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A reappraisal of the problematic European, Late Cretaceous brachiopod *Leptothyrellopsis polonicus* BITNER & PISERA, 1979

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Abstract

This short note presents an emended description of *Leptothyrellopsis polonicus* BITNER & PISERA, 1979 based on new and well-preserved material from Cuesmes and Ciply (Mons Basin, Hainaut, Belgium), as well as re-examination of type and additional material from Mielnik, eastern Poland. The stratigraphic range of *L. polonicus* is defined as from Lower Campanian to Upper Maastrichtian. On the basis of comparisons between *Leptothyrellopsis polonicus* and various other similar-looking brachiopods, including the Recent *Leptothyrella* MUIR-WOOD, *Leptothyrellopsis polonicus* is retained, meantime, in *Incertae sedis*.

Key words: Brachiopods, *Leptothyrellopsis polonicus*, Upper Cretaceous, Poland, Belgium.

Résumé

Cette note présente une description revisée de *Leptothyrellopsis polonicus* BITNER & PISERA, 1979 basée sur un matériel nouveau provenant de Cuesmes et de Ciply (Bassin de Mons, Hainaut, Belgique). Le matériel type ainsi que de nouveaux spécimens provenant de Mielnik (Pologne) ont été examinés. L'amplitude stratigraphique de *Leptothyrellopsis polonicus* s'étend du Campanien Inférieur au Maastrichtien Supérieur. Sur base d'une étude comparative incluant *Leptothyrellopsis polonicus* et d'autres brachiopodes très similaires extérieurement, tel le genre récent *Leptothyrella* MUIR-WOOD 1965, il convient de maintenir *Leptothyrellopsis polonicus* comme *Incertae sedis*.

Mots-clefs: Brachiopodes, *Leptothyrellopsis polonicus*, Crétacé Supérieur, Pologne, Belgique.

Introduction

The monotypic genus *Leptothyrellopsis* and the species *Leptothyrellopsis polonicus* were erected in 1979 by BITNER & PISERA for specimens found at Mielnik (eastern Poland) which were considered by these authors to resemble very closely representatives of the genus *Leptothyrella* MUIR-WOOD, 1965. The original description of BITNER & PISERA (1979) was based on a few, relatively poorly-preserved specimens. More recently, further material has been collected from the type locality at Mielnik by one of us (MAB) and a significant quantity of new and well-preserved material referable to *L. polonicus* has been collected by SIMON from the white chalk facies of the Mons Basin (Hainaut, Belgium) and from the phosphatic chalk of Ciply. From these later collections, important new morphological characters have been observed which necessitate both emendation of the description of *L. polonicus* and reappraisal of its taxonomic affinities. Over the past twenty years, *L. polonicus* has been found in various European countries and its stratigraphic range is now better known. Consequently, a synthesis of the geographic and stratigraphic distribution of *L. polonicus* is included.

Systematic description

Phylum Brachiopoda DUMERIL, 1806
Subphylum Rhynchonelliformea WILLIAMS *et al.* 1996
Class Rhynchonellata WILLIAMS *et al.* 1996
Order Terebratulida WAAGEN, 1883
Suborder Terebratellidina MUIR-WOOD, 1955
Superfamily Uncertain
Family Uncertain

DISCUSSION: At present *Leptothyrellopsis polonicus* cannot be placed with certainty within any existing higher taxonomic category. Further discussion of the taxonomic placement of *L. polonicus* follows the revised morphological description.

Genus *Leptothyrellopsis* BITNER & PISERA, 1979

TYPE SPECIES: *Leptothyrellopsis polonicus* BITNER & PISERA, 1979 by original designation.

DIAGNOSIS

Shell small, slightly biconvex, elongate-oval, densely punctate; foramen large, hypothyrid; ventral valve with dental plates; pedicle collar sessile and generally indistinct; dorsal valve with high, plate-like septal pillar situated mainly anterior of mid-valve; crura slender, arising directly from inner socket ridges; crural plates present, spicules present.

Leptothyrellopsis polonicus BITNER & PISERA, 1979
Plate 1, Figures 1-7.

