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

by Robert MARQUET


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, and four of them are new to science: *Semierycina (Semierycina) kruibekensis* nov. sp., *Scacchia (Scacchia) dufraingi* nov. sp., *Thracia (Thracia) vanremoorteli* nov. sp. et *Cardiomya (sensu lato) annamariae* nov. sp. The large majority of the species seems to be endemic to the North Sea Basin. It is attempted 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 différents 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

<table>
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<tr>
<th>Etages</th>
<th>Horizon (provinces of Vlaams Brabant and Antwerp)</th>
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<td>Assise de Boom</td>
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<td>Horizon à <em>Nucumella taxandrica</em></td>
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<td>Sables de Berg</td>
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<td>Sables de Bautersem</td>
<td>Glaises de Henis</td>
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<td>Horizon à Vertébrés de Hoogbutsel</td>
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<td>Tongrien</td>
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<td>Sables de Grimmertingen</td>
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Fig. 1 – Stratigraphic division of the Oligocene, used by GLIBERT & DE HEINZELIN (1954) and GLIBERT (1957). Nomenclature in French.
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, synonymy 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.

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 Gilbert (1955); after this publication, no new material was added to the IRSNB Oligocene bivalve collection. In the present paper, Gilbert’s descriptions are not repeated, only the material collected during the present survey is discussed. The material studied by Gilbert (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 Bouchez et al. (2010). Abbreviations:
**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* Gilbert, 1955

Pl. 3, Fig. 1


**Type material:** Holotype IRSNB IST 4502.

**Locus typicus:** Boom, prov. Antwerp, Belgium.

**Stratum typicum:** Boom Formation, Rupelian, Early Oligocene.

**Description:** See Gilbert (1957, p. 10, pi. 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* Nystr, 1835

Pl. 3, Fig. 2

1835  –  *Nucula Duchasteli*, Nob. - Nystr, 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 Gilbert (1957, p. 11, pl. 1, fig. 4).

**Occurrence:** Gilbert (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 Gilbert (1957), equally common, which is not in accordance with our data. *Nucula duchasteli* Nystr, 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.

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**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).

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<tr>
<th>SERIES</th>
<th>STAGES</th>
<th>LITHOSTRATIGRAPHY</th>
<th>COMPOSITE SECTION</th>
<th>DINOYST ZONATION</th>
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sp = specimen, fr = fragments, H = height, L = length, HD = hemidiameter (diameter of single valve), D = diameter (of bivalved specimen).
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

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**Nucinella microdus** (BOETTGER, 1869)

Pl. 1, Fig. 8

1869 – **Pleurodon microdus** BOETTGER, - BOETTGER, p. 17, pl. 1, fig. 3.

1871 – **Pleurodon microdus** BOETTGER, - BOETTGER, p. 42, pl. 8, fig. 3.


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 KOELEN, 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 Nuculaninaceae 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 BROCHII).
1837 – Nucula nitida GOLDFUSS, p. 159, pl. 125, fig. 23 (non BROCHII).
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 KOELEN, p. 94.
1884 – Leda gracilis DESH. - SPEYER & VON KOELEN, 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.
1942 – Leda (Leda) westendorpi (NYST) - HEERING, p. 19, pl. 2, figs 12-14.
1942 – Leda (Leda) gracilis DESHAYES - HEERING, p. 259, pl. 2, figs 13-14.
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 (Leda) gracilis DESHAYES 1860 (GÖRGES, p. 12.
1954 – Leda (s.s.) gracilis DESHAYES - GLIBERT & DE HEINZELIN, p. 318.
1954 – Leda (Leda) gracilis DESHAYES - HEERING, p. 19, pl. 2, fig. 6.
1957 – Nuculana gracilis DESHAYES, sp. 1860 - GLIBERT, p. 11, pl. 1, fig. 6.
1973 – Nuculana (Nuculana) westendorpi (NYST, 1839) - NEUFFER, p. 15, pl. 1, fig. 14.
1974 – Nuculana (Saccella) gracilis (DESHAYES, 1860) - RINGÉLÉ, p. 51, pl. 5, 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) - SCHNEITLER & BEYER, p. 203.
1990 – Nuculana (Saccella) westendorpi (NYST 1839) - SCHNEITLER & BEYER, p. 46.
1991 – Nuculana (Saccella) westendorpi NYST, 1839 - MÜLLER & WELLE, p. 152, pl. 1, fig. 1.
1997 – Nuculana (Saccella) westendorpi (NYST, 1839) - WELLE, p. 8.
1998 – Nuculana (Saccella) westendorpi (NYST, 1839) - MÖTHS et al., p. 6, pl. 1, fig. 4.
1999 – Nuculana (Nuculana) westendorpi (NYST, 1839) - WELLE, JÄRSCHKE & DUCKHEIM, p. 16.
2003 – Nuculana (Saccella) westendorpi (NYST, 1839) - WELLE & NAGEL, p. 39.
2008 – Nuculana (Saccella) westendorpi (NYST & WESTENDORP, 1839) - SCHNEITLER & PALM, p. 11, pl. 1, fig. 4.

