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PLIOCENE GASTROPOD FAUNAS FROM KALLO (OOST-VLAANDEREN, BELGIUM) — PART 3. CAENOGASTROPODA: APORRHAIDAE TO MURICIDAE, AND PART 4. BUCCINIDAE TO HELICIDAE

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Marquet, R. Pliocene gastropod faunas from Kallo (Oost-Vlaanderen, Belgium) — Part 3. Caenogastropoda: Aporrhaidae to Muricidae, and Part 4. Buccinidae to Helicidae. — Contr. Tert. Quatern. Geol., 34(3-4): 69-149, 2 tabs, 12 pls. Leiden, October 1997.

With Parts 3 and 4 of the current series, the taxonomic revision of Pliocene gastropods from temporary exposures at Kallo (Oost-Vlaanderen, Belgium) is completed. Material collected from the early Pliocene Kattendijk Formation and the middle-late Pliocene Oorderen, Kruisschans and Merksem members of the Lillo Formation is described and illustrated, and stratigraphic and geographic ranges of species are discussed. Twenty-nine (sub)species are new to the Belgian Pliocene, viz. *Lamellaria perspicua* (Linné, 1758), *Euspira cirriformis gottschei* (Kautsky, 1925), *Cryptonatica operculata* (Jeffreys, 1885), *Krachia zelandica* (Beets, 1946), *Cerithiopsis barleei* Jeffreys, 1867, *Cerithiopsis nana* (Wood, 1848), *Aclis ascaris* (Turton, 1819), *Cirsotrema (C.) fimbriosum exfimbriosum* Sacco, 1891, *Vitreolina philippii* (Rayneval & Ponzi, 1854), *Crinophteiros collinsi* (Sykes, 1903), *Pterynopsis binominatus* (Staadt *in* Cossmann, 1909), *Trophon barvicensis* (Johnston, 1825), *Anachis anglica* (Bell *in* Wood, 1874), *Fusinus longiroster* (Brocchi, 1814), *Babylonella fusiformis subangulosa* (Wood, 1848), *Pyramidella plicosa* Bronn, 1838, *Evalea divisa* (J. Adams, 1797), *Ondina obliqua* (Alder, 1844), *Anisocycla nitidissima* (Montagu, 1803), *Menestho britannica* Bell, 1873, *Brachystomia albella* (Lovén, 1846), *Diaphana minuta* Brown, 1827, *Cylichna concinna* (Wood, 1839), *Philine ventrosa* (Wood, 1839), *Philine denticulata* (J. Adams, 1800) and *Limacina atlanta* (Mörch, 1874). *Brachystomia cerullii* nov. nom. is proposed to replace *Brachystomia lineolata* (Cerulli-Irelli, 1914) *non* Sandberger, 1859, while *Cerithiopsis keukelaari* is described as new, and previous records of '*Cerithiopsis tuberculata* (Montagu, 1803)' are shown not to belong to that species but to four others.

Key words — Gastropoda, Caenogastropoda, Pliocene, North Sea Basin, taxonomy, new species.

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INTRODUCTION

The total number of gastropod species recorded from the Pliocene of the North Sea Basin differs considerably according to author. Glibert (1957, 1958a, b, 1959, 1960) recorded 168 species from Belgium, while Beets (1946) and van Regteren Altena *et al.* (1965) listed 160 and 105 species from The Netherlands, respectively. By contrast, Harmer (1913-1919, 1920-1925) described a total of 766 British species. Species found exclusively at St Erth (Cornwall) and in the Isle of Man, being outside the North Sea Basin, should be excluded. Still, it is obvious that a serious discrepancy exists between these numbers. Harmer certainly exaggerated the species diversity of the British Crags by splitting his material to infinity and by naming very fragmentary and/or eroded material. Belgian and Dutch faunas on the other hand were underestimated. The material described by Glibert was collected mainly during the nineteenth century, long before bulk sieving became common practice in palaeontology. Consequently, most of the rarer and especially the smaller species remained unobserved. In addition, the stratigraphic provenance of this material is often poorly known. Better documented specimens, collected subsequently by Glibert in temporary exposures described by de Heinzelin de Braucourt (1950a, b, 1955a, b), was studied by Glibert in part only. Beets's (1946) material from The Netherlands originated from borehole cores, which means that only a portion of the molluscan fauna is represented in recognisable form. In addition, Beets refrained from giving a stratigraphic interpretation to his material. Van Regteren Altena *et al.* (1965) studied material washed ashore, which is mostly rather eroded, especially the smaller species are very often difficult to recognise and stratigraphic data are lacking. In a number of papers (Marquet, 1993, 1995a, b, 1996, 1997a, b), new records for the Pliocene of Belgium were dis-

cussed, based on Glibert's material present in the IRScNB collections (Brussels), but mostly on specimens collected during dock works at Kallo (province of Oost-Vlaanderen). These dock works enabled new stratigraphic as well as systematic studies on the Pliocene fauna of Belgium. A fossil community new to the Pliocene of the North Sea Basin was discovered, the so-called *Petaloconchus* 'reef' in the Kattendijk Formation (Marquet, 1984). The duration of the works enabled the collection of bulk samples from all levels present. Consequently, a large number of species new for the Pliocene of Belgium were recorded, while the material collected contains excellently preserved specimens which can be used to improve the systematic knowledge of the species represented. Marquet (1993) described the molluscs of the Kruisschans Member (Lillo Formation, late Pliocene), which proved to be far more diverse than previously assumed. Marquet (1995a) discussed the stratigraphy observed at the Kallo dock works and the systematics of Archaeogastropoda from this exposure. In Marquet (1997b) the systematics of the caenogastropod families Potamididae to Tornidae were treated, while Marquet (1997a) described some turrid gastropods from the Pliocene of Belgium, based mainly on Kallo material.

SYSTEMATIC DESCRIPTIONS

Descriptions of Kallo species are brief when they are assignable to well-known taxa; only new or imperfectly known species are described in detail. Their stratigraphic distribution at Kallo is discussed and compared with that in Great Britain and The Netherlands. Dimensions mentioned are those of the specimens illustrated in the plates. Synonymies include the first record of the species in question from the North Sea Basin, references to the stratigraphic distribution of the species outside the North Sea Basin (only those papers with clear illustrations of the species) as well as references which aided in the identification of the species, especially in those cases where names differ from the ones used by Glibert (1957, 1958a, b, 1959, 1960).

Superfamily Stromboidea Rafinesque,1815
Family Aporrhaidae Gray, 1850
Genus *Aporrhais* da Costa, 1778

Aporrhais pespelecani quadrifida da Costa, 1778
Pl. 1, Fig. 1

1778 *Aporrhais pespelecani quadrifida* da Costa, p. 136.
1848 *Aporrhais pes-pelicani* Linn. — Wood, p. 25, pl. 2, fig. 4.
1852 *Chenopus anglicus* d'Orbigny, p. 59 (*partim*).
1918 *Aporrhais pespelicani* (Linné) — Harmer, p. 432, pl. 41, figs 26-30.
1918 *Aporrhais uttingerianus* (Risso) — Harmer, p. 435, pl. 41, fig. 31.
1958a *Aporrhais pespelicani quadrifidus* Da Costa, sp. 1778 — Glibert, p. 25, pl. 2, fig. 21.
1965 *Aporrhais pespelecani quadrifidus* Da Costa, 1778 — van Regteren Altena *et al.*, p. 22, pl. 8, fig. 85.
1979 *Aporrhais pespelicani quadrifida* (Da Costa, 1778) — Geys & Marquet, p. 70, pl. 28, fig. 1.

Dimensions — Height 22 mm, width 23 mm.
Description — Large, elongated shell of about eight whorls, with outer lip expanded into a plate which resembles a bird's foot. The extension ends in three points, the basal one of which is mostly broken off in the Kallo material. The gross sculpture consists of three strong spirals on the ultimate whorl; the uppermost spiral bears tubercles, and the lower one is the weakest. The fine ornament consists of numerous spiral striae over the entire shell.
Discussion — This species is rare in the Oorderen Member at Kallo.

Aporrhais scaldensis van Regteren Altena, 1954
Pl. 1, Fig. 2

1878 *Chenopus pes-pelicani*, L., var. *anglica*, d'Orb — Nyst, pl. 6, fig. 11.
1881 *Chenopus pes-pelicani*, Linn. — Nyst, p. 80.
1918 *Aporrhais Serresianus* (Michaud) var. *Macan-dreae* (Jeffreys) — Harmer, p. 437, pl. 41, fig. 34.
1954 *Aporrhais scaldensis* van Regteren Altena, p. 48.
1958a *Aporrhais scaldensis* Regteren-Altena, 1954 — Glibert, p. 24, pl. 2, fig. 20.
1965 *Aporrhais scaldensis* van Regteren Altena, 1954 — van Regteren Altena *et al.*, p. 22, pl. 8, fig. 84.
1979 *Aporrhais scaldensis* Regteren Altena, 1954 — Geys & Marquet, p. 70, pl. 28, fig. 2.

Dimensions — Height 20 mm, width 15 mm.
Description — Moderately large, elongated shell of about eight whorls, with an expanded outer apertural lip. This expansion terminates in four deeply incised, pointed projections. A small fifth projection may be present between the two lowermost ones. The lowest one is strongly curved. Ornament consists of two or three primary spirals, which bear many small tubercles. A large number of secondary spirals is present over the entire shell.
Discussion — This species is extremely common in the Oorderen Member and ranges more rarely into the Kruisschans Member; some doubtful fragments have been collected from the Kattendijk Formation. It is a typical North Sea Basin Pliocene species.

Superfamily Calyptraeoidea Lamarck, 809
Family Calyptraeidae Lamarck, 1809
Genus *Calyptraea* Lamarck, 1799

Calyptraea chinensis (Linné, 1758)
Pl. 1, Fig. 3

1758 *Patella chinensis* Linné, p. 781.
1848 *Calyptraea Chinensis* Linn. — Wood, p. 159, pl. 18,

fig. 1.
1878 *Calyptraea sinensis*, L. — Nyst, pl. 7, fig. 10.
1881 *Calyptraea sinensis*, Linn. — Nyst, p. 115.
1914 *Calyptraea chinensis* L. sp. — Cerulli-Irelli, p. 210, pl. 18, figs 1-8.
1914 *Calyptraea chinensis* fa. *depressa* Cerulli-Irelli, p. 211, pl. 18, fig. 9.
1914 *Calyptraea chinensis* fa. *conica* Cerulli-Irelli, p. 211, pl. 18, fig. 10.
1914 *Calyptraea chinensis* fa. *cubiliformis* Cerulli-Irelli, p. 211, pl. 18, fig. 11.
1923 *Calyptraea chinensis* (Linné) — Harmer, p. 772, pl. 61, figs 19-22.
1946 *Calyptraea (Calyptraea) chinensis* (Linné, 1758) — Beets, p. 55.
1958a *Calyptraea chinensis* Linné, sp. 1766 — Glibert, p. 23.
1965 *Calyptraea chinensis* (Linné, 1758) — van Regteren Altena *et al.*, p. 22, pl. 8, fig. 23.
1979 *Calyptraea chinensis* (Linnaeus, 1758) — Geys & Marquet, p. 68, pl. 27, fig. 7; pl. 28, fig. 4.
1988 *Calyptraea chinensis* (Linné, 1758) — Graham, p. 308, fig. 125.
1992 *Calyptraea chinensis* (L., 1758) — Cavallo & Repetto, p. 60, fig. 104.

Dimensions — Height 8 mm, width 32 mm.
Description — Large, circular, flattened, patelliform shell with central apex and tongue-shaped internal septum. Ornament consists of growth lines only. Juvenile specimens are relatively higher than adult ones.
Discussion - This well-known species is found at Kallo in the Kattendijk Formation and in the Oorderen and Kruisschans members of the Lillo Formation. It can only be confused with *Capulacmaea kalloensis* Marquet, 1993, which lacks the internal septum. *Calyptraea chinensis* ranges from the Miocene to Recent and is known from the Atlantic and the Mediterranean.

Family Capulidae Fleming, 1822
Genus *Capulus* de Montfort, 1810

Capulus ungaricus (Linné, 1758)
Pl. 1, Fig. 4

1758 *Patella ungarica* Linné, p. 1259.
1843 *Pileopsis ungarica* Linn. — Nyst, p. 355, pl. 35, fig. 8.
1848 *Capulus ungaricus* Linn. — Wood, p. 155, pl. 17, fig. 2a, d-g.
1848 *Capulus militaris* Mont. — Wood, p. 156, pl. 17, fig. 3c-f.
1872 *Capulus recurvatus* S. Wood — Wood, p. 88.
1878 *Pileopsis ungarica*, L. — Nyst, pl. 7, fig. 11a-e.
1881 *Pileopsis ungarica*, Linn — Nyst, p. 116.
1914 *Capulus hungaricus* L. sp. — Cerulli-Irelli, p. 205, pl. 16, figs 24, 33, 35, 36.
1914 *Capulus hungaricus* anom. *isocardiformis* Cerulli-Irelli, p. 206, pl. 16, fig. 34.
1914 *Capulus hungaricus* var. *Tapparoneiana* Cocc. sp. — Cerulli-Irelli, p. 206, pl. 16, figs 37-39.
1923 *Capulus ungaricus* (Linné) — Harmer, p. 763, pl. 61, figs 1-4.
? 1923 *Capulus venustus* Harmer, p. 766, pl. 61, fig. 9.
1923 *Capulus recurvatus* S.V. Wood — Harmer, p. 767, pl. 61, fig. 15.
1946 *Capulus (Capulus) ungaricus* (Linné, 1758) — Beets, p. 55.
1958a *Capulus ungaricus* Linné, sp. 1766 — Glibert, p. 22.
1965 *Capulus ungaricus* (Linnaeus, 1758) — van Regteren Altena *et al.*, p. 21, pl. 8, fig. 82.
1979 *Capulus ungaricus* (Linné, 1766) — Geys & Marquet, p. 68, pl. 27, fig. 1.
1988 *Capulus ungaricus* (Linné, 1758) — Graham, p. 306, fig. 124.
1992 *Capulus hungaricus* (L., 1758) — Cavallo & Repetto, p. 60, fig. 107.

Dimensions — Height 23 mm, width 47 mm.
Description — Large, patelliform shell. The protoconch, which consists of three smooth whorls, is clearly coiled and separated from the teleoconch by a clear ridge. The single adult whorl has a very large expansion rate. The outline is variable, oval, width exceeding height. The internal surface is glossy and clearly shows the muscle impressions. At the start of the teleoconch, axial ribs and irregular, discontinuous spiral lines are present. The ornament of the ultimate whorl consists of axial ribs, crossed by irregular growth lines. Most specimens, however, are eroded to such an extent that they appear nearly smooth.
Discussion — The variation in shape and ornament of this species has given rise to the description of a large number of varieties and synonyms. At Kallo, the species ranges from the Kattendijk Formation to the Kruisschans Member (Lillo Formation); Recent specimens are found in the Atlantic, including the coast of North America, and in the Mediterranean, but not in the North Sea.

