

# *Cyclothyris elegans* (VON HANSTEIN, 1879) and *Cretirhynchia tenuicostata* (VON HANSTEIN, 1879), two valid Lower Maastrichtian rhynchonellid brachiopods from the phosphatic chalk of Ciplly, Belgium

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## Abstract

This paper presents an emended description and illustrations of *Cyclothyris elegans* (VON HANSTEIN, 1879) and of *Cretirhynchia tenuicostata* (VON HANSTEIN, 1879). Lectotypes have been chosen. This *Cyclothyris* and this *Cretirhynchia* are distinct and valid species. *Cyclothyris elegans* is an uncommon species in the Lower Maastrichtian phosphatic chalk of Ciplly [*Belemnella obtusa* Zone] whereas *Cretirhynchia tenuicostata* is a much more common species.

**Key-words:** Brachiopods, Rhynchonellidae, Cretaceous, Lower Maastrichtian, Ciplly, Belgium.

## Résumé

Cet article donne une description détaillée de *Cyclothyris elegans* (VON HANSTEIN, 1879) et de *Cretirhynchia tenuicostata* (VON HANSTEIN, 1879), accompagnée d'illustrations. Un lectotype a été choisi pour chaque espèce. Cette *Cyclothyris* et cette *Cretirhynchia*, datées du Maastrichtien Inférieur [Zone à *Belemnella obtusa*], sont des espèces distinctes et valides. *Cyclothyris elegans* est une espèce peu commune dans la craie phosphatée de Ciplly tandis que *Cretirhynchia tenuicostata* est nettement plus courante.

**Mots-clefs:** Brachiopodes, Rhynchonellidae, Crétacé, Maastrichtien Inférieur, Ciplly, Belgique.

## Introduction

In 1879, VON HANSTEIN designated five new species of brachiopods from the phosphatic chalk of Ciplly: three terebratulid brachiopods [*Terebratula Cipllyensis* (*opus cit.* p. 21), *Terebratulina carinata* (*opus cit.*, p. 27) and *Terebratella Corneti* (*opus cit.*, p. 29)] and two rhynchonellid brachiopods [*Rhynchonella elegans* (*opus cit.*, p. 40) and *Rhynchonella tenuicostata* (*opus cit.*, p. 42)].

VON HANSTEIN (1879) described these species without illustrations. As a result, the species of VON HANSTEIN, with a few exceptions, were nearly forgotten or not recognized by other palaeontologists during a century.

An emended description of *Terebratula cipllyensis* with correct illustrations has been given by PERON (1894, p. 10, pl. V, fig. 9, 10, 11) and this species was also cited by LUNDGREN (1885, p. 57, pl. III, fig. 6). *Terebratulina carinata* was cited by STEINICH (1965, p. 55). *Terebratella corneti* has been revised by OWEN

(1977, p. 225) and it is presently known as *Ruegenella corneti* (VON HANSTEIN, 1879).

The rhynchonellid species of VON HANSTEIN were never referred to in more recent publications, such as the papers of PETTIT (1950) and of POPIEL-BARCZYK (1988). OWEN (1962, p. 61) indicated only that *Rhynchonella elegans* should be investigated.

The original material collected by VON HANSTEIN in Ciplly is preserved at the University of Bonn (Germany). All this material is in need of a revision in order to be correctly placed in the modern nomenclature.

This paper presents an emended description of *Rhynchonella elegans* and of *Rhynchonella tenuicostata* of VON HANSTEIN (1879) and illustrations of some of the original specimens are given on Plate 1 and 2. *Rhynchonella elegans* is registered in the Geological and Palaeontological Institute of the University of Bonn under the number: G.P.I.B.O.-HANSTEIN - 4, whereas *Rhynchonella tenuicostata* is registered under the number: G.P.I.B.O.-HANSTEIN - 5.

Taxonomy follows the Treatise on Invertebrate Paleontology, volume H, Brachiopoda (D. V. AGER in MOORE, 1965). The terminology of WILLIAMS & ROWELL (1965) is respected.

## Systematic description

- Phylum Brachiopoda DUMERIL, 1806
- Class Articulata HUXLEY, 1869
- Order Rhynchonellida KUHN, 1949
- Superfamily Rhynchonellacea GRAY, 1848
- Family Rhynchonellidae GRAY, 1848
- Subfamily Cyclothyridinae MAKRIDIN, 1955,  
emended OWEN 1962
- Genus *Cyclothyris* M'COY, 1844

TYPE SPECIES: *Terebratula latissima* J. DE C. SOWERBY, 1829

Specimens of *Rhynchonella elegans* of VON HANSTEIN (1879), from Ciplly, preserved in the Institut royal des Sciences naturelles de Belgique in Brussels, were opened.

The oval to subtriangular outline of the shell, the uniplicate anterior commissure, the distinct beak ridges and the well defined interarea, are typical features of the genus *Cyclothyris*. As internal characters, the radulifer crura, the absence of cardinal process and of septalium, the broad hinge plates, divided terminally, and the sub-parallel dental plates, are also typical of the genus *Cyclothyris*. This species must be named *Cyclothyris elegans* (VON HANSTEIN, 1879).

*Cyclothyris elegans* (VON HANSTEIN, 1879)

Plate 1, Figures 1-4.

\* 1879 *Rhynchonella elegans* sp. n. — VON HANSTEIN, R., p. 40.

LOCUS TYPICUS: Cibly, Province of Hainaut, Belgium.

STRATUM TYPICUM: Lower Maastrichtian, *Belemnella obtusa* Zone.

DESIGNATION OF A LECTOTYPE

VON HANSTEIN did not designate any type specimen. A lectotype is chosen among the three specimens of the type series of VON HANSTEIN kept in Bonn (reference:

G.P.I.B.O.-HANSTEIN: 4).

This lectotype is a large specimen corresponding with the original diagnosis. The chosen lectotype is illustrated on Plate 1, Fig. 2 a - e.

MATERIAL STUDIED

The type series of VON HANSTEIN (3 specimens), from the phosphatic chalk of Cibly, kept at the University of Bonn (Table 1).

Twenty-nine specimens from the phosphatic chalk of Cibly, kept in the collections of the Institut royal des Sciences naturelles de Belgique at Brussels (Table 2).

All these specimens were measured for their length (L in mm), width (W in mm), thickness (T in mm), apical angle (in degrees), number of costae (NC) and number of costae present on the fold and in the sinus (Tables 1 and 2). The shape of the foramen and the shape of the linguiform extension of the ventral valve were noted for each specimen.