Material: Kruibeke: S50 (1 specimen), Lanaken (Limburg Province, Belgium), Kerniel Sand Member (>50 sp.).

Original localities: Jeurees, 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 posterior dorsal area. Height about 45% of length. Umb 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 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 Kemiel 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 Yoldinacea 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).

Subfamilia Yoldiillinae 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 – Ledea (Nucula) pygmaea MÜNST. (GOLDF.) - VON KOENEN, p. 241.
1884 – Ledea pygmaea MÜNST. - SPEYER & VON KOENEN, pl. 17, figs 4-5.
1907 – Portlandia pygmaea M. sp. - RAVN, p. 260, pl. 1, figs 9-10.
1913 – Portlandia pygmaea V. MÜNSTER sp. - HARDER, p. 52, pl. 3, fig. 15.
1941 – Ledea pygmaea M. MUNSTER - GÖRGES, p. 162.
1942 – Ledea (Jupiteria) pygmaea (von Münster) - HEERING, p. 17, pl. 3, figs 6-7.
1952 – Ledea (Jupiteria) pygmaea (Münster 1835) - GÖRGES, p. 11.
1957 – Nuculanus (Jupiteria) pygmaea (MUNSTER) GOLDFUSS, sp. 1937 - GLIBERT, p. 12, pl. 1, fig. 8.
1973 – Portlandia (Yoldiella) pygmaea (MÜNST. 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 (MÜNST. in GOLDFUSS, 1837) - GÜRS, p. 198.
1997 – Portlandia (Yoldiella) pygmaea (MÜNSTER, 1837) - WELLE, p. 10.
1998 – Portlandia (Yoldiella) pygmaea (MÜNSTER, 1837) - MOTH ET AL., p. 6, pl. 1, fig. 3.
1999 – Yoldiella pygmaea (MÜNSTER, 1837) - WELLE, JAESCHKE & DUCKHEIM, p. 17.
2000 – Yoldiella pygmaea (MÜNSTER, 1837) - MOTH, p. 43, pl. 15, fig. 4.
2003 – Yoldiella pygmaea (MÜNSTER, 1837) - WELLE & NAGEL, p. 40, pl. 1, figs 6-7.

Material: Knuijbeke: 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.
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 Rupel Clay 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 Stemberger 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.

Type species: Arca multistriata LINNAEUS, 1758

Barbatia multistriata (De Koninck, 1838)  
Pl. 3, Fig. 4

1838 – Arca multistriata Mili 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 known 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.