Capulus unguis (J. Sowerby, 1816)
Pl. 1, Fig. 5

1816 *Patella unguis* J. Sowerby, p. 88, pl. 139, figs 7, 8.
1848 *Capulus obliquus* Wood, p. 156, pl. 17, fig. 1.
1848 *Capulus ungaricus* Linn. — Wood, p. 155, pl. 17, fig. 2b, c (*partim*).
1848 *Capulus fallax* Wood, p. 157, pl. 17, fig. 4.
1878 *Pileopsis ungaricus*, L. var. *obliquus*, S. Wood — Nyst, pl. 7, fig. 11f-j.
1881 *Pileopsis ungarica*, L. var. *obliquus*, S. Wood — Nyst, p. 118.
1923 *Capulus obliquus* S.V. Wood — Harmer, p. 765, pl. 61, figs 5, 6.
1923 *Capulus unguis* (J. Sowerby) — Harmer, p. 765, pl. 61, fig. 7.
1923 *Capulus fallax* S.V. Wood — Harmer, p. 766, pl. 61, fig. 9.
1923 *Capulus pumila* Harmer, p. 768, pl. 61, fig. 16.
1946 *Capulus (Capulus) fallax* Wood, 1848 — Beets, p. 54.
1958 *Capulus unguis* Sowerby, sp. 1816 — Glibert, p. 22.
1965 *Capulus unguis* (J. Sowerby, 1816) — van Regteren Altena *et al.*, p. 21, pl. 8, fig. 81.

Dimensions — Height 8 mm, width 19 mm; height 5 mm,

width 11 mm; height 15 mm, width 36 mm.
Description — Large, patelliform shell. The protoconch consists of 3/4 of a whorl and is clearly coiled, the teleoconch whorl having a very large expansion rate. The outline is oval, but very variable, height exceeding width. The glossy interior shows oval muscular impressions. The ornament is limited to growth lines.
Discussion — At Kallo, the species occurs commonly in the Oorderen Member, more rarely in the Kruisschans Member. It is very variable and many synonyms are known. *Capulus unguis* differs from *C. ungaricus* by its reversed height/width ratio and smooth shell. The majority of specimens collected at Kallo belong to forma *obliquus* with an irregular shell form. The typical forma *unguis*, forma *fallax* and forma *pumila* are rare. The last-named probably represents a juvenile shell of the present species, which is known only from the North Sea Basin Pliocene.

Genus *Brocchia* Bronn, 1827

Brocchia sinuosa (Brocchi, 1814)
Pl. 1, Fig. 6

	1814	*Patella sinuosa* Brocchi, p. 257, pl. 1, fig. 1.
	1848	*Capulus militaris* var. *partim-sinuosa* Wood, p. 156, pl. 17, fig. 3a, b.
?	1872	*Capulus ungaricus* var. *sinuosus* Brocchi — Wood, p. 88, pl. 7, fig. 26.
?	1878	*Pileopsis ungaricus*, L. var. *sinuosus*, Brocchi — Nyst, pl. 7, fig. 26.
	1881	*Pileopsis ungarica*, L. var. *sinuosus*, Brocchi — Nyst, p. 118.
	1914	*Brocchia laevis* Brn. — Cerulli-Irelli, p. 207, pl. 17, figs 1, 2.
	1914	*Brocchia laevis* var. *pileata* Cerulli-Irelli, p. 207, pl. 17, fig. 3.
	1914	*Brocchia laevis* var. *lunulata* Cerulli-Irelli, p. 208, pl. 17, figs 4, 5.
	1914	*Brocchia laevis* var. *sinuosa* Br. sp. — Cerulli-Irelli, p. 208, pl. 17, figs 6-11.
	1914	*Brocchia laevis* var. *Cornaliaenae* Cocc., sp. — Cerulli-Irelli, p. 209, pl. 17, figs 12-18.
	1914	*Brocchia laevis* var. *Contii* Cerulli-Irelli, p. 209, pl. 17, figs 19-22.
?	1923	*Brocchia sinuosa* (Brocchi) — Harmer, p. 768, pl. 61, fig. 10.
	1923	*Brocchia plicata* Harmer, p. 769, pl. 61, fig. 11.
	1923	*Brocchia partim-sinuosa* (S.V. Wood) — Harmer, p. 769, pl. 61, fig. 12.
	1923	*Brocchia incerta* (A. Bell) — Harmer, p. 770, pl. 61, fig. 13.
?	1958a	*Brocchia sinuosa* Brocchi, sp. 1814 — Glibert, p. 23.

Dimensions — Height 12 mm, width 24 mm.
Description — Large, irregular, more or less triangular patelliform shell. The protoconch whorl is clearly coiled, the teleoconch whorl has a very large expansion rate, height almost equalling width. The interior is glossy, showing the muscular impressions. Ornament consists of some faint, but broad, plicae on the right side of the shell and of numerous fine, regular axial ribs, crossed by more irregular growth lines. Some of the axial ribs are occasionally eroded.
Discussion — This species is rare in the Oorderen Member; it differs from both the other Capulidae by its peculiar shell form. Italian specimens of this species lack the fine axial ribs characteristic of North Sea Basin *Brocchia*. The former are usually smooth, which is why Cerulli-Irelli (1914) and Rossi Ronchetti (1955) considered them to represent only a variety of *Brocchia laevis* (Bronn, 1831), although Brocchi's (1814) name clearly has priority. However, Cerulli-Irelli (1914) also figured specimens with axial sculpture, under the name var. *contii*. The very regular form figured by Wood (1872), Nyst (1878) and Harmer (1923, pl. 61, fig. 10) has not been recognised at Kallo. Its identity remains doubtful to me; it cannot be ruled out that it is but a form of *Capulus ungaricus*; it does not occur in the extensive series of formae of *Brocchia sinuosa* from the Italian Pliocene published by Cerulli-Irelli (1914).

Superfamily Xenophoroidea Troschel, 852
Family Xenophoridae Troschel, 1852
Genus *Xenophora* Fischer von Waldheim, 1807

Xenophora scaldensis Glibert, 1958a
Pl. 1, Fig. 7

	1946	*Xenophora (Xenophora)* cf. *deshayesi* (Michelotti, 1847) — Beets, p. 57.
	1958a	*Xenophora deshayesi* Michelotti, sp. 1847 subsp. *scaldensis* Glibert, p. 24.

Dimensions — Height 25 mm, width 73 mm (incomplete).
Description — Large, nearly straight-sided conical shell with open umbilicus. Periphery sharply keeled, aperture small, oval and characteristically regularly curved. Ornament consists of very irregular plicae above the periphery. On the shell base, the old apertural rims remain clearly visible as axial growth lines. In this species, fragments of other shells are deposited immediately above the suture only.
Discussion — This species is extremely rare at Kallo, a single fragmentary specimen was collected by F. van Nieulande from the basal layer of the Oorderen Member, and is thus probably derived from the Kattendijk Formation. Glibert (1958a) considered the Pliocene *Xenophora* of Belgium to be a subspecies of the Miocene *X. deshayesi* (Michelotti, 1847). However, according to Janssen (1984) the Miocene North Sea Basin material of this genus contains a second species, *X. burdigalensis* (de Grateloup, 1847). These species differ in the axial ornament on the shell base, being regularly curved in *X. deshayesi* while straight first and after 3/4 turns nearly 90° in *X. burdigalensis*. In addition, *X. deshayesi* is larger, its basal spiral sculpture being heavier and clearly pitted and with the part around the umbilicus convex. Pliocene *Xenophora* from Belgium come closer to *X. deshayesi* in the curvature of the basal growth lines, but the area around the umbilicus is not

convex and the spiral ornament on the shell base is inconspicuous. Furthermore, none of the Pliocene specimens reaches the size of Miocene *X. deshayesi* and their umbilici are mostly open, while the umbilicus of both Miocene species of comparable size is closed. Therefore, *X. scaldensis* is here considered to be a separate species.

Superfamily Vermetoidea Rafinesque, 815
Family Vermetidae Rafinesque, 1815
Genus *Petaloconchus* Lea, 1843

Petaloconchus glomeratus (Linné, 1758)
Pl. 1, Fig. 8

1758 *Serpula glomerata* Linné, p. 787.
1848 *Vermetus intortus* Lam. — Wood, p. 113, pl. 12, fig. 8.
1878 *Vermetus intortus*, Lk. — Nyst, pl. 6, fig. 13.
1881 *Vermetus intortus*, Lamarck — Nyst, p. 84.
1896 *Petaloconchus intortus* Lam. — Sacco, p. 7, pl. 1, figs 12-20.
1918 *Vermetus (Petaloconchus) intortus* (Lamarck) — Harmer, p. 457, pl. 44, figs 33, 34.
1946 *Vermetus (Petaloconchus) intortus* (Lamarck, 1818) — Beets, p. 42.
1958a *Vermetus (Petaloconchus) intortus* Lamarck, sp. 1818 — Glibert, p. 5.
1965 *Vermetus (Vermetus) intortus* (Lamarck, 1818) — van Regteren Altena *et al.*, p. 16, pl. 6, fig. 54.
1992 *Vermetus (Macrophragma) glomeratus* (L., 1758) — Cavallo & Repetto, p. 64, fig. 113.

Dimensions — 30 x 25 mm (colony); 0.9 x 0.8 mm (protoconch).
Description — Moderately large, vermiform shells. The protoconch has a normal coiled gastropod form, consisting of three whorls; the nucleus shows a minutely pitted microsculpture. The teleoconch occasionally develops as a completely irregular, at times a more or less coiled tube, which is circular to quadrangular in cross section. Many specimens grow on a substrate, often a gastropod or bivalve shell, but some show no sign of former attachment to a substrate. A number of these tubes often grew together as a colony; in such cases it is difficult to distinguish individual specimens. Ornament consists of growth lines and irregular longitudinal as well as commarginal plicae. There are no internal laminae.
Discussion — This species is extremely common in the *Petaloconchus* bed of the Kattendijk Formation. The tubes form a dense, *c.* 10-15 cm thick reef at this horizon. A number of small bivalve species lived amongst these tubes. In the Oorderen and Kruisschans members specimens are rare. This species ranges from the Miocene to Recent in the North Sea Basin and in the Mediterranean. Its generic attribution is uncertain, because the supposedly characteristic internal laminae are lacking, but their presence does not seem to be diagnostic for the genus *Petaloconchus* and is inconstant even within the type species of the genus (Gould, 1994). Some specimens from Kallo have a freely coiled middle portion, typical of *Petaloconchus* s. str., while others are attached throughout growth, which would characterise the subgenus *Macrophragma* Carpenter, 1857. Thus there appears to be no reason to distinguish the latter.

Genus *Bivonia* Gray, 1842

Bivonia triqueter (Bivona-Bernardi, 1832)
Pl. 1, Fig. 9

1832 *Vermetus triqueter* Bivona-Bernardi, p. 6.
1896 *Bivonia triquetra* (Bivona) — Sacco, p. 13, pl. 2, figs 1-6.
1912a *Vermetus (Bivonia) triqueter* Bivona — Cossmann, p. 136, pl. 10, figs 4, 5.
1918 *Vermetus (Bivonia) triqueter* (Bivona) — Harmer, p. 460, pl. 44, figs 24-28.
1958a *Vermetus (Bivonia) triqueter* Bivona, sp. 1832 — Glibert, p. 5.
1965 *Vermetus (Bivonia) triqueter* Bivona, 1832 — van Regteren Altena *et al.*, p. 16, pl. 6, fig. 55.

Dimensions — 10 x 3 mm.
Description — Rather small, vermiform shell. The tubes are partially straight and partially curved, but they never form large growths and elaborate colonies such as the ones of the previous species. The tubes are triangular in cross section, with keels on the angles, but lack further ornament.
Discussion — *Petaloconchus intortus* is easily distinguished from this species by the more complex colony growth, the non-triangular cross section of the shell, and the absence of keels. *Bivonia triqueter* is much rarer than *P. intortus* at the same level in the Kattendijk Formation; it is an early Pliocene to Recent species, now occurring in the Mediterranean.

Superfamily Cypraeoidea Rafinesque, 1815
Family Ovulidae Fleming, 1822
Genus *Neosimnia* Fischer, 1884

Neosimnia leathesi scaldisia Schilder, 1933b
Pl. 1, Fig. 10

1843 *Ovula Leathesi* Sow. — Nyst, p. 605, pl. 43, fig. 19.
1878 *Ovula spelta*, Lin. — Nyst, pl. 5, fig. 4.
1881 *Ovula spelta*, Lin. — Nyst, p. 61.
1933b *Neosimnia leathesi scaldisia* Schilder, p. 17, fig. 6.
1958a *Neosimnia leathesi scaldisia* Schilder, 1933 — Glibert, p. 29.
1965 *Simnia (Neosimnia) leathesi* (J. de C. Sowerby, 1824) — van Regteren Altena *et al.*, p. 28, pl. 10, fig. 104.

Dimensions — Height 7 mm, length 18 mm.
Description — Fairly large, convolute shell. No spire is visible in adult shells. The aperture is narrow and longer than the other parts of the shell, being broadest towards the

base. The outer lip is thickened, the inner lip shows a callus. No ornament is present, with the exception of a line running parallel to the aperture, on the dorsal side.
Discussion — This subspecies, which is rare in the *Atrina* level of the Oorderen Member, is confined to the North Sea Basin Pliocene.

Superfamily Lamellarioidea d'Orbigny, 841
Family Lamellariidae d'Orbigny, 1841
Subfamily Velutininae Fleming, 1822
Genus *Capulacmaea* Sars, 1859

Capulacmaea kalloensis Marquet, 1993
Pl. 2, Fig. 2

1965 *Capulacmaea radiata* (M. Sars, 1850) — van Regteren Altena *et al.*, p. 26, pl. 9, fig. 97.
1993 *Capulacmaea kalloensis* Marquet, p. 90, pl. 3, figs 3-5.

Dimensions — Height 2 mm, width 12 mm; height 2 mm, width 7 mm.
Description — Rather small, very thin, flattened patelliform shell, comprising one and a half whorls. The umbo lies close to the centre. Irregular concentric growth lines form the only ornament. The interior of the shell is smooth and glossy.
Discussion — This species was originally described from the Kruisschans Member at Kallo, but has subsequently turned out to be commoner in the Oorderen Member, especially in the *Atrina* level. It superficially resembles *Calyptraea chinensis* (see above), which, however, has an internal septum. The species is restricted to the North Sea Basin Pliocene, having been collected in Dutch beach material, but there are no records from the British Crags yet.

Subfamily Lamellariinae d'Orbigny, 1841
Genus *Lamellaria* Montagu, 1815

Lamellaria perspicua (Linné, 1758)
Pl. 2, Fig. 1

1758 *Helix perspicua* Linné, p. 775.
1842 *Marsenia depressa* Wood, p. 528, pl. 5, figs 8, 9.
1848 *Marsenia tentaculata* Mont. — Wood, p. 151, pl. 15, fig. 10.
1914 *Lamellaria perspicua* L. sp. — Cerulli-Irelli, p. 214, pl. 19, fig. 1.
1988 *Lamellaria perspicua* (Linné, 1758) — Graham, p. 314, fig. 127.

Dimensions — Height 14 mm, width 16 mm.
Description — Fairly large, fragile shell, consisting of two and a half whorls, with an elevated spire and a deep suture. The aperture is extremely large. A narrow callus is present. The ornament consists of growth lines only.
Discussion — This species is new for the Pliocene fauna of Belgium, having been first collected by H. Keukelaar. There are previous records from the British and Italian Pliocene. With a query, Brébion (1964) recorded this species from the late Redonian (late Miocene) of France. Recent specimens extend from Norway and Iceland to the Mediterranean. At Kallo, it is very rare in the Oorderen Member, probably on account of its fragility, but could be confused with *Velutina virgata* (Wood, 1848), which is known from the Luchtbal Member, but has not yet been recognised at Kallo. The aperture of the latter species is relatively smaller and more rounded and the shell is covered by a large number of clear axial ribs.

