Givetian brachiopods from the Trois-Fontaines Formation at Marenne (Belgium, Dinant Synclinorium)

by Jacques GODEFROID & Bernard MOTTEQUIN


Abstract

The brachiopods sampled from the Trois-Fontaines Formation in the Marenne quarry are mainly represented by two species: Spinatrypina (Spinatrypina) fontis n. sp. and Eifyris socia n. sp. Orthid, rhynchonellid, spiriferid and terebratulid brachiopods are also present but much rarer. Among them a new species, Bornhardtina equitis n. sp., is described, the others being only briefly discussed.

Key-words: Brachiopods, Givetian, Belgium.

Résumé

Les brachiopodes récoltés dans la Formation de Trois-Fontaines afleurant dans la carrière de Marenne sont représentés principalement par deux espèces: Spinatrypina (Spinatrypina) fontis n. sp. et Eifyris socia n. sp. Orthid, rhynchonellid, spiriferid et térébratulid brachiopodes sont également présents, mais ils sont beaucoup plus rares. Parmi eux, une nouvelle espèce, Bornhardtina equitis n. sp., est décrite, les autres étant uniquement brièvement discutées.

Mots-clefs: Brachiopodes, Givetien, Belgique.

Introduction

The Marenne quarry is located north of the village of Marenne, on the southern border of the Dinant Synclinorium (Figs. 1, 2). BARCHY et al. (2004, pp. 59-61, figs. 1, 3) described it in detail. The quarried limestones belong to the Givetian Trois-Fontaines Formation (see BULTYNCK et al., 1991, pp. 49-52). The subvertical beds well exposed in the south-eastern wall of the quarry are separated, in the southern part of the latter, from the younger Mont d’Haux Formation (see BULTYNCK et al., id., pp. 55-56, 59) by the fault of Marenne also called faulted zone of Marenne (BARCHY et al., id., fig. 1).

According to BARCHY et al. (id.) the exposed part of the Trois-Fontaines Formation is about 86 m thick and consisting of five units (thickness of these units from the base to the top: 26 m, 11 m, 23 m, 3.2 m, 23 m) (Fig. 3).

The brachiopods described herein have been collected in the dark, well-bedded and bioclastic limestones with silty and crinoidal levels (unit 1), in the fine, dark coloured, well-bedded limestones (unit 3) and in the crinoidal limestones rich in Scoliopora (unit 4).

In units 1 and 3, although some beds are very rich in brachiopods (some of them very large), it is difficult to sample well-preserved material and present the complete inventory of the fauna. On the other hand, in unit 4, spinatrypid and athyrid brachiopods can be collected plentifully, whereas other brachiopods taxa are much scarcer. Only the spinatrypid and athyrid brachiopods and the terebratulid species Bornhardtina equitis n. sp. are described herein in detail; other brachiopod taxa are only shortly discussed (only the original references are given).

All the material is stored in the Palaeontological Department of the "Institut royal des Sciences naturelles de Belgique" at Brussels (IRScNB).

Taxonomy

Abbreviations: L: length of the shell; Ld: length of the dorsal valve; W: width of the shell; T: thickness of the shell; Tv: thickness of the ventral valve; Td: thickness of the dorsal valve.

Order Orthida SCHUCHERT & COOPER, 1932
Suborder Dalmanellidina MOORE, 1952
Superfamily Dalmanelloidea SCHUCHERT, 1913
Family Mystrophoridae SCHUCHERT & COOPER, 1931
Genus Mystrophora KAYSER, 1871
Type species: Orthis areola QUENSTEDT, 1871

Mystrophora sp.

Material and occurrence
One incomplete ventral valve, two ± complete dorsal valves (IRScNB a12035-a12037) from unit 4 (Fig. 3).
Fig. 1 — Schematic geological map of southern Belgium with location of the village of Marene.
Symbols: stippling = Cambrian and Cambro-Ordovician massifs; wide vertical hatching = Lochkovian ("Gedinnian") formations; oblique hatching = Pragian ("Siegenian") formations; close vertical hatching = Emsian formations; horizontal hatching = Mesozoic formations [The Gedinnian and Siegenian stages do not correspond exactly to the official ones defined by the IUGS (see Bultynck & Dejonghe in Godefroid et al., 1994, p. 4)]. Abbreviations: 1 = axis of the Dinant Synclinorium; 2 = axis of the Ardenne Anticlinorium; 3 = axis of the Neufchâteau Synclinorium; 4 = axis of the Givonne Anticlinorium.

