

Rediscovery of the forgotten de Ryckholt Collection (gastropods, bivalves, worms; Late Cretaceous, Belgium)

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ABSTRACT

A significant part of the collection of mid- and Late Cretaceous (Cenomanian, Campanian and Maas-trichtian) gastropods, bivalves and worms described and/or illustrated by de Ryckholt in his seminal work *Mélanges paléontologiques* between 1854 and 1862, has recently been retraced in the historical collections at Liège University. Of the original collection, more than 206 specimens, including 196 nominal types (lectotypes and genotypes), all considered lost, are now available. The genotypes of the gastropod genera *Tudicula* de Ryckholt, 1862a and *Prosopostoma* de Ryckholt, 1862a are photographically illustrated for the first time. *Prosopostoma bucculans*, from the Cenomanian Bernissart Formation (formerly 'Tourtia de Tournai'), is here chosen as the type species of the genus *Prosopostoma*, a possible stromboid. We also reassess the stratigraphic age of the type localities under the revised stratigraphic framework of Belgium and a detailed account on the research history of this material, in order to provide a thorough scientific background for future study of this formidable collection.

Keywords: Cenomanian; Campanian; Maastrichtian; Gastropods; Bivalves; Worms

1. Introduction

De Ryckholt's papers (1851, 1854, 1860-1862a) rank among the first monographs on Cretaceous invertebrate faunas from western Europe. Collectively, De Ryckholt proposed six hundred forty-two new taxonomic names for reception of its material. These fossils were collected at now generally inaccessible localities (Fig. 1) and span the extensive crises in the marine realm during the Cenomanian (e.g. Harries, 1993; Eaton et al., 1997; Coccioni and Galeotti, 2003; Voigt et al., 2006; Wilmsen et al., 2007), whose effects on gastropods are still poorly understood (Ruban, 2013). This abundant data has however never been reassessed, notably because this material was considered lost. The recent recovery of a significant part of this abundant Cretaceous material within the historical collections at Liège University, which house a large number of invertebrates and vertebrates from the Cretaceous of southern Belgium but also from elsewhere in western Europe (e.g. France, Germany, the Netherlands, the British Isles; Mottequin et al., 2012), is therefore of interest.

De Ryckholt's studies remain largely unknown to the palaeontological community for three reasons: (1) only five sets of the three books are available worldwide according to Rosenberg and Petit (1987); (2) de Ryckholt — as we shall demonstrate below — frequently idealised and embellished the line drawings of his specimens; (3) few palaeontologists from Belgium and surrounding countries took interest in Cretaceous part of these collections. As a consequence, much of these rich assemblages have not been thoroughly studied since de Ryckholt's original publications, and constitute an unprecedented opportunity to investigate the taxonomy, diversity and turnover patterns of mid-Cretaceous gastropods.

The aim of the present paper is threefold: (1) to assess the geological and stratigraphic setting of these collections under the modern stratigraphic framework of Belgium; (2) to provide the historical account and research history of this collection; (3) to present the available material and supply photographs of key specimens for the first time, notably the type specimens of the gastropod genera *Prosopostoma* de Ryckholt, 1862a and *Tudicula* de Ryckholt, 1862a.

