

## Earth science collections of the Centre Grégoire Fournier (Maredsous) with comments on Middle Devonian–Carboniferous brachiopods and trilobites from southern Belgium

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**ABSTRACT.** Although the Centre Grégoire Fournier of the Maredsous Abbey is especially famous for the fossils and minerals from the Carboniferous (Viséan) ‘black marble’ of Denée, a marine conservation-Lagerstätte, its palaeontological collections likewise include some types and illustrated specimens of invertebrates (cystoids, goniatites, ostracods, trilobites) and fishes from the Ordovician, Devonian and Carboniferous of Belgium. These specimens are discussed and/or illustrated as is the case of the fragments of two Belgian meteorites (Lesves and Tourinnes-la-Grosse chondrites) that are part of the CGF mineralogical and petrological collections. Moreover, the type material of 30 species and subspecies of Upper Devonian–Pennsylvanian linguliformean and rhynchonelliformean brachiopods (described by de Koninck (1847), J. Fraipont (1888a), Ch. Fraipont (1908), Demanet (1923, 1934), Demanet (in Demanet & Van Straelen, 1938), and Grimm (1998)) and that of two Middle–Upper Devonian species of trilobites (Stainier, 1887; Richter & Richter, 1933), almost all from the Namur–Dinant Basin (southern Belgium), are re-investigated and/or fully figured for the first time in order to facilitate future taxonomic revision. The obscure Tournaisian genus *Anomianella* de Ryckholt (1851) is rejected from the bivalves and transferred to the brachiopods (Craniida). It is probably related to *Petrocrania* Raymond, 1911. The lectotype of *Orthis latissima* M’Coy, 1844 and that of *Producta corrugata* M’Coy, 1844, both from the Viséan of Ireland, are photographically illustrated (for the first time for the former). The lectotype of *Productus murchisonianus* de Koninck, 1847 from the Upper Palaeozoic of Tasmania (Australia) is also designated.

**KEYWORDS:** Ordovician, Devonian, Carboniferous, palaeontology, mineralogy, meteorites, Belgium.

### 1. Introduction

The Centre Grégoire Fournier (CGF) is part of the Maredsous Abbey (Denée, southern Belgium) and is home to the most important collection of invertebrates (e.g., brachiopods, echinoids, graptolites) and vertebrates (fishes) from the Viséan (Moliniacian) ‘black marble’ of Denée, which ranks among the few fossil conservation deposits of the Belgian Carboniferous (see references in Mottequin, 2008a and Mottequin et al., 2015). Although the other palaeontological collections gathered by Dom Grégoire Fournier (1863–1931) cannot be compared with those of the ‘black marble’ of Denée, they include some types and illustrated specimens, notably of goniatites (Delépine, 1940) and fishes (Leriche, 1908), but also worthwhile material generally coming from Ordovician–Carboniferous sections located around Maredsous.

The Centre Grégoire Fournier was originally the museum of natural sciences of the abbatial school of the Maredsous Abbey (Genard, 2018, 2019). Besides the mineralogical and palaeontological collections, this local museum comprises archaeological, botanical, petrological and zoological ones (Henrard, 1951; Parent, 1977, 1979).

The three first objectives of the paper are related to the Centre Grégoire Fournier. This contribution aims at (1) providing brief information on its mineralogical and petrological (meteorites) collections, (2) documenting the types and illustrated specimens included in its palaeontological collections (to the exception of those from the ‘black marble’ of Denée, see above), and (3) highlighting the other valuable collections/specimens in order to promote their inclusion in future researches. The fourth objective is to discuss and to illustrate thoroughly the type specimens of several brachiopod (J. Fraipont, 1888a; Ch. Fraipont, 1908; Demanet, 1923, 1934; Demanet in Demanet & Van Straelen, 1938; Grimm, 1998) and trilobite (Stainier, 1887; Richter & Richter, 1933) species and subspecies from the Middle Devonian–Carboniferous of Belgium.

### 2. Stratigraphy

The reader is referred to Verniers et al. (2002), Bultynck & Dejonghe (2002), Poty et al. (2002), Delmer et al. (2002), and Robaszynski et al. (2002) (and references herein) for the description of the Ordovician, Devonian, Carboniferous, and Cretaceous lithostratigraphic units of southern Belgium (Fig. 1)

mentioned in the text, respectively.

Most of the species discussed here are from the Tournaisian–Viséan (Carboniferous; Fig. 2) carbonate rocks that extensively crop out in southern Belgium on both sides of the major Midi–Eifel fault zone, notably in the Brabant Parautochthon, the Haïne-Sambre-Meuse Overturned Thrust Sheets, and the Dinant Synclinorium (Hance et al., 1999; Belanger et al., 2012) (Fig. 1). These Variscan structural elements constituted the Namur–Dinant Basin that developed along the southeastern margin of Laurussia during Devonian and Mississippian times.

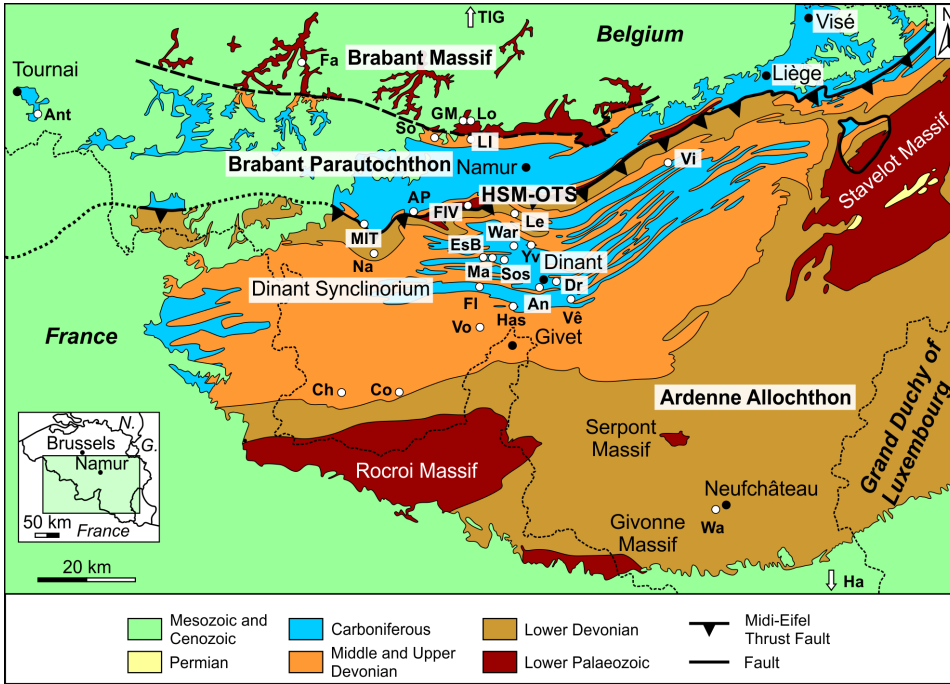
Correlations of the Tournaisian (Hastarian, Ivorian) and Viséan (Moliniacian, Livian, Warnantian) Belgian substages, which are used here, with other chronostratigraphic units were discussed notably by Poty et al. (2006, 2014).

### 3. Material and methods

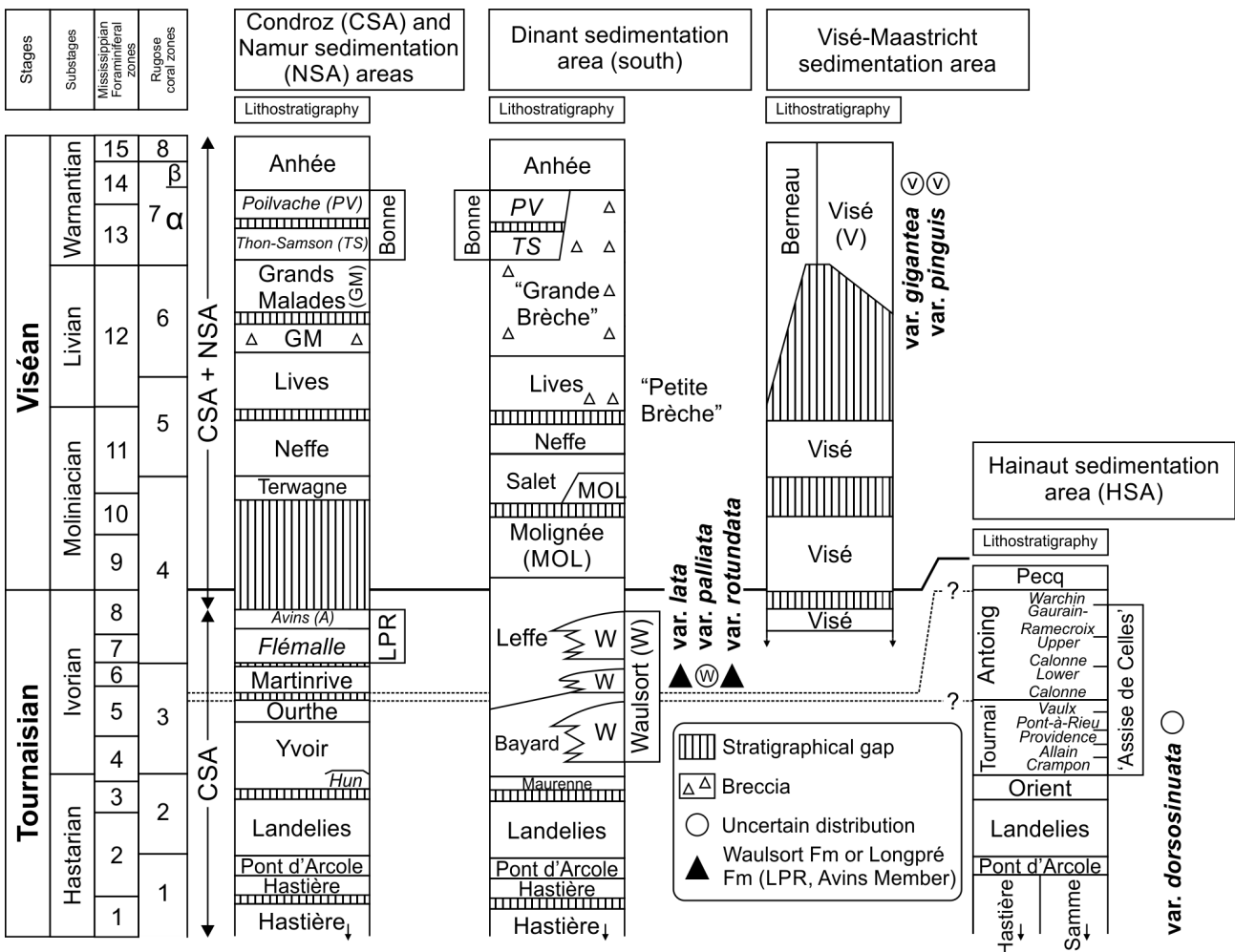
The bulk of the fossils and meteorites illustrated here are housed at the Centre Grégoire Fournier (prefixed CGF) of the Maredsous Abbey (Denée) and at the Royal Belgian Institute of Natural Sciences (prefixed RBINS), Brussels. Additional investigated material is curated at the Université de Liège (palaeontological collections, prefixed ULg.PA), at the Université de Mons (Faculté Polytechnique, Service de Géologie Fondamentale et Appliquée, prefixed UMONS-GFA), and at the National Museum of Ireland (Geological Collection, Natural History Division; prefixed NMING), Dublin.

The species are described herein phylum by phylum and alphabetically classified by their specific name using their original generic assignment. In the legends of the figures, the original (old) names, which are sometimes corrected, are followed by current names given in square brackets. For each species, only the original references are provided, with few exceptions for which additional ones are cited.

Concerning the part devoted to the brachiopods (Section 6.2.), and to a lesser extent to the trilobites (Section 6.3.), most of the remarks expressed by Mottequin (2019) are still valid here and are discussed in Section 6.1.2. The present author aims at contributing to the assessment of the diversity in promoting and facilitating future taxonomic studies. For this reason, the type material of each species and variety is illustrated photographically and discussed, pending the study of further material.



**Figure 1.** Location and schematic geological map of southern Belgium with indication of the localities cited in the text (modified from de Béthune, 1954). Abbreviations: An, Anseremme; Ant, Antoing; AP, Aiseau-Presles; Ch, Chimay; Co, Couvin; EsB, Emerton-sur-Biert; Dr, Dréhance; Fa, Fauquez; Fl, Flavion; FIV, Fosses-la-Ville; GM, Grand-Manil; Ha, Halanzy; Has, Hastière; HSM-OTS, Haine-Sambre-Meuse Overturned Thrust Sheets (Belanger et al., 2012); Le, Lesves; LI, Les Isnes; Lo, Lonzée; Ma, Maredsous; MIT, Montignies-le-Tilleul; Na, Nalinnes; So, Sombrefe; Sos, Sosoye; TIG, Tourinnes-la-Grosse; Vê, Vêves; Vi, Vierset; Vo, Vodlée; Wa, Warmifontaine; War, Warnant; Yv, Yvoir (Poilvache).



**Figure 2.** Stratigraphy, lithostratigraphy (incompletely represented here for the Hainaut and Visé–Maastricht sedimentation areas; formations and members are in roman and italic letters, respectively), and biostratigraphy of the essentially carbonate Tournaisian and Viséan succession of southern Belgium (adapted from Hance et al., 2006a, Poty et al., 2002, 2006, 2014, and Poty, 2016) with indication of the origin of the type material of the varieties of *Schizophoria resupinata* (Martin, 1809) erected by Demanet (1923, 1934) (see text). Note that the ‘Grande Brèche’ is an informal stratigraphic unit resulting from the dissolution of evaporitic levels in the Grands Malades Formation; other brecciated horizons, known as the ‘Petite Brèche’, locally occur within the lower part of the Lives Formation (Haut-le-Wastia Member).

The smallest palaeontological specimens were photographed using a low-vacuum scanning electron microscope (ESEM FEI Quanta 200), but not coated with gold, whereas the larger ones were coated with ammonium chloride sublimate before being photographed.

#### 4. Mineralogical and meteorite collections of the CGF

Although the CGF includes a large didactical mineralogy collection, only the specimens that were cited and/or described in the literature are mentioned here. The mineralogical species found in the Molinee Formation ('black marble' of Denée), namely calcite, fluorite, pyrite, quartz, sphalerite, and sulphur, were discussed by Buttgenbach (1898a, 1900, 1906a) and Fournier (in Fournier & Kaisin, 1929). Aragonite (Fournier, 1899a), barytine (Buttgenbach, 1925), calcite (Buttgenbach, 1898b, 1906a, 1920, 1923, 1925), chalcedony (Fournier, 1899b), hopeite (Buttgenbach, 1906a), quartz (Fournier, 1897a, 1899c, 1904), and wavellite (Fournier, 1897b), which were discovered essentially in Dinantian rocks mainly cropping out in the neighbourhood of the Maredsous Abbey or in eastern Belgium, were the subjects of numerous short notes (see references above). Foreign collections include smithsonite crystals from Almaden (Spain) described by Buttgenbach (1906b).

A small fragment (CGF L945a; 48 g) of the Lesves meteorite (Figs 1, 3A, 3C) (Fournier, 1896a; Renard, 1896), an olivine–enstatite chondrite (L6), is deposited at the CGF as well as a fragment (CGF L945b; 12 g) of the Tourinnes-la-Grosse one (Van Beneden, 1863) (Figs 1, 3B, 3D), an enstatite chondrite (L6). Besides these Belgian meteorites, it is worthwhile to cite fragments of those from Brenham (Kansas, USA; stony-iron, pallasite, CGF L880b; 17.9 g), Dundrum (Ireland; ordinary chondrite (H5), CGF L287; 2 g), Hedjaz (Saudi Arabia; ordinary chondrite (L3.7), CGF L282; 3.5 g), Mills (New Mexico, USA; ordinary chondrite (H6), CGF L378; 5 g), Odessa (Texas, USA; iron (IAB), coarse octahedrite, CGF L377; 7.5 g), and Toluca (Mexico; iron (IAB), coarse octahedrite, CGF L1419; 39.5 g) (see Grady, 2000 for references). Some of these fragments were cited by Dewalque (1905). Further information on the rest of the petrological collections can be found in Henrard (1951).

#### 5. Palaeontological collections of the CGF

##### 5.1. Type and/or illustrated specimens

###### 5.1.1. Cephalopods

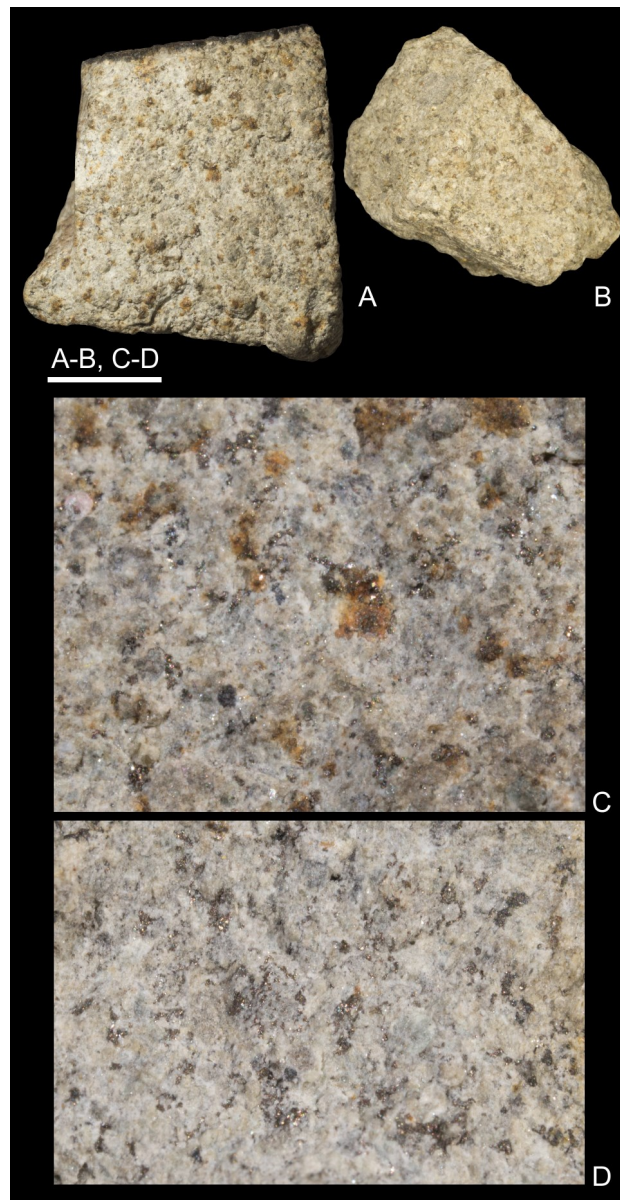
###### *Beyrichoceras fournieri* Delépine, 1940

1940 *Beyrichoceras fournieri* Delépine, p. 19, 67-68, table 2, pl. 4, figs 1-2.

*Type material.* The only specimen available (CGF 2020.11.10/1) was considered by Delépine (1940, in caption of pl. 4, figs 1-2) as the type specimen and is thus the holotype by virtue of monotypy. However, this specimen has not been traced so far and is probably lost.

*Type locality and horizon.* According to Delépine (1940), the holotype was collected in the scree of a ravine on the northern flank of Poilvache (Yvoir, Fig. 1) in the Meuse valley (right side) and, on the basis of the lithological characters of the specimen, this author suggested that it probably originated from black limestones with black cherts, that is to say, probably from the Poilvache Member of the Bonne River Formation (Fig. 2) of early Warnantian age (Viséan).

*Description.* See Delépine (1940).



**Figure 3.** Belgian meteorites (chondrites) housed at the Centre Grégoire Fournier (Maredsous Abbey). A, C. CGF L945, olivine–enstatite chondrite (L6), Lesves (April 13, 1896). B, D. CGF L945b, enstatite chondrite (L6), Tourinnes-la Grosse (December 7, 1863). Scale bar: 10 mm (A-B), 2.5 mm (C-D).

*Remarks.* The species *fournieri* was assigned to the genus *Beyrichoceratoides* Bisat, 1924 (e.g., Bisat, 1952; Currie, 1954; Riley, 1996) whereas it was transferred to the genus *Eoglyphioceras* Brüning, 1923 by Dzik (1997) and Korn & Ebbighausen (2008).

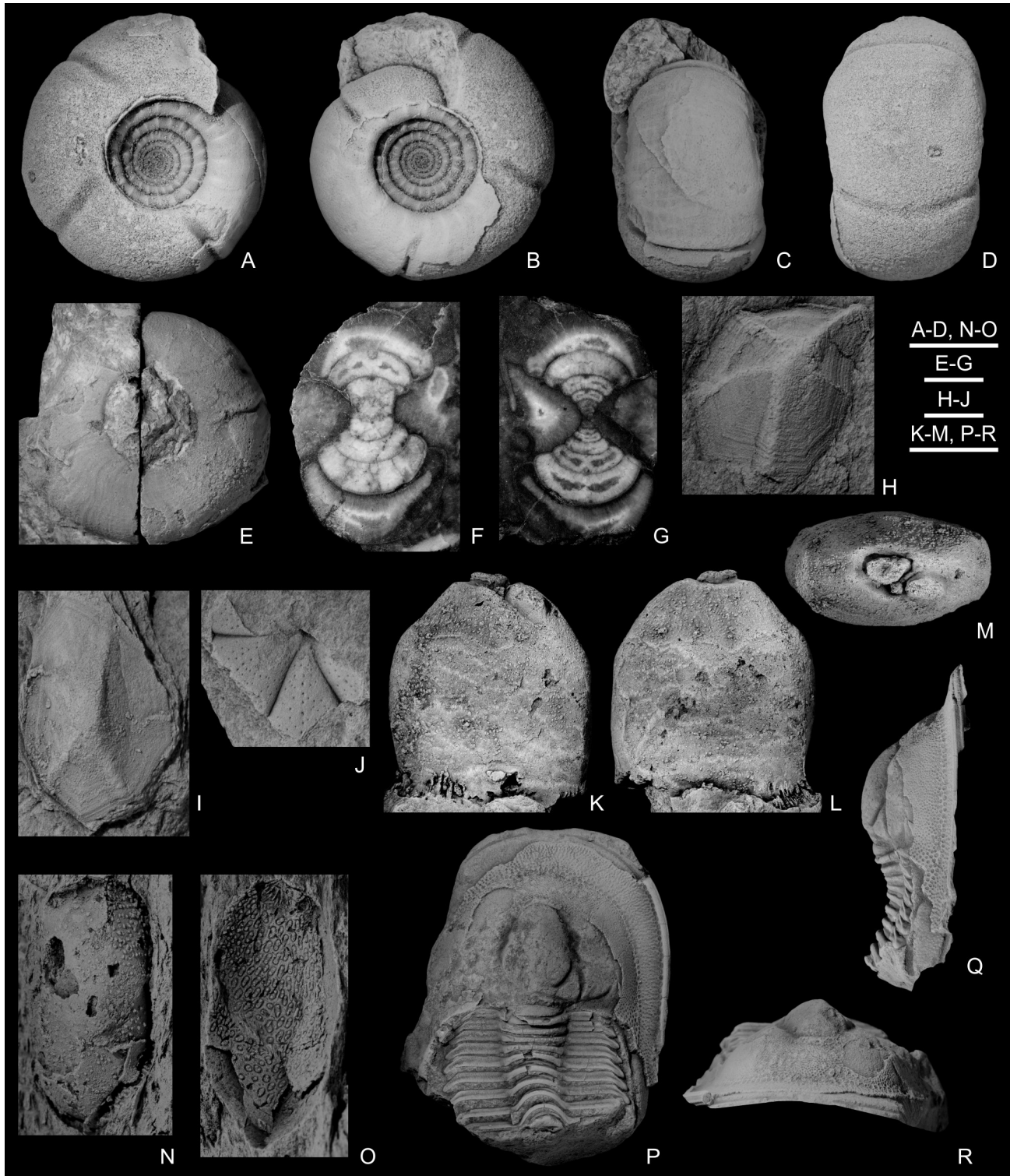
*Current name.* *Eoglyphioceras fournieri* (Delépine, 1940).