Short description
Shell large for the genus (dimensions of the largest dorsal valve (IRScNB a12037): W: (19.45) mm; L: 15.2 mm; T: 4.2 mm), transversally oval. Ventral valve relatively high, with a faint sulcus starting at the beak. Interarea well developed, slightly curved, apsacline. Delthyrium open. Internally, short subparallel dental plates.
Dorsal valve moderately convex with an outline more or less like a half an ellipse (wide, straight hinge line) and a relatively narrow sulcus starting a little anteriorly to the dorsal beak. Interarea slightly curved, anacrine. Internally, cruralium supported by a low median septum and divided by a low median crest.

Fig. 2 — Location of the Marene quarry.
**Fig. 3** — Lithostratigraphic column of the Trois-Fontaines Formation at the Marenne quarry (BARCHY et al. (2004, fig. 3), modified) with the distribution of the brachiopods. In the units 1 and 3, the localization of the fossiliferous beds is approximate. Only the base of the unit 5 is figured here. Abbreviations: E.: Eifelian; F.: Frasnian.

**Remark**

The septum supporting the cruralium in the dorsal valve is rather low and not very high as is the case in *Mystrophora areola* (QUENSTEDT, 1871), type species of the genus.

On the other hand, the shells cannot be assigned to *Skenidium* HALL, 1860 because they do not display the high subpyramidal ventral valve with a free or supported spondylium.

Order Rhynchonellida KUHN, 1949
Superfamily Pugnacoidea RZHONSNTSKAYA, 1956
Family Yunnanellidae RZHONSNTSKAYA, 1959
Subfamily Yunnanellinae RZHONSNTSKAYA, 1959
Genus *Schnurella* SCHMIDT, 1964
Type species: *Terebratula Schnurii* de VERNEUIL, 1840

*Schnurella schnurii* (de VERNEUIL, 1840)
1840 *Terebratula Schnurii* — de VERNEUIL, pp. 261-262, pl. 3, fig. 2a-d.

Material and occurrence

Twelve fragmentary specimens embedded in the limestone (IRScNB a12038, for the whole lot).
The specimens have been collected by P. Bultynck at a time when the quarry was more reduced and the Marenne fault not as clearly exposed as it is presently. S. schnurii comes from beds 11 and 12 in the description of Coen et al. (1974, p. 13). These two beds, not yet precisely located in the survey of Barchy et al. (id.), are situated at about the upper two thirds of unit 1 (Fig. 3).

**Remark**
The specimens display the general characteristics of the species: subtriangular outline, ventral valve flat, dorsal valve strongly convex, flanks and front truncated, low costae restricted to the anterior margin, and costellae.

Order Atrypida Rzhonsnitskaya, 1960
Suborder Atrypidina Moore, 1952
Superfamily Atrypoidea Gill, 1871
Family Atrypidae Gill, 1871
Subfamily Spinatrypinae Copper, 1978
Genus *Spinatrypina* Rzhonsnitskaya, 1964
Subgenus *Spinatrypina (Spinatrypina)* Rzhonsnitskaya, 1964
**Type species**: *Spinatrypina margaritoides* Rzhonsnitskaya, 1964

*Spinatrypina (Spinatrypina) fonds n. sp.*
Plate 1, Figures 1-15; Figures 4-5; Tables 1-2

**Derivatio nominis**
*Fons, fontis* (Latin): spring ("fontaine" in French). Allusion to the name of the formation (the Trois-Fontaines Formation) in which the species occurs.

**Types**
Holotype: IRScnB a12039 (Pl. 1, Figs. 1-5; Table 1);
Paratypes a12040 (Pl. 1, Figs. 6-10; Table 1); IRScnB a12041 (Pl. 1, Figs. 11-15; Table 1); a12042-a12051 (Table 1); a12148 (Fig. 5).

Besides the above-mentioned specimens, the type material includes 198 generally well preserved complete shells and 9 isolated ventral and dorsal valves.

**Locus typicus**
Active quarry at Marenne (near Marche-en-Famenne, province of Luxembourg, Belgium).

**Stratum typicum**
Trois-Fontaines Formation, Early Givetian. All the material comes from unit 4 (Fig. 3).

**Diagnosis**
A species of *Spinatrypina (Spinatrypina)* with a dorsibiconvex profile, a rounded, slightly wider than long outline, relatively fine ribs (42-50 ribs counted at the anterior and lateral margins of adult shells), a transversally irregularly curved ventral valve and concave to indented shoulder lines. Sulcus and fold absent or very weakly developed near the anterior margin.

