Reassessment of the Bivalvia (Mollusca) from the Boom Formation (Rupelian, Oligocene) of Belgium, with description of new species

by Robert MARQUET

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Abstract

The bivalve species found in the Boom Formation (Rupelian, Early Oligocene) in Belgium are taxonomically revised. The distribution of the species over the Members and beds of this Formation is detailed. Of the 39 species occurring in the Boom Formation, 11 are recorded for the first time in Belgium, four of which are new to science: *Semierycina (Semierycina) kruibekensis* nov. sp., *Scacchia (Scacchia) dufraingi* nov. sp., *Thracia (Thracia) vanremoorteli* nov. sp. and *Cardiomya (sensu lato) annamariae* nov. sp. The large majority of the species seems to be endemic to the North Sea Basin. It is attemped to link the distribution of the species to ecological conditions (especially bathymetry) of the different beds.

Keywords: Bivalvia, Mollusca, Rupelian, new species.

Résumé

La taxinomie des espèces de bivalves trouvées dans la Formation de Boom (Rupélien, Oligocène Inférieur) de Belgique est révisée. La distribution des espèces dans les Membres et couches de cette Formation est détaillée. Des 39 espèces trouvées dans la Formation de Boom, 11 sont citées ici pour la première fois en Belgique et quatre sont nouvelles pour la science : *Semierycina (Semierycina) kruibekensis* nov. sp., *Scacchia (Scacchia) dufraingi* nov. sp., *Thracia (Thracia) vanremoorteli* nov. sp. et *Cardiomya (sensu lato) annamariae* nov. sp. Une grande majorité des espèces semble endémique pour le Bassin de la Mer du Nord. Les liens potentiels entre la distribution des espèces et les conditions écologiques (particulièrement la bathymétrie) des differents couches sont discutés.

Mots-clefs: Bivalvia, Mollusca, Rupélien, nouvelles espèces.

Introduction

The mollusca of the Boom Clay in Belgium have been studied since the nineteenth century by DE KONINCK (1838), NYST (1835, 1845) and VINCENT (1930). GLIBERT (1957) completely reviewed this fauna, along with the Belgian Chattian one, and, hence, contributed much to the general understanding of mollusc diversity in the Belgian Oligocene. However, as GLIBERT entirely relied upon the late 1950's stratigraphic classification

Etages	***Horizon* (provinces of Vlaams Brabant and Antwerp)**	***Horizon* (Province of Limburg)**
Chattien		Voort Sand
Rupélien	Assise de Boom	
	Horizon à *Nucunella taxandrica*	Horizon à *Nucula comta*
	Sables de Berg	
Tongrien	Sables de Kerkom	Sables de Vieux-Joncs
	Sables de Bautersem	Glaises de Henis
	Horizon à Vertébrés de Hoogbutsel	
		Sables de Neerrepen
		Sables de Grimmertingen

Fig. 1 – Stratigraphic division of the Oligocene, used by GLIBERT & DE HEINZELIN (1954) and GLIBERT (1957). Nomenclature in French.

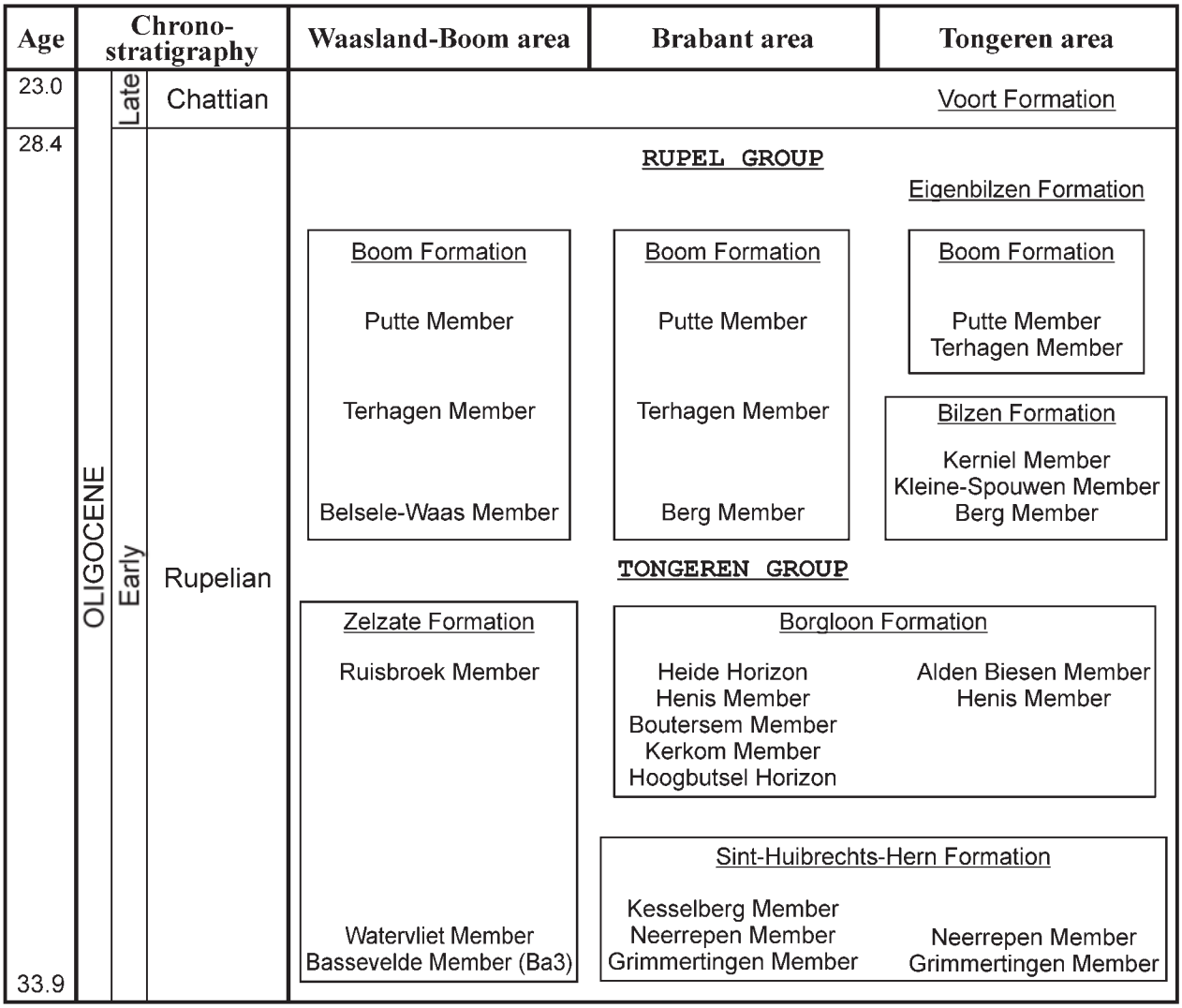


Fig.2 – Current lithostratigraphic subdivision of the Belgian Oligocene in the three main outcrop areas (after STEURBAUT, 1992 and VANDENBERGHE *et al.*, 2003).

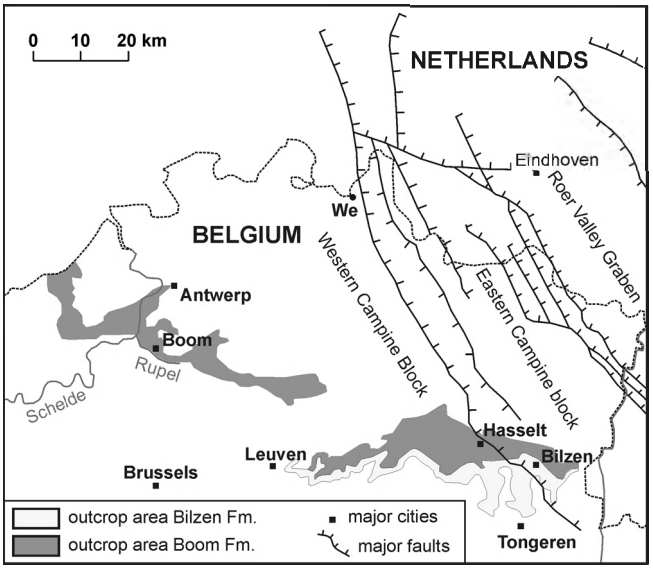
of the Belgian Oligocene, which was not yet very detailed (Fig. 1), his work did not give further insight in mollusc distribution throughout the Boom Clay. Moreover, GLIBERT's material, which is housed in the IRSNB (Brussels), was surface collected, so that the smaller species escaped attention.

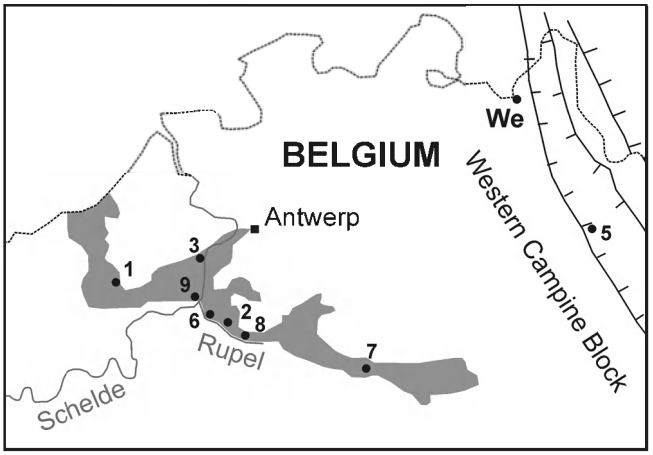
The microstratigraphy of the Boom Clay was unravelled only much later, in the late 1970's (VANDENBERGHE, 1978). The unit appeared to consist of an alternation of clay and silt beds, including large concretations, known as septaria. It was given Formation status in the late 1980's and was subdivided into three Members, in ascending order, the Belsele-Waas Member, the Terhagen Member and the Putte Member (VANDENBERGHE & LAGA, 1986; VANDENBERGHE & VAN ECHELPOEL, 1988) (Fig. 2). The beds with septarian nodules were numbered and their position within the Members was specified. The biostratigraphy of the Boom Formation and the position of the successive septaria-levels (S-levels) was summarised in DE MAN *et al.* (2004), and updated in DE MAN (2006) (Fig. 4).

This totally new stratigraphic context, together with the introduction of sieving techniques, has led to a precise positioning of the new mollusc finds and to the discovery of small-sized species, among which several are new to science. All bivalve species, collected in the Boom Formation by the present author, and these housed at the IRSNB, are discussed in the present paper, including taxonomic and stratigraphical comments and, if necessary, synonomy lists. More than two thirds (29 out of 39) of the Bivalve species from the Boom Clay are figured herein. This paper also aimed at specifying the distribution of all species known so far over the different Members and levels.

Material and methods

The material studied was collected in six localities: Belsele (Sint Niklaas, prov. Oost-Vlaanderen, SVK claypit: map-sheet 15/5-6; x = 132.725, y = 205.000), Kruibeke (prov. Oost-Vlaanderen, Gralex claypit: map-sheet 15/3-4; x = 146.500, y = 208.540), Rumst (prov. Antwerp, Wienerberger claypit: map-sheet 23/3-4; x = 153.550, y = 197.780), Niel (prov. Antwerp, Ceulemans claypit: x = 149.150, y = 199.850), Steendorp (prov. Oost-Vlaanderen, Wienerberger claypit: map-sheet 15/5-6; x = 142.380, y = 202.110) and Lubbeek (prov. Vlaams Brabant, Roelants claypit: map-sheet 32/3-4, x = 181.750, y = 173.100) (Fig. 3). A small quantity of residue from the boring Mol (prov. Antwerp: map-sheet 17/1-2; x = 198.350, y = 211.750) could also be studied. Details of the quarries are given in VANDENBERGHE, 1978, STEURBAUT & HERMAN, 1978 and VANDENBERGHE & VAN ECHELPOEL, 1988.





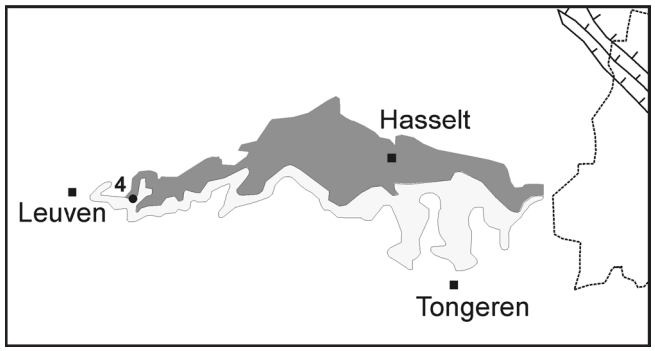


Fig. 3 – Outcrop of the Oligocene in Belgium (after VAN SIMAEYS & VANDENBERGHE, 2006), with localities mentioned in the text (in alphabetical order). 1 = Belsele and Sint Niklaas, 2 = Boom, 3 = Kruibeke, 4 = Lubbeek, 5 = Mol, 6 = Niel, 7 = Putte, 8 = Rumst + Terhagen, 9 = Steendorp, We = Weelde borehole.

In each of the pits samples were taken in the rather sandy septarian levels, not in the clayey levels, which contain few fossils. The material was dried, soaked and sieved at 1 mm mesh. This procedure was repeated until only fossils and pyrite material were left. In the Ceulemans pit at Niel, the method of sampling was somewhat different. In this quarry several large fossilised tree trunks were found. In the vicinity of these trunks (mostly a little above the S30 septarian level), concentrations of fossil material were discovered.

Most molluscan material collected during the recent campaigns was filled with pyrite; the majority of the specimens were bivalved, so in many cases it was not possible to see the inside of the shells. The shells found near fossilised wood also differ at that point, being mostly represented by loose valves without pyrite.

Furthermore, the bivalves from the Boom Clay present in the IRSNB collection were studied. A list of this material can be found in GLIBERT (1955); after this publication, no new material was added to the IRSNB Oligocene bivalve collection. In the present paper, GLIBERT's descriptions are not repeated, only the material collected during the present survey is discussed. The material studied by GLIBERT (1955) was collected solely by surface picking, often in a selective manner, as it has been done for over a century; consequently, it contains hardly any material smaller than 1 cm, whereas rare species are often overrepresented in comparison with the number of common species. The material collected during the author's survey contains mostly species smaller than 1 cm, with no overrepresentation of rare ones; some rare species were not found again. Consequently, this material gives a better insight into the real relative abundance of species.

Systematic palaeontology

In this paper, "locus typicus" is used when a holotype, lectotype or neotype was designated or when the first description was based on material from one locality. "Original localities" is used when the original description was based on material of several localities and no type has been designated. The nomenclature is after BOUCHET *et al.* (2010). Abbreviations:

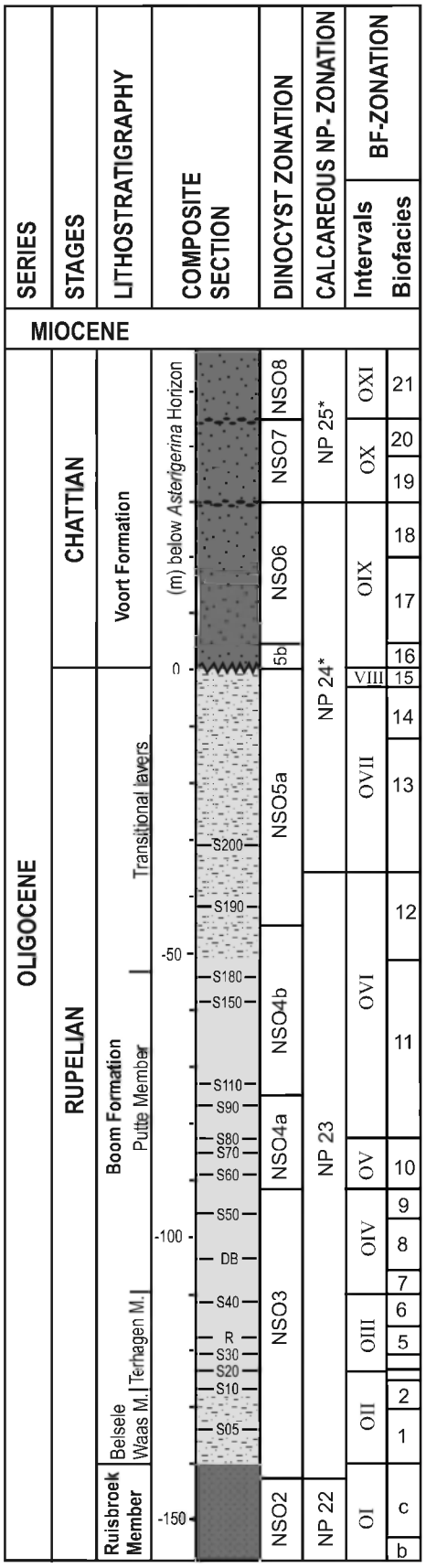


Fig. 4 – Position of the successive septaria-levels (S-levels) and biostratigraphy of the Boom Formation (after De Man *et al.*, 2004, updated in De Man, 2006).

sp = specimen, fr = fragments, H = height, L = length, HD = hemidiameter (diameter of single valve), D = diameter (of bivalved specimen).