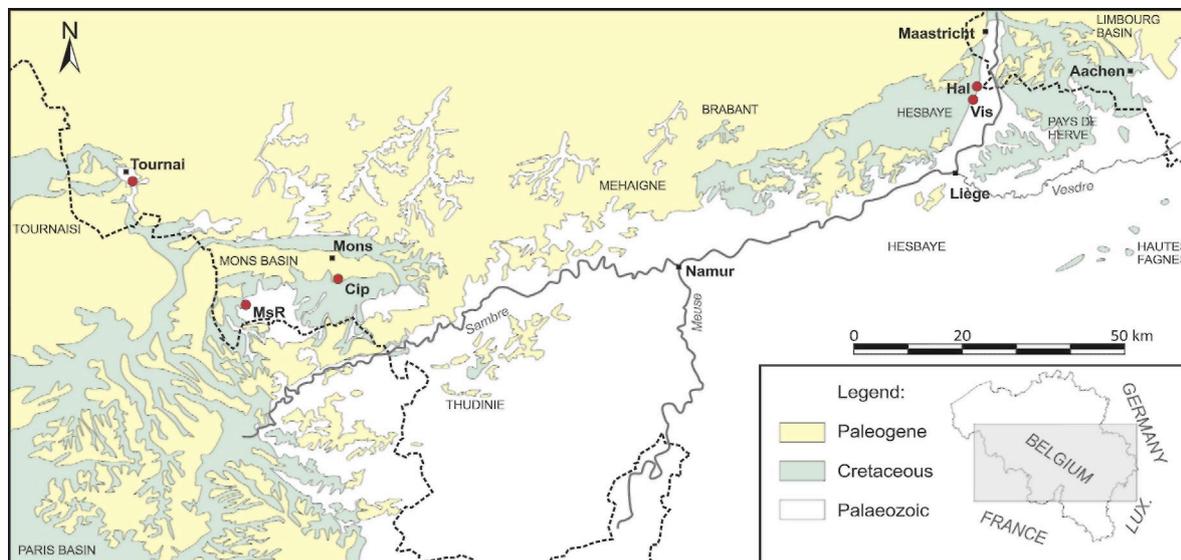
2. Material, methods and history of research

The Chevalier and Baron Philippe Louis François Joseph Adrien de Bounam de Ryckholt was a peculiar character, who lived during the second part of the nineteenth century. Neither palaeontologist nor geologist, not even naturalist, the Baron de Ryckholt was an aristocratic amateur who spent the final years of his life as a fossil collector (Rosenberg and Petit, 1987). He lived in the town of Tournai (Belgium) where he assembled an important collection of invertebrate fossils from Tournaisian (Lower Carboniferous), Upper Cretaceous and Paleocene strata. His collection was also completed by fossils from coeval stratigraphic levels elsewhere in Belgium, namely the Mons (Montignies-sur-Roc, Angre, Ciply) and Visé areas (Malaise, 1860), as well as

various molluscs and worms from the Devonian, Jurassic and Paleogene of Belgium. As a knowledgeable amateur, he described his numerous fossils in a huge work entitled, 'Elucubrations paléontologiques'. This strange French name, once meaning 'long-lasting work', now has a totally different connotation, often in the pejorative sense of 'foolish incongruous work'. A year later, de Ryckholt presented his manuscript to the Belgian Academy of Science. Dumont and Cantraine (1848), two eminent scientists, reviewed the manuscript and accepted it for publication in the 'Mémoires couronnés et Mémoires des Savants Etrangers de l'Académie des Sciences de Belgique'. The subsequent tome, published in 1851 under the title 'Mélanges paléontologiques, première partie' (de Ryckholt, 1851), comprises 176 pages and 10 plates. The second part of the 'Mélanges paléontologiques' (de Ryckholt, 1854) was submitted to the reviewers in 1854, but published the same year by the author who used his personal funds to this end. This second part comprises 205 pages and 9 plates. The third part (de Ryckholt, 1860—1862a) is composed of 15 plates, executed between 1860 and 1862, but devoid of text. In fact, the text was never published and probably never written, the plates having been sent out by de Ryckholt to his colleagues (Crosse, 1863; Rosenberg and Petit, 1987). In addition to the 'Mélanges paléontologiques', de Ryckholt published five articles, namely one on Carboniferous polyplacophorans (de Ryckholt, 1845), one on the classification of cephalopods and brachiopods (de Ryckholt, 1852), one on the importance of shelly faunas for palaeontology (de Ryckholt, 1862b), one on Carboniferous tunicates and polyplacophorans (de Ryckholt, 1862c) and, finally, one on the gastropod genus *Craspedotus* (de Ryckholt, 1862d, see Fig. 2).