**Description**

**External characters**

**General characters**
Shell medium sized, dorsibiconvex and slightly transverse (Fig. 4, Table 1). In ventral view, lateral and anterior margins well rounded and shoulder lines concave to indented, very rarely nearly straight. Width of the hinge line corresponding to 73%-88% of the width of the shell. Maximum width located at mid-length. Anterior commissure more or less rectimarginate to moderately umiplicate. Prominent beak.

**Ventral valve**
Valve moderately thick (W/Tv: 3.5-5.9; L/Tv: 3.2-5.2), with the maximum thickness located at the posterior third of the length. In posterior view, upper surface of the lateral parts of the valve ± plane and gently inclined to the lateral commissures, median part widely rounded (± "tectiform"). Sulcus absent or very shallow, poorly delimited and only present close to the anterior margin; width of the sulcus at the anterior margin corresponding to 46%-63 (70)% of the width of the shell. Tongue, when present, low to very low, poorly delimited laterally, with an outline like a half an ellipse, the best developed tongue being 4.5-5 times wider than high. Shoulder and apical angles varying between 95°-105° and 113°-127° respectively. Small interarea well developed, horizontally striated, curved, slightly apsacline, in some specimens ± orthocline, clearly delimited by blunt lateral ridges, a little less marked close to the cardinal extremities. Delthyrium partially closed by deltidial plates joined at their base; pedicle opening mesothyr.

**Dorsal valve**
Valve wider than long (W/Ld: 1.10-1.25), regularly curved transversely and longitudinally except in the posteralateral regions, which are slightly depressed close to the cardinal extremities. Maximum thickness located at about one-half of the length (W/Td: 2.5-5.9; L/Td: 2.3-4.9). No clearly differentiated fold; on some specimens, a very low and not sharply laterally delimited elevation present close to the anterior margin.

**Table 1**

<table>
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<tr>
<th>Distances (cm) from the beak</th>
<th>Ribs on 1 cm in the median part</th>
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<tr>
<td>1</td>
<td>(9) 11 – 12</td>
</tr>
<tr>
<td>1.5</td>
<td>(8) 9 – 11 (13)</td>
</tr>
<tr>
<td>2</td>
<td>8 – 9 (11)</td>
</tr>
<tr>
<td>2.5</td>
<td>8 – 11</td>
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</table>
Givetian brachiopods

Ornamentation
Ribs tubular, increasing by bifurcation and intercalation. Ribs relatively fine but slightly varying in thickness (Table 1); 42-50 ribs at the anterior and lateral margins. Growth lamellae with their anterior edge slightly upturned; width of the growth lamellae varying generally between 1-1.5 mm in the median part of the valve, rarely reaching 2 mm in width; growth lamellae often more crowded close to the anterior and antero-lateral margins.

Dimensions (Fig. 4, Table 2)

Internal characters (Fig. 5)

Ventral valve
The relatively thick dental plates support bilobed teeth and separate the large umboval cavity from the well-developed dental cavities.

Dorsal valve
No traces of cardinal processes have been observed in the notothyrial pit. A median ridge with a central furrow on its 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 the depression separating the dental lobes fits. The internal crests of the dental sockets give rise to the cranial bases leading to the feathered crura, laterally oriented and ± parallel to the commissure plane. The jugal processes, jugal plates and spiralia have not been observed. The prismatic layer is well developed in the posterior part of the valve.

Comparisons
From the species assigned to the subgenus Spinatrypina (Exatrypa) Copper, 1967a (type species: Terebratulites explanatus von Schlotheim, 1820 in 1820-1823), S. (S.) fontis is separable on the basis of its dorsibiconvex, less flatish profile [exceptionally shells of S. (S.) fontis are flatish (Pl. 1, figs. 11-15) but their interarea are not as large as in typical S. (Exatrypa)]. The closest species are S. (S.) soetenica (Struve, 1964) and S. (S.) girzenensis Copper, 1967b from the Middle Devonian of Germany.

By the size and the number of ribs, the Belgian species is very close to S. (S.) soetenica. It is distinguishable from the German species by its transversely irregularly curved (± "tectiform") ventral valve [the ventral valve of S. (S.) soetenica is more regularly curved. Struve (1964, p. 530) writes: "... mit mehr gerundetem als (flach) dach-förmigen Rücken"] and its clearly concave to indented shoulder lines [shoulder lines nearly straight in S. (S.) soetenica]. From S. (S.) girzenensis, S. (S.) fontis is distinguished by its dorsibiconvex profile and finer ribs. S. (S.) fontis is larger and has more numerous ribs than S. (S.) wotanica (Struve, 1964).