* *v* 1979 *Leptothyrellopsis polonicus sp. n.* - BITNER & PISERA, pp. 82 - 83, text- fig. 5, pl. 7, figs. 1 - 4.
. 1982 *Leptothyrellopsis polonicus* BITNER & PISERA - SURLYK, fig. 1, pl. 3, figs. C - e.
. 1988 *Leptothyrellopsis polonicus* BITNER & PISERA - JOHANSEN, fig. 2.

. 1990 *Leptothyrellopsis polonicus* BITNER & PISERA, 1979 - JOHANSEN & SURLYK, pp. 868 - 869, pl. 11, figs. 1 - 4.
. *v* 1995 *Leptothyrellopsis polonicus* BITNER & PISERA, 1979 - SIMON *in* JAGT *et al.*, p. 12.

MATERIAL INVESTIGATED

POLAND: – Large abandoned quarry at Mielnik, eastern Poland; 8 conjoined specimens, 15 ventral valves and 22 dorsal valves.
– Active quarry at Kornica, eastern Poland; 2 ventral valves and 1 dorsal valve.
– Huge active quarry at Chelm, south-eastern Poland; 2 conjoined specimens, 4 ventral valves, and 1 dorsal valve (BITNER, in prep.).
BELGIUM: The stratigraphy of the Mons Basin localities has been documented previously by ROBASZYNSKI & CHRISTENSEN (1989). The stratigraphy at Altembroeck in the Maastricht area was described by KEUTGEN (in JAGT *et al.* 1995).
– Craibel Quarry, Cuesmes (Mons Basin, Hainaut); six conjoined specimens, three ventral valves, seven dorsal valves and five fragments collected from the top part of the Chalk of Trivières and the base of the Chalk of Obourg/Nouvelles (Base of the lower part of the Upper Campanian).
– Small disused quarry at Nouvelles (Mons Basin, Hainaut, Belgium); three conjoined shells, two ventral valves and six fragments collected from the upper part of the Chalk of Nouvelles (top of lower part of the Upper Campanian).
– VAN DAMME Quarry, Ciply (Mons Basin, Hainaut); thirty-five conjoined specimens, eleven ventral valves, two dorsal valves and some additional fragments, all collected from the phosphatic chalk of Ciply (upper part of the lower Lower Maastrichtian).
– "Château Altembroeck" Quarry, 's Gravensvoeren (Fouron-le-Comte) (Maastricht area, Limburg); four conjoined specimens collected from the Chalk of Vijlen (lower part of the upper part of the Lower Maastrichtian).

Emended description

EXTERNAL CHARACTERS:

The shell is oval to elongate oval in outline, with its maximum width at, or slightly anterior of, valve midlength. The length to width ratios of the ventral and dorsal valves range from 1.15 to 1.52 (ventral) and 0.85 to 1.31 (dorsal) respectively. The shell is slightly biconvex with its thickness to width ratio ranging from 0.15 to 0.48. [The morphological ratios, presented here, take into account material both from Poland and from Belgium.] The anterior commissure is rectimarginate. The external surface of the shell is smooth, except for some growth lines. The beak ridges are distinct and the beak is elongate and slightly attrite apically. The foramen is large, hypothyrid, and bordered by two narrow, disjunct deltidial plates.

INTERNAL CHARACTERS:

Ventral valve

There is a weak development of a pedicle collar which forms a step-like thickening of the shell in only some specimens. Very distinct and well developed dental plates support small teeth which are internally curved and sharply pointed. The valve floor is smooth.

Dorsal valve

A high, plate-like septal pillar occurs in the middle of the dorsal valve. It is developed both anteriorly and ventrally such that it reaches the ventral valve floor. In lateral profile, the septal pillar is subtrapezoidal with its posterior edge higher than the anterior edge. The posterior edge slopes steeply to the dorsal valve floor whereas the anterior edge is gently rounded. The inner socket ridges are strong, high, and anteriorly divergent. The sockets are relatively deep. There is no discernible cardinal process. Outer hinge plates are not developed. In better-preserved specimens from Cuesmes, crura arise directly from the anterior part of the inner socket ridges. The crura are slender, straight, subparallel and directed ventrally. Neither septal flanges nor hood (or ring) are developed from the dorsal septal pillar. Small, recessive, almost vertical, crural plates (seen so far only in well-preserved specimens from Mielnik and from Ciply) extend from the dorsal side of the inner socket ridges to the valve floor. The spicular skeleton is often recrystallized. The lophophore was probably schizolophous.