EMENDED DESCRIPTION

External characters

Large hypothyriddid *Cyclothyris*, clearly subtriangular in outline with a dome-shaped anterior contour, and a slightly cuneiform lateral profile.

Table 1 — Morphological characters measured on the 3 specimens of *Cyclothyris elegans* (VON HANSTEIN, 1879) from the collection of VON HANSTEIN, preserved at the University of Bonn [G.P.I.B.O.-VON HANSTEIN-4]. Phosphatic chalk of Cibly (Lower Maastrichtian, *Belemnella obtusa* Zone). L: length (in mm), W: width (in mm), T: thickness (in mm), Ldv: length of the dorsal valve (in mm), Apic. Angle: apical angle (in degrees), NC: number of costae on the dorsal valve, NC sinus: number of costae in the sinus (ventral valve) and NC fold: number of costae on the fold (dorsal valve). (\*) = Lectotype.

	L mm	W mm	T mm	Ldv mm	Apic. Angle (°)	NC	NC sinus	NC fold
Coll. von Hanstein GPIBO-4	21.0	25.7	12.9	19.7	90	28	8	9
Coll. von Hanstein GPIBO-4	22.5	32.0	15.6	22.2	118	28	7	7
Coll. von Hanstein GPIBO-4 (*)	24.4	32.7	18.3	22.8	105	38	7	6

Table 2 — Morphological characters measured on 29 specimens of *Cyclothyris elegans* (VON HANSTEIN, 1879) from the phosphatic chalk of Cibly (Lower Maastrichtian, *Belemnella obtusa* Zone). This material is kept in the collections of the Institut royal des Sciences naturelles de Belgique at Brussels. L: length (in mm), W: width (in mm), T: thickness (in mm), Ldv: length of the dorsal valve (in mm), Apic. Angle: apical angle (in degrees), NC: number of costae on the dorsal valve, NC sinus: number of costae in the sinus (ventral valve) and NC fold: number of costae on the fold (dorsal valve).

	L mm	W mm	T mm	Ldv mm	Apic. Angle (°)	NC	NC sinus	NC fold
MINIMUM VALUE	20.0	23.9	11.5	17.6	81	29	7	7
MAXIMUM VALUE	29.8	42.0	25.8	26.7	105	59	13	13
MEAN VALUE	25.1	30.0	18.1	22.3	93.9	40.7	9.5	10.0
STANDARD DEVIATION	2.909	4.712	3.570	2.510	5.555	7.859	1.695	1.386
STANDARD ERROR	± 0.54	± 0.88	± 0.66	± 0.47	± 1.03	± 1.46	± 0.32	± 0.26

The dorsal valve is much more convex than the ventral valve, with a clearly developed anterior median fold. The ventral valve has a clearly visible anterior sinus. The linguiform extension of the ventral valve is quite long, broad (more or less 1/2 of the width of the shell), generally arcuate, often U-shaped, sometimes subrectangular and it turns sharply from about a 75° to 90° angle. Asymmetry of the anterior commissure is observed in some specimens.

The beak is relatively long, straight, and just slightly curved at its extremity. It is sharply pointed in outline and quite thick in lateral profile. The apical angle is narrow, and has a mean value of 94°. The foramen is relatively large and circular in 50 % of the specimens. The other specimens have an oval to suboval foramen. In dorsal view, the ventral interareas are slightly concave. On the contrary, the deltidium is clearly convex. The deltidial plates are conjunct, cyclothyrid. The beak-ridges and the interarea are distinct. The posterior commissure is wavy in the examined specimens.

The shell is coarsely costated on its whole outer surface. In transverse section, the costae are roof-shaped and the top of the costae is sharp. The costae situated on the anterior fold and in the corresponding sinus are broader than the costae situated on the lateral parts of the shell. The number of costae varies from 29 to 59, but is generally around 40. They are extremely fine near the umbo, become wider and wider towards the anterior commissure and their number remains constant. Very rarely, a few costae are dividing near the anterior commissure (observed for one specimen).

Seven to thirteen costae occur, on the fold, and in the sinus near the commissure. The sulci are broad and moderately deep.

A well marked growth-line is present near the umbo (more or less at a quarter of the length of the shell). Other growth-lines (if any) are faint and they are never step-like.

The ratio of length to width (L/W) has a minimum value of 0.68, a maximum value of 1.08, and a mean value of 0.85 ( $\pm 0.02$ ). The ratio of thickness to width (T/W) has a minimum value of 0.36, a maximum value of 0.83, and a mean value of 0.61 ( $\pm 0.02$ ). The ratio of length of the dorsal valve to width has a minimum value of 0.61, a maximum value of 0.97, and a mean value of 0.75 ( $\pm 0.01$ ).

#### Internal characters

##### Ventral valve

A long pedicle collar is visible in the serial sections of the beak (Figure 1). The umbonal cavities are oval in cross section. The dental plates are subparallel and quite thin anteriorly. The teeth are large, crenulated and deeply inserted in the socket ridges.

##### Dorsal valve

No cardinal process is developed. The hinge plates are slender, flat or slightly arched ventrally. The hinge plates are clearly forked, as seen in transverse section (Figure 1).

The inner and outer socket-ridges are well developed. The radulifer crura are relatively long and they are given off ventrally.

A median septum occurs, extending from the umbo and persisting over one third of the length of the valve floor. In a specimen investigated, the septum persists to one half of the length of the valve floor. This septum, which does not support the hinge plates, is very thin and remarkably high. Its length is exceptional for a *Cyclothyris*.

#### VARIABILITY OF THE MORPHOLOGICAL CHARACTERS DURING GROWTH

Early juvenile forms have not been available for study and the complete ontogenic development cannot be described. Nevertheless, smaller sized specimens from Ciply are available. During the growth, the convexity of the dorsal valve increases. In outline, younger specimens are triangular, whereas adults are more transversely oval. During growth, the width increases much more than the length. The shape of the linguiform extension does not vary during the growth.