S. (S.) fontis is larger than Spinatrypina pratorum Godefroid, 1988. Its ribs are coarser and do not become finer close to the anterior and lateral margins as is generally the case in S. pratorum.

Geographic and stratigraphic distribution
At present the species is only known from the locus typicus and stratum typicum.

<table>
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<th>Specimen</th>
<th>L</th>
<th>W</th>
<th>T</th>
<th>Tv</th>
<th>Td</th>
<th>Apical angle</th>
<th>Shoulder angle</th>
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<td>0.32</td>
<td>0.33</td>
<td>95°</td>
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</table>
Fig. 4 — *Spinatrypina (Spinatrypina) fontis* n. sp. Scatter diagrams and frequency diagrams.
Type species: Terebratula Eifliensis Schnur, 1853

**Eifyris socia** n. sp.
Figures 6-8, Table 3

**DERIVATIO NOMINIS**
Socia, ae (Latin) (noun in apposition): companion. The species is the companion of Spinatrypina (Spinatrypina) *fontis* n. sp.

**TYPES**
Holotype: IRScNB a12052 (Fig. 6 a-e, Table 3); Paratypes a12054 (Fig. 6 f-j; Table 3); a12053, a12055-a12066 (Table 3); a12149 (Fig. 8A); a12150 (Fig. 8B).

Besides the above-mentioned specimens, the type material includes 76 generally well preserved complete shells and ±20 incomplete specimens.

**LOCUS TYPICUS**
As for Spinatrypina (Spinatrypina) *fontis* n. sp.

**STRATUM TYPICUM**
The same as for S. (S.) *fontis* n. sp.

**DIAGNOSIS**
A species of *Eifyris* with a generally slightly ventribiconvex profile, and a rounded, subpentagonal and generally more or less as wide as long outline. Sulcus well developed but shallow, originating at the posterior quarter or third of the length, with a median furrow. Anterior commissure moderately parasulate on most specimens.
Fig. 6 — *Effyris socia* n. sp. a-e: holotype IRScNB a12052, ventral, dorsal, lateral, posterior and anterior views; f-j: paratype a12054, ventral, dorsal, lateral, posterior and anterior views. X 2.

Table 3

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<td>T: 0.84</td>
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Fig. 7 — *Elfyris socia* n. sp. Scatter diagrams and frequency diagrams.
Fig. 8A — *Eifris socia* n. sp. Specimen IRScNB a12149. Transverse serial sections. Distances are in mm from the top of the ventral umbo. Scale bar = 5 mm.

Fig. 8B — *Eifris socia* n. sp. Specimen IRScNB a12150. Transverse serial sections. Distance is in mm from the top of the ventral umbo. Scale bar = 5 mm.
DESCRIPTION

External characters

General characters
Shell medium sized, generally moderately ventribiconvex, rarely equi- or dorsibiconvex, as wide as long or a little wider than long or longer than wide (Figs. 6-7, Table 3). Maximum width located a little anteriorly to mid-length. In ventral view, outline rounded subpentagonal: shoulder lines slightly to clearly concave, lateral margins curved and "bracket-shaped", anterior margin generally ± rectilinear or very slightly excavated by the sulcus. Anterior commissure moderately parasulate on most specimens, rarely ± uniplicate.

Ventral valve
Valve thick (W/Tv: 2-3.3; L/Tv: 2.1-3.1) with a well marked and more or less regular transversal convexity. Maximum thickness located at about the posterior third of the length. Sulcus wide and shallow, originating generally at the posterior quarter or third of the length of the valve, in some rare specimens more posteriorly on the umbo, with well rounded lateral boundaries developed on some specimens as very low, rounded and wide lateral "ridges". Bottom of the sulcus with a longitudinal groove well marked on almost all the specimens. At the front margin, width of the sulcus corresponding to (50) 55%-70% of the width of the shell. Tongue variably developed (the best developed tongue about two times wider than high), in some thick, more globose specimens, oriented almost perpendicularly to the commissural plane. Interarea (palintrope) badly defined, curved, delthyrium partly concealed by the incurved ventral beak and the dorsal umbo; foramen wide, rounded to ovate, and mesothyroid to permesothyroid.