Family Triviidae Troschel, 1863
Genus and subgenus *Trivia* Gray, 1837

Trivia (T.) coccinelloides coccinelloides
(J. de C. Sowerby, 1823)
Pl. 2, Fig. 4

1823 *Cypraea coccinelloides* J. de C. Sowerby, p. 107, pl. 378, fig. 1.
1835 *Cypraea coccinelloides* Sow. — Nyst, p. 34.
1843 *Cypraea coccinella* Sow. — Nyst, p. 609, pl. 45, fig. 14 (*partim*).
1848 *Cypraea Europaea* Mont. — Wood, p. 17, pl. 2, fig. 6.
1878 *Cypraea europaea*, Mont. — Nyst, pl. 5, fig. 2.
188 *Cypraea europaea*, Mont. — Nyst, p. 59.
1920 *Trivia europaea* (Montagu) — Harmer, p. 507, pl. 45, fig. 11.
1933b *Trivia coccinelloides coccinelloides* (Sowerby) — Schilder, p. 9.
1946 *Trivia (Trivia) monacha* (Da Costa, 1778) sensu latiori — Beets, p. 66 (*partim*).
1958a *Trivia coccinelloides* Sowerby, sp. 1823 subsp. *coccinelloides* — Glibert, p. 27, pl. 2, fig. 25a, b.
1965 *Trivia (Trivia)* sp. — van Regteren Altena *et al.*, p. 27, pl. 10, fig. 102 (*partim*).
1979 *Trivia coccinelloides* (Sowerby, 1823) — Geys & Marquet, p. 70, pl. 28, fig. 3.

Dimensions — Height 7 mm, width 9 mm.
Description — Moderately large, convolute shell with very narrow aperture. Apex only visible in young specimens. Ornament consists of about twenty-nine concentric ribs on the dorsal as well as the apertural side of the shell. In the middle dorsal part of the shell, ribs sometimes split, but this is exceptional.
Discussion — This subspecies is not rare in the Oorderen Member, while in the Kruisschans Member only fragments were found. It is confined to the North Sea Basin middle and late Pliocene.

Trivia (T.) coccinelloides parvula Schilder, 1933b
Pl. 2, Fig. 5

1933b *Trivia coccinelloides parvula* Schilder, p. 8.

1958a *Trivia coccinelloides* Sowerby, sp. 1823 subsp. *parvula* Schilder, 1933 — Glibert, p. 27, pl. 2, fig. 25c.

Dimensions — Height 5 mm, width 7 mm.
Description — This subspecies differs from the previous one in being smaller and in having slightly coarser ribs.
Discussion — This subspecies occurs in the Kattendijk Formation, where some specimens from the *Similipecten* level seem to be plastically deformed. The differences from the nominal subspecies are very slight: in the Kattendijk Formation and in the Oorderen Member the size of *Trivia* shells is rather variable. *Trivia c. parvula* is confined to the North Sea Basin early Pliocene.

Subgenus *Sulcotrivia* Schilder, 1933b

Trivia (Sulcotrivia) testudinella Wood, 1842
Pl. 2, Fig. 3

1842 *Trivia testudinella* Wood, p. 543.
1843 *Cypraea avellana* Sow. — Nyst, p. 608, pl. 45, fig. 13.
1848 *Cypraea avellana* J. Sow. — Wood, p. 15, pl. 2, fig. 5.
1878 *Cypraea avellana*, J. Sow. — Nyst, pl. 5, fig. 1.
1881 *Cypraea avellana*, J. Sow. — Nyst, p. 58.
1888 *Trivia avellana* Sow. — E. Vincent, p. xciii.
1920 *Trivia avellana* (J. Sowerby) — Harmer, p. 509, pl. 45, fig. 10.
1933b *Trivia (Sulcotrivia) testudinella* (Wood) — Schilder, p. 14.
1946 *Trivia (Sulcotrivia) testudinella* Wood, 1848 — Beets, p. 67.
1958a *Trivia (Sulcotrivia) testudinella* Wood, 1842 — Glibert, p. 28.
1965 *Trivia (Sulcotrivia) testudinella* S.V. Wood — van Regteren Altena *et al.*, p. 28, pl. 10, fig. 104.

Dimensions — Height 11 mm, width 12 mm.
Description — Moderately large, convolute shell with very narrow aperture. The spire is not visible in adult specimens. The ornament consists of about thirty-three concentric ribs on the dorsal and ventral sides of the shell. On the dorsal part, an axial depression is visible, and ribs, which often bifurcate, usually end at this depression.
Discussion — Only few specimens of this species have been found at Kallo, none of them *in situ*. It is a North Sea Basin Pliocene species.

Family	Eratoidae Gill, 1871
Genus	*Erato* Risso, 1826
Subgenus	*Eratopsis* Hoernes & Auinger, 1880

Erato (Eratopsis) pernana Sacco, 1894
Pl. 2, Fig. 9

1894 *Erato pernana* Sacco, p. 60, pl. 3, fig. 64.
1848 *Erato Maugeriae* Gray — Wood, p. 19, pl. 2, fig. 11.
1920 *Erato Maugeriae* Gray — Harmer, p. 512, pl. 45, fig. 2.
1933a *Erato (Eratopsis) exmaugeriae* Sacco — Schilder, p. 264.
1933a *Erato (Eratopsis) pernana scaldisia* Schilder — Schilder, p. 281, fig. 57. 1933b *Erato (Eratopsis) pernana scaldisia* Schilder, p. 5, fig. 1.
1946 *Erato (Eratopsis) exmaugeriae* Sacco, 1894 — Beets, p. 65, pl. 3, figs 21-23.
1958a *Erato (Eratopsis) pernana exmaugeriae* Sacco, 1894 — Glibert, p. 26, pl. 2, fig. 24.
1958a *Erato (Eratopsis) pernana scaldisia* Schilder, 1933 — Glibert, p. 26.
1965 *Erato (Eratopsis) pernana* Sacco, 1894 — van Regteren Altena *et al.*, p. 2, pl. 10, fig. 100.

Dimensions — Height 4 mm, width 3 mm (damaged).
Description — Small, convolute shell with very narrow aperture. The spire protrudes slightly above the last whorl. Ornament is absent. The outer lip of the aperture is thickened, and has about sixteen teeth. The inner lip has eight or nine teeth.
Discussion — This species is extremely rare in the *Cultellus* bed of the Oorderen Member. Glibert (1958a) pointed out that it seems inappropriate to distinguish the subspecies *E. p. exmaugeriae* and *E. p. scaldisia*, with both occurring in the same layer and differences too slight to justify separation at the species level. This species occurs in the early and middle Pliocene of the Mediterranean and the North Sea Basin.

Superfamily	Naticoidea Forbes, 1838
Family	Naticidae Forbes, 1838
Subfamily	Polinicinae Gray, 1847
Genus	*Euspira* L. Agassiz, 1838

Euspira cirriformis cirriformis
(J. de C. Sowerby, 1825)
Pl. 2, Fig. 6

1825 *Natica cirriformis* J. de C. Sowerby, p. 125, pl. 479, fig. 1.
1843 *Natica cirriformis* Sow. — Nyst, p. 444, pl. 34, fig. 1.
1848 *Natica cirriformis* J. Sow. — Wood, p. 145, pl. 16, fig. 7.
1878 *Natica cirriformis*, J. Sow. — Nyst, pl. 5, fig. 6.
1881 *Natica cirriformis*, J. Sow. — Nyst, p. 66.
1921 *Natica (Lunatia) cirriformis* (J. Sowerby) var. *discrepans* Harmer, p. 685, pl. 55, fig. 3.
1946 *Natica (Nacca) cirriformis* Sowerby, 1824 — Beets, p. 62.
1946 *Natica* spec. 1 Beets, p. 64, pl. 3, figs 12, 13.
1958a *Polinices (Euspira) cirriformis* Sowerby, sp. 1824 — Glibert, p. 30 (*partim*).
1965 *Polinices (Euspira) cirriformis* (J. de C. Sowerby, 1824) — van Regteren Altena *et al.*, p. 24, pl. 9, fig. 87.
1992 *Euspira cirriformis* (Sowerby, 1824) — Moerdijk *et al.*, p. 5.

Dimensions — Height 23 mm, width 28 mm.
Description — Large, globular, thick-shelled species. The apex protrudes only slightly above the last whorl. The whorls are contiguous and often slightly concave below the suture. The umbilicus is wide, with a depression in the lower part of the whorl. The callus is thick and its parietal part is straight-sided. It protrudes slightly into the umbilicus but never closes it.
Discussion — This species is rare in both the Oorderen and Kruisschans members. In the Kattendijk Formation, material of this species invariably is assignable to subspecies *gottschei* (see below). *Euspira cirriformis* is the easiest recognisable species of its genus at Kallo, with its typical large umbilicus and low spire. It ranges through the middle and late Pliocene of the North Sea Basin.

Euspira cirriformis gottschei (Kautsky, 1925)
Pl. 2, Fig. 8

? 1921 *Natica (Lunatia) cirriformis* (J. Sowerby) — Harmer, p. 685, pl. 55, fig. 2.
1925 *Natica Gottschei* Kautsky, p. 67, pl. 6, fig. 16.
1958a *Polinices (Euspira) cirriformis* Sowerby, sp. 1824 — Glibert, p. 30 (*partim*).
1984 *Euspira gottschei* (Kautsky, 1925) — Janssen, p. 196, pl. 55, fig. 5.

Dimensions — Height 28 mm, width 34 mm.
Description — Large, globular, rather thin-shelled species. The apex protrudes only slightly above the last whorl. The whorls are angular at the suture. The umbilicus is extremely wide, showing the older whorls within it. A straight-sided callus is present. It protrudes only slightly into the upper part of the umbilicus.
Discussion — It was a surprise to find this subspecies in the Kallo Pliocene, since previous records were from the Miocene only. It differs from *E. c. cirriformis* in having a lower shell and angular whorls. Size and shape of the umbilicus and the callus strongly suggest that both are best treated as subspecies of the same taxon, also since they never co-occur. At Kallo, *E. c. gottschei* is confined to the Kattendijk Formation, where it is rare in the *Petaloconchus* bed. However, it is quite common at the *Ditrupa* level of that formation as exposed at Antwerp-Noordkasteel. In view of the fact that only incomplete specimens are known from Kallo, a shell from Antwerp is here illustrated. This subspecies ranges from the middle Miocene to the early Pliocene of the North Sea Basin. Harmer's (1921, pl. 55, fig. 2) *Natica (Lunatia) cirriformis* from Shottisham, could also represent *E. c. gottschei*, while genuine *E. c. cirriformis* from Little Oakley was described by Harmer as var. *discrepans*.

Euspira catenoides (Wood, 1842)
Pl. 2, Fig. 7

1842 *Natica catenoides* Wood, p. 529.
1843 *Natica sowerbyi* Nyst, p. 441, pl. 3, fig. 31.
1848 *Natica catenoides* S. Wood — Wood, p. 141, pl. 15, fig. 10.
1878 *Natica catenoides* S. Wood — Nyst, pl. 5, fig. 7.
1881 *Natica catenoides*, S. Wood — Nyst, p. 66.
1921 *Natica (Lunatia) catenoides* (S.V. Wood) — Harmer, p. 686, pl. 55, fig. 1.
1946 *Natica* spec. 3 Beets, p. 65, pl. 3, figs 15, 16.
1958a *Polinices (Euspira) catenoides* Wood, sp. 1848 — Glibert, p. 31.
1965 *Polinices (Euspira) catenoides* (S.V. Wood, 1842) — van Regteren Altena *et al.*, p. 24, pl. 9, fig. 88.
1979 *Euspira catenoides* (Wood, 1848) — Geys & Marquet, p. 70, pl. 28, fig. 7.
1992 *Euspira catenoides* (Wood, 1842) — Moerdijk *et al.*, p. 5, pl. 1, fig. 2a.

Dimensions — Height 49 mm, width 50 mm.
Description — Very large, globular, rather thin-shelled species with only a slightly protruding apex. Shell broad, diameter slightly exceeding height or equalling height. Whorls are contiguous. The upper lip of the aperture is attached to the penultimate whorl above half-height. The umbilicus is rather narrow. A thick callus is present, which may protrude into the umbilicus, but never closes it. The upper margin of the callus is nearly straight-sided.
Discussion — At Kallo, this species is found only in the Kruisschans Member. It differs from *E. catena* (da Costa, 1778) in being larger and relatively broader but especially in having contiguous rather than angular whorls. A problem in using this character is the tendency of many *Euspira* to 'decorticate', i.e. to lose part of the outer shell layer, especially near the suture and the umbilicus. This species is found in the late Pliocene of the North Sea Basin, but there is a doubtful record (a single fragment) by Brébion (1964) from the Redonian of Gourbesville. Schlesch (1924, p. 30, pl. 10, fig. 15) recorded both *E. catenoides* and *E. catena* from the Pliocene of Iceland. However, the specimen illustrated is relatively higher than southern North Sea Basin material, and the whorls are slightly angular, and is best considered conspecific with the North American Miocene-Recent *Euspira heros* (Say, 1822), which Schlesch (1924) considered to be conspecific with *E. catenoides*.

Euspira catena (da Costa, 1778)
Pl. 2, Fig. 11

1778 *Natica catena* da Costa, p. 83, pl. 5, fig. 7.
1848 *Natica catena* Da Costa — Wood, p. 142, pl. 16, fig. 8.
1878 *Natica catena*, Da Costa — Nyst, pl. 5, fig. 8.
1881 *Natica catena*, Da Costa — Nyst, p. 68.
1921 *Natica (Lunatia) catena* (Da Costa) — Harmer, p. 681, pl. 54, figs 1-3.
1958a *Polinices (Euspira) catena* Da Costa, sp. 1778 f. *catena* s.s. — Glibert, p. 31.
1965 *Polinices (Euspira) catena* (Da Costa, 1778) — van Regteren Altena *et al.*, p. 25, pl. 9, fig. 91.
1979 *Euspira catena* (Da Costa, 1778) — Geys & Marquet, p. 70, pl. 28, fig. 6.
1988 *Lunatia catena* (Da Costa, 1778) — Graham, p. 336,

fig. 135C, 137.
1992 *Euspira catena* (Da Costa, 1778) — Moerdijk *et al.*, p. 4, pl. 1, fig. 2b.

Dimensions — Height 49 mm, width 39 mm.
Description — Large, globular, rather thin shell, with a slightly protruding apex. The whorls are angular. A callus is present in complete, adult shells; it may protrude into the umbilicus, without closing it. The upper margin of the callus is nearly straight or slightly curved. The upper lip of the aperture is attached to the upper half of the penultimate whorl.
Discussion — This species is common in the Kattendijk Formation and in the Oorderen and Kruisschans members. *Euspira helicina hemiclausa* and *E. exvarians* have a higher spire, being higher in relation to width, less globular and the attachment point of their upper apertural lip is lower. The present species ranges from the early Pliocene to the Recent, being known today from the Mediterranean to Denmark. '*Euspira catena* (da Costa, 1778)' as recorded by Cavallo & Repetto (1992, p. 68, fig. 126) is a different species, referable to the genus *Tectonatica* Sacco, 1890. Schlesch (1924) recorded the present species from the Pliocene of Iceland, but did not illustrate his material.