COMPARISON WITH OTHER BRACHIOPODS

Leptothyrellopsis was originally so named by BITNER and PISERA (1979) because of a perceived external similarity to the Recent monotypic genus *Leptothyrella* MUIR -WOOD, 1965, type species *Leptothyrella ignota* (MUIR-WOOD, 1959). However, a restudy of the type material of *L. ignota* by one of us (DIM) has revealed that certain aspects of the original morphological description by MUIR-WOOD are incorrect. In particular, *L. ignota* (Plate 1, Figure 8) possesses recessive dental plates and there are no descending branches; the crura are long, slender, ventromedianly curved and extend almost to the distal extremity of the septal pillar but they do not connect with the latter. Although dental plates are present in both *Leptothyrellopsis* and *Leptothyrella*, the two taxa are readily distinguished on the differing shape and location of the septal pillar. The septal pillar of *Leptothyrellopsis* is subquadrate, with an elongate ventral edge that contacts the ventral valve floor, and is anteromedianly located, whereas the septal pillar in *Leptothyrella* is triangular and distally pointed, and is posteromedianly located. In addition, crural plates, newly identified in *Leptothyrellopsis polonicus*, are not developed in *Leptothyrella ignota*.

Juvenile specimens of *Magas chitoniformis* (VON SCHLOTTHEIM, 1813) and specimens of *Dalligas nobilis* STEINICH, 1968 are often difficult to distinguish from *Leptothyrellopsis polonicus*. However, *Magas chitoniformis* lacks both dental and crural plates at all known growth stages, and the septal pillar of *M. chitoniformis* is differently shaped and more posteriorly located than in *Leptothyrellopsis*. Adult specimens of *Dalligas nobilis* exhibit a low dorsal septalium, lack crural plates and are ribbed on their ventral valve.

Morrissia? suessi BOSQUET, 1859 is another small brachiopod reported from the Maastricht area which exhibits an elongate outline, a long beak, and a large hypothyrid foramen. However, features of the dorsal valve interior of *M.? suessi* are poorly known and a search of the collection of BOSQUET in the Royal Belgian Institute of Natural Sciences, Brussels, failed to find any material referable to *M.? suessi.* Thus the only known specimens of *M.? suessi* are presumed lost.

The only other terebratulid brachiopod known to us that possesses a plate-like septal pillar in the adult stage is the Recent genus *Simplicithyris* ZEZINA, 1976. However in *Simplicithyris* crura are suppressed, and the septal pillar, though located well forward, is very differently shaped to the septal pillar of *Leptothyrellopsis*, being anteriorly digitate rather like a cockscomb. A further point of dissimilarity between the two taxa is the presence of a prominent, excavate pedicle collar in

Simplicithyris. In *Leptothyrellopsis* a pedicle collar is seldom differentiated, although some larger specimens appear to display slight shell thickening in the posteromedian region of the ventral valve.

STRATIGRAPHIC AND GEOGRAPHIC DISTRIBUTION.
Leptothyrellopsis is known from the lower part of the Lower Campanian till the upper part of the Upper Maastrichtian (JOHANSEN 1988, p. 44, fig. 2, no.24).

