polskich Karpat Zewnętrznych. Nowy rodzaj obejmuje kolonie cerioidalne o wyglądzie plokoidalnym, charakteryzujące się pączkowaniem wewnątrzkielichowym, septoparatekalną ścianą koralitów, kostoseptami zbudowanymi z rozgałęzionych trabekul typowych dla koralowców z podrzędu Rhipidogyrina, słupkiem właściwym i tabuloidalnymi dissepimentami. Z rodzaju *Diplocoeniella* opisano tu jeden nowy gatunek *Diplocoeniella gerochi.*

Key words: corals, Scleractinia, *Diplocoeniella*, Polish Outer Carpathians, Barremian, Lower Aptian, new genus, new species.

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INTRODUCTION

The corals described here as the new genus *Diplocoeniella*, occur in Barremian and Lower Aptian conglomerates of the Polish Carpathians (Fig. 1). The corals have been redeposited from their original environment by mass movements such as cohesion flow or dense turbidity currents. The corals are penesynchronous with their host sediments and are derived from shallow-water and marginal parts of the flysch basin.

The corals were found in two localities (Fig. 1). They occur in conglomerates of the Grodziszcze Beds (Subsile-

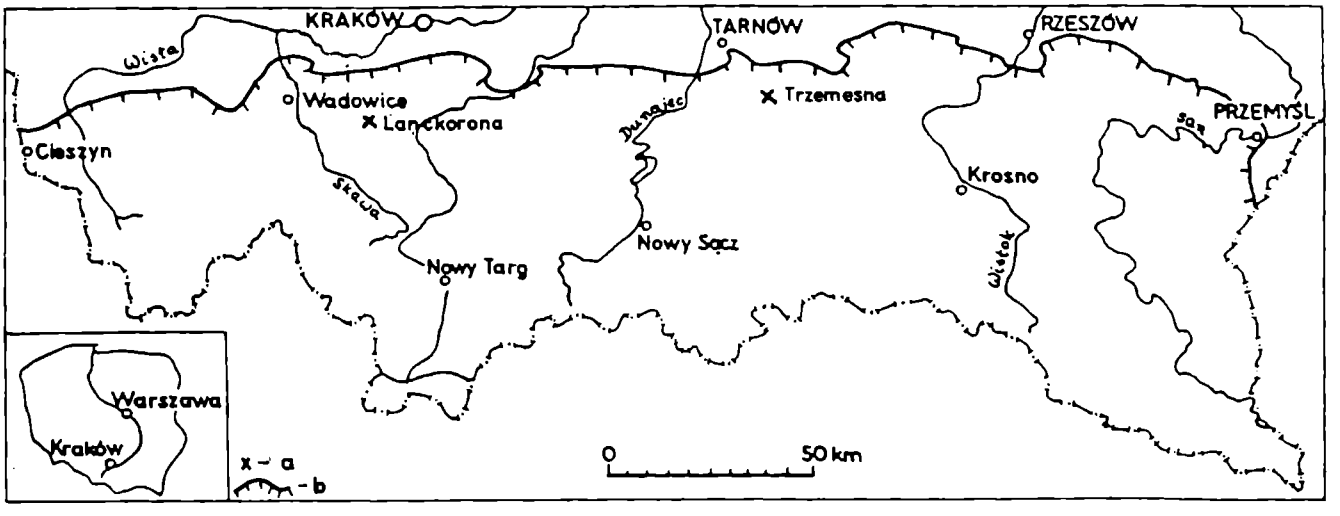

Fig. 1. Location of the outcrops with *Diplocoeniella gerochi* gen. et sp. n. in the Polish Outer Carpathians (Jastrzębia and Trzemesna): *a* – outcrop; *b* – margin of the Carpathian thrusts

sian Unit) at Jastrzębia, 1.5 km east of Lanckorona. Their age was established on the basis of ammonites as early Aptian (Książkiewicz, 1951; see also Morycowa, 1964). A second outcrop is located at Trzemeśnia, about 15 km south of Tarnów, comprising conglomerates of the Grodziszcze Beds (Silesian Unit). The age of these deposits, established on the basis of foraminifers, is late Barremian (L. Koszarski, *personal communication*; see also Morycowa, 1964).

The collection of corals is housed at the Institute of Geological Sciences, Jagiellonian University, Kraków, abbreviated as UJ 4P/ 29, 30.

SYSTEMATIC PALEONTOLOGY

Class ANTHOZOA Ehrenberg, 1834
Order SCLERACTINIA Bourne, 1900
Suborder RHIPIDOGYRINA Roniewicz, 1976

Family PLACOPHYLLIIDAE Eliášová, 1990

Diagnosis of the family Placophylliidae (Eliášová,1990, p. 121): "Polypiers massifs ou rameux. Costoseptes en systèmes égaux à symètrie radiaire qui peut être modifiée par une columelle aplatie en une pseudo-symétrie bilatérale. Éléments radiaires exerts, libres, bicunéiformes, à partie costale large. Bord interne claviformes. Faces latérale subglabre. Columelle styliforme ou aplatie. Muraille parathécale épicostale ou septoparathécale. Dissépiments vésiculeux. Bourgeonnement extracalicinal. Microstructure à trabécules néorhipidacanthes."