Classis Bivalvia Linnaeus, 1758
Subclassis Protobranchia Pelseneer, 1889
Ordo Nuculida Dall, 1889
Superfamilia Nuculoidea Gray, 1824
Familia Nuculidae Gray, 1824
Subfamilia Nuculinae Gray, 1824
Genus and subgenus *Nucula* Lamarck, 1799

Type species: *Nucula nucleus* Linnaeus, 1758

Nucula (Nucula) orbignyi Glibert, 1955
Pl. 3, Fig. 1

1955 – *Nucula orbignyi* Nyst - Glibert, p. 2.

Type material: Holotype IRSNB IST 4502.
Locus typicus: Boom, prov. Antwerp, Belgium.
Stratum typicum: Boom Formation, Rupelian, Early Oligocene.
Description: See Glibert (1957, p. 10, pl. 1, fig. 3).
Occurrence: Most specimens were found in the lower levels of the Boom Formation (S10 to S30), but the species was also found in the late Rupelian boring at Mol.

Nucula (Nucula) duchasteli Nyst, 1835
Pl. 3, Fig. 2

1835 – *Nucula Duchastelii*, Nob. - Nyst, p. 16, pl. 3, fig. 64.

Type material: Lectotype IRSNB IST 4501.
Locus typicus: Boom, prov. Antwerp, Belgium.
Stratum typicum: Boom Formation, Rupelian, Early Oligocene.
Description: See Glibert (1957, p. 11, pl. 1, fig. 4).
Occurrence: Glibert (1957) mentioned 12 localities in the Rupel area, Antwerp and Oost Vlaanderen provinces and Pellenberg in the province of Vlaams Brabant. This and foregoing species are, according to Glibert (1957), equally common, which is not in accordance with our data: *Nucula duchasteli* Nyst, 1835 seems to be much more common. Specimens were found from S30 to S60, so that it only in S30 coexists with the previous species.

Familia Sareptidae STOLICZKA, 1870
Subfamilia Pristiglominae VERRILL & BUSH, 1898
Genus *Pristigloma* DALL, 1900

Type species: *Glomus nitens* JEFFREYS, 1876

Pristigloma sphaerica (VON KOENEN, 1868)
Pl. 1, Fig. 2

1868 – *Leda ? sphaerica* V. KOENEN - VON KOENEN, p. 96, pl. 27, fig. 7, pl. 28, fig. 4.
1957 – *Nuculana ? sphaerica* KOENEN, sp. 1868 - GLIBERT, p. 12.
1975 – *Portlandia* (s. l.) *sphaerica* (VON KOENEN, 1868) - VAN DEN BOSCH, CADÉE & JANSSEN, p. 122, pl. 1, fig. 4.
2000 – *Yoldiella sphaerica* (KOENEN, 1868) - MOTHS, p. 43, pl. 15, fig. 3.

Material: GLIBERT (1957) mentioned the species from three localities in the Rupel Formation of the Antwerp province: Hemiksem, Kontich and Steendorp. Later it was found only at Mol, -225 m (1 fragment).
Original localities: Joachimsthal and Hermsdorf, Germany.
Stratum typicum: Rupelian, Early Oligocene.
Dimensions: Pl. 1, Fig. 2 (coll. IRSNB IST 7259): H - 2.4 mm, L - 2.6 mm, D - 1.8 mm.
Description: Very small, rather flat, elliptical species, equivalve and nearly equilateral. Very fragile. Length only slightly exceeding height. Anterior as well as posterior margins rounded, both lacking a rostrum. Umbo only slightly protruding, lying slightly before half of dorsal margin. Growth lines indistinct. Interior characters invisible because the specimen studied is filled with pyrite.
Remarks: The species is here included in the genus *Pristigloma* DALL, 1900 because it lacks a rostrum and has V-shaped teeth, as observed in specimens from the Rupelian of Winterswijk (The Netherlands). *Pristigloma* is a genus found in deep water (MOORE, ed., 1969, p. 239).
Occurrence: This species seems to be limited to the Early Oligocene and the Rupelian-Chattian transition layers in the North Sea Basin, but it is always very rare.

Ordo Solemyida DALL, 1889
Superfamilia Manzanelloidea CHRONIC, 1952
Familia Manzanellidae CHRONIC, 1952
Genus *Nucinella* WOOD, 1851

Type species: *Nucinella ovalis* WOOD, 1840

Nucinella microdus (BOETTGER, 1869)
Pl. 1, Fig. 8

1869 – *Pleurodon microdus* BOETTG. - BOETTGER, p. 17, pl. 1, fig. 3.
1871 – *Pleurodon microdus* BOETTG. - BOETTGER, p. 42, pl. 8, fig. 3.

Material: Kruibeke: S41 (3 sp.), S50 (26 sp.), Niel: S30 (driftwood) (29 sp.), S41 (7 sp.), S50 (12 sp.), Rumst: S41 (7 sp.), S50 (9 sp.), Steendorp: S41 (11 sp.), Mol: -225 m (1? sp.).
Locus typicus: Offenbach, Hessen, Germany.
Stratum typicum: "Rupelton", Rupelian, Early Oligocene.
Dimensions: Pl. 1, Fig. 8a (coll. IRSNB IST 7269): H - 2.3 mm, L - 2.1 mm, HD - 1.6 mm, Pl. 1, Fig. 8b (coll. IRSNB IST 7270): H - 3.1 mm, L - 2.6 mm, HD - 1.9 mm, Pl. 1, Fig. 8c (coll. IRSNB IST 7271): H - 3.5 mm, L - 2.8 mm, HD - 2.0 mm,.
Description: Very small, equivalve, inequilateral, obtuse, rather solid shell. Length 75-90 % of height. Dorsal margin short, arched, passing into anterior and posterior margins at a distinct angle. Anterior margin short, straight, ventral regularly curved and passing imperceptibly into rounded posterior margin. Ornament only consisting of weak concentric growth lines, some of which can become more pronounced. Umbo distinctly protruding. Left valve with 8 teeth. Anterior tooth very small, nearly imperceptible. Central teeth relatively long, highest tooth central, broadest close to anterior margin. Strongly elongated tooth present low on anterior margin. Right valve with same number of teeth, but with two elongated anterior teeth and only 6 teeth below the umbo. Hinge line distinctly broadening below largest teeth. Very fine irregular tubercles present on hinge line.
Remarks: Several other species of this family occur in the Oligocene and Neogene of North Sea Basin. *Nucinella cincta* VON KOENEN, 1893 (p. 1070, pl. 79, figs 13-15) occurs in the German Lattorfian and in the Belgian Grimmertingen Sand Member (GLIBERT & DE HEINZELIN, 1954, p. 321, pl. 1, fig. 11). This species is relatively broader, anterior margin and ventral margin form an angle and the hinge has less teeth. *Nucinella dobergensis* (LIENENKLAUS, 1891) (see MÜLLER & WELLE, 1991, p. 154, pl. 4, figs 6-7 and MOTHS, 2000, p. 45, pl. 15, fig. 7) (= *Pleurodon zinndorfi* ZILCH, 1937) is broader and shorter, with only three short teeth in the central hinge part. The Neogene *Nucinella ovalis* (WOOD, 1840) is narrower, the number of teeth is lower and the shell is less angular.
Occurrence: This species has been found before only in

the Rupelian Clays of the Mainz Basin. Although it is rather common in the Belgian Boom Formation, it has not been recorded before. Most specimens occur in the Putte Clay Member, the S30 material was found near a fossil tree.

Superfamilia Solemyoidea H. & A. ADAMS, 1857
Familia Solemyidae H. & A. ADAMS, 1857
Genus and subgenus *Solemya* LAMARCK, 1818

Type species: *Tellina togata* POLI, 1795

"***Solemya (Solemya) obovata*** VON KOENEN, 1868"

Remarks: GLIBERT (1957, p. 13) mentioned the presence of 8 specimens in the IRSNB collection from Kontich, Antwerp province, Boom Formation. On inspection, these however proved to be badly damaged, all lacking umbo and hinge. The specimens are twice as large as *S. obovata*, higher in relation to length and they show radial ornament on part of the shell. This material in reality belongs to *Barbatia multistriata* (DE KONINCK, 1838).

Ordo Nuculanida
CARTER, D. C. CAMPBELL & M. R. CAMPBELL, 2000
Superfamilia Nuculanoidea H. & A. ADAMS, 1858
Familia Nuculanidae H. & A. ADAMS, 1858
Subfamilia Nuculaninae H. & A. ADAMS, 1858
Genus *Saccella* WOODRING, 1925

Type species: *Nucula commutata* PHILIPPI, 1844

Saccella westendorpi gracilis (DESHAYES, 1860)
Pl. 1, Figs 3-4

1837 – *Nucula striata* GOLDFUSS, p. 157, pl. 125, fig. 15 (*non* LAMARCK).
1837 – *Nucula minuta* GOLDFUSS, p. 158, (*pars*, *non* BROCCHI).
1837 – *Nucula nitida* GOLDFUSS, p. 159, pl. 125, fig. 23 (*non* BROCCHI).
1860 – *Leda gracilis* DESHAYES, p. 831, pl. 64, figs 24-26.
1863 – *Leda gracilis* DESHAYES - SANDBERGER, p. 345, pl. 28, fig. 5.
1868 – *Leda gracilis* DESH. - VON KOENEN, p. 94.
1884 – *Leda gracilis* DESH. - SPEYER & VON KOENEN, pl. 17, figs 6-11.
1907 – *Leda gracilis* DESHAYES - RAVN, p. 259, pl. 1, fig. 11.
1907 – *Leda westendorpi* NYST - RAVN, p. 259, pl. 1, fig. 12.
1941 – *Leda gracilis* DESHAYES - GÖRGES, p. 161.
1942 – *Leda (Ledina) westendorpi* (NYST) - HEERING, p. 19, pl. 2, figs 12-14.
1942 – *Leda (Ledina) gracilis* DESHAYES - HEERING, p. 259, pl. 2, figs 15-16.
1943 – *Leda (Leda) gracilis* DESHAYES - ALBRECHT & VALK, p. 109, pl. 9, figs 322-325.
1949 – *Nuculana gracilis* DESH. - GILLET, p. 53, textfig. 11.
1952 – *Leda (Ledina) gracilis* DESHAYES 1860 - GÖRGES, p. 12.
1954 – *Leda* (s.s.) *gracilis* DESHAYES - GLIBERT & DE HEINZELIN, p. 318.
1954 – *Leda (Ledina) gracilis* DESHAYES - HEERING, p. 19, pl. 2, fig. 6.
1957 – *Nuculana gracilis* DESHAYES, sp. 1860 - GLIBERT, p. 11, pl. 1, fig. 6.
1962 – *Nuculana westendorpi* NYST - HÖLZL, p. 42, pl. 1, figs 7-9.
1973 – *Nuculana (Nuculana) westendorpi* (NYST, 1839) - NEUFFER, p. 15, pl. 1, fig. 14.
1974 – *Nuculana (Saccella) gracilis* (DESHAYES, 1860) - RINGELÉ, p. 51, pl. 3, fig. 1.
1979 – *Nuculana (Saccella) westendorpi* NYST 1839 - R. JANSSEN, p. 18.
1983 – *Nuculana (Saccella) westendorpi* NYST 1839 - A. MÜLLER, p. 26, pl. 6, figs 7-8.
1987 – *Nuculana (Saccella) westendorpi* (NYST 1839) - SCHNETLER & BEYER, p. 203.
1990 – *Nuculana (Saccella) westendorpi* (NYST 1839) - SCHNETLER & BEYER, p. 46.
1991 – *Nuculana (Saccella) westendorpi* NYST, 1839 - MÜLLER & WELLE, p. 152, pl. 1, fig. 1.
1995 – *Nuculana westendorpi* - GÜRS, p. 197, pl. 35, figs 7-8.
1997 – *Nuculana (Saccella) westendorpi* (NYST, 1839) - WELLE, p. 8.
1998 – *Nuculana (Saccella) westendorpi* (NYST, 1839) - MOTHS *et al.*, p. 6, pl. 1, fig. 4.
1999 – *Nuculana (Nuculana) westendorpi* (NYST, 1839) - WELLE, JAESCHKE & DUCKHEIM, p. 16.
2003 – *Nuculana (Saccella) westendorpi* (NYST, 1839) - WELLE & NAGEL, p. 39.
2008 – *Nuculana (Saccella) westendorpi* (NYST & WESTENDORP, 1839) - SCHNETLER & PALM, p. 11, pl. 1, fig. 4.

Material: Kruibeke: S50 (1 specimen), Lanaken (Limburg Province, Belgium), Kerniel Sand Member (>50 sp.).
Original localities: Jeurres, Etrechy, Morigny, Paris Basin, France.
Stratum typicum: Sables de Fontainebleau, Rupelian, Early Oligocene.
Dimensions: Pl. 1, Fig. 3 (coll. IRSNB IST 7260): H - 2.0 mm, L - 3.0 mm, D - 1.2 mm; Pl. 1, Fig. 4a (coll. IRSNB IST 7261): H - 7.9 mm, L - 4.2 mm, HD - 1.3 mm; Pl. 1, Fig. 4b (coll. IRSNB IST 7262): H - 10.2 mm, L - 4.66 mm, HD - 1.8 mm; Pl. 1, Fig. 4c (coll. IRSNB IST 7263): H - 6.8 mm, L - 3.6 mm, HD - 1.2 mm; Pl. 1, Fig. 4d-f (coll. IRSNB IST 7264): H - 8.3 mm, L - 4.3 mm, HD - 1.5 mm.
Description: Rather small, elongated oval, fragile and rather convex shell. Anterior and ventral margins rounded, posterior margin ending in a distinct rostrum. A weak carina delimits the anterior area; a much more

distinct carina separates the narrow posterodorsal area. Height about 45 % of length. Umbo only slightly protruding, closer to the anterior margin (at about 40 % of length). Outer surface covered by 27 to 32 clear concentric ribs, which are broader than the intercostal areas. Whole surface with pustulose microsculpture. Hinge with a distinct triangular resilifer. Teeth angular in shape. Anterior side with 15 to 17 teeth, posterior with 20 to 25. Pallial line and muscle scars indistinct.
Remarks: This taxon was considered by most authors after 1960 to be a synonym of *Saccella westendorpi westendorpi* from the Miocene of the North Sea Basin (NYST & WESTENDORP, 1839). RINGELÉ (1974) however proved statistically that Miocene and Chattian specimens (Voort, Campine area, Belgium) differ significantly. Oligocene shells have a higher mean number of hinge teeth, the shell is more convex (length/diameter ratio 1.66 versus 1.21-1.48) and the concentric rib pattern is less variable. All Oligocene specimens are completely covered with ribs, while some Miocene specimens have ribs covering the whole shell, but in others only the posterior part is ribbed or only growth lines are present. Oligocene and Miocene populations however differ only slightly in other characteristics, so both are considered here as parts of one evolutionary lineage.
Occurrence: The subspecies *Saccella westendorpi gracilis* is very rare in the Boom Formation, but common in the Kerniel Sand Member. In Chattian deposits it becomes more common again, so this species is limited to sandy deposits, while accidentally a specimen became buried in the Boom Clay. The distribution of the subspecies is limited to the Early and Late Oligocene of the North Sea Basin.

