A reappraisal of *Eurypterus dumonti* STAINIER, 1917 and its position within the Adelophthalmidae TOLLERTON, 1989

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Abstract

The Carboniferous eurypterid *Eurypterus dumonti* STAINIER, 1917 from Mechelen-aan-de-Maas (Maasmechelen), Belgium is redescribed and assigned to the genus *Adelophthalmus*. It is diagnosed as having a raised triangle of unknown function, dorsally on opisthosomal segment 7 and a carapace articulating laterally against the second opisthosomal segment. Earlier assignments of this species to the genus *Unionopterus*, based on the carapace shape figured in the original description (STAINIER 1917), are incorrect and the existence of a Carboniferous eurypterid with the characteristics described for *Unionopterus* must be questioned. The appendages in *A. dumonti* are completely exposed and provide an unrivalled insight into the number of appendage podomeres in the genus; this species is interpreted to have a podomere count consistent with most other eurypterids. Small pustules previously thought to be cuticle sculpture are here interpreted as diagenetic "dumb-bells" (see BRIGGS & WILBY 1996) following microbial activity on the carcase prior to fossilisation. These "dumb-bells" are the oldest non-marine record of this diagenetic feature. A number of other features are also interpreted differently from the original description. Possible lineages within the *Adelophthalmus* clade are identified, *A. dumonti* is probably closely related to *A. imhofi* (Czech Republic) and *A. moyseyi* (United Kingdom).

Key words: Eurypterida, appendages, '*dumb-bells*', Belgium, Coal Measures.

Résumé

L'euryptéride carbonifère de Mechelen-sur-Meuse (Maasmechelen), Belgique, originalement décrit comme *Eurypterus dumonti* STAINIER, 1917 fait ici le sujet d'une nouvelle description, résultant de son transfert au genre *Adelophthalmus*. Cet euryptéride est caractérisé par la possession d'un triangle surélévé sur le segment opisthosomal 7, et par une carapace articulant latéralement contre le deuxième segment opisthosomal. L'attribution de cette espèce au genre *Unionopterus*, basée sur la forme de la carapace comme figurée dans la description originale (STAINIER 1917) s'est révélée incorrecte. L'existence d'un euryptéride carbonifère avec des caractéristiques comme celles décrites pour *Unionopterus*, est assez douteuse. Les appendices d'*Adelophthalmus dumonti* sont exceptionellement bien exposées et permettent d'obtenir une idée précise du nombre de podomères appendiculaires de ce genre. Le nombre de podomères de *A. dumonti* est interprété comme comparable à celui d'autres euryptérides. Des petites pustules originalement considérées comme ornementales sont réinterprétées ici comme des "*dumb-bells*" (cfr. BRIGGS & WILBY 1996), résultant d'action bactérielle avant la fossilisation. Ces structures indiquent que le fossile n'est pas une exuvie. L'interprétation d'un nombre d'autres caractéristiques diffère aussi de celle de la description originale. Des lignes de descendance possible du clade *Adelophthalmus* sont identifiées, et la proximité d'*A. dumonti* à *A. imhofi* (République Tchèque) et à *A. moyseyi* (Royaume-Uni) est suggérée.

Mots-clefs: Eurypterida, appendices, '*dumb-bells*', Belgique, terrain houiller.

Introduction

Eurypterids are a diverse group of Palaeozoic, aquatic chelicerates ranging from the Upper Ordovician (TOLLERTON 2004) to the Upper Permian (PLOTNICK 1983). They occur most frequently in the Silurian and Lower Devonian of Europe and North America. Post-Devonian eurypterids are rare and had migrated from their earlier marginal marine environments into brackish and freshwater settings (PLOTNICK 1983; TETLIE 2004) – the Carboniferous Coal Measures of Europe, North America and China being classic examples. Although known from the Devonian (TETLIE *et al.* 2004; TETLIE & DUNLOP 2005; POSCHMANN 2005), adelophthalmids constitute most of the post-Devonian eurypterids, both in terms of the number of species and individuals. They represent one of only two eurypterid clades to survive into the Carboniferous; the other, and more diverse clade, includes the gigantic sweep-feeding hibbertopterids (*Hibbertopterus*, *Cyrtoctenus*, *Campylocephalus*, *Hastimima*, *Dunsopterus* and *Vernonopterus*) and the peculiar woodwardopterids (the Devonian *Borchgrevinkium* and the Carboniferous *Woodwardopterus*, *Mycterops* and *Megarachne*), this latter group being allied to the hibbertopterids (SELDEN *et al.* 2005).

Adelophthalmids are small, streamlined, nektonic eurypterids with prominent cuticle sculpture, which have previously been referred to six genera. As discussed by TETLIE & DUNLOP (2005) only *Adelophthalmus* VON MEYER, 1853 and *Unionopterus* CHERNYSHEV, 1948 appear to be valid, and the four other proposed genera are synonyms of *Adelophthalmus*. While the morphology of *Adelophthalmus* is relatively well-known (KJELLESVIG-

WAERING 1948, 1963; VAN OYEN 1956; WILLS 1964; KUES & KIETZKE 1981; POSCHMANN in press), our knowledge of *Unionopterus* is extremely poor; this genus contains only one species and is known only from a single specimen from Kazakhstan, described by CHERNYSHEV (1948) as *U. anastasiae*. The original description was in Russian and contained rather poor illustrations. Based solely upon these figures of CHERNYSHEV (1948), the genus has variously been interpreted as allied to *Adelophthalmus* (CASTER & KJELLESVIG-WAERING 1964; TOLLERTON 1989), *incertae sedis* (NOVOJILOV 1962; STØRMER 1974; PLOTNICK 1983), or was ignored altogether (STØRMER 1955). TETLIE (2004) and TETLIE & DUNLOP (2005) realised that the specimen described by STAINIER (1917) as *Eurypterus dumonti* and later assigned to *Adelophthalmus* by VAN OYEN (1956), appeared different from other species of *Adelophthalmus*. They listed some similarities, especially in terms of carapace shape and the width of the marginal rim, to the specimen described by CHERNYSHEV (1948) and suggested that the Belgian species might also belong to *Unionopterus*. As demonstrated below, this conclusion was incorrect; the anterior of the carapace of the Belgian fossil is incompletely preserved, and its shape is not trapezoid as figured by STAINIER (1917), but parabolic, with a narrow marginal rim, as in other species of *Adelophthalmus*.