Emended diagnosis of the family Placophylliidae: Costosepta disposed in radial or pseudobilateral symmetry (caused by elongated columella). Claviform internal edge of septa. Lateral faces of radial elements covered by small granules or nearly smooth. Columella present or absent. Endotheca or endotheca and exotheca dissepimental. Budding inter- and/or intracalicular Microstructure rhipidogyrin-type.

Remarks: Several features given by Eliášová as diagnostic of the family Placophylliidae can be considered as diagnostic for genera only, such as intercalicular budding, vesicular dissepiments, the form of columella. An emended diagnosis of the family Placophylliidae is proposed here. This emended diagnosis will allow the inclusion into this family of other genera, such as *Diplocoeniella* n.gen. and *Pseudoironella* Sikharulidze.

Eliášová (1990, p. 121) included the genera *Placophyllia* d'Orbigny and *Diplocoenia* de Fromentel in the family Placophylliidae. The microstructure and systematic position of the genus *Diplocoenia* have not been sufficiently documented or definitely established. Vaughan and Wells (1943) and Wells (1956) placed this genus in the family Faviidae (suborder Faviina), and Alloiteau (1952) in the family Smilotrochiidae (suborder Meandrina). Later this genus has been included in the family Isastraeidae (suborder Astraeoina: Alloiteau, 1958; Morycowa, 1964, 1971; Turnšek 1981). Roniewicz (1976) placed this genus into the group "Incertae sedis".

Genus *Diplocoeniella* nov.
Type species: *Diplocoeniella gerochi* gen. et sp. n.

Etymology: *Diplocoeniella* – from the genus *Diplocoenia* (with which specimens of the new genus are confused), and from ellus (Lat.: *ellus, -a,-um*) -diminutive.

Diagnosis: Cerioid colonies, plocoid in appearance. Intracalicular budding (division) without septal connections between centres of corallites and occasionally marginal budding. Septoparathecal wall of corallites and internal parathecal pseudowall. Costosepta consist of mini and medium size branching trabeculae, typical of rhipidogyrin corals. Lateral faces of radial elements are covered by small granules. Columella styliform. Endotheca are composed of tabuloid dissepiments. The genus is monotypic.

Remarks: The new genus *Diplocoeniella* differs from all other genera of the suborder Rhipidogyrina. Some similarity, in external appearance only, can be seen between the genera *Diplocoeniella* gen. n. and *Pseudoironella* Sikharulidze (Sikharulidze, 1979, p. 26; Albian, Georgia), *Ironella* Krasnov & Starostina, 1970 (from the Upper Jurassic of the Caucasus) and *Ogilvinella* (= *Ogilviella* Eliášová,1973, 1976; from the Tithonian of the Western Carpathians) (Tab.1).

Diplocoeniella gen.n. unlike the *Pseudoironella* possesses a

Table 1

Comparison of some generic features of *Diplocoeniella gerochi* gen. et sp. n. and *Pseudoironella* Sikharulidze, *Ironella* Krasnov et Starostina and *Ogilvinella* Eliášová (Rhipidogyrina); dissep. – dissepiments; intercal. – intercalicular budding; intracal. – intacalicular budding

Genera	Type of colony	Budding	Septes lonsdaleoid	Wall	Columella	Endotheca	Exotheca
Diplocoeniella gen. n.	cerioid	intracal. (rare marginal)	–	septoparatheca	styliform	tabuloid	–
Pseudoironella Sikharulidze, 1979	plocoid	intercal.	–	septotheca	parietal	tabuloid	rare dissep.
Ironella Krasnov et Starostina	plocoid	intracal.	present (see Krasnov & Starostina, 1970, pl. 5, fig. 2a)	paratheca	absent	vesicular (after Sikharul, 1979)	vesicular (well develop)
Ogilvinella Eliášová 1973	plocoid	intercal.	non typic, sporadic	septoparatheca	lamellar	vesicular	dense, vesicular

cerioid form of colony (in appearance only plocoid), well-developed styliform columella and intracalicular budding. *Pseudoironella* is plocoid, it has parietal columella and is characterised by intercalicular budding.

The genus *Diplocoeniella* differs from the genus *Ironella* in: 1) the cerioid form of the colony (in *Ironella* – plocoid colony), 2) tabuloid endotheca (according to Krasnov & Starostina (1970), *Ironella* has vesicular exotheca; according to Roniewicz (1976), endotheca is tabuloid and vesicular); exotheca with trabecular layers in places, 3) the absence of lonsdaleoid septa (in *Ironella* lonsdaleoid septa present; see Krasnov & Starostina, 1970, pl. 5, fig. 2a), 4) the presence of well-developed columella (according to Krasnov & Starostina (1970), in *Ironella* these are absent; according to Roniewicz (1976) and Sikharulidze (1979) they are absent or rudimentary).

Diplocoeniella gen.n. differs from the genus *Ogilvinella* in: 1) the cerioid form of the colony (plocoid in *Ogilvinella*), 2) budding (intercalicular budding in *Ogilvinella*), 3) tabular endotheca (instead of large vesicular endo- and exotheca in *Ogilvinella*), 4) styliform columella, round in transverse section (lamellar columella in the *Ogilvinella*), 5) the absence of lonsdaleoid septa (in *Ogilvinella* rare "non-typical" lonsdaleoid septa are present; see Eliášová, 1973).