Dorsal valve
Valve ± regularly arched, with a subrounded to subelliptical outline. Maximum thickness located at about mid-length (W/Td: 2.2-4.4; L/Td: 2.1-4.3). Fold poorly developed, low, rounded and limited to the anterior half or third part of the valve.

Ornamentation
Concentric growth lamellae slightly lamellose and rather regularly spaced. Width of the growth lamellae in the central part of the valve rarely exceeding 1 mm.

Dimensions (Fig. 7; Table 3)

Internal characters (Fig. 8)

Ventral valve
The dental plates are thin and well differentiated. They separate a large and subrounded central pedicle cavity from a lateral pair of well-defined apical cavities and support subrectangular teeth.

Dorsal valve
The dental sockets are relatively deep and limited by prominent inner socket ridges and weak outer ridges. Anteriorly, the latter are not differentiated from the valve edges. The cardinal plate with a high median ridge is slightly ventrally concave and apically perforate (Fig. 8B). A low myophragm is present. The jugum is relatively long; the laterally oriented spiral cones comprise at least 9 whorls.

COMPARISONS
From Efyris eifliensis, E. socia (the youngest known species of the genus) can be differentiated by its different ventral sulcus (the rounded ridges bounding the sulcus of E. eifliensis are much more developed than those visible on some specimens of E. socia), and dorsal fold (more developed in E. eifliensis than in E. socia) as well as by its less parasulate anterior commissure.

E. socia differs from Athyris (Efyris) kirbergensis STRUVE, 1992 by its subpentagonal outline (the outline of the German species is rounded to rhomb-shaped), its better marked sulcus and fold, and its anterior commissure generally slightly parasulate [the anterior commissure of A. (E.) kirbergensis is uniplicate].

E. socia is very close to Athyris (Efyris) lehmenensis STRUVE, 1992 from which it can be differentiated by its rounded subpentagonal outline [and not rounded or rhomb-shaped as in A. (E.) lehmenensis], its less developed, but wider ventral sulcus [at the front, the width of the sulcus of E. socia corresponds to (50) 55%-70% of the width of the shell; in A. (E.) lehmenensis, the width of the sulcus measured on the figures of the species in ALVAREZ et al. (1996, pl. 7, figs. 39, 40) corresponds to 35%-40%] and its anterior commissure generally slightly parasulate [the anterior commissure of A. (E.) lehmenensis is uniplicate or very slightly parasulate].

E. socia is larger than Athyris bayeti RIGAUX, 1908 (compare Table 3 with the dimensions given by BRICE, 1988, p. 351), its sulcus is wider at the front margin and its growth lamellae are less marked. Moreover, E. socia is generally ventribiconvex while A. bayeti is biconvex.

From Athyris davidsoni RIGAUX, 1873 and A. kaisini RIGAUX, 1908, E. socia is distinguished by its larger size (see dimensions of A. davidsoni and A. kaisini in BRICE, id., pp. 352, 354) and its different outline.

Athyris oehlerti RIGAUX, 1908 is typically smaller than E. socia.

The outline of E. socia is rounded subpentagonally whereas Athyris concentrica murchisoni BRICE, 1988 is transversally elliptic.

Atrythyris betencourtii (RIGAUX, 1892) differs from E. socia by its lenticular outline and by its radial, external undulations, similar to those shown the German species included by STRUVE (1965) in Atrythyris.

Athyris cingulata FICNER & HAVLIČEK, 1978 is smaller than E. socia and strongly parasulate; A. mollizonata FICNER & HAVLIČEK, 1978 is more rounded than E. socia. Moreover, both species from Moravia have more lamellose and widely spaced growth lamellae than E. socia.
Order Spiriferida Waagen, 1883  
Suborder Spiriferidina Waagen, 1883  
Superfamily Reticularoidea Waagen, 1883  
Family Reticulariidae Waagen, 1883  
Subfamily Reticulariinae Waagen, 1883  
Genus Gerolsteinites Struve, 1990  
**Type species:** Spirifera Gerolsteinensis Steininger, 1853  
**Gerolsteinites sp.**  
Figure 9

**Material and occurrence**
Four fragmentary ventral and dorsal valves (IRScNB a12067 for the whole lot). Same occurrence as Schnurella schnurii (unit 1).

Four complete shells from the level with Scoliopora (unit 4): IRScNB a12068A (Fig. 9 a-e), a12068B (Fig. 9 f-j), a12068C-E.