Except for *A. dumonti*, several other eurypterids are recorded from Belgium. The oldest Belgian eurypterids are *Cyrtoctenus dewalquei* (FRAIPONT, 1889) and *Adelophthalmus* (?) *lohesti* (DEWALQUE *in* FRAIPONT, 1889) from the middle to late Famennian (late Devonian) of the Condroz Group at Pont de Bonne Modave. The single specimen of *E. lohesti* was first interpreted as possibly belonging to *Adelophthalmus* by KJELLESVIG-WAERING (1958, p. 1141). However, STØRMER & WATERSTON (1968, p. 83) interpreted it as a possible stylonurid, a view supported here. Most of the other fragmentary fossils figured by FRAIPONT (1889) were reinterpreted by STØRMER & WATERSTON (1968) as belonging to *Cyrtoctenus*. The probably related woodwardopterid *Mycterops matthieui* PRUVOST, 1924, is known from the Mons Mbr. of the Charleroi Fm., Charleroi, Bashkirian. Apart from *A. dumonti*, the Belgian Carboniferous has also yielded three other unequivocal adelophthalmids. *A. moyseyi* (WOODWARD, 1907) was recorded from the Mons Mbr. of the Charleroi Fm., in the Coal Measures of Bernissart, Bashkirian by PRUVOST (1930). Also from the same unit comes *A. corneti* (PRUVOST, 1939), collected from a drill core at Rieu-du-Cur, Quaregnon. Finally, *A. cambieri* (PRUVOST, 1930) is known from the As Mbr. of the Charleroi Fm. Charbonnages Reunis coal mine, Charleroi, Bashkirian. All named occurrences of eurypterids in Belgium are from the Upper Devonian or Carboniferous; the country has one of the most diverse Upper Palaeozoic eurypterid faunas known.

Late Carboniferous geology of the Campine Basin

The Belgian Carboniferous is classically divided into a fully marine, carbonate-dominated "Dinantian", overlain by a predominantly continental, siliciclastic coal-bearing "Silesian". The internationally agreed chronostratigraphic standard scale for the late Carboniferous has not found wide acceptance in Belgium, and the traditional divisions of the "Silesian" into Namurian A, B and C, and Westphalian A, B, C and D are still widely used (Fig. 1).

Whereas the southern Wallonian Basin outcrops at the surface, the coal deposits of the northern Campine Basin are entirely covered by post-Carboniferous deposits. The Campine Basin can be further subdivided into the western Antwerp Campine, only containing Serpukhovian (Namurian A-C) and Bashkirian (Westphalian A-B) deposits poor in coal, and the eastern Limburg Campine, preserving coal-rich Moscovian (Westphalian C-D) deposits. In the Campine Basin, the transition from the fully-marine carbonate-dominated "Dinantian" to the continental "Silesian" is represented by the Souvré Fm., dating to the Viséan-Serpukhovian boundary. It is overlain by the Belgian Coal Measures Group, containing all Carboniferous siliciclastic coal-bearing sediments. This group evidences a regression, with a transition from a marine pro-delta environment near the base, through lower/upper delta plain, to lower/upper alluvial plain near the top (LANGENAEKER & DUSAR 1992; DREESEN *et al.* 1995). In their recent review of the late Carboniferous stratigraphy of Belgium, DELMER *et al.* (2001) subdivided the Belgian Coal Measures Group into six formations (Fig. 2).

Because Belgian Carboniferous eurypterid discoveries are limited to the Châtelet and Charleroi formations, only these two units are discussed. The sediments of the Châtelet Fm. are composed of non-marine shales, sandstones, thin coal seams and rootlet beds. Two pervasive marine horizons divide the Châtelet Fm. into two members: the Sarnsbank marine band at the base of the Châtelet Fm. forms the base of the Ransart Mbr., while the Finefrau Nebenbank band defines the base of the overlying Floriffoux Mbr. The Châtelet Fm. attains a thickness of 500 m in the Campine area. The succeeding Charleroi Fm. contains several thick coal seams, and consists of a very characteristic rhythmic succession of coal-mudstone-sandstone sedimentary sequences. Faint marine bands subdivide the Charleroi Fm. into three members: the basal Mons Mbr., the As Mbr. and the Eikenberg Mbr. The Charleroi Fm. reaches a thickness of over 1000 m in the northeastern Campine basin.

Stratigraphical assignment and age of the specimen

The eurypterid fossil was recovered from a depth of 435 m, from the core of boring no. 32, carried out in the southern Campine coalfield near Mechelen-aan-de-Maas, which nowadays is a borough of Maasmechelen (Fig. 1).