Subfamily Anadarinae REINHARDT, 1935  
Genus Bathyarca KOEHL, 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.  
1890 – Arca Saxonica von KOENEN, p. 1107, pl. 73, figs 9-12.  
1934 – Arca Lundensis von KOENEN, p. 1109.  
1957 – Bathyarca (Bathyarca) bündensis (v. KOENEN) - GÖRGES, p. 119, 123.  
1975 – Bathyarca saxonica (von KOENEN, 1868) - VON DEN BOSCH, CADÉE & JANSSS, p. 122, pl. 1, fig. 5.  
1979 – Bathyarca bellula (WIECHMANN 1874) - R. JANSSSEN, p. 26, pl. 1, fig. 11.  
1983 – Bathyarca bellula (WIECHMANN, 1874) - A. MÜLLER, p. 27.  
1998 – Batharca bellula (WIECHMANN, 1874) - MOITIS et al., p. 7, pl. 2, fig. 2.  
1999 – Bathyarca bellula (WIECHMANN, 1874) - WELLE, JAESCHKE & DUCKHEIM, p. 17.  
2000 – Bathyarca bellula (WIECHMANN, 1874) - MOITS, p. 44, pl. 16, fig. 3.

Material: Rumst: S50 (3 sp.), Kruiiske: S50 (10 sp.), Niël: 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
Bathyarca pectunculoides

**Time for the Belgian Oligocene. Miocene to Recent**

This species is recorded here for the first time for the Belgian Oligocene. Miocene to Recent

**Remarks**

**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

**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.

**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-Hem 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 independent 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 L a m a r c k , 1807 in G l i b e r t & d e H e i n z e l i n (1954, p. 331) and R. J A N S S E N (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 G L I B E R T ’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: G L I B E R T (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. M A R Q U E T 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 N E W E L L , 1965

Superfamilia Pterioidea G r a y , 1847

Familia Isognomonidae W O O D R I N G , 1925

Genus Isognomon L I G H T F O O T , 1786

Type species: Ostrea perna L I N N A E U S , 1767

Isognomon sp.

Pl. 1, Fig. 9

Dimensions: Pl. 1, Fig. 9 (coll. IRSNB IST 7272): L - 23 mm (fragment).

Remarks: G L I B E R T (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 N E U F F E R, 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 F É R U S S A C , 1822

Superfamilia Ostreoidea R A F I N E S Q U E , 1815

Familia Gryphaeaeae V Y A L O V , 1936

Subfamilia Pycnodonteinae S T E N Z E L , 1959

Genus and subgenus Pycnodonte F I S C H E R V ON W A L D H E I M , 1835

Type species: Gryphaea gigantica S O L A N D E R in B R A N D E R , 1766

Pycnodonte (Pycnodonte) paradoxa (N Y S T , 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 G L I B E R T (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 G r a y , 1854

Superfamilia Pectinoidea R A F I N E S Q U E , 1815

Familia Pectinidae R A F I N E S Q U E , 1815

Subfamilia Palliolinae K O R O B K O V , 1960

Tribus Palliolini K O R O B K O V , 1960

Genus Palliolum M O N T E R O S A T O , 1884

Type species: Pecten incomparabilis R I S S O , 1826

Palliolum deshayesi (N Y S T , 1836)

Pl. 3, Fig. 5

1834 – Pecten pictus GOLDFUSS, p. 67, pl. 97, fig. 4 (non D A C O S T A)

*Type material:* Lectotype IRSNB IST 3825, figured specimens IRSNB IST 3826, 3827.


*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* DAcosta, 1778, p. 144, figs 1, 2, 4, 5 (see for instance NEUFFER, 1944, p. 25, infrapaginal note). The name given by DAcosta 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.

**Palliololum permistum** (BEYRICH, 1848)

*Original localities:* Görzig, Hermsdorf, Brandenburg, Germany.

*Stratum typicum:* “Septarienton”, 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).


*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.

*Stratum 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.

*Description:* See VINCENT (1930, p. 6, text-fig. 5).

*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.
Family 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.