###### *'Goniatites' (Pericyclus?) tuberculatus* Delépine, 1940 (Fig. 4A-G)

1940 *'Goniatites' (Pericyclus?) tuberculatus* Delépine, p. 42-43, pl. 3, fig. 7.

*Type material.* The only specimen (CGF 2020.11.10/2) illustrated by Delépine (1940, pl. 3, fig. 7) is hereby designated as the lectotype (Fig. 4A-D) as this author failed to designate a holotype. A second specimen (CGF 2020.11.10/3) was





**Figure 4.** A-G. *'Goniatites' (Pericyclus?) tuberculatus* Delépine, 1940 [*Hammatocyclus? tuberculatus* (Delépine, 1940)]; Flavion, Waulsort Formation (Tournaisian, Ivorian). A-D. CGF 2020.11.10/2 (lectotype), internal mould with shelly fragments. E-G. CGF 2020.11.10/3 (paralectotype), specimen sectioned transversally. H-J. *Cheirocrinus cf. constrictus* Bather, 1913 [*Homocystes cf. constrictus* (Bather, 1913)], internal moulds of isolated thecal plates; Fosses-la-Ville, Fosses Formation (Ashgill). H. CGF 2020.11.10/5. I. CGF 2020.11.10/6. J. CGF 2020.11.10/7. K-O. *Haplosphaeronis proiciens* Regnéll, 1951; Fauquez, Huet Formation (Katian). K-M. RBINS a7836 (holotype), internal mould of complete theca in left lateral, right lateral and oral views. N-O. CGF 2020.11.10/9 (paratype), internal and external (showing the fans of the ambulacral furrows) moulds of incomplete theca. P-R. *Harpes macrocephalus* Goldfuss, 1839, CGF 2020.11.10/13, incomplete specimen in dorsal, lateral and frontal views; Couvin (Trou Bodet), Jemelle Formation (Eifelian). Scale bars: 5 mm (A-D, N-O), 10 mm (E-G, K-M, P-R), 2 mm (H-J).



mentioned but not figured by this author; therefore, it is a paralectotype and is illustrated here for the first time (Fig. 4E-G).

*Type locality and horizon.* Flavion (see Demanet, 1958), Waulsort Formation (Tournaisian, Ivorian) (Figs 1-2).

*Description.* See Delépine (1940).

*Remarks.* The species is listed in several publications, but the poor original illustrations and the restricted material available precluded a categoric generic assignment. It was tentatively assigned to *Hammatocylcus* Schindewolf, 1951 by Schindewolf (1951) and Ebbighausen et al. (2010).

*Current name.* *Hammatocylcus? tuberculatus* (Delépine, 1940).

### 5.1.2. Echinoderms

*Remarks.* Besides both cystoid species discussed below, Regnéll (1951, p. 37) reported an external mould (CGF 2020.11.10/4) of a stem fragment of Pelmatozoa (type A sensu Regnéll, 1951) from Grand-Manil (Fig. 1). It is from the Huet Formation of probably early Katian age according to Herbosch & Verniers (2014). This specimen does not deserve to be figured here due to its poor state of preservation.

***Cheirocrinus cf. constrictus* Bather, 1913**  
(Fig. 4H-J)

1951 *Cheirocrinus cf. constrictus* Bather, 1913; Regnéll, p. 10-12, pl. 1, figs 1-8.

*Material.* On the eight specimens illustrated by Regnéll (1951, pl. 1, figs 1-8), three belong to the CGF collections and come from Fosses-la-Ville (Fig. 1): CGF 2020.11.10/5 (pl. 1, fig. 3; Fig. 4H), CGF 2020.11.10/6 (pl. 1, fig. 1; Fig. 4I), and CGF 2020.11.10/7 (pl. 1, fig. 7; Fig. 4J).

*Description.* See Regnéll (1951).

*Remarks.* These specimens from the Condroz Inlier were collected within the Ordovician (Ashgill) Fosses Formation. Bather's species was transferred to *Homocystites* Barrande, 1887 by Paul (1968) (see also Zamora et al., 2019).

*Current name.* *Homocystites cf. constrictus* (Bather, 1913).

***Haplosphaeronis proiciens* Regnéll, 1951**  
(Fig. 4K-O)

1951 *Haplosphaeronis* [sic] *proiciens* Regnéll, p. 31-35, pl. 4, figs 1-7, pl. 5, figs 1-7, pl. 6, fig. 9.

*Type material.* See Regnéll (1951). Three paratypes from Fauquez (see below) were mentioned but not illustrated by this author: CGF 2020.11.10/8 (not traced), 2020.11.10/9 (Fig. 4N-O), and 2020.11.10/10.

*Type locality and horizon.* Disused Huet quarry, north of Fauquez (Fig. 1) in the Sennette valley (Brabant Massif) (e.g., Vanmeirhaeghe et al., 2005; Verniers et al., 2005), Huet Formation (Ordovician, early Katian; see Herbosch & Verniers' (2014) discussion on the age of this lithostratigraphic unit).

*Description.* See Regnéll (1951).

*Remarks.* New illustrations of the holotype (RBINS a7836) (Regnéll, 1951, pl. 4, fig. 3) are provided here (Fig. 4K-M).

*Current name.* *Haplosphaeronis proiciens* Regnéll, 1951

### 5.1.3. Ostracods

***Bairdia protracta* Rome, 1971, non Eichwald, 1860**

1971 *Bairdia protracta* Rome, p. 23, 45, figs 29-30.

*Type material.* No holotype was designated by Rome (1971), who only illustrated a single specimen (RBINS b5719) by drawings; it is hereby designated as the lectotype (Rome, 1971, figs 29-30). The CGF collections include one unillustrated specimen (CGF 2020.11.10/11) from the type locality, which was identified by Rome (in coll.), and is accompanied by several drawings made by this author. There is no doubt that it is part of the type material and is thus considered as a paralectotype.

*Type locality and horizon.* Maredsous (see Conil, 1968) (Fig. 1), upper part of the Etroëungt Formation (latest Famennian, Strunian).

*Description.* See Rome (1971).

*Remarks.* *Bairdia protracta* Eichwald, 1860 (Silurian, a probable representative of the genus *Rishona* Sohn, 1960 according to Sohn, 1960) and *Bairdia protracta* Rome, 1971 are primary homonyms. The latter is a junior homonym and should be renamed. Attention is drawn to the fact that all the specimens illustrated by Rome (1971) are now curated at the RBINS (RBINS b5709-5736), except those identified as *Beyrichiopsis annulata* (figs 13-15), *Bairdia* aff. *kinderhookensis* (figs 31-32), *Rectobairdia dilatata* (figs 36-38), and *Orthobairdia irregularis* (figs 44-46) that are lost. Note that some *Bairdia* species (not *protracta*) described by Rome (1971) were revised by Lethiers (1975), who considered them as morphotypes of a single species.

*Current name.* *Bairdia protracta* Rome, 1971, non Eichwald, 1860.

### 5.1.4. Trilobites

*Remarks.* The CGF collections include one paratype (CGF 2020.11.10/12, unillustrated) of the upper Famennian species *Omegops maretolensis* (Richter & Richter, 1933) (see Section 6.3.).

***Harpes macrocephalus* Goldfuss, 1839**  
(Fig. 4P-R)

1897c *Harpes macrocephalus* Goldf.; Fournier, p. 52, unnumbered fig.

*Material.* CGF 2020.11.10/13 (Fig. 4P-R); Fournier (1897c) indicated that this incomplete specimen was collected from the Couvinian limestones of Petigny near Couvin, but the handwritten label, accompanying it, clearly indicates Couvin (Trou Bodet) as the locality (Fig. 1), which is most probably the right one, and it is thus from the Jemelle Formation (Eifelian). This fact is corroborated by Maillieux (1938, and unpublished RBINS archives) who indicated that this locality yielded Goldfuss' species (Couvin 3 in the RBINS archives).

*Description.* See Fournier (1897c).

*Remarks.* Although several authors reported the presence of trilobites in the Devonian of the Namur-Dinant Basin during the 19th century (see references in Taghon et al., 2012), few were described and/or illustrated. To our knowledge, Fournier's (1897c) specimen (CGF 2020.11.10/13) identified as *Harpes macrocephalus* Goldfuss, 1839 from the Eifelian of the Couvin area was the first to be illustrated photographically. This specimen was briefly discussed by Malaise (1897).

### 5.1.5. Fishes

***Sandalodus morrissi* Davis, 1883**  
(Fig. 5A-C)

1908 *Sandalodus Morrissi* Davis; Leriche, p. 283-285, pl. 8, fig. 6.

*Material.* CGF 2020.11.10/14 (Fig. 5A-C), Yvoir (Fig. 1), Landelies Formation (Hastarian) (Fig. 2).

*Description.* See Leriche (1908).

*Remarks.* Leriche's (1908) report of this species is the only one in the Tournaisian of southern Belgium (Derycke et al., 1995).

***Deltodus robustus*** (de Koninck, 1878)  
(Fig. 5D-F)

1908 *Deltodus robustus* de Koninck; Leriche, p. 282-283, pl. 8, fig. 5.

*Material.* CGF 2020.11.10/15 (Fig. 5D-F), Ermeton-sur-Biert (Fig. 1), 'Assise d'Hastière (?)' according to Leriche (1908). After de Dorlodot's (1895) stratigraphic scheme followed by Leriche (1908), the 'Assise d'Hastière' included the Hastière, Pont d'Arcole, Landelies, and Maurenne formations (Fig. 2). The matrix enclosing the plate is a crinoidal limestone that indicates either the Hastière Formation or the Landelies Formation; both lithostratigraphic units are of Hastarian age.

*Description.* See Leriche (1908).

*Remarks.* According to de Koninck (1878), his species *Sandalodus robustus*, which was transferred to *Deltodus* Morris & Roberts, 1862 by Leriche (1908), was erected on the basis of a single incomplete tooth plate that has thus to be considered as the holotype by monotypy. Until so far, this specimen has not been traced in the RBINS collections although Leriche (1908) noted, in a footnote, that he studied it at Brussels.

## 5.2. Further comments on the CGF collections

Except for the invertebrate and vertebrate collections from the Viséan 'black marble' of Denée (e.g., Mottequin et al., 2015), which rendered the CGF famous among the palaeontological community, the rest of CGF palaeontological collection consists of about 150 drawers including mostly Cambrian–Neogene invertebrates.

Palaeozoic and Cenozoic fossils come essentially from Belgium contrary to the Mesozoic ones which include many specimens from France and, to a lesser extent, from Germany and Switzerland. The scientific interest essentially lies in the Belgian specimens, especially those originating from the Devonian and Carboniferous outcrops more or less closely situated around the Maredsous Abbey (the Belgian fossiliferous localities are plotted in Fig. 1). Some collections deserve to be highlighted in this paragraph:

Ordovician invertebrates (e.g., brachiopods, trilobites, etc.) from the disused Lefèvre quarry (now inaccessible) at Grand-Manil (Huet Formation, early Katian) and from the Fosses-la-Ville area (Fosses Formation, Ashgill);

One enigmatic vertebrate from the Warmifontaine slate quarries (La Roche Formation; Pragian);

One exceptional longitudinal section of a large cephalopod (*Manticoceras?*) from a Frasnian mudmound (Vodelée?) (Fig. 5G);

One ophiuroid (*Ophiuulax decheni* (Dewalque, 1881); Fig. 5H) from the upper Famennian (Angertal-Schichten sensu Paul (1939), now included within the Velbert Formation, e.g., Amler & Herbig, 2006) of the Ratingen area (Germany, Velbert Anticline), offered to the CGF in 1934 by H. Paul (Paul, 1939; Ubaghs, 1941; Schmidt, 1944);

One screw-shaped fossil of uncertain affinities named *Spiraxis interstitialis* by Stainier (1894) from Les Isnes quarries (Bois de la Rocq Formation; latest Famennian);

Invertebrates (e.g., brachiopods, molluscs) from the Tournaisian (Ivorian) of Flavion, Maredsous and Sosoye (Waulsort Formation and/or Les Avins Member (Longpré

Formation); see Section 6.1.1.) and from the Viséan (Anhée Formation, Warnantian) of Warnant (Fig. 2);

Nicely preserved invertebrates from the historical type areas (Tournai and Visé) of the Tournaisian and Viséan stages;

Conodonts from the Tournaisian succession of the Maredsous area (Ghysens & Conil, 1973);

One rostrum of an unidentified Ichthyosauria (Fig. 5K) from the Lower–Middle Jurassic (Toarcian–Bajocian) of the Belgian Lorraine (Halanzky);

Some vertebrate remains (sharks, mosasaurs, teleostean fishes (Fig. 5I–J)) from the Coniacian (?)–basal Campanian (?) Lonzée Member of the Lonzée area, near Gembloux.

## 6. Comments on Devonian and Carboniferous brachiopods and trilobites originally described in southern Belgium

### 6.1. Preliminary remarks

#### 6.1.1. Stratigraphical comments

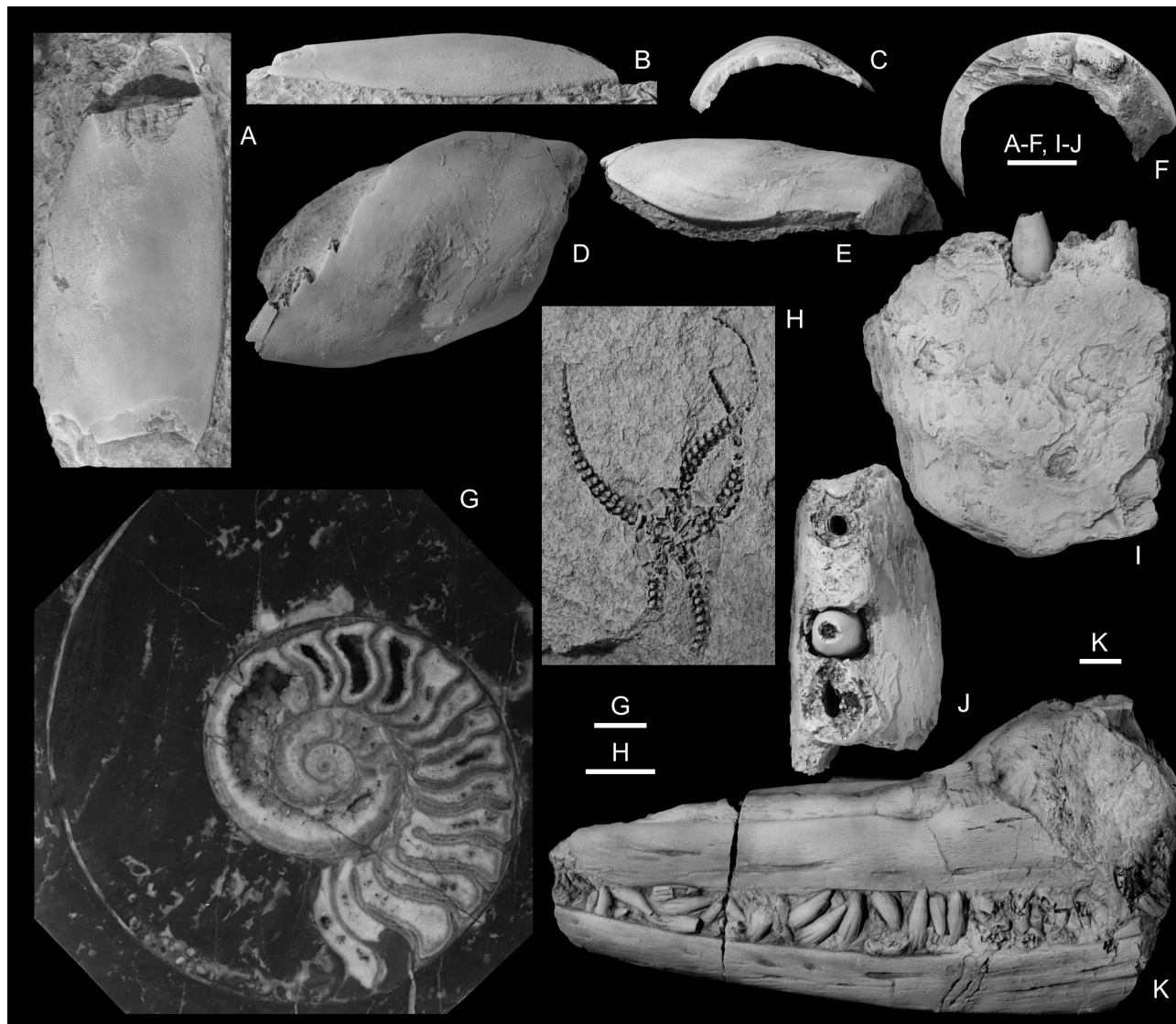
Many brachiopod species and varieties were introduced by Demanet (1923) for specimens originating from Maredsous (disused lime kiln quarry, known as the 'carrière du four à chaux' in the Belgian literature) and Sosoye. The reader is referred to Fournier (1892, 1896b), Demanet (1923), and Delcambre & Pingot (2018) for more details concerning these major sections (Fig. 1). Besides the fact that the type specimens were very poorly illustrated in the original publication, it appears that the Sosoye material comes from two distinct stratigraphic levels, namely the Waulsort Formation and the Avins Member (Longpré Formation) (Fig. 2) according to E. Poty (pers. com., February 2020). Both units are of Ivorian age, but the Avins Member (just few metres) capped the Waulsortian buildups (e.g., Poty, 2016). However, it is virtually impossible to ascertain the stratigraphic level in the absence of matrix as is case of most of the specimens present in the collections. In contrast to Sosoye, all the specimens from the disused lime kiln quarry at Maredsous come from the Waulsort Formation.

The type locality and horizon of the brachiopod species and varieties (see comments below) from the Tournai area (Fig. 1) described by Demanet (1934) often remain obscure and some of them were overlooked in the overview published by Demanet (1958). This author indicated 'Assise de Celles' (Fig. 2) as the type horizon for his new species and varieties. Nowadays, this disused stratigraphic unit encompasses two lithostratigraphic ones, from base to top: the Tournai (Hastarian–Ivorian) and Antoing (including the Warchin Member; Ivorian) formations (Poty et al., 2002; Hance et al., 2006a).

#### 6.1.2. Taxonomical comments

According to the article 45.6.4 of the International Code of Zoological Nomenclature (1999), the epithets, which were used for the orthide, productide and spiriferide varieties introduced by Demanet (1923), must be considered as of subspecific rank in his publication.

In spite of the efforts made, it was not possible to locate more syntypes (unless specifically explained) than those illustrated by Demanet (1923), which are all curated at the RBINS. The search for additional specimens belonging to Demanet's collections in those of the Université de Liège were fruitless as was the case of the search for additional chonetidine and rhynchonellide specimens that were studied by Ch. Fraipont (1908). Consequently, unless it was clearly or implicitly exposed by Demanet (1923), it is impossible to state if the only specimen illustrated corresponds to the holotype by monotypy.



**Figure 5.** A-C. *Sandalodus morrissi* Davis, 1883, CGF 2020.11.10/14, posterior dental plate in oral, labial, and mesial views; Yvoir, Landelies Formation (Tournaisian, Hastarian). D-F. *Deltodus robustus* (de Koninck, 1878), CGF 2020.11.10/15, posterior dental plate in oral, lingual and mesial views; Ermeton-sur-Biert, Hastière Formation or Landelies Formation (Tournaisian, Hastarian). G. *Manticoceras?* sp., CGF 2020.11.10/16, longitudinal section; Vodelée (?), Neuville Formation or Les Valisettes Formation, Petit-Mont Member (late Frasnian). H. *Ophiaulax decheni* (Dewalque, 1881), CGF 2020.11.10/17, internal mould; Ratingen area (Germany, Velbert Anticline), Velbert Formation (late Famennian). I-J. Fragment of a lower (?) jaw of an unidentified teleostean fish, CGF 2020.11.10/18, lateral and oclusal views; Loncée, Loncée Member (Coniacian?–basal Campanian?). K. Rostrum of an unidentified Ichthyosauria, CGF 2020.11.10/19, left lateral view; Halanzy area (Toarcian–Bajocian). Scale bars: 10 mm (A-F, I-J, K), 25 mm (G), 2.5 mm (H).

We have thus proceeded to lectotype selection for the species described by Ch. Fraipont (1908) and for most of those of Demanet (1923).

Concerning the syntypes (thus the paralectotypes if a lectotype was previously selected) of the brachiopod species erected by Demanet (1934) curated at the RBINS, only the specimens illustrated in the original papers have been considered, but it is evident that others should be regarded as such. Nonetheless, the screening of the whole RBINS collections for the search for additional syntypes would have been a too time-consuming task for all the species discussed in this paper, and thus remains to be done. Similar remarks apply to the trilobite taxa introduced by Stainier (1887) and Richter & Richter (1933).

It clearly appears that many brachiopod species were erected based on insufficiently preserved specimens or are only known by a very restricted material (sometimes only one specimen is

available). Had these species not been given a name, the present writer would have left them in open nomenclature.

Several species, which were erected on the basis of Belgian material, appear to be primary homonyms of anteriorly published ones. They are not renamed in this paper because they are considered as nomina dubia due to the limited material available, which is generally poorly preserved.

In an overview of the uppermost Famennian (Strunian)–Viséan invertebrate faunas from southern Belgium, Demanet (1958) introduced one new brachiopod genus (*Orbiculoipora*, with no type species selected), several new species (*Chonetes (Semenewia) verbisti*, *Productus (Avonia) humilis*, *Productus (Pustula) tenuissimus*, *Derbya modavensis*, *Hustedia parva*, *Crurithyris sulcata* [non *C. sulcata* Stehli, 1954], *Spirifer fallax* [non *Sp. fallax* Giebel, 1858]) and one new variety (*Schizophoria resupinata* var. *transversalis*) in his faunal lists. These names were used later by Mortelmans (1969, 1973).