Euspira exvarians (Sacco, 1891)
Pl. 2, Fig. 10

1848 *Natica varians* Dujard. — Wood, p. 143, pl. 16, fig. 6.
1878 *Natica varians*, Duj. — Nyst, pl. 5, fig. 10.
1881 *Natica varians* ? Duj. — Nyst, p. 70.
1891 *Natica exvarians* Sacco, p. 70.
1921 *Natica (Lunatia) exvarians* (Sacco) — Harmer, p. 689, pl. 54, fig. 15 (*? partim*).
1921 *Natica (Lunatia) Cavellii* Harmer, p. 695, pl. 54, fig. 13.
1921 *Natica (Lunatia) assimilis* Harmer, p. 696, pl. 54, fig. 17.
1958a *Polinices (Euspira) exvarians* Sacco, sp. 1891 — Glibert, p. 32.
1965 *Polinices (Euspira) exvarians* (Sacco, 1891) — van Regteren Altena *et al.*, p. 25, pl. 9, fig. 92.
1992 *Euspira exvarians* (Sacco, 1891) — Moerdijk *et al.*, p. 5.

Dimensions — Height 45 mm, width 40 mm.
Description — Large, rather thin, elongated globular shell, with clearly protruding apex. The callus is not strongly developed and does not cover the umbilicus, which is narrow, but open. The upper callus margin is nearly straight. The upper lip of the aperture is attached rather low to the penultimate whorl. The whorls are angular.
Discussion — This species is rare in the *Atrina* bed at Kallo. It is rather variable in height/width ratio. *Euspira cavellii* (Harmer, 1921) is considered by many authors to be a separate species, but to me differences appear too slight to justify a separation at the species level, especially so when the figure of the type specimen is considered, rather than later interpretations (see discussion below). *Euspira exvarians* differs from *E. helicina hemiclausa* in having an open umbilicus and angular whorls. Intermediate specimens appear to occur, which is why Moerdijk *et al.* (1992) suggested that they might be lumped. *Euspira helicina hemiclausa* is indeed very variable, especially so since numerous 'decorticated' specimens occur, but the differences displayed by unworn examples are constant enough to warrant separation of these taxa. It cannot be ruled out that Harmer's (1921, pl. 54, fig. 15) figure represents such a 'decorticated' specimen. His fig. 16 (from Antwerp) is here considered to belong to *E. helicina hemiclausa*. The conspecificity of the North Sea Basin specimens and material described by Sacco (1891) is not without question, since no type material has been studied.

Euspira helicina hemiclausa
(J. de C. Sowerby, 1825)
Pl. 2, Fig. 12

1825 *Natica hemiclausa* J. de C. Sowerby, p. 125, pl. 479, fig. 2.
1848 *Natica hemiclausa* J. Sow. — Wood, p. 144, pl. 16, fig. 5.
1848 *Natica proxima* — Wood, p. 143, pl. 16, fig. 4.
1878 *Natica hemiclausa*, J. Sow. — Nyst, pl. 5, fig. 11a, b.
1881 *Natica hemiclausa*, J. Sow. — Nyst, p. 71.
1921 *Natica (Lunatia) helicina* (Brocchi), Sacco — Harmer, p. 683, pl. 54, fig. 5 (*non* 4).
? 1921 *Natica (Polinices) triseriata* (Say) — Harmer, p. 697, pl. 54, fig. 7.
1921 *Natica (Lunatia) proxima* (S.V. Wood) — Harmer, p. 692, pl. 54, fig. 8.
1921 *Natica (Lunatia) proxima* var. *Woodii* Harmer, p. 693, l. 54, figs 9, 10.
1921 *Natica (Lunatia) exvarians* (Sacco) — Harmer, p. 698, pl. 54, fig. 16 (*partim*).
1921 *Natica (Polinices) lactea* Guilding — Harmer, p. 699, pl. 54, fig. 19.
1958a *Polinices (Euspira) hemiclausa* Sowerby, sp. 1824 — Glibert, p. 32.
1965 *Polinices (Euspira) hemiclausa* (+ var.) (J. de C. Sowerby, 1824) — van Regteren Altena *et al.*, p. 24, pl. 9, fig. 89.
1992 *Euspira hemiclausa* (Sowerby, 1824) — Moerdijk *et al.*, p. 5.
1993 *Polinices hemiclausa* (Sowerby, 1824) — Marquet, p. 91.

Dimensions — Height 13 mm, width 12 mm; height 30 mm, width 22 mm; height 19 mm, width 18 mm.
Description — Rather large, thick-shelled, usually fairly high-spired globular shell. The umbilicus is usually almost closed by an extension of the callus. The adapical part of the callus may be slightly curved to clearly angular, but not straight. The whorls are contiguous, but appear angular in decorticated specimens.
Discussion — This species extends from the Kattendijk Formation into the Oorderen and Kruisschans members. It is the commonest naticid at Kallo, especially in the Oorderen Member, contrary to the observations by Glibert (1958a, b) for other localities. The species is extremely

variable in height/width ratio and in the degree of closure of the umbilicus. The shape of the callus also varies. For that reason, a large number of names have been applied to this species, especially by Harmer (1921). Janssen (1984) suggested that *Euspira helicina hemiclausa* forms an evolutionary lineage with the Miocene *E. h. protracta* (von Eichwald, 1830) and the Mediterranean Pliocene *E. h. helicina* (Brocchi, 1814). This view is adopted here. Material from the Kattendijk Formation tends to have more tumid whorls which may have a slight subsutural depression. Their spires are mostly higher than in stratigraphically younger specimens. Their umbilicus is mostly only partially closed above. It is possible that this type was described by van Regteren Altena *et al.* (1965) and Moerdijk *et al.* (1992) as *E. cavellii* (Harmer, 1921). The subsutural depression, which was considered typical of this species by these authors, is not mentioned in Harmer's original description, nor is it apparent in his figure. The Kattendijk Formation-type shell might be considered to represent a distinct subspecies, which might be linked with '*Euspira varians* var. *dollfusi*' of Brébion (1964, *nomen nudum*) from the Redonian from Gourbesville (France), but no topotype material was available to me. Schlesch (1924, p. 30) recorded '*Natica (Euspira) proxima* (S.V. Wood)' from the Pliocene of Iceland. This species is synonymous with *E. helicina hemiclausa*. However, Schlesch did not illustrate his material, which is why his attribution cannot be checked.

Subfamily Naticinae Forbes, 1838
Genus *Cryptonatica* Dall, 1892

Cryptonatica operculata (Jeffreys, 1885)
Pl. 3, Fig. 1

1848 *Natica clausa* Broderip and Sowerby — Wood, p. 147, pl. 16, fig. 2 (? *partim*).
1885 *Natica operculata* Jeffreys, p. 34, pl. 4, fig. 7, 7a.
? 1921 *Natica affinis* (Gmelin) — Harmer, p. 674, pl. 56, fig. 7.
1946 *Natica (Tectonatica) clausa* Broderip et Sowerby, 1829 — Beets, p. 62 (? *partim*).
1965 *Natica (Cryptonatica) clausa* Broderip & Sowerby, 1829 — van Regteren Altena *et al.*, p. 26, pl. 9, fig. 95 (? *partim*).
1993 *Cryptonatica operculata* (Jeffreys, 1885) — Bouchet & Warén, p. 759, figs 1793, 1813-1816, 1839, 1845, 1878, 1892, 1893, 1907.

Dimensions — Height 19 mm, width 19.5 mm.
Description — Rather large, thin-shelled, globular species with low spire. The whorls are tumid and angular. The aperture has a slight callus, which extends laterally, so that the umbilicus is completely closed. The first half whorl of the protoconch has a diameter of about 0.65 mm.
Discussion — Amongst the taxa considered herein this species resembles only *Euspira catena* in shell form, but the closed umbilicus is very typical. A single specimen of this species was found in the *Atrina* bed (Oorderen Member) by G. Willems, while protoconchs were collected by A. Janse. The species is new for Belgium. In Dutch beach and British Red Crag material, similar specimens have been collected which were identified as *Tectonatica clausa* (Broderip & Sowerby, 1829) [= *Cryptonatica affinis* (Gmelin, 1791)]. According to Bouchet & Warén (1993), this species differs from *C. operculata* mainly by its operculum (which is not preserved in our specimen) and in the protoconch, which has a much smaller first half-whorl in *C. affinis*. Although the top of the Kallo specimen is rather eroded, its first half-whorl appears to be larger than that in *C. affinis* (0.5 mm). This character has not been checked in the British and Dutch material. *Cryptonatica operculata* is a more southerly species of shallower water than *C. affinis*; its occurrence in the Oorderen Member is thus more easily explained.

Genus *Natica* Scopoli, 1777

Natica crassa Nyst, 1843
Pl. 3, Fig. 2

1842 *Natica multipunctata* Wood, p. 529.
1843 *Natica crassa* Nyst, p. 443, pl. 37, fig. 33.
1848 *Natica multipunctata* S. Wood — Wood, p. 148, pl. 16, fig. 9.
1848 *Natica consors* Wood, p. 148, pl. 16, fig. 9d, e.
1878 *Natica millepunctata*, Lk. — Nyst, pl. 5, fig. 5.
1881 *Natica millepunctata*, Lk. — Nyst, p. 61.
1921 *Natica multipunctata* S.V. Wood — Harmer, p. 677, pl. 55, figs 12, 13.
1921 *Natica multipunctata* var. *consors* S.V. Wood — Harmer, p. 667, pl. 55, fig. 14.
1921 *Natica tigrina* Defrance — Harmer, p. 679, pl. 55, fig. 15.
1946 *Natica (Natica) millepunctata multipunctata* Wood, 1848 — Beets, p. 63.
1956 *Natica bevelandensis* Pouderoyen, p. 78.
1958a *Natica (Natica) multipunctata* Wood, 1842 — Glibert, p. 29.
1965 *Natica (Natica) multipunctata* S.V. Wood, 1842 — van Regteren Altena *et al.*, p. 26, pl. 9, fig. 96.
1965 *Natica (Natica) bevelandensis* Pouderoyen, 1956 — van Regteren Altena *et al.*, p. 26, pl. 9, fig. 97.
1979 *Natica multipunctata* Wood, 1842 — Geys & Marquet, p. 70, pl. 28, fig. 5.
1992 *Natica multipunctata* Wood, 1842 — Moerdijk *et al.*, p. 7.
1992 *Natica (Natica) bevelandensis* Pouderoyen, 1956 — Moerdijk *et al.*, p. 7.
1993 *Natica multipunctata* Wood, 1842 — Marquet, p. 90, pl. 3, fig. 6.
1995 *Natica woodi* Verberckt, p. 113.

Dimensions — Height 24 mm, width 22 mm.
Description — Large, solid, rather low-spired, globular shell. The aperture is very large. The upper part of the callus is straight; it does not protrude into the umbilicus. The whorls are angular. The umbilicus is very large and contains a funiculus.
Discussion — This species occurs very commonly in the Oorderen and Kruisschans members. No specimens were

found in the Kattendijk Formation at Kallo, although the species does occur in that unit at other localities. Specimens from the Oorderen Member often preserve opercula, while dissociated opercula are also quite common. Specimens with a higher spire from Dutch beaches have been described as *Natica bevelandensis* Pouderoyen, 1956. This form is also found in the Kruisschans Member at Kallo, but is linked with the typical form by many intermediate specimens. Verberckt (1995) has recently pointed out that the commonly used name *Natica multipunctata* Wood, 1842 is preoccupied by *Natica multipunctata* de Blainville, 1825, and suggested the replacement name *Natica woodi*. However, this is unavailable, because of primary homonymy with *Natica woodi* Deshayes, 1864 (now *Sigatica woodi*) from the Thanetian (Palaeocene) of France. Furthermore, there exist two senior synonyms, *Natica crassa* Nyst, 1835 and *N. bevelandensis* Pouderoyen, 1956, the first of which is here adopted as the oldest available name. The species ranges throughout the entire Pliocene of the North Sea Basin; Brébion (1964) also recorded it from the Redonian.

Superfamily	Tonnoidea Suter, 1913
Family	Ficidae Meek, 1864
Genus	*Ficus* Röding, 1798

Ficus conditus subintermedius (d'Orbigny, 1852)
Pl. 3, Fig. 3

1848 *Pyrula reticulata* Lam. — Wood, p. 42, pl. 2, fig. 12.
1852 *Pyrula subintermedia* d'Orbigny, p. 173.
1878 *Ficula intermedia* ? Sism. — Nyst, pl. 1, fig. 8.
1881 *Ficula intermedia* ? Sismonda — Nyst, p. 40.
1920 *Ficula condita* (Brongniart) — Harmer, p. 515, pl. 46, fig. 12.
1946 *Ficus (Ficus) condita* (Brongniart, 1823) — Beets, p. 68.
1959 *Ficus conditus stricticostatus* Sacco, 1891 — Glibert, p. 4.
1992 *Ficus conditus subintermedius* (d'Orbigny, 1852) — Cavallo & Repetto, p. 72, fig. 133.

Dimensions — Height 51 mm, width 32 mm (damaged).
Description — Very large, globular shell with long siphonal canal. Umbilicus and callus are absent. The apex protrudes only slightly above the last whorl. Ornament consists of a large number of strong primary spiral ribs, with a weaker secondary one in between. These ribs are crossed by axial ribs, which are weaker than the primary spirals.
Discussion — This species, a specimen of which was collected at Kallo by K. Peeters, is extremely rare in the Kattendijk Formation. Glibert (1959) used the name *Ficus conditus stricticostatus* Sacco, 1891 for Pliocene *Ficus*. However, this is only one of many varieties of this species from the Italian Pliocene and certainly not a subspecies, neither geographic nor stratigraphic. The oldest name applied to Pliocene specimens of *Ficus conditus* (Brongniart, 1823) is *subintermedius* of d'Orbigny (1852), which is used here in the sense of a subspecies. The name *Ficus subintermedius* (d'Orbigny, 1852) is often applied to Recent Indo-Pacific shells, for example by Kira (1955, p. 44) and Springsteen & Leobrera (1989, p. 108), which, however, have a much finer reticulate ornament and a less wide adapical part of the whorls. The Recent shells appear to be in need of a new name.

Family	Cassidae Latreille, 1825
Subfamily	Cassinae Latreille, 1825
Genus	*Galeodea* Link, 1805

Galeodea bicatenata (J. Sowerby, 1816)
Pl. 3, Fig. 4

1816 *Cassis bicatenata* J. Sowerby, p. 117, pl. 151.
1843 *Cassis bicatenata* Sow. — Nyst, p. 565, pl. 46, fig. 6.
1848 *Cassis bicatenata* J. Sow. — Wood, p. 27, pl. 4, fig. 5.
1872 *Cassidaria bicatenata*, var. *ecatenata* Wood, p. 11, pl. 6, fig. 2a, b.
1878 *Cassidaria bicatenata*, J. Sow. — Nyst, pl. 2, fig. 14.
1881 *Cassidaria bicatenata*, J. Sowerby — Nyst, p. 34.
?1914 *Cassidaria tyrrhena* (Chemitz) — Harmer, p. 58, pl. 2, fig. 13.
1914 *Cassidaria bicatenata* J. Sowerby, var. *Canhami*, A. Bell — Harmer, p. 59, pl. 2, fig. 14.
1920 *Cassidaria bicatenata*, J. Sowerby — Harmer, p. 514, pl. 45, fig. 14.
1920 *Cassidaria bicatenata*, J. Sowerby var. *ecatenata*, S.V. Wood — Harmer, p. 515, pl. 45, figs 15, 16.
1946 *Galeodea bicatenata* (Sowerby, 1817) — Beets, p. 67.
1959 *Cassidaria bicatenata* Sowerby, sp. 1824 — Glibert, p. 1.
1965 *Galeodea bicatenata* (J. Sowerby, 1817) — van Regteren Altena *et al.*, p. 28, pl. 10, fig. 106.
1979 *Galeodea bicatenata* (Sowerby, 1817) — Geys & Marquet, p. 72, pl. 29, fig. 1.