**Remark**
These spiriferid brachiopods are provisionally assigned to the genus Gerolsteinites Struve, 1990 because of their ventribiconvex profile, their low, shallow, rounded sulcus and low, rounded fold, both starting on the umbo as well as their few (7-8) rounded, low, simple costae starting on the umbo or a little more anteriorly. Struve (1992, p. 582) distinguished Gerolsteinites from Undispirifer Havliček, 1957 by its more developed sulcus, fold and costae, its ventribiconvex profile (when Undispirifer is aequibiconvex), and its higher ventral interarea. These differentiating characters, evident on Spirifera Gerolsteinensis Steininger, 1853, type species of the genus, are however not so clearly marked on our specimens. Carter et al. (1994, p. 354) shortly discuss these characters and conclude that "Gerolsteinites at most should have subgeneric rank".

Our specimens differs from G. gerolsteinensis and G. givefex (Struve, 1981) by their size and ornamentation. They belong likely to two different species but more material is needed for reaching a decision.

Order Terebratulida Waagen, 1883  
Suborder Centronellidina Stehli, 1965  
Superfamily Stringocephaloidea King, 1850  
Family Stringocephalidae King, 1850  
Subfamily Newberriinae Struve, 1982  
Genus Hessenhausia Struve, 1982  
**Type species:** Rauffia pseudocaiqua Schulz, 1914  
**Hessenhausia pseudocaiqua** (Schulz, 1914)

1914 Rauffia pseudocaiqua nov. gen., nov. sp. – Schulz, pp. 371-374, pl. 7, figs. 7, 8; pl. 9, figs. 1-10.

**Material and occurrence**
One almost complete shell (IRScNB a12069) and one fragmentary (IRScNB a12070). Coquina beds with numerous terebratulid brachiopods are intercalated in unit 3 (Fig. 3). However, it is difficult to collect complete or nearly complete specimens. At present, only this species and those described below have been recognized in these fossiliferous levels.

**Short description**
Large, thick shell (L: ± 8.2 cm; W: ± 7 cm, T: ± 5.4 cm), ± aequibiconvex, with an elongate subelliptical outline. Ventral interarea (palintrope) strongly curved; ventral beak ± in contact with the dorsal umbo.

Dorsal valve with a clear median longitudinal depression (sulcus?).

Subfamily Bornhardtininae Cloud, 1942  
Genus Bornhardtina Schulz, 1914  
**Type species:** "Bornhardtina uncitoides Schulz, 1914"  
**Bornhardtina equitis** n. sp.

Plate 2, Figures 1-10, Table 4
Givetian brachiopods

**DE RIVATIO NOMINIS**

*Equis, itis* (Latin): knight ("chevalier" in French). The specimens have been collected by E. Chevalier, research worker at the “Université de Liège”.

**TYPES**

Holotype: IRScNB a12071 (Pl. 2, Figs. 1-5), Paratype IRScNB a12072 (Pl. 2, Figs. 6-10), Paratype IRScNB a12073.

**LOCUS TYPICUS**

As for *Spinatrypina (Spinatrypina) fontis* n. sp.

**STRATUM TYPICUM**

Trois-Fontaines Formation, Early Givetian. The holotype and paratypes come from unit 3 (some meters above the base) (Fig. 3).

**DIAGNOSIS**

A large, wider than long species of *Bornhardtina* with a subtriangular outline in ventral view, a clearly curved palintrope and a dorsal valve with a well marked transversely elliptical outline.

**DESCRIPTION**

**External characters**

**General characters**

Shell large-sized and aequibiconvex to ventribiconvex (Table 4), weakly to moderately asymmetrical, clearly wider than long. Maximum width located between the anterior third and fourth part of the length. In ventral view subtriangular outline with the base of the triangle widely rounded. Anterior commissure rectimarginate to slightly uniplicate (?).

**Ventral valve**

Valve ± regularly curved transversely and longitudinally. No sulcus but a slight flattening of the anterior half of the median part of the valve. Shoulder lines slightly to clearly concave. Shoulder angle of 93°-95°. Palintrope high, clearly curved, orthocline in its basal part and anacline in its distal part. Delthyrium partly closed by deldial plates obliquely towards the plane of symmetry. Beak incurved, overhanging the dorsal umbo but not concealing the delthyrium.

**Dorsal valve**

Typically wider than long and with a well elliptical outline. No fold but a very weekly marked flattening of the anterior half of the median part of the valve.