In the two first parts of the 'Mélanges paléontologiques', de Ryckholt described and figured c. 75 gastropod species of Devonian, Carboniferous, Jurassic and Cretaceous age, six Palaeozoic bellerophonitids, c. 160 Devonian to Paleogene bivalve species, six species of Devonian, Cretaceous and Paleogene worms, ten Devonian and Carboniferous brachiopod species, ten scaphopod species of Devonian, Carboniferous and Cretaceous age, two Carboniferous polyplacophorans and one Devonian conulariid. In the third part, 297 Cretaceous gastropods are illustrated. In total, de Ryckholt (1851, 1854, 1860-1862a) described and illustrated 642 species, inclusive of 19 new genera and 564 new species.

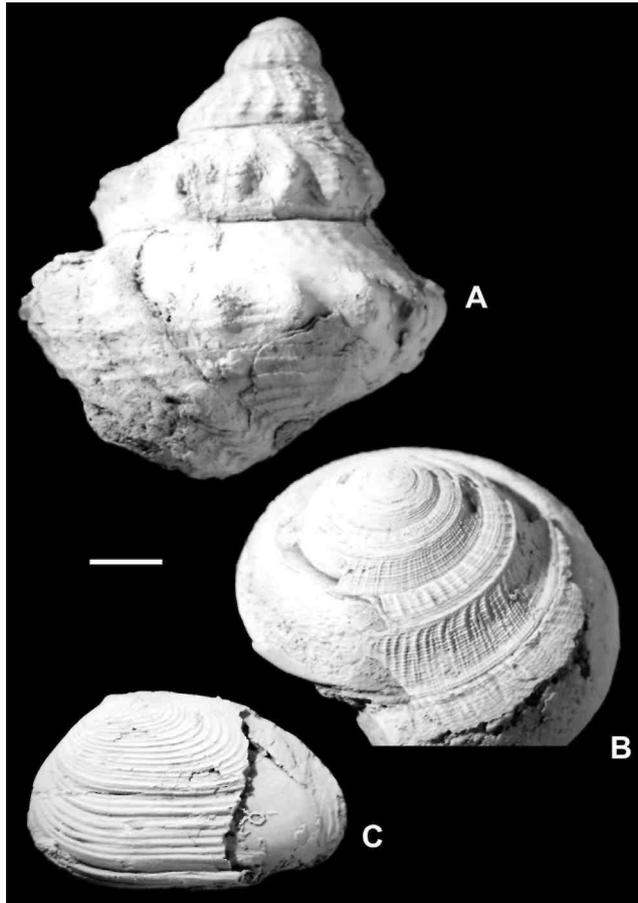
Fig. 1. Geological map of southern Belgium and surrounding areas, with position of localities cited in the text (red dots) (modified from de Béthune, 1954). Legend: MsR: Montignies-sur-Roc, Cip: Cipli (Mons Basin), Hal: Halembye, Vis: Visé (Liège-Limburg Basin). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article)



Rosenberg and Petit (1987) discussed the validity of de Ryckholt's taxa with respect to the International Code of Zoological Nomenclature. Their conclusion was that the 564 taxa were valid because they were cited — albeit rarely — in the subsequent literature. These authors indicated at least seven authors who used de Ryckholt's names during the nineteenth and twentieth centuries. Cornet and Briart (1866) cited the species in their list of Cretaceous faunas, transferring some species to other genera. The same list was used by Dewalque (1868) and Mourlon (1881). Cornet and Briart (1873), Ubaghs (1879), Holzappel (1887), Fritsch (1910), Zahálka (1911), Vincent (1930) and Neave (1939) cited and discussed several of de Ryckholt's taxa. Finally, Ruhoff (1980), in his review of fossil molluscs, introduced de Ryckholt's taxa in his synonymy lists. Rosenberg and Petit (1987) also recorded the nineteen genera erected by de Ryckholt and discussed one, *Tudicula* de Ryckholt, 1862a. More

recently, Vokes (1980), Abdel-Gawad (1986), Bartho-lomaeus (1996), Hoare (2002), Vermeij et al. (2004), Sigwart (2007), Pocklington and Coates (2010), Donovan and Van den Hoek Ostende (2011) and Donovan and Jagt (2013) used and/or discussed taxon names created by de Ryckholt, mainly the Palaeozoic and late Mesozoic ones. Godefroid et al. (2006) discussed and illustrated a single type specimen of a so-called Carboniferous scaphopod from de Ryckholt's collection.