I give below the original diagnosis of the genus *Diplocoenia*, after de Fromentel, 1857 (p. 38–39) and reproduce in Fig. 5g the original photo of the *Diplocoenia mirabilis* de Fromentel (de Fromentel, 1857, pl. 5, fig. 8), the type species of the genus *Diplocoenia*, because the specimens of the new genus *Diplocoeniella* were confused with those of *Diplocoenia*.

"Polypier pédiculé, étalé en lames minces. Plateau inférieur recouvert par une forte épithèque plissée concentriquement. Chaque polypiérite a deux muraille, l'une saillante columnaire cachée par les cloisons, mais indiquée par bourrelet circulaire; l'autre pariétale, visible, séparant les côtes et soudée aux murailles voisines semblables. Les cloisons sont épaisses, entières, et se continuent avec les côtes. La columelle est forte et styliforme. La multiplication a lieu par gemmation submarginale et à la périphérie du polypier".

In this diagnosis only morphological features are considered. However, modern studies are based not only on morphology, but also on the microstructure of skeletons. The author had the opportunity to view, many years ago, *Diplocoenia mirabilis* de Fromentel, the type species of the genus *Diplocoenia* which now could not be found in the Fromentel collection (Dr Barta-Calmus, Museum of Natural History, Paris – *personal communication*). However, in that collection *Diplocoenia saltensis* de Fromentel, 1862 is present (No MO3609, Sault – Lower Aptian). The morphology of corallites of *D. mirabilis* and *D. saltensis* is similar. Unfortunately, the microstructure of these specimens is not preserved. Figure 6f in this paper presents a fragment of the calicular surface of above mentioned *D. saltensis*, and Figures 6d and 6e present transverse and longitudinal sections od *Diplocoenia* aff. *coespitosa* (Etallon) (Lower Aptian; Morycowa, 1964). The microstructure of this specimen is also not preserved.

Diplocoeniella gerochi sp.n.
Figs. 2a, b; 3a–d; 4a–e; 5a–b; 6c

Holotype: ING 4P/29, Figs.: 3a–d; 4a–e; 5a, b; 6c.
Type-locality: Jastrzębia (Subsilesian Unit, Polish Outer Carpathians).
Type level: Lower Aptian (Książkiewicz, 1951; Morycowa, 1964), Grodziszcze Beds.
Etymology: Patronymic, in honour of the late Prof. Stanisław Geroch.
Paratype: ING 4P/30; Figs: 3b–c.
Type-locality: Trzemesna (Silesian Unit; Polish Outer Carpathians).
Type level: Barremian (Morycowa, 1964), Grodziszcze Beds.
Diagnosis: Two cycles of costosepta, with well-developed costal part and thickened in internal edge of septa of first cycle. Styliform columella, round in transverse section. Tabuloid dissepiments.
Material: Two colonies (No: UJ 4P/ 29 & UJ 4P/ 30) and four fragments of colonies; five thin sections (No: UJ 29a-b, 30a-c).
Dimensions (in mm):
Diameter of colonies: No 29: 95 x 55; No 30: 55 x 40.
Height of colonies: No 29: 55; No 30: 25.
Diameter of corallites: 1.5, rare to 2.5.
Diameter of calices: 0.8–1.2.
Distance beetwen calicinal centers: 1.3–2.7.
Number of costosepta: 12 (+ 1–3 rudimentary in the wall region).
Diameter of trabeculae: 40–90 μm.
Density of lateral trabeculae in transverse section: 4–7/250 μm.

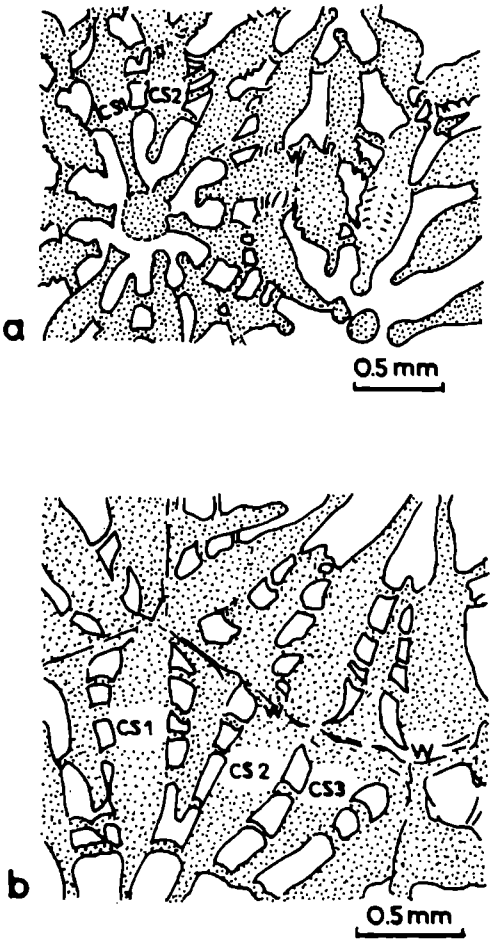

Fig. 2. **a** – *Diplocoeniella gerochi* gen. et sp. n. (Holotype No UJ 4P29). Note the weakly developed septoparathecal wall of adjacent corallites. It is made up of dissepiments and of costae of adjacent corallites, disposed alternately along a zigzag line. **b** – *Diplocoenia* aff. *coespitosa* (Etallon) (Polish Outer Carpathians. Collection UJ 4P28; Lower Aptian). Septoparatheca is made up of enlarged ends of costae projecting from neighbouring corallites and coming to mutual contact along a straight line. In some places there are also dissepiments; CS1, CS2, CS3 – costosepta of first, second and third cycles; w – wall

