

# The genus *Iowatrypa* COPPER, 1973 (Brachiopoda) in the Les Valisettes Formation (late Frasnian of the Philippeville Anticlinorium, southern Belgium).

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## Abstract

A new species of the genus *Iowatrypa* COPPER, 1973 [*I. philippevillensis* n. sp. (Pseudogruenewaldtiinae)] is described from the late Frasnian (Upper *Palmatolepis rhenana* Zone) Les Valisettes Formation (Philippeville Anticlinorium).

**Key-words:** Brachiopods. Atrypida. Late Frasnian. Systematic palaeontology.

## Résumé

Une nouvelle espèce du genre *Iowatrypa* COPPER, 1973 de la Formation des Valisettes (Frasnien terminal; Anticlinorium de Philippeville) est décrite [*I. philippevillensis* n. sp. (Pseudogruenewaldtiinae)].

**Mots-clefs:** Brachiopodes. Atrypida. Frasnien terminal. Paléontologie systématique.

## Introduction

In this paper, a new species of the genus *Iowatrypa* COPPER, 1973 is described from the Les Valisettes Formation (late Frasnian) of the Philippeville Anticlinorium (= Philippeville Massif in the Belgian literature). The late Frasnian atrypids from the southern flank of the Dinant Synclinorium were recently described by GODEFROID & HELSEN (1998) where their extinction is closely related to the appearance of green and black shales of the Matagne Formation (GODEFROID & HELSEN, 1998, p. 267).

In the Philippeville Anticlinorium, the extinction of the atrypid brachiopods occurs in the upper part of the Les Valisettes Formation, just below the base of the dark shales of the Matagne Formation, which is later than on the southern border of the Dinant Synclinorium (GODEFROID & HELSEN, 1998, pp. 267-268, fig. 20). New collections of fossils from the Neuville railway section include the last atrypids of the genus *Costatrypa* COPPER,

1973. *Costatrypa*'s highest occurrence is less than 1 m below the base of the Matagne Formation at position eight meters higher than the level previously reported by GODEFROID & HELSEN (1998, p. 266, fig. 2I).

The dominant atrypids of the Les Valisettes Formation include species of the genera *Iowatrypa* and *Costatrypa*. Less abundant are species of the genera *Spinatrypa* (*Spinatrypa*) STAINBROOK, 1945, *Desquamatia* (*Desquamatia*) ALEKSEEVA, 1960, and possibly *Waiotrypa* BALIŃSKI, 1997. *Spinatrypina* RZHONSNITSKAYA, 1964 may also be present in the massive reddish-pinkish limestone mounds developed within the formation but requires further investigation to confirm its occurrence.

All figured and measured specimens are stored at the Royal Belgian Institute of natural Sciences at Brussels, where they are numbered IRScNB a11993 – a12001.

## Stratigraphy

GEOLOGICAL CONTEXT, LITHOSTRATIGRAPHICAL UNITS AND BIOSTRATIGRAPHY

The Philippeville Anticlinorium includes the W-E oriented Givetian and Frasnian anticlines located in the central part of the Dinant Synclinorium that are surrounded by Famennian deposits. BOULVAIN *et al.* (1993, pp. 2-7) summarized the ideas concerning the development of this structural unit. Six Frasnian formations with a cumulative thickness of  $\pm 350$  m are recognized in the Philippeville Anticlinorium. In ascending order, these are: the Nismes, Pont de la Folle, Philippeville, Neuville, Les Valisettes, and Matagne formations (for descriptions of these formations see BOULVAIN *et al.*, 1993; 1999).

In the Philippeville Anticlinorium, the upper part of the Frasnian starts with the Neuville Formation (thickness: 15-25 m; Lower *Palmatolepis rhenana* Zone) that consists of nodular limestones and shales with limestone nodules. The overlying Les Valisettes Formation (thickness: at least 90 m; Upper *P. rhenana* Zone) is made up of shales, although it includes in the Neuville railway section (the type section) red to green nodular limestone and shales with calcareous nodules. The well-developed pink-