Fig. 2. A. *Craspedotus capistratus* de Ryckholt, 1861, ULg 9592 (lectotype; specimen illustrated by de Ryckholt, 1861, pi. 27, fig. 2), lateral view, Montignies-sur-Roc, Bernissart Formation. B. *Pleurotomaria cymoploca* de Ryckholt, 1861, ULg 9677 (lectotype; specimen illustrated by de Ryckholt, 1861, pi. 31, figs. 22-22), detail of ornament, Tournai, Bernissart Formation. C. *Astarte mutabilis* de Ryckholt, 1854, ULg 10859a (lectotype; illustrated by de Ryckholt, 1854, pi. 15, figs 23-24), Montignies-sur-Roc, Bernissart Formation. Scale bar equals 5 mm.

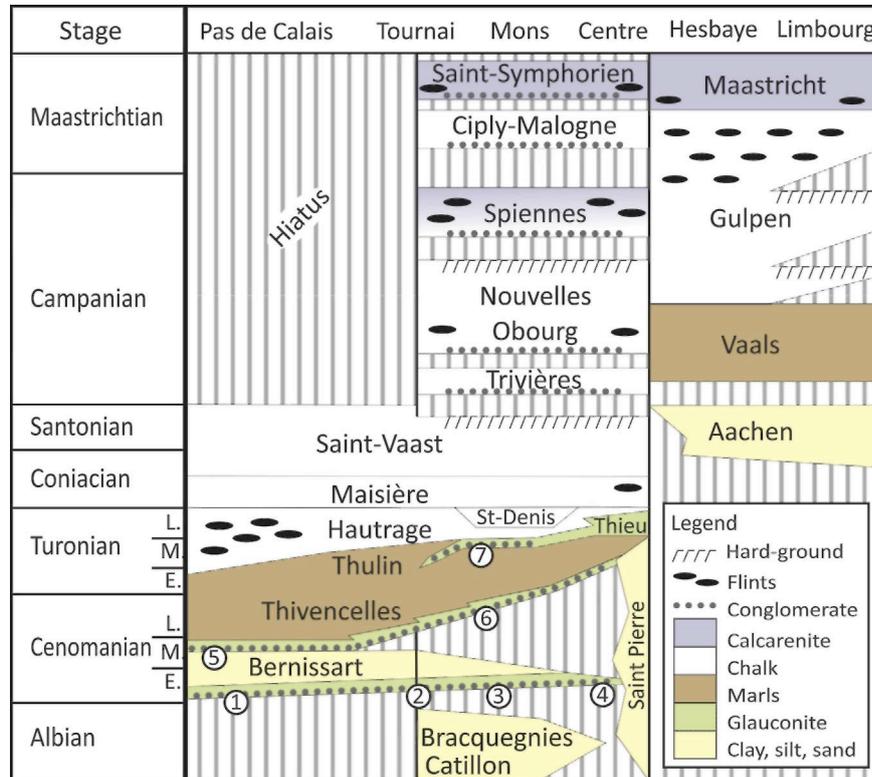


The Mesozoic and Cenozoic taxa were assumed to have been lost. After de Ryckholt's death, his collection became dispersed. Dewalque (1879) indicated that he bought the Silurian and Devonian fossils, and that the Carboniferous collection went to the Institut Royal des Sciences Naturelles de Belgique at Brussels (Belgium) where it still is today (S. Goolaerts, pers. comm., January 2013). The University of Liège purchased the Cretaceous fossils.