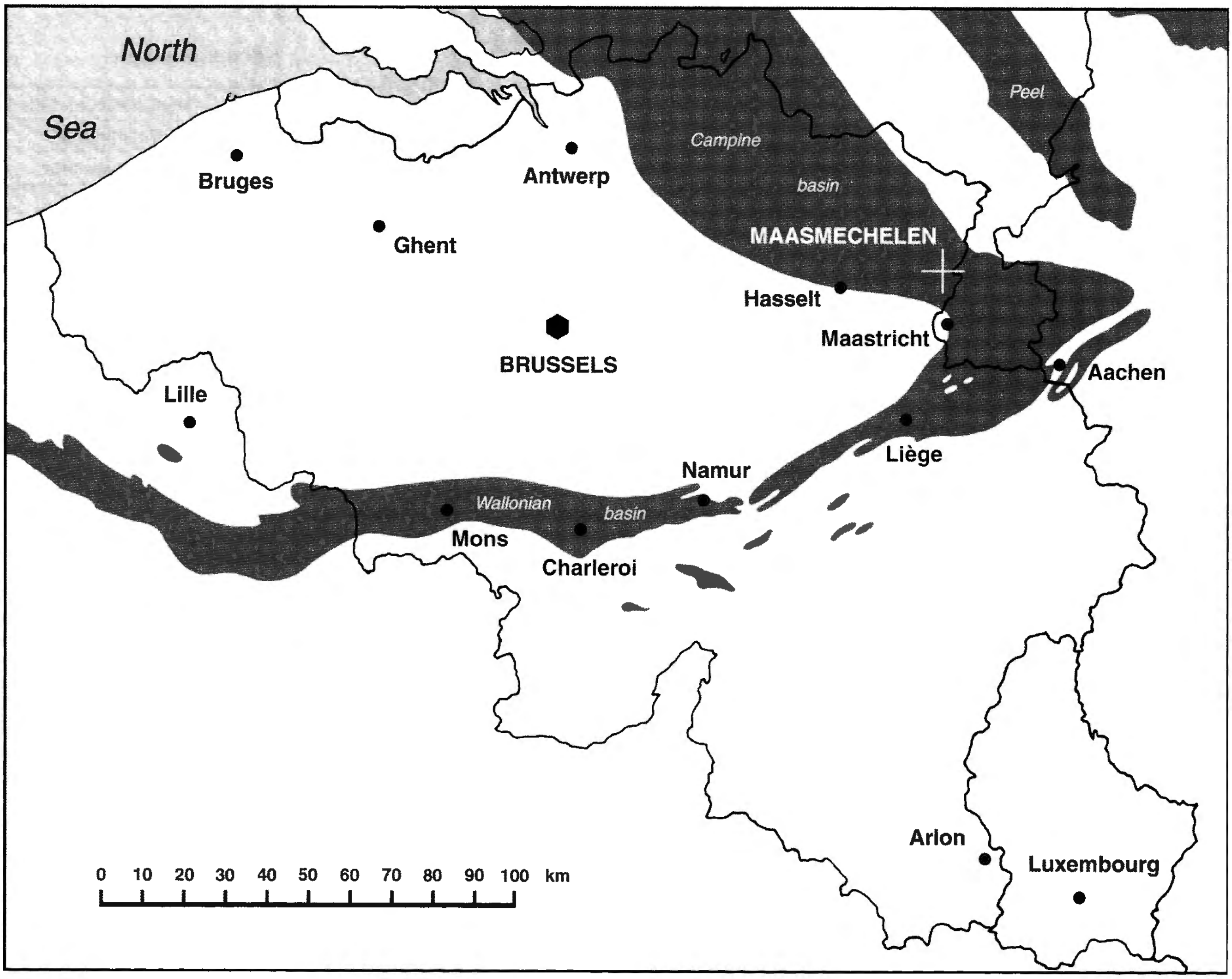

Fig. 1 — Map of Belgium showing the geographic extent of the Belgian Coal Measures Group. The position of Maasmechelen, of which Mechelen-aan-de-Maas nowadays is part, is indicated by the cross-hairs. Adapted from Renier 1930 and Paproth *et al.* 1983.

In his original description, Stainier (1917) stated that the fossil was found in a grey, fine-grained sandstone containing scattered plant fragments, above a thin seam of coal, about midway through the "great barren measure" ("grande stampe stérile") and approximately 570 m above the "Millstone Grit" ("poudingue"). The "great barren measure" was the upper subdivision of the Lower Westphalian A "assise de Châtelet" (Stainier 1911). The "Millstone Grit" was considered by Stainier (1911, 1917) to be a single, widespread grit-level forming the boundary between the Namurian and Westphalian stages. Renier (1930), however, showed there was no such thing as a single, continuous "Millstone Grit" reference stratum, and subdivided the "assise de Châtelet" into the lower "zone d'Oupeye" and the upper "zone de Beyne". The eurypterid described herein was discovered in the "zone de Beyne", as recognised by Pruvost (1930). Paproth *et al.* (1983) formally established the "zone d'Oupeye" as the Ransart Mbr., and the "zone the Beyne" as the Floriffoux Mbr.. In the latest review of Belgian Carboniferous stratigraphy, Delmer *et al.* (2001), recognizing the "assise de Châtelet", erected the Châtelet Fm. to contain the Ransart and Floriffoux members. Accordingly, the eurypterid comes from approximately the middle of the Floriffoux Mbr. of the Châtelet Fm. in the Belgian Coal Measures Group, and is of early Late Bashkirian age (Fig. 2).

Material and methods

Stainier (1917) gave no repository details for the specimen he described. The single specimen of *A. dumonti* (Stainier, 1917) is now held at the Royal Belgian Institute of Natural Sciences in Brussels, Belgium registered under number RBINS a7706. It consists of part and counterpart; the part being relatively complete, lacking some appendages, pretelson and telson, while the counterpart is less complete, consisting of only the carapace, partial appendages and six anterior segments. The counterpart has been repaired after breakage during original splitting of the

