

A new Late Maastrichtian rhynchonellide brachiopod from the Kunrade Limestone facies near Maastricht (Southern Limburg, The Netherlands)

by Eric SIMON

SIMON, E., 2002. – A new Late Maastrichtian rhynchonellide brachiopod from the Kunrade Limestone facies near Maastricht (Southern Limburg, The Netherlands). *Bulletin de l'Institut royal des Sciences naturelles de Belgique, Sciences de la Terre*, 73: 137-148, 2 pls., 3 figs., Bruxelles-Brussel, March 31, 2003 – ISSN 0374-6291.

Abstract

This paper presents a Late Maastrichtian rhynchonellide brachiopod species collected from the Kunrade Limestone (Maastricht area, The Netherlands). BOSQUET (1860) designated this rhynchonellide species as *Rhynchonella alata* NILSSON, 1827 non VALENCIENNES in LAMARCK, 1819. This designation is no longer acceptable as a reappraisal of this brachiopod, using transverse serial sections, allows the erection of a new species of the genus *Almerarhynchia* CALZADA, 1974. The presence of an *Almerarhynchia* species in the Maastricht area, confirms that Tethyan pulses occurred during the Late Maastrichtian in the Maastricht area.

Key-words: Brachiopods, Cyclothyrididae, Cretaceous, Upper Maastrichtian, Kunrade, Netherlands.

Résumé

Cet article présente un brachiopode rhynchonellide du Maastrichtien Supérieur, collecté dans le Calcaire de Kunrade (Région de Maastricht, Pays-Bas) et qui fut jadis reconnu par BOSQUET (1860) comme étant *Rhynchonella alata* NILSSON, 1827 non VALENCIENNES in LAMARCK, 1819. Cette détermination, n'est plus acceptable car une révision, utilisant des sections transversales sériées, permet d'ériger une nouvelle espèce appartenant au genre *Almerarhynchia* CALZADA, 1974. La découverte dans la région de Maastricht d'une espèce d'*Almerarhynchia* confirme que des pulsions Téthysiennes se seraient produites à cet endroit durant le Maastrichtien Supérieur.

Mots-cléfs: Brachiopodes, Cyclothyrididae, Crétacé, Maastrichtien Supérieur, Kunrade, Pays-Bas.

Introduction

The Kunrade Limestone facies, exposed in the eastern part of southern Limburg (Fig. 1), has been already studied by several authors for determining its stratigraphical position. This original facies is considered as an Upper Maastrichtian deposit. KENNEDY (1986, p. 159) indicated that ammonites collected from the upper part of the Kunrade Limestone are all of Late Maastrichtian age. The presence of the Late Maastrichtian *Belmontitella junior* NOWAK, 1913 was confirmed by FELDER &

BLESS (1989). JAGT (1999, p. 18) pointed out that the Kunrade Limestone facies was subdivided in 1989 by FELDER & BLESS into two ecozones (ecozone IV and V) both of Late Maastrichtian age. Ecozone IV equates with the Lanaye Member (Gulpen Formation) whereas the ecozone V could match the base of the Emael Member (Maastricht Formation). Ecozone IV could be best correlated with HOFKER's (1966) benthic foraminifer zone F (cited in JAGT, 1999, p. 18) equating exactly with the Lanaye Member (Gulpen Formation). JAGT (1988) also confirmed this assertion on the basis of a crinoid distribution pattern. Stratigraphically, the brachiopod material studied in this paper is considered as representative of ecozone IV *sensu* FELDER & BLESS (1989, fig. 3, p. 35).

Since the 19th century, the Kunrade Limestone facies, which is widely distributed in the Kunrade-Benzenrade-Heerlen area (Fig. 1), is well known for yielding large numbers of well-preserved specimens of brachiopods. Both rhynchonellide and terebratulid brachiopods are present. Surprisingly, these brachiopods were rarely studied, although rich brachiopod collections, containing this original material, are preserved in several museums, mainly in the Natuurhistorisch Museum Maastricht (NHMM) and in the Institut royal des Sciences naturelles de Belgique in Brussels (IRScNB).

BOSQUET himself paid very little attention to this special fauna and, in 1860, in his list of fossil fauna and flora, he cited only four brachiopod species known from Kunrade. More recently, SENDEN (1975, pp. 25-27) insisted on the giant size of the brachiopod specimens found in the Kunrade area. This author illustrated a *Terebratula* species and a *Terebratulina* species but without precise diagnoses. The present paper is a first step in studying the brachiopod fauna from Kunrade and in updating the taxonomic position of one rhynchonellide species collected there in very great numbers.

The rhynchonellide species studied in this paper is certainly the species identified by BOSQUET (1860) in his list of fossil and flora, under the n° 587, as *Rhynchonella alata* NILSSON non LAMARCK. NILSSON (1827, p. 35, n°10) described under the name *Rhynchonella alata* LAMARCK, a "Senonian" rhynchonellide species collected from Mörby (Sweden). The specimen of *R. alata* illustrated by NILSSON (1827, pl. 4, figs. 8, A.B.B.) has a general outline which can be confused with the rhynchonellide species collected from Kunrade and described in this paper. Especially, NILSSON's drawing presenting *R. alata* in lateral profile (1827, pl. 4, fig. 8B.) is, at first glance, disturbing. Such confusion arose in BOSQUET (1860).

However, several characters of the species collected from Kunrade are very distinctive (mainly the internal characters)