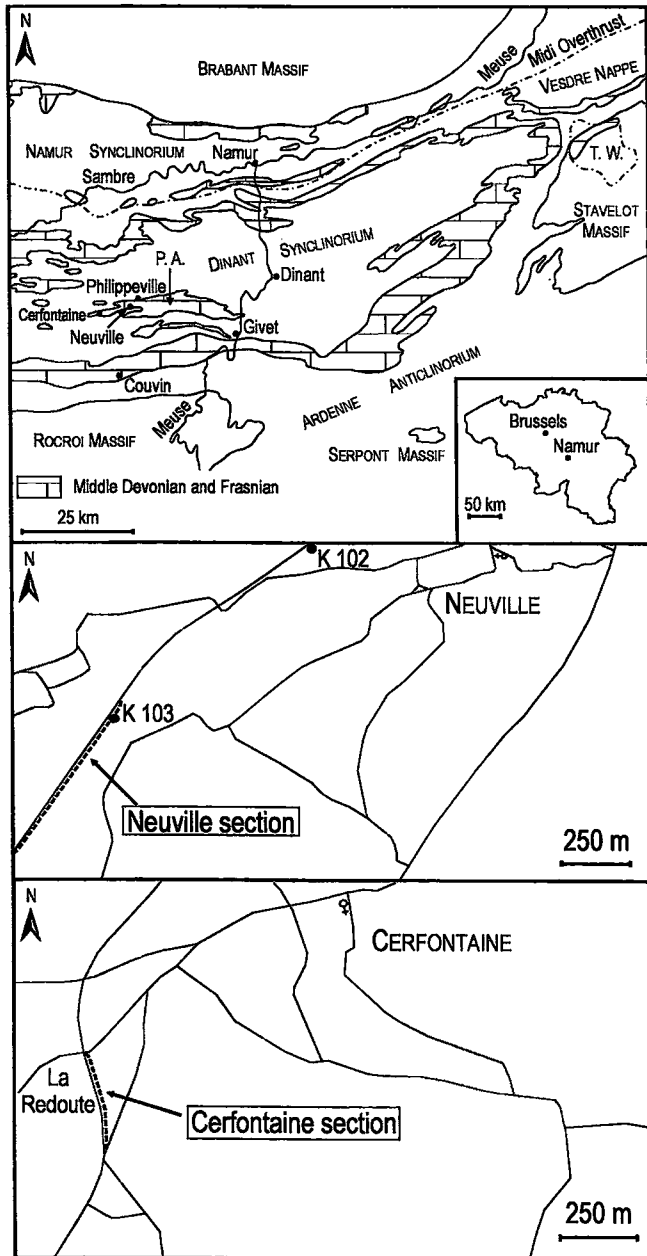


Fig. 1 – Schematic geological map of southern Belgium with location of the fossiliferous localities. P. A.: Philippeville Anticlinorium; T.W.: Theux Window.

ish-reddish massive limestone mounds within these two formations are placed in the Petit-Mont Member. According to COEN as cited by BULTYNCK & DEJONGHE *in* BOULVAIN *et al.* (1999, p. 6), the Les Valisettes Formation should be restricted to the Philippeville Anticlinorium where it was originally defined. Nevertheless, it has sometimes been used for designating the shaly episodes between the Neuville and the Matagne formations on the southern flank of the Dinant Synclinorium, and between the Neuville and the Barvaux formations on the south-eastern border of this synclinorium. The upper part of the Frasnian succession consists of the black to dark

greenish-brownish shales of the Matagne Formation (thickness:  $\pm 10$  m; *P. linguiformis* Zone).

#### OUTCROPS (Fig. 1)

The studied material comes from the Neuville and Cerfontaine sections located on the southern flank of the Philippeville Anticlinorium (topographic map 1:25000 Froidchapelle – Senzeille 57/3-4).

The Neuville railway section (BM-2002-8) is located south-west of the village of Neuville, on the eastern side of a trench dug for the Couvin-Charleroi railway [grid references of the milestone 103 (Belgian Lambert system): X = 159.473; Y = 95.359]. This section was described by numerous authors (BOUCKAERT & MOURAVIEFF, 1970; COEN & COEN-AUBERT, 1976, pp. 2-6; BOULVAIN *et al.*, 1993, pp. 20-21, pp. 27-28, figs. 6-7; 1999, pp. 74-75, p. 80, figs. NEU2 and VAL1; BULTYNCK *et al.* 1998, p. 29, p. 34, p. 39, figs. 10-13; CASIER, 2003). GODEFROID & HELSEN (1998, pp. 265-266, fig. 2I) have briefly discussed the occurrences and stratigraphic ranges of atrypid brachiopods in the Neuville and Les Valisettes formations.

The section of Cerfontaine (BM-2003-3) is located on the eastern side of the bypass road of Cerfontaine at the La Redoute locality (grid references of the northern extremity of the outcrop: X = 152.269; Y = 94.950). The Les Valisettes Formation is exposed for a distance of 250 m and is essentially shaly (lower and upper contacts are lacking). The lower  $\pm 36$  m of the formation consists of green shales and a sparse macrofauna that includes cyrtospiriferid and productellid brachiopods. The middle part of the formation (thickness:  $\pm 7$  m) consists of nodular argillaceous limestones and nodular shales with massive rugose corals and brachiopods (mainly cyrtospiriferids and atrypids). The upper  $\pm 33$  m of the formation consists of green to greenish-brownish shales with levels rich in nodules. The macrofauna includes some rugose corals and abundant brachiopods (mainly cyrtospiriferids, atrypids and athyridids). Shells of the genus *Iowatrypa* were collected from the 216 m – 240 m interval of the northern part of the outcrop.

#### Systematic palaeontology

Abbreviations: aa – apical angle; sa – shoulder angle; L – length of the ventral valve; Uld – Unrolled length of the dorsal valve; Ulv – Unrolled length of the ventral valve; T – thickness of the shell; W – width of the shell; Whl – width of the hinge line. The ratios and measurements of angles put between brackets are less frequent.