POLAND: The original type locality at Mielnik on the Bug River, eastern Poland, has been the subject of a number of previous investigations (BIEDA 1958, POŻARYSKI 1960, GAŹDZICKA 1981, PERYT 1981, OLSZEWSKA 1990). In those investigations there is general agreement that the lower part of the section, below the hardground, is Campanian, and that the upper part, above the hardground, is Lower Maastrichtian. There is, however, less agreement as to the extent of the stratigraphic gap associated with the hardground horizon. On the basis of calcareous nanoplankton, GAŹDZICKA (1981) assigned the lower part of the section to the upper part of the Lower Campanian (*Broinsobraces parca* coccolith Zone), while the upper part she referred to the *Quadrum trifidum* coccolith Zone which comprises the Upper Campanian and the lowermost part of the Maastrichtian. However, PERYT (1981), on Foraminifera, determined the age of the part of the section below the hardground as Upper Campanian (*Globigerinelloides multispinus* Zone), and the upper part, above the hardground, as uppermost Lower Maastrichtian (*Rugoglobigerina pennyi* Zone). According to PERYT, the lower part of the Lower Maastrichtian is absent. More recently, OLSZEWSKA (1990) subdivided the Mielnik section into three intervals: (1) the uppermost Lower Campanian and the lowermost Upper Campanian (*Belemnitella mucronata* Zone) below the hardground, (2) the lowermost Lower Maastrichtian (*Belemnitella lanceolata* or *B. pseudobtusa* Zone) above the hardground, and (3) a stratigraphic gap, associated with the intervening hardground horizon, comprising the upper part of the Upper Campanian (at least *Belemnitella langei* Zone). *Leptothyrellopsis*-bearing deposits from other sites in Poland have drawn much less attention. The Chalk from nearby Kornica, on the basis of calcareous nanoplankton, has been assigned to the upper part of the Lower Maastrichtian, or the Middle Maastrichtian (GAŹDZICKA, 1981). Based on Foraminifera, the Upper Cretaceous chalk deposits exposed at Chełm, south-eastern Poland, are defined as Lower and Upper Maastrichtian (WITWICTKA 1958).

GERMANY: Kronsmoor, Lagerdorf; Upper Campanian to Lower Maastrichtian boundary.
ENGLAND: Norfolk; several localities (see JOHANSEN & SURLYK, 1990, p. 869). From the Upper Campanian to Lower Maastrichtian.

BELGIUM: Cuesmes, Obourg, Harmignies and Nouvelles (Mons Basin, Hainaut). White chalk facies. From the base of the Upper Campanian (top of the Chalk of Trivières) to the upper part of the Upper Campanian (Craie de Spiennes).

Ciply (Mons Basin, Hainaut): phosphatic chalk of Ciply; Upper part of the lower Lower Maastrichtian (*Belemnella obtusa* Zone).

Altembroeck (Maastricht area). Lower part of the upper part of the Lower Maastrichtian (*Belemnella sumensis* Zone).

DISCUSSION
Leptothyrellopsis polonicus possesses a puzzling set of morphological characteristics that currently preclude unequivocal placement of this genus in any existing higher taxonomic category of terebratulid brachiopod. The presence of dental plates precludes placement in the superfamily Terebratelloidea (as redefined in the forthcoming revision of the Treatise on Invertebrate Paleontology, Part H, Brachiopoda, MACKINNON, in prep.). In the possession of a non-bifurcate ventral edge to the septal pillar *L. polonicus* differs from other Cretaceous chalk brachiopods in which a juvenile axial loop stage (see RICHARDSON 1975, MACKINNON 1993 for definitions of terms used in descriptions of loop ontogeny) has been observed (e.g. STEINICH 1965). As previously discussed, *L. polonicus* differs from modern *Leptothyrella ignota* in the radically different shape and location of the septal pillar, and in the possession of crural plates.

Currently, our understanding of the phylogenetic relationships of Mesozoic septate terebratulids is very incomplete and we are reluctant to ''shoe-horn'' *Leptothyrellopsis polonicus* into any currently accepted higher taxon because there is, quite simply, inadequate morphological justification for doing so. Consequently, for the time being at least, we prefer to place *Leptothyrellopsis* in *Incertae sedis*.

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PLATE 1

Fig. 1 – *Leptothyrellopsis polonicus* BITNER & PISERA, 1979. Holotype. Mielnik (eastern Poland). Lower part of the Upper Campanian. 1a: dorsal view, 1b: ventral view, 1c: lateral view. Magnification: 13.4 x. (Original illustration from BITNER & PISERA, 1979).