Dimensions — Height 95 mm, width 67 mm; height 85 mm, width 54 mm.
Description — Very large, solid, more or less globular shell with pointed spire, angular whorls and a well-developed siphonal canal. The aperture has an everted outer lip. Weak teeth are present on the inner side of the lip. The columellar apertural lip forms a glossy extension on the ultimate whorl, which bears plicae and covers the umbilical groove. Several varices may be present. Ornament consists of 30-40 spiral ribs, with often weaker secondary ones in between. On the upper part of the whorls, one of the ribs may bear tubercles. The spirals are often crossed by much weaker prosocline axial lines.
Discussion — This species occurs fairly frequently at Kallo, and ranges from the Kattendijk Formation to the Kruisschans Member. Specimens from the former unit were occasionally inhabited by pagurids, which is indicated by encrusting *Hydractinia* sp. A few specimens have much finer and more numerous (about 40) spiral ribs,

which lack tubercles. This form, *ecatenata* Wood, 1872, closely resembles Recent *Galeodea rugosa* (Linné, 1771). This, however, has a narrower shell with even less angular whorls. The present species is confined to the Pliocene North Sea Basin and also occurs in part of the Redonian. Harmer (1914, p. 58) recorded *G. rugosa* from the Red Crag of Boyton and Walton, under the name of '*Cassidaria tyrrhena* (Chemnitz)'. That author also pointed out that one of Nyst's (1878) specimens (pl. 2, fig. 14b) might represent the same species. Nyst's specimen survives in the IRScNB collections, but is a typical juvenile *G. bicatenata*. Harmer's figure of *G. rugosa* also represents a juvenile specimen judging by its weakly developed apertural lip and narrow callus. It is wider than extant specimens of *G. rugosa* and the typical columellar lip of that species, extended into a thin flange, is absent (see Graham, 1988, p. 351, fig. 144; Poppe & Goto, 1990, pl. 21, figs 5, 6). Harmer (1920, p. 515) recorded *G. rugosa* also from the Pleistocene Wexford Gravel. The lip fragment illustrated, however, is unrecognisable at the species level. Whether or not *G. rugosa* did occur in the Pliocene and Pleistocene of the North Sea Basin thus remains to be determined. Rasmussen (1956, p. 61, pl. 5, fig. 3) and Rasmussen (1968, p. 118) recorded *G. echinophora* (Linné, 1758) from the Danish late Miocene 'Gram Stufe', and Moths (1989, pl. 13, fig. 63) did the same for the German late Miocene 'Langenfeld Stufe'. *Galeodea echinophora*, as figured by Poppe & Goto (1990, pl. 21, figs 1-4) is a Pliocene-Recent species of the Mediterranean. There are no records from the North Sea Basin Pliocene. The German and Danish Miocene specimens do not have the same shell shape as Recent Mediterranean specimens. In addition, Recent specimens have a very variable spiral ornament: most often few spiral ribs occur, with very large, near-square tubercles on several spirals. The Miocene specimens all appear to have but a single row, rarely two rows, of much smaller tubercles and a higher number of spiral ribs, which brings them closer to *G. bicatenata*, of which they could represent a subspecies.

Genus and Subgenus *Semicassis* Mörch, 1852

Semicassis (S.) laevigata laevigata
(Defrance, 1817)
Pl. 3, Fig. 5

1872 *Cassis saburon* Bruguière — Wood, p. 10, pl. 6, fig. 1.
1878 *Cassis saburon*, Brug. — Nyst, pl. 3, fig. 1; pl. 28, fig. 6.
1881 *Cassis saburon*, Brug. — Nyst, p. 35.
1914 *Cassis (Semicassis saburon)* [*sic*] (Bruguière) — Harmer, p. 59.
1959 *Semicassis* cf. *laevigata* Defrance, 1817 — Glibert, p. 3, pl. 3, fig. 1.
? 1965 *Phalium (Semicassis)* sp. — van Regteren Altena *et al.*, p. 28, pl. 10, fig. 107.
1992 *Phalium (Semicassis) saburon* (Bruguière, 1792) — Cavallo & Repetto, p. 74, fig. 139.

Dimensions — Height 51 mm, width 32 mm.
Description — Large, solid, more or less globular shell with pointed spire, contiguous whorls and short siphonal canal. The aperture has a strongly thickened outer lip, which bears conspicuous, irregular teeth on the inside. The inner apertural lip forms only a weak extension onto the ultimate whorl, which bears strong plicae. The older whorls bear weak spiral ribs, the last whorl is smooth.
Discussion — Only a single specimen of this rare species was found at Kallo, but unfortunately *ex situ*. The shell is partially covered by *Hydractinia* sp., which is found most commonly in the Kattendijk Formation. Recent *Semicassis saburon* (Bruguière, 1792), figured by Poppe & Goto (1990, pl. 21, figs 9-11) is clearly different, because the last whorl is completely covered by spiral ribs. '*Phalium miolaevigatum*' (*sensu* Glibert, 1952) from the early Miocene of Belgium, with its weak spirals and low spire, is also different and could represent an undescribed species. *Semicassis miolaevigata* (Sacco, 1890), which is found in the late Miocene, resembles *S. laevigata*, but spiral ribs occur around the siphonal canal. It could very well represent a late Miocene subspecies of *S. laevigata*.

Suborder Ptenoglossa Gray, 1853
Superfamily Triphoroidea Gray, 1847
Family Triphoridae Gray, 1847

Representatives of this family have recently been described in detail by Marquet (1996) and are merely listed here.

Subfamily Triphorinae Gray, 1847
Genus *Marshallora* Bouchet & Warén, 1980
M. adversa (Montagu, 1803)
Genus *Norephora* Gründel, 1975
N. pliocaenica Marquet, 1996
Genus *Triphora* de Blainville, 1825 s. lat.
T. radiospirata Marquet, 1996

Subfamily Metaxiinae Marshall, 1977
Genus *Metaxia* Monterosato, 1884
M. metaxa (delle Chiaje, 1828)

Superfamily Cerithiopsoidea H. & A. Adams, 1854
Family Newtoniellidae Korobkov, 1960
Genus *Krachia* Baluk, 1975

Krachia zelandica (Beets, 1946)
Pl. 3, Figs 6, 9

1946 *Seila zelandica* Beets, p. 47, pl. 3, fig. 1.

Dimensions — Height 4.0 mm, width 0.7 mm (Pl. 3, Fig. 6), protoconch height 0.8 mm; height 6 mm, width 1 mm (Pl. 3, Fig. 9).

Description — Small, turriculate, dextral shell with well-developed siphonal canal, comprising up to eleven teleoconch whorls. Specimens from Kallo and the holotype all lack their protoconch. It is preserved in a specimen from the Antwerp Scheldt Right Bank docks, 'Diestien' (= Kattendijk Formation ?): it consists of a small, pointed nucleus and two tumid, smooth whorls. Teleoconch and protoconch are separated by an orthocline growth line. Two spiral ribs with tubercles appear at the onset of the teleoconch, the first at 1/3, the second at 2/3 of whorl height. The third spiral, which is much weaker than the other two, appears adapically close to the suture on the second teleoconch whorl. The whorls are not tumid, but the suture is clearly visible by the presence of a slight subsutural depression. The ornament consists of three spirals on the older whorls and five on the last whorl. The adapical spiral is much weaker than the second and third. The fourth and fifth spirals lie close together on the shell base. About nineteen axial ribs per whorl cross these spirals and form clear tubercles on the first, second and third spiral, vague ones on the fourth but none on the fifth. The tubercles are smaller than the square spaces between the spiral and axial ribs. The shell base is slightly tumid.

Discussion — This is a rare species in the *Petaloconchus* bed, being present also in the Luchtbal Member (A. Janse Colln, from Antwerp, B2 Kanaaldok; IRScNB coll.). Beets's species has not been recorded from the British Pliocene. At Haamstede (The Netherlands) but a single, incomplete specimen was found (Beets, 1946), which agrees well in sculpture and shell form with the material from the Kattendijk Formation. The most marked difference is the absence in Beets's specimen of the abapical basal spiral, but the last whorl in his specimen is not intact. All specimens studied differ from *Cerithiopsis subulatum* (Wood, 1848) and *C. tubercularis* (Montagu, 1803) in having smaller tubercles, a subsutural depression and a longer siphonal canal. The present specimens resemble the Miocene *Cerithiopsis* sp. 1 of Janssen (1984), but the ornament of that species is different. *Cerithiopsis jeffreysi* Watson, 1885 (= *Cerithiopsis pulchella* Jeffreys, 1858), as figured by van Aartsen *et al.* (1983, pl. 115, fig. 131), Warén (1980, pl. 4, fig. 15) and Graham (1988, p. 472, fig. 199) bears a superficial resemblance to this species as well. However, it has one less spiral on the last whorl and appears less slender, especially in Warén's and Graham's figures, which probably represent the same specimen. The present species is here placed in the genus *Krachia* as defined by Bouchet & Warén (1993), on account of the presence of two additional spirals without tubercles on the last whorl. It resembles *Krachia cossmanni* (Dautzenberg & Fischer, 1896), as figured by Bouchet & Warén (1993, figs 1344, 1345, 1356).

Family Cerithiopsidae H. & A. Adams, 1854
Subfamily Cerithiopsinae H. & A. Adams, 1854
Genus
and subgenus *Cerithiopsis* Forbes & Hanley, 1851

Cerithiopsis (C.) nana (Wood, 1848)
Pl. 5, Fig. 2

1848 *Cerithium tuberculare* var. *nanum* Wood, p. 70, pl. 8, fig. 5c.
1915 *Cerithiopsis minima* (Brusina) — Harmer, p. 423, pl. 41, fig. 22.
1965 *Cerithiopsis nana* (S.V. Wood, 1848) — van Regteren Altena *et al.*, p. 18, pl. 6, fig. 64.

Dimensions — Height 4.5 mm, width 1.7 mm, protoconch height 0.12 mm.

Description — Small, rather broad shell with flat-sided whorls and shallow suture. The protoconch is paucispiral and consists of one and a half whorls, which are smooth and broad, with shallow suture. The teleoconch ornament starts with three tuberculate spiral ribs. The spirals become stronger adapically to abapically. Five and a half teleoconch whorls are present in the most complete fragment studied. The last whorl has three nearly equally strong spirals with tubercles. The shell base is lined by a strong spiral rib, which lacks tubercles. These spiral ribs are crossed by 16 axial ribs. On the points of intersection, tubercles occur, which are square and slightly smaller than the intercostal spaces. The aperture is rounded, the shell base smooth. The siphonal canal is fairly long and slightly bent.

Discussion — This species, which is new for the Pliocene of Belgium, is rare in the *Petaloconchus* bed of the Kattendijk Formation; it was recorded from Dutch beaches and from Great Britain (Coralline Crag). Harmer (1915, p. 423) remarked that the species is 'conical at the summit', which agrees with our paucispiral specimen. All other Cerithiopsidae from the Pliocene of Belgium have a multispiral protoconch. The shell shape is described as 'pupoid', but Harmer (1915) figured two specimens (figs 22, 23), and only in the second specimen is this character very pronounced. The specimen in fig. 22 has the same shape as our material. Harmer (1915) lumped Pliocene material with an extant Mediterranean species, which extends to Atlantic Spain (Rio de Vigo), *C. minima* Brusina, 1865. Rolan Mosquera (1983, p. 179, text-fig.) illustrated a specimen that clearly shows a slender protoconch with four whorls. *Cerithiopsis nana* (Wood, 1848) differs in the same character from the Mediterranean species *C. nana* Jeffreys, 1867, the protoconch of which was illustrated by van Aartsen *et al.* (1983, fig. 133). It consists of 4½ smooth whorls; this means that *C. nana* should be renamed, but at this time it cannot be demonstrated beyond doubt that it really is distinct from *C. minima*.

Cerithiopsis (C.) keukelaari n. sp.
Pl. 3, Fig. 8

Diagnosis — A species of *Cerithiopsis* with a protoconch which is smooth except for a microsculpture of discontinuous spiral lines and with teleoconch ornament of three rows of elongated tubercles, which are only interconnected by

very inconspicuous axial ribs; the intercostal areas are small compared with the tubercles. The shell base is smooth.

Locus typicus — Vrasenedok, Kallo, municipality of Beveren, province of Oost-Vlaanderen (Belgium); coordinates x = 140,850, y = 216,700 (see map in Hoedemakers & Marquet, 1992).

Stratum typicum — *Cultellus* level, Oorderen Member (Lillo Formation), middle Pliocene.

Derivatio nominis — after Hans Keukelaar, who collected the holotype of the species.

Dimensions — Height 4 mm, width 1 mm (holotype).

Material — In addition to the holotype (RGM 396 197), a single specimen from the same locality and level (A. Ratinckx Colln); 1 specimen from Antwerp-Noordkasteel docks (A. Janse Colln; Luchtbal Member, Lillo Formation, middle Pliocene); 4 specimens from Antwerp-Austruweel (IRScNB IG 8845; 'Scaldisien'); 1 specimen from Antwerp-Verbindingsdok (IRScNB IG 9014; 'Scaldisien supérieur'); 14 specimens from Antwerp-new docks 1909 (IRScNB; 'Poederlien'); 1 specimen from Antwerp-Austruweel Polderdijk (IRScNB IG 9149; 'Scaldisien supérieur'), and 1 specimen from Austruweel-Polderdijk, -7.9 m (IRScNB IG 9149; 'Scaldisien base').

Description — Small, dextral, turriculate shell, consisting of eight flat whorls with inconspicuous sutures. A short siphonal canal is present. The protoconch consists of three tumid whorls, which appear smooth but a microsculpture of interrupted, irregularly distributed spiral lines is present. Protoconch and teleoconch are not separated, but the teleoconch whorls are clearly less tumid. The teleoconch ornament starts abruptly with three rows of tubercles, the central one appearing slightly before the other two. Later whorls also have three spiral rows of tubercles, which are interconnected by very weak axial ribs. The tubercles are rectangular, extended axially, and are separated by narrow grooves. The intercostal areas are much smaller than the tubercles. The shell base is sharply delimited by a carina and bears no ornament.

Discussion — This species is extremely rare in the Oorderen Member; it differs clearly from *Cerithiopsis subulata* (Wood, 1848) in having a protoconch without macrosculpture and from *C. nana* (Wood, 1848) in being more slender and in having a multispiral protoconch. In *C. tubercularis* (Montagu, 1803) and *C. barleei* Jeffreys, 1867, granules instead of interrupted spiral lines are present on the protoconch, which also has one and a half whorl more, while the teleoconch tubercles are square and more widely spaced. I do not know of any other Recent or fossil species closely resembling it, especially in regard to the rectangular shape of the tubercles and the narrow intercostal areas.

Cerithiopsis (C.) barleei Jeffreys, 1867
Pl. 5, Fig. 1

1867 *Cerithiopsis Barleei* Jeffreys, p. 268.
1869 *Cerithiopsis Barleei* Jeffr. — Jeffreys, pl. 81, fig. 2.
1886 *C. Barleei*, Jeffr. — Watson, p. 91, pl. 4, fig. 4.
1918 *Cerithiopsis Barleei* Jeffreys — Harmer, p. 419, pl. 41, fig. 14 (*partim*).
1958a *Cerithiopsis tubercularis* Montagu, sp. 1803 var. *tubercularis* s.s. — Glibert, p. 8, pl. 2, fig. 4a (*partim*).
1965 *Cerithiopsis tubercularis* (Montagu, 1803) — van Regteren Altena *et al.*, p. 18; pl. 6, fig. 62 (?).
1974 *Cerithiopsis barlei* Jeffreys — Rodriguez Babio & Thiriot-Quiévreux, p. 536, pl. 3, fig. F.
1980 *Cerithiopsis barleei* Jeffreys, 1867a — Warén, p. 25, pl. 4, fig. 13.
1982 *Cerithiopsis barleei* Jeffreys, 1867 — Fretter & Graham, p. 369, fig. 259.
1988 *Cerithiopsis barleei* Jeffreys, 1867 — Graham, p. 468, fig. 197.