**Ornamentation**

Concentric growth lines (some of them could be even slightly lamellose); width of the growth lamellae varying from 1.5 to 3.0 (4.0?) mm.

**Dimensions** (Table 4)

Internal characters

Not studied.

**COMPARISONS**

*Bornhardtina equitis* is close to *B. triangularis* Wedekind, 1934 but the new species has a different, wider than long outline and its palintrope and ventral beak are more incurved.

*B. equitis* is distinguishable from *B. laevis* laevis (McCoy, 1852) († = *B. uncitoides* Schulz, 1914), *B. ovalis* Wedekind, 1934, *B. sulcata* Ting, 1936 and *B. laevis ellipsoides* Struve, 1982 by its typically wider than long outline and its widely elliptical dorsal valve.

*B. equitis* differs from *B. onychophora* (Spierersbach, 1919) by the same characters as those mentioned above as well as by its less incurved palintrope and ventral beak.

The orientation of the palintrope of *B. equitis* differs completely from the one (bended in ventral direction) of *B. ahuetensis* Ting, 1936.

*B. equitis* is larger than *B. rugosa* Ting, 1936 and has no concentric "rugae".

The outline of *B. equitis* is unlike that of *B. skalensis* Biernat, 1953 and its ventral umbo and beak are more developed.

From the Russian species assigned to *Bornhardtina* (*B. langurica*, *B. rhiphaeica*, *B. tarasurica*, *B. rensselianiformis*) and described by Khodalevich & Breivel (1972, pp. 159-163), the Belgian species can be differentiated by its size and outline. Moreover, concerning *B. tarasurica*, this species has ventral and dorsal sulci that are absent in *B. equitis*.

The outline of *B. equitis* is unlike that of *B. coulteri* Brown, 1944 (compare pl. 2, figs. 1, 6 and pl. 4, fig. 7, pl. 5, fig. 3 in Brown).

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**Table 4**

<table>
<thead>
<tr>
<th>Specimen IRScNB</th>
<th>Dimensions (cm)</th>
<th>Apical angle</th>
<th>Shoulder angle</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>L</td>
<td>W</td>
<td>T</td>
</tr>
<tr>
<td>Holotype</td>
<td>6.20</td>
<td>7.14</td>
<td>4.60</td>
</tr>
<tr>
<td>a12072</td>
<td>6.30</td>
<td>± 7.60</td>
<td>± 3.15</td>
</tr>
</tbody>
</table>
Many new species of *Bornhardtina* have been described from the Givetian of China. We cannot compare the new species with all these species because some of the Chinese publications were not accessible. *B. equitis* is clearly distinguishable on the basis of the general shape, outline and/or peculiar characters (curvature of the beak, development of the palintrope, presence of sulcus on both valves) from the following species: *B. (Parabornhardtina) yunnanensis* SUN & HOU, 1964 (in HOU, H.-f. & XIAN, Si-y.), *B. bisulcata* YANG (MS) (in ZHANG et al., 1983, p. 379), *B. burtiniformis* FANG, 1974, *B. convexa* FANG, 1974 (in FANG & CHU), *B. orientalis* WU, 1974 (in YANG, Y., YU, C.-m. & WU, Q.).

Relationships with and differences between *B. equitis* n. sp. and *B. tianshanensis* YANG (MS) (in ZHANG et al., 1983, p. 380), but also *B. speciosa* WANG and *B. dahekouensis* XIAN, both species listed by TALENT et al. (2001, pp. 114-115), remain to be clarified and specified.

*Bornhardtina onychophora* (SPRIESTERSBACH, 1919)

1919 *Uncites (Bornhardtina) laevis* McCoy n. var. onychophora – SPRIESTERSBACH, pp. 447-454, pl. 26, figs. 1-3, pl. 27, figs. 1, 2.

**MATERIAL AND OCCURRENCE**

One specimen with partially broken ventral beak (IRScNB a12074), one incomplete specimen (IRScNB a12075) from unit 3 (Fig. 3).

**SHORT DESCRIPTION**

Shell thick and large (L: ± 7.4 cm; W: ± 6.0 cm; T: ± 4.8 cm). Ventral valve strongly asymmetrical. In ventral view, anterior half with anterior and lateral margins ± rounded; posterior half roughly subtriangular and asymmetrical. Beak of the most complete specimen broken but, on the basis of the curvature of the remaining part of the umbo, strongly curved and clearly overhanging the dorsal umbo. No ventral sulcus nor dorsal fold.