Fig. 2 – *Leptothyrellopsis polonicus* BITNER & PISERA, 1979. Specimen from the phosphatic chalk of Ciply (VAN DAMME quarry;, Ciply, Mons basin, Hainaut, Belgium). 2a: dorsal valve in ventral view showing crural plates. 2b: A detail of the same specimen illustrating the structure of the socket and a crural plate. The trace of the crus is perceptible (Scale bar: 100 µm). Upper part of the lower part of the Lower Maastrichtian (*Belemnella obtusa* Zone). Specimen preserved at the Institut royal des Sciences naturelles de Belgique in Brussels (IRScNB. – IST n°10749). Magnification: 16 x.

Fig. 3 – *Leptothyrellopsis polonicus* BITNER & PISERA, 1979. Specimen (uncleaned) from the phosphatic chalk of Ciply (VAN DAMME quarry, Ciply, Mons basin, Hainaut, Belgium). Dorsal valve in ventral view showing well developed crural plates. Upper part of the lower part of the Lower Maastrichtian (*Belemnella obtusa* Zone). Specimen preserved at the Institut royal des Sciences naturelles de Belgique in Brussels (IRScNB. – IST n°10750). Magnification: 25 x.

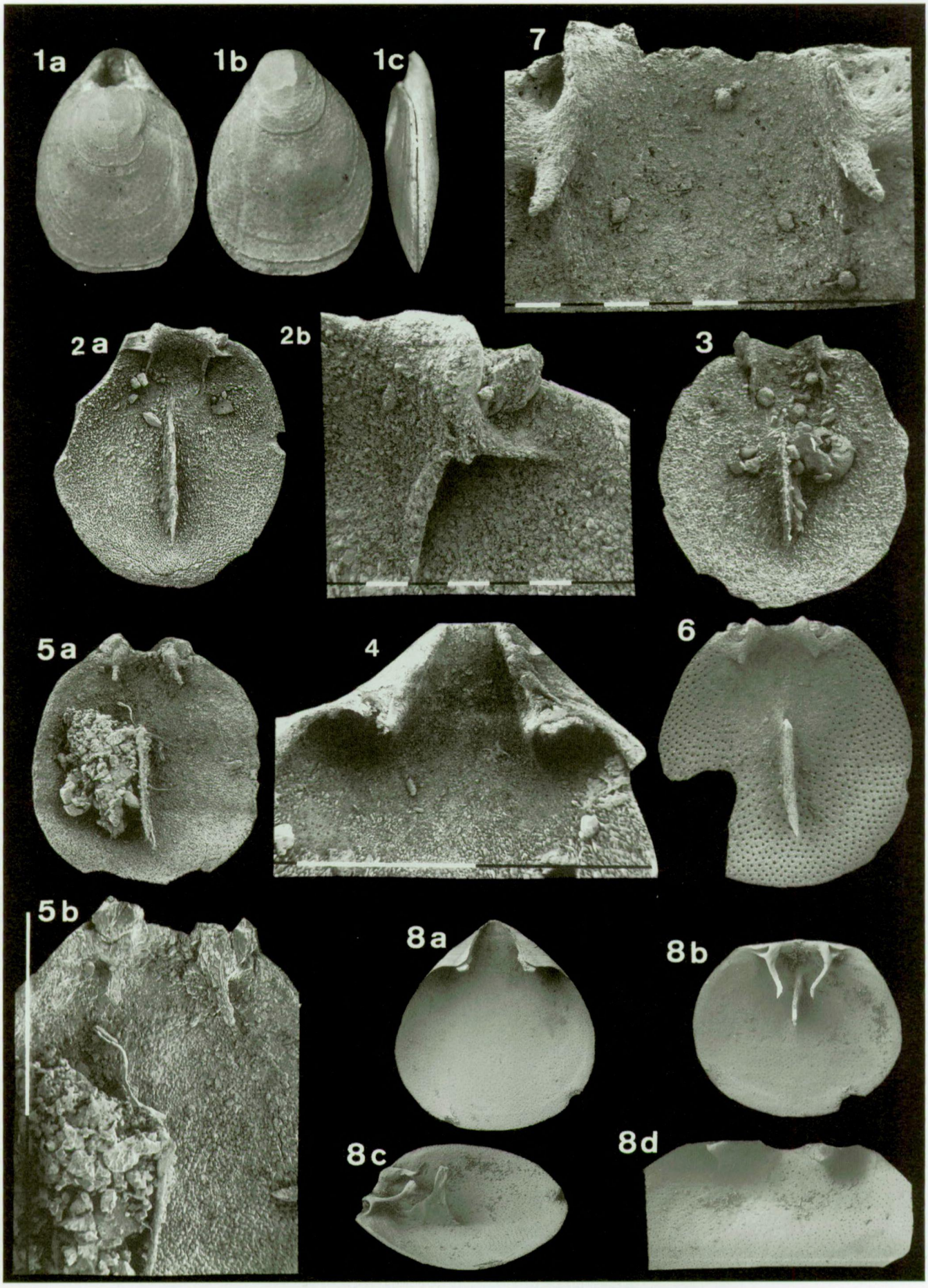
Fig. 4 – *Leptothyrellopsis polonicus* BITNER & PISERA, 1979. Specimen from the phosphatic chalk of Ciply (VAN DAMMEquarry, Ciply, Mons basin, Hainaut, Belgium). A detail of a ventral valve showing the dental plates in oblique anterior view. Upper part of the lower part of the Lower Maastrichtian (*Belemnella obtusa* Zone). Specimen preserved at the Institut royal des Sciences naturelles de Belgique in Brussels (IRScNB. – IST n°10751). Scale bar: 1 mm.

