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

by Bernard MOTTEQUIN


Abstract

A new species of the genus *Iowatrypa* COPPER, 1973 (*I. philippiviensis* n. sp. [Pseudogruenewaldtiniae]) is described from the late Frasnian (Upper *Palmatolepis* *rhena* 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. philippiviensis* n. sp. [Pseudogruenewaldtiniae]).


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 Neuvile 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. 21).

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* BALINSKI, 1997. *Spinatrypa* *rzhonskii* ALEKSEEVA, 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 Famenian 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 ± 350 m are recognized in the Philippeville Anticlinorium. In ascending order, these are: the Nismes, Pont de la Folle, Philippeville, Neuvile, 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 rhena* Zone) that consists of nodular limestones and shales with limestone nodules. The overlying Les Valisettes Formation (thickness: at least 90 m; Upper *P. rhena* 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-
ish-reddish massive limestone mounds within these two formations are placed in the Petit-Mont Member. According to Coen as cited by Bulynck & Dejonghe in Boulvaïn et al. (1999, p. 6), the Les Valises 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 southeastern 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: ± 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 Frœschvallée – 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 & Mouraviev, 1970; Coen & Coen-Aubert, 1976, pp. 2-6; Bouvain et al., 1993, pp. 20-21, pp. 27-28, figs. 6-7; 1999, pp. 74-75, p. 80, figs. NEU2 and VAL1; Bulynck et al. 1998, p. 29, p. 34, p. 39, figs. 10-13; Casier, 2003). Godefroid & Helsen (1998, pp. 265-266, fig. 21) have briefly discussed the occurrences and stratigraphic ranges of atrypid brachiopods in the Neuville and Les Valises 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 Valises Formation is exposed for a distance of 250 m and is essentially shaly (lower and upper contacts are lacking). The lower ± 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: ± 7 m) consists of nodular argillaceous limestones and nodular shales with massive rugose corals and brachiopods (mainly cyrtospiriferids and atrypids). The upper ± 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 lowatrypa 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; Ul – unrolled length of the dorsal valve; Ulw – 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 Pseudogruenwaldtiinae Rzhonsnitskaya, Yudina & Sokiran, 1997
Table 1

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Dimensions in mm</th>
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<td>22</td>
<td>13.5</td>
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<td>12</td>
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<tr>
<td>Paratype D</td>
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<td>13.55</td>
<td>23</td>
<td>15</td>
<td>10.4</td>
<td>122°</td>
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</table>

**Genus Iowatrypa COPPER, 1973**

Type-species  
Atrypa owensis WEBSTER, 1921

**Iowatrypa philippevillensis** n. sp.   
Plate 1: Figures 1-5; Figures 2-4; Table 1


**DE RIVATIO NOMINIS**  
Allusion to the Philippveille 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), equiubiconvex to ventribiconvex species of Iowatrypa with a subquadratic 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 equiubiconvex 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 umbalon 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
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 burried 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 11999. 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.: carinal 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 sec-
tioned specimen). The prismatic layer is poorly and only
developed in the anterior part of the valve.

DISCUSSION OF THE SYNONYM AND COMPARISONS

GODEFROID & HELSEN (1998, p. 266, fig. 21) have indi-
cated the occurrence of I. philippovichilis and I. ultima
(see below) in the section of Neувель under the name
?Waiotrypa sp. I. philippovichilis comprises the speci-
mens between 103/222 – 103/197.

I. philippovichilis 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 pos-
terior part of the shell), its less prominentumbo. When
present, the tongue is better developed and defined in
the first species.

I. philippovichilis differs from I. circuvinis GODE-
FROID & HELSEN, 1998 (pp. 249-252, figs. 5, 6A-P, 7)
by its bigger size, a less prominentumbo and a generally
less inflated ventral valve (different profile). I. cf. cir-
cuvinis GODEFROID & HELSEN, 1996 (p. 252, fig. 6Q-U)
attains a similar size to the one of I. philippovichilis, but
its dorsal valve is more flattened and itsumbo 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. philippovichilis resemble Wai-
otrypa? pluvia GODEFROID & HELSEN, 1998 (pp. 252-255,
figs. SC, 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 developedumbo 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. ameri-
cana (see COOPER & DUTRO, 1982, pl. 24: 13). This species
has been regarded as a probable synonym of I. owenensis
(WESTER, 1921) by COOPER (1973, p. 496) and COOPER
& CHEN (1995, p. 256) but the problem is not yet resolved

I. philippovichilis is separable from Anatrypa tami-
ica MARKOVSII, 1955 (in MIRKOVIC) and A. timana var.
markovskii LYASHENKO, 1959 (p. 141, pl. 26: 5-6) [spe-
cies and variety assigned to Iowatrypa by COOPER (1973,
p. 495)] by the absence of ventral sulcus and by the rare
median groove on the dorsal valve. Furthermore, I. tima-
ica has coarser ribs. BALSIN (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 & BALSIN (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. philippovichilis is distinguished from I. keranica
YUDINA, 1998 (pp. 37-39, figs. 1-2) 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 Vali-
settes Formation (Upper P. rhenana Zone) and appears to
be restricted to the Philippeville Anticlinorium (Neувель
and Cerfontaine sections).

Iowatrypa ultima MOTTEQUIN, 2003

e. p. 1998 ?Waiotrypa sp. – GODEFROID & HELSEN, p. 266,
fig. 21.
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 SYNONYM AND COMPARISONS

GODEFROID & HELSEN (1998, p. 266, fig. 21) have indi-
cated the occurrence of I. ultima in the section of Neувель
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 Syncli-
rorium. I. ultima differs from I. rotundicollis GODEFROID,
1994 by the presence of its interarea, its less ventrivexcov-
ex profile, and longer outline. I. ultima can be distin-
guished from I. circuvinis GODEFROID & HELSEN, 1998
by its larger size, its less ventrivexcovex profile and the
presence of an interarea.

STRATIGRAPHIC RANGE AND GEOGRAPHIC DISTRIBUTION

I. ultima is known from the Barvaux (south-eastern bor-
der of the Dinant Synclinorium) and Lambermont forma-
tions (northern border of the Dinant Synclinorium and
Vesdre Nappe). It occurs within the Les Valisettes For-
formation (Philippeville Anticlinorium) at a similar stratig-
graphic level (Upper P. rhenana Zone), but it is clearly
less abundant than I. philippovichilis.

Neувель 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 Iowatrypia 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. circuonnis, I. ultima and I. philippievillensis. The range of Iowatrypia (in terms of conodont zones) in southern Belgium (Dinant Syncliniron, Philippeville Anticlinorium and Vesdre Nappe) spans the interval of the Palaeotolepis jamiaeae (upper part of the Boussu-en-Fagne Member of the Grands Breux Formation) to the Upper P. rhenana zones (Les Valisettes, Barvax and Lambermont formations).

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References


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Explanation of Plate 1

PLATE 1

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

Iowatrypa philippewillensis 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).