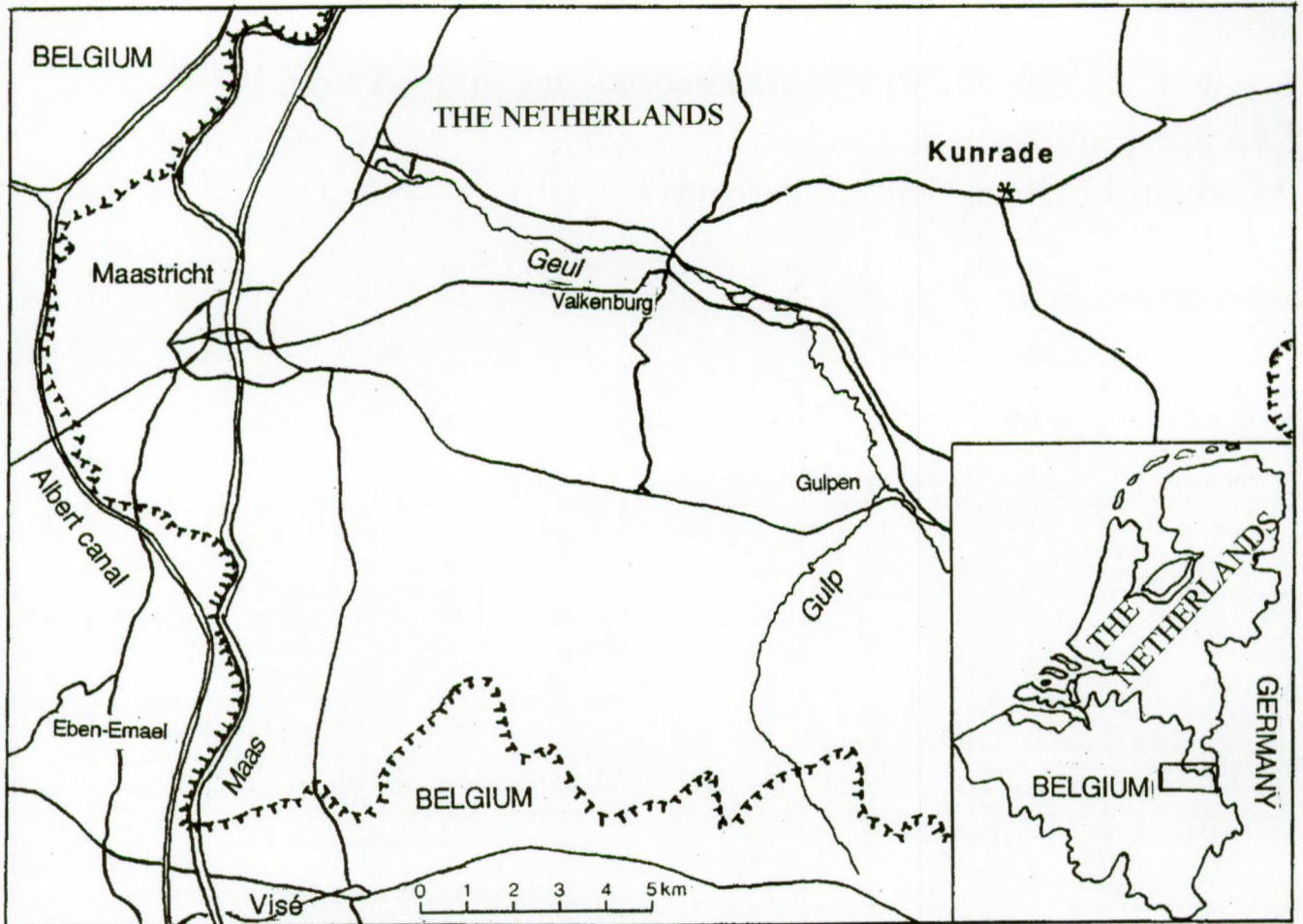


Fig. 1 — Map showing the position of Kunrade in the Maastricht area (Limburg, The Netherlands).

and these will be discussed in the taxonomic part of this paper, excluding any confusion with *R. alata* NILSSON, 1827.

There is still another taxonomic problem. NILSSON (1827, p. 35) was confused about his material collected from Mörby and a rhynchonellide brachiopod described as *Rhynchonella alata* by VALENCIENNES in LAMARCK, 1819 (Volume 6, part 1, p. 254, n° 43). In this work, there is only a very short diagnosis of *R. alata* and this species is not illustrated. The precise provenance of this species of LAMARCK is still unknown but it is actually preserved in the Muséum d'Histoire naturelle in Geneva. Specimens of *R. alata* VALENCIENNES in LAMARCK, 1819 preserved in the same collection are also illustrated in the Catalogue of the LAMARCK's collection, published in Geneva (1917, Part 1, fossils, pl. 12, figs. 64-69). Not all the rhynchonellide specimens presented in this plate 12 are likely representatives of the same species. But the two rhynchonellide brachiopods illustrated in figs. 64 and 65 are reminiscent of a large Cenomanian species of *Cyclothyris* M'COY, 1844 presenting a wide dorsal fold which becomes prominent anteriorly, producing a trilobation of the shell. Such a large dorsal fold, with trilobation of the shell, is not developed in the *R. alata sensu* NILSSON, 1827. For this reason, the binomen *Rhynchonella alata*, as used by NILSSON in 1827 for a specimen from Mörby, is not valid and therefore a new diagnosis should be made for this rhynchonellide species. The name *alata*

is no longer available for a rhynchonellide brachiopod differing from the species described in 1819 by VALENCIENNES in LAMARCK.

The rhynchonellide species collected from Kunrade and studied in this paper is described as a new species, representative of the genus *Almerarhynchia* CALZADA, 1974. This new name should not be applied to the material collected by NILSSON from Mörby as the rhynchonellide species from Kunrade shows several distinctive characters.

Material and methods

The material studied in this paper is preserved partly in the Natuurhistorisch Museum Maastricht (NHMM) and partly in the Institut royal des Sciences naturelles de Belgique in Brussels (IRScNB).

Material from the Kunrade Limestone facies preserved in the IRScNB:

44 complete bivalved specimens from the Bosquet collection.
58 complete bivalved specimens from the Ubaghs collection.

Material from the Kunrade Limestone facies preserved in the NHMM:

152 complete bivalved specimens from the Senden collection.

Transverse serial sections were made by the method described by AGER (1965, pp. 212-218) and peels were taken on cellulose acetate following the method of STERNBERG & BELDING (1942). Peels of the serial sections are preserved in the NHMM.

Taxonomy follows the Treatise on Invertebrate Paleontology, Part H (Revised), Brachiopoda, Hemithiridoidea, volume 4: 1027-1376 (MANCENIDO, OWEN, DONG-LI & DAGYS in R.L. Kaesler, ed., 2002).

Taxonomic description

Phylum Brachiopoda DUMÉRIL, 1806
 Subphylum Rhynchonelliformea WILLIAMS *et al.*, 1996
 Class Rhynchonellata WILLIAMS *et al.*, 1996
 Order Rhynchonellida KUHN, 1949
 Superfamily Hemithiridoidea RZHONSNITSKAIA, 1956
 Family Cyclothyrididae MAKRIDIN, 1955
 Subfamily Cyclothyridinae MAKRIDIN, 1955 emended
 OWEN, 1962

Genus *Almerarhynchia* CALZADA, 1974

Type species: *Almerarhynchia virgiliana* CALZADA, 1974

The rhynchonellide brachiopod described in this note fits the diagnosis of the genus *Almerarhynchia* erected by CALZADA (1974, p. 94) and fits the emended diagnosis published by CALZADA & POCOVI (1980, p. 9). The material from Kunrade studied in this paper presents the internal characters of the genus *Almerarhynchia* as seen in transverse serial sections (Fig. 2 and Fig. 3). The dental plates are straight and subparallel. The dorsal septum is poorly developed. The radulifer crura are anteriorly widened and deflected ventrally. Crura are distally canaliform, steeply curved, with a subtriangular outline.

Almerarhynchia kunradensis sp. n.

Text-Figures 2-3, Plate 1, Figures 1-3, Plate 2,
 Figures 1-2

1860 *Rhynchonella alata* Nils. non Lamk. - BOSQUET,
 n° 587.

v 1975 *Cretirhynchia alata* - SENDEN, p. 26.

Derivatio nominis: from "Kunrade" the name of the locality, Limburg, The Netherlands, where the type specimen has been found.

Locus typicus: Kunrade, Limburg, The Netherlands.

Stratum typicum: Kunrade Limestone facies. Late Maastrichtian, mainly ecozone IV of FELDER & BLESS (1989) corresponding to the Lanaye Member of the Gulpen Formation.