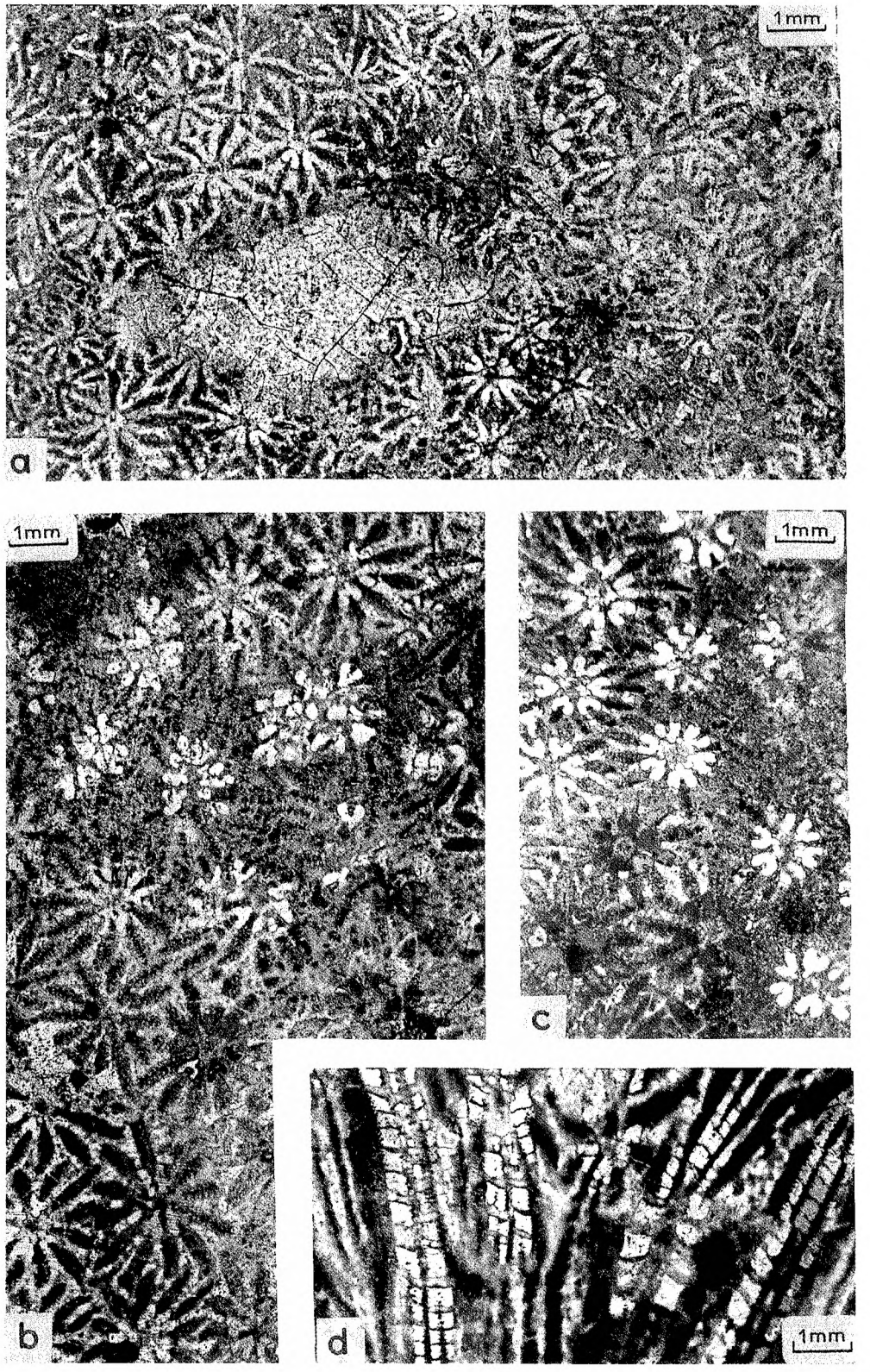

Fig. 3. *Diplocoeniella gerochi* gen. et sp. n.: Holotype No UJ 4P29, Jastrzębia – Lower Aptian. **a** – Transverse section of corallites (thin section No 4P29a; see also Morycowa, 1964, pl. 14, fig. 1c). **b, c** – Paratype UJ 4P30, Trzemesna – Barremian. b. Transverse section of corallites (thin section No 4P30a). c. Transverse section of corallites (thin section No 4P30b, see also Morycowa, 1964, pl. 14, fig. 3) showing corallite in the stage of intracalicular budding in the lower right-hand corner. **d** – Holotype (thin section No 4P 29b), longitudinal section showing tabuloid dissepiments of corallites (see also Morycowa, 1964, pl 14, fig. 1e)