Nevertheless, as noted by Mottequin & Sevastopulo (2009) and Mottequin & Simon (2017a) for *Crurithyris sulcata* Demanet, 1958, they have to be considered as nomina nuda, according to the article 13 of the International Code of Zoological Nomenclature (1999), as Demanet (1958) failed to provide a description or a definition of his new genus, species and variety.

Two productidine species described by de Koninck (1847) are discussed below as one of them (*Productus dissimilis*) was overlooked by Mottequin (2019) whereas the second (*P. murchisonianus*) was based originally on material from Western Europe (e.g., Belgium, Germany) and Australia (Tasmania).

## 6.2. Upper Devonian and Carboniferous brachiopods

### 6.2.1. Orders Lingulida and Craniida/Remarks

Representatives of the orders Lingulida and Craniida have always been the poor relations of the studies on Devonian and Carboniferous brachiopods from southern Belgium, notably due to their scarcity in most of the lithostratigraphic units. Demanet's (1934) monograph should be thus considered as an exception as he described and photographically illustrated or discussed several lingulides and craniides, including some of those erected by de Koninck (1843 in 1842–1844), de Ryckholt (1851), and J. Fraipont (1888a, 1888b), from the Tournaisian and Viséan succession of the Namur–Dinant Basin. Some of these species were recently illustrated by Mottequin & Simon (2017a, 2017b) and Mottequin et al. (2019), but they are still unrevised. The focus is put here on the type material of the lingulide species erected by J. Fraipont (1888a), Demanet (1934), Demanet (in Demanet & Van Straelen, 1938), and Grimm (1998). The re-illustration of Demanet's material should facilitate a future revision of the Mississippian and Pennsylvanian lingulides of Western Europe (see previous references in Mottequin et al., 2019 and herein), but this latter aspect is not tackled. Consequently, the Devonian and Carboniferous lingulide species from southern Belgium previously assigned to the 'catch-all' genus *Lingula* Bruguière, 1797 still need revised identifications to genera (requiring observations of the internal structures) and their validity is not discussed here. Demanet (1958) and Mortelmans (1969, 1973) provided information related to the stratigraphic distribution of the lingulides within the Tournaisian succession of the Tournai area, but the revision of these data is still outstanding (Mottequin & Simon, 2017a, 2017b).

De Ryckholt (1851, p. 17, 167, pl. 10, figs 21–23) erected the genus *Anomianella* (with *Anomianella proteus* as type species, by monotypy) based on material from the Tournaisian succession of Tournai (Fig. 1) and it was only three years later that he provided a description (de Ryckholt, 1854, p. 45–47). This genus was considered as a bivalve of the Family Anomiidae (Stoliczka 1870–1871; Vokes 1967, 1980) and was sporadically cited in the literature (e.g. Crosse, 1863; Rosenberg & Petit, 1987). Although it is currently only known by de Ryckholt's (1851) drawings because specimens identified as such have not yet been traced in de Ryckholt's collections, it is more plausible to consider *Anomianella* as a craniide brachiopod for several reasons (as already suggested by de Ryckholt, 1854, p. 46, footnote): (1) the specimens are fixed by their ventral valve on brachiopods and molluscs, and (2) they have the faculties to imitate the ornamentation of their host. Based on these data, the resemblances with *Petrocrania* Raymond, 1911 (Craniidae) are striking, and both genera might be closely related, if not identical. Furthermore, de Ryckholt (1854) indicated that *Anomianella* is represented by many species in the Devonian and the Carboniferous of Belgium. According to our knowledge of the Belgian material, only

craniides match with de Ryckholt's (1851, 1854) description and illustrations. Nonetheless, it is more reasonable to currently consider *Anomianella* as a nomen dubium pending further investigation, notably the revision of the Tournaisian craniides from Tournai (see recent illustrations in Mottequin & Simon, 2017a, fig. 12g–h, and 2017b, fig. 6).

### 6.2.2. Order Lingulida/Superfamily Linguloidea

***Lingula elongata*** Demanet (in Demanet & Van Straelen, 1938), non Hall, 1847  
(Fig. 6A–E)

1938 *Lingula elongata* Demanet in Demanet & Van Straelen, p. 117, pl. 107, figs 14–17.

1941 *Lingula elongata* Demanet; Demanet, p. 212–213, 294, 296, pl. 12, figs 5–8 (enlargement of Demanet in Demanet & Van Straelen, pl. 107, figs 14–17).

*Type material.* No lectotype is designated among the four syntypes (RBINS a6379–6382; undifferentiated valves; Fig. 6A–E) illustrated by Demanet (in Demanet & Van Straelen, 1938) and re-illustrated few years later by Demanet (1941).

*Provenance and horizon.* The syntypes are from Nalinnes 1, the Aiseau-Presles colliery and Montignies-le-Tilleul (Forte Taille colliery) (Fig. 1). According to Demanet (1941), this species is only known from the Andenne Formation (latest Serpukhovian to early Bashkirian; Namurian B–C of the traditional subdivision).

*Description.* See Demanet (in Demanet & Van Straelen, 1938) and Demanet (1941).

*Remarks.* As rightly indicated by Calver (in Lumsden et al., 1967) and Graham (1970), *Lingula elongata* Hall, 1847 (from the Upper Ordovician Trenton Group) and *L. elongata* Demanet, 1934 are primary homonyms (articles 53.3, 57.2 of the Code) (see also Graham's (1970) discussion related to Tate's intention of naming *L. elongata* some specimens from the Lower Carboniferous of Northumberland that were briefly discussed in Davidson, 1860). Considering the poor preservation of the illustrated syntypes and their different origins, it is currently more reasonable to opt for the status quo pending the revision of the lingulides from the Belgian Coal Measure Group and to not propose a new name to solve the homonymy with Hall's species. Note that specimens identified as *L. elongata* were figured by Van Leckwyck et al. (1951) and Deleers & Pastiels (1952).

*Current name.* '*Lingula*' *elongata* Demanet (in Demanet & Van Straelen, 1938), non Hall, 1847.

***Lingula maillieuxi*** Grimm, 1998  
(Fig. 6F–G)

1940a *Lingula* n. sp. Maillieux, p. 8.

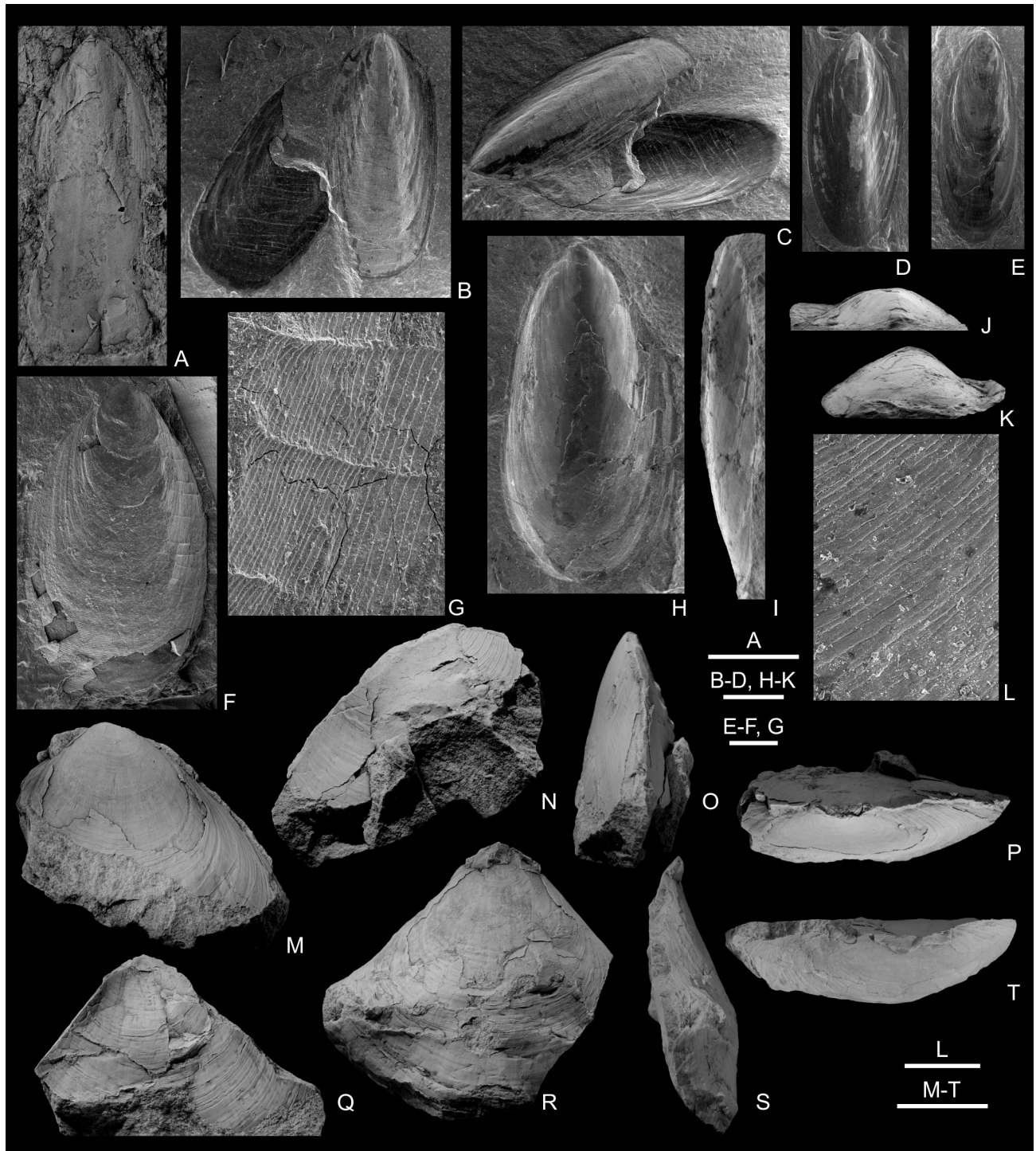
1998 *Lingula maillieuxi* Grimm, p. 75–76, 82, pl. 1, fig. 4.

*Type material.* The holotype (a ventral valve (?); RBINS 1705) selected by Grimm (1998, pl. 1, fig. 4) is the only specimen available (Fig. 6F–G).

*Type locality and horizon.* Couvin 40a (Figs 1–2), Nismes Formation (La Prée Member) (early Frasnian).

*Description.* See Grimm (1998).

*Remarks.* The anterior part of the holotype was not illustrated by Grimm (1998) and details of the ornamentation are provided here for the first time (Fig. 6G). Lingulides from the Upper Devonian of southern Belgium have received scant attention until so far (see Mottequin, 2019), although they are abundant in some poorly oxygenated, argillaceous



**Figure 6.** A-E. *Lingula elongata* Demanet (in Demanet & Van Straelen, 1938), non Hall, 1847 [*'Lingula' elongata* Demanet (in Demanet & Van Straelen, 1938), non Hall, 1847]; syntypes. A. RBINS a6379, undifferentiated valve in plan view; Nalinnes 1, Andenne Formation (?) (Namurian?). B-C. RBINS a6380, articulated specimen in plan and oblique lateral views (SEM); Montignies-le-Tilleul, Forte Taille colliery (Espinoy shaft), Andenne Formation (Namurian). D. RBINS a6381, undifferentiated valve (SEM), Aiseau-Presles colliery (Panama shaft, Roselies), stage 560 m above the Gouffre fault, 125 m south of the shaft, Andenne Formation (Namurian). E. RBINS a6382, undifferentiated valve (SEM); same provenance and age than RBINS a6380. F-G. *Lingula maillieuxi* Grimm, 1998 [*'Lingula' maillieuxi* Grimm, 1998], RBINS a1705 (holotype), ventral valve (?) in plan view and detail (SEM); Couvin 40a, Nismes Formation, La Prée Member (early Frasnian). H-L. *Lingula straeleni* Demanet, 1934 [*'Lingula' straeleni* Demanet, 1934], RBINS a5802 (lectotype), undifferentiated valve in plan, lateral, posterior and anterior views, and close-up of the ornamentation (SEM); Tournai area, Tournaisian (precise origin and lithostratigraphic unit unknown). M-T. *Trigonoglossa tornacensis* Demanet, 1934; Antoin 3, Tournai Formation (Tournaisian). M-P. RBINS a5806 (lectotype), incomplete articulated specimen in ventral, dorsal, lateral and posterior views. Q-T. RBINS a5807 (paralectotype), incomplete articulated specimen in dorsal, ventral, lateral and posterior views. Scale bars: 5 mm (A), 2 mm (B-D, H-K), 1 mm (E-F), 100 µm (G), 200 µm (L), 10 mm (M-T).

environments, notably within the upper Frasnian Matagne Formation (e.g., Mottequin & Poty, 2016) in which Grimm (1998) recognized representatives of the genus *Dignomia* Hall, 1871.

*Current name.* ‘*Lingula*’ *maillieuxi* Grimm, 1998.

***Lingula straeleni*** Demanet, 1934  
(Fig. 6H-L)

1934 *Lingula straeleni* Demanet, p. 14-15, 104, pl. 1, figs 4-5, text-fig. 1.

2019 ‘*Lingularia*’ *straeleni* (Demanet, 1934); Mottequin et al., p.10, fig. 6.7-22.

*Type material.* Mottequin et al. (2019) selected the lectotype (RBINS a5802 (Fig. 6H-L); Demanet, 1934, pl. 1, fig. 5; Mottequin et al., 2019, fig. 6.14-17) among the specimens considered by Demanet (1934) as paratypes. The specimens RBINS a5801 (Demanet, 1934, pl. 1, fig. 4; Mottequin et al., 2019, fig. 6.7-13) and RBINS a5803 (Demanet, 1934, text-fig. 1; Mottequin et al., 2019, fig. 6.18-22) are paralectotypes.

*Type locality and horizon.* Tournai area, ‘Assise de Celles’ (Tournaisian) (Demanet, 1934) (see Mottequin et al.’s (2019) discussion concerning the type horizon) (Figs 1-2).

*Description.* See Demanet (1934).

*Remarks.* See Mottequin et al.’s (2019) discussion.

*Current name.* ‘*Lingula*’ *straeleni* (Demanet, 1934).

***Trigonoglossa tornacensis*** Demanet, 1934  
(Fig. 6M-T)

1934 *Trigonoglossa tornacensis* Demanet, p. 19-20, 104, pl. 1, figs 8-9.

*Types.* The articulated but crushed specimens RBINS a5806 (Demanet, 1934, pl. 1, fig. 8) and RBINS a5807 (Demanet, 1934, pl. 1, fig. 9) were considered as paratypes by Demanet (1934), who did not select a holotype. The specimen RBINS a5806 (Fig. 6M-P) is hereby designated as the lectotype. The specimen RBINS a5807 (Fig. 6Q-T) is thus a paralectotype.

*Type locality and horizon.* Antoing 3 (= La Chapelle quarry in Demanet, 1958), ‘Assise de Celles’ (Demanet, 1934) (Figs 1-2). According to Mortelmans (1969), the species would be only known from the Tournai Formation (upper part of the Allain Member; Tournaisian, Ivorian).

*Description.* See Demanet (1934).

*Remarks.* According to Winkler Prins & Amler (2006), *Trigonoglossa tornacensis* is probably a synonym of *T. scotica* (Davidson, 1860) from the Viséan–Serpukhovian of Scotland (Graham, 1970). The poor state of preservation of Demanet’s (1934) material precludes at this stage to confirm (or otherwise) this opinion, although both specimens available seem to be more developed in width.

*Current name.* *Trigonoglossa tornacensis* Demanet, 1934.

### 6.2.3. Order Lingulida/Superfamily Discinoidea

***Orbiculoidea ingens*** Demanet (in Demanet & Van Straelen, 1938)  
(Fig. 7A-C)

1938 *Orbiculoidea ingens* Demanet (in Demanet & Van Straelen), p. 118, pl. 107, figs 18-19.

1941 *Orbiculoidea ingens* Demanet: Demanet, p. 214, pl. 12, figs 13-14 (enlargement of Demanet in Demanet & Van Straelen, 1938, pl. 107, figs 18-19).

*Type material.* The dorsal valve RBINS a6384 (Demanet in Demanet & Van Straelen, 1938, pl. 107, fig. 19; Demanet, 1941, pl. 12, fig. 13) is hereby designated as the lectotype (Fig. 7A) whereas the second dorsal valve RBINS a6383 (Demanet in Demanet & Van Straelen, 1938, pl. 107, fig. 18; Demanet, 1941, pl. 12, fig. 14) is a paralectotype (Fig. 7B-C).

*Type locality and horizon.* Montignies-le-Tilleul (Fig. 1), Forte-Taille colliery, Espinoy shaft (see Demanet, 1941 for more details), upper part of the Andenne Formation (Bashkirian, Namurian C of the traditional subdivision).

*Description.* See Demanet (in Demanet & Van Straelen, 1938), Demanet (1941).

*Remarks.* The type material is poorly preserved and crushed, thus unsuitable for species description. According to the data provided by Demanet (1941), this species is recognized in Belgium within the Andenne Formation (latest Serpukhovian to early Bashkirian; Namurian A–C of the traditional subdivision). The species was reported in Germany (e.g., Schwarzbach & Reichelt, 1940) and in Poland (Korejwo & Teller, 1968), and doubtfully in the Netherlands (Dorsman, 1945).

*Current name.* *Orbiculoidea ingens* Demanet (in Demanet & Van Straelen, 1938).

***Discina (Orbiculoidea) multistriata*** J. Fraipont, 1888a  
(Fig. 7D-F)

1875 *Discinia* [sic] *nitida* ? Phillips; Dewalque, p. 119.

1888a *Discina (Orbiculoidea)* [sic] *multistriata* J. Fraipont, p. 162-164, unnumbered figures.

1934 *Orb.* [= *Orbiculoidea*] *multistriata*; Demanet, p. 25.

*Type material.* The incomplete, crushed dorsal valve (and its external mould) (ULg.PA.2020.07.13/1; Fig. 7D-F) illustrated by J. Fraipont (1888a, unnumbered and embellished figures) is hereby designated as the holotype by monotypy.

*Type locality and horizon.* Vierset (Royseux section; Fig. 1), Comblain-au-Pont Formation (latest Famennian, Strunian).

*Description.* See J. Fraipont (1888a), who interpreted the holotype as a ventral valve. He mentioned that a fusiform slit was developed in an infundibuliform excavation (i.e. the apical region), from the centre towards the posterior margin, and that two small circular muscular impressions were developed on both sides of this slit. A careful examination indicates that all these features are the results of deficient preservation.

*Remarks.* Although this species was overlooked by Mottequin (2019), it is the only discinid described from the uppermost Famennian (Strunian) of the Namur–Dinant Basin and should be thus added to Mottequin & Brice’s (2016) review of Strunian brachiopods from this area. Note that Dehée (1929) did not report discinids in the contemporaneous succession of the Avesnois (northern France), but Mortelmans (1969) reported the occurrence of representatives of the genus *Orbiculoidea* d’Orbigny, 1847 within the Etrœungt Formation (Tournai area). Nevertheless, J. Fraipont’s species remains inadequately known (see also remarks related to *Orbiculoidea portlockiana* Demanet, 1934).

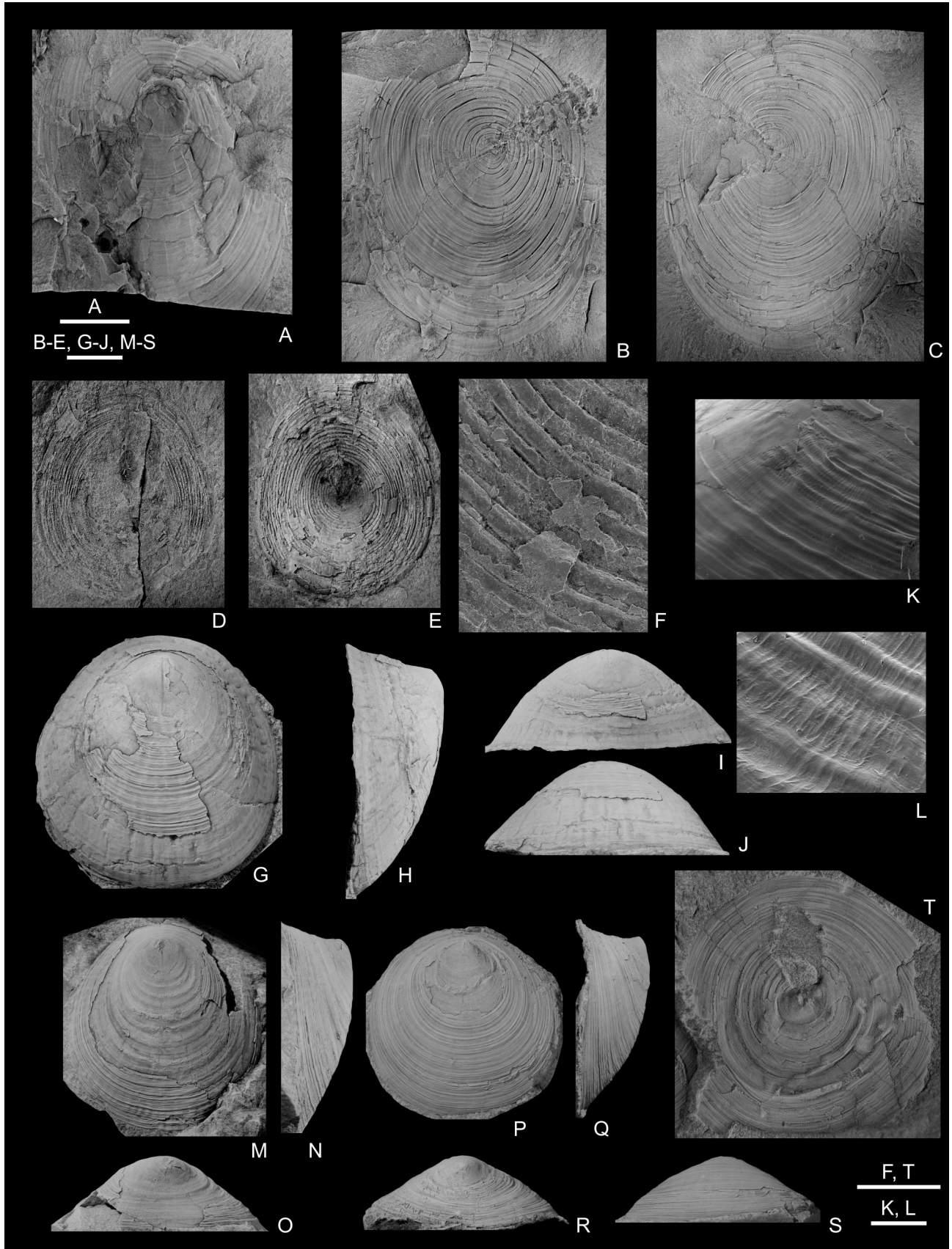
*Current name.* *Orbiculoidea multistriata* (J. Fraipont, 1888a).