Order Atrypida RZHONSNITSKAYA, 1960  
 Suborder Atrypidina MOORE, 1952  
 Superfamily Atrypoidea GILL, 1871  
 Family Atrypidae GILL, 1871  
 Subfamily Pseudogruenewaltdiinae RZHONSNITSKAYA,  
 YUDINA & SOKIRAN, 1997

Table 1

<i>Iowatrypa philippevillensis</i> n. sp.								
Specimen	Dimensions in mm						aa	sa
	W	L	Ulv	Uld	T			
Holotype	15.3	13.25	20	14	8.25	120°	151°	
Paratype A	13.65	12.05	17	13	8	125°	152°	
Paratype B	14.65	13.2	22	13.5	9.2	137°	153°	
Paratype C	12.35	11.4	16	12	6.05	122°	157°	
Paratype D	15.5	13.55	23	15	10.4	122°	156°	

Genus *Iowatrypa* COPPER, 1973

## Type-species

*Atrypa owensis* WEBSTER, 1921*Iowatrypa philippevillensis* n. sp.

Plate 1: Figures 1-5; Figures 2-4; Table 1

e. p. 1998 ?*Waiotrypa* sp. – GODEFROID & HELSEN, p. 266, fig. 2I.

## DERIVATIO NOMINIS

Allusion to the Philippeville Anticlinorium.

## TYPES

Holotype: IRScNB a11993; Paratypes A: IRScNB a11994; B: IRScNB a11995; C: IRScNB a11996; D: IRScNB a11997; E: IRScNB a11998; F: IRScNB a11999; G: IRScNB a12000. Cerfontaine section, between 216 m – 240 m from the northern extremity of the outcrop.

## LOCUS TYPICUS

Cerfontaine section, on the eastern side of the bypass road of Cerfontaine at the La Redoute locality [grid references of the northern extremity of the outcrop (Belgian Lambert system): X = 152.269; Y = 94.950].

## STRATUM TYPICUM

Upper part of the Les Valisettes Formation (late Frasnian).

## MATERIAL

90 of the 465 specimens examined are in relatively good state of preservation, 218 satisfactory; 157 specimens are fragmental and/or deformed.

## DIAGNOSIS

A generally wider than long (W/L: 0.96-1.36), equibiconvex to ventribiconvex species of *Iowatrypa* with a subqua-

dratic to subrounded outline (maximum W = 18.5 mm; maximum L = 15.4 mm; maximum T = 10.7 mm). Rectimarginate to moderately uniplicate anterior commissure. Interarea lacking.

## DESCRIPTION

## External characters

*General characters*

The equibiconvex to ventribiconvex and generally wider than long [W/L: (0.96) 1.01-1.27 (1.36)] shell displays a straight hinge line and indented shoulder lines. The hinge line is shorter than the width [Whl/W: (0.58) 0.65-0.84 (0.90)], maximum width near the hinge line to about the mid-length. The outline is subquadratic to subrounded (rounded to straight anterior margin). The anterior commissure is rectimarginate to uniplicate.

*Ventral valve*

In lateral profile view, the convexity is variable [ULv/L: (1.04) 1.14-1.60 (1.76)]; the anterior third is generally more curved than the two posterior thirds (except the umbonal part). In posterior view, its upper surface is dome-shaped (more rarely carinate); the flanks slope slightly to moderately towards the lateral commissure. Lacks a sulcus; the tongue is absent (rectimarginate anterior commissure) or represented generally by a poorly to moderately marked undulation. Some rare specimens have a well-defined and subtrapezoidal tongue which is more or less perpendicular to the commissural plane. The beak is erect and pierced by a minute transapical foramen with no visible interarea between the beak and cardinal margin. The shoulder lines are indented by a small prominent umbo. The apical angle varies between (105°) 114°-138°; the shoulder angle between (145°) 151°-168°.

*Dorsal valve*

In lateral view, its upper surface is moderately curved. It is slightly to moderately inflated in posterior view. The