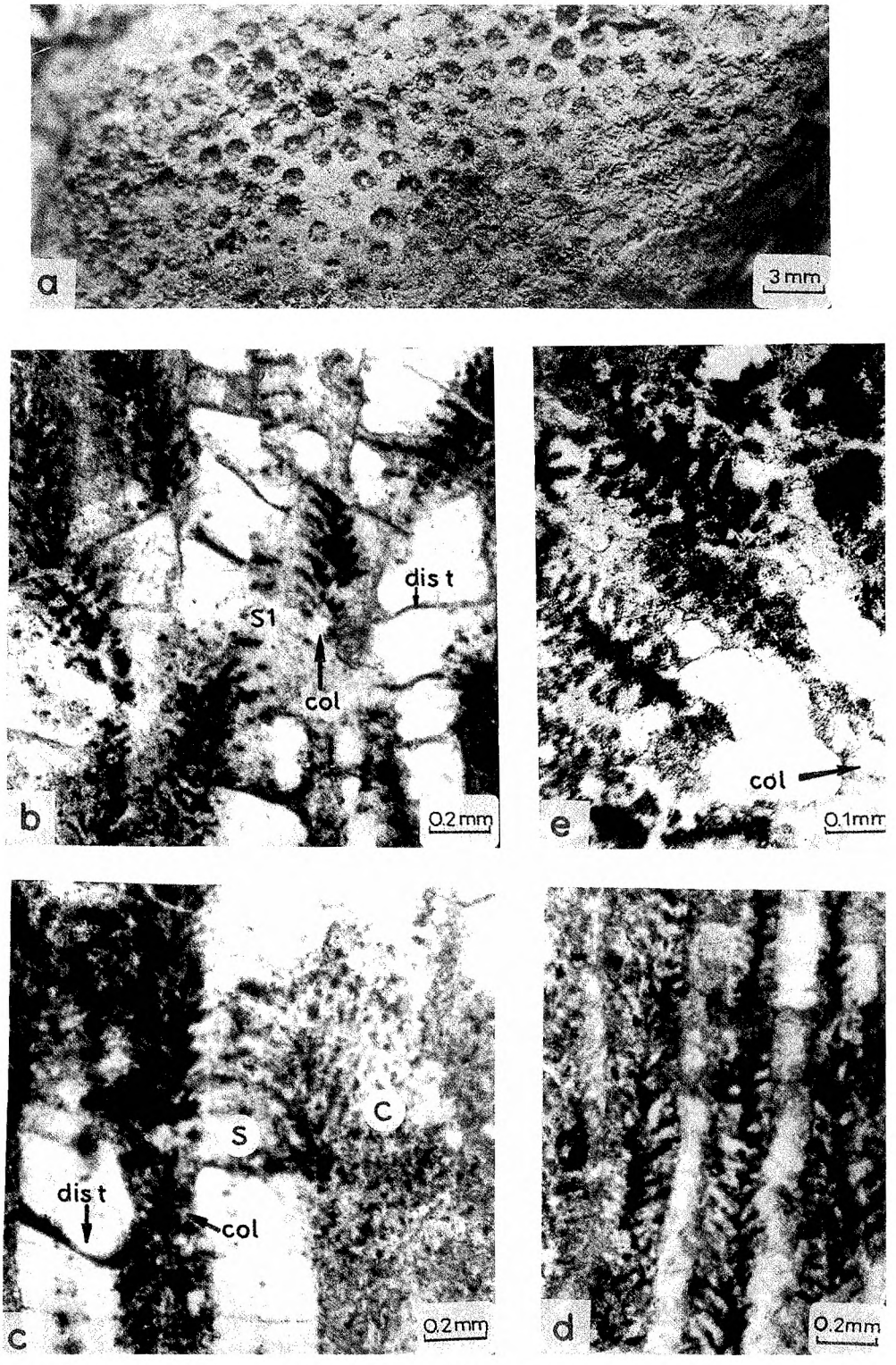

Fig. 4. *Diplocoeniella gerochi* gen. et sp. n.; Holotype No UJ 4P29. **a** – Fragment of the calicular surface of the colony (see also Morycowa, 1964, pl. 14, fig. 1a, 1b). **b-d** –Enlarged fragments of longitudinal thin section of corallites from Fig. 3d. b, showing tabuloid dissepiments (dis t), columella (col) built by branched trabecula, and costosepta with the septal trabeculae (S1) directed subhorizontally in the central zone of corallite. c. The same thin section showing subvertical trabeculae in the costal part (C), and subhorizontal trabeculae in the axial part of the septum (S). d. The same thin section, perpendicular to the septal blade; **e** – Paratype No UJ 4 P30. Transverse thin section (No 4P30c) of costosepta of two adjacent corallites with traces of branched trabeculae (black areas), claviform edge of septum and fragment of columella (col)