Familia Yoldiidae DALL, 1908
Subfamilia Yoldiinae DALL, 1908
Genus *Portlandia* MÖRCH, 1857

Type species: Nucula arctica GRAY, 1824

Portlandia deshayesiana (NYST, 1835)
Pl. 3, Fig. 3

1835 – *Nucula Deshayesiana* (DUCHASTEL) NYST, p. 16, pl. 3, fig. 63.

Type material: Lectotype IRSNB IST 4503.
Locus typicus: Boom, prov. Antwerp, Belgium.
Stratum typicum: Boom Clay Member, Rupelian, Early Oligocene.
Description: See GLIBERT (1957, p. 12, pl. 1, fig. 7).
Occurrence: This is the most common bivalve species all through the Boom Formation, present in the whole North Sea basin. It seems to be limited to clay deposits.

Subfamilia Yoldiellinae ALLEN & HANNAH, 1986
Genus *Yoldiella* VERRILL & BUSCH, 1897

Type species: *Yoldia lucida* LOVÉN, 1846

Yoldiella pygmaea pygmaea (GOLDFUSS, 1837)
Pl. 1, Fig. 1

1837 – *Nucula pygmaea* GOLDFUSS, p. 157, pl. 125, fig. 17.
1868 – *Leda (Nucula) pygmaea* MÜNST. (GOLDF.) - VON KOENEN, p. 241.
1884 – *Leda pygmaea* MÜNST. - SPEYER & VON KOENEN, pl. 17, figs 4-5.
1907 – *Portlandia pygmaea* MÜ. sp. - RAVN, p. 260, pl. 1, figs 9-10.
1913 – *Portlandia pygmaea* V. MÜNSTER sp. - HARDER, p. 52, pl. 3, fig. 15.
1941 – *Leda pygmaea* v. MÜNSTER - GÖRGES, p. 162.
1942 – *Leda (Jupiteria) pygmaea* (VON MÜNSTER) - HEERING, p. 17, pl. 3, figs 6-7.
1952 – *Leda (Jupiteria) pygmaea* (MÜNSTER 1835) - GÖRGES, p. 11.
1957 – *Nuculana (Jupiteria) pygmaea* (MUNSTER) GOLDFUSS, sp. 1937 - GLIBERT, p. 12, pl. 1, fig. 8.
1973 – *Portlandia (Yoldiella) pygmaea* (MÜNSTER *in* GOLDFUSS, 1837) - NEUFFER, p. 16.
1979 – *Portlandia (Yoldiella) pygmaea* (MÜNSTER, 1837) - R. JANSSEN, p. 19, pl. 1, fig. 3.
1987 – *Portlandia (Yoldiella) pygmaea* (VON MÜNSTER, 1837) - SCHNETLER & BEYER, p. 203.
1990 – *Portlandia (Yoldiella) pygmaea* (VON MÜNSTER, 1837) - SCHNETLER & BEYER, p. 46.
1995 – *Yoldiella pygmaea* (MÜNSTER *in* GOLDFUSS, 1837) - GÜRS, p. 198.
1997 – *Portlandia (Yoldiella) pygmaea* (MÜNSTER, 1837) - WELLE, p. 10.
1998 – *Portlandia (Yoldiella) pygmaea* (MÜNSTER, 1837) - MOTHS *et al.*, p. 6, pl. 1, fig. 3.
1999 – *Yoldiella pygmaea* (MÜNSTER, 1837) - WELLE, JAESCHKE & DUCKHEIM, p. 17.
2000 – *Yoldiella pygmaea* (MÜNSTER, 1837) - MOTHS, p. 43, pl. 15, fig. 4.
2003 – *Yoldiella pygmaea* (MÜNSTER, 1837) - WELLE & NAGEL, p. 40, pl. 1, figs 6-7.

Material: Kruibeke: S20 (1 sp.), S41 (>50 sp.), S50 (>50 sp.); Steendorp: (>50 sp.); Niel: S41 (42 sp.), S50 (20 sp.); Rumst: S41 (>50 sp.), S50 (24 sp.); Mol: -225 m (9 sp.).
Locus typicus: Mecklenburg, Germany.
Stratum typicum: Sternberger Gestein, Chattian, Late Oligocene.
Dimensions: Pl. 1, Fig. 1a (coll. IRSNB IST 7257): H - 2.0 mm, L - 2.8 mm, D - 1.35 mm; Pl. 1, Fig. 1b (coll.

IRSNB IST 7258): H - 2.6 mm, L - 3.65 mm, D - 1.9 mm.
Description: Small, elliptical species, equivalve and inequilateral. Shell tumid, fragile. External surface smooth, except for concentric growth lines, some of which can become more pronounced. Anterior margin regularly curved, posterior pointed and often, but not always, with a rostrum. Umbo distinct, lying at 35-45 % of total length from anterior margin. Height about 65-67 % of shell length. All specimens collected in the Rupel Clay are bivalved and filled with pyrite, so the internal characters of the shell could not be studied.
Remarks: This species was considered as ranging from Early Oligocene to Early Pliocene in the North Sea Basin. MARQUET (2002) however split the material into two taxa: *Yoldiella philippiana wesselinghi* MARQUET, 2002 (Miocene and Pliocene) and *Yoldiella pygmaea* (Oligocene). They were separated on the basis of the rostrum, which is clearly delimited in material from the Sternberger Gestein, but not so in Neogene specimens; this character is however very variable. The shells from the Boom Formation, however, mostly lack a distinct rostrum and subsequently the separation can be put in doubt.
Occurrence: GLIBERT (1957) mentioned Chattian and Miocene localities only, so the species is new for the Boom Formation, in which it is the most common bivalve species, except for *Portlandia deshayesiana* (NYST, 1835). It is still scarce in S20, and is only common from S41 to S50. The species has been found in deposits in Belgium, The Netherlands and Germany, from Early to Late Oligocene and perhaps continues into the Miocene and Pliocene (see above). It does not occur in Oligocene deposits outside the North Sea Basin.

Subclassis Autobranchia GROBBEN, 1894
Superordo Pteriomorphia BUERLEN, 1944
Ordo Arcida GRAY, 1854
Superfamilia Arcoidea LAMARCK, 1809
Familia Arcidae LAMARCK, 1809
Subfamilia Arcinae LAMARCK, 1809
Genus *Barbatia* GRAY, 1842

Type species: *Arca barbata* LINNAEUS, 1758

Barbatia multistriata (DE KONINCK, 1838)
Pl. 3, Fig. 4

1838 – *Arca multistriata* Mihi DE KONINCK, p. 31, pl. 3, fig. 4.

Type material: Lectotype IRSNB IST 4504.
Material: Belsele: S10 (1 sp.), Steendorp: S20 (1 sp.).
Locus typicus: Basel, Oost Vlaanderen, Belgium.
Stratum typicum: Boom Clay, Rupelian, Early Oligocene.
Description: See GLIBERT (1957, p. 13, pl. 1, fig. 9), as *Barbatia decussata* NYST & WESTENDORP, 1839 (*non* SOWERBY). This name however is preoccupied by *Arca decussata*. GÜRS in his unpublished Ph. D. thesis (1995, p. 200) restored the oldest name available, *Arca multistriata* DE KONINCK, 1838.
Occurrence: This species has now been found in only two localities, in the S10 and S20 levels. It is know from Rupelian and Chattian deposits throughout the North Sea Basin. SORGENFREI (1940, p. 18) also mentioned it, with doubt, from the Early Miocene of Klintinghoved, Denmark; without illustration, however, this cannot be ascertained.

Subfamilia Anadarinae REINHART, 1935
Genus *Bathyarca* KOBELT, 1891

Type species: *Arca pectunculoides* SCACCHI, 1929

Bathyarca bellula (WIECHMANN, 1874)
Pl. 1, Fig. 5

1874 – *Arca bellula* WIECHMANN, p. 206, pl. 9, fig. 5.
1893 – *Arca Saxonica* VON KOENEN, p. 1107, pl. 73, figs 9-12.
1893 – *Arca Bundensis* VON KOENEN, p. 1109.
1941 – *Arca bündensis* V. KOENEN - GÖRGES, p. 160, pl. 3, figs 14-15.
1957 – *Bathyarca (Bathyarca) bündensis* (V. KOENEN) - GÖRGES, p. 119, 123.
1975 – *Bathyarca saxonica* (VON KOENEN, 1868) - VAN DEN BOSCH, CADÉE & JANSSEN, p. 122, pl. 1, fig. 5.
1979 – *Bathyarca bellula* (WIECHMANN 1874) - R. JANSSEN, p. 26, pl. 1, fig. 11.
1983 – *Bathyarca bellula* (WIECHMANN, 1874) - A. MÜLLER, p. 27.
1998 – *Batharca bellula* (WIECHMANN, 1874) - MOTHS *et al.*, p. 7, pl. 2, fig. 2.
1999 – *Bathyarca bellula* (WIECHMANN, 1874) - WELLE, JAESCHKE & DUCKHEIM, p. 17.
2000 – *Bathyarca bellula* (WIECHMANN, 1874) - MOTHS, p. 44, pl. 16, fig. 3.

Material: Rumst: S50 (3 sp.), Kruibeke: S50 (10 sp.), Niel: S41 (2 sp.), S50 (2 sp.).
Dimensions: Pl. 1, Fig. 5a (coll. IRSNB IST 7265): H - 2.4 mm, L - 2.7 mm, D - 1.0 mm; Pl. 1, Fig. 5b (coll. IRSNB IST 7266): H - 1.65 mm, L - 1.9 mm, D - 1.25 mm.
Locus typicus: Krefeld, Niederrhein, Germany.
Stratum typicum: Grafenberger Schichten, Early

Chattian, Late Oligocene.
Description: Very small, fragile, tumid, inequivalve and inequilateral shell. Shape oval, dorsal margin straight. Anterior margin more curved than posterior one, which can become nearly straight. Height about 85 % of length. Umbo clearly protruding, nearly at the middle of the dorsal margin, pointing to the anterior side. Ornament consisting of radial and concentric ribs. Radial ribs fine and widely spaced on anterior part, closer to each other near posterior margin, fading in the middle portion of the shell. Concentric ribs narrower than intercostal spaces, in some specimens forming weak scales on anterior and posterior area. Hinge consisting of two bifid anterior and three single posterior teeth, which all run parallel to the dorsal margin. Pallial line indistinct, anterior muscle scar large, reniform, close to the hinge. Posterior muscle scar narrower.
Remarks: This species is recorded here for the first time for the Belgian Oligocene. Miocene to Recent *Bathyarca pectunculoides* (SCACCHI, 1834) differ in the shell ratios (they are lower in relation to length), the umbo lies closer to the anterior margin, the ornament is finer and a distinct plica divides the anterior and posterior parts of the shell (see MARQUET, 2002, p. 26, pl. 9, fig. 2).
Occurrence: This species seems to be limited to the Putte Clay Member of the Boom Formation in Belgium. In Germany it is also recorded in Chattian deposits. It is, again, an endemic species for the North Sea Basin. Contrary to the species mentioned before, this species is usually found as loose valves, no bivalved specimens were encountered.

Familia Glycymerididae DALL, 1808
Subfamilia Glycymeridinae DALL, 1808
Genus *Glycymeris* DA COSTA, 1778
Subgenus *Chevronia*
MOERDIJK & VAN NIEULANDE, 2000

Type species: *Arca obovata* LAMARCK, 1819

Glycymeris (Chevronia) lunulata lunulata
auct. non NYST, 1836
Pl. 1, Fig. 6

Type material: The figure of the species on pl. 4, fig. 29 in NYST (1836) is poor, showing only the outer surface and not the internal characters. This NYST also mentioned in 1845 (p. 250), without further discussing what was wrong with his figure and without providing a new one. The shell figured could not be identified in the Nyst collection at the IRSNB with certainty, but two specimens from Vliermaal probably represent material described by NYST (1836). They, however, undoubtedly belong to the next species treated here. This problem will be discussed in a forthcoming paper on the Grimmertingen Sand Member molluscan fauna.
Material: GLIBERT (1957) recorded 9 specimens from Basel, Boom, Niel, Rupelmonde, Steendorp and Terhagen. Only two juvenile specimens were collected later, in the Ceulemans claypit at Niel, in sediment near driftwood in the S30 septarian level.
Locus typicus: Vliermaal, prov. Limburg, Belgium.
Stratum typicum: Grimmertingen Sand Member, Sint-Huibrechts-Hern Formation, Rupelian, Early Oligocene.
Dimensions: Pl. 1, Fig. 6 (coll. IRSNB IST 7267): H - 60 mm, L - 58 mm, HD - 18 mm.
Description: See *Glycymeris lunulata* NYST, sp. 1836 in GLIBERT (1957 p. 14, pl. 1, fig. 10).
Remarks: Glycymeridae occur in shallow water rather than in deeper water, such as prevailed during deposition of the Boom Formation. The specimens mentioned by GLIBERT (1957) all look strongly eroded and their identification is not absolutely certain. The same applies for the juvenile specimens collected at Niel. However, the material from GLIBERT shows incrustation by pyrite, which shows it originates from the Boom Clay.
Occurrence: Lately only found in S30 in the Boom Clay, but much more common in shallow water sandy Oligocene deposits (Rupelian and Chattian). Probably the material from the Boom Formation was transported over a rather long distance. GLIBERT & DE HEINZELIN (1954) and VON KOENEN (1893) mentioned its occurrence respectively in the Grimmertingen Sand Member and in the Lattorf Stufe. This material belongs to a different species. The subspecies *G. lunulata baldii* GLIBERT & VAN DE POEL, 1965 ranges to the Miocene, but probably the Miocene shells belong to an independant species, *G. baldii*.

Glycymeris (Chevronia) planicostalis
(LAMARCK, 1814)
Pl. 1, Fig. 7

Type material: A lectotype has been designated by GÜRS (1995, p. 206): Lamarck collection in NHM Genf 46069a.
Material: GLIBERT (1957) mentioned 6 shells from Basel, Boom, Noeveren and Rumst. No material was found after these records.
Locus typicus: Jeures near Etampes, Paris Basin,

France.
Stratum typicum: "Stampien", Rupelian, Early Oligocene.
Dimensions: Plate 1, Fig. 7 (coll. IRSNB IST 7268): H - 70 mm, L - 70 mm, HD - 23 mm.
Description: see under the name *Glycymeris obovata* LAMARCK, sp. 1807 in GLIBERT & DE HEINZELIN (1954, p. 331) and R. JANSSEN (1979b, p. 32, pl. 1, figs 17-18).
Remarks: These shells also are eroded and some show pyrite traces, so they probably originated from the Boom Formation.
Occurrence: It is not known in which level GLIBERT's material was found. The species is very common in the Berg Sand Member in the province of Limburg (Belgium), the occasional specimens from the Boom Clay look worn and transported.

Genus and subgenus *Axinactis* MÖRCH, 1861

Type species: *Pectunculus inaequalis* G.B. SOWERBY, 1833

Axinactis angusticostata (LAMARCK, 1807)

Material: GLIBERT (1957, p. 15, pl. 1, fig. 11) figured a shell allegedly from Rumst, clearly belonging to this species, but it is not eroded and it shows no traces of pyrite, so its occurrence in the Boom Formation is far from sure. MARQUET *et al.* (2008) discussed the presence of this species in the Borgloon Formation and concluded that its occurrence in that deposit is doubtful also.