Dimensions — Height 4.1 mm, width 1.3 mm, protoconch height 0.5 mm.

Description — Small, slender shell, with five protoconch and at least eight teleoconch whorls. Shell rather broad for a member of the Cerithiopsidae, regularly broadening; whorls flat-sided, suture rather deeply incised. Protoconch nucleus and subsequent whorl globular and smooth. Other protoconch whorls tumid, with deep suture; both last whorls have a slight carina. The last three protoconch whorls are ornamented with 16 to 26 fine, prosocline brephic axial ribs, which are best developed on the abapical half of the whorls and which become obsolete near the adapical suture. The ribs are much narrower than the intercostal areas. The end of the protoconch is sharply delimited by a prosocline growth line. The teleoconch ornament starts with two tuberculate spiral ribs. The abapical one is stronger and continues the protoconch carina. A weaker adapical spiral starts on the second teleoconch whorl. On the last teleoconch whorl, three equally strong tuberculate spiral ribs and one abapical spiral without tubercles are present. The spirals are crossed by 14 axial ribs. The tubercles are rounded and slightly smaller than the square intercostal areas. The aperture is never complete in the material studied. In the best-preserved specimen, it is square, with a short, slightly bent siphonal canal. The shell base is smooth.

Discussion — According to Fretter & Graham (1982), this species differs from *C. tubercularis* by its protoconch, which has no macrosculpture in the latter and axial ribs in the present species. The microsculpture of small tubercles, which should be present in both species, was not observed in our material, which, however, is invariably slightly eroded. Watson (1886) and Rodriguez Babio & Thiriot-Quiévreux (1974) illustrated the protoconch of *C. barleei*, and their figures show the same number of whorls as in our specimens, also ornamented with axial ornament only. The species is new for the Pliocene of Belgium; Harmer (1918) figured specimens from the British Crags. Van Regteren Altena *et al.* (1965) illustrated specimens which could belong to this species; this beach material, however, is invariably too poorly preserved to observe protoconch characters. At the present day, this species ranges from SW England to the Mediterranean (Fretter & Graham, 1982).

Subgenus *Cerithiopsidella* Bartsch, 1911

Cerithiopsis (Cerithiopsidella) subulata
(Wood, 1848)
Pl. 3, Fig. 7

1848 *Cerithium tuberculare* var. *subulatum* Wood, p. 70, pl. 8, fig. 5, 5b.
1918 *Cerithiopsis tubercularis* (Montagu) — Harmer, p. 420, pl. 41, figs 20, 21(?).
1918 *Cerithiopsis Barleei* Jeffreys — Harmer, p. 419 (*partim*).
1958a *Cerithiopsis tubercularis* Montagu, sp. 1803 var. *tubercularis* s.s. — Glibert, p. 8, pl. 2, fig. 4a (*partim*).
1958a *Cerithiopsis tubercularis* Montagu, sp. 1803 var. *subulata* Wood, 1848 — Glibert, p. 8, pl. 2, fig. 4b.
1965 *Cerithiopsis tubercularis* (Montagu, 1803) — van Regteren Altena *et al.*, p. 18, pl. 6, fig. 62 (?).
1965 *Cerithiopsis subulata* (S.V. Wood, 1848) — van Regteren Altena *et al.*, p. 18, pl. 6, fig. 63.

Dimensions — Height 9 mm, width 2.0 mm.
Description — Small, turriculate shell of up to ten teleoconch whorls, which rapidly increase in size after the protoconch, but remain nearly of the same width after the fifth teleoconch whorl. The whorls are extremely flat-sided and the suture is very shallow, which gives the shell a tubular shape. The protoconch is multispiral, consisting of four and a half whorls. Its whorls are tumid, the ultimate one with a weak carina. Nucleus tumid, first two whorls smooth. The two and a half last protoconch whorls are covered with dense, diagonal, cancellate sculpture. This consists of about 20 sharp, continuous, opisthocline axial ribs on the last whorl, which turn slightly above the carina and are as wide as 1/3 of the intercostal areas; between them run discontinuous weaker prosocline ribs which are best visible on the abapical part of the whorls. The end of the protoconch is clearly delimited and sinuous. The teleoconch ornament starts with three spiral ribs; the adapical one is by far the weakest and lies close to the central one. The carina of the protoconch continues as the abapical teleoconch spiral and becomes slightly narrower after the end of the protoconch. Later whorls bear three equal spiral rows of tubercles, joined by weak spiral and 16 axial ribs. The tubercles are as large as the depressions in between; the tubercles as well as the intercostal areas are square. The last whorl bears two more smooth spirals, which are close together; the abapical one is stronger. The aperture is square, the siphonal canal very short.
Discussion — This species occurs commonly in the Kattendijk Formation and rarely in the Oorderen Member, the Kattendijk Formation specimens being smaller, with a more regularly broadening shell. They may have one spiral less on the shell base, but the protoconchs of both are indistinguishable. Harmer (1918) considered *C. subulata* to be synonymous with *Cerithiopsis barleei*; the specimens he figured belong to the latter species. *C. barleei*, however, has only axial sculpture on the protoconch, its siphonal canal is longer and only one smooth spiral rib is present above the shell base. The protoconch of *Cerithiopsis tuberculata* (Montagu, 1803) was described and figured by Fretter & Graham (1982, p. 368, fig. 258); it is smooth, except for a microsculpture consisting of granules. None of the specimens studied from the Belgian Pliocene, formerly considered to belong to *C. tubercularis*, has a similar protoconch, always a reticulate or axial sculpture and a carina are present. Therefore, the occurrence of *C. tubercularis* in the Pliocene of the North Sea Basin is considered doubtful. Mediterranean specimens figured by Cavallo & Repetto (1992, p. 78, fig. 150) lack a protoconch and their specific attribution is remains therefore uncertain. The name '*subulata*' was used by Wood (1848) for a more cylindrical variety of *C. tubercularis*. Van Regteren Altena *et al.* (1965) considered this to be a separate species, based only on the cylindrical shell shape. Glibert (1958a), however, considered it to be a variety at best. Its protoconch ornament, however, clearly shows it to be a distinct species. *Cerithiopsis atalaya* Watson (1886, p. 94, pl. 4, fig. 9) from Madeira has a closely similar teleoconch, but a different protoconch with axial ribs, crossed by two spirals. *C. subulata* is here placed in the subgenus *Cerithiopsidella*. Gründel (1980, fig. 2) illustrated the protoconch of *Cerithiopsis (Cerithiopsidella) daphnelloides* (R. Janssen, 1978) from the German Chattian (late Oligocene). Its protoconch ornament is similar to that of *C. subulata*.

Subfamily Seilinae Golikov & Starobogatov, 1975
Genus *Seila* Adams, 1868

Seila trilineata (Philippi, 1836)
Pl. 5, Fig. 3

1836 *Cerithium trilineatum* Philippi, p. 195.
1848 *Cerithium trilineatum* Phil. — Wood, p. 70, pl. 8, fig. 4.
1918 *Newtoniella (Seila) trilineata* (Philippi) — Harmer, p. 424, pl. 41, fig. 24.
1946 *Seila (S.) turritissima* Sacco, 1895 — Beets, p. 46, pl. 3, fig. 2.
1958 *Seila trilineata* Philippi, sp. 1836 — Glibert, p. 8.
1965 *Seila trilineata* (Philippi, 1836) — van Regteren Altena *et al.*, p. 18, pl. 6, fig. 65.

Dimensions — Height 8 mm, width 2 mm (incomplete).
Description — Small, dextral, turriculate shell. The whorls are flat and the suture is shallow. The siphonal canal is relatively long. The available specimen does not preserve the protoconch, but this was observed on a specimen from Sutton (Great Britain; Coralline Crag). It is paucispiral and consists of two whorls. The nucleus is tumid; the second whorl is tumid at first but becomes carinate near the start of the teleoconch. The ornament of the first protoconch whorl is eroded, the second whorl shows seven thick axial ribs, which are slightly narrower than the intercostal areas. Near the start of the teleoconch, tubercles appear on the axial ribs, forming a spiral row at 1/3 below the adapical suture. On the teleoconch, the thick axial ribs disappear. The row of tubercles becomes a continuous central spiral; an abapical spiral start slightly later. The adapical spiral appears last and remains weaker on several subsequent whorls. At the same time, fine axial lines appear. The

ornament consists on the youngest whorls of three to four strong, continuous spirals, which lack tubercles. Between the spirals run very fine axial striae. These are prosocline between the adapical and the second rib, opisthocline between the next spirals.
Discussion — Only a few incomplete specimens were found at Kallo, in the *Petaloconchus* bed. The species is easily recognised by its ornament. *Seila trilineata* ranges from the late Oligocene to Recent (Mediterranean).

Family	Eumetulidae Golikov & Starobogatov, 1975
Subfamily	Eumetulinae Golikov & Starobogatov, 1975
Genus and subgenus	*Laiocochlis* Dunker & Metzger, 1874

Laiocochlis (L.) sinistrata (Nyst, 1835)
Pl. 4, Fig. 1

1835 *Cerithium sinistratum* Nyst, p. 28, fig. 25.
1843 *Cerithium sinistratum* Nyst — Nyst, p. 541, pl. 42, fig. 10 (*non* fig. 9).
1878 *Cerithium sinistratum*, Nyst — Nyst, pl. 6, fig. 9.
1881 *Cerithium sinistratum*, Nyst — Nyst, p. 78.
1918 *Laeocochlis granosa* (S.V. Wood) — Harmer, p. 427, pl. 41, fig. 13 (*partim*).
1958a *Laiocochlis sinistrata* Nyst, sp. 1835 — Glibert, p. 9, pl. 2, fig. 6.
1993 *Laiocochlis sinistrata* (Nyst, 1835) — Bouchet & Warén, p. 614, figs 1281, 1288, 1367-1370.

Dimensions — Height 20 mm, width 5 mm; height 3 mm, width 1 mm.
Description — Fairly large, sinistral, turriculate shell with a relatively long siphonal canal. The whorls are fairly tumid and the suture is deep. The protoconch consists of two to three whorls, which are much more tumid than the teleoconch whorls. Their ornament consists of numerous axial ribs, crossed by many very fine spiral striae. On the teleoconch whorl two keels appear. On the next whorl, a third spiral develops between them. On the third whorl, spirals and axials are at first equally strong. Later, the axial ribs gradually disappear. Ultimately, only four spiral ribs remain, without axial sculpture.
Discussion — This species resembles sinistral Triphoridae. Members of this family occurring in the Pliocene of Belgium, however, are smaller and have a shallow suture. Their teleoconch has at most 4 spirals adapical of the shell base. These spirals bear tubercles to the ultimate whorl, except in *Inella vandermarki* Marquet, 1995. Their protoconchs are smooth in *I. vandermarki*, or possess two marked spiral ribs (*Norephora pliocaenica* Marquet, 1995, *Triphora radiospirata* Marquet, 1995, *T. antwerpiensis* Marquet, 1995) or are multispiral in *Monophora adversa* (Montagu, 1803). The present species is very rare in the Kattendijk Formation, where only fragments have been collected. The species is nowadays restricted to cold or deep water and occurs in the Barents Sea, along the Norwegian coast to the western Skaggerak, the Shetlands and Faroes, Iceland and from Davis Straits to Newfoundland, from depths of 200 to 1,420 m (Bouchet & Warén, 1993).

Superfamily	Janthinoidea Lamarck, 1810
Family	Aclididae Sars, 1878
Genus	*Aclis* Lovén, 1846

Aclis ascaris (Turton, 1819)
Pl. 4, Fig. 2

? 1842 *Alvania supra-nitida* Wood, p. 534.
? 1848 *Alvania ascaris* Turt. — Wood, p. 99, pl. 12, fig. 11.
? 1914 *Aclis supranitida* Wood sp. + var. — Cerulli-Irelli, p. 243, pl. 21, figs 37-41.
? 1922 *Aclis supranitida* (S.V. Wood) — Harmer, p. 868, pl. 65, fig. 24.
? 1965 *Aclis minor* (Brown, 1827) — van Regteren Altena *et al.*, p. 21, pl. 8, fig. 77.
1983 *Aclis ascaris* (Turton, 1819) — Rolan Mosquera, p. 189, text-fig.
1988 *Aclis ascaris* (Turton, 1819) — Graham, p. 505, fig. 213.

Dimensions — Height 1 mm, width 0.5 mm (fragment).
Description — Very small, turriculate shell with small umbilicus and lacking a siphonal canal. The whorls are tumid, the suture deep. One of the available specimens consists of four protoconch and four teleoconch whorls, the other of four proto- and two teleoconch whorls but both are incomplete. The protoconch is multispiral, smooth and glossy. The teleoconch starts abruptly with two spiral ribs. The number of ribs increases, until six ribs are present on the last preserved whorl.
Discussion — Although the specimens are incomplete, they are easily distinguished from other turriculate gastropods from Kallo. Dutch and British (Coralline Crag) material was identified as *Aclis minor* (Brown, 1827), but the Belgian specimens agree completely in ornament and size with *A. ascaris* as figured by Rolan Mosquera (1983). The species is new for Belgium, having been collected by A. Janse and H. Keukelaar from the Oorderen Member. At the present day, the species ranges from the Mediterranean to southern Scandinavia (Rolan Mosquera, 1983; Graham, 1988).

Family	Epitoniidae Berry, 1910
Subfamily	Epitoniinae Berry, 1910
Genus and subgenus	*Cirsotrema* Mörch, 1857

Cirsotrema (C.) fimbriosum fimbriosum (Wood, 1842)
Pl. 4, Fig. 4

1842 *Scalaria fimbriosa* Wood, p. 535.

1848 *Scalaria fimbriosa* S. Wood — Wood, p. 9, pl. 8, fig. 12.
1878 *Scalaria fimbriosa* S. Wood — Nyst, pl. 6, fig. 18a (*non* b = *C. f. exfimbriosum*).
1881 *Scalaria fimbriosa* S. Wood — Nyst, p. 89.
1879 *Scalaria fimbriosa* S. Wood — Wood, p. 25, pl. 3, fig. 17.
1920 *Scala (Cirsotrema) fimbriosa* (S.V. Wood) — Harmer, p. 542, pl. 48, figs 1, 2, 6.
1958a *Cirsotrema fimbriosum* Wood, sp. 1842 — Glibert, p. 11 (*partim*).
1965 *Cirsotrema fimbriosum* (S.V. Wood, 1848) — van Regteren Altena *et al.*, p. 19, pl. 7, fig. 69.

Dimensions — Height 28 mm, width 13 mm (incomplete).
Description — Rather large, holostomatous turriculate shell. The whorls are tumid, the suture deep. The protoconch consists of about four smooth whorls, the teleoconch of about eight whorls. The ornament includes spiral as well as axial ribs. There are eleven to fourteen axial ribs per whorl, which are as thick as the intercostal spaces and foliated. Varices are rarely present. The shell base is separated by a disc, ending at the upper margin of the aperture. Between the axials, about six much weaker spiral ribs are present.
Discussion — This subspecies is confined to the Kattendijk Formation. Specimens from the Oorderen Member are slightly different (see below). In Great Britain, *C. f. fimbriosum* appears to be restricted to the Coralline Crag. It also occurs in the French Redonian, but Brébion (1964) did not specify the subspecies.