#### COMPARISON WITH OTHER SPECIES OF *CYCLOTHYRIS*

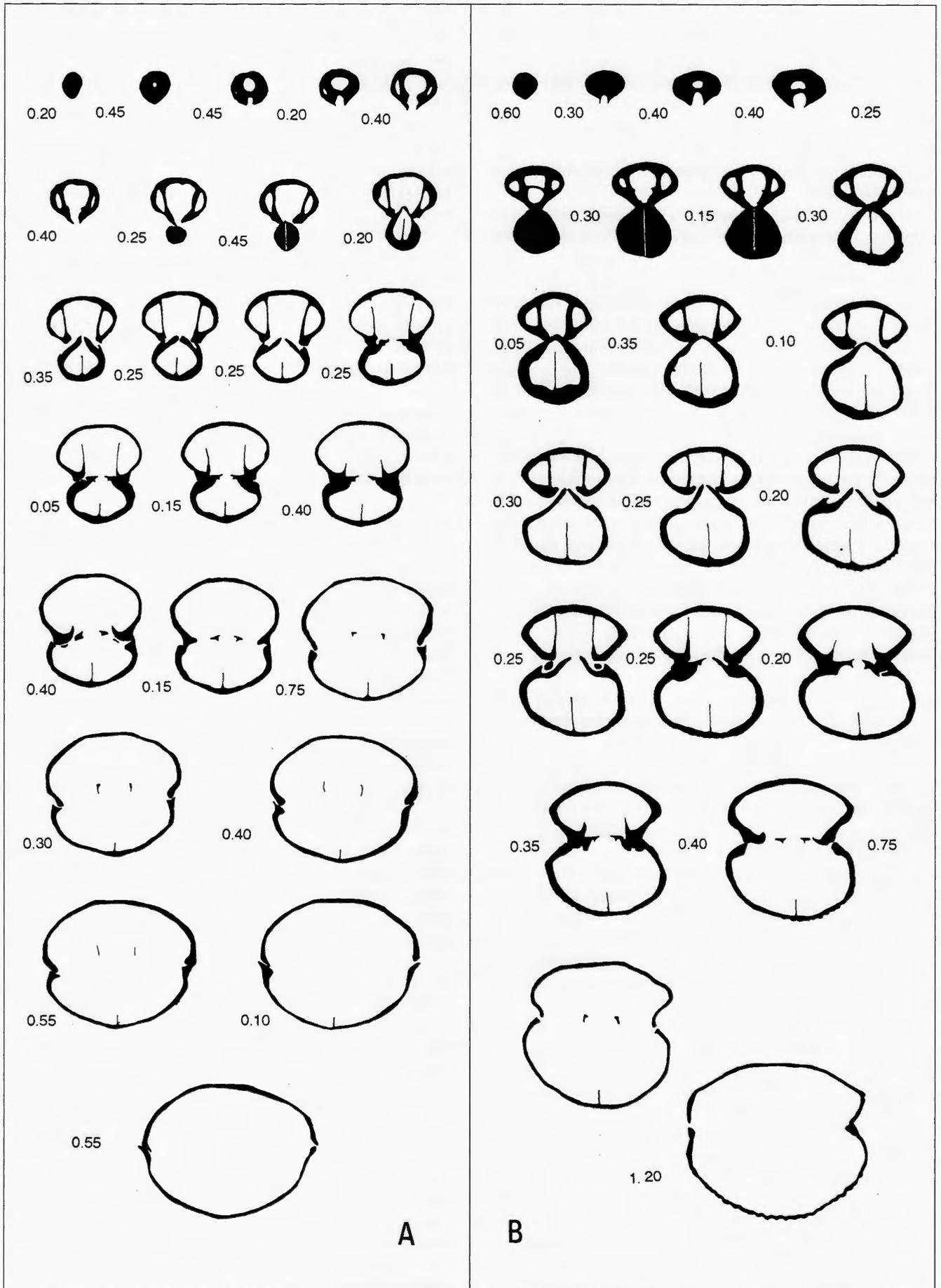
*Cyclothyris elegans* (VON HANSTEIN, 1879) is a fairly variable species and some specimens are sometimes similar to *Cyclothyris difformis* (VALENCIENNES in LAMARCK, 1819) or to *Cyclothyris compressa* (VALENCIENNES in LAMARCK, 1819). Externally, *Cyclothyris elegans* (VON HANSTEIN, 1879) can be distinguished from these species by its costae present on the fold and in the sinus. In *Cyclothyris elegans* (VON HANSTEIN, 1879) these costae are broader than the costae present on the lateral parts of the shell. Generally, the intervening sulci are also broader on the fold and in the sinus. Moreover, the costae of *Cyclothyris difformis* (VALENCIENNES in LAMARCK, 1819) are interrupted by step-like growth-lines whereas in *Cyclothyris elegans* (VON HANSTEIN, 1879) only one growth-line, near the umbo, is clearly visible on the shell. Other growth-lines (if any) are very faint. OWEN (p. 44, 1962) already pointed out that the type and position on the valves of growth-lines is regarded as a specific character.

*Cyclothyris compressa* (VALENCIENNES in LAMARCK, 1819) has stronger angular costae.

Internally, *Cyclothyris elegans* (VON HANSTEIN, 1879) is immediately distinguished from the other described species by its longer, thin septum. The crura of *Cyclothyris elegans* are also longer.

#### STRATIGRAPHICAL RANGE OF THE GENUS *CYCLOTHYRIS*

The type species *Cyclothyris latissima* (J. DE C. SOWERBY, 1829) is of Aptian age. PETTIT (pl. 1, 1950) selected and illustrated a lectotype for this species. This author indicated that the septum is absent or very feeble in this species and he pointed out that further investigation is necessary before the name *Cyclothyris*, strictly applicable to the Aptian *latissima* group, can be applied to Cenomanian and later species (PETTIT, p. viii, 1950).



But, OWEN (p. 44, 1962) interpreted the genus as a variable group in which the median septum is short and does not support the hinge-plates. The stratigraphical range of the genus *Cyclothyris* was therefore extended to Albian and Cenomanian species. For OWEN (p. 61, 1962), *Cyclothyris* probably died out in the Upper Cenomanian with *C. compressa*.

Nevertheless, more recent rhynchonellid brachiopods have been referred to the genus *Cyclothyris*.

KATZ (1974), for instance, estimated that *Cyclothyris* species are also present in Turonian and Maastrichtian sediments. POPIEL-BARCZYK (p. 16, 1988) described and illustrated a *Cyclothyris* sp. from the Campanian and the Maastrichtian of the Middle Vistula River valley in Poland. She made serial sections of two specimens in which a pedicel collar, subparallel dental plates, typical hinge-plates and a short median septum were visible.

Recently, RADULOVIC & RAMAMOORTHY (p. 81, 1992) described a new *Cyclothyris* sp. from the Early Maastrichtian of the Dalmia mines, near Ariyalur, Tamilnadu State, South India. This determination was only based on the external characters and no serial sections have been made.

The present study of *Cyclothyris elegans* shows that this species possesses all the typical features of the genus as presented by OWEN (1962). The only striking difference, is the presence of a longer median septum in the dorsal valve of *C. elegans*. The stratigraphical range of the genus *Cyclothyris* in Western Europe is consequently extended to the Maastrichtian.