Ordo Pteriida NEWELL, 1965
Superfamilia Pterioidea GRAY, 1847
Familia Isognomonidae WOODRING, 1925
Genus *Isognomon* LIGHTFOOT, 1786

Type species: *Ostrea perna* LINNAEUS, 1767

Isognomon sp.
Pl. 1, Fig. 9

Dimensions: Pl. 1, Fig. 9 (coll. IRSNB IST 7272): L - 23 mm (fragment).
Remarks: GLIBERT (1957, p.16) mentioned the presence of one specimen in the Boom Formation at Niel. From this shell however only part of the hinge is preserved. In the Mainz Basin two *Isognomon* species occur: *I. heberti* (COSSMANN & LAMBERT, 1884, p. 100, pl. 1, fig. 13, type from the Paris Basin "Stampien") and *I. maxillata sandbergeri* (DESHAYES, 1861) (see NEUFFER, 1973, p. 28, pl. 12, fig. 1). With the material at hand it is impossible to ascertain which species is present in Belgium.

Ordo Ostreida FÉRUSSAC, 1822
Superfamilia Ostreoidea RAFINESQUE, 1815
Familia Gryphaeidae VYALOV, 1936
Subfamilia Pycnodonteinae STENZEL, 1959
Genus and subgenus *Pycnodonte* FISCHER VON WALDHEIM, 1835

Type species: *Gryphaea gigantica* SOLANDER *in* BRANDER, 1766

Pycnodonte (Pycnodonte) paradoxa (NYST, 1835)
Pl. 3, Fig. 7

1835 – *Avicula paradoxa*, Nob. NYST, p. 36, pl. 5, fig. 55.

Type material: Lectotype Coll. IRSNB IST 4507.
Material: Rumst: S30 (11 sp.), Niel: S20 (2 sp.), Steendorp: S30 (1 sp.).
Locus typicus: Boom, province of Antwerp, Belgium.
Stratum typicum: Boom Clay Formation, Rupelian, Early Oligocene.
Description: See GLIBERT (1957, p. 21, pl. 1, fig. 16).
Remarks: This species has been found in a limited part of the Boom Clay Formation: it is typical of S20-S30 and consequently of the Terhagen Clay Member. In this level, specimens can be abundant and they form clusters of several individuals, which are preserved nearly always as bivalved specimens.

Ordo Pectinida GRAY, 1854
Superfamilia Pectinoidea RAFINESQUE, 1815
Familia Pectinidae RAFINESQUE, 1815
Subfamilia Palliolinae KOROBKOV, 1960
Tribus Palliolini KOROBKOV, 1960
Genus *Palliolum* MONTEROSATO, 1884

Type species: *Pecten incomparabilis* RISSO, 1826

Palliolum deshayesi (NYST, 1836)
Pl. 3, Fig. 5

1834 – *Pecten pictus* GOLDFUSS, p. 67, pl. 97, fig. 4 (*non* DA COSTA)

1836 – *Pecten Deshayesi*, Nob. NYST, p. 15, pl. 2, fig. 38.

Type material: Lectotype IRSNB IST 3825, figured specimens IRSNB IST 3826, 3827.
Material: Rumst: S20 (4 fr.), Kruibeke: S60 (1? fr.), Steendorp: S30 (1 fr.), Niel: S30 (2 fr.)
Locus typicus: Kleine Spouwen, Limburg, Belgium.
Stratum typicum: Berg Sand Member, Rupelian, Early Oligocene.
Remarks: It has been known for a long time that the name *Pecten pictus* GOLDFUSS, 1834 was preoccupied by *Pecten Pictus* DA COSTA, 1778, p. 144, pl. 9, figs 1, 2, 4, 5 (see for instance NEUFFER, p. 36, infrapaginal note; ROGER, 1944, p. 25, infrapaginal note). The name given by DA COSTA is a synonym of *Aequipecten opercularis* (LINNAEUS, 1758). Because the name of GOLDFUSS has been very widely used for the Oligocene species, no previous author replaced it. There is however a synonym, given only two years later by NYST, which can be used for the species. GLIBERT (1957, p. 19) recorded material from this species from two Boom Formation localities; he separated these as a forma *diomedes* D'ORBIGNY, 1852, characterised by more distinct radial ribs. In view of the variability of the sculpture in Pectinidae, this form is seen here as a synonym, not as a subspecies; the material from the Boom Formation is too scanty to make such a distinction.
Occurrence: With the exception of one doubtful fragment from the S60 bed at Kruibeke, all specimens were found in the lower parts of the Boom Clay: S20-S30.

Palliolum permistum (BEYRICH, 1848)

Original localities: Görzig, Hermsdorf, Brandenburg, Germany.
Stratum typicum: "Septarienton", Rupelian, Early Oligocene.
Description: See VINCENT (1930, p. 4, text-fig. 4).
Remarks: GLIBERT (1957, p. 20) mentioned this species from three localities in the Boom Formation, but it was not found during our survey.

Palliolum delheidi VINCENT, 1930
Pl. 3, Fig. 6

1930 – *Chlamys (Hilberia) Delheidi* nov. sp. - Vincent, p. 6, text-fig. 5.

Type material: Syntypes Coll. IRSNB IST 1806-1807.
Locus typicus: Niel, prov. of Antwerp, Belgium.
Stratum typicum: Boom Formation, Rupelian, Early Oligocene.
Description: See VINCENT (1930, p. 6, text-fig. 5).
Remarks: No material of this species has been found in the recent survey. GLIBERT (1957, p. 19) mentioned it from 3 localities in the Rupel area.

Genus *Hilberia* VON TEPPNER, 1922

Type species: *Pecten soellingensis* VON KOENEN, 1868

Hilberia hoeninghausi (DEFRANCE, 1825)

Type material: Syntypes NHM Genf 3331 (*fide* Gürs, 1995, p. 219).
Material: Kruibeke: S30 (4 fr.), Niel: S30 (19 fr.), Steendorp: S30 (6 fr.), Rumst: S30 (4 fr.).
Locus typicus: Kleine Spouwen, Limburg, Belgium.
Stratum typicum: Berg Sand Member, Rupelian, Early Oligocene.
Description: See GLIBERT & DE HEINZELIN (1954, p. 324) and GLIBERT (1957, p. 17, pl. 1, fig. 12).
Occurrence: Material has now only been found in the S30 septarian level, in which the species is rather common.

Hilberia rupeliensis (VON KOENEN, 1868)

Original localities: Rupelmonde, prov. Oost-Vlaanderen, Belgium; Oberkaufungen near Kassel, Germany.
Statum typicum: Boom Formation, Rupelian, Early Oligocene.
Description: See VINCENT (1930, p. 8, text-figs 6-7) and GLIBERT (1957, p. 17, pl. 1, fig. 14).
Remarks: Of this rare species, which GLIBERT (1957) recorded from 6 localities, no new material was found.

Hilberia stettinensis (VON KOENEN, 1868)

Original localities: Stettin and Neustadt-Magdeburg, Germany.
Stratum typicum: Stettiner Sand, Magdeburg Sand, Rupelian, Early Oligocene.
Remarks: This species was not encountered in the present survey in the Rupel Formation, but it occurred abundantly in the Ruisbroek Sand Member (Zelzate Formation, Rupelian) at Ruisbroek, prov. Antwerp, Belgium. GLIBERT (1957) mentioned three specimens from the Boom Formation at Hoboken, which he did not figure nor describe; undoubtedly they belong to this species.

Familia Spondylidae GRAY, 1826
Genus *Spondylus* LINNAEUS, 1758

Type species: *Spondylus gaederopus* LINNAEUS, 1758

Spondylus sp.
Pl. 1, Fig. 10

Dimensions: Pl. 1, Fig. 10 (coll. IRSNB IST 7273): L - 33 mm (fragment).
Remarks: Only one fragmentary specimen from the Boom Clay at Boom was mentioned by GLIBERT (1957, p. 21), which is figured here. It is, however, impossible to identify the species.

Clade Heterodonta NEUMAYR, 1884
Ordo Lucinida GRAY, 1854
Superfamilia Lucinoidea J. FLEMING, 1828
Familia Lucinidae J. FLEMING, 1828
Subfamilia Lucininae J. FLEMING, 1828
Genus and subgenus *Callucina* DALL, 1901

Type species: *Lucina radians* CONRAD, 1841

Callucina (Callucina) thierensi (HÉBERT, 1849)
Pl. 2, Figs 3-4

Synonymy: see MARQUET *et al.* (2008, p. 17).
Additional references:
1884 – *Lucina thierensi* HÉBERT juv? - SPEYER, pl. 12, fig. 7.
1952 – *Myrtea thierensi* HEBERT - GÖRGES, p. 42.
1973 – *Callucina (Callucinopsis) thierensi* (HEBERT, 1849) - NEUFFER, p. 49, pl. 10, figs 1-2.
1979 – *Parvilucina (Callucina) thierensi* (HEBERT 1849) - R. JANSSEN, p. 72.

Material: Niel, S30 (driftwood, 41 sp.), Steendorp, S41 (2 ? sp.); Kruibeke, S20 (1 ? sp.), S50 (2 ? sp.); Rumst, S50 (1 ? sp.).
Locus typicus: Jeurres, Paris Basin, France.
Stratum typicum: Falun de Jeurres, "Stampien", Rupelian, Early Oligocene.
Dimensions: Pl. 2, Fig. 3a (coll. IRSNB IST 7278): H - 5.3 mm, L - 4.6 mm, HD - 2.1 mm; Pl. 2, Fig. 3b (coll. IRSNB IST 7279): H - 3.6 mm, L - 3.8 mm, HD - 1.7 mm; Fig. 3c-d (coll. IRSNB IST 7280): H - 3.1 mm, L - 3.3 mm, HD - 1.5 mm; Pl. 2, fig. 4a, b (coll. IRSNB IST 7281): H - 4.1 mm, L - 4.6 mm, D - 2.0 mm.
Description: see MARQUET *et al.* (2008, p. 17, pl. 2, fig. 4).
Remarks: The material figured here only differs from that of the Alden Biesen Sand Member (Borgloon Formation) by its more distinct concentric ribs, but this character is too variable to separate the specimens of both Formations.
Occurrence: The species has not previously been found in the Boom Formation. Most specimens were found near to driftwood in the S30 level at Niel. The material from the other localities is fragmentary and partly covered with pyrite, so that the identification remains uncertain. The species seems to be more common in the rather brackish Borgloon Formation in Belgium. In Germany it has been found up to the Chattian.

Superfamilia Thyasiroidea DALL, 1900
Familia Thyasiridae DALL, 1900
Genus and subgenus *Thyasira* LEACH *in* LAMARCK, 1818

Type species: *Amphidesma flexuosa* LAMARCK, 1818

Thyasira (Thyasira) benedeni (DE KONINCK, 1838)
Pl. 2, Fig. 1; Pl. 3, Fig. 8

1835 – *Axinus angulatus* NYST, p. 6 (non SOWERBY).
1838 – *Axinus angulatus* SOW. - DE KONINCK, p. 34 (*non* SOWERBY).
1838 – *Axinus Benedeni* mihi DE KONINCK, p. 35, pl. 2, figs 2-3.
1845 – *Axinus angulatus* SOW. - NYST, p. 141, pl. 3, fig. 13 (*non* SOWERBY).
1845 – *Axinus nysti* PHILIPPI, p. 46.
1868 – *Cryptodon unicarinatus* NYST -VON KOENEN, p.101, pl. 27, fig. 9 (*pars*, *non* NYST).
1889 – *Axinus unicarinatus* NYST - VINCENT, p. 39.
1913 – *Cryptodon unicarinatus* NYST, sp. - HARDER, p. 58, pl. 4, fig. 20.
1949 – *Thyasira unicarinata* (NYST) - GILLET, p. 58, pl. 4, fig. 9.
1957 – *Thyasira nysti* PHILIPPI, sp. 1846 - GLIBERT, p. 32, pl. 3, fig. 7.
1975 – *Thyasira nysti* (PHILIPPI, 1846) - VAN DEN BOSCH, CADÉE & JANSSEN, p. 122, pl. 1, figs 6-7.
1995 – *Thyasira benedeni* (DE KONINCK, 1838) - GÜRS, p. 239, pl. 43, fig. 7.
1999 – *Thyasira (Thyasira) benedeni* (DE KONINCK, 1838) - WELLE, JAESCHKE & DUCKHEIM, p. 20.
2000 – *Thyasira benedeni* (KONINCK, 1838) - MOTHS, p. 47, pl. 17, fig. 4.

Type material: Lectotype IRSNB IST 4510.
Material: Rumst: S30 (1), S41 (24), S50 (8); Kruibeke: S41 (1), S50 (27); Steendorp: S41 (15), Niel: S41 (10), S50 (9).
Locus typicus: Boom, Antwerp province, Belgium.
Stratum typicum: Boom Clay, Rupelian, Early Oligocene.
Dimensions: Pl. 2, Fig. 1 (coll. IRSNB IST 7276): H - 7.6 mm, L - 6.8 mm, D - 4.4 mm.

Description: Middle sized, very fragile, equivalve and inequilateral shell. Shape pointed oval, dorsal margin straight behind umbo, slightly concave before. Length 85 % of height. Anterior and ventral margins rounded, posterior margin incised by a carina which runs from the umbo to the transition of anterior and ventral margin. Posterior area sunken, clearly delimited by carina. Umbo at about half of dorsal margin, distinct, pointed slightly to the anterior side. Lunula deep. Ornament consisting of coarse growth lines. Interior not seen in any of the specimens studied.
Remarks: Because of the confusion between the different species of Thyasiridae occurring in the Rupelian, all species are treated here. A figure of the present species can be found in GLIBERT (1957, pl. 3, fig. 7). NYST (1835) described his *Axinus angulatus* from the Boom Clay Formation at Boom, province of Antwerp, Belgium. This name was however preoccupied, so it was renamed *Axinus nysti* by PHILIPPI (1845). The name given by DE KONINCK (1838) was however overlooked.

GLIBERT (1957, p. 33, pl. 3, fig. 8) also mentioned a species from the Belgian Chattian as *Thyasira hanseata* (KAUTSKY, 1925). This species is slightly smaller than *T. benedeni* (DE KONINCK, 1838), possesses a more distinct double posterior plica and is relatively higher in relation to width. *T. hanseata*, however, was described from the Miocene Hemmoor Stufe and the differences between Miocene material and the Pliocene to Recent *Thyasira flexuosa* (MONTAGU, 1803) are negligible. Accordingly, A.W. JANSSEN (1984, p. 60) used the name *T. flexuosa* for Hemmorian material from Miste, The Netherlands. R. JANSSEN (1974, p. 74) used the same name for his German Chattian material. Although both authors refrained from calling *T. hanseata* a synonym of *T. flexuosa*, it can safely be assumed both taxa are synonyms.
Occurrence: *Thyasira benedeni* (DE KONINCK, 1838) is an endemic species for the North Sea basin; it occurs in Belgium in the Boom Formation from S30 to S50.

Thyasira (Thyasira) obtusa (BEYRICH, 1848)
Pl. 2, Fig. 2

1848 – *Cryptodon obtusus* BEYRICH, p. 58.
1868 – *Cryptodon obtusus* BEYR. ? - VON KOENEN, p. 102, pl. 27, figs 5, 8.
1975 – *Thyasira obtusa* (BEYRICH, 1848) - VAN DEN BOSCH, CADÉE & JANSSEN, p. 136, pl. 8, fig. 5.
1998 – *Thyasira* cf. *obtusa* (BEYRICH, 1848) - WELLE, p. 145.
1999 – *Thyasira (Thyasira)* cf. *obtusa* (BEYRICH, 1848) - WELLE, JAESCHKE & DUCKHEIM, p. 20.
2000 – *Thyasira obtusa* (BEYRICH, 1848) - MOTHS, p. 47, pl. 17, fig. 3.