Those of Cenozoic age were obtained by the palaeontologist, A. Thielens, according to Dewalque (1879), who also added that he received these fossils from Thielens when the latter left Belgium. Subsequently, Liège University inherited Dewalque's collection when he retired. Thus the whole non-Carboniferous collection of de Ryckholt (489 specimens, of which 429 correspond to type specimens) should be housed in the collections of Liège University. So far, we have been fortunate enough to trace portions of the Cretaceous material described by de Ryckholt in a part of the university collection that was left uncurated since the nineteenth century. Two hundred and six specimens were recovered, including 192 lectotypes (Figs. 2 and 5) and two genotypes (*Tudicula* and *Proso-postoma*), the others being illustrated material of species previously described. The remaining 223 specimens have not been traced yet and we doubt that they are really in the collections of the University of Liège. Already in 1987, Rosenberg and Petit, referring to personal communication by the late

Annie V. Dhondt, former curator at the Institut royal des Sciences naturelles de Belgique at Brussels, indicated that many of de Ryckholt's species are not present among his material and sometimes do not even occur at the type localities indicated by him.

Fig. 3. Stratigraphic distribution and age of Cretaceous formations of Belgium and surrounding areas in France and the southeast Netherlands (modified from Robaszynski et al., 2001, with additions from Amédéo and Robaszynski (2010) and Kennedy et al. (2011)). Numbers refers to 'tourtia' horizons: 1: Pas-de-Calais Tournai, 2: Hautrage, 3: Tournai, 4: Montignies-sur-Roc, 5: Valentienne, 6: Mons, 7: Maubeuge.



The collection newly found in Liège is mainly composed of gastropods (Figs. 2A-B and 5) from the mid-Cretaceous 'Tourtia de Tournai' (Bernissart Formation) from Tournai and Montignies-sur-Roc (Mons Basin, southern Belgium). The 'Tourtia de Tournai' is a conglomeratic level, formed of pebbles of pre-Cenomanian rocks in a chalky, marly or sandy matrix, often ferruginous or glauconitic (e.g. Amédéo and Robaszynski, 2010; Kennedy et al., 2011). Additional material includes bivalves (Fig. 2C) and worms from the 'Tourtia de Tournai', but also from Cibly and Visé areas (Campanian and Maastrichtian; see Fig. 1). For a complete list of taxa reference is made to Appendix 1 (online supplementary data).

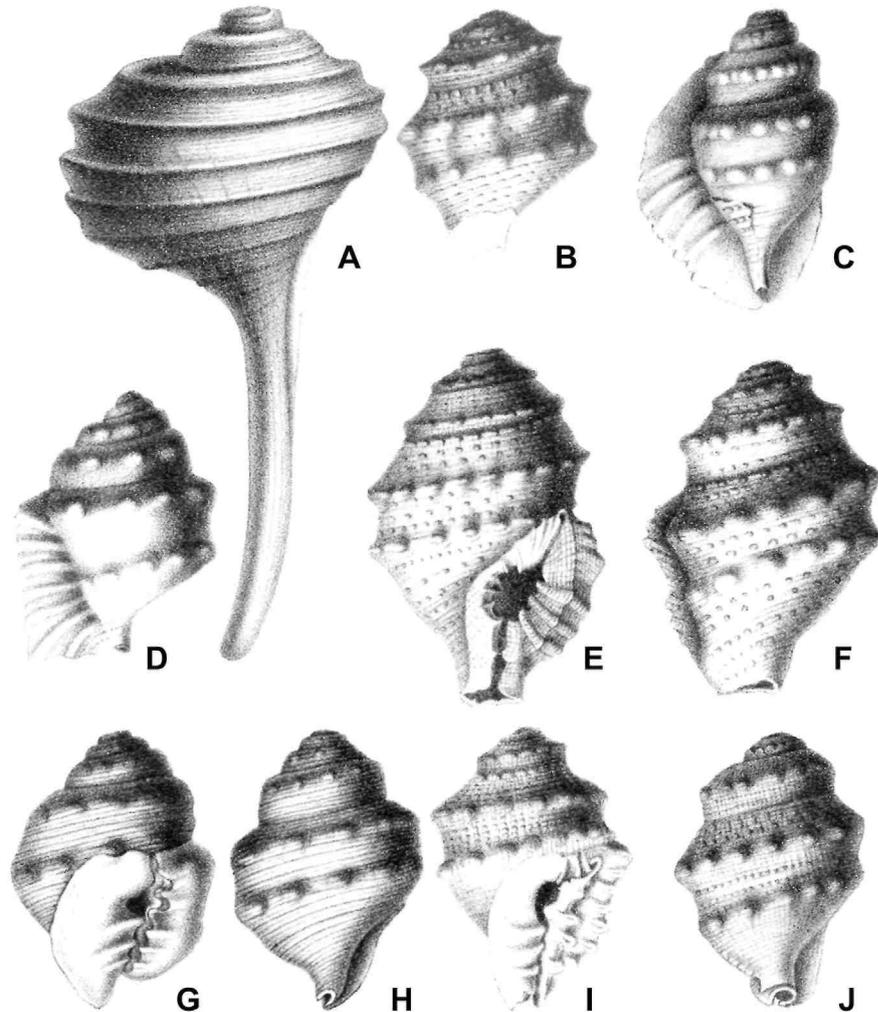
The numerous quarries in the Tournai area, the type locality of the Lower Carboniferous Tournaisian Stage, also penetrate the Cretaceous 'Tourtia' (Bernissart Formation) (Fig. 3) resting unconformably on the Palaeozoic basement. At Tournai and Montignies-sur-Roc, the 'Tourtia' yielded an Early (*Mantelliceras mantelli* Zone) to early Middle Cenomanian assemblage (*Turrilites costatus* Sub-zone, *Acanthoceras rhotomagense* Zone according to Kennedy et al., 2011). Thus, it is not Turanian in age as previously stated by de Ryckholt. This gastropod fauna is of wide interest considering the biotic crises affecting marine invertebrates during the Cenomanian (e.g. Bilotte, 1989; Harries and Little, 1999; Skelton et al., 2003; Monnet, 2009), and the poorly understood response of gastropods to these events (Ruban, 2013).