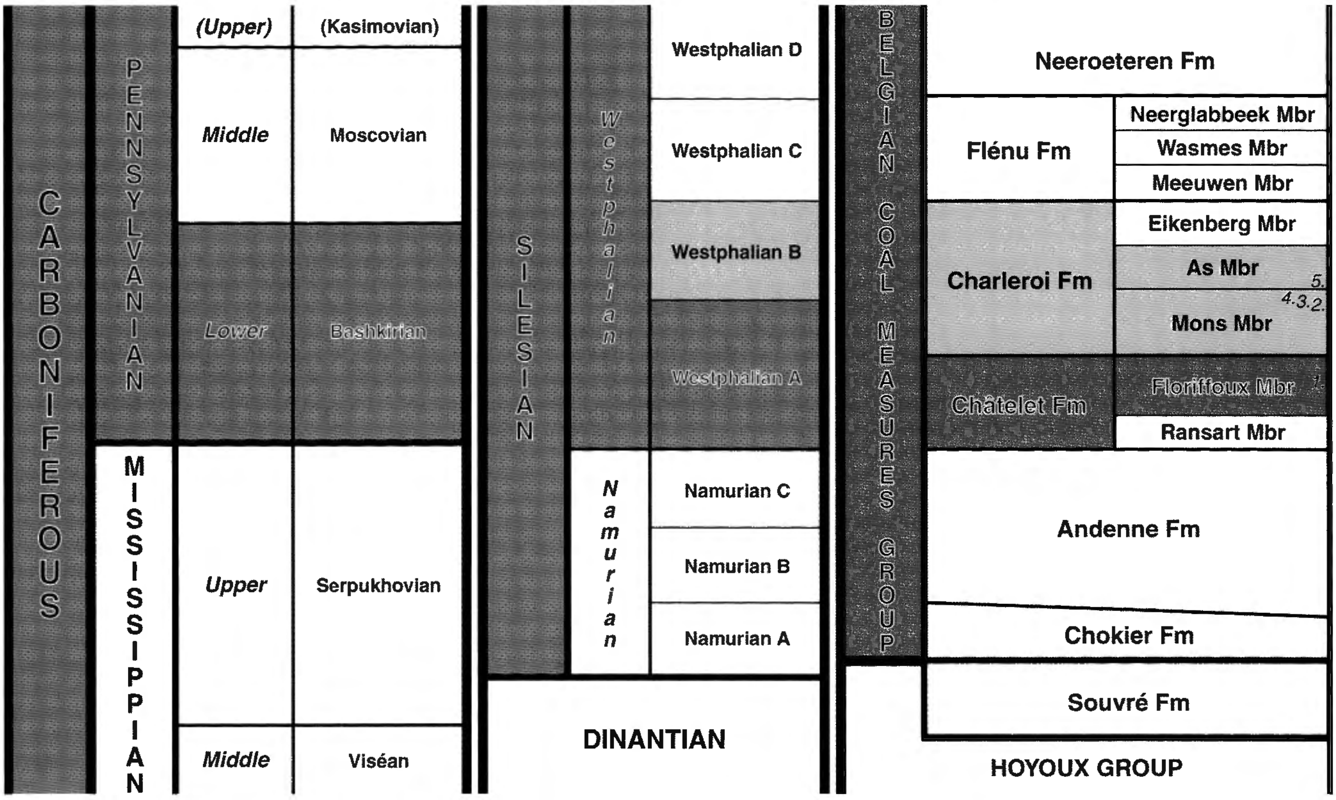

Fig. 2 — Stratigraphy of the late Carboniferous Belgian Coal Measures Group in the Campine Basin. Ages and units relevant to *A. dumonti* are indicated in dark grey. Units containing other eurypterids, and that do not overlap with the occurrence of *A. dumonti* are in light grey. Left column shows the internationally agreed chronostratigraphical division of the late Carboniferous. Late Pennsylvanian deposits are not represented in Belgium. Therefore, the Kasimovian is put in brackets, and the Gzhelian is omitted. Middle column shows the traditional late Carboniferous time-scale as still often used in Belgium. The Stephanian is omitted because no deposits of this age are known in Belgium. Right column shows the lithostratigraphic division of the late Carboniferous in the Campine Basin. Italic numbers on the right hand side of the column denote the approximate stratigraphical distribution of Belgian Carboniferous eurypterids: *1. A. dumonti*; *2. A. corneti*; *3. A. moyseyi*; *4. M. mathieui*; *5. A. cambieri.* Lithostratigraphic division adapted from DELMER *et al.* 2001.

core sample. The original orientation of the core sample is not indicated, so the way-up of the eurypterid is not known. The bedding planes intersect the core at an angle of around 70°, suggesting the beds originally had a dip of around 20° if the core was drilled vertically. Photographs were taken using a Nikon D100 digital SLR camera. The part was photographed initially under alcohol and subsequently with a coating of ammonium chloride, while the counterpart was photographed dry (the old glue was too brittle and fragile for alcohol) and coated with ammonium chloride. *Camera lucida* drawings were made using a Wild stereoscope with a drawing tube attachment. Morphological terminology follows TOLLERTON (1989) and higher systematics follows TETLIE (2004). The following abbreviations are used in the text and figures: c = carapace, ch = chelicerae, cx = coxa, db = dumb-bells, e = eye, gl = genal lobe, o = ocelli, pl = plant fragment, s = spine, t = raised triangle; prosomal appendages are numbered with Roman numerals I-VI, individual podomeres in prosomal appendages 1-9 (1 is the coxa) and opisthosomal segments 1-11 (pretelson and telson not preserved). In the text, short denotation of individual podomeres of appendages is made by combining appendage numbers with podomere numbers, e.g. III-7. All reference to left and right in the text refer to the more complete part unless otherwise stated.