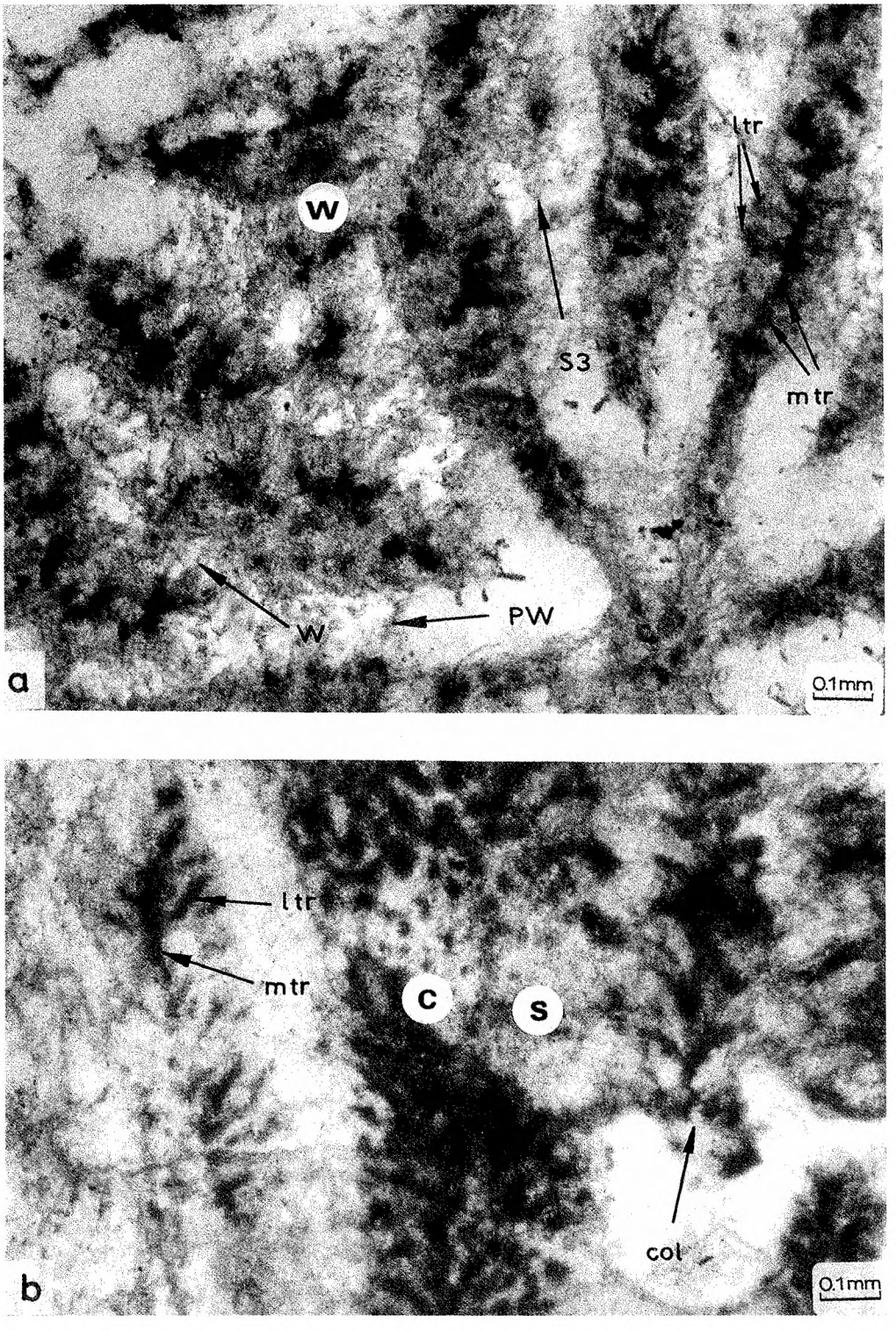

Fig. 5. *Diplocoeniella gerochi* gen. et sp. n.; Holotype No UJ 4P29. **a** – Fragment of the transverse thin section (No 4P29a) presented in Fig. 3a, showing the septoparathecal wall (W) between two neighbouring corallites, with septa S3 occurring in places (S3), pseudothecal wall (PW), the traces (black areas) of main trabeculae (m tr) and lateral (secondary) trabeculae (l tr) as well as the type of radial element ornamentation. **b** – Fragment of the longitudinal thin section presented in Fig. 3d (4P29b), showing columella (col) and trabeculae arranged in divergent system (c – costa, s – septum, in middle part of photo) and perpendicular section to septal blade (on the right). The traces (black areas) of main trabeculae (m tr) and lateral (secondary) trabeculae (l tr)