Cirsotrema (C.) fimbriosum exfimbriosum
Sacco, 1891
Pl. 4, Fig. 6

1878 *Scalaria fimbriosa* S. Wood — Nyst, pl. 6, fig. 18b (*non* a = *C. f. fimbriosum*).
1881 *Scalaria fimbriosa* S. Wood — Nyst, p. 89.
1891 *Cirsotrema exfimbriosum* Sacco, p. 48.
1920 *Scala (Cirsotrema) fimbriosa* var. *exfimbriosa* (Sacco) — Harmer, p. 543, pl. 48, figs 3, 4.
1958a *Cirsotrema fimbriosum* Wood, sp. 1842 — Glibert, p. 11 (*partim*).

Dimensions — Height 20 mm, width 10 mm (incomplete).
Description — This subspecies resembles the previous one but there are some constant differences. The ribs are narrower than the interspaces and are only slightly foliated. Varices are commonly present.
Discussion — This subspecies is only rarely found in the Oorderen Member at Kallo. In Great Britain, it occurs in the Red Crag. Because of this temporal separation from *C. f. fimbriosum*, it is here considered to be a subspecies.

Cirsotrema (C.) funiculus (Wood, 1872)
Pl. 4, Fig. 5

1848 *Scalaria varicosa* Lam. — Wood, p. 90, pl. 8, fig. 14.
1872 *Scalaria varicosa* Lamarck — Wood, p. 98.
1872 *Scalaria funiculus* Wood, p. 98.
1920 *Scala (Cirsotrema) funiculus* (S.V. Wood) — Harmer, p. 544, pl. 48, fig. 8.
1946 *Cirsotrema (Cirsotrema) funiculus* (Wood, 1872) — Beets, p. 48.
1958a *Cirsotrema funiculus* Wood, sp. 1842 — Glibert, p. 12, pl. 2, fig. 8.
1965 *Cirsotrema funiculus* (S.V. Wood, 1872) — van Regteren Altena *et al.*, p. 19, pl. 7, fig. 69.

Dimensions — Height 13 mm, width 9 mm (fragment).
Description — Fairly large, turriculate shell with tumid whorls and a deep suture. The ornament consists of equally strong axial and spiral ribs. There are sixteen to seventeen axials on the last whorl, which are narrower than the intercostal spaces. Varices occur on each whorl. Seven to eight spirals are present between the axials. The shell base is separated by a disc.
Discussion — This species can be distinguished from the previous one by its weaker, more numerous axial ribs. It is extremely rare at Kallo, and only *ex situ* fragments have been found. It occurs in the North Sea Basin and in the Italian Pliocene; there are also doubtful records from the Redonian (Brébion, 1964).

Genus *Acirsa* Mörch, 1857
Subgenus *Hemiacirsa* de Boury, 1890

Acirsa (Hemiacirsa) aff. penepolaris (Wood, 1872)
Pl. 4, Fig. 3

aff. 1872 *Turritella ? penepolaris* Wood, p. 53, pl. 4, fig. 20.
aff. 1879 *Turritella (Mesalia) penepolaris* S. Wood — Wood, p. 26, pl. 2, fig. 14.
aff. 1888 *Acirsa penepolaris* Wood — E. Vincent, p. xciv.
aff. 1920 *Scala (Plesioacirsa) chatwini* Harmer, p. 557, pl. 48, figs 38, 39.
aff. 1958a *Acirsa (Plesioacirsa) penepolaris* Wood, sp. 1848 — Glibert, p. 10.

Dimensions — Height 10 mm, width 3 mm (incomplete).
Description — Rather small, very slender turriculate shell, with shallow suture and only very slightly tumid whorls. More than eight whorls are present. The aperture is oval, pointed above with an angle between columellar and parietal lip. Ornament is absent in the heavily worn Kallo specimen; in fresh shells of *A. penepolaris*, it consists of very fine spirals (see Harmer, 1920).
Discussion — This taxon is extremely rare at Kallo. Only a single worn specimen has been found by A. Ratinckx, but *ex situ*. It resembles the North Sea Basin Miocene *Acirsa (Hemiacirsa)* aff. *duvergieri* (de Boury *in* Cossmann, 1912), as figured by Janssen (1984, pl. 50, fig. 1) which, however, has some axial ornament. It might represent a subspecies of the Miocene taxon. The conspecificity of the Kallo shell with Wood's species is uncertain, on account of poor preservation. In Britain, *A. penepolaris* is known from the Coralline and Red Crags; there are no records from The Netherlands.

Genus *Epitonium* Röding, 1798

Epitonium frondiculum frondiculum (Wood, 1842)
Pl. 4, Fig. 7

1842 *Scalaria frondicula* Wood, p. 535.
1843 *Scalaria frondosa* Sow. — Nyst, p. 393, pl. 38, fig. 7.
1848 *Scalaria frondicula* S. Wood — Wood, p. 92, pl. 8, figs 1, 6.
1878 *Scalaria frondicula* S. Wood — Nyst, pl. 6, fig. 15.
1881 *Scalaria frondicula* S. Wood — Nyst, p. 87.
1920 *Scala (Linctoscala) frondicula* (S.V. Wood) — Harmer, p. 531, pl. 48, figs 19, 20.
1946 *Scala (Spiniscala) frondicula* (Wood, 1848) — Beets, p. 49.
1958a *Scala (Spiniscala) frondicula* Wood, sp. 1848 — Glibert, p. 13.
1965 *Epitonium (Epitonium) frondiculum* (S.V. Wood, 1848) — van Regteren Altena *et al.*, p. 20, pl. 7, fig. 74.
1979 *Scala frondicula* (Wood, 1848) — Geys & Marquet, p. 68, pl. 27, fig. 6.

Dimensions — Height 32 mm, width 12 mm.
Description — Large, turriculate shell with slightly inflated whorls and a deep suture. Up to about fifteen teleoconch whorls present. The ornament includes only slightly prosocline axial ribs, which bear spines on their adapical end. On the last whorl, about fifteen ribs are present, which are narrower than the intercostal spaces, but as they are not perpendicular to the shell surface the intercostal spaces look smaller. The colour of the shell is mostly yellow.
Discussion — This beautiful species, which at Kallo is restricted to the Oorderen Member, can be recognised by its absence of spiral ribs and a basal disc and by the presence of spines on the ribs. It occurs in the Redonian and in the North Sea Basin and Italian Pliocene (Brébion, 1964; Sacco, 1891).

Epitonium subulatum (J. de C. Sowerby, 1823)
Pl. 4, Fig. 8

1823 *Scalaria subulata* J. de C. Sowerby, p. 125, pl. 390, fig. 1.
1848 *Scalaria subulata* J. Sow. — Wood, p. 93, pl. 8, fig. 18.
1878 *Scalaria subulata* J. Sow. — Nyst, pl. 6, fig. 17.
1881 *Scalaria subulata* J. Sow. — Nyst, p. 89.
1920 *Scala (Clathrus) subulata* (J. Sowerby) — Harmer, p. 537, pl. 47, figs 26, 27.
1958a *Scala (Clathrus) subulata* Sowerby, sp. 1823 — Glibert, p. 14, pl. 2, fig. 9.
1965 *Epitonium (Epitonium) proximum* (De Boury, 1890) — van Regteren Altena *et al.*, p. 19, pl. 7, fig. 72.

Dimensions — Height 19 mm, width 6 mm.
Description — Large, slender, turriculate shell with inflated whorls and a deep suture, consisting of about nine teleoconch whorls. The ornament is limited to axial ribs, which bear no spines. The last whorl has about eight ribs which are about half the width of the intercostal space and are square in cross section. The colour of the shell is brownish-yellow.
Discussion — At Kallo, this species occurs in the *Similipecten* and *Petaloconchus* beds of the Kattendijk Formation. It can be recognised by its few, non-spinose and square axial ribs. *Epitonium subulatum* occurs in the North Sea Basin Pliocene and in the Redonian (Brébion, 1964).

Epitonium foliaceum (J. de C. Sowerby, 1823)
Pl. 4, Fig. 9

1823 *Scalaria foliacea* J. de C. Sowerby, p. 125, pl. 390, fig. 2.
1878 *Scalaria foliacea* J. Sow. — Nyst, pl. 6, fig. 14.
1881 *Scalaria foliacea* J. Sowerby — Nyst, p. 86.
1891 *Scala foliacea belgica* Sacco, p. 27.
1912b *Clathrus belgicus* Sacco — Cossmann, p. 171, pl. 2, figs 1, 2.
1914 *Scala (Clathrus) foliacea* Sow. — Cerulli-Irelli, p. 233, pl. 12, fig. 5.
1914 *Scala (Clathrus) foliacea* var. *septemcostata* Conti — Cerulli-Irelli, p. 233, pl. 12, figs 3, 4.
1914 *Scala (Clathrus) foliacea* var. *belgica* Sacco — Cerulli-Irelli, p. 233, pl. 12, figs 6, 7.
1920 *Scala (Nobiliscala) belgica* (Sacco) — Harmer, p. 539, pl. 48, fig. 26.
1958a *Scala (Nobiliscala) foliacea belgica* Sacco, sp. 1891 — Glibert, p. 14, pl. 2, fig. 10.

Dimensions — Height 20 mm, width 10 mm.
Description — Large, rather broad turriculate shell with very tumid whorls and a deep suture. Six teleoconch whorls are present. The ornament consists only of axial ribs, which are much narrower than the intercostal spaces and are set obliquely against the shell axis. There are eight non-spinose ribs on the last whorl. The colour is yellow.
Discussion — This species occurs rarely in the Oorderen Member at Kallo. It can be recognised by the low number of ribs that bear no spines and by the relatively broad shell. The var. *belgica* Sacco (1891) is but a forma, not a subspecies, because it co-occurs in the Italian Pliocene with typical specimens of *E. foliaceum*, as illustrated by Cerulli-Irelli (1914). The species is also found in the Redonian (Brébion, 1964).

Epitonium clathratulum minutum
(J. de C. Sowerby, 1823)
Pl. 4, Fig. 10

1823 *Scalaria minuta* J. de C. Sowerby, p. 125, pls 390-391, figs 3, 4.
1848 *Scalaria clathratula* Turt. — Wood, p. 94, pl. 8, fig. 19b.
1878 *Scalaria clathratula* Turt. — Nyst, pl. 8, fig. 16.
1881 *Scalaria clathratula* Adams — Nyst, p. 88.
1912a *Hyaloscala minuta* (Sow.) — Cossmann, p. 40, pl. 1, fig. 45.
1920 *Scala (Hyaloscala) minuta* (J. Sowerby) — Harmer, p. 555, pl. 48, figs 34-37.

1952 *Scala (Hyaloscala) clathratula* (Sowerby) — van der Burg, p. 51, pl. 3, fig. 12.
1958a *Scala (Hyaloscala) clathratula minuta* Sowerby, sp. 1823 — Glibert, p. 14.
1965 *Epitonium (Epitonium) clathratulum minutum* (J. de C. Sowerby, 1823) — van Regteren Altena *et al.*, p. 20, pl. 7, fig. 75a.
1983 *Scala (Hyaloscala) minuta* Sowerby — Aimassi & Ferrero Mortara, pl. 1, fig. 1.

Dimensions — Height 20 mm, width 6 mm.
Description — Rather large, very slender turriculate shell with inflated whorls and a deep suture, consisting of up to nine teleoconch whorls. Protoconch with 3 flat-sided smooth whorls. The ornament consists only of slightly prosocline to nearly orthocline axial ribs, which are sharp, very narrow and lack spines. The last whorl has about nineteen ribs. The colour is greyish or white.
Discussion — At Kallo this taxon is relatively rare in the Oorderen and Kruisschans members, although it does occur in the Kattendijk Formation at other localities. It can easily be distinguished by its numerous very fine ribs. This subspecies occurs also in the Redonian (Brébion, 1964). Cerulli-Irelli (1914) recorded it from the Italian Pliocene, but the identity of his material is uncertain: de Boury (*in* Harmer, 1920) considered it to be a separate species. Aimassi & Ferrero Mortara (1983), however, illustrated a specimen that undoubtedly belongs to *E. c. minutum*.

Superfamily Eulimoidea H. & A. Adams, 1853
Family Eulimidae H. & A. Adams, 1853
Genus and subgenus *Eulima* Risso, 1826

Eulima (E.) glabra (da Costa, 1778)
Pl. 4, Fig. 11

1778 *Strombiformis glabra* da Costa, p. 117.
1848 *Eulima subulata* Mont. — Wood, p. 9, pl. 19, fig. 3.
1878 *Eulima subulata* Donov. — Nyst, pl. 6, fig. 5.
1881 *Eulima subulata* ? Donovan — Nyst, p. 74.
1920 *Eulima bilineata* Alder — Harmer, p. 589, pl. 50, fig. 12.
1946 *Leiostraca subulata* (Donovan, 1803) — Beets, p. 50.
1958a *Leiostraca glabra* Da Costa, sp. 1778 — Glibert, p. 16.
1965 *Eulima glabra* (Da Costa, 1778) — van Regteren Altena *et al.*, p. 21, pl. 8, fig. 79.
1984 *Eulima (Eulima) glabra* (Da Costa, 1778) — Janssen, p. 181, pl. 51, fig. 10.
1988 *Eulima glabra* (Da Costa, 1778) — Graham, p. 520, fig. 221.
1992 *Eulima glabra* (Da Costa, 1778) — Cavallo & Repetto, p. 82, fig. 173.

Dimensions — Height 12 mm, width 2 mm.
Description — Rather small, very slender, needle-like turriculate shell of about twelve whorls. The suture is very shallow and barely recognisable. The shell is smooth and glossy, and lacks ornament, except for very faint growth lines. The aperture shows a narrow, well-defined callus. Neither an umbilicus nor a siphonal canal is present. The outer lip of the aperture is mostly straight, only slightly curving backwards below. Some specimens still show a colour pattern, consisting of dark and white spiral bands.
Discussion — At Kallo, this species is rare in the Kattendijk Formation and fairly common in the Oorderen Member. It is known in the North Sea Basin from the Miocene onwards and occurs in the British, Dutch and Italian Pliocene. At the present day, it ranges from the Mediterranean to the British Isles, but it is absent from the North Sea. It occurs in the sublittoral to depths of 200 m, probably on ophiuroids (Graham, 1988).

Genus *Melanella* Bowdich, 1822

Melanella alba (da Costa, 1778)
Pl. 4, Fig. 12

1778 *Strombiformis alba* da Costa, p. 116.
1848 *Eulima polita* Linn. — Wood, p. 96, pl. 19, fig. 1
1878 *Eulima intermedia* ? Cant. — Nyst, pl. 6, fig. 6.
1881 *Eulima intermedia* Cantr. — Nyst, p. 75.
1920 *Eulima polita* (Linné) — Harmer, p. 587, pl. 50, fig 10.
1958a *Melanella (Balcis) alba* Da Costa, sp. 1778 — Glibert, p. 16.
1965 *Balcis alba* (Da Costa, 1778) — van Regteren Altena *et al.*, p. 21, pl. 8, fig. 80.
1984 *Balcis (Balcis) alba* (Da Costa, 1778) - Janssen, p. 177, pl. 51, figs 1-5.
1988 *Melanella alba* (Da Costa, 1778) — Graham, p. 526, fig. 224.