Systematic palaeontology

Order **Eurypterida** BURMEISTER, 1843
Superfamily **Adelophthalmoidea** superfam. nov.
Diagnosis: Small swimming eurypterids with very generalised appearance; carapace parabolic (possible exception *Unionopterus*) with intramarginal eyes; swimming leg of *Adelophthalmus* type; genital spatulae possibly present in all taxa; midsection second order differentiation present; telson lanceolate.
Remarks: TETLIE (2004) informally raised this superfamily based on his cladogram, and encompassing the same genera as suggested here. TETLIE (2004) suggested that this superfamily could be divided into the basal Nanahughmilleridae (*Nanahughmilleria* KJELLESVIG-WAERING, 1961 and possibly *Pittsfordipterus* KJELLESVIG-WAERING & LEUTZE, 1966) with appendages II-V of *Hughmilleria* type, and the more derived Adelophthalmidae (*Parahughmilleria* KJELLESVIG-WAERING, 1961 and *Adelophthalmus*) with reduced spinosity of the appendages. The enigmatic *Unionopterus* might represent the only post-Silurian occurrence of the Nanahughmilleridae if the

appendage spinosity indicated by CHERNYSHEV (1948) was correct.

Family **Adelophthalmidae** TOLLERTON, 1989
Remarks: TOLLERTON (1989) raised this family for *Parahughmilleria*, *Bassipterus* KJELLESVIG-WAERING & LEUTZE, 1966, *Adelophthalmus* and *Unionopterus*, based on having *Adelophthalmus* types of spiniferous (II-V) and swimming (VI) appendages respectively. TETLIE (2004) interpreted *Bassipterus virginicus* KJELLESVIG-WAERING & LEUTZE, 1966, the only known species of *Bassipterus*, as a junior synonym of *Parahughmilleria bellistriata* (KJELLESVIG-WAERING, 1950). As mentioned above, *Unionopterus* was described as having appendages II-V of *Hughmilleria* type although its stratigraphical position would be more consistent with an identity within the Adelophthalmidae. TOLLERTON (1989) claimed that species within *Adelophthalmus* with completely non-spiniferous appendages would constitute a new genus of a new family within the Slimonioidea. A new genus might be warranted, but to erect a new family, and transferring it into the Slimonioidea based on a character loss, which clearly has happened independently in the two clades in question (TETLIE 2004), cannot be defended from a phylogenetic point of view.

Genus ***Adelophthalmus*** VON MEYER, 1853
Diagnosis: Medium sized streamlined eurypterid; carapace parabolic with narrow marginal rim and small, hinged triangular "locking" mechanism anteriorly; intramarginal reniform eyes; ocelli between or slightly behind eyes; prosomal appendages II-V *Adelophthalmus* type; VI swimming leg of *Adelophthalmus* type; metastoma oval; first opisthosomal segment of reduced length and tapering in length laterally; midsection (and usually anterior and posterior) second order opisthosomal differentiation; genital operculum with spatulae; telson long and styliform; dense cuticular sculpture of minute scales (emended from TETLIE & DUNLOP 2005).

Adelophthalmus dumonti (STAINIER, 1917)
Figs. 3-5

Eurypterus sp.; SCHMITZ & STAINIER 1910, pp. 293, 296.
v**Eurypterus dumonti*; STAINIER 1917, p. 646, pl. 53, figs. 1-4.
Eurypterus Dumonti STAINIER; PRUVOST 1930, p. 191.
Eurypterus dumonti STAINER [sic]; MOORE 1936, p. 371.
Eurypterus? *dumonti* STAINIER; KJELLESVIG-WAERING 1948, p. 6.
Adelophthalmus dumonti STAINIER; VAN OYEN 1956, p. 49.
Adelophthalmus derbiensis WOODWARD; VAN OYEN 1956, p. 61.
Adelophthalmus dumonti; PLOTNICK 1983, p. 385.
Unionopterus dumonti; TETLIE 2004, pp. 183, 250, 283.
Unionopterus dumonti; TETLIE & DUNLOP 2005, p. 6.

Diagnosis: Small *Adelophthalmus* with thickened bands distally on podomeres of walking legs; genal lobes on carapace which articulate laterally with second tergite, and correspondingly laterally reduced first tergite; anterior and midsection, but lacking posterior second order opisthosomal differentiation; raised triangle on opisthosomal segment 7.
Type locality: Mechelen-aan-de-Maas (= Maasmechelen), Limburg, Belgium.
Type horizon: Above a thin coal seam, approximately in the middle of the Floriffoux Mbr. of the Châtelet Fm., in the Belgian Coal Measures Group.
Remarks: The suspicion that this species should be assigned to the poorly known *Unionopterus* (TETLIE & DUNLOP 2005) was mainly based on the carapace shape and the broad marginal carapace rim figured by STAINIER (1917). As demonstrated herein, the indicated shape was influenced by an incomplete anterior margin and was not the true carapace shape, while the marginal rim is narrow as in other species of *Adelophthalmus*. Also note that we do not acknowledge the sÿnonymy of *A. dumonti* with *A. derbiensis* WOODWARD, 1907 as suggested by VAN OYEN (1956). *A. derbiensis* itself was synonymized with *A. moyseyi* by KJELLESVIG-WAERING (1948), something we support, but we also note that *A. moyseyi* and *A. dumonti* are very similar (see below).

Description

Almost complete specimen with preserved length 32.5 mm, maximum opisthosomal width 11.5 mm. Preserved part of carapace 7.5 mm long, 9.7 mm wide at posterior margin. Anterior and left carapace margins are incomplete (Figs 3A, 4A). Lateral angle 95°, carapace L/W ratio restored to approximately 0.79, giving a parabolic shape (TOLLERTON 1989). Carapace with very narrow (0.1 – 0.2 mm wide) marginal rim on lateral margins. Right eye well-preserved and reniform, 1.2 mm long. The ocelli are positioned between the eyes on the counterpart (Fig. 4B). On the right postero-lateral carapace corner of the part (Fig. 4A), a large rounded genal lobe projects posteriorly. A curious cardioid (heart-shaped) depression (Fig. 4A) is positioned between the eyes and the anterior carapace margin; interpreted as representing very unusual preservation of the chelicerae (see below). Four partial podomeres of left appendage II may possibly be observed. Poorly preserved remains of appendage II extend past the carapace margin on the right and this appendage evidently did not extend far beyond the margin. No podomere details can be seen on this appendage. Appendage III is preserved on both sides. On the right, podomeres III-4 to III-7 (for podomere abbreviations, see Fig. 4C) are probably preserved, although podomere boundaries are not seen (Fig. 4B). On the left, some of the carapace has been broken away (Figs 3A, 4A), exposing more of the proximal podomeres, and eight podomeres (coxa to III-8) can be seen (Fig. 4C). Appendage IV is best preserved on the left where coxa to IV-8 can be seen; on the right only a fragment is present. Appendage V is only preserved on the left, and seven podomeres (V-2 to V-8) are preserved. V-7 has the proximal end of a very large spine preserved. The podomeres do not have crenulated distal margins, but a thickened distal margin is