Holotype

Almerarhynchia kunradensis sp. n. Plate 1, Figure 1a-e. The holotype is a complete bivalved specimen of the UBAGHS collection, collected from the Kunrade Limestone. Dimensions of holotype: 29.0 mm long, 32.5 mm

wide and 20.2 mm thick. The holotype is preserved in the IRScNB in Brussels under the reference IRScNB - MI n°10889.

Paratypes

All paratypes were collected from the Kunrade Limestone facies in Kunrade near Maastricht (Limburg, The Netherlands).

A. kunradensis sp. n. NHMM n° 2002 136 (ex SENDEN collection). Text-Figure 2, Plate 1, Figures 2a-e. Specimen used for transverse serial sections. Dimensions: 24.0 long, 26.3 mm wide and 19.1 mm thick.

A. kunradensis sp. n. IRScNB - MI n° 10890 (ex BOSQUET collection). Plate 1, Figures 3a-e. Dimensions: 27.7 mm long, 28.3 mm wide and 19.6 mm thick.

A. kunradensis sp. n. NHMM n° 2002 137 (ex SENDEN collection). Plate 2, Figures 1a-e. Dimensions: 27.4 mm long, 32.7 mm wide and 16.8 mm thick.

A. kunradensis sp. n. NHMM n° 2002 138 (ex SENDEN collection). Plate 2, Figures 2a-e. Dimensions: 25.9 mm long, 29.7 mm wide and 14.6 mm thick.

A. kunradensis sp. n. IRScNB - MI n° 10895 (ex UBAGHS collection). Text-Figure 3. Dimensions: 22.7 mm long, 26.2 mm wide and 17.1 mm thick.

Diagnosis

Medium to large-sized, often dissymmetrical *Almerarhynchia*, about 23.5 mm long, 27.0 mm wide and 18.0 mm thick, transversely oval in outline, dome-shaped in anterior contour and convexo-plane in lateral profile. Dorsal valve quite convex with a very low fold. Ventral valve flatter, with a relatively wide but clearly marked sulcus. Linguiform extension trapezoidal. Umbo slightly produced. Beak strong, pointed and suberect. Hypothyrid foramen large, typically oval and rimmed. About 25-30 strong radiating costae, clearly defined. Dental plates subparallel. Dorsal septum poorly developed. Hinge plates deflected ventrally, straight, unforked with a marked ventral concavity. Crura distally canaliform, steeply curved anteriorly with a subtriangular outline.

Description

External characters

Medium to large-sized rhynchonellide brachiopod about 14.0/28.0 mm long, 20.0/32.0 mm wide and 13.0/20.0 mm thick, transversely oval in outline, dome-shaped in anterior contour and dorsibiconvex to convexo-plane in lateral profile. Very few specimens exhibit uniplicate symmetrical shell outline, but most specimens collected are clearly asymmetrical although the asymmetry affecting the shell is always relatively weak. The dorsal valve is strongly convex with a maximum convexity situated near the middle of the valve. Anteriorly, the dorsal valve is slightly depressed in most specimens. A very low dorsal median fold is developed only on its anterior part and is bounded by relatively discrete edges. The ventral valve is

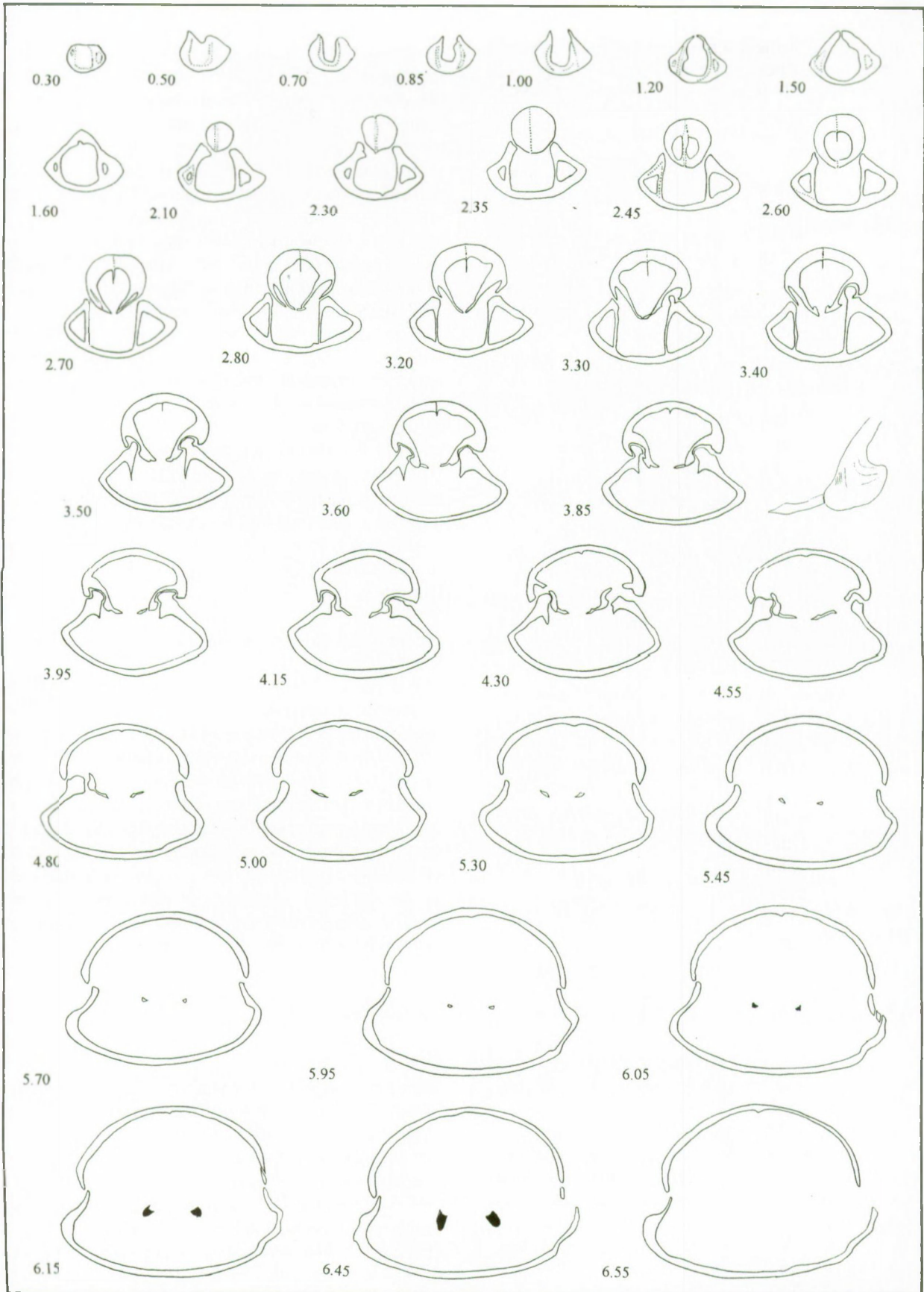


Fig. 2 — Transverse serial sections through the umbonal part of *Almerarhynchia kunradensis* sp. n. collected from the Kunrade Limestone (Upper Maastrichtian, *Belemnitella junior* Zone), Kunrade (Limburg, The Netherlands). Paratype n° NHMM. n° 2002 136. (Magnification: x 2.3).