Superfamily Thyasiroidea Dall, 1900
Family 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 - REVERE, p. 58, pl. 4, fig. 20.
1949 – Thyasira unicarinata (NYST) - Gillet, p. 58, pl. 4, fig. 9.
1957 – Thyasira nysti Philippi, sp. 1846 - Gillet, p. 58, pl. 4, fig. 20.
1975 – Thyasira nysti (Fourn., 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), Niei: 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, equivaleve 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 Aximus angulatus from the Boom Clay Formation at Boom, province of Antwerp, Belgium. This name was however preoccupied, so it was renamed Aximus 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 obtusa (MONTAGU, 1803) are negligible. Accordingly, A.W. JANSSSEN (1984, p. 60) used the name T. flexuosa for Hemmorian material from Miste, The Netherlands. R. JANSSSEN (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 BEYRICH, ? - VON KOENNEN, p. 102, pl. 27, figs 5, 8.
1975 – Thyasira obtusa (BEYRICH, 1848) - VAN DEN BOSCH, CADÉE & JANSSSEN, p. 136, pl. 8, fig. 5.
1999 – Thyasira (Thyasira) cf. obtusa (BEYRICH, 1848) - WELLE, JAECHKE & DUCKHEIM, p. 20.
2000 – Thyasira obtusa (BEYRICH, 1848) - MOTHERS, 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 IS 7277): H - 16.6 mm, L - 16.1 mm, D - 9.8 mm.

Description: Rather large, fragile, equivaleve 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 & JANSSSEN (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*

**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: Plate 1, Fig. 11a-b (coll. IRSNB IS 7274): H - 2.8 mm, L - 2.6 mm, D - 1.7 mm; Pl. 1, Fig. 11c-d (coll. IRSNB IS 7275): H - 1.75 mm, L - 1.8 mm, D - 1.0 mm.

Description: Small, equivaleve, 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)

1839 – Venericardia Kickxia. 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 Kickxia, 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).
Bivalvia from the Boom Formation (Rupelian) of Belgium

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, pi. 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 Gliebert (1957, pl. 3, fig. 11) can be given.

Locus typicus: Basel, province Oost Vlaanderen, Belgium.

Stratum typicum: Boom Formation, Rupelian, Early Oligocene.

Description: See Gliebert (1957, p. 35, pi. 3, fig. 11).

Remarks: Four specimens of this distinct species were mentioned by Gliebert (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: Krubeke, S50 (4 sp.), Niel, S50 (2 sp.).

Locus typicus: Claypit of the Argex (Gralex) Company at Krubeke, 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, equivaleve, nearly equilateral, fragile shell. Prodissocoench 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 imperceptibly 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 A1 strong, AII 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 (Gliebert, 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 Dufrain, 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.

*Description:* 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 AII. Resilium rather indistinct. On the inside of the shell, radial striaion 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. JANSSSEN (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.

Superfamily Glossoidea GRAY, 1847
Família 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 Runst, 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.

Superfamily Tellinoidea DE BLAINVILLE, 1814
Família 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 posteria BEYRICH in VON KOENEN, p. 259.
1884 – Tellina posteria BEYRICH - SPEYER & VON KOENEN, pl. 31, fig. 8.
1944 – Tellina posteria BEYRICH - HEERING, p. 41, pl. 4, figs 19-20.
1952 – Moerella posteria (BEYRICH 1866) - GÖRGES, p. 51, pl. 1, figs 25-27.
1957 – Moerella posteria (BEYRICH) - GÖRGES, p. 120.
1957 – Angulus (Moerella) posteria (BEYRICH) KOENEN, sp. 1868 - GLIBERT, p. 43.
1979 – Tellina (Peronidia) posteria BEYRICH 1868 - R. JANSSSEN, p. 113, pl. 3, fig. 59.
1990 – Angulus posterus (BEYRICH, 1868) - SCHNETLER & BEYER, p. 47.
1998 – Tellina (Peronidia) posteria BEYRICH, 1868 - MOENS, PEHL & ALBRECHT, p. 17, pl. 11, fig. 3.
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
Bivalvia from the Boom Formation (Rupelian) of Belgium

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 completely certain.

**Order 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 subpissum* (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) subpissum* occurs in hyposalinic conditions, while the nominal subspecies is present in euryhaline environments.

*Occurrence:* Glébert (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 Niei and in the Mol boring; no number of specimens could be given in Table 1, because only fragments were found.