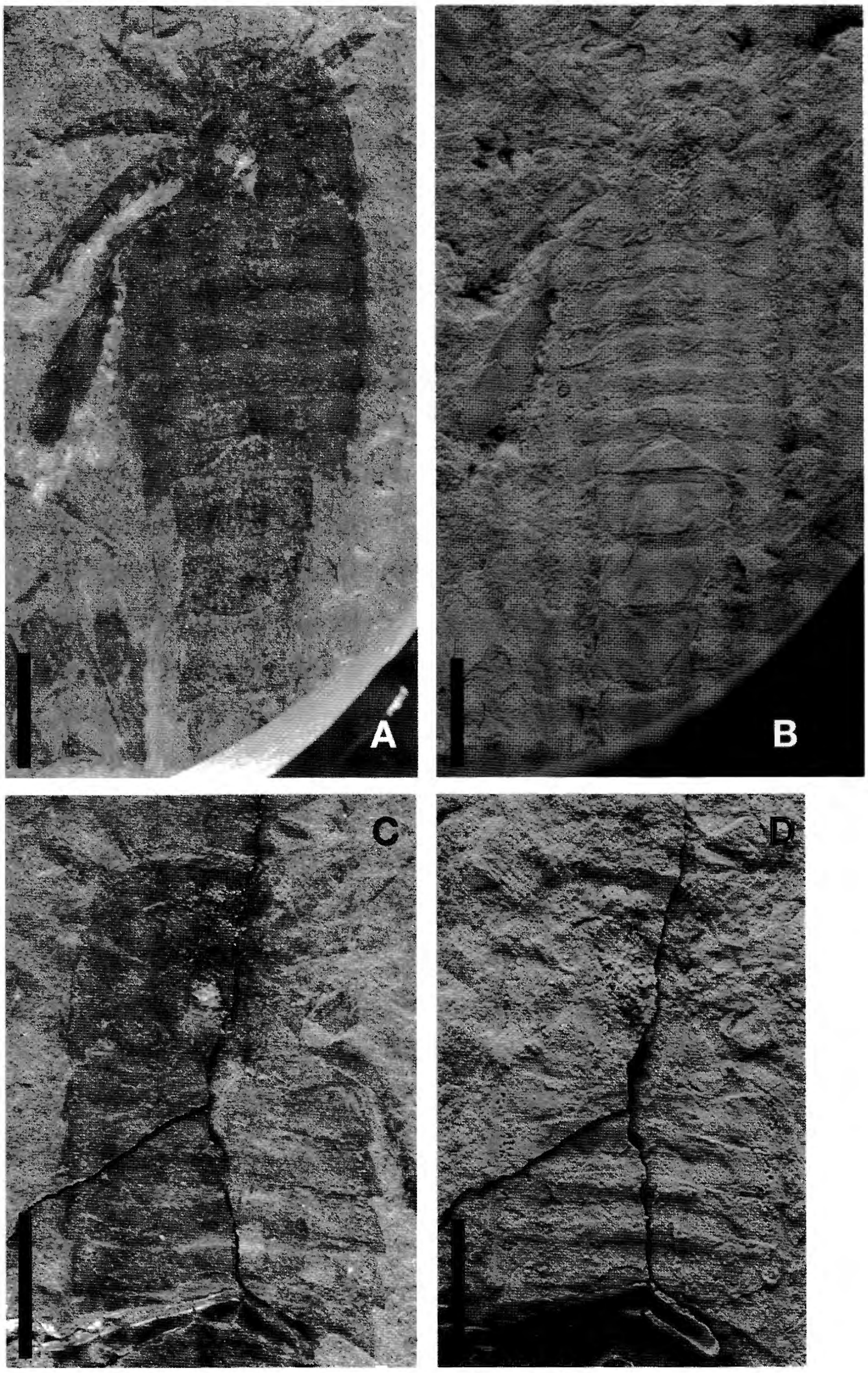

Fig. 3 — *Adelophthalmus dumonti* (STAINIER, 1917). A) Photograph of RBINS a7706 (part) submersed in alcohol; B) Photograph of RBINS a7706 (part) coated with ammonium chloride; C) Photograph of RBINS a7706 (counterpart) taken under normal conditions; D) Photograph of RBINS a7706 (counterpart) coated with ammonium chloride. Scale bars are 5.0 mm.

observed on several podomeres on appendages IV and V. The podomere lengths (parallel to longest axis of appendage) and widths (perpendicular to longest axis of appendage) in mm of appendages III-V on the left side are: III-2 0.5/1.2*; III-3 0.8/1.4*; III-4 0.8/1.3*; III-50.9/1.1*; III-6 0.7/1.0*; III-7 0.7/0.6*; III-8 0.9*/0.4*; IV-2 0.6/1.5; IV-3 1.1/1.3; IV-4 1.0/1.3; IV-5 1.0/1.2; IV-6 0.9/1.0; IV-7 0.9/0.8/ IV-8 0.3*/0.4; V-2 0.6*/1.4*; V-3 1.0/1.5; V-4 1.4/1.5; V-5 1.8/1.3; V-6 2.0/1.0; V-7 2.1/0.8 V-8 0.9*/ 0.5 (* denotes measurement of incomplete podomeres).