It is interesting to pay attention to the structure of the median septum and mainly to its posterior part. The septum of *Cyclothyris elegans* is directly visible, in serial sections (Figure 1), through the shell structure in the umbo of the dorsal valve. The posterior part of the septum completely divides the umbo of the dorsal valve in two equal parts. A similar structure is visible in the serial sections of *Cyclothyris difformis* (OWEN, fig. 8 p. 53, 1962). On the contrary, the specimens of *Cyclothyris* sp. illustrated in the serial sections of POPIEL-BARCZYK (fig. 17, 18 p. 17, 1988) exhibit a median dorsal septum which is extremely small in the umbo of the dorsal valve. The septum, in this case, does not divide completely the umbo of the dorsal valve.

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Fig. 1 — Serial sections in two specimens of *Cyclothyris elegans* (VON HANSTEIN, 1879) from Ciply, phosphatic chalk, Lower Maastrichtian, *Belemnella obtusa* Zone.

A: Fully adult and intact specimen with an asymmetrical anterior commissure (Length: 23.2 mm, width: 30.0 mm). This specimen is illustrated Plate 1, Fig. 3 a-e.

B: Larger adult specimen (Length: 25.1 mm, width: 33.0 mm). For its size and its general outline, this gerontic specimen is comparable to the lectotype. For the two specimens, the pedicel collar, the subparallel dental plates and the forked hinge plates are well visible.

This character indicates a possible relation between *Cyclothyris elegans* and some Cenomanian species such as *Cyclothyris difformis* while *Cyclothyris* sp. from Poland should be closer to Aptian and Lower Albian species.

The median septum is absent or very feeble in the Aptian representatives of the *latissima* group. But it is clearly developed in the Lower Albian species such as *Cyclothyris antidichotoma* (BUVIGNIER, 1842). Specimens of *Cyclothyris antidichotoma* (BUVIGNIER, 1842) from the Upper Aptian have a less developed septum than the specimens from the Lower Albian (OWEN, fig. 5, p. 48, fig 6, p. 49, 1962). Moreover, the septum becomes more developed and longer in Cenomanian species (OWEN, fig 8, p. 53, 1962). Therefore, a further development of the dorsal septum, through Turonian and more recent species, can be taken into account. But, the specimens studied by POPIEL-BARCZYK (1988) indicate that other *Cyclothyris* species, conserving the original very short and feeble septum, were still present during the Maastrichtian in Poland. This indicates that, probably, two different groups of *Cyclothyris* were present during the Maastrichtian in Europe.

Therefore, a splitting of the genus *Cyclothyris* could be envisaged, but possible Turonian, Coniacian, Santonian and Campanian species must be, at first, carefully studied for their internal structure.

A splitting of the genus *Cyclothyris* was made in 1977 by LOBATSHEVA & TITOVA, who designated the genus *Septatoechia*. A recent study of *Septatoechia* and a restriction of its stratigraphical range were published by MOTCHUROVA-DEKOVA in 1994 (p. 27). The type-species is *Septatoechia inflata* TITOVA, 1977 from the Maastrichtian of Turkmenia. This species has a relatively small foramen, a very high and long septum and subparallel to slightly convergent dental plates. However, the specimen sectioned by LOBATSHEVA & TITOVA (fig. 1, p. 104, 1977) does not show the typical forked hinge plates observed in the representatives of the genus *Cyclothyris*. There is no visible pedicel collar in the beak of *Septatoechia inflata* TITOVA, 1977 as it is always observed in the different species of *Cyclothyris*.

Externally and internally, *Cyclothyris elegans* (VON HANSTEIN, 1879) has much in common with *Septatoechia inflata* TITOVA, 1977. But, *Cyclothyris elegans* (VON HANSTEIN, 1879) has a pedicel collar, strongly divided hinge plates and ventrally arched hinge-plates like the representatives of the genus *Cyclothyris*.

For these reasons, the author thinks that the species of VON HANSTEIN is better placed in the genus *Cyclothyris*. Further investigations concerning the genus *Septatoechia* should be useful.

#### Genus *Cretirhynchia* PETTITT, 1950

TYPE SPECIES: *Terebratula plicatilis* J. SOWERBY, 1816

Specimens of *Rhynchonella tenuicostata* of VON HAN-

STEIN (1879), from Cibly, preserved in the Institut royal des Sciences naturelles de Belgique in Brussels, were opened. The general outline of the shell, the lack of a pedicle collar, the presence of a persistent septum in the dorsal valve, the radulifer crura, the absence of cardinal process and of septalium, the broad and convergent hinge plates and the striated large dental sockets, indicate that this species is a representative of the genus *Cretirhynchia*. This species must be named *Cretirhynchia tenuicostata* (VON HANSTEIN, 1879).

*Cretirhynchia tenuicostata* (VON HANSTEIN, 1879).  
Plate 2, Figures 1 - 6.

\* 1879 *Rhynchonella tenuicostata* sp. n. — VON HANSTEIN, R., p. 42.

LOCUS TYPICUS: Cibly, Province of Hainaut, Belgium.

STRATUM TYPICUM: Lower Maastrichtian, *Belemnella obtusa* Zone.

DESIGNATION OF A LECTOTYPE

VON HANSTEIN did not designate any type specimen. A lectotype is chosen among the four specimens of the type series of VON HANSTEIN preserved in Bonn (reference: G.P.I.B.O.-HANSTEIN: 5).

This lectotype is a medium sized specimen corresponding with the original diagnosis. The chosen lectotype is illustrated on Plate 2, Fig. 2 a-e.

MATERIAL STUDIED

The type series of VON HANSTEIN (4 specimens), from the phosphatic chalk of Cibly, kept at the University of Bonn (Table 3).

Thirty specimens from the phosphatic chalk of Cibly, kept in the collections of the Institut royal des Sciences naturelles de Belgique at Brussels (Table 4).

All these specimens were measured for their length (L in mm), width (W in mm), thickness (T in mm), apical angle (in degrees), number of costae (NC) and number of costae present on the fold and in the sinus (Tables 3 and 4). The shape of the foramen and the shape of the linguiform extension of the ventral valve were noted for each specimen.