relatively flat but exhibits a maximum posterior convexity near the umbo. The sulcus of the ventral valve is very low in the middle of the valve but appears deeper anteriorly and is often limited by sharp edges. The asymmetry of the shell can modify the shape of the sulcus which can be limited by a unique left or right sharp edge and by a smoother slope on the opposite side. In general, the sulcus is better drawn and wider than the corresponding dorsal fold. The linguiform extension is fairly broad and sharply trapezoidal. The trapezoidal aspect can be modified by the asymmetry of the shell. An arcuate linguiform extension is rarely observed in this species. The beak is strong, pointed and suberect. Sometimes, the beak is relatively long and the shell appears more subtriangular in outline. In other specimens, the beak is relatively shorter and the oval outline of the shell is evident. The beak ridges are very distinct. The hypothryridid, rimmed foramen is proportionally very large and oval, rarely subcircular, with conjunct protruding deltidial plates. The interareas are wide, slightly curved. The posterior commissure is curved. Both valves have approximately 24-28 sharp costae, becoming more elevated towards the anterolateral commissures. An average of 6-8 costae ornament the dorsal fold and 5-7 are present within the ventral sulcus. The costae are not reduced in number near the anterior part of the shell and incipient splitting has never been observed. Often, two or three faint growth-lines are visible on the shell surface but these growth-lines are not step-like. Sometimes, several faint laminae are developed along the commissure.

Internal characters

In transverse serial sections (Fig. 2 and Fig. 3) a well-developed pedicle collar has not been observed in the beak. In the ventral valve, dental plates are straight, slightly divergent in the extreme posterior part of the umbo, but anteriorly, they become subparallel or parallel. The length of the dental plates is variable. They can be relatively long in some specimens (Fig. 2) or much shorter (Fig. 3). When they are shorter, the dental plates remain slightly divergent.

Teeth appear anteriorly subquadrate in transverse section.

In the dorsal valve, outer socket ridges are well developed in the posterior part of the valve but they become much lower anteriorly. The sockets themselves are relatively shallow in transverse section. The inner socket ridges are deeply curved and higher than the outer socket ridges. A poorly developed septum is visible on the dorsal valve floor. It is thin and clearly visible in the extreme posterior part of the valve but its height decreases quickly. It is barely visible in the transverse sections when the crura appear. Hinge plates are thin, slightly given off ventrally. A ventral concavity is sometimes developed (Fig. 3) but this concavity does not always appear clearly (Fig. 2). Hinge plates are not forked. Crura are short, extremely thin in transverse sections in their posterior and median parts, but becoming suddenly wider and wider in their anterior part. There, the crura are

steeply curved, widened and deflected ventrally. In their distal part, the crura are clearly canaliform (Fig. 3).

Comparison with other rhynchonellide brachiopods

Comparison between *Almerarhynchia kunradensis* sp. n. and the representatives of the genus *Cyclothyris* M'COY, 1844.

The general aspect of the shell of *A. kunradensis* sp. n. may lead to confusion with some species of the genus *Cyclothyris* M'COY, 1844 mainly with the Cenomanian representative *C. difformis* (VALENCIENNES in LAMARCK, 1819). The genus *Cyclothyris* M'COY, 1844 was revised by OWEN (1962) and Cenomanian species of *Cyclothyris* were exhaustively described in OWEN (1988). *C. difformis* is often more asymmetrical and more variable in outline, with its linguiform extension often broadly arcuate and with its beak which is not so strong and less produced than in *A. kunradensis* sp. n. The foramen of *C. difformis* is circular or subcircular whereas the foramen in *A. kunradensis* sp. n. is oval and relatively larger.

Some internal characters observed in the transverse serial sections of *A. kunradensis* sp. n. suggest a possible affinity to the genus *Cyclothyris* M'COY, 1844. At first glance, the type of hinge-tooth and socket is rather similar to the type observed in *Cyclothyris* (OWEN, 1962 figs. 4-8). In *A. kunradensis* sp. n., the shape of hinge plates appears more similar to the *Cyclothyris* type than to the *Almerarhynchia* type because they are not subhorizontal but deflected ventrally. This is an important specific difference between *A. kunradensis* sp. n. and the other representatives of the genus *Almerarhynchia*.

C. difformis has also a very different internal structure. Hinge plates of *C. difformis* are arched ventrally and are forked. Hinge plates of *A. kunradensis* sp. n. are nearly straight, unforked, and often, present a ventral concavity. Anteriorly, the crura of *C. difformis* are ventrally arched, are not widened and are not steeply deflected to the ventral valve as they are in the genus *Almerarhynchia*. In their distal part, the crura of *C. difformis* and other *Cyclothyris* species are dorsally concave and this concavity is facing the dorsal valve. In *A. kunradensis* sp. n. the crura are slightly facing each other but not as clearly as in *Cretirhynchia* div. sp.

Comparison between *Almerarhynchia kunradensis* sp. n. and the other representatives of the genus *Almerarhynchia* CALZADA, 1974.

The genus *Almerarhynchia* was erected by CALZADA (1974, p. 94) for *A. virgiliana* (type species) but the diagnosis was later emended by CALZADA & POCIVI (1980, p. 9) when these authors included *A. pocoviana* in this genus.

A. kunradensis sp. n. exhibits the essential external and internal characters of the genus *Almerarhynchia* CALZADA, 1974 (Fig. 2 and Fig. 3). The costate shell surface is rather similar. This is seen well when