Posterior to the eyes, on the carapace and extending onto the anterior opisthosomal segment, two depressions mimic the outline of the posterior parts of coxae VI. Appendage VI also has podomeres 7, 7a and 8 preserved on the left side, and a minute notch in VI-8 suggest the position of VI-9. Proximally, the podomeres between the

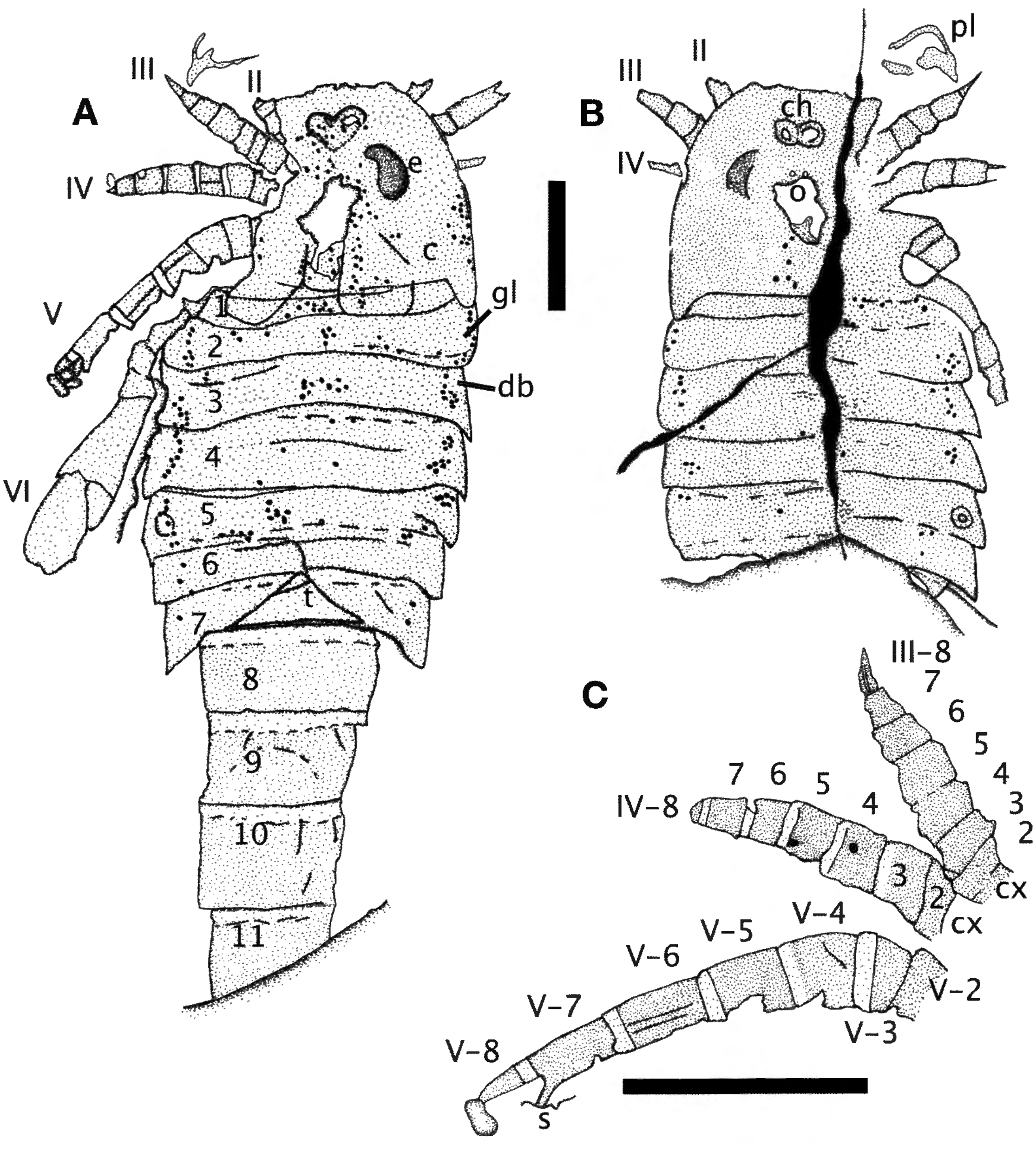

Fig. 4 — *Adelophthalmus dumonti* (Stainier, 1917). A) *Camera lucida* drawing of RBINS a7706 (part); B) *Camera lucida* drawing of RBINS a7706 (counterpart); C) details of the appendages exposed on the left side of the part. Scale bars are 5.0 mm.

coxa and VI-7 are present, but partly covered by tergites and their outlines cannot be identified. The posterior margin of the metastoma is interpreted as relatively straight or truncated.

The anterior opisthosomal segment is strongly reduced in length compared to the more posterior ones, and is surrounded by genal lobes, almost giving the appearance of being incorporated into the carapace. The postero-lateral corner (genal lobe) of the carapace surrounds the entire anterior segment, so the carapace articulates with the second opisthosomal segment laterally. The second segment lacks lateral epimera just like the anterior segment. The following segments become wider until the opisthosoma reaches its maximum width on the fourth segment. Gradually, these segments develop longer epimera until those of the seventh segment. On the seventh segment, a median raised area forms a triangle with its apex pointing towards the carapace. There is a moderate first order opisthosomal differentiation (Tollerton 1989). The four anterior-most segments (8-11) represent the incomplete postabdomen. As in most eurypterids, these segments are narrower, but longer than the segments in the preabdomen. The segments in the postabdomen have no epimera preserved. The preserved segment lengths (along the midline) and widths in mm are: 1) 0.6/9.3*; 2) 1.3/11.0*; 3) 1.8/10.9*; 4) 3.0/11.5; 5) 1.7/11.2; 6) 1.4/10.4; 7) 1.9/9.5; 8) 3.9/6.6; 9) 3.4/5.4; 10) 3.7/5.2; 11) 3.2*/4.2 (* denotes measurement of an incomplete segment). The pretelson and the telson are not preserved as they were outside of the area covered by the core, but comparison with other species of *Adelophthalmus* (e.g. *A. imhofi* Reuss, 1855) suggest that this species probably