The fossils from the Cibly area (Mons Basin) most probably stem from the Cibly-Malagne and Saint-Symphorien formations (Early to Late Maastrichtian based on coleoid assemblages; see Robaszynski et al., 2001), the 'Senonian' Stage of the former authors, including de Ryckholt.

The fossils labelled 'Visé' come from the eastern part of Belgium (Liège-Limbourg Basin). The Visé quarries (type locality for the Viséan Stage) also expose Upper Cretaceous strata, and the fossils are from the Early Campanian Vaals Formation, which consists of argillaceous and glauconitic chalks in this area, and the chalky Gulpen Formation of early Late Campanian to Early Maastrichtian age, based on coleoid and ammonite

assemblages (e.g. Jagt, 1989, 1999; Keutgen, 2011).

Fig. 4. Copies of original line drawings of species of *Tudicula* and *Prosopostoma* illustrated (without scale) by de Ryckholt (1862a). A. *Tudicula amphinemalis* (de Ryckholt, 1862a) (pl. 33, fig. 8), ULg 9809, lateral view, Vaals Formation, Visé. B. *Prosopostoma bucculans* de Ryckholt, 1862a (pi. 36, fig. 8), ULg 9732, lateral view, Bernissart Formation, Montignies-sur-Roc. C. *Prosopostoma pudens* de Ryckholt, 1862a (pl. 36, fig. 3), ULg 9727, lateral view, Bernissart Formation, Montignies-sur-Roc. D. *Prosopostoma ridens* de Ryckholt, 1862a (pl. 36, fig. 9), ULg 9733, lateral view, Bernissart Formation, Montignies-sur-Roc. E-F. *Prosopostoma ringens* de Ryckholt, 1862a (pl. 36, figs 1-2), not found in the ULg collections, apertural and lateral views, probably Bernissart Formation, probably Montignies-sur-Roc. G-H. *Prosopostoma sibilans* de Ryckholt, 1862a (pl. 36, figs 6-7), ULg 9730, apertural and lateral views, Bernissart Formation, Montignies-sur-Roc. I-J. *Prosopostoma silens* de Ryckholt, 1862a (pi. 36, figs 4-5), ULg 9728, lateral view, Bernissart Formation, Montignies-sur-Roc.