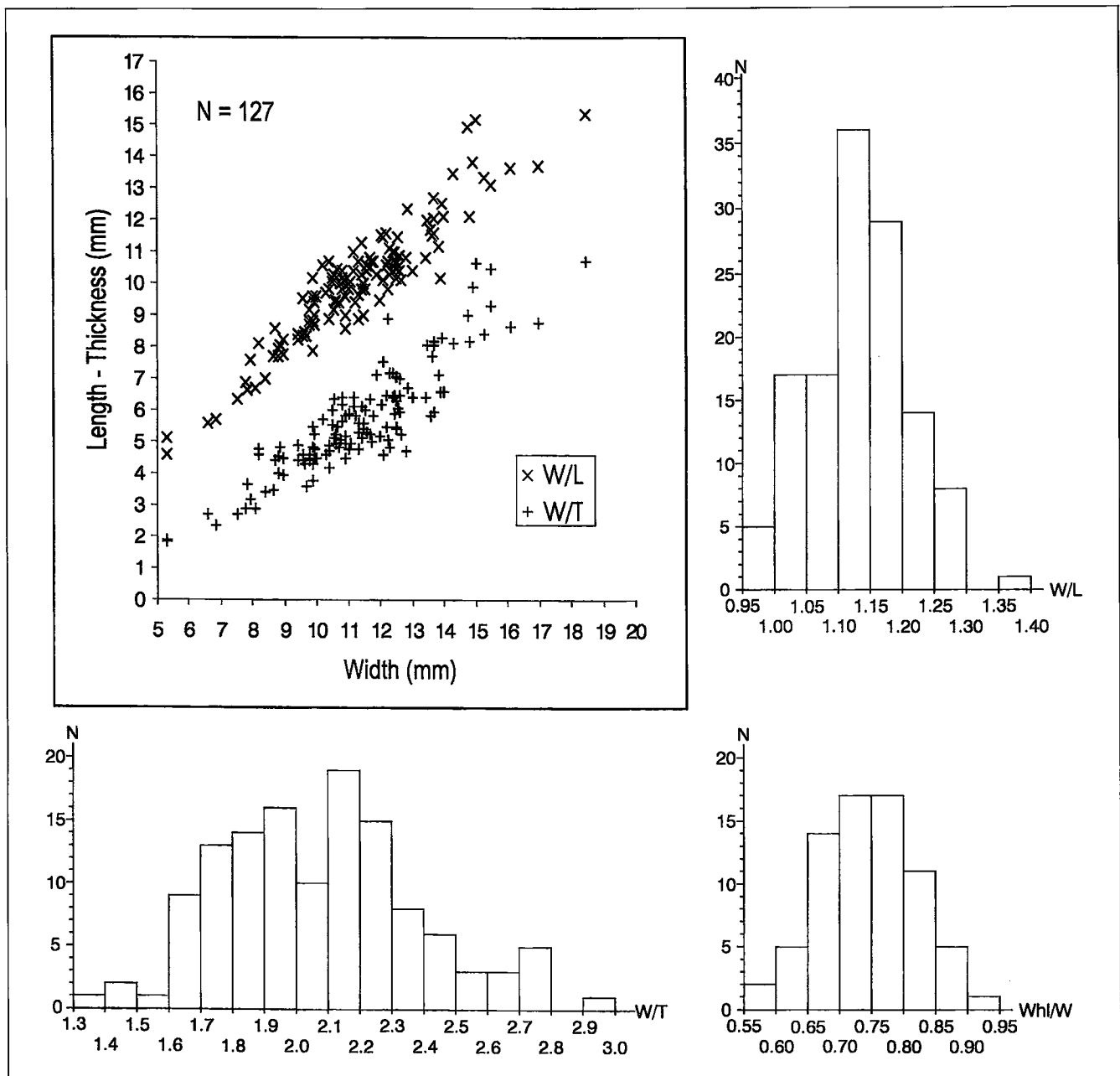


Fig. 2 – *Iowatrypa philippevillensis* n. sp. Scatter diagram plotting width/length and width/ thickness; frequency diagrams.

central part of the valve is flattened, although a small number of shells have a narrow and median furrow present in its posterior part. The flanks slope gently to moderately towards the commissures. The postero-lateral regions are frequently flattened (Fig. 4A: 1.4, 1.55, 1.85, 2.25) to concave (Fig. 3: 1.95, 2.05, 2.1, 2.35). Usually, maximum valve thickness is near the mid-length and then, although in some specimens with a well-developed tongue, their maximum thickness is at the anterior margin.

#### Ornamentation

Radial tubular ribs increase principally by bifurcation and more rarely by intercalation on the ventral valve; on the

dorsal valve, they increase principally by intercalation and more rarely by bifurcation. Along the anterior margin their number varies between (10) 11-14 (15) per 5 mm. The growth lamellae with an average spacing of about 1-1.5 mm in the central part of the shell are more closely spaced near the commissure.

#### Dimensions (Fig. 2, table 1)

Internal characters (Figs. 3-4)