***Orbiculoidea portlockiana*** Demanet, 1934  
(Figs 7G-T, 8A-C)

1934 *Orbiculoidea portlockiana* Demanet, p. 24-26, 104, pl. 1, figs 14-17, text-fig. 6.

*Type material.* Demanet (1934) illustrated four specimens





**Figure 7.** A-C. *Orbiculoidea ingens* Demanet (in Demanet & Van Straelen, 1938); Montignies-le-Tilleul, Forte-Taille colliery, Espinoy shaft, upper part of the Andenne Formation (Bashkirian, Namurian C of the traditional subdivision). A. RBINS a6384 (lectotype), crushed dorsal valve. B-C. RBINS a6383 (paralectotype), flattened dorsal valve and external mould. D-F. *Discina (Orbiculoidea) multistriata* J. Fraipont, 1888a [*Orbiculoidea multistriata* (J. Fraipont, 1888a)], ULg.PA. 2020.07.13/1 (holotype by monotypy), incomplete, crushed dorsal valve and external mould; Vierset (Roysel section), Comblain-au-Pont Formation (latest Famennian, Strunian). G-T. *Orbiculoidea portlockiana* Demanet, 1934; Tournai area, 'Assise de Celles' (Toumaisan). G-L. RBINS a5814 (lectotype), dorsal valve in plan, lateral, posterior and anterior views, and detail (SEM) of the radial striae developed on inner shell layers. M-O. RBINS a5815 (paralectotype), incomplete dorsal valve in plan, lateral and posterior views. P-S. RBINS a5817 (paralectotype), dorsal valve in plan, lateral, posterior and anterior views. T. RBINS a5816 (paralectotype), external mould of a ventral valve. Scale bars: 5 mm (A, B-E, G-J, M-S, T), 1 mm (F, K), 250 µm (L).

(three dorsal valves and one external ventral mould) that he considered as paratypes (without selecting a holotype): RBINS a5814 (pl. 1, fig. 14, text-fig. 6; Fig. 7G-L), RBINS a5815 (pl. 1, fig. 15, not text-fig. 6 as wrongly indicated; Fig. 7M-O), RBINS a5816 (pl. 1, fig. 16; Fig. 7T), and RBINS a5817 (pl. 1, fig. 17; Figs 7P-S, 8A-C). The specimen RBINS a5814 is hereby designated as the lectotype, the other specimens should be thus considered as paralectotypes.

*Type locality and horizon.* Tournai area, ‘Assise de Celles’ (Demagnet, 1934) (Figs 1-2). Mortelmans (1969) reported the species in the Tournai (Crampon (Hastarian or Ivorian)), Pont-à-Rieu, and Vaulx members (both latter are Ivorian in age) and in the Antoing (Warchin Member of Ivorian age) formations.

*Description.* See Demagnet (1934). Not all fila are continuously traceable, and they sometimes form outwardly convex drapes (e.g., Fig. 7M). Detail of the radial arrays of pits observed on the surface of the dorsal valve, which are similar to those observed in *Orbiculoidea nitida* (Phillips, 1836) by Williams & Curry (1991), is provided in Fig. 8A-C. Demagnet (1934, text-fig. 6) illustrated the thin radial striae observed on the lectotype (Fig. 7K-L) and extrapolated their presence on the whole shell. However, they are only developed on the inner shell layers.

*Remarks.* Demagnet (1934) considered *Orbiculoidea multistriata* (J. Fraipont, 1888a) (see above) as a doubtful synonym (!) of *O. portlockiana*, but the deplorable state of knowledge concerning J. Fraipont’s species precludes further discussion. Graham (1972) considered *O. portlockiana* as a junior synonym of *O. cincta* (Portlock, 1843) from the upper Viséan of Benburb in Co. Tyrone (Northern Ireland) (Mitchell & Mitchell, 1982). This author selected a lectotype for Portlock’s species but noted that it was not traced. To our knowledge, there is no recent illustration of topotypes of *O. cincta*, but comparison with Portlock’s (1843) drawings shows that the dorsal apex is clearly more posteriorly located in *O. portlockiana* than in the North Irish species. Note also that Řehoř & Řehořová (1972) erected a subspecies (*Orbiculoidea portlockiana namuriana*) based on material from the former Czech Republic.

*Current name.* *Orbiculoidea portlockiana* Demagnet, 1934.

***Orbiculoidea tornacensis*** Demagnet, 1934  
(Fig. 8D-H)

1934 *Orbiculoidea tornacensis* Demagnet, p. 26-27, 104, pl. 1, fig. 18, text-fig. 7.

*Type material.* The dorsal valve RBINS a5818 (Fig. 8D-H) was selected as the holotype by Demagnet (1934, pl. 1, fig. 18, text-fig. 7).

*Type locality and horizon.* Antoing 3 (= La Chapelle quarry in Demagnet, 1958), ‘Assise de Celles’ (Tournaisian) (Demagnet, 1934) (Figs 1-2). Mortelmans (1969) reported the species in the Orient (?) (Hastarian), Tournai (Crampon (Hastarian or Ivorian), Allain, Pont-à-Rieu, and Vaulx members (the latter three are Ivorian in age)) and in the Antoing (Warchin Member of Ivorian age) formations.

*Description.* See Demagnet (1934).

*Remarks.* Although Graham (1972) considered *Orbiculoidea tornacensis* as a junior synonym of *O. cincta* (Portlock, 1843), the remark already expressed for *O. portlockiana* (see above) is still valid in this case but it is only based on the holotype of the species *tornacensis*. Further material is obviously needed for an accurate comparison. *Orbiculoidea tornacensis* was reported on several occasions in the Lower Carboniferous of Poland (Holy Cross Mountains,

Pomerania) (e.g., Kicuła & Żakowa, 1966; Korejwo, 1979; Żakowa & Chlebowski, 1984) and these records should be revised in the future.

*Current name.* *Orbiculoidea tornacensis* Demagnet, 1934.

***Roemerella maillieuxi*** Demagnet, 1934  
(Fig. 8I-Q)

1934 *Roemerella maillieuxi* Demagnet, p. 27-28, 104, pl. 1, figs 19, 19a, text-figs 8, 8a, 8b.

*Type material.* The incomplete, articulated specimen RBINS a5819 (Demagnet, 1934, pl. 1, fig. 19-19a, text-fig. 8, 8a-b; Fig. 8I-Q) was selected as the holotype by Demagnet (1934).

*Type locality and horizon.* Tournai area, ‘Assise de Celles’ (Demagnet, 1934) (Figs 1-2). No more information was provided by Demagnet (1958) and Mortelmans (1969).

*Description.* See Demagnet (1934). Pitted microornament homogeneously developed was observed on the ventral valve of the holotype (Fig. 8P-Q).

*Remarks.* Mottequin’s (2019) comment made for the Devonian species *Roemerella forrierensis* Maillieux, 1932 is valid concerning the generic assignment of Demagnet’s species.

*Current name.* *Roemerella maillieuxi* Demagnet, 1934.

#### 6.2.4. Order Productida/Suborder Chonetidina

***Chonetes parva*** Ch. Fraipont, 1908, non Shumard, 1855  
(Fig. 9A-B)

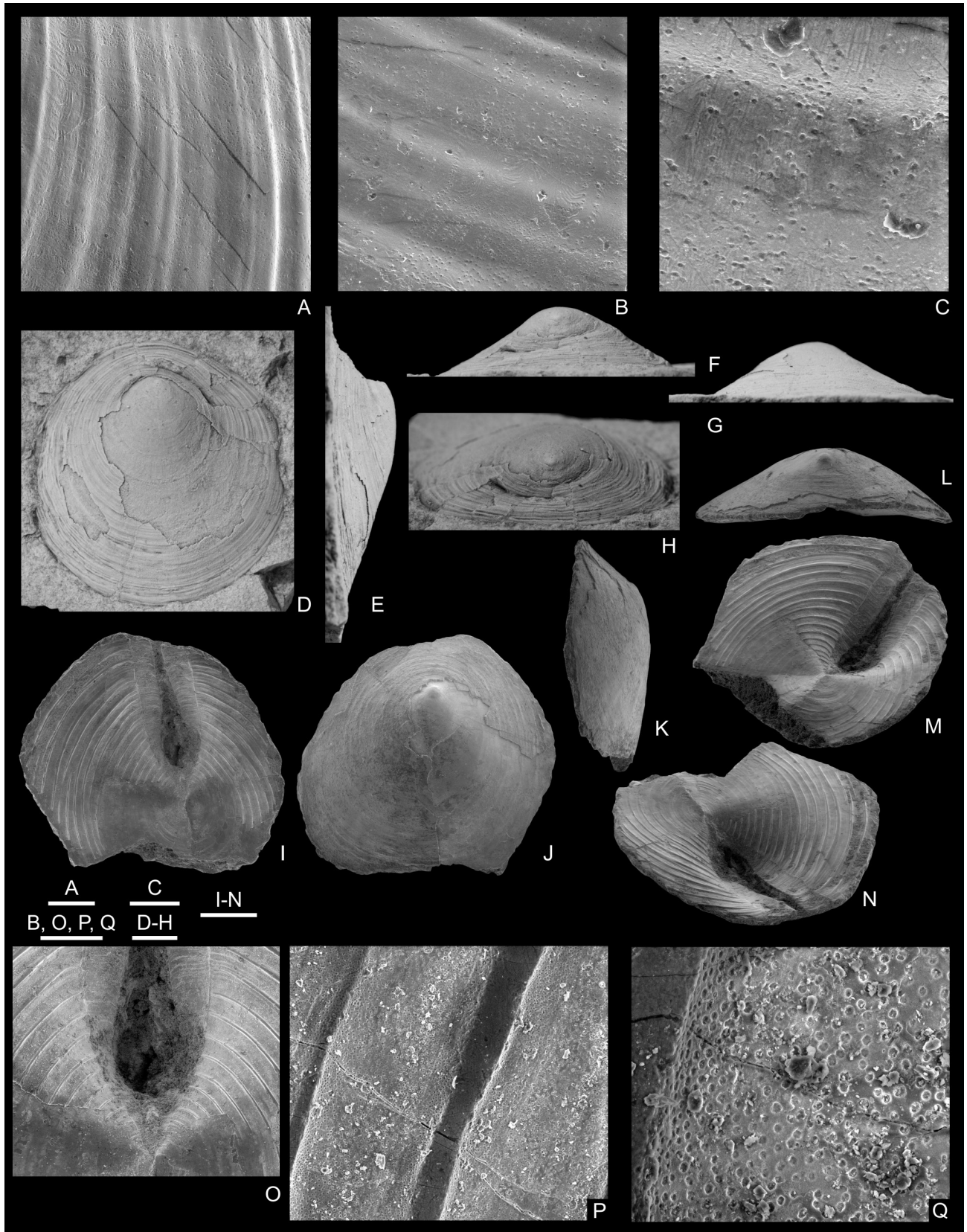
1908 *Chonetes parva* Ch. Fraipont, p. M10-M11, pl. 4, fig. 2a-b.

*Type material.* The external mould of a minute dorsal valve (ULg.PA. 2020.07.13/2) with some shelly fragments illustrated by Ch. Fraipont (1908) is hereby designated as the lectotype (Fig. 9A-B).

*Type locality and horizon.* Flavion (Fig. 1); according to Ch. Fraipont (1908), this species is known from the ‘Waulsortien’, which corresponded in those days to the Waulsortian facies (Tournaisian). The matrix is a dark limestone (mudstone) that could be from the Leffe Formation (Tournaisian, Ivorian) or even from the Molignée Formation (Viséan, Moliniacian) (Fig. 2).

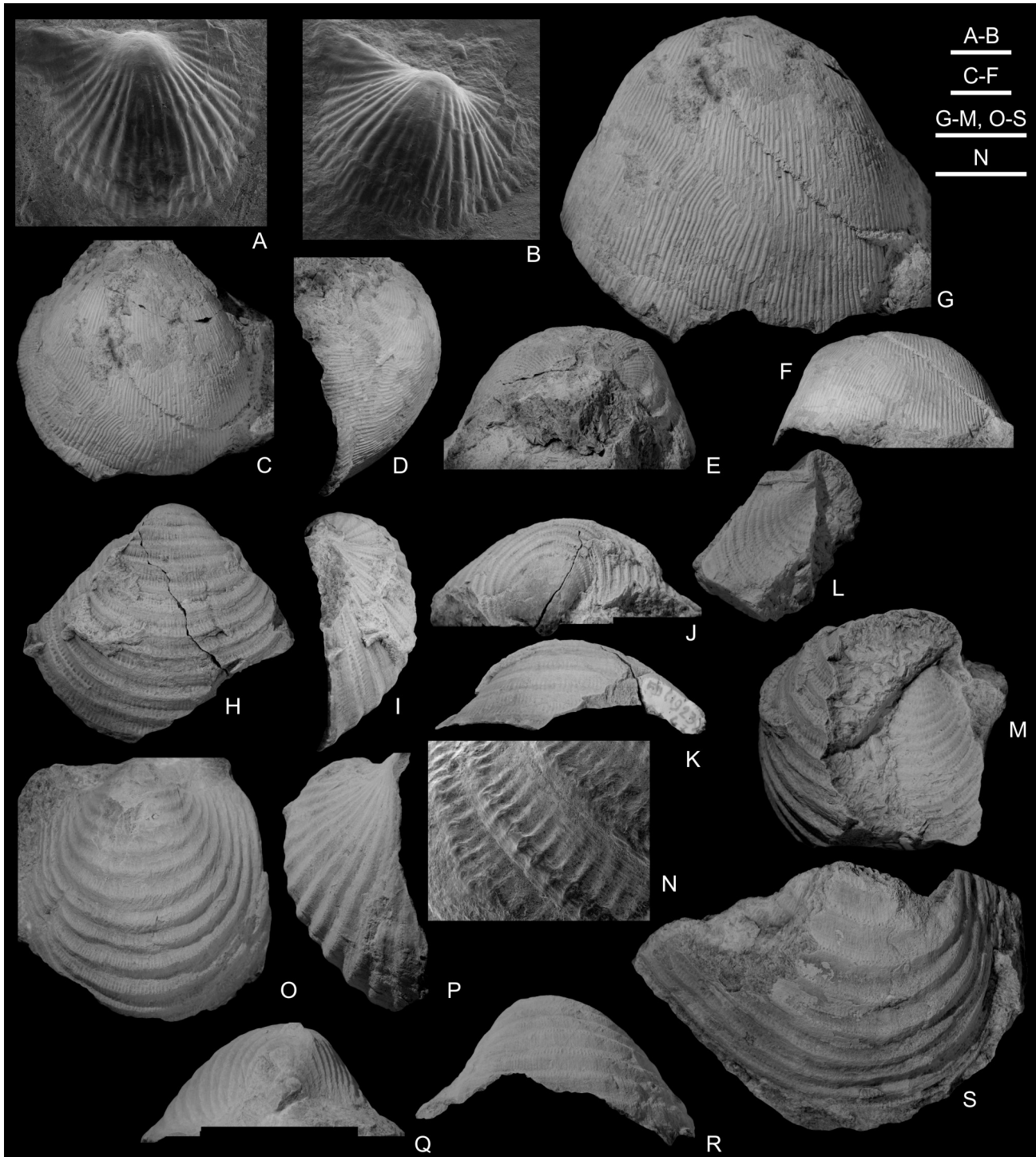
*Description.* See Ch. Fraipont (1908).

*Remarks.* *Chonetes parva* Shumard, 1855 from the Coal Measures of Boone County (USA, Missouri) and *Chonetes parva* Ch. Fraipont, 1908 are primary homonyms (Articles 53.3, 57.2 of the Code). Shumard’s species was not illustrated in the original publication and was considered as a synonym of *Chonetes flemingi* Norwood & Pratten (1854)—the type species of *Chonetinella* Ramsbottom, 1952—by Keyes (1894). Although the part 1 of the volume 3 (second series) of the Journal of the Academy of Natural Sciences of Philadelphia, which includes the description of *C. flemingi*, was released in May, 1855, extra copies were printed for the authors in August, 1854; thus, following the Article 21.8 of the Code, 1854 is the year of publication. Shumard’s species was published at the end of the year 1855 according to Shumard’s report dated November, 1855. According to the Article 57.2, the junior name, i.e. *Chonetes parva* Ch. Fraipont, 1908, is permanently invalid and should be renamed but, due to the lack of additional specimens, no new name is currently proposed pending the thorough study of the Tournaisian–Viséan chonetidines from southern Belgium, which is well beyond the scope of this paper. Delépine (1928), who studied the brachiopod fauna from the Molignée Formation, did not report this species. From the



**Figure 8.** A-C. *Orbiculoidea portlockiana* Demanet, 1934, RBINS a5817 (paralectotype), dorsal valve (see Fig. 7P-S), detail of pitted microornament close to the anterior margin (all SEM); Tournai area, 'Assise de Celles' (Tournaisian). D-H. *Orbiculoidea tornacensis* Demanet, 1934, RBINS a5818 (holotype), dorsal valve in plan, lateral, posterior, anterior, and inclined posterior views; Antoing 3, 'Assise de Celles' (Tournaisian). I-Q. *Roemerella maillieuxi* Demanet, 1934, RBINS a5819 (holotype), incomplete articulated specimen in ventral, dorsal, lateral, posterior, oblique ventral, and oblique posteroventral views, partial enlargement of the pedicle opening, and detail of pitted microornament on ventral valve (all SEM); Tournai area, 'Assise de Celles' (Tournaisian). Scale bars: 250  $\mu$ m (A), 200  $\mu$ m (B, P), 50  $\mu$ m (C, Q), 2 mm (D-H, I-N), 1 mm (O).





**Figure 9.** A-B. *Chonetes parva* Ch. Fraipont, 1908, non Shumard, 1855 [*'Chonetes' parvus* Ch. Fraipont, 1908, non Shumard, 1855], ULg.PA. 2020.07.13/2 (lectotype), dorsal external mould in plan and lateral oblique views (SEM); Flavion, Leffe Formation (Tournaisian, Ivorian) or Molinee Formation (Viséan, Moliniacian). C-G. *Productus corrugatus* var. *contortus* Demanet, 1923 [*Linoprotonia? contorta* (Demanet, 1923)], RBINS a11777 (lectotype), incomplete ventral valve in plan, lateral, posterior and anterior views, and detail of the ornamentation; Maredsous, Waulsort Formation (Tournaisian, Ivorian). H-S. *Productus fourmieri* Demanet, 1923 [*Scutepustula fourmieri* (Demanet, 1923)]; Maredsous, Waulsort Formation (Tournaisian, Ivorian). H-N. RBINS a11787, incomplete articulated specimen in ventral, lateral, posterior, anterior partial dorsal (a part is enclosed in matrix), and lateral oblique (showing the partial dorsal external mould) views, and detail of ornamentation (SEM). O-R. RBINS a11786, ventral valve in plan, lateral, posterior and anterior views. S. RBINS a11788, fragment of ventral valve in plan view. Scale bars: 1 mm (A-B), 10 mm (C-F, G-M, O-S), 2 mm (N).

generic viewpoint, the costate ornamentation with few intercalations and the presence of well-developed ears may suggest an assignment to *Plicochonetes* Paeckelmann, 1930.

*Current name.* *'Chonetes' parvus* Ch. Fraipont, 1908, non Shumard, 1855.

#### 6.2.5. Order Productida/Suborder Productidina

*Productus corrugatus* var. *contortus* Demanet, 1923  
(Fig. 9C-G)

1923 *Productus corrugatus* McCoy var. *contortus* Demanet,

p. 92, 94, 152-153, pl. 7, fig. 37, tables A-B.

*Type material.* The incomplete ventral valve (RBINS a11777) illustrated by Demanet (1923, pl. 7, fig. 37) is hereby designated as the lectotype (Fig. 9C-G).

*Type locality and horizon.* Maredsous (lime kiln quarry), Waulsort Formation (Tournaisian, Ivorian) (Figs 1-2).

*Description.* See Demanet (1923).

*Remarks.* According to Demanet (1923), the main external feature of his variety is the sinuous ornamentation that occurs per place as if the shell was broken and the pieces oriented obliquely to the general direction of the shell growth. This author considered this character as sufficient for allowing discrimination from *Producta corrugata* M'Coy, 1844, a species that Ferguson (1971, p. 554) thought to belong in his new genus *Linoprotonia*. The almost complete ventral valve registered NMING:F7186 (M'Coy, 1844, pl. 20, fig. 13 (reversed); Fig. 10A-C), from the Lower Carboniferous of Kiltullagh, Castlereagh, Co. Roscommon (Ireland), was considered as the type of the species by Delépine (1928, p. 26). According to the Article 74.6 of the Code, this citation as 'type de McCoy' acts as lectotype designation (it is impossible to be certain that it corresponds to the holotype by monotypy). The lectotype of M'Coy's species was figured by Delépine (1928, pl. 6, figs 67-67bis) and Legrand-Blain (2009, pl. 2, fig. 12), but its generic assignment remains uncertain as important characters such as the presence of spines near the hinge cannot be ascertained. The poor state of preservation of the lectotype of Demanet's (1923) variety precludes a valuable comparison with the species *corrugata*. Of course, its particular ornament is most probably the result of problems encountered during the growth, but it does not display the strong rugae observed in the latter species. Demanet's species is temporarily promoted to specific rank pending the revision of the West European *Linoprotonia* species, including the species discussed by Ferguson (1971) and Mottequin (2010), but it must be noted that the species *contorta* differs from the type species of *Linoprotonia* in shell shape (ill-versus well-developed ears, location of the maximum width). Therefore, Demanet's species is doubtfully assigned to *Linoprotonia*. It was reported in the Moline Formation (Viséan, Moliniacian) by Demanet (1923), but not mentioned in Delépine (1928), as well as in the Tournaisian of Tournai.

*Current name.* *Linoprotonia? contorta* (Demanet, 1923).

#### ***Productus dissimilis* de Koninck, 1847**

1847 *Productus dissimilis* de Koninck, p. 255-256, pl. 16, fig. 5a-c.

*Type material.* The single specimen illustrated by de Koninck (1847) has not been traced and may be considered as lost as it is not included in de Koninck's collection stored at the Muséum national d'Histoire naturelle, Paris (Gatinaud, 1946; Pacaud, 2015).

*Type locality and horizon.* According to de Koninck (1847), this species comes from the 'calcaire dévonien des environs de Chimay. Il y est très-rare', but its accurate age remains unknown as the Devonian limestones from the Chimay area are Eifelian to Frasnian in age (Marion & Barchy, 1999).

*Description.* See de Koninck (1847).