*Order uncertain*  

Superfamilia Hiattelloidea Gray, 1824  

Familia Hiattellidae Gray, 1824

Genus and subgenus *Hiattella* Daudin in Bosc, 1801

*Type species:* *Mya arctica* Linnaeus, 1758

*Hiattella (Hiattella) arctica* (Linnaeus, 1758)

*Occurrence:* Glébert (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:* Glébert (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 Thracioidae Stolizcka, 1870
Familia Thraciidae Stolizcka, 1870
Genus and subgenus Thracia Sowerby, 1823

Type species: Mya pubescens Pulteney, 1799

Thracia (Thracia) vanremoorteli nov. sp.

PI. 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. - Motus, 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.).


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 Belgium, 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 distinctly 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 Cuspidarioidea DALI, 1886  
Familia Cuspidariidae DALI, 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* GLIBERT, 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:** Kruiibeke, 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* GLIBET & 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 clayspit, 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 claysip, 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, timid, 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 is close to the genus Tropidomya Dal., 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).

Glébert (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 Morehi” from the Late Oligocene of Arhus (Denmark); it occurs at that locality together with C. kochi. This material is more tumpid, with slightly different ornamentation, but both names could be synonyms. Cardiomya moerchii differs from C. annamariaceae 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 tumpid 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 Glébert (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 Glébert (1957). Eleven are recorded here for the first time, including four new species. One species, Thysirisa (T.) obtusa (Beyrich, 1848), was recorded earlier by Van Den Bosch, Cadée & Janssen (1975). Eight species recorded by Glébert (1957) were not found again. These are for the larger 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. Bel. = Belsele-Waas Member; T = found near tree trunks; Gl = recorded by Glébert (1957); x = present.
<table>
<thead>
<tr>
<th>Species name</th>
<th>Authors</th>
<th>Species number</th>
<th>Belgian</th>
<th>Terhagen</th>
<th>Putte</th>
<th>Mol</th>
<th>Gl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nucula orbignyi</td>
<td>GLIBERT, 1955</td>
<td>9</td>
<td>1</td>
<td>1</td>
<td>7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Nucula duchasteli</td>
<td>NYST, 1835</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td>8</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>Yoldiella p. pygmaea</td>
<td>(GOLDFUSS, 1835)</td>
<td>16</td>
<td>-</td>
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<td>Cuspidaria (C.) clava</td>
<td>BÉYRICH, 1848</td>
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| 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 *Cyclocardita kickxi* (NYST, 1835) and *Carinastearte kickxi* (NYST, 1835) both in the Belsele-Waas, although very rare, and the Terhagen Members. 

VAN DEN BOSCH, CADEÉ & JANSSSEN (1975) recognised in the Rupelian Brinkheume 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 Brinkheume 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. 

VAN DEN BOSCH, CADEÉ & JANSSSEN (1975) proposed that the Dutch Assemblage zone and the Belgian S20 horizon probably represents 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 pyritised 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.

**Acknowledgements**

I wish to thank the companies Argex, Ceulemans and Wienerberger for allowing access to their respective claypits. The photographs in this paper were made by J. Laporte, W. Mizeur and J. Cilis (SEM). L. Dufrain and W. Vannemoortele helped during fieldwork and donated specimens. S. Goolaerts (KUL) gave material from the Mol boriing. K. Hoedemakers and O. Lambert are thanked for the linguistic improvements of the manuscript. Finally, I am very grateful to the reviewers R. Janssen (Forschungsinstitut Senckenberg), E. Steurbaut (Royal Belgian Institute of Natural Sciences) and J. Welle (Geologisch-Paläontologisches Institut Münster) for their constructive comments.

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well logs in the Rupel Group between North Belgium, the Lower-Rhine area in Germany and Southern Limburg and the Achterhoek in The Netherlands. Aardkundige Mededelingen, 11: 69-84.


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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) planicostalis (Lamarck, 1814). Boom, 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* Welde & 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, c, 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, 10c, 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 – *Carinostarte kickxi* (NYST, 1835). Basel, Oost-Vlaanderen province; Boom Clay, Rupelian. Coll. IRSNB IST 3794 (lectotype).
Bivalvia from the Boom Formation (Rupelian) of Belgium