#### Ventral valve

The teeth are massive, bilobed in transverse section with

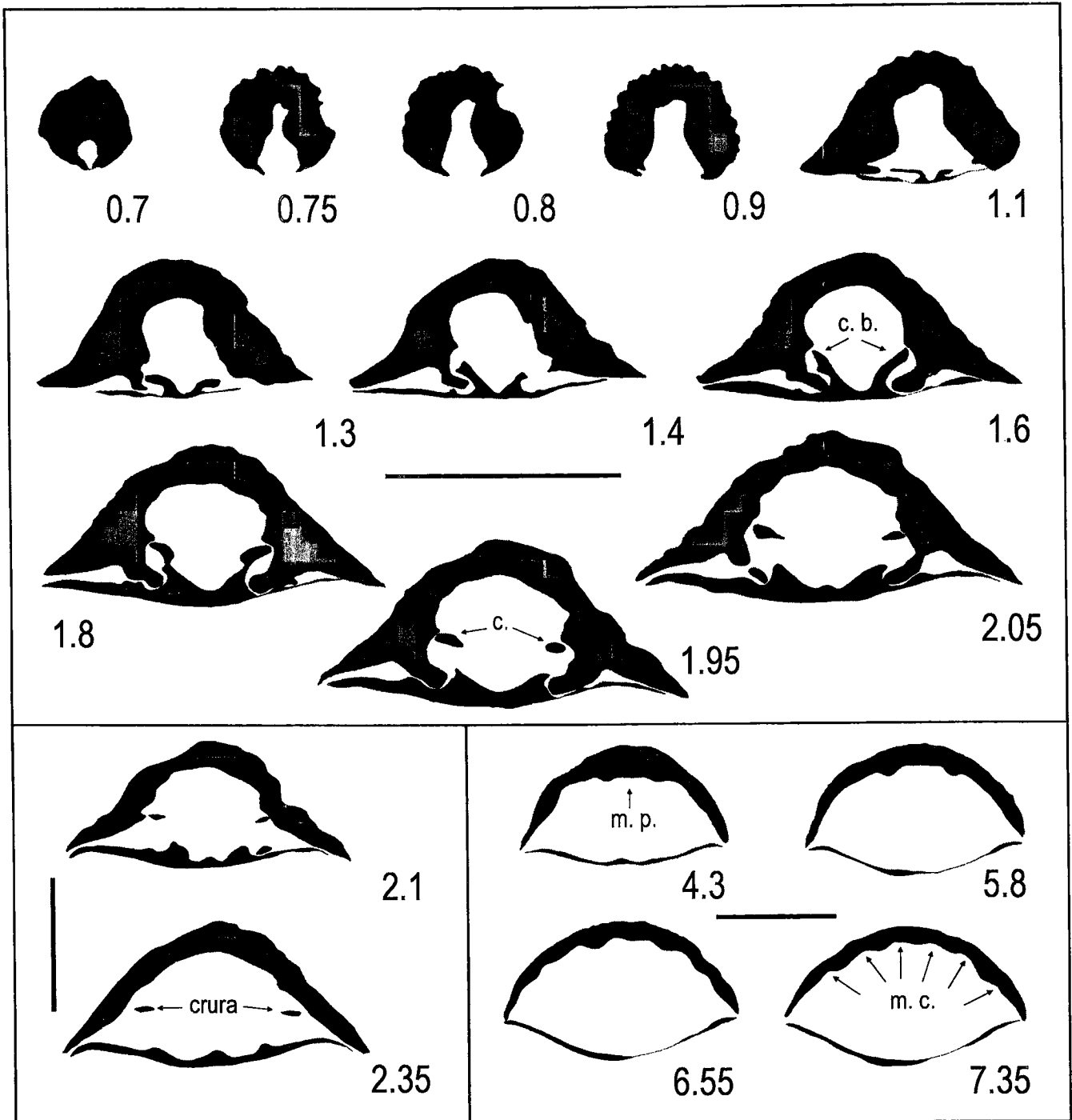


Fig. 3 – *Iowatrypa philippevillensis* n. sp. Paratype E. Specimen IRScNB a11998. Transverse serial sections. Distances are in mm from the top of the ventral umbo. Scale bar = 5 mm. Measurements: width = 13.5 mm; length = 13.75 mm; thickness = 8.15 mm.

thick supports. Pedicle collar not observed. The valve is thickened by prismatic calcite layer in its posterior and middle parts. The muscle platform is flat to concave; it rises progressively towards the anterior margin, up to the posterior third of the valve. Numerous mantle canals are marked on the internal face of the valve and the ribs are visible near the front.

#### *Dorsal valve*

No traces of cardinal process have been observed in the notothyrial pit. A median and subtriangular crest is located anterior of the notothyrial cavity; it divides the muscle field and is buried in the posterior part of the valve, below the notothyrial floor. The dental sockets are divided by a submedian crest in which fits the depression