*Remarks.* *Productus dissimilis* de Koninck, 1847 (not *Productus dissimilis* Hall, 1858 from the Upper Devonian of Iowa; see discussion in Muir-Wood & Cooper, 1960) should be added to Mottequin's (2019) catalogue of Devonian species described in Belgium before 1950. This species is still incompletely known and was only cited occasionally in the Belgian and French literature. Murlon (1876, 1881), followed

by Gosselet (1888), doubtfully reported it from the Upper Famennian ('assises de Montfort et d'Evieux') of southern Belgium contrary to Maillieux (1933, 1941), who cited *Productus (Avonia) dissimilis* and *Pustula dissimilis* as occurring in the lower Famennian of this area, but specimens identified as such have not been traced in the RBINS collections. The species was reported from the Eifelian of Germany by Spriestersbach (1942) as *Productella dissimilis*, and assigned doubtfully to the genus *Helaspis* Imbrie, 1959 by May (1984, 2003). Nonetheless, it is currently impossible to discuss validly the generic assignment of this taxon further.

*Current name.* '*Productus*' *dissimilis* de Koninck, 1847.

#### ***Productus fournieri* Demanet, 1923**

(Fig. 9H-S)

1923 *Productus fournieri* Demanet, p. 92, 94, 158-159, pl. 7, figs 46-48, tables A-B.

*Type material.* The articulated specimen RBINS a11787 (Demanet, 1923, pl. 7, fig. 47) is hereby designated as the lectotype (Fig. 9H-N); the ventral valves RBINS a11786 (Fig. 9O-R) and a11788 (Fig. 9S) (Demanet, 1923, pl. 7, figs 46, 48) are paralectotypes.

*Type locality and horizon.* Maredsous (lime kiln quarry), Waulsort Formation (Tournaisian, Ivorian) (Figs 1-2).

*Description.* See Demanet (1923).

*Remarks.* Sarytcheva (in Sarytcheva et al., 1963) rightly included the species *fournieri* in her new genus *Scutepestula*, whose type species is from the Tournaisian of South Urals. Carter (1999) challenged this generic assignment, but re-examination of the Belgian species confirms the development of closely spaced rugae bearing well-differentiated bands of elongate spine bases (Fig. 9N). It is obvious that further specimens are needed to validly compare the species *Scutepestula fournieri* from those listed by Sarytcheva (in Sarytcheva et al., 1963) and Carter (1999).

*Current name.* *Scutepestula fournieri* (Demanet, 1923).

#### ***Productus maretolensis* Demanet, 1923**

(Fig. 11A-D)

1923 *Productus maretolensis* Demanet, p. 94, 145-146, pl. 7, fig. 45, tables A-B.

*Type material.* The distorted ventral valve RBINS a11785 (Demanet, 1923, pl. 7, fig. 45) is hereby designated as the lectotype (Fig. 11A-D).

*Type locality and horizon.* Maredsous (lime kiln quarry), Waulsort Formation (Tournaisian, Ivorian) (Figs 1-2).

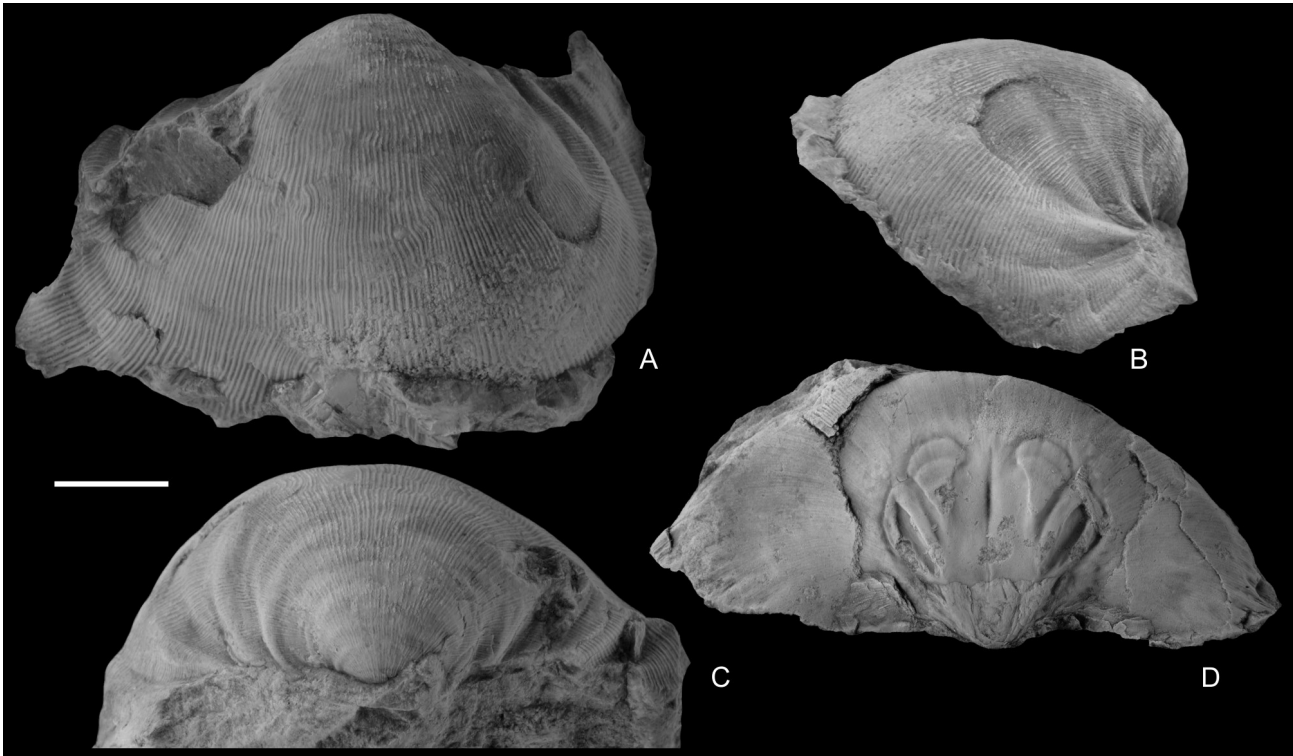
*Description.* See Demanet (1923).

*Remarks.* The large size, the shape and the ornamentation (few rugae and spines on visceral disk) suggest an assignment to *Tolmatchoffia* Fredericks, 1933 rather than to *Dictyoclostus* Muir-Wood, 1930. The lectotype displays two circular drill holes perpendicular to shell surface in the umbonal area (Fig. 11B-C) similar to those previously reported in Mississippian brachiopods from the Namur-Dinant Basin (Mottequin & Sevastopulo, 2009; Mottequin & Simon, 2017a, 2017b).

*Current name.* *Tolmatchoffia maretolensis* (Demanet, 1923).

#### ***Productus murchisonianus* de Koninck, 1847**

1847 *Productus murchisonianus* de Koninck, p. 245-249, pl. 16, fig. 3a-b (?), c, not fig. 3d-f.



**Figure 10.** A-C. *Producta corrugata* M'Coy, 1844; NMING:F7186 (lectotype), almost complete ventral valve in plan, lateral and posterior views; Kiltullagh, Castlereagh, Co. Roscommon (Ireland), Lower Carboniferous. D. *Orthis latissima* M'Coy, 1844 [*Schizophoria* (*S.*) *latissima* (M'Coy, 1844), probably a junior synonym of *S. (S.) resupinata resupinata* (Martin, 1809)], NMING:F7449 (lectotype), incomplete and crushed dorsal internal mould with some shelly remains; St. John's Point, Dunkineely, Co. Donegal (Ireland), probably Arundian. Scale bar: 10 mm for all.

*Type material.* De Koninck (1847) erected the species *Productus murchisonianus* based on material from Tasmania, Belgium, Germany, and France (see also de Koninck, 1877). According to Gatinaud (1946) and Pacaud (2015), only one of the Australian specimens (MNHN.F.R06377) illustrated by de Koninck (1847, pl. 16, fig. 3c) has been recovered from the collections of the Muséum national d'Histoire naturelle (Paris), but other unillustrated specimens from Western Europe are also available in this institution: Belgium (Chaufontaine (MNHN.F.R50559; Famennian?), Chimay (MNHN.F.R50557; Frasnian?, it seems to be related to *Caucasiproductus?* sp. indet. sensu Mottequin, 2008b) and Germany (Gerolstein (MNHN.F.R50556), Paffrath (MNHN.F.R50558)). It is obvious that de Koninck's (1847) species encompasses several taxa of different ages and should be restricted to the single illustrated specimen still available (MNHN.F.R06377; an articulated internal mould), which is hereby designated as the lectotype following the Recommendation 74B of the Code (illustrations are available via the website of the Muséum national d'Histoire naturelle: <https://science.mnhn.fr/taxon/species/productus/murchisonianus>).

*Type locality and horizon.* The lectotype is devoid of detailed information related to its provenance and age. De Koninck (1847) simply indicated that it comes from the Devonian sandstone of Van Diemen's Land (the former name of Tasmania). Etheridge (1878) and Johnston (1888) indicated a Carboniferous age and, according to the latter author, it is from the Carboniferous Lower Marine Beds. Johnston (1887) also listed the species in his list of Upper Palaeozoic fossils from Tasmania. Nevertheless, this species could be younger (Permian) (see below).

*Description.* See de Koninck (1847).

*Remarks.* The lectotype displays strong similarities with representatives of the Permian strophalosiid genus *Wyndhamia*

Booker, 1929 (e.g., *Wyndhamia jukesii* (Etheridge, 1880); see Maxwell, 1954, and Clarke, 1969), but more specimens are required to reach a more confident generic identification. Moreover, *Productus murchisonianus* could be considered as a nomen oblitum.

*Current name.* '*Productus*' *murchisonianus* de Koninck, 1847.

#### *Productus plicatiliformis* Demanet, 1923

(Fig. 11E-H)

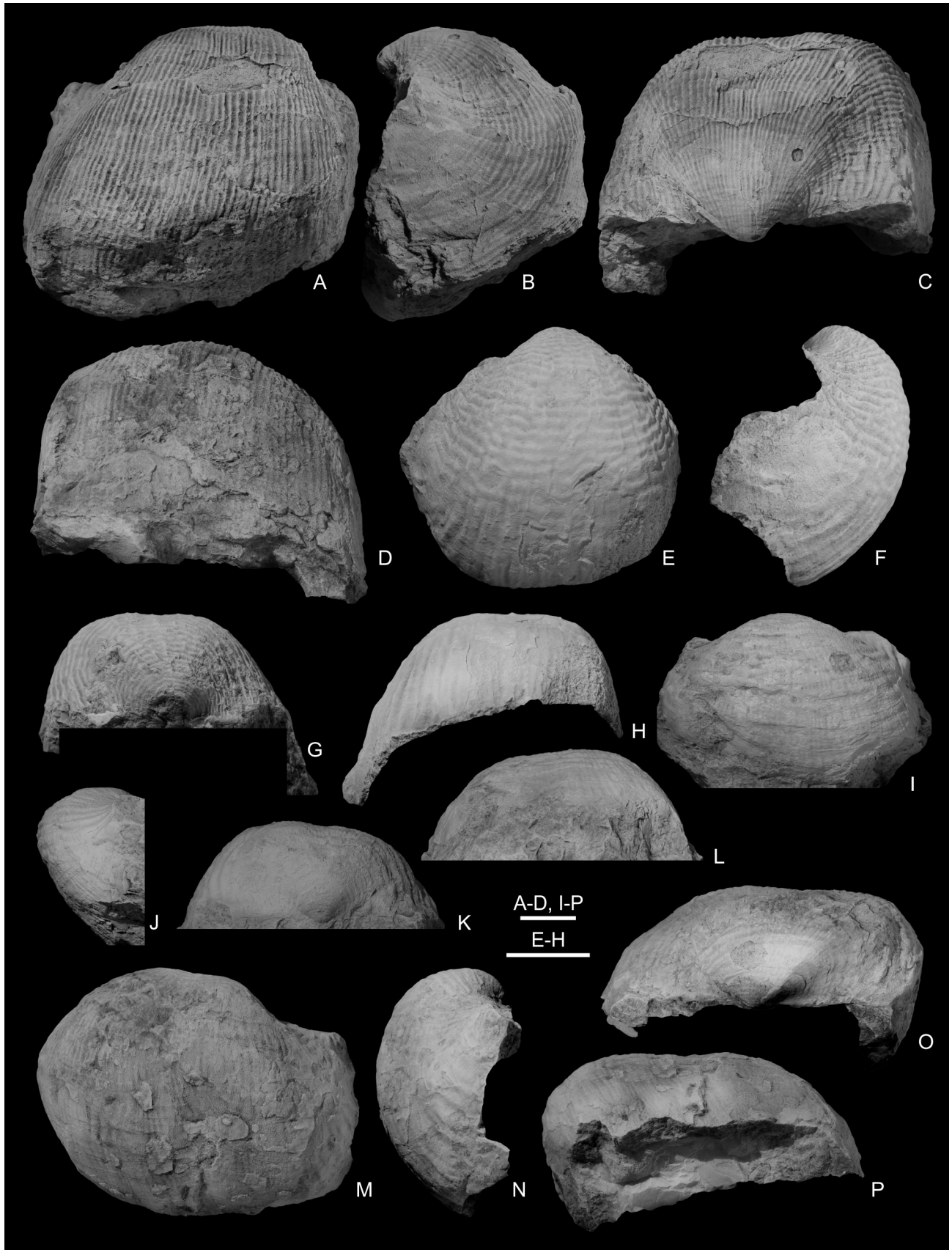
1923 *Productus plicatiliformis* Demanet, p. 94, 161, pl. 8, fig. 52, tables A-B.

*Type material.* The incomplete ventral valve (RBINS a11792) illustrated by Demanet (1923) is hereby designated as the lectotype (Fig. 11E-H).

*Type locality and horizon.* Maredsous (lime kiln quarry), Waulsort Formation (Tournaisian, Ivorian) (Figs 1-2).

*Description.* See Demanet (1923).

*Remarks.* The lectotype displays strong, irregular rugae in the umbonal region and on the venter, and some elongate spine bases in these regions; costae and growth lines are developed on the flanks and on the trail. There is a kind of discontinuous (poor preservation?) low, median costa arising in the umbonal area. At first sight, based on the strong rugae and shape, this specimen could remind externally juveniles of *Levitusia humerosa* (Sowerby, 1822 in 1821–1822) (see Brunton, 1979), which is common in the Avins Member (e.g., Demanet, 1958; Brunton, 1979; Hance et al., 2006b), but the development of ribbing in the anterior part of the shell, is not observed in the latter species. From the ornamentation viewpoint, the species *plicatiliformis* is close to the representatives of the genus *Seminucella* Carter, 1987, but is considerably larger and its flanks are not subparallel. It seems more advisable to



**Figure 11.** Productidines from Maredsous, Waulsort Formation (Tournaisian, Ivorian). A-D. *Productus maretioleis* Demanet, 1923 [*Tolmatchoffia maretioleis* (Demanet, 1923)], RBINS a11785 (lectotype), distorted ventral valve in plan, lateral, posterior and anterior views. E-H. *Productus plicatiliformis* Demanet, 1923 [*Kadraliproductus? plicatiliformis* (Demanet, 1923)], RBINS a11792 (lectotype), incomplete ventral valve in plan, lateral, posterior and anterior views. I-P. *Productus salei* Demanet, 1923 [*Dictyoclostus? salei* (Demanet, 1923)]. I-L. RBINS a11783 (paralectotype), distorted ventral valve in plan, lateral, posterior and anterior views. M-P. RBINS a11784 (lectotype), distorted and incomplete ventral valve in plan, lateral, posterior and anterior views. Scale bars: 10 mm for all.



temporarily assign this species to *Kadraliproductus* Galitskaya 1977 as it displays the same type of ornamentation, but less coarse, than that of *K. kadralensis* (Gladchenko, 1955) from the upper Tournaisian of Kirghizstan, even if the deficient preservation cannot permit to know accurately the longitudinal profile of the lectotype as *Kadraliproductus* is characterized by a strongly inflated, often geniculate ventral valve.

*Current name.* *Kadraliproductus? plicatiliformis* (Demagnet, 1923).

***Productus saleei* Demagnet, 1923**

(Fig. 11I-P)

1923 *Productus Saleei* Demagnet, p. 94, 157-158, pl. 7, figs 43-44, tables A-B.

*Type material.* The distorted ventral valve (an internal mould with shelly remains; RBINS a11784) illustrated by Demagnet (1923, pl. 7, fig. 44) is hereby designated as the lectotype (Fig. 11M-P); the deformed ventral valve (RBINS a11783; Demagnet, 1923, pl. 7, fig. 43) is a paralectotype (Fig. 11I-L).

*Type locality and horizon.* Maredsous (lime kiln quarry), Waulsort Formation (Tournaisian, Ivorian) (Figs 1-2).

*Description.* See Demagnet (1923).

*Remarks.* Both specimens available at hand are inadequately preserved. Their shell is finely and entirely costate and strongly rugate in the posterior part. Nalivkin (1979) assigned the species *saleei* to the genus *Fluctuaria* Muir-Wood & Cooper, 1960, but the Waulsortian material has nothing in common (e.g., absence of prominent rugae, outline not elongated) with its type species, i.e. *F. undata* (Defrance, 1826) from the Viséan (Warnantian) of Visé. The large size and the shape of the ventral valve (with development of sulcus) and the ornamentation suggest a provisional assignment to *Dictyoclostus* Muir-Wood, 1928.

*Current name.* *Dictyoclostus? saleei* (Demagnet, 1923).

***Productus semireticulatus* var. *minima* Demagnet, 1923**

(Fig. 12A-R)

1923 *Productus semireticulatus* var. *minima* Demagnet, p. 70, 144-145, pl. 6, fig. 32a-c, tables A-B.

*Type material.* Among the three syntypes available, of which two were previously illustrated, the specimen RBINS a11772 (Demagnet, 1923, pl. 6, fig. 32b-c) is hereby designated as the lectotype (Fig. 12G-L). The specimens RBINS a11771A (Demagnet, 1923, pl. 6, fig. 32a; Fig. 12A-F) and RBINS a11771B (Fig. 12M-R) are paralectotypes.

*Type locality and horizon.* Sosoye, Waulsort Formation or Longpré Formation (Avins Member) (Tournaisian, Ivorian) (Figs 1-2).

*Description.* See Demagnet (1923).

*Remarks.* According to Muir-Wood (1928), Demagnet's variety probably belongs to her *longispinus* group. Nevertheless, the type material does not reveal the presence of six symmetrically arranged spines as observed in representatives of the genus *Eomarginifera* Muir-Wood, 1930, and more particularly in its type species *E. longispina* (Sowerby, 1814 in 1812-1815). To our knowledge, it seems that Nalivkin (1948) was the first to promote this variety to a specific status; it was later assigned to the genus *Tomiproductus* Sarytcheva in Sarytcheva et al., 1963 by Nalivkin & Fotieva (1973) and Nalivkin (1979) on the basis of Uralian material identified as such (e.g., Kucheva, 2019). Nevertheless, until now, the generic affinities of Demagnet's species remain unclear due to the absence of data related to its internal morphology. Externally,

the less inflated ventral umbo, the less convex and reticulate disk and evident concentric rugae prevent an assignment to *Tomiproductus*, but these features make it closer to *Marginatia* Muir-Wood & Cooper, 1960.

*Current name.* *Marginatia? minima* (Demagnet, 1923).

***Productus soreili* Demagnet 1923**

(Fig. 12S-V)

1923 *Productus Soreili* Demagnet, p. 94, 136-137, pl. 5, fig. 20a-b, tables A-B.

*Type material.* The poorly preserved ventral valve (RBINS a11759) illustrated by Demagnet (1923, pl. 5, fig. 20a-b) is hereby designated as the lectotype (Fig. 12S-V) because he reported that the species is quite common in the type locality.

*Type locality and horizon.* Maredsous (lime kiln quarry), Waulsort Formation (Tournaisian, Ivorian) (Figs 1-2).

*Description.* See Demagnet (1923).

*Remarks.* The species was reported, but not illustrated, from Waulsortian facies of north-west County Limerick by Shephard-Thorn (1963), who assigned it to the genus *Pustula* Thomas, 1914. The presence of numerous low, irregular rugae and the few spines may suggest such an assignment.

*Current name.* *Pustula? soreili* (Demagnet, 1923).

**6.2.6. Order Orthotetida**

***Orthotetes crenistria* var. *maxima* Demagnet, 1923**

(Fig. 13A-C)

1923 *Orthotetes* [sic] *crenistria* var. *maxima* Demagnet, p. 94, 126, pl. 5, fig. 10, tables A-B.

*Type material.* The dorsal valve (RBINS a11749, Fig. 13A-C) illustrated by Demagnet (1923, pl. 5, fig. 10) is hereby designated as the holotype (by monotypy) as he clearly stated that only one specimen was available for study.

*Type locality and horizon.* Maredsous (lime kiln quarry), Waulsort Formation (Tournaisian, Ivorian) (Figs 1-2).

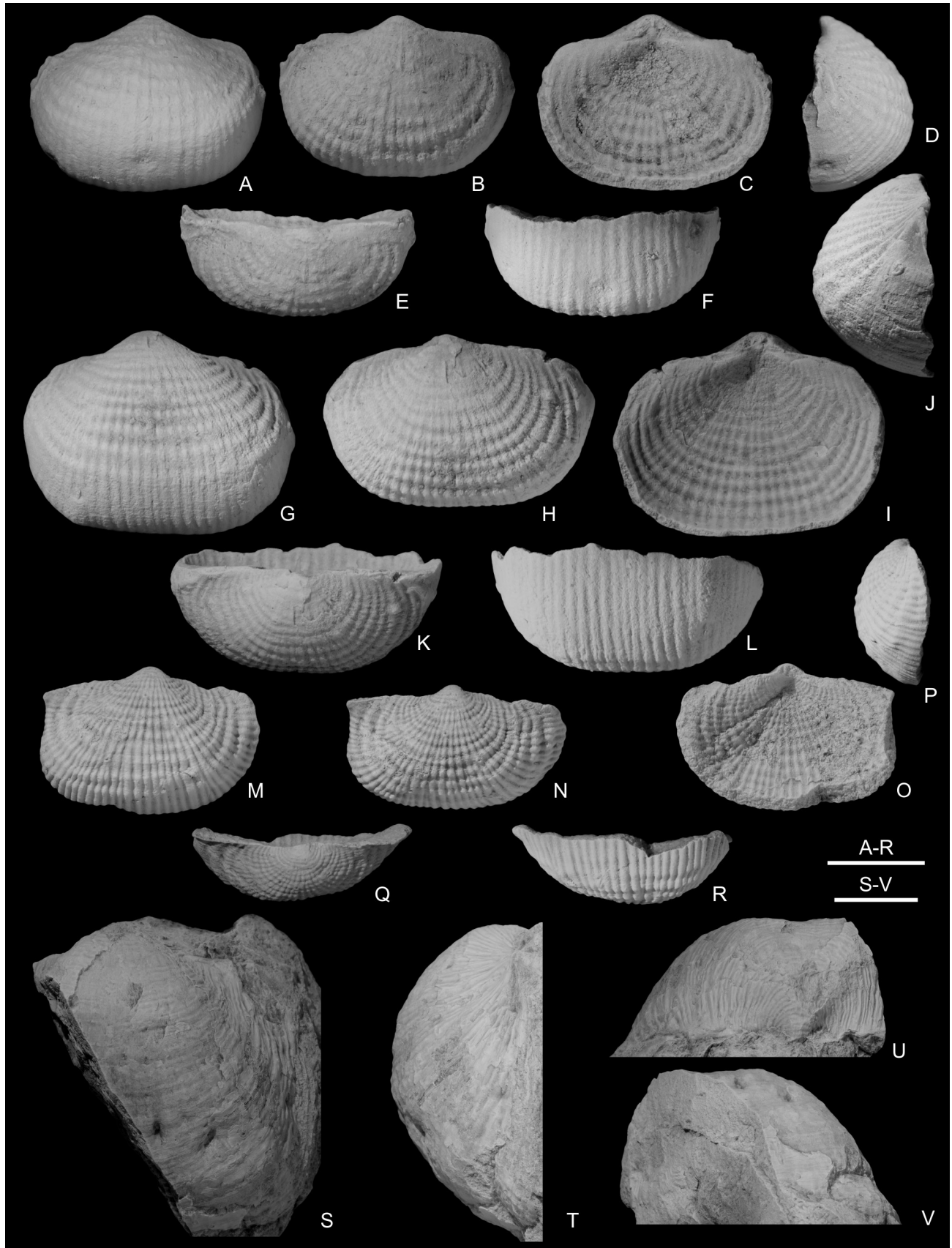
*Description.* See Demagnet (1923).