Fig. 5 – *Leptothyrellopsis polonicus* BITNER & PISERA, 1979. Specimen (uncleaned) from the top of the Chalk of Trivières (Craibel quarry, Cuesmes, Mons basin, Hainaut, Belgium). Lowermost Upper Campanian (*Belemnitella mucronata* Zone). 5a: dorsal valve in ventral view with intact crura. The septal pillar and a part of the spicular skeleton are visible. Specimen preserved at the Institut royal des Sciences naturelles de Belgique in Brussels (IRScNB. - IST n°10752). Magnification: 21.5 x. 5b: same specimen showing a detail of the crura. Scale bar: 1 mm.

Fig. 6 – *Leptothyrellopsis polonicus* BITNER & PISERA, 1979. Specimen (cleaned) from the top of the Chalk of Trivières (Craibel quarry, Cuesmes, Mons basin, Hainaut, Belgium). Lowermost Upper Campanian (*Belemnitella mucronata* Zone). Dorsal valve in ventral view: the base of the crura are clearly visible. Specimen preserved at the Institut royal des Sciences naturelles de Belgique in Brussels (IRScNB. – IST n°10753). Magnification: 21.5 x.

Fig. 7 – *Leptothyrellopsis polonicus* BITNER & PISERA, 1979. Another specimen from the top of the Chalk of Trivières (Craibel quarry, Cuesmes, Mons basin, Hainaut, Belgium). Lowermost Upper Campanian (*Belemnitella mucronata* Zone). A detail of the sockets, intact crura and crural plates. Specimen preserved at the Institut royal des Sciences naturelles de Belgique in Brussels (IRScNB. – IST n°10754). Scale bar: 100 µm.

Fig. 8 – *Leptothyrella ignota* (MUIR - WOOD, 1959). Recent. Specimen collected by the reasearch vessel VITJAZ (18-03-1973) from the Indian Ocean (Lat.: 88°54.4' E., Long.: 12°46.7' S.) at a depth of 4600 m. Station 6744 - 30, Sigsby Trawl. 8a: ventral valve in dorsal view. 8b: dorsal valve in ventral view showing the septal pillar, placed posteriorly, and the crura. 8c: dorsal valve in lateral view. The posterior position of the septal pillar is clearly visible. (Magnification: 8.5 x. 8d: a detail of the internal structure of the beak showing dental plates (Magnification: 13.2 x). Specimen preserved at the Geological Department of the University of Canterbury, Christchurch, New Zealand.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