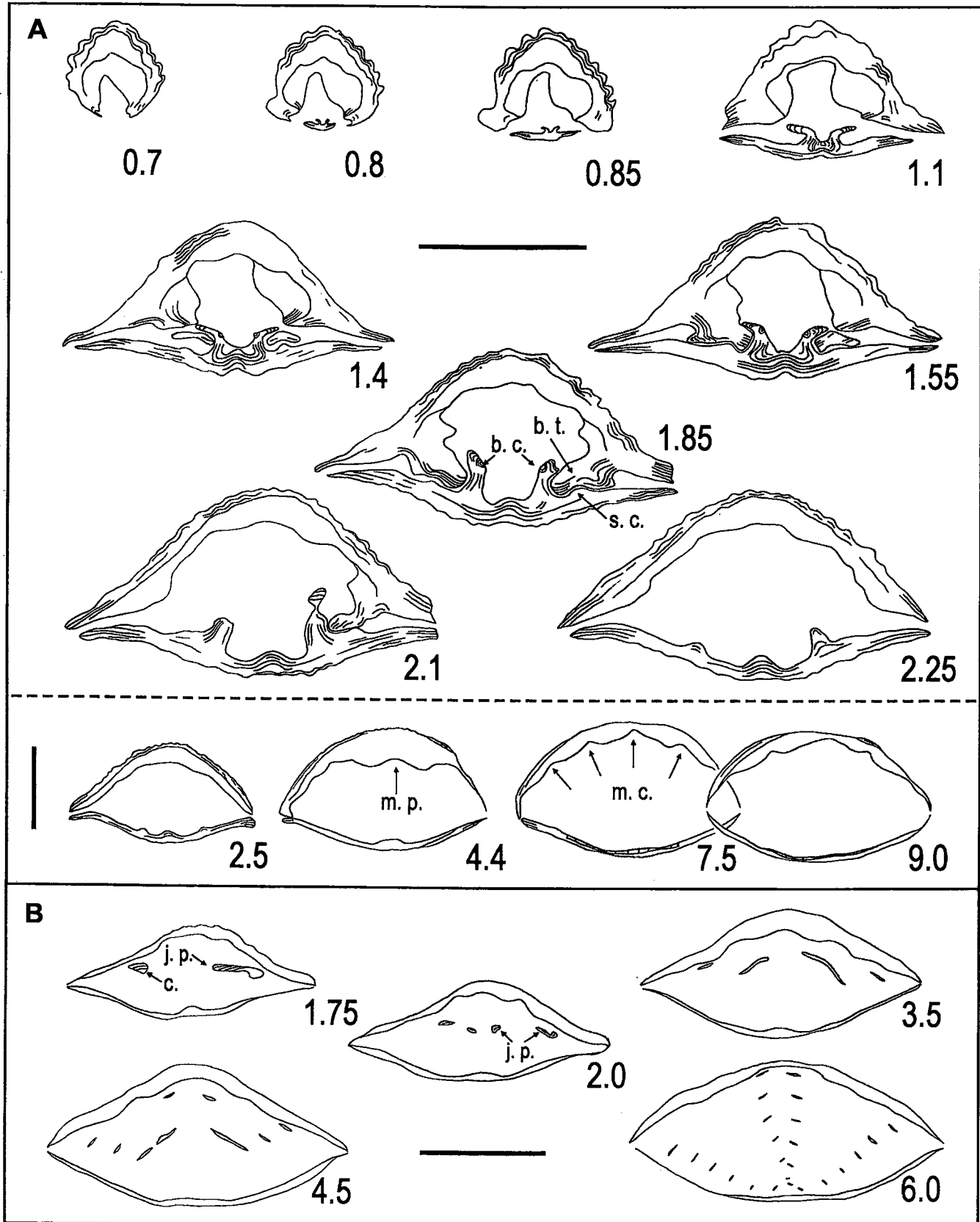


Fig. 4A – *Iowatrypa philippevillensis* n. sp. Paratype F. Specimen IRScNB a1999. Transverse serial sections. Distances are in mm from the top of the ventral umbo. Scale bar = 5 mm. Measurements: width = 14.8 mm; length = 15.0 mm; thickness = 9.1 mm. Abbreviations: b. t.: bilobed tooth; c. b.: crural bases; m. p.: muscle platform; m. c.: mantle canals; s. c.: submedian crest.

Fig. 4B – *Iowatrypa philippevillensis* n. sp. Paratype G. Specimen IRScNB a12000. Transverse serial sections. Distances are in mm from the top of the ventral umbo. Scale bar = 5 mm. Measurements: width = 13.4 mm; length = 10.8 mm; thickness = 6.4 mm. Abbreviations: c.: crus; j. p.: jugal process.

separating the dental lobes. The internal crests of the dental sockets give rise to the crural bases leading to the fibrous crura, laterally oriented and parallel to the commissure plane. The jugal processes are separate; no jugal plates have been observed. The dorso-medially oriented spiral cones comprise at least 6 whorls (1 sectioned specimen). The prismatic layer is poorly and only developed in the anterior part of the valve.

#### DISCUSSION OF THE SYNONYMY AND COMPARISONS

GODEFROID & HELSEN (1998, p. 266, fig. 2I) have indicated the occurrence of *I. philippevillensis* and *I. ultima* (see below) in the section of Neuville under the name ?*Waiotrypa* sp. *I. philippevillensis* comprises the specimens between 103/222 – 103/197.

*I. philippevillensis* is distinguished from *I. rotundicollis* GODEFROID, 1994 (pp. 86-92, pl. 1: 1-11; text-figs. 2-5) by its finer ribs (its ribs are never so coarse in the posterior part of the shell), its less prominent umbo. When present, the tongue is better developed and defined in the first species.

*I. philippevillensis* differs from *I. circuitionis* GODEFROID & HELSEN, 1998 (pp. 249-252, figs. 5, 6A-P, 7) by its bigger size, a less prominent umbo and a generally less inflated ventral valve (different profile). *I. cf. circuitionis* GODEFROID & HELSEN, 1998 (p. 252, fig. 6Q-U) attains a similar size to the one of *I. philippevillensis*, but its dorsal valve is more flattened and its umbo is more prominent. Moreover, the anterior margin of the ventral valve is weakly sulcate.

The new species differs principally from *I. ultima* MOTTEQUIN, 2003 (pp. 71-75, pl. 1: 1-5; figs. 2A, 3, tables 1-2) by its smaller size, the absence of interarea and its finer ribs.