*Remarks.* Demagnet (1934) placed *Orthotetes crenistria maxima* in the synonymy of the poorly known species *Orthotetes fascifera* Tornquist, 1895 from the Viséan of the Rossberg Massif (France, southern Vosges), which was transferred to *Schuchertella* Girty, 1904 by Paeckelmann (1930) and himself. However, according to Tornquist (1895), the shell of his new species is very flat, which precludes such synonymy. Currently, based on the features observable on the holotype, Demagnet's (1923) species is assigned to *Schellwienella* Thomas, 1910 but readily cannot be considered as a subspecies of *S. crenistria* (Phillips, 1836) due to its more inflated dorsal valve. Furthermore, this *Schellwienella* displays a more transverse outline than that of *S. radialiformis* Demagnet, 1934 from the Tournaisian of the Tournai area (see Mottequin & Simon, 2017b).

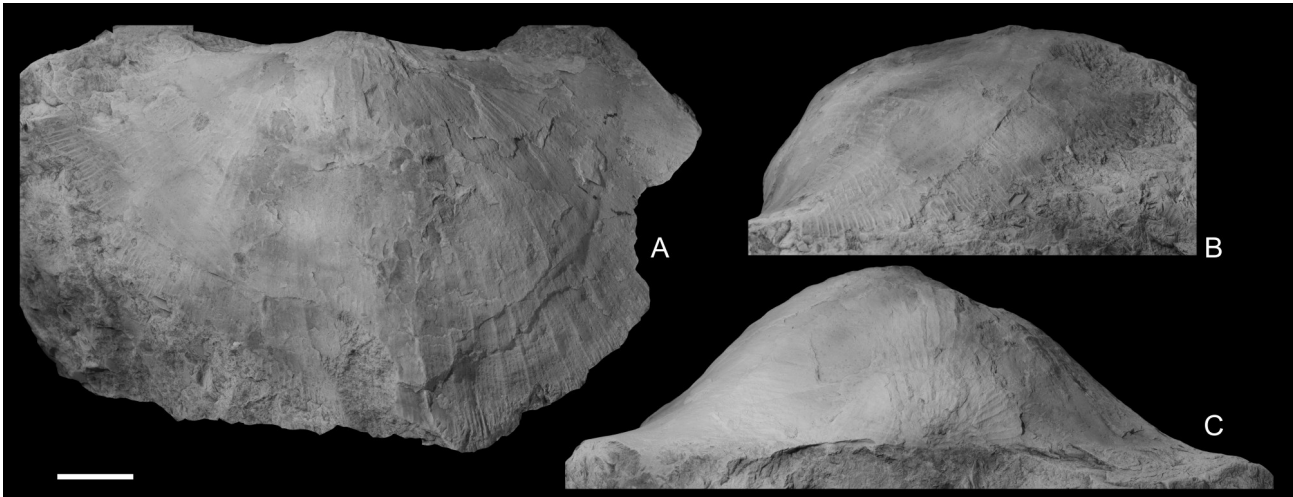
*Current name.* *Schellwienella maxima* (Demagnet, 1923).

**6.2.7. Order Orthida**

Dumont (1832), Davreux (1833) and de Koninck (1843, in 1842-1844) were the first to report the presence of schizophoriids in the Mississippian of southern Belgium. Six varieties of *Schizophoria* (*Schizophoria*) *resupinata* (Martin, 1809) were described by Demagnet (1923, 1934) on the basis of specimens from the Tournaisian and the Viséan of the Namur-Dinant Basin, namely the varieties (subspecies according to the Code,



**Figure 12.** A-R. *Productus semireticulatus* var. *minima* Demanet, 1923 [*Marginatia? minima* (Demanet, 1923)]; Sosoye, Waulsort Formation or Longpré Formation (Avins Member) (Tournaisian, Ivorian). A-F. RBINS a11771A (paralectotype), articulated specimen in ventral, posteroventral, dorsal, lateral, posterior and anterior views. G-L. RBINS a11772 (lectotype), articulated specimen in ventral, posteroventral, dorsal, lateral, posterior and anterior views. M-R. RBINS a11771B (paralectotype), articulated specimen in ventral, posteroventral, dorsal, lateral, posterior and anterior views. S-V. *Productus soreili* Demanet, 1923 [*Pustula? soreili* (Demanet, 1923)], RBINS a11759 (lectotype), incomplete ventral valve in plan, lateral, posterior and anterior views; Maredsous, Waulsort Formation (Tournaisian, Ivorian). Scale bars: 5 mm (A-R), 10 mm (S-V).



**Figure 13.** *Orthotetes crenistria* var. *maxima* Demanet, 1923 [*Schellwienella maxima* (Demanet, 1923)]; Maredsous, Waulsort Formation (Tournaisian, Ivorian). A-C. RBINS a11749 (holotype), ventral valve (RBINS a11749) in plan, lateral and posterior views. Scale bar: 10 mm for all.

see preliminary remarks above) *dorsosinuata*, *gigantea*, *lata*, *palliat*a, *pinguis*, and *rotundata* (Figs 2, 14). They were subsequently discussed notably by Bond (1941), Parkinson (1954), Pocock (1965, 1968), Brunton (1968), Lazarev (1976), Martínez Chacón (1979), and Żakowa (1989). Most of these varieties have been synonymized with *Schizophoria* (*S.*) *resupinata* (Martin, 1809) or other species, but some of them were considered as distinct subspecies although there is no consensus according to the literature data (see above). The complete investigation of the different *Schizophoria* lineages present in the Belgian Carboniferous succession is well beyond the scope of this paper as it requires, wherever it is possible, new field collections in order to detail the relationships between the shape of the shell and the environmental conditions (see also Parkinson, 1954, and Bassett & Bryant, 2006). As a first step in this direction, the illustrated type specimens figured by Demanet (1923, 1934) are fully illustrated here for the first time; to our knowledge, only one original specimen of *S.* (*S.*) *resupinata dorsosinuata* Demanet, 1934 was figured recently by Mottequin & Weyer (2019).

Besides Demanet's subspecies enumerated above, at least five species were recognized in the Mississippian succession of southern Belgium: *Schizophoria* (*S.*) *connivens* (Phillips, 1836), *S.* (*S.*) aff. *hudsoni* George, 1932 (George's species was considered as distinct of *S. connivens* by Pocock, 1965, but as a synonym of Phillips' species by Pocock, 1968), *S.* (*S.*) *resupinata resupinata*, *S.* (*Pocockia*) *gibbera* (Portlock, 1843), and *S.* (*Paraschizophoria*) *woodi* Bond, 1941 (see Demanet, 1923, 1934, 1941; Bond, 1941; Pocock 1965, 1968). In Belgium, the youngest occurrence of *Schizophoria*, which cannot be checked currently, could be Demanet's (1943) doubtful report of the genus within the Ransart Member of the Châtelet Formation (Bashkirian, Westphalian A according to the traditional subdivision). It is also necessary to cite here the species *Orthis Koninckii* (recte *konincki*) introduced by d'Orbigny (1849) for Devonian and Carboniferous schizophoriids illustrated by de Koninck (1843 in 1842–1844). It was briefly discussed by Pocock (1965), but it remains inadequately known.

The thorough revision of the Tournaisian and Viséan schizophoriids from Western Europe is long overdue and it should be a long-term work involving the revision of numerous types. Note that the neotype of the species *resupinata* was selected by George & Ponsford (1938, p. 228) and figured by Bond (1941, pl. 21, figs A-C), Parkinson (1954, fig. 1), Pocock (1965, pl. 3 [Carboniferous], fig. 7a-e), Wright (1965, fig.

210,5a-5b), and Brunton (1968, pl. 2, figs 1-3).

***Schizophoria resupinata* var. *dorsosinuata* Demanet, 1934**  
(Figs 14A, 15A-J)

1934 *Schizophoria resupinata* var. *dorsosinuata* Demanet, p. 53-54, 105, pl. 3, figs 14-15.

*Type material.* Both specimens illustrated by Demanet (1934) are hereby designated as lectotype (RBINS a5869, Figs 14A, 15A-E; Demanet, 1934, pl. 3, figs 14, 14a-14b; Mottequin & Weyer, 2019, fig. 18a-e) and paralectotype (RBINS a5870, Fig. 15F-J; Demanet, 1934, pl. 3, fig. 15, 15a-15b), respectively.

*Type locality and horizon.* Tournai area, 'Assise de Celles' (Demanet, 1934) (Figs 1-2). Mortelmans (1969) recorded the species in the Tournai Formation (Pont-à-Rieu Member of Ivorian age).

*Description.* See Demanet (1934), Brunton (1968), and Pocock (1968).

*Remarks.* According to Pocock (1968), Demanet's varieties (except *palliat*a) merely represent extreme individual variations. Nevertheless, such a statement should be reassessed in the future, based on the reinvestigation of the types of the different species and subspecies.

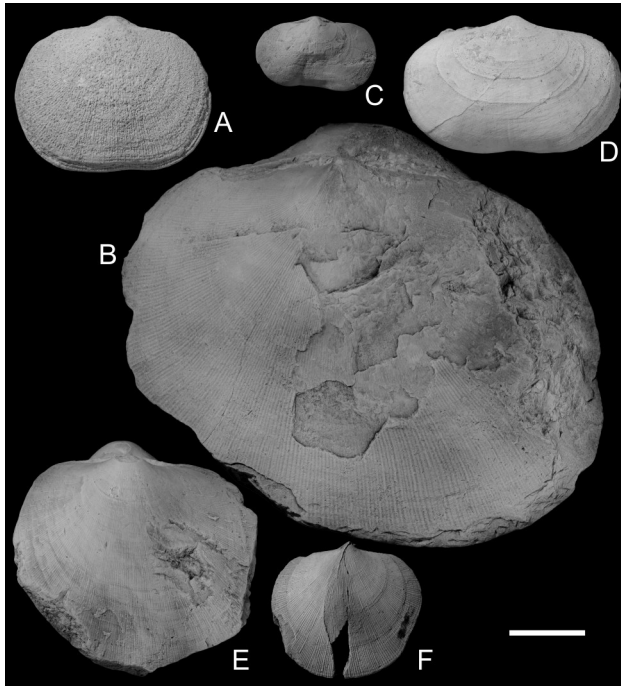
*Current name.* *Schizophoria* (*Schizophoria*) *resupinata dorsosinuata* Demanet, 1934.

***Schizophoria resupinata* var. *gigantea* Demanet, 1934**  
(Figs 14B, 15K-Q)

1934 *Schizophoria resupinata* var. *gigantea* Demanet, p. 60, 105, pl. 4, figs 12-13.

*Type material.* Both specimens illustrated by Demanet (1934) are hereby designated as lectotype (RBINS a5888, Figs 14B, 15K-O; Demanet, 1934, pl. 4, fig. 12) and paralectotype (RBINS a5889, Fig. 15P-Q; Demanet, 1934, pl. 4, fig. 13), respectively.

*Type locality and horizon.* Visé, Visé Formation (Viséan, Warnantian) (Figs 1-2). Note that four main facies composed of pale to grey limestones are distinguished among this lithostratigraphic unit (see Poty et al., 2002 for more details). Most of the macrofossils that contributed to the fame of the Viséan fauna from Visé (Mottequin & Poty, in press) were collected within buildups composed of massive algal and



**Figure 14.** Size comparison of the lectotypes of Demanet's (1923, 1934) varieties of *Schizophoria (Schizophoria) resupinata* (Martin, 1809); all are presented in ventral view. A. *Schizophoria resupinata* var. *dorsosinuata* Demanet, 1934 [*Schizophoria (Schizophoria) resupinata dorsosinuata* Demanet, 1934], RBINS a5869 (Fig. 15A-E); Tournai area, 'Assise de Celles' (Tournaisian). B. *Schizophoria resupinata* var. *gigantea* Demanet, 1934 [*Schizophoria (Schizophoria) resupinata gigantea* Demanet, 1934], RBINS a5888 (Fig. 15K-O); Visé, Visé Formation (Viséan, Warnantian). C. *Schizophoria resupinata* var. *lata* Demanet, 1923 [*Schizophoria (Schizophoria) resupinata lata* Demanet, 1923], RBINS a11743 (Fig. 15R-V); Sosoye, Waulsort Formation or Longpré Formation (Avins Member) (Tournaisian, Ivorian). D. *Schizophoria resupinata* var. *palliat*a Demanet, 1934 [*Schizophoria (Pocockia) linguata* (Quenstedt, 1871 in 1868–1871)], RBINS a5883 (Fig. 16A-D); Dréhance, Waulsort Formation (Tournaisian, Ivorian). E. *Schizophoria resupinata* var. *pinguis* Demanet, 1934 [*Schizophoria (Schizophoria) resupinata pinguis* Demanet, 1934], RBINS a5885 (Fig. 17F-J); Visé, Visé Formation (Viséan, Warnantian). F. *Schizophoria resupinata* var. *rotundata* Demanet, 1923 [*Schizophoria (Schizophoria) resupinata rotundata* Demanet, 1923], RBINS a11744 (Fig. 16I-M); Sosoye, Waulsort Formation or Longpré Formation (Avins Member) (Tournaisian, Ivorian). Scale bar: 10 mm for all.

bioclastic boundstones (Poty et al., 2002) belonging to the Mississippian Foraminifer Zone 14 (Poty et al., 2006). According to Aretz & Chevalier (2007), this particular lithofacies is close to the Cracoean facies of England (Mundy, 1994).

*Description.* See Demanet (1934), Pocock (1968).

*Remarks.* As for *Schizophoria resupinata* var. *dorsosinuata*.

*Current name.* *Schizophoria (Schizophoria) resupinata gigantea* Demanet, 1934.

***Schizophoria resupinata* var. *lata*** Demanet, 1923 (Figs 14C, 15R-V)

1923 *Schizophoria resupinata* Martin var. *lata* Demanet, p. 69, 122, pl. 5, fig. 4, tables A-B.

1934 *Schizophoria resupinata* var. *lata* Demanet; Demanet, p. 50-51, 105, pl. 3, figs 6-8.

*Type material.* The specimen RBINS a11743 (Figs 14C, 15R-

V) figured by Demanet (1923, pl. 5, fig. 4) is hereby designated as the lectotype.

*Type locality and horizon.* Sosoye, Waulsort Formation or Longpré Formation (Avins Member) (Tournaisian, Ivorian) (Figs 1-2).

*Description.* See Demanet (1923, 1934) and Pocock (1968).

*Remarks.* As for *Schizophoria resupinata* var. *dorsosinuata*. The lectotype of this subspecies is a young specimen that is considerably smaller than most of the specimens (RBINS a5861–5863; not illustrated here) figured by Demanet (1934) from the Waulsort Formation (Vèves; Fig. 1). Furthermore, Demanet (1934) compared *S. resupinata* var. *lata* Demanet, 1923 with *Orthis latissima* M'Coy, 1844 but he was probably not aware about the distorted character of the specimen illustrated by M'Coy (1844). *Orthis latissima* undoubtedly belongs to *Schizophoria* and is probably a junior synonym of the long ranging species *S. (S.) r. resupinata* (Martin, 1809) (compare the large dorsal muscle field of the lectotype with that of Martin's species illustrated by Pocock (1968, text-fig. 14)) as mentioned by Davidson (1861). M'Coy's species has been overlooked in the studies dedicated to the Carboniferous schizophoriids from Western Europe (e.g., Bond, 1941; Pocock, 1968). For taxonomical purpose, the incomplete and crushed dorsal internal mould with some shelly remains (NMING:F7449, Fig. 10D), illustrated by M'Coy (1844, pl. 20, fig. 20 [left part]), is hereby designated as the lectotype (it is impossible to be certain that it corresponds to the holotype by monotypy). It comes from St. John's Point, Dunkineely, Co. Donegal (Ireland), and is probably of Arundian age (N.T. Monaghan, pers. com., September 2008). The shelly fragment showing the muscle scars and corresponding to M'Coy's central figure has not been traced, whereas the right is most probably an external reconstruction of the lectotype showing the fine ornament.

*Current name.* *Schizophoria (Schizophoria) resupinata lata* Demanet, 1934.

***Schizophoria resupinata* var. *palliat*a** Demanet, 1934 (Figs 14D, 16A-H)

1934 *Schizophoria resupinata* var. *palliat*a Demanet, p. 58-59, 105, pl. 4, figs 7-8.

*Type material.* Contrary to Pocock's (1965) statement, both specimens illustrated by Demanet (1934, pl. 4, figs 7-8) are not lost. Bond (1941) selected the almost complete ventral valve (RBINS a5883, Figs 14D, 16A-D) illustrated by Demanet (1934, pl. 4, figs 7, 7a-7b) as the holotype. According to the Article 74.5 of the Code, the misuse of the term 'holotype' by Bond (1941) acts however as lectotype designation as this author explicitly indicated, when wrongly using the term 'holotype', that he was selecting from the specimens illustrated by Demanet (1934); the dorsal valve RBINS a5884 (Demanet, 1934, pl. 4, fig. 8) is thus a paralectotype (Fig. 16E-H).

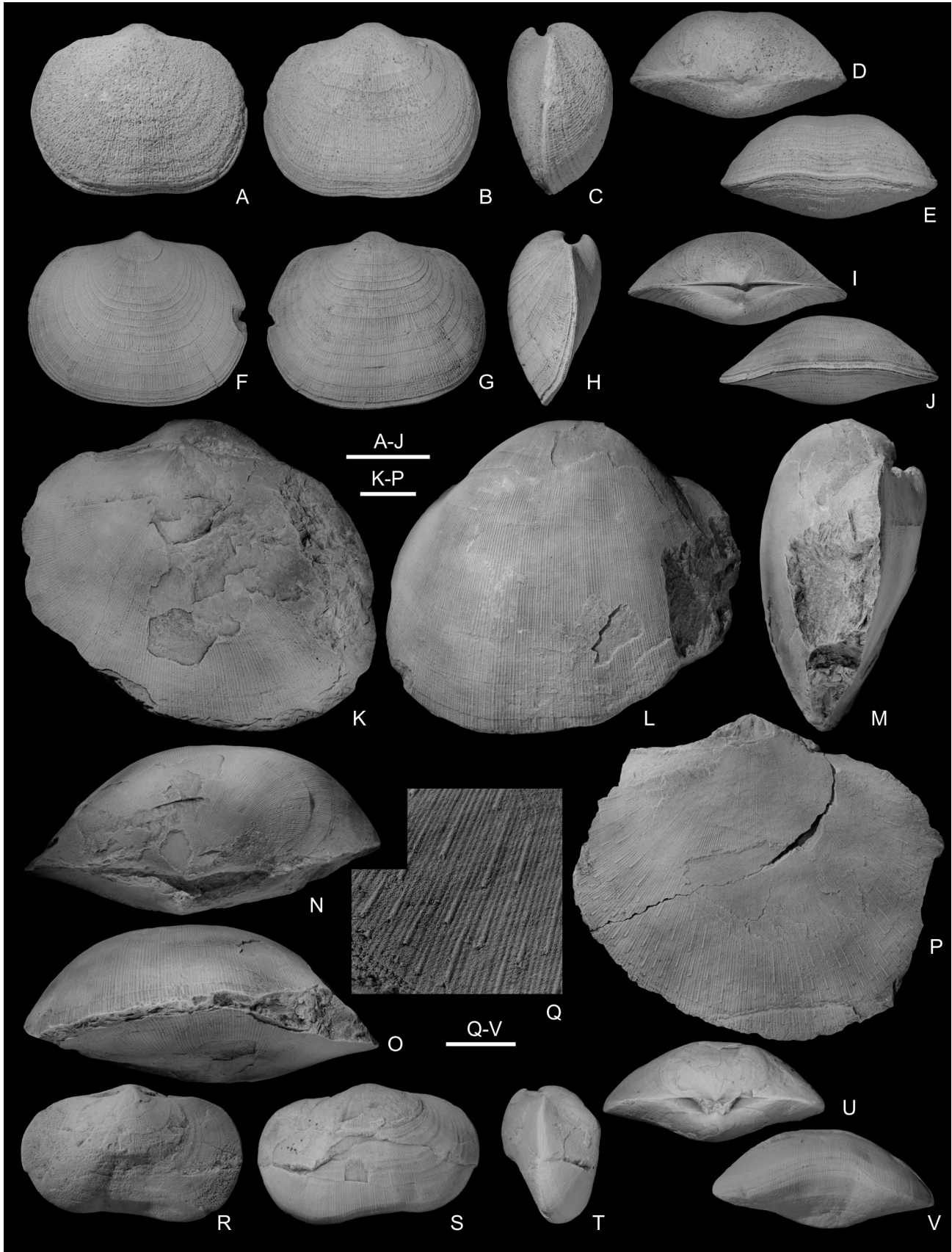
*Type locality and horizon.* Dréhance (Fossé des Tchawias), Waulsort Formation (Tournaisian, Ivorian) (Figs 1-2).

*Description.* See Demanet (1934), Bond (1941) and Pocock (1968).