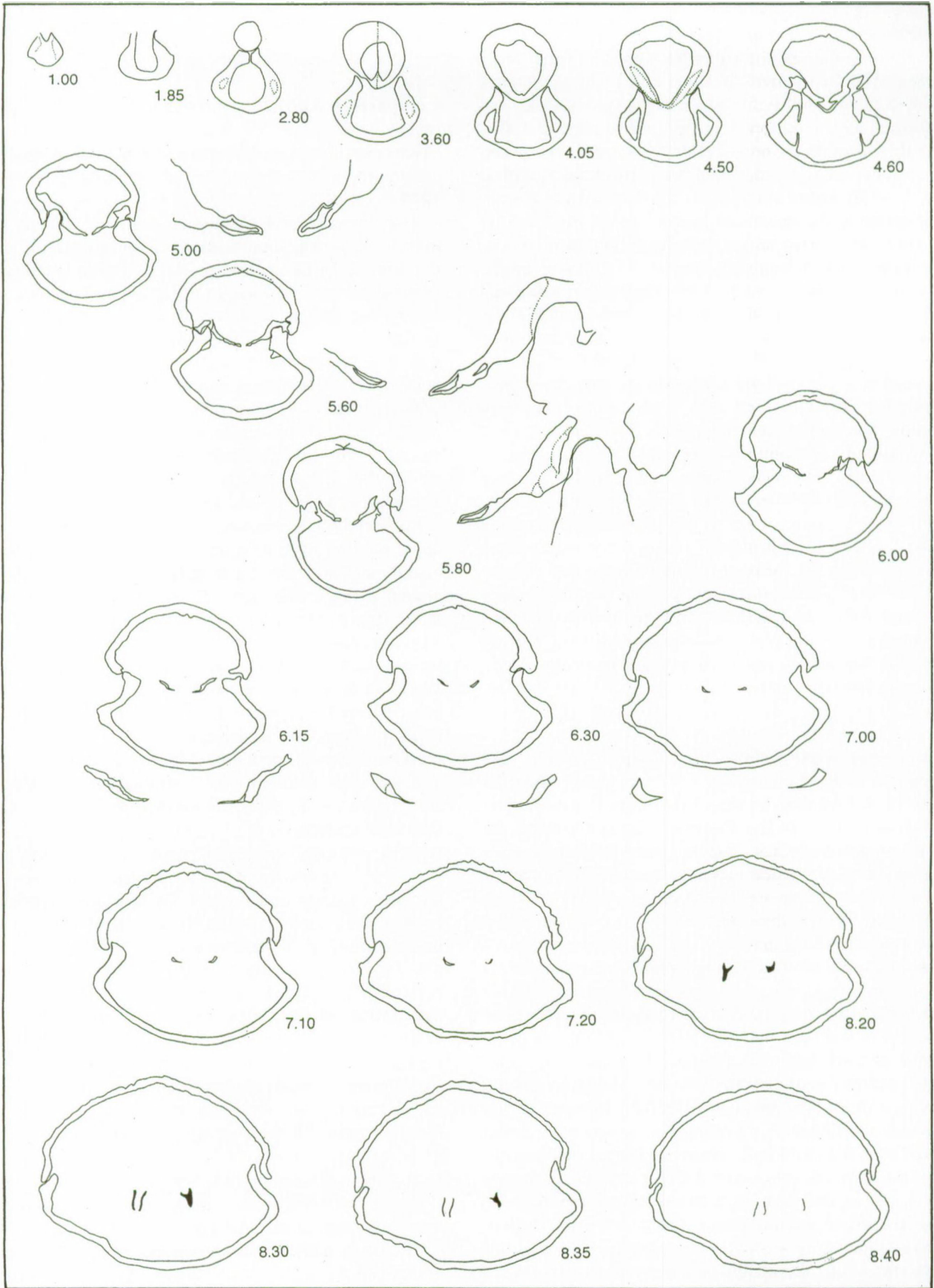


Fig. 3 — Transverse serial sections through the umbonal part of *Almerarhynchia kunradensis* sp. n. collected from the Kunrade Limestone (Upper Maastrichtian, *Belemnitella junior* Zone), Kunrade (Limburg, The Netherlands). Paratype n° IRScNB - MI n° 10895. (Magnification: x 2.3).

A. pocoviana CALZADA & POCovi, 1980 (Plate 2, Fig. 3a-e) is compared with the specimens of *A. kunradensis* sp. n. illustrated herein. In both taxa, the large, rimmed, oval, hypothyridid foramen is identical. The dental plates are straight and subparallel. The dorsal septum is poorly developed and is mainly a dorsal myophragm, ridgelike to indistinct. The radulifer crura are anteriorly widened and deflected ventrally. In their distal part, the crura become extremely narrow before widening. Anteriorly the crura are clearly canaliform.

A. virgiliana CALZADA, 1974 from the Maastrichtian of Figols (Prepireneo, Cataluña, Spain), is a smaller species than *A. kunradensis* sp. n. *A. virgiliana* has a more acutely biconvex, symmetrical shell which is ornamented with fewer costae. *A. kunradensis* sp. n. cannot be confused with *A. virgiliana*.

No confusion should arise between *A. reigi* CALZADA, 1989 and *A. kunradensis* sp. n. *A. reigi* has a more or less subpentagonal outline and is clearly lenticular in lateral profile and anterior contour. The shell of *A. kunradensis* sp. n. is never equibiconvex in lateral profile and in anterior contour. *A. reigi* possesses numerous fine costae (± 48) and its linguiform extension is broadly arcuate. *A. reigi* which is considered as a species preserving primitive characters for the genus *Almerarhynchia* (CALZADA, 1989, p. 79) exhibits a fine, high but very short septum, clearly visible in the extreme posterior part of the dorsal valve as it is also observed in the transverse sections of *A. kunradensis* sp. n. (Fig. 2).

A. pocoviana CALZADA & POCovi, 1980 (pp. 11-13, fig. 3, pl. 5, figs. 1-4) is a rhynchonellide brachiopod which has a similar size and outline when compared to *A. kunradensis* sp. n. However *A. pocoviana* (Pl. 2, Figs. 3a-e) has a more equibiconvex lateral profile. Its ventral valve is more convex than the ventral valve of *A. kunradensis* sp. n. The shell of *A. pocoviana* is symmetrical and it possesses a wider arcuate to subtrapezoidal linguiform extension. The costae ornamenting the shell of *A. pocoviana* are more regularly spaced on the shell surface. In *A. kunradensis* sp. n. the costae on the dorsal fold are wider than the costae seen on the lateral slopes of the valve. It is also noteworthy that the dorsal fold is better defined in *A. kunradensis* sp. n. than in *A. pocoviana*. Internally, the dorsal septum of *A. kunradensis* appears a little longer than in *A. pocoviana*.

Some obvious specific differences are observed between *A. kunradensis* sp. n. and all the other *Almerarhynchia* species. The hinge plates which are often subhorizontal in transverse section are ventrally oriented in *A. kunradensis* sp. n. Before widening in their distal part, the crura of *Almerarhynchia* div. sp. are horizontal in section whereas those of *A. kunradensis* sp. n. are ventrally oriented. The dorsal concavity of the crura, slightly facing each other, in *A. kunradensis* sp. n. is not observed in the sections of the other representatives of the genus *Almerarhynchia*. These latter characters could be taken into account for erecting a new genus or subgenus. But, this proposition would hardly be advisable. These characters are only of specific importance and, at the present

state of knowledge, the erection of a new taxon could probably raise more boundary taxonomical problems for the near future. Moreover, for its external characters, *A. virgiliana* CALZADA, 1974 appears very similar to *Hesperorhynchia superba* WARREN, 1937 a rhynchonellide brachiopod from the Bearpaw Formation (Saskatchewan). As the internal characters of *H. superba* are not completely known, further studies remain necessary for establishing a synonymy between *Almerarhynchia* CALZADA, 1974 and *Hesperorhynchia* WARREN, 1937. But, as it could be already difficult to place a limit (if any) between the genus *Almerarhynchia* and the genus *Hesperorhynchia*, the author would avoid a premature proposal of a new taxon based on subtle differences observed in *A. kunradensis* sp. n. The original characters observed in *A. kunradensis* sp. n. indicate that a more variable generic entity for the genus *Almerarhynchia* might be involved.