Some specimens of *I. philippevillensis* resemble *Waiotrypa? pluvia* GODEFROID & HELSEN, 1998 (pp. 252-255, figs. 5C, 8-9) by their outlines, but they are separable by the lack of an interarea and finer ribs.

The new species differs from *Gruenewaldtia americana* STAINBROOK, 1945 (p. 52, pl. 5: 18-23, 27, 28, fig. 1: 6) by its less developed umbo and its less elongated outline [W/L: 0.96-1.36 versus 0.88-1.18 in *I. americana* (27 measured specimens)]. Moreover, the Belgian form never displays a ventral interarea as it is the case for *I. americana* (see COOPER & DUTRO, 1982, pl. 24: 13). This species has been regarded as a probable synonym of *I. owenensis* (WEBSTER, 1921) by COPPER (1973, p. 496) and COPPER & CHEN (1995, p. 256) but the problem is not yet resolved according to DAY & COPPER (1998, p. 180, p. 184).

*I. philippevillensis* is separable from *Anatrypa timanica* MARKOVSKI, 1955 (in MIKRIUKOV) and *A. timanica* var. *markovskii* LYASHENKO, 1959 (p. 141, pl. 26: 5-6) [species and variety assigned to *Iowatrypa* by COPPER (1973, p. 495)] by the absence of ventral sulcus and by the rare median groove on the dorsal valve. Furthermore, *I. timanica* has coarser ribs. BALIŃSKI (1979, pp. 57-58, pl. 14: 1-5, fig. -text 20) figured Polish specimens which he placed under *I. markovskii*. They were placed in doubtful

synonymy with *I. americana* (STAINBROOK, 1945) by RACKI & BALIŃSKI (1998, p. 287). These specimens resemble the new species but they differ by their very shallow sulcus, the presence of a low interarea in the juvenile specimens and smaller teeth.

*I. philippevillensis* is distinguished from *I. keranica* YUDINA (1998, pp. 37-39, figs. 1e-o, 2) by the absence of well-developed ears and additional folds on the ventral valve of the largest shells (see YUDINA, 1998, fig. 11).

#### STRATIGRAPHIC RANGE AND GEOGRAPHIC DISTRIBUTION

The species is known in the upper part of the Les Valisettes Formation (Upper *P. rhenana* Zone) and appears to be restricted to the Philippeville Anticlinorium (Neuville and Cerfontaine sections).

#### *Iowatrypa ultima* MOTTEQUIN, 2003

e. p. 1998 ?*Waiotrypa* sp. – GODEFROID & HELSEN, p. 266, fig. 2I.

2003 *Iowatrypa ultima* n. sp. – MOTTEQUIN, pp. 71-75, pl. 1: 1-5; figs. 2A, 3, tables 1-2.

#### MATERIAL

7 complete specimens.

#### DESCRIPTION

See MOTTEQUIN (2003).

#### DISCUSSION OF THE SYNONYMY AND COMPARISONS

GODEFROID & HELSEN (1998, p. 266, fig. 2I) have indicated the occurrence of *I. ultima* in the section of Neuville under the name ?*Waiotrypa* sp. This species comprises the specimens located between 103/268 – 103/261. The specimen located between 103/261 – 103/252 is poorly preserved and does not permit a species identification.

In the description of *I. ultima*, MOTTEQUIN (2003) did not make distinctions between it and the other species of *Iowatrypa* from the southern flank of the Dinant Synclinorium. *I. ultima* differs from *I. rotundicollis* GODEFROID, 1994 by the presence of its interarea, its less ventribiconvex profile, and longer outline. *I. ultima* can be distinguished from *I. circuitionis* GODEFROID & HELSEN, 1998 by its larger size, its less ventribiconvex profile and the presence of an interarea.

#### STRATIGRAPHIC RANGE AND GEOGRAPHIC DISTRIBUTION

*I. ultima* is known from the Barvaux (south-eastern border of the Dinant Synclinorium) and Lambermont formations (northern border of the Dinant Synclinorium and Vedre Nappe). It occurs within the Les Valisettes Formation (Philippeville Anticlinorium) at a similar stratigraphic level (Upper *P. rhenana* Zone), but it is clearly less abundant than *I. philippevillensis*.

Neuville section: between 103/268 – 103/261 and 103/211 – 103/209.

Cerfontaine section: between 216 m – 240 m from the northern extremity of the outcrop.

## Conclusions

Since the recognition of the cosmopolitan genus *Iowatrypa* COPPER, 1973 in the Frasnian of southern Belgium and the description of *I. rotundicollis* by GODEFROID (1994), three other species belonging to this genus have subsequently been described from this area: *I. circuitionis*, *I. ultima* and *I. philippevillensis*. The range of *Iowatrypa* (in terms of conodont zones) in southern Belgium (Dinant Synclinorium, Philippeville Anticlinorium and Vesdre Nappe) spans the interval of the *Palmatolepis jamieae* (upper part of the Boussu-en-Fagne Member of the Grands Breux Formation) to the Upper *P. rhenana* zones (Les Valisettes, Barvaux and Lambermont formations).