Material: Kruibeke, S60 (7 sp.).
Locus typicus: Hermsdorf, Brandenburg, Germany.
Stratum typicum: "Septarienton", Rupelian, Early Oligocene.
Dimensions: Plate 2, fig. 2 (coll. IRSNB IST 7277): H - 16.6 mm, L - 16.1 mm, D - 9.8 mm.
Description: Rather large, fragile, equivalve and inequilateral shell. Shape nearly round, pointed dorsally. Anterodorsal margin clearly concave, long, posterodorsal margin convex. A plica runs between the umbo and the transition between the straight posterior and the curved ventral margin, delimiting a narrow posterior area. Lunula very deep. Length 110 % of height. Umbo closer to posterior margin, pointing to anterior side. Concentric, irregular growth lines are the only ornament present.
Remarks: GLIBERT (1957) did not mention the species from the Belgian Oligocene, but VAN DEN BOSCH, CADÉE & JANSSEN (1975) figured a specimen from the Kennedy Tunnel on the Ring Highway at Antwerp. *Thyasira obtusa* (BEYRICH, 1848) clearly differs from the preceding species by the larger size, the length, which exceeds height, and the position of the umbo.
Occurrence: This species seems to be limited to the S60 level of the Boom Clay Formation. It also is an endemic North Sea basin species.

Genus *Axinopsida* KEEN & CHAVAN, 1951

Type species: *Axinopsis orbiculata* SARS, 1878

Axinopsida marisae WELLE & NAGEL, 2003
Pl. 1, Fig. 11

2003 – *Axinopsida marisae* n. sp. WELLE & NAGEL, p. 57, pl. 8, figs 68-71.

Material: Steendorp, S41 (7 sp.); Kruibeke, S50 (> 50 sp.); Niel, S41 (2 sp.), S50 (12 sp.); Rumst, S41 (10 sp.), S50 (17 sp.); Mol, -225 m (2 sp.)
Locus typicus: Baugrube Landeszentralbank, Magdeburg, Germany.
Stratum typicum: Magdeburger Sand, Rupelian, Early Oligocene.
Dimensions: Pl. 1, Fig. 11a-b (coll. IRSNB IST 7274): H - 2.8 mm, L - 2.6 mm, D - 1.7 mm; Pl. 1, Fig. 11c-d (coll. IRSNB IST 7275): H - 1.75 mm, L - 1.8 mm, D - 1.0 mm.
Description: Small, equivalve, inequilateral fragile shell. Shape tumid oval, all margins rounded, except for the short, straight anterodorsal part. Length nearly equal to height (95 %), shell strongly asymmetric. A

very weak plica separates a narrow posterior part of the shell. Umbo clearly protruding, pointing to the anterior margin and at 30 % of the total length from the posterior margin. Lunula shallow. Ornament consisting of rather distinct growth lines. Inside could not be observed.
Remarks: This species occurs together with *Thyasira (T.) benedeni* (DE KONINCK, 1838), which differs by its much higher size, its much more distinct plica and its sunken posterior part. Furthermore, *Thyasira (T.) benedeni* is much more symmetric, with the umbo closer to the middle of the dorsal margin and the lunula is deeper.
Occurrence: Although it is a rather common species in the Boom Clay Formation, it has not been recorded in Belgium before. It only occurs in the Putte Clay Member. The type locality is the only locality in which the species had previously been found.

Ordo Carditida DALL, 1900
Superfamilia Carditoidea FÉRUSSAC, 1822
Familia Carditidae FÉRUSSAC, 1822
Subfamilia Carditamerinae CHAVAN, 1969
Genus and subgenus *Cyclocardia* CONRAD, 1867

Type species: *Cardita borealis* CONRAD, 1831

Cyclocardia (Cyclocardia) kickxi
(NYST & WESTENDORP, 1839)
Pl. 3, Fig. 9

1839 – *Venericardia Kickxii*. Nob. NYST & WESTENDORP, p. 9, pl. 11, fig. 12.

Type material: Lectotype IRSNB IST 4509.
Locus typicus: Boom, province of Antwerp, Belgium.
Stratum typicum: Boom Formation, Rupelian, Early Oligocene.
Description: See GLIBERT (1957, p. 29, pl. 3, fig. 5).
Occurrence: GLIBERT (1957) mentioned the presence of several thousands of specimens from this species in the IRSNB collection. During the recent survey treated here, less than 50 specimens were found. This is obviously the result of different collection methods, surface picking against bulk sieving. All material collected recently comes from the earliest parts of the Boom Formation, S10 Belsele-Waas Member to S30 Terhagen Clay Member.

Superfamilia Crassatelloidea FÉRUSSAC, 1822
Familia Astartidae D'ORBIGNY, 1814
Genus *Carinastarte* HINSCH, 1952

Type species: *Astarte reimersi* SEMPER *in* RAVN, 1907

Carinastarte kickxi (NYST, 1835)
Pl. 3, Fig. 10

1834 – *Astarte Kickxii*, Nob. NYST, p. 8, pl. 1, fig. 31.

Type material: Lectotype IRSNB IST 3794.
Locus typicus: Basel, province of Oost Vlaanderen, Belgium.
Stratum typicum: Boom Formation, Rupelian, Early Oligocene.
Description: See GLIBERT (1957, p. 25, pl. 3, fig. 2).
Remarks: This species is considered here as a member of the genus *Carinastarte*, because of the rectangular shape of the shell, which is completely covered with ribs; these do not fade near the ventral margin.
Occurrence: The same remark as for the preceding species applies here too: *Carinastarte kickxi* (NYST, 1835) is typical of the earliest part of the Boom Formation, but much rarer than in the material studied by GLIBERT (1957).

Ordo Venerida GRAY, 1854
Superfamilia Arctoidea NEWTON, 1891
Familia Arcticidae NEWTON, 1891
Genus *Arctica* SCHUMACHER, 1817

Type species: *Venus islandica* LINNAEUS, 1767

Arctica islandica rotundata (AGASSIZ, 1845)

Description: See GLIBERT (1957, p. 31, pl. 6, fig. 18).
Occurrence: GLIBERT (1957) mentioned 18 specimens collected from the Boom Formation. In the present survey only small and damaged specimens were found in the Belsele-Waas Member at Sint Niklaas, in the sandy basal level. Possibly, fragments were also found at Niel near a tree trunk. The species however occurs abundantly in the older phosphorite level at Sint Niklaas (Ruisbroek Sand Member), in the Berg Sand Member and in the younger Chattian Voort Formation. This species consequently seems to be limited to sandy substrates, lacking in clayey sand and clay. Its distribution encompasses the North Sea basin, but also the Paratethys (Hungary, Egerian, Chattian, coll. of the author).

Superfamilia Galeommatoidea GRAY, 1840
Familia Galeommatidae GRAY, 1840
Genus *Spaniorinus* DALL, 1899

Type species: *Solecardia cossmanni* DALL, 1900

Spaniorinus striatulus (NYST, 1845)

1845 – *Spaniorinus striatulus*, Nob. NYST, p. 90, pl. 4, fig. 7.

Type material: Holotype IRSNB IST 4511. This specimen is so badly damaged by pyritic decay that no better figure than that of GLIBERT (1957, pl. 3, fig. 11) can be given.
Locus typicus: Basel, province Oost Vlaanderen, Belgium.
Stratum typicum: Boom Formation, Rupelian, Early Oligocene.
Description: See GLIBERT (1957, p. 35, pl. 3, fig. 11).
Remarks: Four specimens of this distinct species were mentioned by GLIBERT (1957), but it has not been found during the recent survey.

Familia Lasaeidae GRAY, 1842
Genus and subgenus *Semierycina* DE MONTEROSATO *in* COSSMANN, 1911

Type species: *Lepton prysmaticum* DE MONTEROSATO, 1878

Semierycina (Semierycina) kruibekensis nov. sp.
Pl. 2, Fig. 5

Type material: Holotype: right valve IRSNB IST 7284, paratypes IST 7282, 7283, 7285.
Other material: Kruibeke, S50 (4 sp.); Niel, S50 (2 sp.).
Locus typicus: Claypit of the Argex (Gralex) Company at Kruibeke, province Oost Vlaanderen, Belgium.
Stratum typicum: S50 septarian level, Putte Clay Member, Boom Formation, Rupelian, Early Oligocene.
Derivatio nominis: After the type locality.
Dimensions: Pl. 2, Fig. 5a (coll. IRSNB IST 7282): H - 2.9 mm, L - 2.2 mm, HD - 0.9 mm; Pl. 2, Fig. 5b (coll. IRSNB IST 7283): H - 2.8 mm, L - 2.05 mm, HD - 0.8 mm; Pl. 2, Figs 5c, f, g (coll. IRSNB IST 7284, holotype): H - 1.5 mm, l - 2.2 mm, D - 1.4 mm; Pl. 2, Fig. 5d (coll. IRSNB IST 7275): H - 1.2 mm, L - 1.8 mm, HD - 0.6 mm.
Description: Small, equivalve, nearly equilateral, fragile shell. Prodissoconch relatively large, smooth. Shape elongated oval. Height 74 % of length. Umbo little protruding, only very slightly closer to anterior than to posterior margin, prosogyrate. Dorsal margin slightly more curved on anterior than on posterior side. Anterior and posterior margins rounded, passing imperceptably into the partly straight ventral margin. Ornament consisting of very dense concentric ribs, with even more narrow intercostal spaces; the ribs become more distinct towards the ventral margin. Hinge only observed in right valve, weakly developed. Hinge line narrowing behind umbo. Lateral tooth AI strong, AIII very faint and short. Cardinal 1 rather strong, tubercular; between this tooth and the next a depression occurs. PI and PIII well developed, with an incision between both. Pallial line and muscle scars indistinct.
Remarks: The genus *Semierycina* is recorded here for the first time in the Oligocene of the North Sea Basin. In the Neogene of the basin, three species have been found. *Semierycina (S.) kautskyi* (GLIBERT, 1945) ranges from Miocene to Pliocene; it is figured by MARQUET (2005, p. 13, pl. 4, fig. 2). This species has a much larger straight part on the ventral margin, the lateral teeth are much better developed and remains of tooth 3b can occur in the right valve. *Semierycina (S.) mionitidum* (KAUTSKY, 1939), figured by A.W. JANSSEN (1984, p. 64, pl. 2, fig. 3), occurs in the Miocene of the North Sea Basin and the Paratethys. It is much higher in relation to length than the new species and the umbo is less distinct. *Semierycina (S.) nitida* (TURTON, 1822) is found from Pliocene to Recent from the East Atlantic to the Mediterranean (see MARQUET, 2005, p. 14, pl. 6, fig. 1). *S. (S.) nitida* also is higher in relation to length than *Semierycina (S.) kruibekensis*, its dorsal margin is nearly straight and the umbo lies farther from the middle of the dorsal margin. The shape of the new species also slightly resembles that of *Bornia deltoidea* (WOOD, 1851), a species from the Pliocene of the North Sea Basin, and perhaps also occurring in the Miocene of the Paratethys (see MARQUET, 2005, p. 17, pl. 7, fig. 2). The latter is much larger, the ornament consists of a pitted microsculpture without concentric ribs and the hinge differs.
Occurrence: The new species is rare and seems only to occur in the S50 level of the Putte Clay Member.

Genus and subgenus *Scacchia* PHILIPPI, 1844

Type species: *Tellina elliptica* SCACCHI, 1838

Scacchia (Scacchia) dufraingi nov. sp.
Pl. 2, Figs 6-7

Type material: Holotype: IRSNB IST 7286, paratype IST 7287, paratype IST 7288 (from Kruibeke).
Other material: Kruibeke: S41 (1 sp.); Niel: S41 (1 sp.), S50 (3 sp.); Steendorp: S41 (2 sp.).
Locus typicus: Claypit of the Company Ceulemans at Niel, province Antwerp, Belgium.
Stratum typicum: S50 septarian level, Putte Clay Member, Boom Formation, Rupelian, Early Oligocene.
Derivatio nominis: After Leo Dufraing, for his valuable help during fieldwork.
Dimensions: Pl. 2, Fig. 6a (coll. IRSNB IST 7286, holotype): H - 1.4 mm, L - 1.9 mm, HD - 0.4 mm; Pl. 2, Fig. 6b (coll. IRSNB IST 7287): H - 1.5 mm, L - 1.95 mm, HD - 0.45 mm; Pl. 2, Fig. 7a-c (coll. IRSNB IST 7288): H - 1.4 mm, L - 1.7 mm, D - 1.21 mm;
Desciption: Small, rounded oval, fragile shell, equivalve and nearly inequilateral. Umbo only slightly protruding, closer to the posterior side (at 40 % of total length). Height 80 % of length. Posterodorsal margin convex, anterodorsal concave close to the umbo and becoming nearly straight further to the anterior side. Anterior, posterior and ventral margins rounded, passing smoothly into each other; only the posterior side is slightly angular. Sculpture of very weak, rather irregular growth lines. Hinge teeth weak. Left valve with short 2 and 4b, lying close to each other below the umbo. Posterior lateral PII stronger than anterior AII; between both a socket is present. Right valve with strong 3b and weaker anterior lateral AI. Resilium rather indistinct. On the inside of the shell, radial striation occurs.
Remarks: *Scacchia (S.) elliptica* (SCACCHI, 1838), occurring from Pliocene to Recent in the North Sea Basin (see MARQUET, 2005, pl. 5, fig. 1), is much more asymmetric and the resilium is more distinct. *Scacchia (S.) degrangei* (COSSMANN & PEYROT, 1911), known from the Miocene of the North Sea Basin and of Aquitaine is figured by A.W. JANSSEN (1984, p. 64, pl. 2, figs 1-2). This species is higher in relation to length and has a very distinct irregular radial sculpture on the outer surface, especially on the anterior and posterior parts of the shell.
Occurrence: The species has been found only in the Putte Clay Member of the Boom Formation. This is the first record of the genus for the Oligocene of the North Sea Basin.

Superfamilia Glossoidea GRAY, 1847
Familia Glossidae GRAY, 1847
Genus *Glossus* POLI, 1795

Type species: *Glossus rubicundus* POLI, 1795 = *Cardium humanum* LINNAEUS, 1758

Glossus sp.

Occurrence: GLIBERT (1957, p. 31) mentioned two fragments from Rumst, which could be different from *Glossus subtransversus* (D'ORBIGNY, 1852), ranging from the Rupelian to the Chattian; the material is however too fragmentary to allow conclusions.

Superfamilia Tellinoidea DE BLAINVILLE, 1814
Familia Tellinidae DE BLAINVILLE, 1814
Genus *Angulus* MEGERLE VON MÜHLFELD, 1811
Subgenus *Peronidia* DALL, 1900

Type species: *Tellina albicans* GMELIN, 1791

Angulus (Peronidia) cf. ***posterus***
(BEYRICH *in* VON KOENEN, 1868)
Pl. 2, Fig. 8

1868 – *Tellina postera* BEYRICH *in* VON KOENEN, p. 259.
1884 – *Tellina postera* BEYRICH - SPEYER & VON KOENEN, pl. 31, fig. 8.
1941 – *Tellina postera* BEYRICH - GÖRGES, p. 169.
1944 – *Tellina postera* BEYRICH - HEERING, p. 41, pl. 4, figs 19-20.
1952 – *Moerella postera* (BEYRICH 1866) - GÖRGES, p. 51, pl. 1, figs 25-27.
1957 – *Moerella postera* (BEYRICH) - GÖRGES, p. 120.
1957 – *Angulus (Moerella) postera* (BEYRICH) KOENEN, sp. 1868 - GLIBERT, p. 43.
1979 – *Tellina (Peronidia) postera* BEYRICH 1868 - R. JANSSEN, p. 113, pl. 3, fig. 59.
1987 – *Tellina (Peronidia) postera* BEYRICH, 1868 - SCHNETLER & BEYER, p. 203.
1990 – *Angulus posterus* (BEYRICH, 1868) - SCHNETLER & BEYER, p. 47.
1998 – *Tellina (Peronidia) postera* BEYRICH, 1868 - MOTHS, PIEHL & ALBRECHT, p. 17, pl. 11, fig. 3.
1999 – *Tellina (Angulus) postera* BEYRICH, 1868 - WELLE, JAESCHKE & DUCKHEIM, p. 25.
2008 – *Angulus posterus* (BEYRICH in VON KOENEN, 1868) - SCHNETLER & PALM, p. 20, pl. 2, fig. 7.