Table 3 — Morphological characters measured on the 4 specimens of *Cretirhynchia tenuicostata* (VON HANSTEIN, 1879) from the collection of VON HANSTEIN, preserved at the University of Bonn [G.P.I.B.O.-VON HANSTEIN-5]. Phosphatic chalk of Cibly (Lower Maastrichtian, *Belemnella obtusa* Zone). L: length (in mm), W: width (in mm), T: thickness (in mm), Ldv: length of the dorsal valve (in mm), Apic. Angle: apical angle (in degrees), NC: number of costae on the dorsal valve, NC sinus: number of costae in the sinus (ventral valve) and NC fold: number of costae on the fold (dorsal valve). (\*) = Lectotype.

	L mm	W mm	T mm	Ldv mm	Apic. Angle (°)	NC	NC sinus	NC fold
Coll. von hanstein GPIBO-5.	19.9	23.4	12.4	18.1	117	49	5	6
Coll. von Hanstein GPIBO-5. (*)	16.6	16.4	11.1	14.5	98	42	4	4
Coll. von Hanstein GPIBO-5.	14.5	15.1	10.5	12.6	106	41	4	3
Coll. von Hanstein GPIBO-5.	19.7	25.1	14.6	18.2	113	52	7	8

Table 4 — Morphological characters measured on 34 specimens of *Cretirhynchia tenuicostata* (VON HANSTEIN, 1879) from the phosphatic chalk of Cibly (Lower Maastrichtian, *Belemnella obtusa* Zone). This material is kept in the collections of the Institut royal des Sciences naturelles de Belgique at Brussels. L: length (in mm), W: width (in mm), T: thickness (in mm), Ldv: length of the dorsal valve (in mm), Apic. Angle: apical angle (in degrees), NC: number of costae on the dorsal valve, NC sinus: number of costae in the sinus (ventral valve) and NC fold: number of costae on the fold (dorsal valve).

	L mm	W mm	T mm	Ldv mm	Ap. Angle (°)	NC	NC sinus	NC fold
MINIMUM VALUE	11.5	11.6	6.9	10.0	85	31	2	3
MAXIMUM VALUE	20.1	23.5	15.7	17.6	120	58	7	8
MEAN VALUE	15.5	16.5	10.5	13.3	102	42.9	4.4	5.25
STANDARD DEVIATION	2.548	3.356	1.868	2.289	7.804	7.352	1.400	1.437
STANDARD ERROR	±0.44	±0.56	±0.32	±0.39	±1.34	±1.28	±0.24	±0.25

## EMENDED DESCRIPTION

## External characters

Small hypothyridd *Cretirhynchia*, clearly subtriangular in outline with a dome-shaped to oval anterior contour, and a slightly cuneiform lateral profile.

The dorsal valve is more convex than the ventral valve, with a low anterior median fold. The ventral valve has a shallow anterior sinus. The linguiform extension of the ventral valve is short, narrow (1/3 of the width of the shell), generally trapezoidal, sometimes rectangular, rarely U-shaped and turns sharply from about a 60° to 90° angle.

The beak is short, curved, sharply pointed in outline but moderately thick in lateral profile. The apical angle is relatively narrow, and has a mean value of 102°. The foramen is small and circular in 90 % of the specimens. It was functional as indicated by the short protruding tube made by the deltidial plates. In dorsal view, the ventral interareas are slightly concave, relatively long and growth lines are visible. The beak-ridges are distinct. The posterior commissure is straight in young individuals but slightly wavy in older specimens.

The shell is densely costated on its whole outer surface. These sculptures are also visible, in a weaker form, on the inside. The number of costae varies from 31 to 58, but is generally around 40. They are extremely fine near the umbo, become slightly wider towards the anterior commissure and their number remains constant except near the commissure, where suddenly, an anti-dichotomic structure commonly appears. It is not rare to see two or three costae fused together along the anterior commissure.

Five costae generally occur, on the fold, near the commissure. In the bottom of the sinus, near the commissure, four costae are generally present. The sulci are narrow but shallow. A fine, regular concentric ornamentation is always present. Some distinct growth-lines occur near the commissure.

The ratio of length to width (L/W) has a minimum value of 0.82, a maximum value of 1.19, and a mean value of 0.95 ( $\pm 0.01$ ). The ratio of thickness to width (T/W) has a minimum value of 0.53, a maximum value of 0.95, and a mean value of 0.65, ( $\pm 0.01$ ). The ratio of length of the dorsal valve to width has a minimum value of 0.63, a maximum value of 0.94, and a mean value of 0.81 ( $\pm 0.01$ ).

## Internal characters (Figure 2)

## Ventral valve

No pedicle collar is observed in the transverse sections of the beak. The shell is clearly thickened in the umbonal region. Posteriorly, the umbonal cavities are subtriangular in transverse section. Small, bulbous teeth occur, supported by short and relatively thick, convergent dental plates. Muscles scars are not visible in the opened specimens.

## Dorsal valve

A median septum occurs, extending from the umbo and

persisting over 1/3 of the length of the valve floor. This septum is not elevated. The hinge plates are thick and not forked on their internal sides. The radulifer crura are short. The sockets are relatively deep, striated and the inner socket-ridges are elevated.

## VARIABILITY OF THE MORPHOLOGICAL CHARACTERS DURING GROWTH

Early juvenile forms have not been available for study and the complete ontogenic development cannot be described. Nevertheless, different sized specimens from Cibly are available. During the growth, the convexity of the dorsal valve decreases with the size; the young individuals have a subspherical dorsal valve whereas large adults are much more flat. In outline, young specimens are triangular, whereas adults are more subpentagonal and sometimes (but rarely) transversely oval. The shape of the linguiform extension does not vary during the growth but, it is more steep (90°) in young shells than in some older specimens.

COMPARISON WITH OTHER SPECIES OF *CRETIRHYNCHIA*

The presence of numerous fine costae on the whole surface of the shell distinguishes *Cretirhynchia tenuicostata* from *Cretirhynchia arcuata* (PETTIT, 1950) which exhibits only a few thick ribs at the anterior commissure.

The presence of clearly visible costae distinguishes *Cretirhynchia tenuicostata* from all the more or less smooth *Cretirhynchia* species such as *C. limbata* (VON SCHLOTTHEIM, 1813), *C. undulata* (PUSCH, 1837), *C. lentiformis* (WOODWARD, 1833), *C. subplicata* (MANTELL, 1822) and *C. robusta* (TATE, 1865).

The poorly developed fold of *Cretirhynchia tenuicostata*, which remains always very low through ontogeny, distinguishes it from *Cretirhynchia retracta* (ROEMER, 1841). This latter species has a very elevated fold.

The typical triangular shape of *C. tenuicostata*, its dome-shaped - oval anterior outline and its oval, slightly cuneiform lateral profile, avoid a possible confusion with *C. plicatilis* (SOWERBY, 1816).