Some specimens of *A. kunradensis* sp. n. from the collection of BOSQUET and preserved in the IRScNB in Brussels, are labelled as *Rhynchonella alata* NILSSON, 1827. *R. alata* NILSSON, 1827 is a brachiopod collected from Mörby (Sweden), described and illustrated by NILSSON in 1827 (p. 35, pl. 4, figs. 8A.B.B.). The illustrated specimen of *R. alata* NILSSON, 1827 seems to have a more symmetrical outline than *A. kunradensis* sp. n. The interarea of *R. alata* NILSSON, 1827 is more extensive than the interarea of *A. kunradensis* sp. n. The foramen of *R. alata* NILSSON, 1827 is much smaller and its beak is noticeably weaker and less protruding. Costae of *R. alata* NILSSON, 1827 appear relatively smooth and flat near the commissure. In complete specimens of *A. kunradensis* sp. n. the costae are sharp and more angular. Although the dorsal fold of *A. kunradensis* is poorly developed, it remains visible. The dorsal fold of *R. alata* NILSSON, 1827 is undeveloped. Internal characters of *R. alata* NILSSON, 1827 remain unknown.

Comments

SENDEN (1975, p. 25) proposed that the rhynchonellide brachiopod from Kunrade formerly considered by BOSQUET (1860) as *Rhynchonella alata* NILSSON, 1827 should be placed in the genus *Cretirhynchia* PETTITT, 1950. The external characters observed and the results of the transverse serial sections do not confirm this opinion. The very large cyclothyridid, rimmed, foramen, the coarse costae ornamenting the shell as well as the wide linguiform extension observed in *Almerarhynchia kunradensis* sp. n. are not typical characters for the genus *Cretirhynchia*. A sharper concept of the genus *Cretirhynchia* has been described recently by SIMON & OWEN (2001) who pointed out the following internal characters:

- The dental plates are thick and convergent ventrally.
- Hinge plates are ventrally deflected, simple, subtriangular and never forked.
- The crural bases are subquadrate.
- The raduliform crura are straight, moderately concave distally and they remain close together.

– The crura are never strongly deflected ventrally and they are not distally widened.

In *A. kunradensis* n. sp., the dental plates are relatively thin and they are posteriorly divergent and anteriorly subparallel. The crural base are not subquadrate. The crura are steeply curved, widened and deflected ventrally.

The external aspect of the shell of *A. kunradensis* sp. n., with its coarse costae and its large hypothyriddid foramen, indicates that this rhynchonellide brachiopod was living in an environment with a high energy level. *A. kunradensis* sp. n. exhibits the typical outline of a rhynchonellide brachiopod living in a sublittoral transgressive sea-floor as already pointed out by AGER (1965, p. 144-146) for the species of the genus *Cyclothyris* M'COY, 1844. This theory is also confirmed for all the other species of terebratulid brachiopods from Kunrade that are massive species with an impressive large and attrite foramen. However, the fine-grained sediment observed in the matrix indicated a greater depth than a sublittoral environment. It is probable that this brachiopod fauna in Kunrade was not strictly sublittoral but established at greater depth and subjected to strong water currents.

In the assemblage studied, specimens with either right or left asymmetry are observed although few specimens exhibit a perfect bilateral symmetry. As this rhynchonellide brachiopod has been collected in huge quantities in the neighbourhood of Kunrade, it may be assumed that this species was very gregarious. The slight asymmetrical

outline of the shell could thus be attributed to the density of the individuals and to their gregarious way of life (LEE, 1978; ASGAARD & BROMLEY, 1990). In this case, the asymmetrical outline should be considered as a dissymmetry and not strictly as a true asymmetry as it has been pointed out by GASPARD (1991, p. 34).

Almerarhynchia kunradensis sp. n. is the first Maastrichtian rhynchonellide species of this genus described from the Maastricht area. Other species of *Almerarhynchia*, described by CALZADA (1974, 1989), CALZADA & POCOVI (1980), were collected from Upper Cretaceous Tethyan deposits in the Pre-Pyrenean region. The occurrence of a species of *Almerarhynchia* in the Upper Maastrichtian brachiopod fauna of Kunrade confirms Tethyan pulses in the Maastricht area which could have influenced the composition of the Upper Maastrichtian fauna as already pointed out by JAGT (1999, p. 35).

Acknowledgements

I wish to express my gratitude to J.W.M. JAGT (Maastricht) for the loan of specimens from the SENDEN collection preserved in the NHMM and for his advice concerning the stratigraphy of the Kunrade deposits. I am greatly indebted to S. CALZADA (Barcelona) for sending original specimens of *Almerarhynchia pocoviana* CALZADA & POCOVI, 1980. I am very grateful to M. MANCEÑO (La Plata) and E.F. OWEN (London) for kindly reviewing the manuscript. W. MISEUR (Brussels) made the fine photographs.

References

- AGER, D.V., 1965. Serial grinding techniques. In: Handbook of Paleontological techniques. San Francisco, London, Freeman and Co., pp. 212-224.
- AGER, D.V., 1965. The adaptation of Mesozoic brachiopods to different environments. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **1**, 143-172.
- ASGAARD, U. & BROMLEY, R.G., 1990. Population dynamics and autecology of "*Rhynchonella*" *triangularis* WAHL., a late Cretaceous rocky coast brachiopod. In: MACKINNON, D.I., LEE, D.E. & CAMPBELL, J.D. (eds.): Brachiopods through time. Balkema, Rotterdam, 247-252.
- BOSQUET, J., 1860. Fossile Fauna en Flora van het Krijt van Limburg. Afdruk uit Staring's "Bodem van Nederland", IIde deel, 31 pp.
- CALZADA, S., 1974. *Almerarhynchia* n. gen. *virgiliana* n. sp. del Maastrichtense de Figols, Prepireneo catalan. *Acta Geologica Hispanica*, **9** (3): 92-97.
- CALZADA, S., 1989. Una nueva especie de *Almerarhynchia* (Brachiopoda) del Cretácico Superior Pirenaico. *Revista Española de Paleontología*, **4**, 75-79.
- CALZADA, S. & POCOVI, A., 1980. Braquiópodos senonienses de la sierra del Mont-Roig (Prepireneo de Lérida). *Boletín de la real Sociedad española de la Historia natural (Geología)*, **78**, 5-19.
- DUMÉRIL, A.M.C., 1806. Zoologie analytique ou méthode naturelle de classification des animaux. Allais (ed.), Paris, XXIV + 344 pp.
- FAVRE, J., 1917 in CLERC, M. & FAVRE, J., 1910-18. Catalogue illustré de la collection LAMARCK. Première partie, fossiles. Conchyfères Monomyaires fossiles, III^e section, Brachiopodes. Muséum d'Histoire naturelle de Genève, Genève, 117 pls.
- FELDER, P.J. & BLESS, M.J.M., 1989. Biostratigraphy and ecostatigraphy of Late Cretaceous deposits in the Kunrade area (South-Limburg, SE Netherlands). *Annales de la Société géologique de Belgique*, **112** (1): 31-45.
- GASPARD, D., 1991. Les cas de non-symétrie chez les rhynchonelles. Quelle(s) signification(s)? *Geobios*, **13**, 33-44.
- HOFKER, J., 1966. Maastrichtian, Danian and Paleocene Foraminifera. The Foraminifera of the type Maastrichtian in South Limburg, Netherlands, together with the Foraminifera of the Danske Kalk and the overlying Greensands and Clays as found in Denmark. *Palaeontographica, supplement*, **A10**, ii + 376.
- JAGT, J.W.M., 1988. Some stratigraphical and faunal aspects of the Upper Cretaceous of southern Limburg (The Netherlands) and contiguous areas. In: The Chalk District of the Euregio Meuse-Rhine, M. Streel & M.J.M. Bless (eds.). Selected papers on Upper Cretaceous deposits. Natuurhistorisch Museum Maastricht/Université d'Etat Liège: 25-39.
- JAGT, J.W.M., 1999. Late Cretaceous – Early Palaeogene echinoderms and the K/T boundary in the southeast Netherlands and northeast Belgium. Part I: Introduction and stratigraphy. *Scripta Geologica*, **116**, 1-57.
- KENNEDY, W.J., 1986. The ammonite fauna of the type Maastrichtian with a revision of *Ammonites colligatus* BINKHORST,