Material: Only one specimen has been found in the

S50 septarian layer at Kruibeke.
Locus typicus: Doberg near Bünde, Westfalen, Germany (R. JANSSEN, 1979, p. 113).
Stratum typicum: Doberg Schichten, Early Chattian, Late Oligocene.
Dimensions: Pl. 2, Fig. 8 (coll. IRSNB IST 7289): H - 3.8 mm, L - 6.1 mm, D - 1.6 mm.
Description: The specimen collected lacks almost all of its shell, so that only an internal mould remains. The hinge characters could not be observed. For a complete description and figure, see A.W. JANSSEN (1984, p. 89, pl. 33, figs 4-5).
Occurrence: The species has been described from the Chattian (Late Oligocene), but it abounds in the Miocene of the North Sea Basin. Only Oligocene records are listed here in the synonymy. The only other Early Oligocene record is that of WELLE, JAESCHKE & DUCKHEIM (1999) from the Böhlener Schichten at Leipzig. Only a single defective specimen was found in the Belgian Oligocene, so its occurrence is not yet compeletely certain.

Ordo Myida STOLICZKA, 1870
Superfamilia Myoidea LAMARCK, 1809
Familia Corbulidae LAMARCK, 1818
Subfamilia Corbulinae LAMARCK, 1818
Genus *Corbula* BRONGNIART, 1792
Subgenus *Varicorbula* GRANT & GALE, 1831

Type species: *Tellina gibba* OLIVI, 1792

Corbula (Varicobula) gibba gibba (OLIVI, 1792)

Remarks: MARQUET *et al.* (2008, p. 28, pl. 5, fig. 3) mentioned the presence of the subspecies or ecophenotype *Corbula (V.) gibba subpisum* (D'ORBIGNY, 1852) in the Borgloon Formation. The material collected in the Boom Formation is clearly distinct and belongs to the nominal subspecies. This confirms that the subspecies *C. (V.) subpisum* occurs in hyposalinic conditions, while the nominal subspecies is present in euryhaline environments.
Occurrence: GLIBERT (1957, p. 46) listed abundant material from the Boom Formation (3000 specimens) and several hundreds of shells from the Berg Sand Member and the Chattian Voort Formation. In the present survey material was found from S"0' to S50, but always in smaller numbers, except in a bed between S30 and S40 of about 5 cm thick. Specimens are found in this bed close together in dense clusters, often embedded in pyrite; few other molluscan species occur together with *Corbula g. gibba* in this bed. The species ranges from the Late Eocene to Recent: its first occurrence seems to be in the Ratheim-Schichten (Priabonian) in the Niederrhein area (J. WELLE, pers. comm., 2010).

Superfamilia Pholadoidea LAMARCK, 1809
Familia Teredinidae RAFINESQUE, 1815

Teredinidae indet.

Occurrence: No identifiable material has been found of this family, but fragments of tubes abound around the tree trunks in the S30 level at Niel and in the Mol boring; no number of specimens could be given in Table 1, because only fragments were found.

Order uncertain
Superfamilia Hiatelloidea GRAY, 1824
Familia Hiatellidae GRAY, 1824
Genus and subgenus *Hiatella* DAUDIN *in* BOSC, 1801

Type species: Mya arctica LINNAEUS, 1758

Hiatella (Hiatella) arctica (LINNAEUS, 1758)

Occurrence: GLIBERT (1957, p. 44) mentioned the presence of this species in "Tongrien" deposits (= Borgloon Formation), but this could not be confirmed by MARQUET *et al.* (2008). In addition, the species is found in the Berg Sand Member (Rupelian) and in the Chattian Voort Formation. It continues from the Miocene to Recent. This is the first record for the Belgian Boom Formation, in which the species occurs rarely.

Ordo Pholadomyida NEWELL, 1965
Superfamilia Pholadomyoidea KING, 1844
Familia Pholadomyidae KING, 1844
Genus and subgenus *Pholadomya*
G.B. SOWERBY, 1823

Type species: *Pholadomya candida* GRAY, 1847

Pholadomya (Pholadomya) aff. ***puschi***
GOLDFUSS, 1837

Occurrence: GLIBERT (1957, p. 48) mentioned material

from Niel and Rupelmonde. Fragments were collected now at Sint Niklaas (Belsele), in the sandy base of the Boom Formation. The material is too fragmentary to be identified.

Superfamilia Thracioidea STOLIZCKA, 1870
Familia Thraciidae STOLIZCKA, 1870
Genus and subgenus *Thracia* SOWERBY, 1823

Type species: *Mya pubescens* PULTENEY, 1799

Thracia (Thracia) vanremoorteli nov. sp.
Pl. 2, Fig. 9

1868 – *Thracia Nysti* VON KOENEN, p. 268 (*pars*, *non* pl. 30, figs 4-5).
1957 – *Thracia ventricosa* Philippi, sp. 1843 - GLIBERT, p. 47 (pars, non pl. 4, fig. 3).
?2000 – *Thracia* sp. - MOTHS, p. 48, pl. 18, fig. 3.

Type material: Holotype IRSNB IST 7290.
Other material: Kruibeke, S50 (14 sp.); Rumst, S50 (2 sp.), S30 (2 fr.); Mol, -225 m (2 fr.).
Locus typicus: Kruibeke, claypit of the Gralex (Argex) Company, province Oost Vlaanderen, Belgium.
Stratum typicum: S50 septarian level, Putte Clay Member, Boom Formation, Rupelian, Early Oligocene.
Dimensions: Pl. 2, Fig. 9 (coll. IRSNB IST 7290, holotype): H - 4.7 mm, L - 7.0 mm, D - 2,4 mm.
Derivatio nominis: After Mr. W. Van Remoortele, for his valuable help during fieldwork.
Description: Rather small, fragile, inequilateral and inequivalve shell. Both valves are rather flat. Umbo clearly protruding, at 35-40 % of total length from the posterior margin. Height only 65 % of length. Anterodorsal margin slightly concave, passing gradually into rostrate anterior margin. Posterodorsal margin nearly straight, passing into the short, straight posterior margin at an angle of 140°. Ventral margin rounded in central part, nearly straight at the anterior side and concave behind the umbo; the concavity can however vary among specimens. A carina runs between the umbo and the junction between ventral and posterior margin, delimiting a triangular posterior area. Sculpture consists of rather coarse growth lines. Small granules are distinct on the posterior area only. Inside of the shell not seen.
Remarks: *Thracia nysti* VON KOENEN, 1868 was described from the Rupelian "Septarienton" in Germany, but the author also mentioned material from Belgium, without figuring it. *T. nysti* is clearly higher in relation to length than the new species, more tumid, the posterior margin is distinctly longer and the ventral margin is straight, without the posterior concave part.

GLIBERT (1957) described Chattian (Voort Formation) material from Belgium under the name *Thracia ventricosa* PHILIPPI, 1843 and included also five unidentifiable fragments of Thraciidae from the Boom Formation under this name. However, the Mediterranean *Thracia ventricosa* PHILIPPI, 1843 does not occur in the North Sea Basin (see MARQUET, 2005, p. 105). The Pliocene material from the North Sea Basin is considered by MARQUET (2005) as belonging to *Thracia (T.) inflata inflata* J. DE C. SOWERBY, 1845; Miocene and Chattian material was described as *Thracia (T.) inflata microgranosa* MARQUET, 2005. The ventral margin of this subspecies is also concave near the posterior side. It differs by its much higher shell, lesser umbonal angle and the anterior side is not rostrate. In Miocene material the granules on the posterior area are more distinct.

GLIBERT (1957) considered the Chattian species *Thracia (T.) speyeri* VON KOENEN *in* SPEYER, 1884 as a synonym of *Thracia ventricosa*. GLIBERT & VAN DE POEL (1966, p. 7) separated both again as two species. R. JANSSEN (1979, p. 146, pl. 4, fig. 81) gave a good illustration and description of *Thracia (T.) speyeri.* This species is also much higher in relation to length than *Thracia (T.) vanremoorteri* nov. sp., the umbo protrudes less and lies closer to the middle of the dorsal margin. The ventral margin is rounded without concave part, the anterior rostrum is lacking and the posterior margin is markedly higher.

Thracia (T.) weinheimensis R. JANSSEN, 1979 is a Rupelian to Chattian species from the Mainz Basin and the Kassel area, Germany. It was figured by NEUFFER (1973, p. 91, pl. 7, fig. 48, pl. 13, figs 12-13) under the preoccupied name *Thracia (T.) elongata* SANDBERGER, 1861 (*non* ROEMER, 1841 *nec* PHILIPPI, 1844). This species is lower than *Thracia (T.) vanremoorteri*, dorsal and ventral margins run nearly parallel and they are nearly straight.

Another species of the same genus occurring in the Rupelian of the Mainz basin is *Thracia (T.) faba* SANDBERGER, 1861, figured by NEUFFER (1973, p. 92, pl. 7, fig. 19). It is a regularly rounded species, rather resembling *T. nysti* in shape. The umbo lies near the middle of the dorsal margin, the shell is relatively higher, posterior and anterior margins are both more rounded and the whole ventral margin is convex. The posterior area is not distincly separated.
Occurrence: *Thracia (T.) vanremoorteri* nov. sp. is found

with certainty in the septarian level S50; fragments were found in S30 and at Mol. Also the fragments from *Thracia*, which GLIBERT (1957) listed, could belong to this species, as well as the Belgian specimens, which VON KOENEN (1868) mentioned in his description of *Thracia nysti*. Furthermore, a very similar specimen from Malliss, Germany was figured by MOTHS (2000).

Clade Septibranchia (within Pholadomyida)
Superfamilia Cuspidaroidea DALL, 1886
Familia Cuspidariidae DALL, 1886
Genus and subgenus *Cuspidaria* NARD, 1840

Type species: Tellina cuspidata OLIVI, 1792

Cuspidaria (Cuspidaria) clava (BEYRICH, 1848)
Pl. 2, Fig. 10

1848 – *Corbula clava* BEYRICH, p. 54.
1868 – *Neaera clava* BEYRICH - VON KOENEN, p. 118, pl. 7, fig. 6 (*pars* ?).
1957 – *Cuspidaria* (s.s.) *precuspidata* GILLET, S. et THEOBALD, N., 1936 - GLIBERT, p. 47 (*pars*, *non* pl. 3, fig. 12).
1983 – *Cuspidaria (Cuspidaria) clava* (BEYRICH, 1848) - MÜLLER, p. 36.
2000 – *Cuspidaria (Cuspidaria) clava* (BEYRICH, 1848) - MOTHS, p. 49, pl. 18, fig. 5.

Material: Kruibeke, S50 (14 sp.); Steendorp, S41 (3 sp.); Rumst, S41 (1 sp.), S50 (5 sp.); Niel, S41 (2 sp.), S50 (3 sp.).
Locus typicus: Hermsdorf, Brandenburg, Germany.
Stratum typicum: Rupelian, Early Oligocene.
Dimensions: Plate 2, figs 10a, b (coll. IRSNB IST 7291): H - 2.1 mm, L - 3.1 mm, D - 1.5 mm; Plate 2, figs 10c, d (coll. IRSNB IST 7292): shell fragment 1.3 x 1.2 mm.
Description: Small, brittle, rather flat, spoon shaped inequilateral and inequivalve shell, gaping at the posterior end. Umbo rather strongly protruding, opisthogyrate, lying at the middle of total length; umbonal angle 120°. Height 65 % of length. Anterodorsal margin nearly straight, posterodorsal concave. Anterior margin short, slightly angular. Ventral margin rounded in anterior and central parts, distinctly concave posterior, behind umbo. Posterior part ending in a short rostrum. Ornament of numerous irregular growth lines, which are narrower than the intercostal spaces. The ribs are more distinct on the rostrum and often consist of two narrow ridges, crossed by interrupted angular ribs. Extremely fine microgranules present between ribs. Internal characters not seen.
Remarks: GLIBERT (1957, p. 47) mentioned under the name of *Cuspidaria* (s.s.) *precuspidata* GILLET & THEOBALD, 1936 material from Kontich near Antwerp, Belgium (erroneously placed in the Berg Sand Member, only Boom Formation occurs at that locality), together with Chattian material from Houthalen, Voort and Zwartberg, which does indeed belong to this species. R. JANSSEN (1979, p. 150, pl. 4, fig. 84) separated both species. The Chattian species *C. precuspidata* differs from the Rupelian *Cuspidaria (C.) clava* by its much more elongated rostrum, which is not pointed, while the rostral part is not separated by a depression. VON KOENEN (1868) figured *Cuspidaria clava*, but in his text included *Cuspidaria (C.) subcuspidata* (D'ORBIGNY, 1852), a species differing by the nearly straight dorsal margin between umbo and rostrum and the much more pointed umbo (see R. JANSSEN, 1979, p. 149, pl. 4, fig. 83). Hence the "*pars*" in the reference to VON KOENEN (1868).
Occurrence: In the Belgian Rupelian this species is only found in the S41 and S50 septarian beds, Putte Clay Member. In Germany it occurs at Malliss and several other Rupelian clay localities (see VON KOENEN, 1868). Chattian records by the same author are dubious.

Genus *Cardiomya* A. ADAMS, 1864

Type species: *Neaera gouldiana* HINDS, 1843

Cardiomya (sensu lato) annamariae **nov. sp.**
Pl. 2, Figs 11-12

Type material: Holotype IRSNB IST 7293; paratype from Rumst, Wienerberger claypit, province of Antwerp, Belgium; S50 level IRSNB IST 7294.
Other material: Niel, S50 (10 sp.); Steendorp, S41 (2 sp.), Kruibeke, S50 (23 sp.); Rumst, S50 (7 sp.).
Locus typicus: Niel, Ceulemans claypit, province of Antwerp, Belgium.
Stratum typicum: Septarian level S50, Putte Member, Boom Formation, Rupelian, Early Oligocene.
Dimensions: Pl. 2, Fig. 11 (coll. IRSNB IST 7293, holotype): H - 4.44 mm, L - 6.49 mm, HD - 4.0 mm; Pl. 2, Fig. 12a-c (coll. IRSNB IST 727294): H - 4.4 mm, L - 6.5 mm, D - 4.0 mm (fragment).
Derivatio nominis: After my wife Anne-Marie Hansenne.
Description: Small, tumid, brittle, spoon shaped inequilateral and inequivalve shell, gaping at the posterior end. Height 65 % of length. Umbonal angle 110°. Umbo lying at 60 % of total length from the posterior end, only slightly protruding, opisthogyrate.

Anterodorsal margin nearly straight, posterodorsal concave near the umbo and straight near the posterior margin. Posterior margin short, nearly straight. Anterior margin forming a slight angle with ventral margin, very short. Anterior and central parts of ventral margin curved, strongly concave near posterior margin, straight on rostrum. A depression clearly separates a much lower posterior rostral area. Except for the rostrum, 15-20 broad concentric ribs are present. Between the ribs, an irregular microsculpture of lines occurs, converging on the main ribs. On the rostrum, two carinae occur, running from the umbo to the junction of respectively the dorsal and the ventral margin with the posterior margin. The concentric ribs from the central part come closer together near the ventral carina and they become less distinct. Between and above both carinae, rough irregular concentric ribs lie closely together. Fragments show no hinge teeth.