3. Results

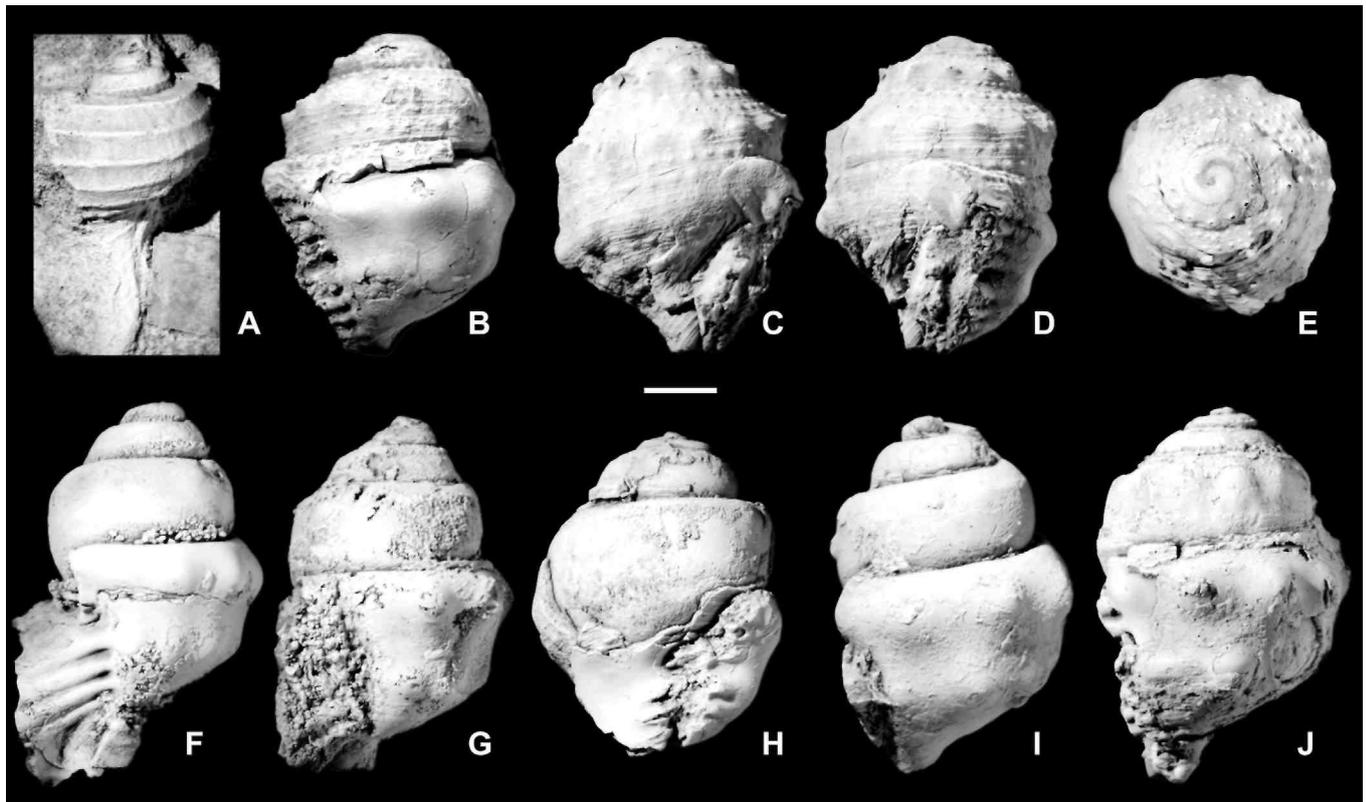
As noted above, the material described by de Ryckholt was illustrated in line drawings but caveats are necessary regarding the figured specimen, which were idealised, sometimes even to a great extent. Imagination is needed to recognise the fossil from the drawing(s), particularly where internal/external moulds or shell fragments are concerned. Rosenberg and Petit (1987) already highlighted this; this is why we have chosen to illustrate several taxa of the de Ryckholt's collection next to the original drawings (Fig. 2).