*Cretirhynchia woodwardi* (DAVIDSON, 1852) has a lesser number of wider ribs increasing strongly in width towards the anterior commissure. This is not the case with *Cretirhynchia tenuicostata*. Moreover, for *Cretirhynchia woodwardi*, there is no fusion of costae near the anterior commissure and its linguiform extension is typically arcuate and not rectangular or subtrapezoidal as for *Cretirhynchia tenuicostata*.

## GEOGRAPHICAL AND STRATIGRAPHICAL DISTRIBUTIONS

*Cretirhynchia tenuicostata* is relatively common in the phosphatic chalk of Cibly whereas *Cyclothyris elegans* is clearly uncommon. ROBASYNSKI & CHRISTENSEN (1989) have proposed an Early Maastrichtian age, *Belemnella obtusa* Zone, for this unit. These species must be searched in the Maastrichtian from other regions such as the Maastricht area in Belgium and Netherlands, northwest Europe and Poland.

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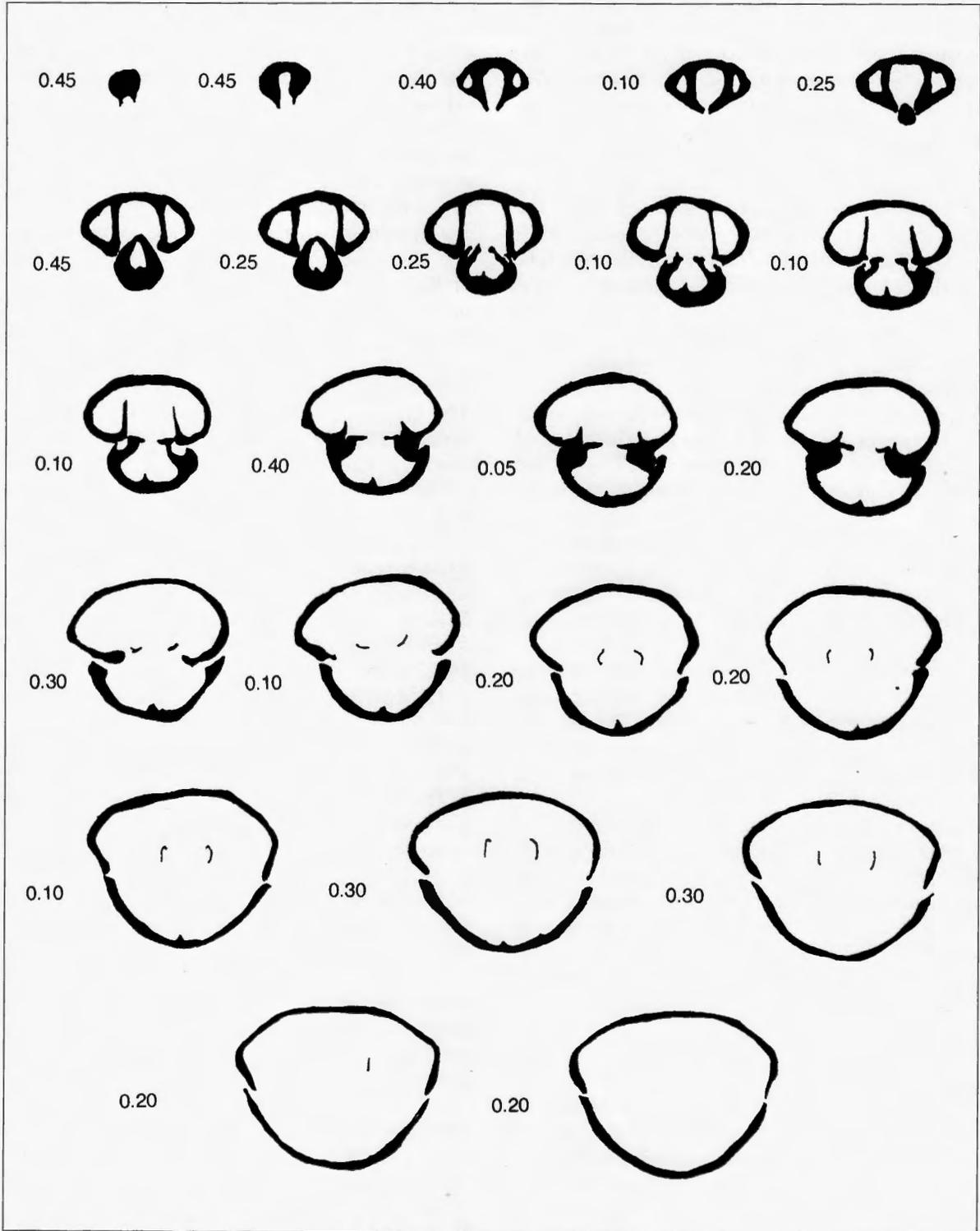


Fig. 2 — Serial sections in a young adult specimen of *Cretirhynchia tenuicostata* (VON HANSTEIN, 1879) from Ciplly, phosphatic chalk, Lower Maastrichtian, *Belemnella obtusa* Zone. The lack of a pedicle collar, the divergent dental plates, the persistent septum, the unforked hinge plates and the simple radulifer crura are well visible. (Length: 17.0 mm, width: 18.2 mm).