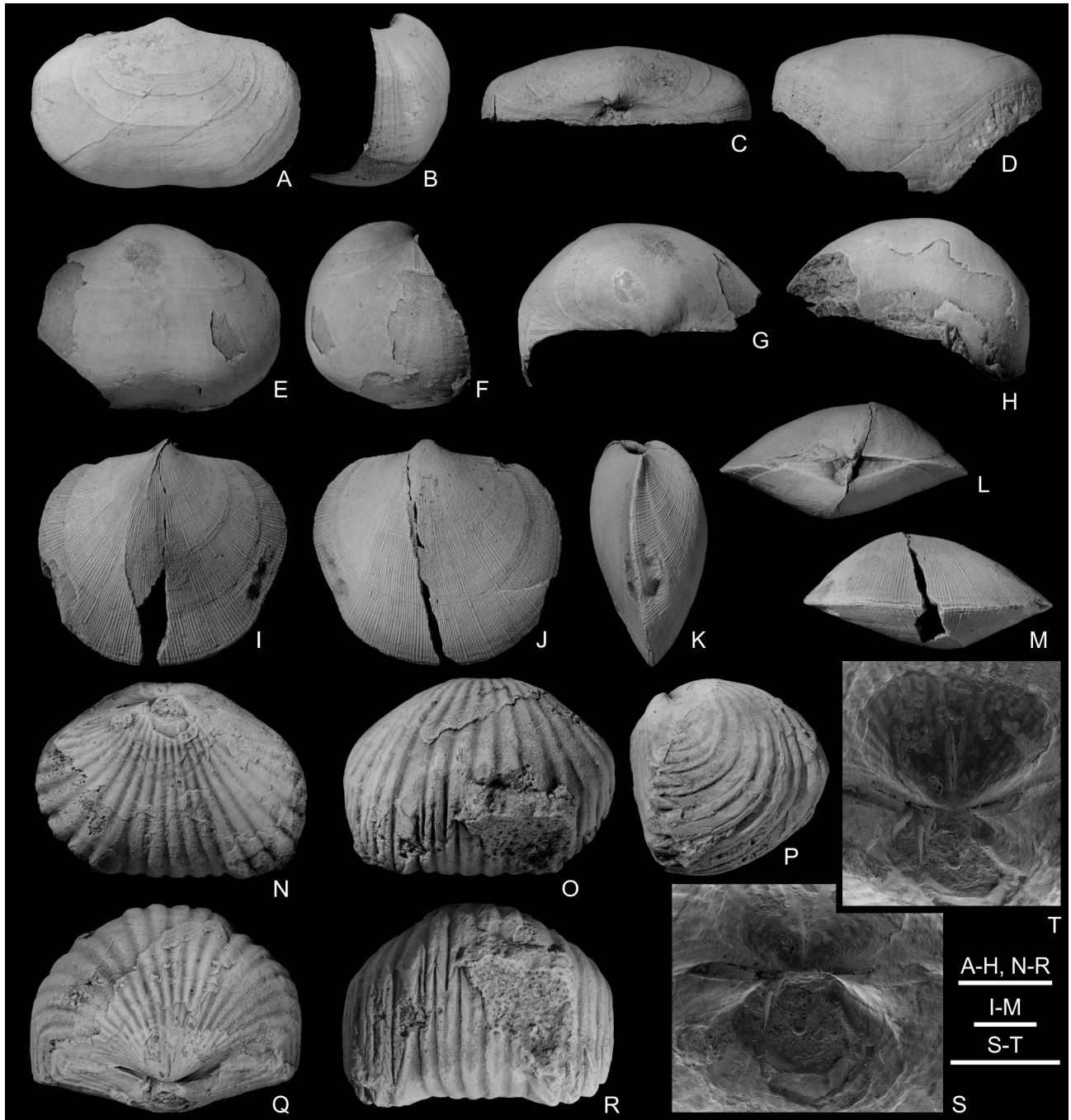
*Remarks.* Bond (1941) promoted Demanet's variety to species level and it was considered later as a junior synonym of *Orthis linguata* Quenstedt, 1871 in 1868–1871 from the 'Bergkalke von Ratingen' (Germany, Velbert Anticline; see Herbig, 2016 for an overview of the Mississippian succession in this area). This species was included by Lazarev (1976) in his new subgenus *Schizophoria (Pocockia)*.

*Current name.* *Schizophoria (Pocockia) linguata* (Quenstedt, 1871 in 1868–1871).





**Figure 15.** A-J. *Schizophoria resupinata* var. *dorsosinuata* Demanet, 1934 [*Schizophoria* (*Schizophoria*) *resupinata dorsosinuata* Demanet, 1934]; Tournai area, 'Assise de Celles' (Tournaïsiens). A-E. RBINS a5869 (lectotype), articulated specimen in ventral, dorsal, lateral, posterior and anterior views. F-J. RBINS a5870 (paralectotype), articulated specimen in ventral, dorsal, lateral, posterior and anterior views. K-P. *Schizophoria resupinata* var. *gigantea* Demanet, 1934 [*Schizophoria* (*Schizophoria*) *resupinata gigantea* Demanet, 1934]; Visé, Visé Formation (Viséan, Warnantian). K-O. RBINS a5888 (lectotype), distorted articulated specimen in ventral, dorsal, lateral, posterior and anterior views. P-Q. RBINS a5889 (paralectotype), ventral valve in plan view and detail of the ornamentation. R-V. *Schizophoria resupinata* var. *lata* Demanet, 1923 [*Schizophoria* (*Schizophoria*) *resupinata lata* Demanet, 1923], RBINS a11743 (lectotype) in ventral, dorsal, lateral, posterior and anterior views; Sosoye, Waulsort Formation or Longpré Formation (Avin Member) (Tournaïsiens, Ivorian). Scale bars: 10 mm (A-J, K-P), 5 mm (Q-V).



**Figure 16.** A-H. *Schizophoria resupinata* var. *palliata* Demanet, 1934 [*Schizophoria* (*Pocockia*) *linguata* (Quenstedt, 1871 in 1868–1871)]; Dréhanche, Waulsort Formation (Tournaisian, Ivorian). A-D. RBINS a5883 (lectotype), almost complete valve in plan, lateral, posterior and anterior views. E-H. RBINS a5884 (paralectotype), slightly distorted dorsal valve in plan, lateral, posterior and anterior views. I-M. *Schizophoria resupinata* var. *rotundata* Demanet, 1923 [*Schizophoria* (*Schizophoria*) *resupinata rotundata* Demanet, 1923], RBINS a11744 (lectotype), slightly distorted articulated specimen in ventral, dorsal, lateral, posterior and anterior views; Sosoye, Waulsort Formation or Longpré Formation (Avins Member) (Tournaisian, Ivorian). N-T. *Camarophoria destinezi* Ch. Fraipont, 1908 [*Pleuropugnoides? destinezi* (Ch. Fraipont, 1908)], ULg.PA. 2020.07.13/3 (lectotype), articulated specimen in ventral, dorsal, lateral, posterior and anterior views, and detail (SEM) of the dental plates and the dorsal septum; Flavion, Waulsort Formation (Tournaisian, Ivorian). Scale bars: 10 mm (A-H, N-R), 5 mm (I-M, S-T).

***Schizophoria resupinata* var. *pinguis* Demanet, 1934**  
(Figs 14E, 17A-O)

1934 *Schizophoria resupinata* var. *pinguis* Demanet, p. 59-60, 105, pl. 4, figs 9-11.

*Type material.* The specimen RBINS a5885 illustrated by Demanet (1934, pl. 4, fig. 9-9a) is hereby designated as the lectotype (Figs 14E, 17F-J). The two other specimens RBINS a5886 (Demanet, 1934, pl. 4, fig. 10) (Fig. 17A-E) and RBINS

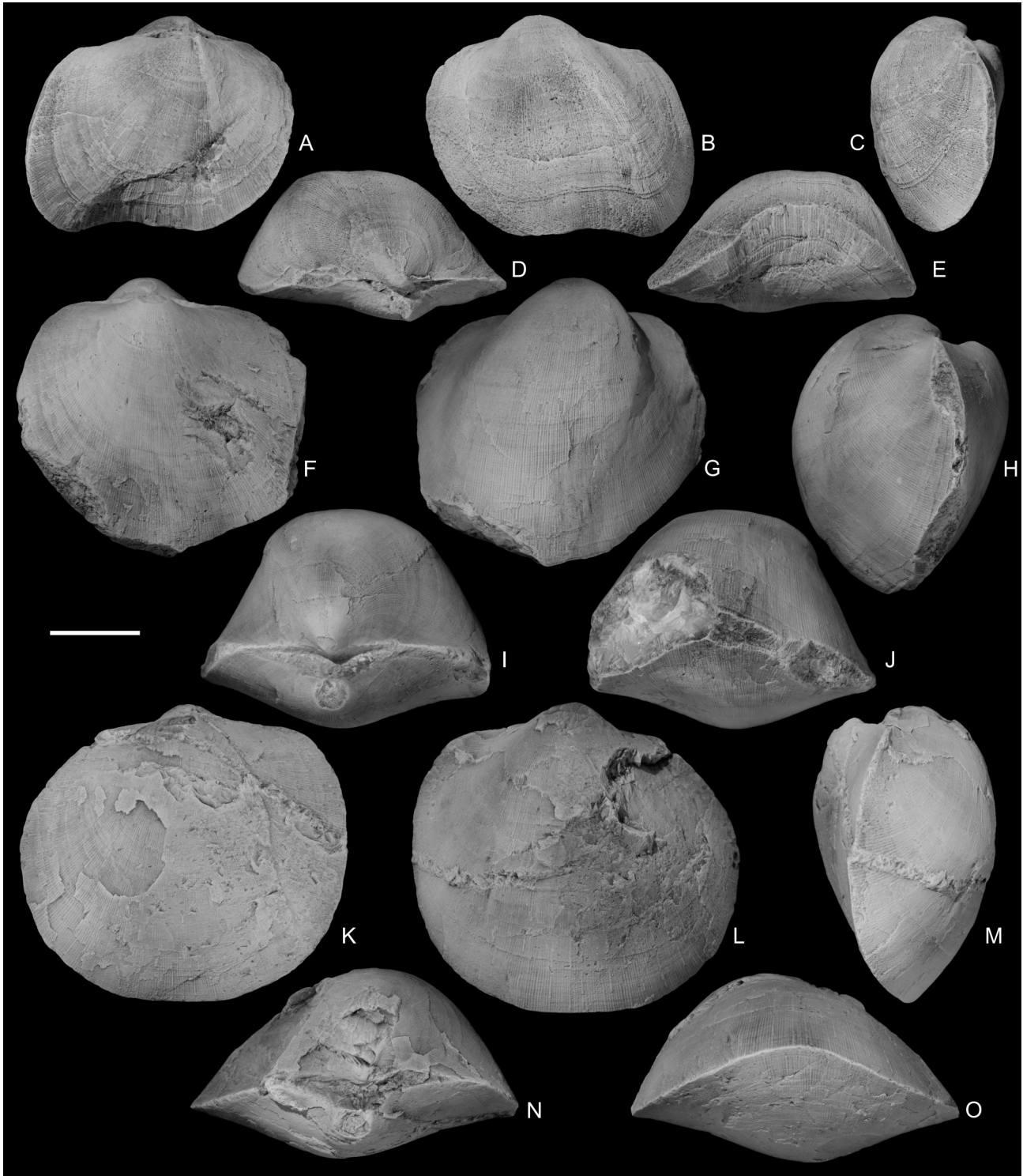
a5887 (Demanet, 1934, pl. 4, fig. 11) (Fig. 17K-O) have thus to be considered as paralectotypes.

*Type locality and horizon.* Visé, Visé Formation (Viséan, Warnantian) (Figs 1-2). See remark for *Schizophoria resupinata* var. *gigantea*.

*Description.* See Demanet (1934) and Pocock (1965, 1968).

*Remarks.* As for *Schizophoria resupinata* var. *dorsosinuata*.

*Current name.* *Schizophoria* (*Schizophoria*) *resupinata pinguis* Demanet, 1934.



**Figure 17.** *Schizophoria resupinata* var. *pinguis* Demanet, 1934 [*Schizophoria* (*Schizophoria*) *resupinata pinguis* Demanet, 1934]; Visé, Visé Formation (Viséan, Warnantian). A-E. RBINS a5886 (paralectotype), distorted articulated specimen in ventral, dorsal, lateral, posterior and anterior views. F-J. RBINS a5885 (lectotype), distorted articulated specimen in ventral, dorsal, lateral, posterior and anterior views. K-O. RBINS a5887 (paralectotype), distorted articulated specimen in ventral, dorsal, lateral, posterior and anterior views. Scale bar: 10 mm.

***Schizophoria resupinata* var. *rotundata* Demanet, 1923**  
(Figs 14F, 16I-M)

1923 *Schizophoria resupinata* Martin var. *rotundata*  
Demanet, p. 69, 122, pl. 5, fig. 5, tables A-B.

1934 *Schizophoria resupinata* var. *rotundata* Demanet;  
Demanet, p. 51-53, 105, pl. 3, figs 9-13, text-fig. 10.

*Type material.* The specimen RBINS a11744 figured by

Demanet (1923, pl. 5, fig. 5) is hereby designated as the lectotype (Figs 14F, 16I-M).

*Type locality and horizon.* Sosoye, Waulsort Formation or Longpré Formation (Avins Member) (Tournaisian, Ivorian) (Figs 1-2).

*Description.* See Demanet (1923, 1934) and Pocock (1965, 1968).

*Remarks.* As for *Schizophoria resupinata* var. *dorsosinuata*. Besides the lectotype, Demanet (1934, pl. 3, fig. 11) illustrated a

dorsal valve (RBINS a5866) from the Waulsort Formation of the Dinant area (Anseremme, Fig. 1) assigned to the variety *rotundata* whereas the other specimens (RBINS a5864-5865, 5867-5868) identified as such by Demanet (1934, pl. 3, figs 9-10, 12-13, text-fig. 10) are from the Hastarian Pont d'Arcole Formation at Hastière (Fig. 1).

*Current name.* *Schizophoria* (*Schizophoria*) *resupinata rotundata* Demanet, 1923.

#### 6.2.8. Order Rhynchonellida

***Camarophoria destinezi*** Ch. Fraipont, 1908  
(Fig. 16N-T)

1908 *Camarophoria Destinezi* Ch. Fraipont, p. M11-M12, pl. 4, fig. 3a-d.

*Type material.* The articulated, partly decorticated specimen (ULg.PA. 2020.07.13/3) illustrated by Ch. Fraipont (1908, pl. 4, fig. 3a-d) is hereby designated as the lectotype (Fig. 16N-T).

*Type locality and horizon.* Flavion; as for *Chonetes parva* (see above), Ch. Fraipont (1908) indicated 'Waulsortien' as the type horizon, Waulsort Formation (Tournaisian, Ivorian) (Figs 1-2).

*Description.* See Ch. Fraipont (1908).

*Remarks.* As recently indicated by Mottequin & Simon (2017b), several costate rhynchonellid species were reported in the Waulsortian mounds by de Koninck (1887) and Demanet (1923, 1958), but none were recently revised. At first view, Ch. Fraipont's (1908) species differs from *Rhynchonella laeta* de Koninck, 1887, probably a representative of the genus *Pleuropugnoides* Ferguson, 1966 and possibly a junior synonym of *P. pleurodon* (Phillips, 1836), by its larger size, by its rounded ribs and its less developed sulcus. These two taxa were reported from the Flavion Waulsortian mound by Demanet (1958), who did not cite the species *destinezi*. The broken beak of the lectotype shows thin dental plates largely diverging anteriorly in the most posterior part and well-developed, concave palintropes (Fig. 16S-T); the decortication enables to observe the onset of the dorsal median septum reflected by the presence of a median furrow (Fig. 16S-T). From the generic viewpoint, a provisional assignment to *Pleuropugnoides* Ferguson, 1966 is the most satisfactory pending the examination of further material.

*Current name.* *Pleuropugnoides? destinezi* (Ch. Fraipont, 1908).

#### 6.2.9. Order Spiriferida

***Spirifer konincki var. attenuiformis*** Demanet, 1923  
(Fig. 18A-F)

1923 *Spirifer Konincki* Dewalque vel Douglas [sic] var. *attenuiformis* Demanet, p. 94, 170-171, pl. 8, fig. 60a-b, tables A-B.

*Type material.* The almost complete specimen (RBINS a11800) figured by Demanet (1923, pl. 8, fig. 60a-b) is hereby designated as the lectotype (Fig. 18A-F).

*Type locality and horizon.* Maredsous (lime kiln quarry), Waulsort Formation (Tournaisian, Ivorian) (Figs 1-2).

*Description.* See Demanet (1923).

*Remarks.* Bublichenko (1976) and Sartenaer & Plodowski (2002) rightly considered the single specimen illustrated by Demanet (1923) as a juvenile of *Mesochorospira konincki* (Dewalque, 1895). This catalogue is an opportunity to complement Sartenaer & Plodowski's (2002) revision of *M. konincki* in figuring the internal mould of a large specimen that illustrates their description of the ventral muscle field (Fig. 18G-L).

*Current name.* *Mesochorospira konincki* (Dewalque, 1895).

***Spirifer konincki var. latissimus*** Demanet, 1923  
(Fig. 19A-E)

1923 *Spirifer konincki* Dewalque vel Douglas var. *latissimus* Demanet, p. 94, 169-170, pl.8, fig. 61, tables A-B.

*Type material.* The incomplete and distorted specimen (RBINS a11801) illustrated by Demanet (1923, pl. 8, fig. 61) is hereby designated as the lectotype (Fig. 19A-E).

*Type locality and horizon.* Maredsous (lime kiln quarry), Waulsort Formation (Tournaisian, Ivorian) (Figs 1-2).

*Description.* See Demanet (1923).

*Remarks.* As stated by Sartenaer & Plodowski (2002), the only specimen illustrated by Demanet (1923) is distinct from *Mesochorospira konincki* due to its ribbing pattern and its markedly transverse outline. On the flanks, some of the inner ribs bifurcate anteriorly, but it is highly probable that they bifurcate near the beak; there is no fasciculation. Microornament consists of capillae and growth microlines (reticulate pattern) (Fig. 19E). The broken beak shows relatively thin but well-individualized dental plates (Fig. 19D). The particular outline and the ribbing pattern suggest an assignment to *Grandispirifer* Yang, 1959, but the development of distinct dental plates challenges such assignment. Nevertheless, until now, all the sections in specimens assigned to Yang's genus are poorly detailed and better illustrations are badly needed (Yang, 1959; Shi et al., 2016). Also, the presence of dental adminicula in *Grandispirifer* was discussed by different authors such as Plodowski (1970), Thomas (1971), Legrand-Blain (1986), and Carter (2006).

*Current name.* *Grandispirifer? latissimus* (Demanet, 1923).

#### 6.2.10. Order Terebratulida

***Camarophoria pentangulata*** Demanet, 1923  
(Fig. 20A-F)

1923 *Camarophoria pentangulata* Demanet, p. 190-191, pl. 11, fig. 88a-b, tables A-B.

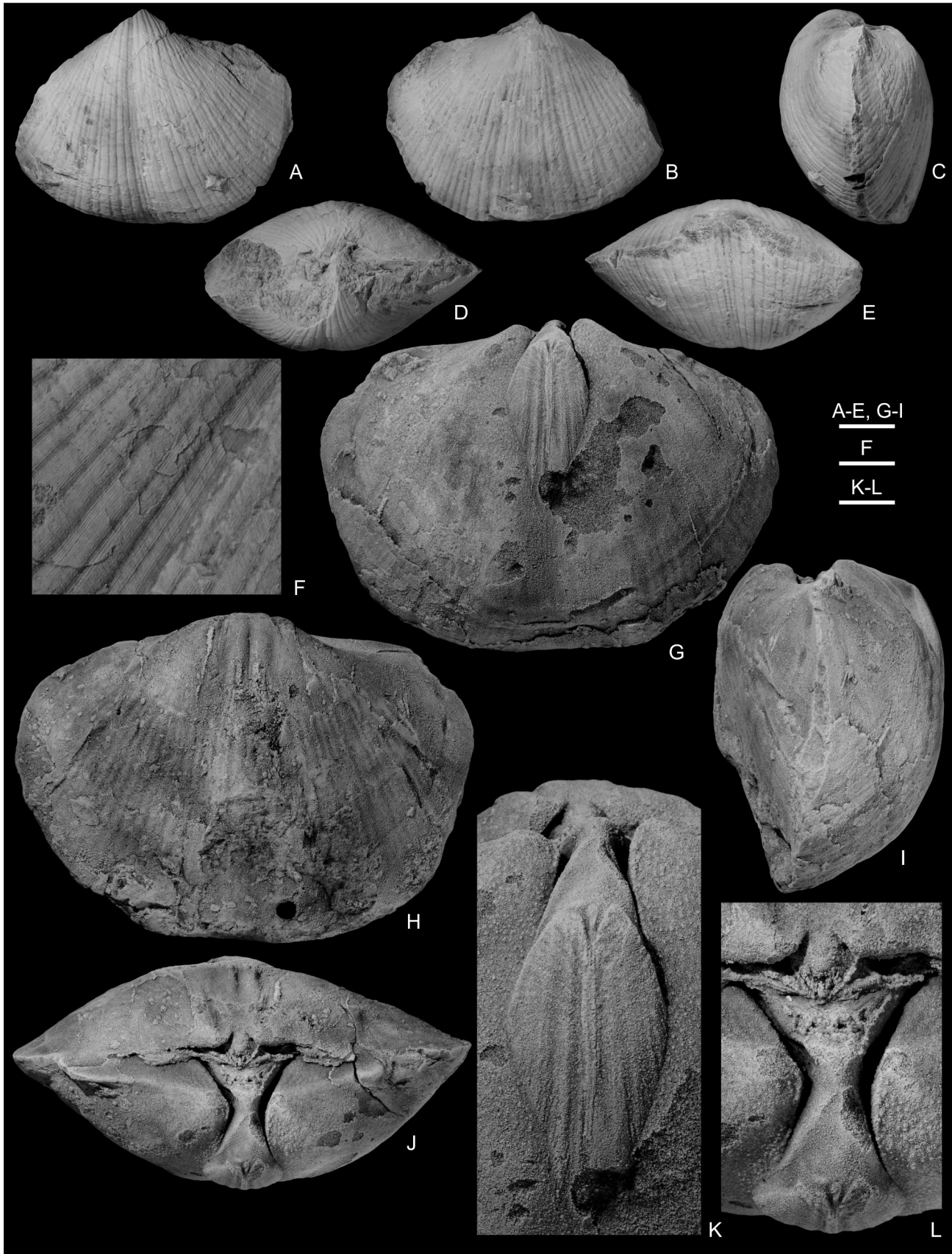
*Type material.* The articulated specimen (RBINS a11828) illustrated by Demanet (1923) is hereby designated as the lectotype (Fig. 20A-F).

*Type locality and horizon.* Sosoye, Waulsort Formation or Longpré Formation (Les Avins Member) (Tournaisian, Ivorian) (Figs 1-2).