Remarks: The new species is included here in the genus *Cardiomya* A. ADAMS, 1864 with doubt, because members of this genus should be radially ribbed, which is not the case here. It comes close to the genus *Tropidomya* DALL, 1886, but, as far as can be seen on fragments, the anterior cardinal tooth, characteristic of this genus, is lacking (MOORE, ed., 1969, p. 845).

GLIBERT (1957, p. 48, pl. 4, fig. 8) recorded the presence of *Cardiomya kochi* (PHILIPPI, 1843) in the Chattian Voort Sand. This species was also figured by R. JANSSEN (1979, p. 151, pl. 4, figs 85-86). *Cardiomya kochi* differs from the new species in being higher in relation to length, with a more protruding umbo. Furthermore, the sculpture consists of at least 40 concentric ribs with narrow intercostal spaces and three to four radial ribs, which run on the posterior part of the shell, before the rostrum. No carinae are present on the rostrum of *Cardiomya kochi*.

HARDER (1913, p. 61, pl. 4, fig. 25) described the species "*Neaera Mørchi*" from the Late Oligocene of Århus (Denmark); it occurs at that locality together with *C. kochi*. This material is more tumid, with slightly different ornamentation, but both names could be synonyms. *Cardiomya moerchi* differs from *C. annamariae* in the same characters as *C. kochi*.

Cardiomya reticosa (VON KOENEN, 1868, p. 119, pl. 7, fig. 3) was described from the German Rupelian. MOTHS (2000, pl. 18, fig. 4) refigured it from the Rupelian of Malliss, Germany. *C. reticosa* differs from the new species in being nearly as high as long, with a narrower rostrum. The shell is more tumid and at least six radial ribs occur on the posterior part of the shell before the rostrum. Only one carina is present on the rostrum.

Cardiomya (C.) costellata (DESHAYES, 1833) occurs in the Neogene of the North Sea Basin. Pliocene material of this species from Belgium was described by MARQUET (2005, p. 111, pl. 61, fig. 3), Miocene specimens from The Netherlands (Miste) by A.W. JANSSEN (1984, p. 110, pl. 41, fig. 4). It clearly differs from the new species in having about seven very distinct radial ribs on the central and anterior part of the shell, with only very faint concentric growth lines.

Occurrence: The new species has, as yet, been found only in the Belgian Rupelian, in the septarian levels S41 and S50 of the Putte Clay Member.

Conclusions

The bivalve fauna of the Boom Formation consists of a total of 39 species. Of these 39, 27 were found in previous surveys published by GLIBERT (1957). Eleven are recorded here for the first time, including four new species. One species, *Thyasira (T.) obtusa* (BEYRICH, 1848), was recorded earlier by VAN DEN BOSCH, CADÉE & JANSSEN (1975). Eight species recorded by GLIBERT (1957) were not found again. These are for the larger part Pectinidae and unidentifiable species, which were found as single specimens and which were probably carried in by accident. The distribution of the species in the different septarian levels is given in Table 1, although, for some, the exact ranges are not yet known. The number of species is highest in level S50, followed by S30. The highest number of specimens has also been recorded in S50, in which several hundreds of individual shells have been collected during the present survey. A close inspection of Table 1 shows that a number of species has stratigraphic/ecologic significance. The latter will be detailed in the following paragraphs.

The Belsele-Waas Member of the Boom Formation contains two species, characteristic of sandy deposits, rather than clayey: *Arctica islandica rotundata* (AGASSIZ, 1845) and *Pholadomya* cf. *puschi* GOLDFUSS, 1837. These are very rare (1 specimen of *A. islandica rotundata* at Niel, around the tree trunks, just above S30) or do not occur in higher levels. It can be concluded that this Member corresponds to the lowest water level of the Boom Formation.

The following species seem to be restricted to

Table 1. – Distribution of the species over the septarian levels and the Members of the Boom Formation. Bels. = Belsele-Waas Member; T = found near tree trunks; Gl = recorded by GLIBERT (1957); x = present.

	S0-10	S20	S30	S41	S50	S60	Mol	Gl.
	Bels.	Terhagen		Putte				
Nucula orbignyi GLIBERT, 1955	1	1	7	-	-	-	4	x
Nucula duchasteli NYST, 1835	-	-	8	13	12	12	-	x
Yoldiella p. pygmaea (GOLDFUSS, 1835)	-	1	-	>50	>50	-	9	-
Pristigloma sphaerica (VON KOENEN, 1868)	-	-	-	-	-	-	1	x
Portlandia deshayesiana (NYST, 1835)	1	8	25	>50	>50	12	1	x
Saccella westendorpi gracilis (DESHAYES, 1860)	-	-	-	-	1	-	-	-
Barbatia multistriata (DE KONINCK, 1838)	1	1	-	-	-	-	-	x
Bathyarca bellula (WIECHMANN, 1874)	-	-	-	2	15	-	-	-
Glycymeris l. lunulata (NYST, 1936) auct.	-	-	2T	-	-	-	-	x
Glycymeris planicostalis (LAMARCK, 1814)	-	-	-	-	-	-	-	x
Nucinella microdus (BOETTGER, 1869)	-	-	29	28	47	-	1	-
Isognomon sp.	-	-	-	-	-	-	-	x
Palliolum deshayesi (NYST, 1835)	-	4	4	-	1	-	-	x
Palliolum permistum (BEYRICH, 1848)	-	-	-	-	-	-	-	x
Palliolum delheidi VINCENT, 1930	-	-	-	-	-	-	-	x
Hilberia hoeninghausi (DEFRANCE, 1825)	-	-	>50	-	-	-	-	x
Hilberia rupeliensis (VON KOENEN, 1868)	-	-	-	-	-	-	-	x
Hilberia stettinensis (VON KOENEN, 1868)	-	-	-	-	-	-	-	x
Spondylus sp.	-	-	-	-	-	-	-	x
Pycnodonte (P.) paradoxa (NYST, 1835)	-	2	6	-	-	-	-	x
Callucina (C.) thierensi (HÉBERT, 1849)	-	1?	41T	2?	3?	-	-	-
Thyasira (T.) benedeni (DE KONINCK, 1838)	-	-	1	50	44	-	-	x
Thyasira (T.) obtusa (BEYRICH, 1848)	-	-	-	-	-	7	-	x
Axinopsida marisae WELLE & NAGEL, 2003	-	-	-	19	>50	-	2	-
Semierycina (S.) kruibekensis nov. sp.	-	-	-	-	10	-	-	-
Scacchia (S.) dufraingi nov. sp.	-	-	-	4	6	-	-	-
Spaniorinus ? striatulus (NYST, 1845)	-	-	-	-	-	-	-	x
Cyclocardia kickxi (NYST & WESTENDORP, 1839)	1	3	24	-	-	-	-	x
Carinastarte kickxi (NYST, 1835)	1	2	17	-	-	-	-	x
Angulus cf. *posterus* (BEYRICH *in* VON KOENEN, 1868)	-	-	-	-	1	-	-	-
Arctica islandica rotundata (AGASSIZ, 1845)	5	-	2T	-	-	-	-	x
Glossus sp.	-	-	-	-	-	-	-	x
Corbula (Varicobula) g. gibba (OLIVI, 1792)	2	46	>50T	>50	>50	-	-	x
Hiatella (H.) arctica (LINNAEUS, 1758)	1	-	-	-	1	-	-	-
Teredinidae indet.	-	-	xT	-	-	-	x	-
Pholadomya cf. *puschi* GOLDFUSS, 1837	1	-	-	-	-	-	-	x
Thracia vanremoorteli nov. sp.	-	-	2	-	18	-	2	x
Cuspidaria (C.) clava (BEYRICH, 1848)	-	-	-	5	22	-	-	x
Cardiomya (sensu lato) annamariae nov. sp.	-	-	-	2	40	-	-	x
Species number	**9**	**10**	**16**	**12**	**18**	**3**	**8**	**28**

the lower part of the Boom Formation: *Hilberia hoeninghausi* (DEFRANCE, 1825) and *Pycnodonte paradoxa* (NYST, 1835) restricted to the Terhagen Member, and *Cyclocardia kickxi* (NYST, 1835) and *Carinastarte kickxi* (NYST, 1835) both in the Belsele-Waas, although very rare, and the Terhagen Members. VAN DEN BOSCH, CADÉE & JANSSEN (1975) recognised in the Rupelian Brinkheurne Formation at Miste, the Netherlands, an Assemblage zone characterized by the same latter three species. These deposits could have the same age, or indicate a similar palaeoenvironment. VANDENBERGHE *et al.* (2001, fig. 15) correlated the earliest part of the Brinkheurne Formation, the Kotten Member, with the Terhagen Member. This would mean that the Dutch Assemblage zone and the Belgian S20 to S30 septarian levels could be contemporaneous. This was also proposed by VAN DEN BOSCH & A.W. JANSSEN (1990, table 1). The high frequencies of the four species mentioned above also indicate deposition in rather shallow water; these species also commonly occur in the more sandy intervals of the Belgian Rupelian (Ruisbroek and Berg Sand Members).

Bathyarca bellula (WIECHMANN, 1874), *Thyasira (T.) benedeni* (DE KONINCK, 1838), *Thyasira (T.) obtusa* (BEYRICH, 1848), *Axinopsida marisae* WELLE & NAGEL, 2003, *Scacchia (S.) dufraingi* nov. sp., *Cuspidaria (C.) clava* (BEYRICH, 1848) and *Cardiomya (sensu lato) annamariae* nov. sp. characterize the Putte Member of the Boom Formation, with *T. (T.) obtusa* appearing to be restricted to septarian level S60. The *Serpula septaria* - *Ancistrosyrinx volgeri* Assemblage zone of VAN DEN BOSCH, CADÉE & JANSSEN (1975) contains a large number of species, which are not found in the Belgian Putte Member. Only one species, *Thyasira (T.) obtusa* (BEYRICH, 1848), is in common. This could point to a correlation of the Dutch Assemblage Zone with S60 and to the existence of a hiatus between the Dutch Assemblage zones, corresponding with the interval from S40 to S50 in Belgium, or, the presence of a different environment in both countries. The S50 horizon probably represents the deepest water deposit of all fossiliferous levels from the Boom Clay Formation, in view of the dominance of Thyasiridae and Cuspidariidae, which point to deposition in deep water, below the euphotic zone. It must however be stressed that the clayey layers, found between the septarian levels, probably represent the deepest water conditions, although it is difficult to prove, as no body fossils have been preserved, and only ichnofossils can be found.

The number of species culminates in S50. Level S30 is the second highest in species diversity. However, this is essentially due to the species enrichment exclusively found at Niel, around sunken tree trunks. This material seems to originate from a shallower environment. It is represented by single valves, not pyritised internally, whereas in all other parts of the Boom Formation, except for the Belsele-Waas Member, specimens are bivalved and pyritysed internally. The sediment around these trees is also much coarser than the surrounding clay. Some of the species collected seem to have lived on the wood. An undescribed species of the gastropod genus *Cocculina* DALL, 1882, for example, is found solely around the trunks. Vertebrate fossils are also more common in the sediment around the tree trunks. Large and small shark teeth are abundantly present and, as all tooth types from a single species are represented, it even seems that some of them belonged to the same individual. The sedimentological and faunistic data led us to believe that the trees were brought in by currents from shallower water, carrying a number of species living on them, and acting as a physical barrier, concentrating material, which would otherwise become scattered.

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Explanation of the plates

PLATE 1

Fig. 1a, b – *Yoldiella pygmaea pygmaea* (GOLDFUSS, 1837). Kruibeke, Oost-Vlaanderen province, Argex (Gralex) Quarry; S41 septarian bed, Putte Clay Member, Rupelian. 1a: coll IRSNB IST 7257, 1b: coll IRSNB IST 7258.

Fig. 2 – *Pristigloma sphaerica* (VON KOENEN, 1868). Mol, Antwerp province, boring; - 225 m, passage Rupelian-Chattian, Rupelian. Coll IRSNB IST 7259.

Fig. 3 – *Saccella westendorpi gracilis* (DESHAYES, 1860). Kruibeke, Oost-Vlaanderen province, Argex (Gralex) Quarry; S50 septarian bed, Putte Clay Member, Rupelian. Coll IRSNB IST 7260.

Fig. 4a-f – *Saccella westendorpi gracilis* (DESHAYES, 1860). Lanaken, Limburg province, Albertkanaal at Briegden; Kerniel Sand, Bilzen Formation, Rupelian. 4a: coll IRSNB IST 7261, 4b: coll IRSNB IST 7262, 4c: coll IRSNB IST 7263, 4d-f: coll IRSNB IST 7264.

Fig. 5a, b – *Bathyarca bellula* (WIECHMANN, 1874). Kruibeke, Oost-Vlaanderen province, Argex (Gralex) Quarry; S50 septarian bed, Putte Clay Member, Rupelian. 5a: coll IRSNB IST 7265, 5b: coll. IRSNB IST 7266.

Fig. 6a, b – *Glycymeris (Chevronia) lunulata lunulata* auct. non NYST, 1936. Steendorp, Antwerp province; Boom Formation, Rupelian. Coll. IRSNB IST 7267.

Fig. 7a, b – *Glycymeris (Chevronia) planicostalis* (LAMARCK, 1814). Boom, Antwerp province; Boom Formation, Rupelian. Coll. IRSNB IST 7268.

Fig. 8 – *Nucinella microdus* (BOETTGER, 1869). 8a: coll IRSNB IST, Rumst, Oost-Vlaanderen province, Wienerberger Quarry, S50 septarian bed, Putte Clay Member, Rupelian; 8b, c: Niel, Antwerp province, Ceulemans Quarry, S30 septarian bed, Terhagen Clay Member, Rupelian. 8a: coll IRSNB IST 7269, 8b: coll. IRSNB IST 7270, 8c: coll. IRSNB IST 7271.

Fig. 9 – *Isognomon* sp. Niel, Antwerp province; Boom Formation, Rupelian. Coll. IRSNB IST 7272.

Fig. 10 – *Spondylus* sp. Boom, Antwerp province; Boom Formation, Rupelian. Coll. IRSNB IST 7273.

Fig. 11 – *Axinopsida marisae* WELLE & NAGEL, 2003. Kruibeke, Oost-Vlaanderen province, Argex (Gralex) Quarry; S50 septarian bed, Putte Clay Member, Rupelian. 11a: coll IRSNB IST 7274, 11b: coll. IRSNB IST 7275.

PLATE 2

Fig. 1 – *Thyasira (Thyasira) benedeni* (DE KONINCK, 1838). Rumst, Antwerp province, Wienerberger Quarry; S41 septarian bed, Putte Clay Member, Rupelian. Coll IRSNB IST 7276.

Fig. 2 – *Thyasira (Thyasira) obtusa* (BEYRICH, 1848). Kruibeke, Oost-Vlaanderen province, Argex (Gralex) Quarry; S60 septarian bed, Putte Clay Member, Rupelian. Coll IRSNB IST 7277.

Fig. 3 – *Callucina (Callucina) thierensi* (HÉBERT, 1849). Niel, Antwerp province, Ceulemans Quarry; S30 septarian bed, Terhagen Clay Member, Rupelian. 3a: coll. IRSNB IST 7278, 3b: coll. IRSNB IST 7279, 3c, d: coll. IRSNB IST 7280.

Fig. 4 – *Callucina (Callucina) thierensi* (HÉBERT, 1849). Kruibeke, Oost-Vlaanderen province, Argex (Gralex) Quarry; S50 septarian bed, Putte Clay Member, Rupelian. Coll IRSNB IST 7281.