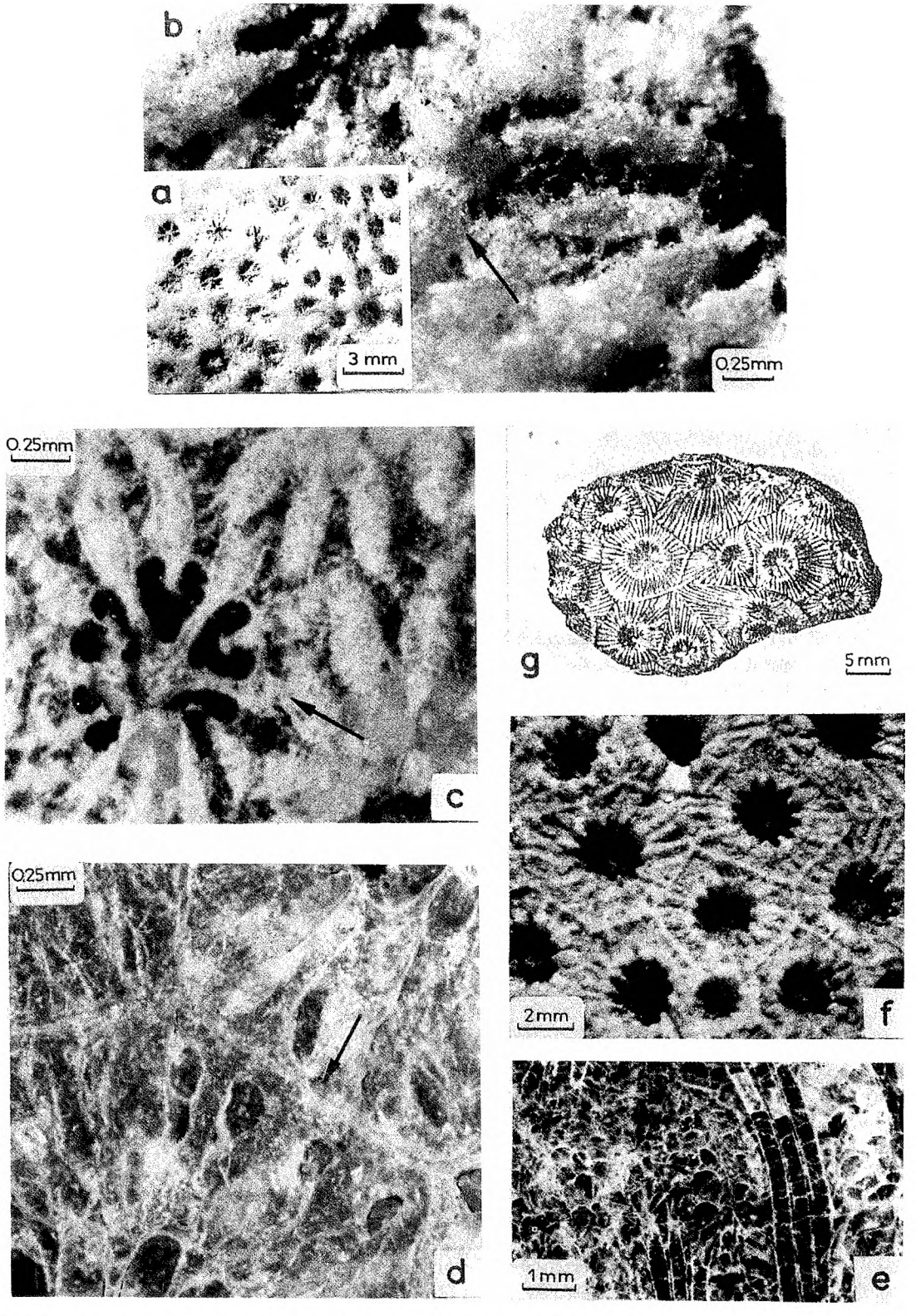

Fig. 6. *Diplocoenia stellata* (Etallon). **a** – Calicular surface of the hypotypoid (No D 4316; Museum of Natural History, Basel) described by Koby,1881, pl. 27, figs. 3, 3a (Berner Jura: St. Ursanne – Oxfordian). **b** – Detail of the same surface, showing the wall beetwen neighbouring corallites (arrow). **c** – *Diplocoeniella gerochi* sp. n., Holotype, No UJ 4P 29 (Jastrzębia: Lower Aptian). Note septoparathecal wall (arrow) of the adjacent corallites. **d** –*Diplocoenia* aff. *coespitosa* (Etallon) from the Polish Outer Carpathians (UJ 4P27, Jastrzębia – Lower Aptian). The wall of corallites is made up of enlarged ends of costae projecting from neighboring corallites (arrow). **e** – The same specimen. Longitudinal section showing vesicular dissepiments of the external zone of the corallites. **f** –*Diplocoenia saltensis* de Fromentel (holotype, collection: de Fromentel, No MO3609, Sault, France – Lower Aptian). Note well marked polygonal wall of corallites. **g** – *Diplocoenia mirabilis* de Fromentel (type species of the genus *Diplocoenia*; Saint Dizier – Hauterivian) presented by de Fromentel, 1857, pl. 5, fig. 8

Density of lateral trabeculae in longitudinal section: 4–6/250 μm.

Description: Cerioid colonies, plocoid in appearance. Calices circular, rather deep. Intracalicular budding (division) without trabecular connections and occasionally marginal budding. The wall of corallites is septoparathecal. It is made up of dissepiments and opposing ends of costa of adjacent corallites, disposed alternately along a zigzag line. This wall is frequentely well marked on the calicular surface of colony but not so well in transverse thin sections. The parathecal, internal pseudowall is generally well seen. Costosepta with well-developed costal part. Six septa of the first cycle (S1) reach the columella. At regular intervals the internal edges of septa are thickened laterally, assuming the shape of claviform, T-like form (or in places V-form), slightly resembling auriculae. Six septa of the second cycle (S2) attain about half the length of S1 and have no such enlargements. Sporadically, in the wall zone, very small radial elements of the third cycle occur. Lateral surface of radial elements covered by small sharp granules. Columella styliform, round in tranverse section. Endotheca composed of thin tabuloid dissepiments, flat in the central part, convex in the peripheral part of corallites.

Microstructure: Costosepta consist of mini to medium size (Morycowa & Roniewicz, 1995) branching trabeculae, typical of rhipidogyrin corals. The main trabeculae forming septal mid-line measure 40 to 90 μm in diameter. In the septal part they are arranged subperpendicularly to the axis of divergence. In the costal part they are arranged at a sharp angle.The lateral (secondary) trabeculae directed from this mid-line are densely and regularly spaced (Figs. 4d, e). The angle between the vertical axis of the main trabecula and the lateral trabeculae is about 40–70°. Columella consists of the branching trabecula.