1861. *Bulletin de l'Institut royal des Sciences naturelles de Belgique, Sciences de la Terre*, **56**, 151-267.
- 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**, Paris, 343 pp.
- LEE, D., 1978. Aspects of the ecology and paleoecology of the brachiopod *Notosaria nigricans* (Sowerby). *Journal of the Royal Society of New Zealand*, **8** (4): 395-417.
- MAKRIDIN, W.P., 1955. Some Jurassic rhynchonellids from the European part of the U.S.S.R. *Zapiski Geologicheskogo Fakulteta Kharkovskogo Universiteta*, **12**, 81-91. [in Russian].
- MANCEÑIDO, M.O., OWEN, E.F., DONG-LI, S., & DAGYS, A.S., 2002. Brachiopoda, Hemithyridoidea in Treatise on Invertebrate Paleontology, Part H (Revised), **4**: 1027-1376, R.L. Kaesler (ed.), Boulder, Colorado, USA.
- M'COY, F., 1844. A Synopsis of the Characters of the Carboniferous Limestone Fossils of Ireland. Dublin, viii + 207pp.
- NILSSON, S., 1827. *Petrificata suecana*. *Officina Berlingiana, Londini Gothorum* (Lund), 39 pp. [in Latin].
- NOWAK, J., 1913. Untersuchungen über die Cephalopoden der oberen Kreide in Polen. III Teil. *Bulletin de l'Académie des Sciences de Cracovie*, **6**(B): 335-412.
- OWEN, E.F., 1962. The brachiopod genus *Cyclothyris*. *Bulletin of the British Museum (Natural History), Geology*, **7** (2): 2-63.
- OWEN, E.F., 1988. Cenomanian brachiopods from the Lower Chalk of Britain and northern Europe. *Bulletin of the British Museum (Natural History), Geology series*, **44** (2): 65-175.
- PETTITT, N.E., 1950. A Monograph on some Rhynchonellidae of the British Chalk. Part 1. *Palaeontographical Society*, **103**, 1-26.
- RZHONSNITSKAYA, M.A., 1956. Systematization of Rhynchonellida. *XX Congreso Geológico Internacional, Mexico, Resúmenes de Trabajos presentados, Report*, **20**, 125-126.
- SENDEN, F.M.H., 1975. Reuzen uit kunrader kalksteen. *Mededelingen van de Afdeling Limburg der Nederlandse geologische Vereniging*, **19** (3): 25-27.
- SIMON, E. & OWEN, E.F., 2001. A first step in the revision of the genus *Cretirhynchia* PETTITT, 1950. *Bulletin de l'Institut royal des Sciences naturelles de Belgique, Sciences de la Terre*, **71**, 53-118.
- STERNBERG, R.M. & BELDING, H.F., 1942. Dry-peel technique. *Journal of Paleontology*, **16**, 135-136.
- WARREN, P.S., 1937. A Rhynchonellid Brachiopod from the Bearpaw Formation of Saskatchewan. *Transactions of the Royal Society of Canada, Section IV, Geological Sciences including Mineralogy, Ser. 3*, **31**: 1-4.

Eric SIMON
Département de Paléontologie
Section des Invertébrés fossiles
Institut royal des Sciences
naturelles de Belgique
rue Vautier, 29
B-1000 Bruxelles
Belgique
E-mail: ericssimon98brach@yahoo.fr

Typescript submitted: July 15, 2002
Revised typescript received: November 30, 2002

Explanation of Plates

PLATE 1

Almerarhynchia kunradensis sp. n.

All the specimens were collected from the Kunrade Limestone facies (Upper Maastrichtian, *Belemnitella junior* Zone) in Kunrade near Maastricht (Limburg, The Netherlands). a: dorsal view, b: ventral view, c: lateral view, d: anterior view, e: posterior view. Magnification: x 1.5 (except Fig. 1a which has a magnification x 1.4).

Fig. 1 — Holotype, complete bivalved specimen (*ex* collection UBAGHS), IRScNB in Brussels: IRScNB – MI 10889.

Fig. 2 — Paratype, complete bivalved specimen (*ex* collection SENDEN), NHMM in Maastricht under the reference NHMM 2002 136. This specimen was used for transverse serial sections (Text-Fig. 2).

Fig. 3 — Paratype, slightly dissymmetrical complete bivalved specimen (*ex* collection BOSQUET), preserved in the IRScNB in Brussels under the reference IRScNB - MI 10890.

PLATE 2

a: dorsal view, b: ventral view, c: lateral view, d: anterior view, e: posterior view.

Almerarhynchia kunradensis sp. n.

Paratypes, Kunrade Limestone facies (Upper Maastrichtian, *Belemnitella junior* Zone), Kunrade near Maastricht (Zuid-Limburg, The Netherlands).

Magnification: x 1.5

Fig. 1 — Complete bivalved specimen (*ex* collection SENDEN), NHMM n°2002 137.

Fig. 2 — Complete bivalved specimen (*ex* collection SENDEN), NHMM n°2002 138.

Almerarhynchia pocoviana CALZADA & POCOVI, 1980.

Fig. 3 — Specimen collected in the Sierra del Mont-Roig (Prepirineo de Lérida, Spain) *ex*-S. CALZADA coll. Upper Campanian; IRScNB – MI 10891.