## References

- AGER, D. V., 1965. Mesozoic and Cenozoic Rhynchonellacea. in MOORE, R. C. (ed.). Treatise on Invertebrate Paleontology (H) Brachiopoda. Geological Society of America & University of Kansas Press, Lawrence, H 597 - H625.
- BUVIGNIER, A., 1842. Description de quelques-uns des fossiles nouveaux signalés dans le cours de l'ouvrage. in SAUVAGE, C. & BUVIGNIER, A., 1842. Statistique minéralogique et géologique du Département des Ardennes. 554 pp., 5 pl., Mézières.
- DAVIDSON, T., 1852. A Monograph of the British Fossil Brachiopoda. Part II. The Palaeontographical Society ed. London, 117 pp., 12 pls.
- DUMERIL, A. M. C., 1806. Zoologie analytique ou méthode naturelle de classification des animaux. Allais, Paris, XXIV + 344 pp.
- GRAY, J. E., 1848. On the arrangement of the Brachiopoda. *Annals of natural History, London*, 2 (2): 435-440.
- VON HANSTEIN, R., 1879. Die Brachiopoden der oberen Kreide von Ciplý. Inaugural - Dissertation zur Erlangung der Doctorwürde bei der philosophischen Fakultät der Rheinischen Friedrich - Wilhelms - Universität zu Bonn, 56 pp.
- HUXLEY, T. H., 1869. An introduction to the classification of animals. John Churchill & sons, London, 147 pp.
- KATZ, Y. I., in BLANK, M. Ia., KRIMHOLTS, G. Ia., NAIDIN, D.P., SAVCZINSKAJA, O. V., 1974. Atlas of the Upper Cretaceous Fauna of the Donbass. Ministerstvo Vishnevo i srednevo spetsialnovo obrazovania UkrSSR, Komunarskii gornometallurgicheskii institut. 639 pp., 128 pls., 69 text-figs., Moscow (Nedra), [in Russian].
- KUHN, O., 1949. Lehrbuch der Paläozoologie. E. Schweizerbart ed., Stuttgart, 326 pp.
- DE LAMARCK, J. B., 1819. Histoire naturelle des animaux sans vertèbres. Classe onzième. Les Conchifères. 6, 343 pp., Paris.
- LOBATSCHJEVA, S. V. & TITOVA, M. V., 1977. About a new genus of rhynchonelloid brachiopods from the Cretaceous of Turkmenia [in Russian]. *Annual of the All-Union palaeontological societies*, 19: 102-113.
- LUNDGREN, B., 1885. Undersökningar öfver Brachiopoderna i Sverges Kritsystem. *Ur Lunds Universitets Årsskrift*, 20: 1-71.
- M'COY, F., 1844. A Synopsis of the characters of the Carboniferous Limestone fossils of Ireland. Dublin, viii + 207 pp., 29 pl.
- MAKRIDIN, W. P., 1955. Some Jurassic rhynchonellids from the European part of the U.S.S.R. [in Russian] *Zapiski Geol. Fak. Kharkov State University*, 12: 81-91.
- MANTSELL, G., 1822. Fossils of the South Downs; or Illustrations of the Geology of Sussex. London, 211 pp.
- MATTHEWS, S. C., 1973. Notes on Open Nomenclature and on Synonymy Lists. *Palaeontology*, 16 (4): 713-719.
- MOTCHUROVA-DEKOVA, N., 1994. New data about the evolution and phylogenetic relations of brachiopod families Basiliolidae and Cyclothyrididae on the basis of Late Cretaceous rhynchonellids from Bulgaria. *Geologica Balcanica*, 24 (4): 21-29.
- OWEN, E. F., 1962. The Brachiopod Genus Cyclothyris. *Bulletin of the British Museum (Natural History), Geology*, 7 (2): 2-63.
- OWEN, E. F., 1977. Evolutionary trends in some mesozoic Terebratellacea. *Bulletin of the British Museum (Natural History) Geology*, 28 (3): 205 - 253.
- PERON, M. A., 1894. Les Brachiopodes du terrain Crétacé supérieur de Ciplý (Belgique). *Association Française pour l'Avancement des Sciences*, 23: 1 - 15.
- PETTITT, N. E., 1950. A Monograph on some Rhynchonellidae of the British Chalk. Part 1. *Palaeontographical Society*, 103: 1-26. London.
- PETTITT, N. E., 1953. A Monograph on some Rhynchonellidae of the British Chalk. Part 2. *Palaeontographical Society*, 107: 27-52. London.
- POPIEL-BARCZYK, E., 1988. Upper Cretaceous Rhynchonellids (Brachiopoda) from the middle Vistula river valley in Poland. *Prace Muzeum Ziemi*, 40: 3-21.
- PUSCH, G. G., 1837. Polens Paläontologie oder Abbildung und Beschreibung der vorzüglichsten und der noch unbeschriebenen Petrefakten aus den Gebirgsformation in Polen, Volhynien und den Karpathen nebst einigen allgemeinen Beiträgen zur Petrefaktenkunde und einem Versuch zur Vervollständigung der Geschichte des Europäischen Auer-Ochsen. E. Schweizerbarts Verlagshandlung Ed. Stuttgart, III-XIII + 218 pp.
- RADULOVIC, V. & RAMAMOORTHY, K., 1992. Late Cretaceous (Early Maastrichtian) brachiopods from South India. *Senckenbergiana lethaea*, 72: 77 - 89.
- ROBASZYNSKI, F. & CHRISTENSEN, W. K., 1989. The Upper Campanian - Lower Maastrichtian chalks of the Mons basin, Belgium: a preliminary study of belemnites and foraminifera in the Harmignies and Ciplý areas. *Geologie en Mijnbouw*, 68: 391 - 408.
- ROEMER, F.A., 1841. Die Versteinerungen des norddeutschen Kreidegebirge. Hannover, 145 pp., 16 pls.
- VON SCHLOTTHEIM, E. F., 1813. Beiträge zur Naturgeschichte, der Versteinerungen in geognostischer Hinsicht. *Leonhards Taschenbuch für die gesammte Mineralogie*, 7 (1): 3-134.
- SOWERBY, J., 1812-1822. The Mineral Conchology of Great Britain, (II), 251 pp., London.
- SOWERBY, J. DE C., 1829. The Mineral Conchology of Great Britain, (VI), 230 pp., Index, London.
- STEINICH, G., 1965. Die artikulaten Brachiopoden der Rügener Schreibkreide (Unter - Maastricht). *Paläontologische Abhandlungen, Abteilung A, Paläozoologie*, 2 (1): 1 - 220.
- TATE, R., 1865. On the correlation of the Cretaceous formations of the north-east of Ireland. *Quarterly Journal of the Geological Society of London*, 21: 15 - 44.
- WILLIAMS, A. & ROWELL, A. J., 1965. Brachiopod anatomy and morphology. in MOORE, R. C. (ed). Treatise on Invertebrate Paleontology, (H) Brachiopoda. 1: H6 - H155. Geological Society of America & University of Kansas Press, Lawrence.
- WOODWARD, S. P., 1833. Outline of the geology of Norfolk. Norwich, 54pp.

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## PLATE 1

*Cyclothyris elegans* (VON HANSTEIN, 1879)

All the specimens were collected in Ciplu.