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### Explanation of Plate 1

#### PLATE 1

Except otherwise indicated, the specimens are figured at magnification x 1.5. Photos Wilfried MISEUR.  
a: ventral view; b: dorsal view; c: lateral view; d: posterior view, e: anterior view.

#### *Iowatrypa philippevillensis* n. sp.

- Fig. 1 a-e — Holotype, specimen IRScNB a11993. Cerfontaine, outcrop BM-2003-3.  
Fig. 2 a-e — Paratype A, specimen IRScNB a11994. Same locality.  
Fig. 3 a-e — Paratype B, specimen IRScNB a11995. Same locality.  
Fig. 4 a-e — Paratype C, specimen IRScNB a11996. Same locality.  
Fig. 5 a-e — Paratype D, specimen IRScNB a11997. Same locality.

#### *Iowatrypa ultima* MOTTEQUIN, 2003

- Fig. 6 a-e — specimen IRScNB a12001. Neuville, outcrop BM-2002-8 (x 2).

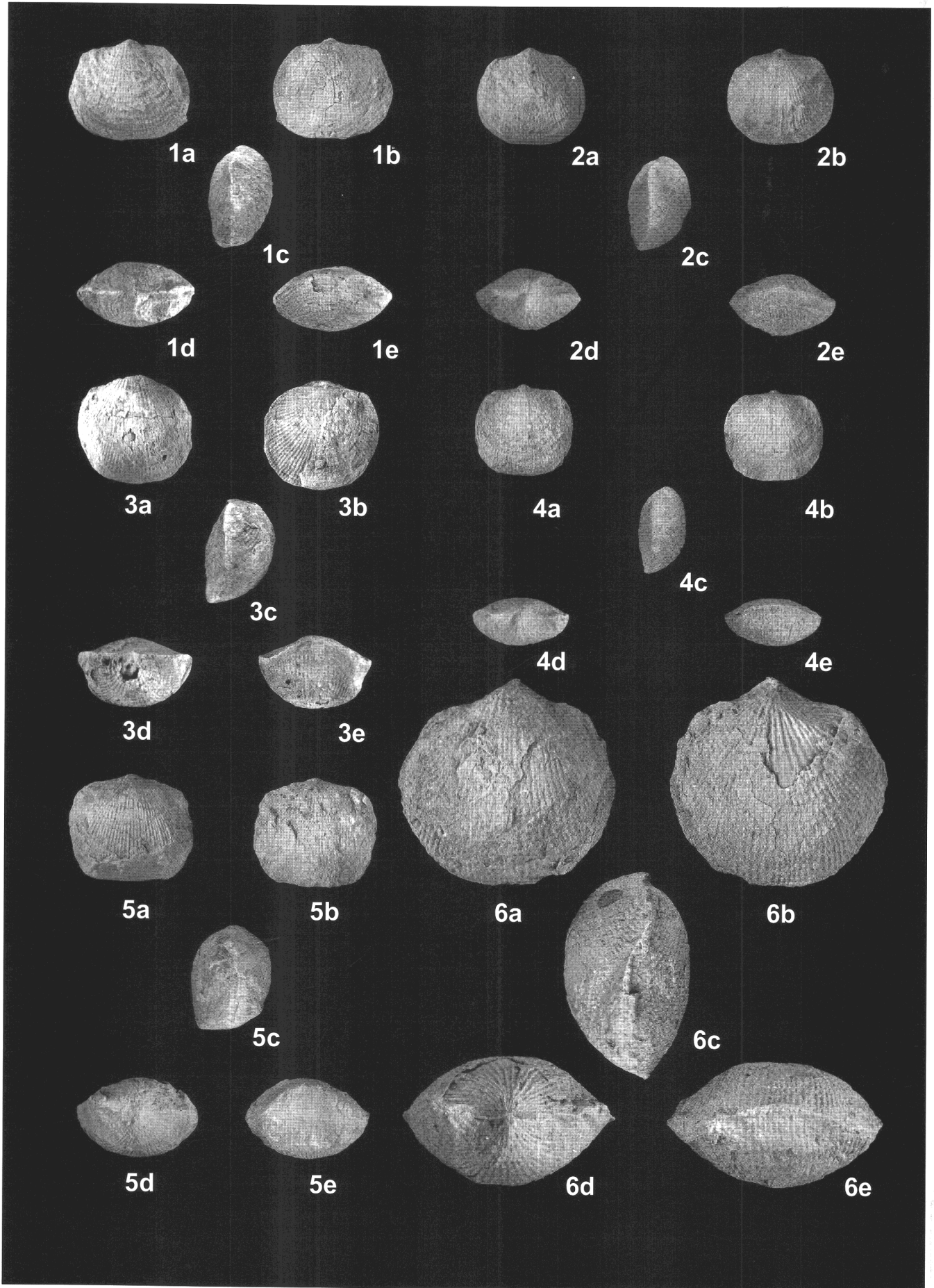


PLATE I