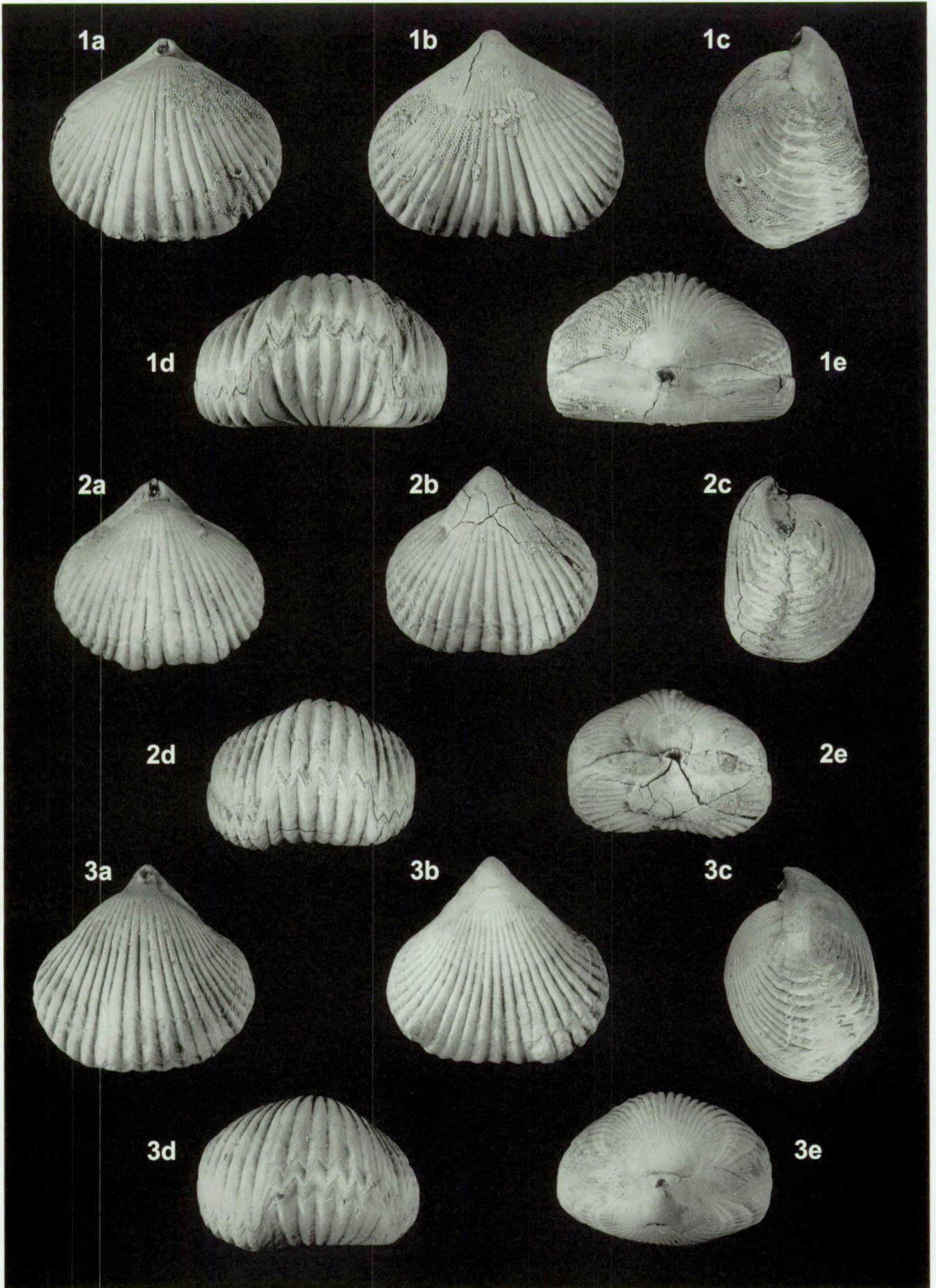


PLATE 1

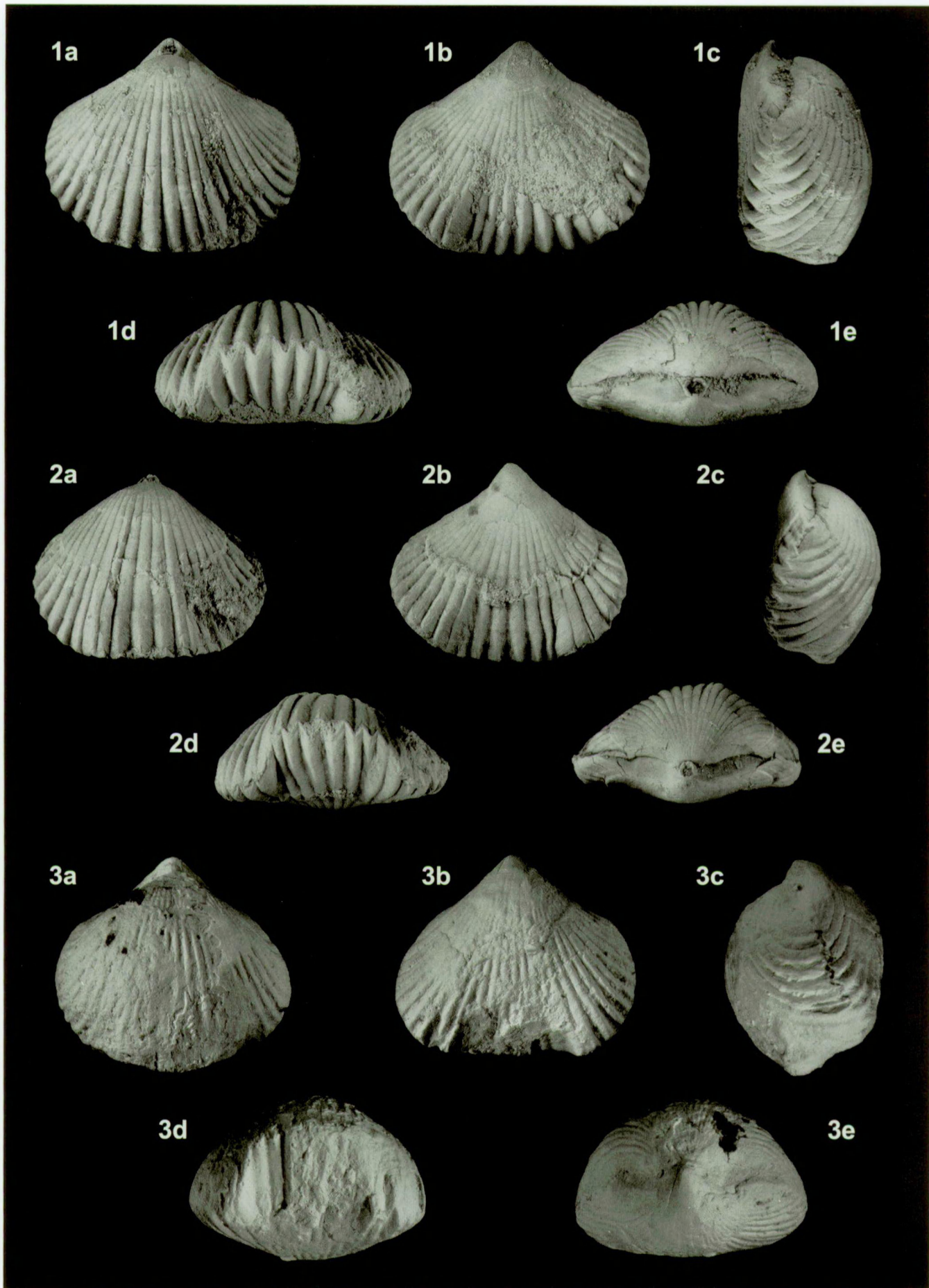


PLATE 2