Tudicula amphinemalis de Ryckholt, 1862a (Figs. 4 and 5A) is the type species of the genus *Tudicula* de Ryckholt, 1862a. The latter was discussed by Dodge (1957), and subsequently by Rosenberg and Petit (1987), who concluded that *Tudicula* de Ryckholt, 1862a was a junior objective synonym of *Tudicula* Röding, 1798. *Tudicula* H. and A. Adams, 1864 was renamed *Tudivasum* by Rosenberg and Petit (1987) to avoid any

confusion. Hence, Rosenberg and Petit (1987) never examined the type specimen of *Tudicula* as it was assumed lost, and based their interpretation exclusively on pi. 33, fig. 9 in de Ryckholt (1862a). The specimen, which is labelled ULg 9805, is photographically illustrated here for the first time (see Fig. 5A). However, Kiel (pers. comm., July 2013) has doubts about the attribution of a Cretaceous neogastropod to the recent genus *Tudicula* Röding, 1798. The discussion remains open.

The genus *Prosopostoma*, introduced by de Ryckholt in June 1862a without description, contains six species (Fig. 4B-J): *P. bucculans*, *P. pudens*, *P. ridens*, *P. ringens*, *P. sibilans* and *P. silens* (see de Ryckholt, 1860-1862a, pl. 36, figs 1-9). De Ryckholt did not designate any type species for his genus. Four of the six species are based on internal moulds; the shell is preserved in *P. bucculans* and *P. sibilans*, but only the latter is complete and shows fine ornament. The type specimen of *P. bucculans* (specimen ULg 9732) is herein chosen as the genotype of the genus *Prosopostoma*. Based on the original illustration, Rosenberg and Petit (1987) proposed that the genus belonged to the Stromboidea or Tonnoidea. We suggest placement of *Prosopostoma* in the former superfamily because of the typically ragged opening and the humpy ornament of the shell, which are frequently encountered in other stromboideans (Kreipl et al., 1999). Rather than giving a systematic description of *Prosopostoma*, we made the choice of only figuring the type material (Fig. 5), together with some other specimens of de Ryckholt's collection (Fig. 2) as a base for further comparisons.

Fig. 5. A. *Tudicula amphinemalis* (de Ryckholt, 1862a) (pi. 33, fig. 8), ULg 9809 (lectotype) in lateral view, Vaals Formation, Visé. B-E. *Prosopostoma bucculans* de Ryckholt, 1862a (pl. 36, fig. 9), ULg 9732 (lectotype) in lateral, apertural, 'semi-apertural and apical views, Bernissart Formation, Montignies-sur-Roc. F. *Prosopostoma pudens* de Ryckholt 1862a, ULg 9727 (lectotype) in lateral view, Bernissart Formation, Montignies-sur-Roc. G. *Prosopostoma ridens* de Ryckholt, 1862a, ULg 9733 (lectotype) in lateral view, Bernissart Formation, Montignies-sur-Roc. H-I. *Prosopostoma sibilans* de Ryckholt, 1862, Bernissart Formation, Montignies-sur-Roc; H. ULg 9730 (lectotype) in apertural and lateral views; I. ULg 9731 in lateral view. J. *Prosopostoma silens* de Ryckholt, 1862a, ULg 9728 (lectotype) in lateral view, Bernissart Formation, Montignies-sur-Roc. Scale bar equals 5 mm.



4. Conclusions

The recent recovery among the large palaeontological collections of the Liège University of a significant part of the Cretaceous specimens described and/or illustrated by de Ryckholt between 1851 and 1862, allows us to provide, for some of them, the first photographic illustrations, notably those of the type species of the Cretaceous (Cenomanian) gastropods *Tudicula* de Ryckholt, 1862a and *Prosopostoma* de Ryckholt, 1862a. The type species of *Prosopostoma* is chosen among the six species assigned to this genus by de Ryckholt (1860-1862a), namely *P. bucculans*.

Acknowledgements

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.cretres.2013.10.002>.

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