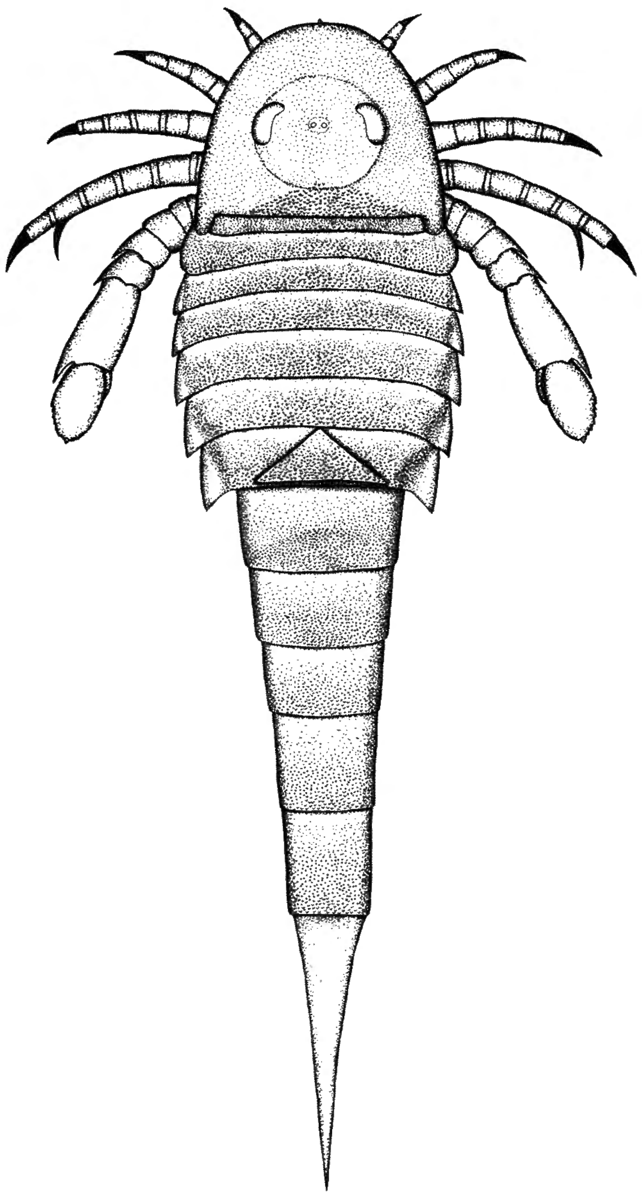

Fig. 5 — Dorsal reconstruction of *Adelophthalmus dumonti* (STAINIER, 1917) based on RBINS a7706 and a pretelson and telson based on the presumably closely related *Adelophthalmus imhofi*.

also had a relatively long, lanceolate telson and we have reconstructed it as such (Fig. 5).

Taphonomy

A number of post-mortem changes have affected this eurypterid, which misled STAINIER in his original description. The identification of these is a stark reminder that taphonomical processes were not understood by most earlier authors and older publications are therefore occasionally inaccurate in the information they portray. Illustrations are sometimes idealised, to the extent that, rather than being a reliable depiction of the specimen, they reflect the author's personal views on what the fossil should actually look like. It is therefore imprudent to place too much emphasis on illustrations without re-examining the fossil. As previously mentioned, STAINIER's (1917) description is defective on many counts. First, the anterior carapace margin was interpreted as complete by STAINIER (1917). This is certainly not the case, and the jagged anterior and left-hand margins suggest that the animal might have been scavenged prior to fossilisation. From the partially complete right-hand margin, it is clear that the carapace was more or less parabolic, as in other species of *Adelophthalmus*, not trapezoid as suggested by STAINIER (1917).

Second, as the carcase decomposed, small (0.1 – 0.2 mm) crystal bundles, or "dumb-bells" (BRIGGS & WILBY 1996) were formed along the lateral margins, the oral cavity and anterior parts of the digestive system. 'Dumb-bells' are very early diagenetic features, starting to form three days after death in shrimp carcases (BRIGGS & KEAR 1994). They are originally composed of aragonite, but aragonite is less stable than calcite and all 'dumb-bells' found in fossils have been recrystallised to calcite (BRIGGS & KEAR 1994). We have not analysed the composition of the suspected 'dumb-bells' in this fossil. They are commonly found in association with phosphatization, but nothing resembling phosphatized muscle tissue was identified in the Belgian eurypterid. These 'dumb-bells' (Figure 6) were identified as ornamentation by STAINIER (1917). No 'dumb-bells' are seen on the postabdomen, which had thicker, annulate segments, a condition not favourable for aragonite precipitation as pH would become too low following decomposition of the locally more abundant organic material (BRIGGS & WILBY 1996). 'Dumb-bells' are most commonly developed in restricted marine conditions, but have also been found previously in specimens from a non-marine (lacustrine) setting at Las Hoyas, Spain (BRIGGS & WILBY 1996). The Belgian Carboniferous occurrence is the oldest example of 'dumb-bells' from a non-marine locality. The specimen has ornamentation, seen on the counterpart consisting of fine scales as typical for the genus. This was not mentioned by STAINIER (1917) who largely ignored the relevance of the counterpart, stating that: "the counterpart of the fossil is fractured and incomplete, and therefore of little use for palæontological purposes" (STAINIER 1917, p. 639).

Fig. 6 — Dumb bells on right side, third and fourth segments of *Adelophthalmus dumonti* (STAINIER, 1917) holotype, RBINS a 7706.

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