Fig. 5 – *Semierycina (Semierycina) kruibekensis* nov. sp. Kruibeke, Oost-Vlaanderen province, Argex (Gralex) Quarry; S50 septarian bed, Putte Clay Member, Rupelian. 5a: coll IRSNB IST 7282 (paratype), 5b coll IRSNB IST 7283 (paratype), 5c, e, f: coll IRSNB IST 7284 (holotype), 5d: coll IRSNB IST 7285 (paratype).

Fig. 6 – *Scacchia (Scacchia) dufraingi* nov. sp. Niel, Antwerp province, Ceulemans Quarry; S50 septarian bed, Putte Clay Member, Rupelian. 6a: coll. IRSNB IST 7286 (holotype), 6b: coll. IRSNB IST 7287 (paratype).

Fig. 7 – *Scacchia (Scacchia) dufraingi* nov. sp. Kruibeke, Oost-Vlaanderen province, Argex (Gralex) Quarry; S50 septarian bed, Putte Clay Member, Rupelian. Coll IRSNB IST 7288 (paratype).

Fig. 8 – *Angulus* cf. *posterus* (BEYRICH *in* VON KOENEN, 1868). Kruibeke, Oost-Vlaanderen province, Argex (Gralex) Quarry; S50 septarian bed, Putte Clay Member, Rupelian. Coll IRSNB IST 7289.

Fig. 9 – *Thracia (Thracia) vanremoorteli* nov. sp. Kruibeke, Oost-Vlaanderen province, Argex (Gralex) Quarry; S50 septarian bed, Putte Clay Member, Rupelian. Coll IRSNB IST 7290 (holotype).

Fig. 10 – *Cuspidaria (Cuspidaria) clava* (BEYRICH, 1848). Kruibeke, Oost-Vlaanderen province, Argex (Gralex) Quarry; S50 septarian bed, Putte Clay Member, Rupelian. 10a, b: Coll IRSNB IST 7291, 10 c, d: Coll IRSNB IST 7292.

Fig. 11a – *Cardiomya (sensu lato) annamariae* nov. sp. Rumst, Antwerp province, Wienerberger Quarry; S50 septarian bed, Putte Clay Member, Rupelian. Coll IRSNB IST 7293 (holotype).

Fig. 12a-c – *Cardiomya (sensu lato) annamariae* nov. sp. Niel, Antwerp province, Ceulemans Quarry; S50 septarian bed, Putte Clay Member, Rupelian. Coll. IRSNB IST 7294 (paratype).

PLATE 3

Fig. 1 – *Nucula (Nucula) orbignyi* GLIBERT, 1955. Boom, Antwerp province; Boom Clay, Rupelian. Coll. IRSNB IST 4502 (holotype).

Fig. 2 – *Nucula (Nucula) duchasteli* NYST, 1835. Boom, Antwerp province; Boom Clay, Rupelian. Coll. IRSNB IST 4501 (lectotype).

Fig. 3 – *Portlandia deshayesiana* (NYST, 1835). Boom, Antwerp province; Boom Clay, Rupelian. Coll. IRSNB IST 4503 (lectotype).

Fig. 4 – *Barbatia multistriata* (DE KONINCK, 1838). Boom, Antwerp province; Boom Clay, Rupelian. Coll. IRSNB IST 4504 (lectotype).

Fig. 5 – *Palliolum deshayesi* (NYST, 1836). Kleine Spouwen, Limburg, Belgium. Berg Sand Member, Rupelian, Early Oligocene. Coll. IRSNB IST 3825 (lectotype), Coll. IRSNB IST 3826, 3827 (paralectotypes).

Fig. 6 – *Palliolum delheidi* (VINCENT, 1930). Niel, Antwerp province; Boom Clay, Rupelian. Coll. IRSNB IST 1806-1807 (syntypes).

Fig. 7 – *Pycnodonte (Pycnodonte) paradoxa* (NYST, 1835). Boom, Antwerp province; Boom Clay, Rupelian. Coll. IRSNB IST 4507 (lectotype).

Fig. 8 – *Thyasira (Thyasira) benedeni* (DE KONINCK, 1838). Boom, Antwerp province; Boom Clay, Rupelian. Coll. IRSNB IST 4510 (lectotype).

Fig. 9 – *Cyclocardia kickxi* (NYST & WESTENDORP, 1839). Boom, Antwerp province; Boom Clay, Rupelian. Coll. IRSNB IST 4509 (lectotype).

Fig. 10 – *Carinastarte kickxi* (NYST, 1835). Basel, Oost-Vlaanderen province; Boom Clay, Rupelian. Coll. IRSNB IST 3794 (lectotype).

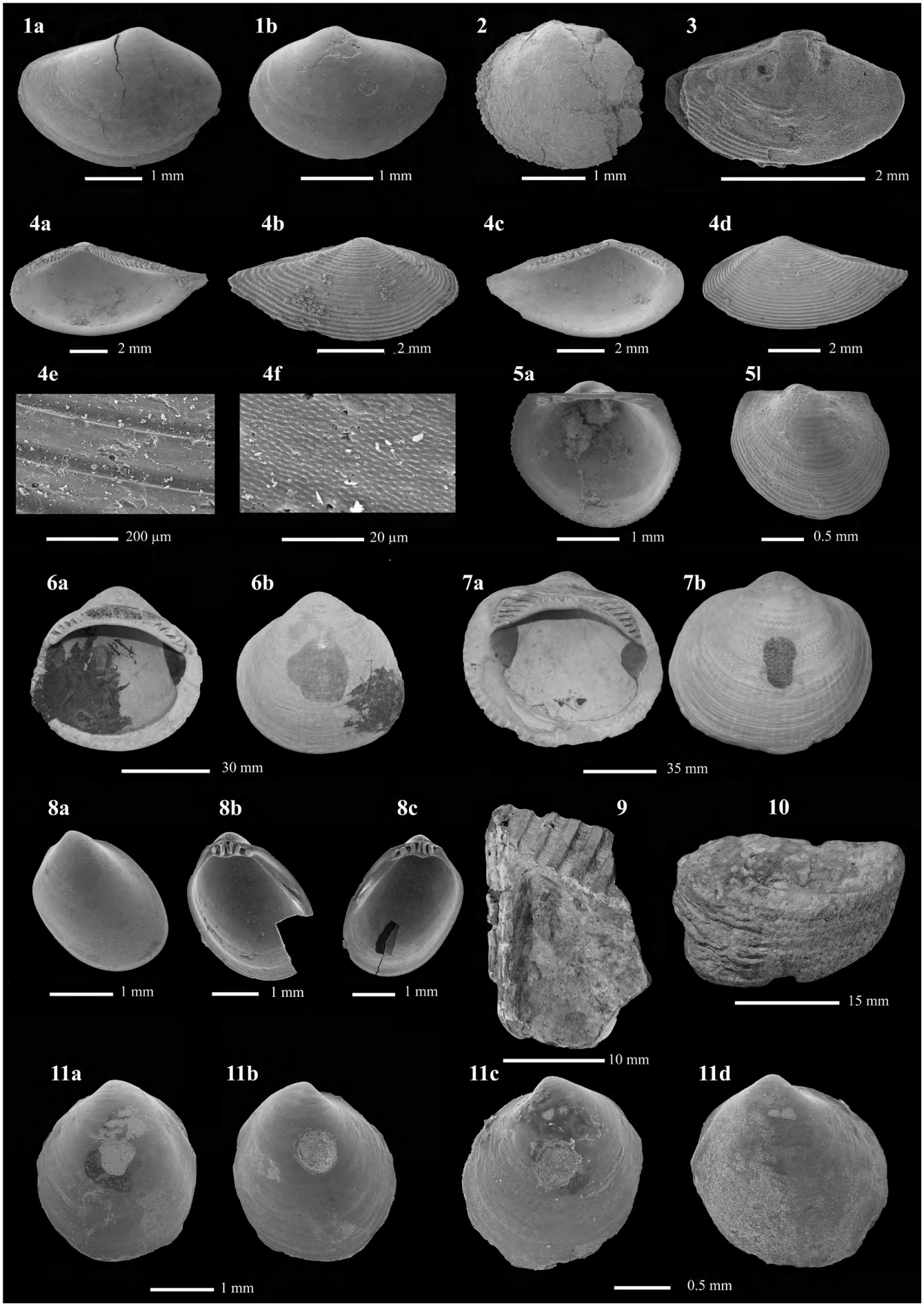
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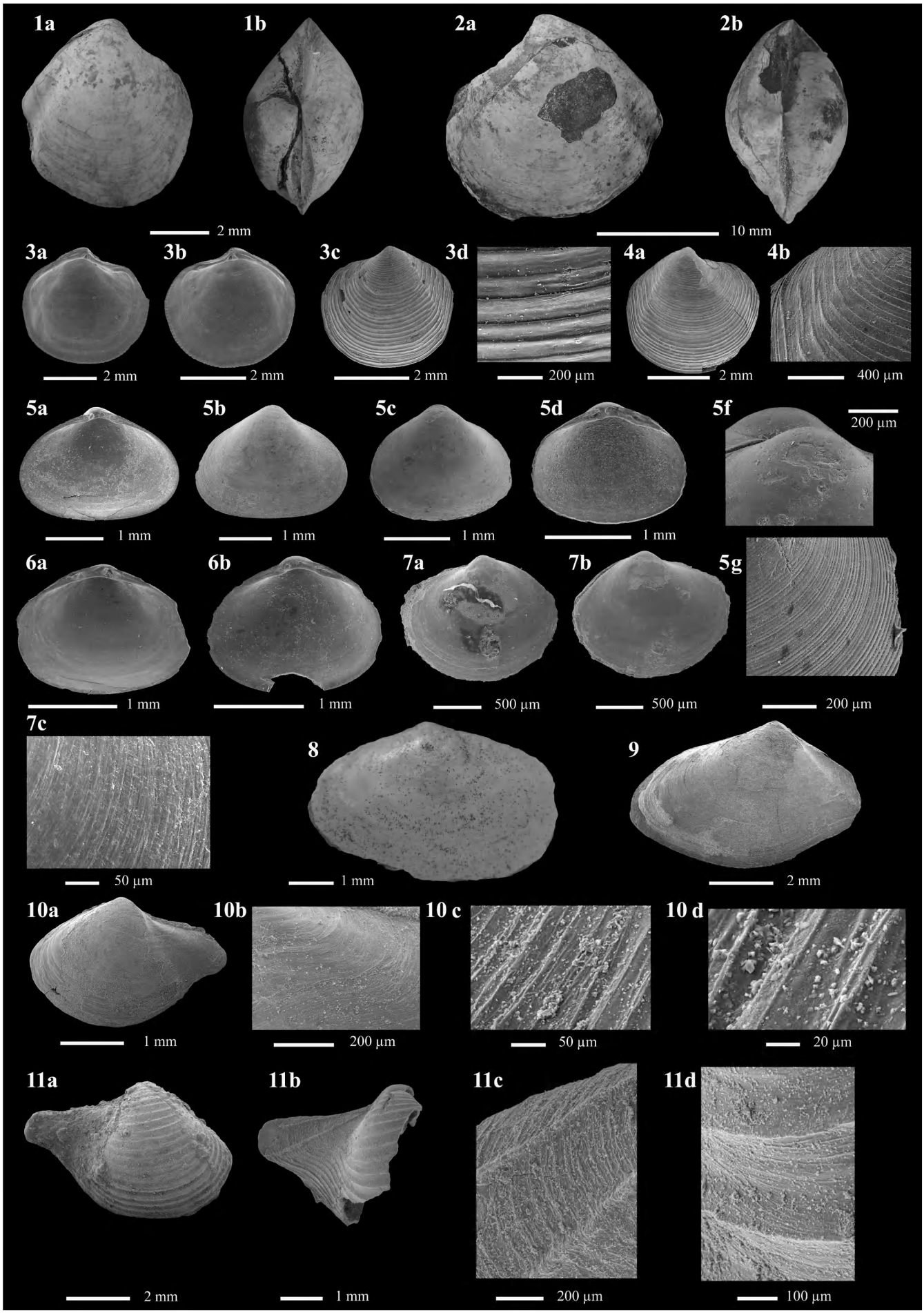
PLATE 1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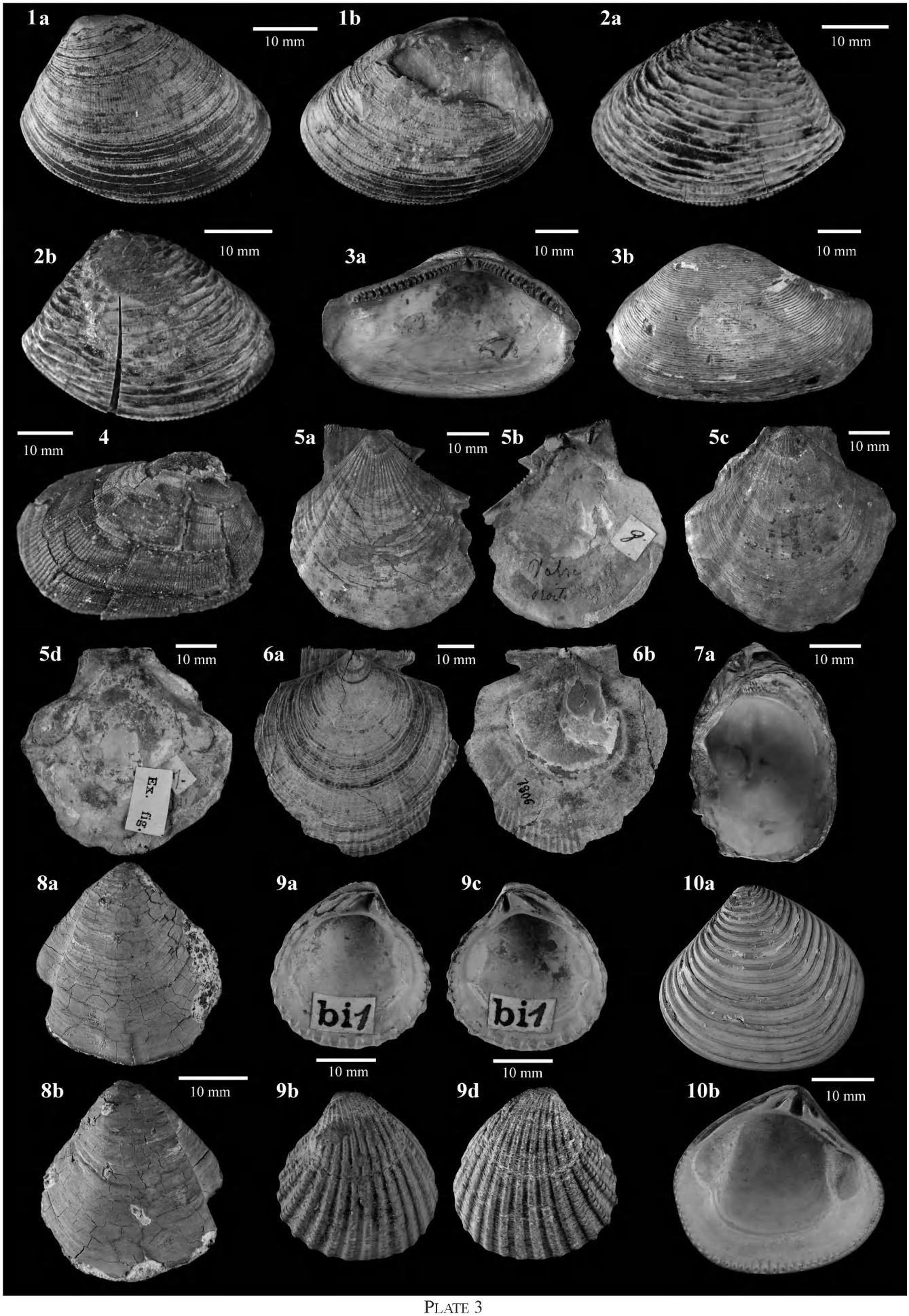
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PLATE 3