Stratigraphy: Lower Maastrichtian (*Belemnella obtusa* Zone)

- Fig. 1 — Small adult and intact specimen preserved at the Institut royal des Sciences naturelles de Belgique (I.S.T.-10662). a: dorsal view, b: ventral view, c: lateral view, d: anterior view, e: posterior view. (Length: 23.2 mm, width: 23.8 mm).
- Fig. 2 — Specimen from the collection of VON HANSTEIN, preserved at the University of Bonn [G.P.I.B.O.-HANSTEIN 4]. This specimen is chosen as lectotype. a: dorsal view, b: ventral view, c: lateral view, d: anterior view, e: posterior view. (Length: 24.4 mm, width: 32.7 mm).
- Fig. 3 — Fully adult and intact specimen preserved at the Institut royal des Sciences naturelles de Belgique (I.S.T.-10663). a: dorsal view, b: ventral view, c: lateral view, d: anterior view, e: posterior view. (Length: 23.2 mm, width: 30.0 mm). This specimen, which has an asymmetrical anterior commissure, has been used for serial sections (Fig. 1-A).
- Fig. 4 — Larger adult specimen preserved at the Institut royal des Sciences naturelles de Belgique (I.S.T.-10664). a: ventral view, b: lateral view, c: anterior view. (Length: 25.1 mm, width: 33.0 mm). This specimen has been used for serial sections (Fig. 1-B).

## PLATE 2

*Cretirhynchia tenuicostata* (VON HANSTEIN, 1879)

All the specimens were collected in Ciplu.

Stratigraphy: Lower Maastrichtian (*Belemnella obtusa* Zone)

- Fig. 1 — Specimen from the collection of VON HANSTEIN, preserved at the University of Bonn [G.P.I.B.O.-HANSTEIN 5]. a: dorsal view, b: ventral view, c: lateral view, d: anterior view, e: posterior view. (Length: 14.5 mm).
- Fig. 2 — Specimen from the collection of VON HANSTEIN, preserved at the University of Bonn [G.P.I.B.O.-HANSTEIN 5]. This specimen is chosen as lectotype. a: dorsal view, b: ventral view, c: lateral view, d: anterior view, e: posterior view. (Length: 16.6 mm).
- Fig. 3 — Fully adult and intact specimen preserved at the Institut royal des Sciences naturelles de Belgique (I.S.T.-10665). a: dorsal view, b: ventral view, c: lateral view, d: anterior view, e: posterior view. (Length: 19.8 mm), ventral valve up.
- Fig. 4 — Specimen from the collection of VON HANSTEIN, preserved at the University of Bonn [G.P.I.B.O.-HANSTEIN 5]. a: dorsal view, b: ventral view, c: lateral view. (Length: 19.7 mm).
- Fig. 5 — Ventral valve of an opened specimen preserved at the Institut royal des Sciences naturelles de Belgique (I.S.T.-10666). 5 a: dorsal view. 5 b: antero-dorsal view showing the small dental plates. (Length of the valve: 17.6 mm).
- Fig. 6 — Detailed view of a dorsal valve, showing the crura, the socket-ridges and the septum. Specimen preserved at the Institut royal des Sciences naturelles de Belgique (I. S. T.- 10667) (Magnification: x 4.6).

Plate 1.

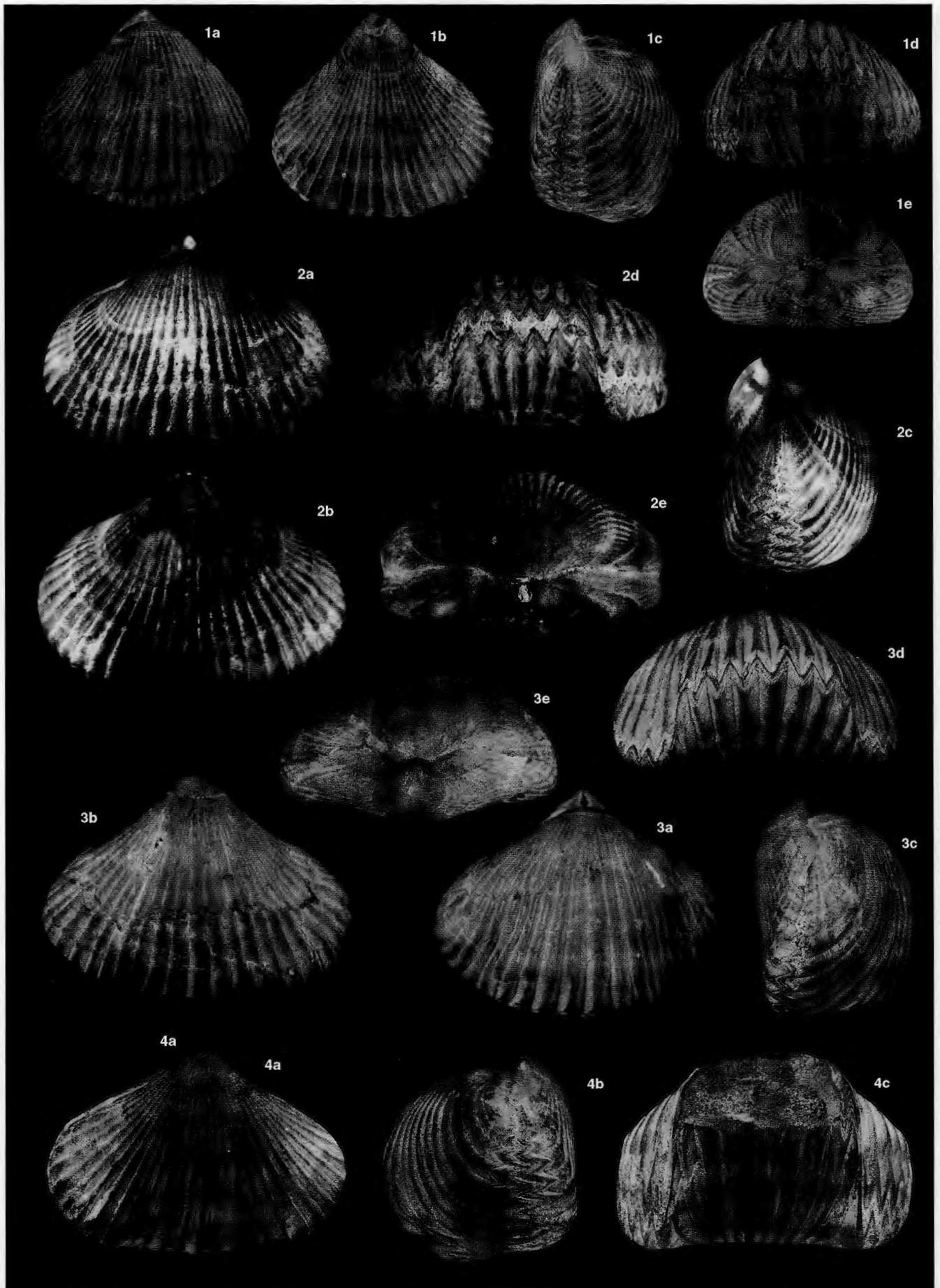


Plate 2.