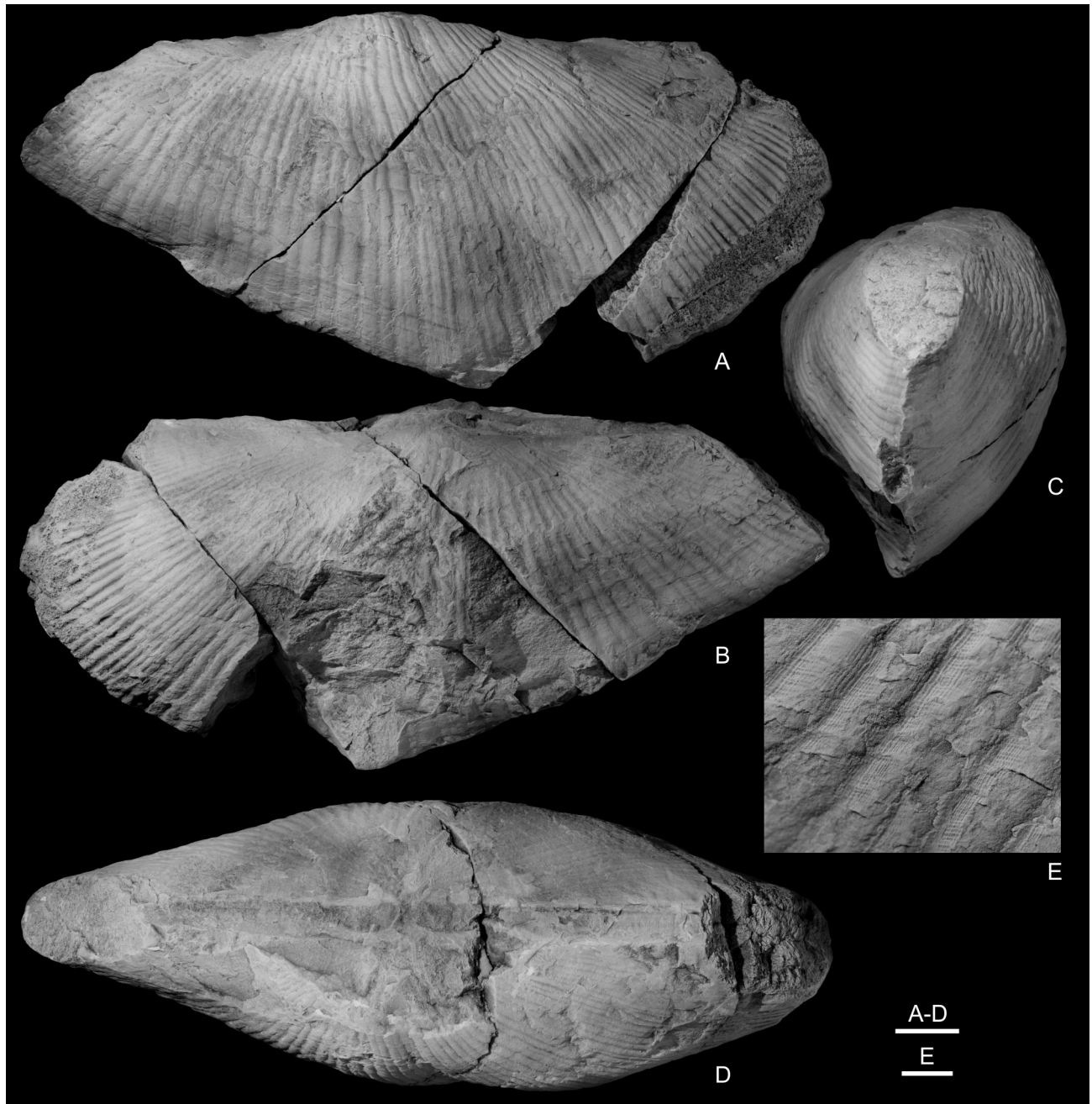
*Description.* See Demanet (1923).

*Remarks.* The particular morphology (strongly ventribiconvex profile, plicosulcate anterior commissure) of this minute shell recalls that of *Terebratula reflexa* de Koninck, 1843 in 1842-1844 from the Viséan (Warnantian) of Visé, which is also markedly ventribiconvex and strongly unisulcate (Fig. 20G-K; specimen RBINS a5402 illustrated by de Koninck, 1887, pl. 16, figs 84-89) to plicosulcate. Such external morphologies are reported from the rhynchonellides and the terebratulides, but the internal features of de Koninck and Demanet's species remain largely unknown even if some abraded specimens or partial internal moulds of the former display short, divergent dental plates. Due to the absence of data related to the internal features, *Terebratula reflexa* was doubtfully assigned by Stehli (1961) to his new cryptonellid genus *Gacina* although he likewise recognized that it could equally belong to *Cryptacanthia* White & St. John, 1867. The outline of *T. reflexa* is less developed in length than those of the other species assigned to *Gacina* by Stehli (1961) and is more in accordance with the shape of





**Figure 18.** A-F. *Spirifer konincki* var. *attenuiformis* Demanet, 1923 [*Mesochorispira konincki* (Dewalque, 1895)], RBINS a11800 (lectotype), articulated specimen in ventral, dorsal, lateral, posterior and anterior views, and close-up of the microornament in the sulcus; Maredsous, Waulsort Formation (Tournaisian, Ivorian). G-L. *Mesochorispira konincki* (Dewalque, 1895), UMONS-GFA 2019-11-21/1, slightly crushed internal mould in ventral, dorsal, lateral and posterior views, close-up of the ventral muscle field and detail of the cardinalia and dental plates; Soignies (?), Ecaussinnes Formation (Tournaisian, Ivorian). Scale bars: 10 mm (A-F, G-L), 2 mm (F), K-L (5 mm).



**Figure 19.** *Spirifer konincki* var. *latissimus* Demanet, 1923 [*Grandispirifer? latissimus* (Demanet, 1923)]; Maredsous, Waulsort Formation (Tournaisian, Ivorian). A-E. RBINS a11801 (lectotype), incomplete and distorted articulated specimen in ventral, dorsal, lateral and posterior views, and enlargement of the microornament on the left ventral flank. Scale bars: 10 mm (A-D), 2 mm (E).

*Cryptacanthia* species (e.g., White & St. John, 1867; Dunbar & Condra, 1932; Cooper, 1957), but the European species can display a strong median dorsal rib (plicosulcate commissure). For all these reasons, both species described in Belgium are doubtfully ascribed to the terebratulide genus *Cryptacanthia* rather than to *Gacina*. However, it is not at all excluded that each of them belongs to distinct genera or even distinct order. Further research is therefore required.

*Current name.* *Cryptacanthia? pentangulata* (Demanet, 1923).

### 6.3. Middle and Upper Devonian trilobites

*Phacops (Phacops) accipitrinus maretolensis* Richter & Richter, 1933  
(Fig. 21A-O)

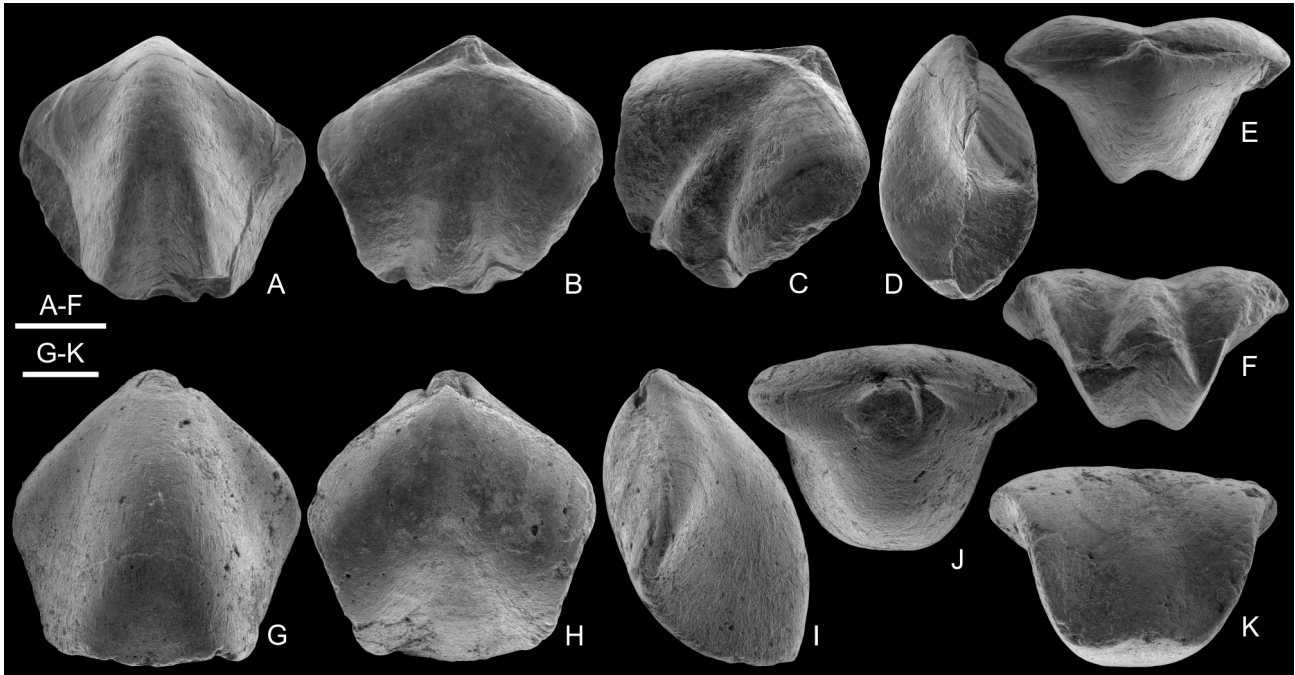
1933 *Phacops (Phacops) accipitrinus maretolensis* Richter & Richter: 1933, p. 12-15, pl. 2, figs 9-14.

*Type material.* The illustrated type specimens were selected by Richter & Richter (1933, pl. 2, figs 9-14) and are photographically illustrated herein for the first time: holotype (RBINS a7812, pl. 2, fig. 9 a-b; Fig. 21A-D) and illustrated paratypes RBINS a7813 (pl. 2, fig. 10; Fig. 21E-H), a7814 (pl. 2, fig. 11; only a plaster mould is available), a7815 (pl. 2, fig. 12; Fig. 21I-J), a7816 (pl. 2, fig. 13; Fig. 21K), a7817 (pl. 2, fig. 14; Fig. 21L-O). The CGF collection also includes one unfigured paratype (CGF 2020.11.10/12, unillustrated).

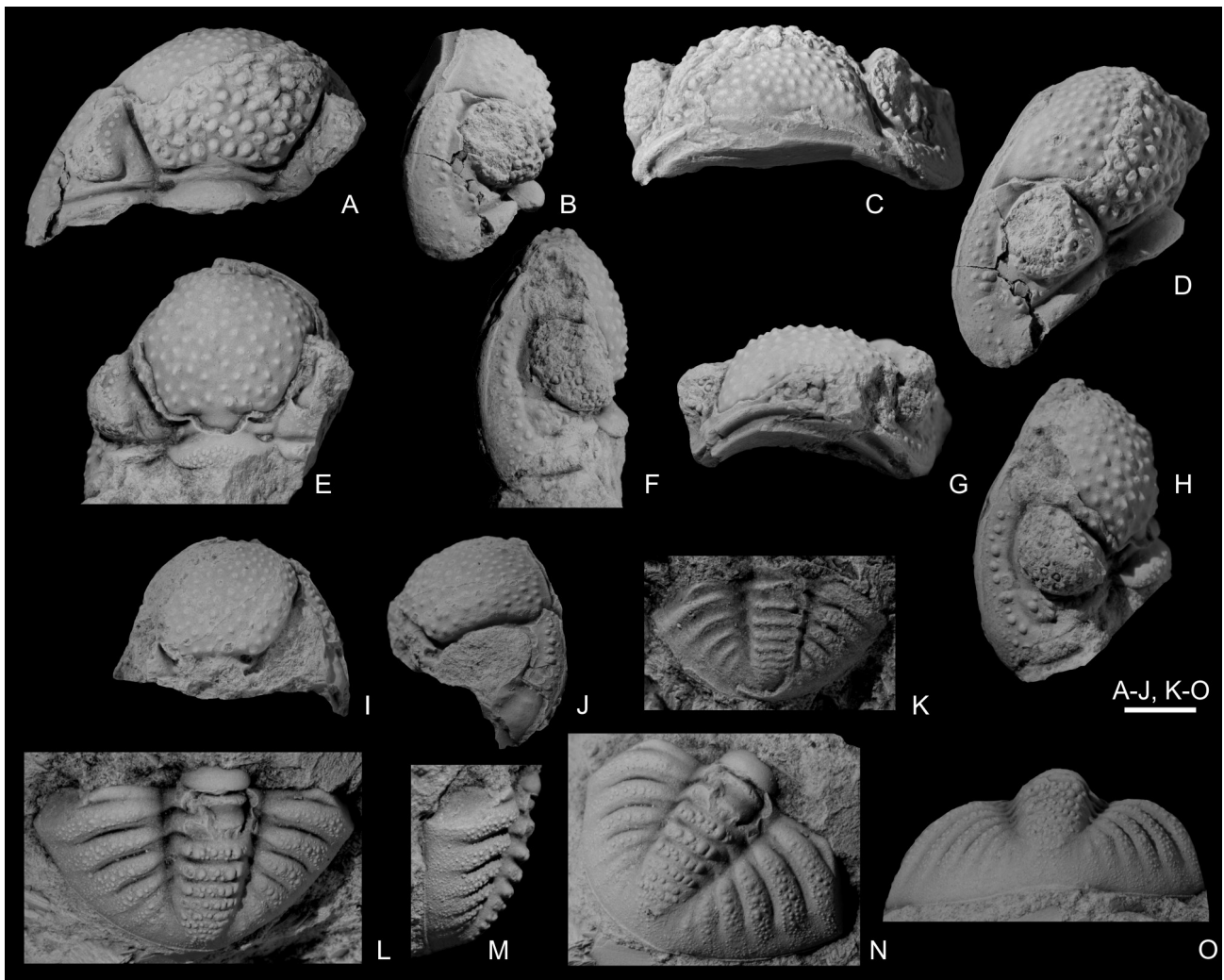
*Type locality and horizon.* Maredsous (Bioul 525) (Fig. 1), Etrœungt Formation (latest Famennian, 'Strunian').

*Description.* See Richter & Richter (1933).

*Remarks.* Struve (1976) erected the genus *Omegops* for



**Figure 20.** A-F. *Camarophoria pentangulata* Demanet, 1923 [*Cryptacanthia? pentangulata* (Demanet, 1923)], RBINS a11828 (lectotype), articulated specimen in ventral, dorsal, oblique dorsal, lateral, posterior and anterior views (SEM); Sosoye, Waulsort Formation or Longpré Formation (Avins Member) (Tournaisian, Ivorian). G-K. *Cryptacanthia? reflexa* (de Koninck, 1843 in 1842–1844), RBINS a5402 (topotype), internal mould in ventral, dorsal, lateral, posterior and anterior views (SEM); Visé, Visé Formation (Viséan, Warnantian). Scale bars: 10 mm (A-F, G-K).



**Figure 21.** *Phacops (Phacops) accipitrinus maretioleis* Richter & Richter, 1933 [*Omegops maretioleis* (Richter & Richter, 1933)]; Bioul 525, Etrœungt Formation (latest Famennian, Strunian). A-D. RBINS a7812 (holotype), incomplete cephalon in dorsal, lateral, frontal and posterolateral views. E-H. RBINS a7813 (paratype), incomplete cephalon in dorsal, lateral, frontal and posterolateral views. I-J. RBINS A7815 (paratype), incomplete cephalon in dorsal and posterolateral views. K. RBINS a7816 (paratype), pygidium in dorsal view. L-O. RBINS a7817 (paratype), pygidium in dorsal, lateral, posterolateral and frontal views. Scale bar: 4 mm (A-J), 2 mm (K-O).

*Calymene accipitrina* Phillips, 1841 from the Famennian Pilton Beds of England and Richter & Richter's subspecies was promoted to a specific status by Crônier & Feist (in Denayer et al., 2020).

*Current name.* *Omegops maretolensis* (Richter & Richter, 1933).

***Dechenella striata*** Stainier, 1887  
(Fig. 22A–Y)

1887 *Dechenella striata* Stainier, p. 80–83, pl. 4, fig. 1a–d.

*Type material.* The syntypes consist of eight cephalon fragments (RBINS a7629A–H, only the first five are illustrated in Fig. 22A–L, they all participated to Stainier's (1887, pl. 4, fig. 1a) reconstruction figure), four pygidia (RBINS a7630A (Stainier, 1887, pl. 4, fig. 1b, d; Fig. 22Q–S), a7630C (Fig. 22M–N), a7630D (Fig. 22O–P), and a7631 (Fig. 22T–V)), and one hypostome (RBINS a7630B (Stainier, 1887, pl. 4, fig. 1c; Fig. 22W–Y)).

*Type locality and horizon.* Sombreffe 6189 (Fig. 1), Alvaux Member of the Bois de Bordeaux Formation (Givetian).

*Description.* See Stainier (1887).

*Remarks.* *Dechenella striata*, originally illustrated by strongly embellished drawings and reconstruction, was doubtfully placed in synonymy with *D. verneuili* (Barrande, 1852), namely the type species of the genus *Dechenella* Kayser, 1880, by Richter (1912). This opinion was maintained by Richter & Richter (1950) according to their synonymy list related to Barrande's species and followed notably by Maillieux (1933), Asselberghs (1936), and Fourmarier (1954) in their faunal lists for the Alvaux Formation, although Maillieux (1940b) used Stainier's species name. Note that Stainier's species was erroneously cited as *Dechenella striatella* by Dormal (1888) (see Forir, 1896). Nevertheless, the type material of Stainier's (1887) has never been photographically illustrated so far. In order to promote the revision of this species, the type material (at least the best preserved) is illustrated photographically for the first time, but no lectotype is designated among the syntypes at this stage.

*Current name.* *Dechenella striata* Stainier, 1887.

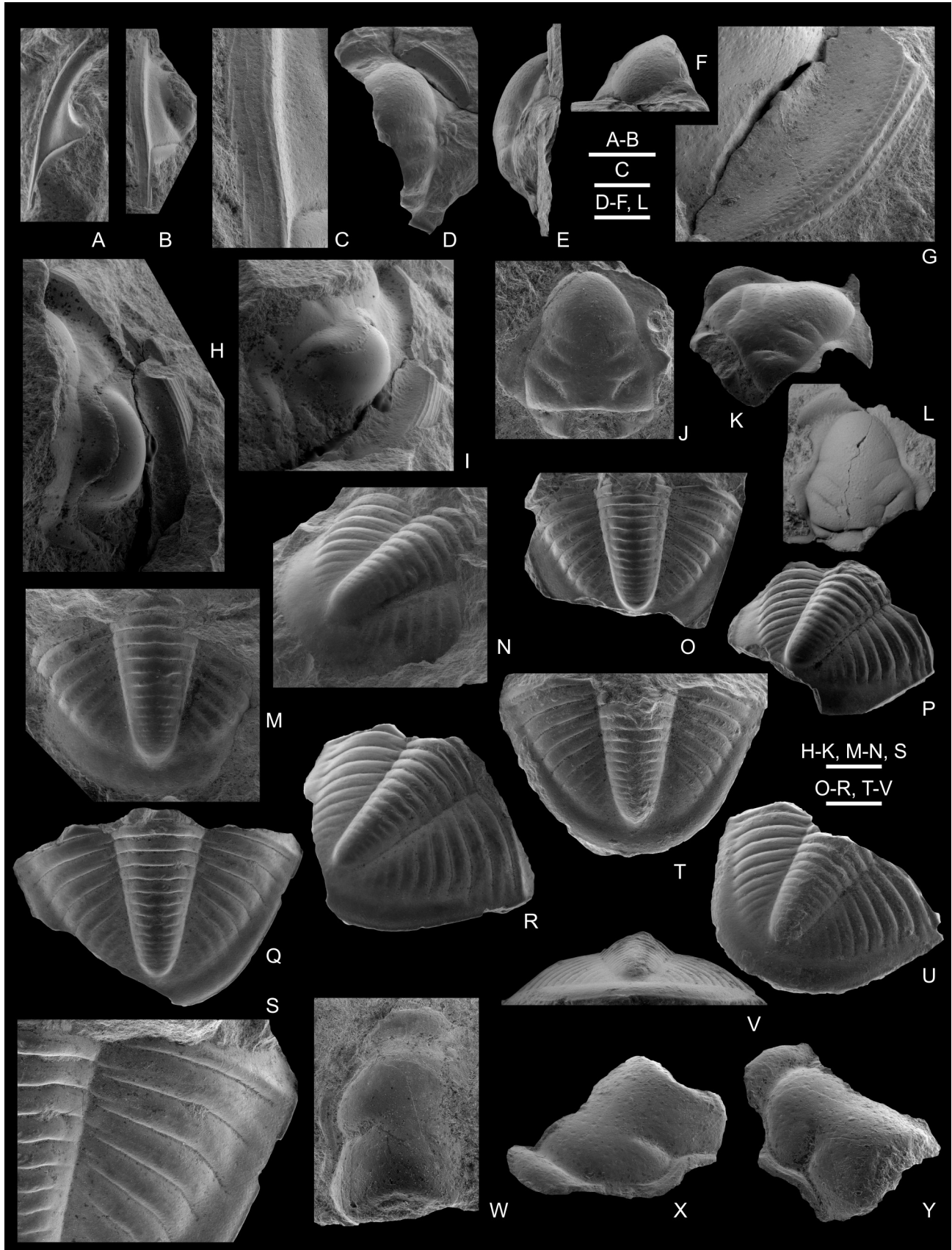
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**Figure 22.** Syntypes of *Dechenella striata* Stainier, 1887 from Sombrefte 6189, Bois de Bordeaux Formation, Alvaux Member (Givetian). A-C. RBINS a7629A, librigena in dorsal and lateral views, and close-up. D-G. RBINS a7629B, incomplete cranidium in dorsal, lateral and frontal views, and close-up. H-I. RBINS a7629C, incomplete cranidium and librigena in dorsal and oblique lateral views. J-K. RBINS a7629D, incomplete cranidium in dorsal and oblique lateral views. L. RBINS a7629E, almost complete cranidium in dorsal view. M-N. RBINS a7630C, pygidium in dorsal and posterolateral views. O-P. RBINS a7630D, incomplete pygidium in dorsal and posterolateral views. Q-S. RBINS a7630A, incomplete pygidium in dorsal and posterolateral views, and detail. T-V. RBINS a7631, pygidium in dorsal, posterolateral and frontal views. W-Y. RBINS a7630B, hypostome in dorsal, anterolateral and posterolateral views. Specimen RBINS a7629E on Fig. 22L was coated with ammonium chloride; the rest of the material was imaged using a SEM (specimens uncoated). Scale bars: 2 mm (A-B, D-F, L, O-R, T-V), 0.5 mm (C), 1 mm (G, H-K, M-N, S, W-Y).

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