Remarks: The new species was previously described and illustrated by Morycowa (1964) as *Diplocoenia stellata* (Etallon, 1859). In that paper, the author considered the species in question to belong to the genus *Diplocoenia*. However, some reservations arose from considerations of intracalicular, axial budding, only sporadically marginal budding and weakly delineated walls of corallites (see Morycowa l.c., p. 63). It was also suggested that more detailed comparison of the specimens from the Carpathians with the type specimen could determine the generic position of this species.

It was impossible to compare the Carpathian species with the original specimen of *Actinocoenia stellata* Etallon, 1859 (= *Diplocoenia stellata* (Etallon)), because the latter could not be found in the Etallon collection in the Museum of Natural History, Paris. Also no comparison could be made with the specimen described by Koby as *Diplocoenia stellata* (Etallon) (Koby, 1881, pl. 27, fig. 3, 3a; Museum Natural History, Basel, No. D 4316), which is poorly preserved. The previous identification was based exclusively on the morphology of the corallites (see Fig. 6a, b). Therefore, the present author decided to create a new species and new genus, on the basis of well preserved specimens from the Carpathians. The newly created species *Diplocoeniella gerochi* sp.n. is included in the family Placophylliidae, suborder Rhipidogyrina.

It is possible that some species previously determined as *Diplocoenia* (e.g., *Diplocoenia lobata* (Etallon, 1859), *D. minima* (Etallon, 1849); Koby, 1904) may be included in the new genus *Diplocoeniella*. This question requires further investigation.

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Streszczenie

DIPLOCOENIELLA, NOWY RODZAJ KORALOWCA Z PODRZĘDU RHIPIDOGYRINA (SCLERACTINIA, KREDA DOLNA)

Elżbieta Morycowa

Ustanowiony nowy rodzaj koralowca *Diplocoeniella* występuje w utworach barremu i aptu dolnego polskich Karpat zewnętrznych (Fig. 1). Gatunkiem typowym tego rodzaju jest *Diplocoeniella gerochi* sp.n.. Pozycja systematyczna nowego rodzaju *Diplocoeniella* jest możliwa do ustalenia na podstawie mikrostruktury szkieletu. Mikrostruktura ta jest typowa dla przedstawicieli podrzędu Rhipidogyrina.

Zbliżonym morfologicznie rodzajem jest *Diplocoenia* de Fromentel, 1857. Różnice pomiędzy rodzajami *Diplocoeniella* gen.n. i *Diplocoenia* de Fromentel, 1857, polegają na: 1) typie pączkowania (u *Diplocoenia* marginalne bez deformacji kielicha, u *Diplocoeniella* prawie wyłącznie osiowe, z deformacją kielicha), 2) wykształceniu ściany (septotekalna, wyraźnie prostolinijna u *Diplocoenia* i septoparatekalna, słabo zaznaczająca się, zygzakowata u *Diplocoeniella)*, 3) budowie endoteki (u *Diplocoenia* dissepimenta pęcherzykowate, dobrze wykształcone w partiach peryferycznych koralitów i płaskie w ich częściach środkowych; u *Diplocoeniella* – endoteka subtabuloidalna). Pozycja systematyczna rodzaju *Diplocoenia* nie jest dotychczas udokumentowana. Nie jest znana bowiem mikrostruktura szkieletu tego rodzaju. Vaughan i Wells (1943) umieścili ten rodzaj w rodzinie Faviidae (podrząd Faviina), Alloiteau (1952) – w rodzinie Smilotrochiidae (podrząd Meandrina), a następnie w rodzinie Isastraeidae, (podrząd Astraeoida) (Alloiteau, 1958; Morycowa, 1964, 1971; Turnšek, 1981). Roniewicz (1976) umieściła ten rodzaj w grupie „Incertae sedis", a Eliášová (1990), włączyła go do rodziny Placophyllidae (podrząd Rhipidogyrina).

Rewizja gatunków jurajskich i kredowych zaliczanych do rodzaju *Diplocoenia* jest niezbędna. Wydaje się, że niektóre gatunki, np. jurajskie opisane przez Koby'ego z Gór Jura (1881) mogą reprezentować *Diplocoeniella* lub jeszcze inny rodzaj.

Najbardziej zbliżonym rodzajem do *Diplocoeniella* gen.n. wydaje się być *Pseudoironella* Sikharulidze, 1979 (Tabl. 1).

Ze względu na podobieństwo morfologiczne szkieletu koralitów, gatunek *Diplocoeniella gerochi* sp.n. został wcześniej oznaczony (Morycowa, 1964) na podstawie porównań z okazem opisanym przez Koby'ego z jury górnej Gór Jura (Koby, 1881, pl. 27, fig. 3, 3a; Museum Natural History, Bazylea, coll. nr. D 4316), jako *Diplocoenia stellata* (Etallon, 1862). Ponieważ jednak mikrostruktura i typ pączkowania *D. stellata* z Gór Jura nie są znane z powodu zlego stanu zachowania tej kolonii, a studia porównawcze z holotypem tego gatunku (*Actinocoenia stellata* Etallon (Etallon, 1859; jura górna, koll. Etallona, Muséum National, d'Histoire Naturelle, Paryż) nie są możliwe do przeprowadzenia ze względu na zaginięcie okazu typowego, dlatego dobrze zachowane okazy z kredy dolnej Karpat opisano tu jako nowy gatunek. Wydaje się prawdopodobne, że *D. stellata* (Etallon) i *D. gerochi* reprezentują ten sam gatunek.