In the ventral valve, teeth located on the dorsal side of important postero-lateral thickenings of the valve (no individualized dental plates). In the dorsal valve, hinge plates disjunct.

*Bornhardtina* sp.

**MATERIAL AND OCCURRENCE**

Three incomplete dorsal valves (IRScNB a12076 for the whole lot) from unit 4 (Fig. 3).

**REMARK**

These three free dorsal valves display the typical disjunct hinge plates with the inner parts gently bent in dorsomedian direction.

Subfamily Stringocephalinae KING, 1850

**Genus Stringocephalus** DÉFRANCE, 1825 (in DE BLAINVILLE)

**Type species**: *Terebratula Burtini* DÉFRANCE, 1825 (in DE BLAINVILLE)

*Stringocephalus* cf. *glinskii* STRUVE, 1992

1992 *Stringocephalus glinskii* n. sp. – STRUVE, pp. 593-594.

2001 *Stringocephalus glinskii* STRUVE, 1992 – THORMANN & WEDDGE, pl. 7, figs. 51, 52.

**MATERIAL AND OCCURRENCE**

One complete shell (IRScNB a12077), three broken and disarticulated ventral valves (IRScNB a12078 for the whole lot) from unit 4 (Fig. 3).

**REMARK**

These specimens (dimensions of the specimen a12077: W: 38 mm; L: 30.9 mm; T: 18.1 mm) are provisionally assigned to *S. glinskii* on the basis of their wider than long outline corresponding in ventral view to a half ellipse topped by a triangle, their widely elliptical dorsal valve and their aequibiconvexity.

**Conclusions**

First of all it must be noted that the data given on Figure 3 are preliminary and must be refined by further sampling. That is particularly true for the faunas of units 1 and 3. In unit 3 for example, the fossiliferous beds are not rare, but well-preserved specimens are difficult to collect. Studied specimens from that unit were not collected in situ but in the debris at the base of the wall of the quarry. Their position in the stratigraphic column is consequently approximate.

At present, three faunas or assemblages have been recognized (from the base to the top):

- **Fauna 1**: This assemblage recognized in unit 1 includes *Schnurella schnurii* and *Gerolsteinites* sp. Other brachiopods are also present but too fragmentary to be identified with precision; they consist of indeterminable fragments of spinatrypids and reticulariids. Outside de Marenne area, on the southern flank of the Dinant Synclinorium, this assemblage is also present at Couvin (Haine quarry) (BULTYNCK, 1970, p. 50, "Undispirifer" = *Gerolsteinites*) and Pondrôme (GODEFROID, 1995, p. 107).

- **Fauna 2**: It is represented by many terebratulid brachiopods (*Hessenhausia, Bornhardtina*) in unit 3. Isolated shells of *Stringocephalus* have not yet been collected and among the numerous sections of brachiopods visible in the fossiliferous beds, none have been identified as *Stringocephalus* on the basis of the presence of large cardinal process and septa in the two valves. However, that absence could be the result from collection failure.

- **Fauna 3**: The highly diversified and rich association dominated by atrypid and athyrid brachiopods characterizes the level with *Scoliopora* (unit 4). *Stringocephalus* is present.
Acknowledgements

M. COEN-AUBERT helped one of us (J. GODFROID) to discover the Marenne quarry and its brachiopod fauna. P. BULTYNCK and E. CHEVALIER gave us some good brachiopod specimens. The photographs have been perfectly made by W. MISSEUR, F. ALVAREZ (Oviedo) and R. GOURVENNEC (Brest) kindly reviewed the manuscript. We thank all these persons whole-heartedly.

References


Explanations of the plates

PLATE 1

All figures are X2.

*Spinatrypina (Spinatrypina) fontis* n. sp.

Figs. 1-5 — Holotype IRScNB a12039.
Figs. 6-10 — Paratype IRScNB a12040.
Figs. 11-15 — Paratype IRScNB a12041.

1, 6, 11: ventral views; 2, 7, 12: dorsal views; 3, 8, 13: lateral views; 4, 9, 14: posterior views; 5, 10, 15: anterior views.

PLATE 2

All figures are natural size.

*Bornhardtina equitis* n. sp.

Figs. 1-5 — Holotype IRScNB a12071.
Figs. 6-10 — Paratype IRScNB a12072.

1, 6: ventral views; 2, 7: dorsal views; 3, 8: lateral views; 4, 9: posterior views; 5, 10: anterior views.