Dimensions — Height 13 mm, width 4 mm (incomplete).
Description — Fairly large, slender turriculate shell with an extremely shallow suture. Complete specimens consist of eleven to seventeen nearly flat-sided whorls. The shell is either straight or slightly twisted. The broadest part of the whorls lies near their base. The aperture is rounded-oval, pointed above, with a narrow callus. The outer lip is slightly sinuous. The shell is glossy, apparently smooth, but with extremely fine growth lines.
Discussion — This species is extremely rare at Kallo: a single *ex situ* specimen was found. It can be distinguished from *Eulima glabra* by its larger dimensions, relatively broader shell and sinuous outer lip. The range of variation of this species was well illustrated by Janssen (1984). The species is known in the North Sea Basin from the late Oligocene onwards, with records from the British and Dutch Pliocene. At the present day, it ranges from Norway to the Mediterranean, living from depths of 16 to 135 m on a holothurian species (Graham, 1988).

Genus *Vitreolina* Monterosato, 1884

Vitreolina philippii (Rayneval & Ponzi, 1854)

Pl. 4, Fig. 13

1854 *Eulima philippii* Rayneval & Ponzi, p. 17.
1983 *Balcis curva* (Jeffreys *in* Monterosato, 1874) — Rolan Mosquera, p. 196, text-fig.
1988 *Vitreolina philippii* (Rayneval & Ponzi, 1854) — Graham, p. 534, figs 219 (10), 220 (10), 228.

Dimensions — Height 2.5 mm, width 0.5 mm.
Description — Very small, turriculate shell with strongly bent spire and very shallow sutures. The shell is smooth, very glossy and thin. It consists of nine to eleven flattened whorls. The last whorl comprises slightly less than half the total height. The aperture is drop-shaped, pointed above. A narrow callus is present. The outer apertural lip runs opisthoclinally and shows a clear anal sinus.
Discussion — This species has not been recorded previously from the North Sea Basin Pliocene. It was first described from the Italian Pliocene by Rayneval & Ponzi (1854), and was probably lumped by Cerulli-Irelli (1914) with another species with a bent spire, *Eulima incurva* (Renieri, 1804). It can be distinguished from *E. glabra* and *Melanella alba* by its smaller dimensions, its bent spire and the curved outer apertural lip. Only a few specimens have been found in the Oorderen Member at Kallo by H. Keukelaar. At present, the species occurs from the Mediterranean to Norway, from the sublittoral to depths of 200 m, and it appears to be the commonest Recent British eulimid (Graham, 1988).

Genus *Crinophteiros* Bouchet & Warén, 1986

Crinophteiros collinsi (Sykes, 1903)
Pl. 4, Fig. 14

1903 *Eulima collinsi* Sykes, p. 349, pl. 14, fig. 8.
1983 *Balcis collinsi* (Sykes, 1909) — Rolan Mosquera, p. 196, text-fig.
1988 *Vitreolina collinsi* (Sykes, 1909) — Graham, p. 536, figs 219 (11), 220 (11), 229.

Dimensions — Height 3.5 mm, width 1 mm.
Description — Very small, glossy, turriculate shell, with a slightly twisted spire and shallow suture. The shell is composed of nine to ten nearly flat-sided whorls. The last whorl matches about half the total shell height. The aperture is oval, pointed above. The outer lip is curved, with an anal sinus and a peripheral bulge. A narrow callus is present. Umbilicus lacking.
Discussion — This species is new for the North Sea Basin Pliocene. It also seems to be unknown elsewhere as a fossil. It differs from *Vitreolina philippii* by its much less twisted spire and broader shell, with less strongly curved outer apertural lip. It is chiefly a Mediterranean species, but has also been recorded along the Atlantic coast of Europe to the Channel Islands and western Scotland (Graham, 1988).

Order Neogastropoda Thiele, 1929
Superfamily Muricoidea Rafinesque, 1815
Family Muricidae Rafinesque, 1815
Subfamily Trophoninae Cossmann, 1903
Genus *Pterynopsis* Vokes, 1972

Pterynopsis binominatus
(Staadt *in* Cossmann, 1909)
Pl. 5, Fig. 4

1825 *Murex tortuosus* J. de C. Sowerby, p. 48, pl. 434, fig. 2.
1848 *Murex tortuosus* J. Sow. — Wood, p. 40, pl. 4, fig. 9.
1878 *Murex tortuosus*, J. Sow. — Nyst, pl. 1, fig. 1.
1881 *Murex tortuosus*, J. Sow. — Nyst, p. 3.
1909 *Murex binominatus* Staadt *in* Cossmann, p. 68.
1914 *Ocinebra erinacea boytonensis* Harmer, p. 125, pl. 12, fig. 8.
1918 *Ocinebra tortuosa* (J. Sowerby) — Harmer, p. 342, pl. 35, figs 7, 8, 10, 14.
1918 *Murex (Pteropurpura) boytonensis* (F.W. Harmer) — Harmer, p. 339, pl. 35, fig. 21.
1946 *Trophon* sp. 1 — Beets, p. 70, pl. 3, figs 24, 25.
1959 *Purpura (Tritonalia) canhami* Wood, sp. 1872 — Glibert, p. 5, pl. 3, fig. 2 (*partim*).
1965 *Ocenebra (Ocenebra) canhami* (S.V. Wood, 1872) — van Regteren Altena *et al.*, p. 30, pl. 11, fig. 117a (*partim*).
1972 *Pterynopsis boytonensis* (Harmer, 1914) — Vokes, p. 2, pl. 2, fig. 2.

Dimensions — Height 44 mm, width 20 mm; height 28.5 mm, width 14 mm; height 44 mm, width 24 mm (damaged).
Description — Large, fairly slender, fusiform shell, consisting of about seven teleoconch whorls. The suture is deep. The siphonal canal is rather long and oblique in relation to the shell axis. The ornament consists primarily of three varices on each adult whorl, giving the shell a triangular form when seen from above. On older whorls, more varices are present. The varices are foliated and may bear short spines. Between the varices, two (on the older whorls) or three spiral ribs are present. These may bear two tubercles between subsequent varices. The aperture has a narrow callus and three faint tubercles on the inside of the outer lip. Shells are mostly yellow or grey in colour.
Discussion — The development of the varices and their spines is very variable in this species. It was lumped by Glibert (1959) and van Regteren Altena *et al.* (1965) with the next species. Vokes (1972) separated them again. Although juvenile specimens of *P. binominatus* have more varices, this character does not continue in the adult shell of the species. Consequently, the view from above is completely different in *Pterynotus canhami*. Furthermore, the present species is much more slender than *Pterynotus canhami*. J. de C. Sowerby's (1825) name *Murex tortuosus* was preoccupied; the oldest synonym is Staadt's name. Vokes (1972) doubted the conspecificity of *Murex tortuosus* (= *M. binominatus*) with Harmer's *Ocinebra boytonensis*. Here, the latter is considered to be a well-developed, large form of *Pterynopsis binominatus*. The species occurs

rarely at Kallo and ranges from the Kattendijk Formation to the Oorderen Member.

Genus *Pterynotus* Swainson, 1833

Pterynotus canhami (Wood, 1872)
Pl. 5, Fig. 5

1872 *Murex Canhami* Wood, p. 30, pl. 7, fig. 14.
1918 *Ocinebra Canhami* (S.V. Wood) — Harmer, p. 342, pl. 35, figs 15, 16.
1959 *Purpura (Tritonalia) canhami* Wood, sp. 1872 — Glibert, p. 5 (*partim*).
1965 *Ocenebra (Ocenebra) canhami* (S.V. Wood, 1872) — van Regteren Altena *et al.*, p. 30 (*partim*).

Dimensions — Height 28 mm, width 16 mm.
Description — Large, fusiform shell, consisting of about seven teleoconch whorls, with deep suture and fairly long, oblique siphonal canal. The ornament consists primarily of about six varices per whorl, giving the shell a rounded quadrangular outlook when seen from above. The varices are foliated and may bear short spines. Between the varices, two (on older whorls) to five spiral ribs are present, which bear one or two tubercles between subsequent varices. The aperture has a narrow callus. No teeth are present on the outer lip in the specimens studied.
Discussion — This species is much rarer at Kallo than the previous one: only a single specimen was collected from the Oorderen Member. Another specimen was found in material that had been dredged from the Westerscheldt and dumped at Yerseke (The Netherlands). Vokes (1972) placed this species, with much doubt, in the genus *Boreotrophon* P. Fischer, 1884, rather than in *Pterynopsis* on account of the higher number of varices. *Boreotrophon*, however, contains Arctic cold water species, which is not in accordance with its occurrence in the Oorderen Member. *Boreotrophon* has subsequently been synonymised with *Trophon* de Montfort, 1810 by Bouchet & Warén (1985) on account of their radulae and opercula being identical; *P. canhami* certainly does not belong to the genus *Trophon*. Instead, it best matches the definition of *Pterynotus*. Species referred to this genus, such as *P. atlantideus* Bouchet & Warén, 1985, have intervarical nodes, as does the Pliocene species.

Genus *Trophon* de Montfort, 1810

Trophon muricatus (Montagu, 1803)
Pl. 6, Fig. 3

1848 *Trophon muricatum* Mont. — Wood, p. 50, pl. 6, fig. 5.
1878 *Murex (Trophon) muricatus*, Mont. — Nyst, pl. 1, fig. 4.
1881 *Murex muricatus*, Mont. — Nyst, p. 6.
1914 *Trophon muricatus* Montagu + var. — Harmer, p. 131, pl. 12, figs 18-21.
1918 *Trophon (Trophonopsis) muricatus* Montagu + var. — Harmer, p. 354, pl. 36, figs 12-16.
1937 *Trophon muricatus* (Montagu 1803) — van Regteren Altena, p. 33.
1946 *Trophon (Trophonopsis) muricatus* (Montagu, 1803) — Beets, p. 69.
1959 *Trophonopsis* (s.s.) *muricata* Montagu, sp. 1803 — Glibert, p. 6, pl. 3, fig. 3.
1965 *Trophon (Trophonopsis) muricatus* (Montagu, 1803) — van Regteren Altena *et al.*, p. 29, pl. 11, fig. 112.
1979 *Trophonopsis muricata* (Montagu, 1803) — Geys & Marquet, p. 72, pl. 29, fig. 3.
1985 *Trophon muricatus* (Montagu, 1803) — Bouchet & Warén, p. 134, figs 298-301.
1988 *Trophonopsis muricatus* (Montagu, 1803) — Graham, p. 362, fig. 148.

Dimensions — Height 11 m, width 5 mm.
Description — Rather small, slender, fusiform shell with long siphonal canal, with two smooth protoconch and six tumid teleoconch whorls with deep suture. The aperture is semicircular, and has a narrow callus and teeth on the inside of the outer lip. The ornament consists of about nine spirals and sixteen axial ribs per whorl, which may be equally strong or one of both may be dominant, depending in part on the degree of wear of the shell. The protoconch is smooth.
Discussion — This variable species is not rare in the Oorderen and Kruisschans members. At present, it occurs from the Mediterranean to southern and south-western England (Graham, 1988).

Trophon barvicensis (Johnston, 1825)
Pl. 6, Fig. 2

1825 *Fusus Barvicensis* Johnston, p. 221.
1872 *Trophon Barvicensis* Johnston — Wood, p. 27, pl. 6, fig. 20.
1918 *Trophon (Trophonopsis) barvicensis* (Johnston) — Harmer, p. 357, pl. 40, figs 29, 30.
1985 *Trophon barvicensis* (Johnston, 1825) — Bouchet & Warén, p. 131, figs 291-296, 341.
1988 *Trophonopsis barvicensis* (Johnston, 1825) — Graham, p. 364, fig. 149.

Dimensions — Height 12 mm, width 5 mm.
Description — Small, slender, fusiform shell with long, straight siphonal canal, with about five teleoconch whorls; the protoconch is not preserved in the available specimens. The aperture is fairly elongate. The axial ornament consists of about twelve sharp, slightly foliated ribs on the last whorl. Between and on them run about ten spiral ribs.
Discussion — This species differs from the previous by its ornament, siphonal canal and aperture. Bouchet & Warén (1985) mentioned the extreme variability of -ornament in species of this genus. According to them, *T. barvicensis* is a northerly species, which reaches south to Morocco in greater depths. At Kallo, only a single, incomplete specimen was collected from in the *Petaloconchus* bed of the Kattendijk Formation by F. van Nieulande. It is new for the

Belgian Pliocene fauna; there are records from the British Red Crag (rare), but not yet from Dutch beaches.

Subfamily Ocinebrinae Cossmann, 1903
Genus *Spinucella* Vermeij, 1993

Spinucella tetragona tetragona
(J. de C. Sowerby, 1825)
Pl. 5, Fig. 1

1825 *Buccinum tetragonum* J. de C. Sowerby, p. 13, pl. 414, fig. 1.
1843 *Murex alveolatus* Sow. — Nyst, p. 547, pl. 43, fig. 1.
1848 *Purpura tetragona* J. Sow. (+ var. *vulgaris, alveolata, intermedia, tenera*) — Wood, p. 38, pl. 4, fig. 7.
1878 *Purpura tetragona*, L. (+ var. *vulgaris, intermedia*) — Nyst, pl. 3, fig. 5.
1881 *Purpura tetragona*, J. Sowerby — Nyst, p. 39.
1887 *Acanthina tetragona*, Sow. — E. Vincent, p. 225, pl. 10, figs 2-7; pl. 11, figs 1-5.
1914 *Purpura tetragona* (J. Sowerby) — Harmer, p. 116, pl. 11, figs 6, 9.
1918 *Purpura tetragona* (J. Sowerby) var. *intermedia* S.V. Wood — Harmer, p. 336, pl. 34, fig. 28.
1937 *Nucella tetragona* (J. Sowerby 1823) — van Regteren Altena, p. 35.
1946 *Nucella (Nucella) tetragona* (Sowerby, 1823) — Beets, p. 72.
1959 *Nucella tetragona* Sowerby, sp. 1825 — Glibert, p. 8.
1965 *Thais (Polytropa) tetragona* (J. de C. Sowerby, 1823) — van Regteren Altena *et al.*, p. 29, pl. 11, fig. 113.
1965 *Thais (Polytropa) lapillus vulgaris* (S.V. Wood, 1848) — van Regteren Altena *et al.*, p. 30, pl. 11, fig. 114b (?).
1979 *Nucella tetragona* (Sowerby, 1825) — Geys & Marquet, p. 72, pl. 29, fig. 2.
1993 *Spinucella tetragona* (J. de C. Sowerby, 1825) — Vermeij, p. 20, pl. 1, figs 3, 4.

Dimensions — Height 45 mm, width 30 mm; height 41 mm, width 28 mm; height 42 mm, width 28 mm; height 62 mm, width 48 mm.
Description — Large, fusiform shell, consisting of about six teleoconch whorls. The aperture is large, semicircular, with a short siphonal canal and a clear callus. The umbilicus may be closed or wide open. The outer apertural lip may bear up to six teeth, lying rather far away from the edge. In perfectly preserved specimens, a very short spine on the lower part of the outer lip is present. Most specimens have a deep suture, but this may also become shallow in rare specimens. The ornament consists in typical specimens of about eight primary spirals on the last whorl, with one secondary one in between. These are crossed by about seventeen axial ribs, which form spines on the points of intersection with the spirals. Some specimens, however, completely lose the axials, while the primary and secondary spirals become nearly equally strong and much more numerous.
Discussion — The extreme variation of this species has led authors to distinguish numerous varieties. Specimens without axial ornament are very close to *Nucella lapillus* (Linné, 1758). The most extreme specimen from Kallo, however, shows very clearly the diagnostic labral spine of the genus *Spinucella*. The classification of similar specimens depends completely on the relative value given to this character. Since their ornament is not typical of *Spinucella*, while many 'well' sculptured specimens lack the labral spine, it is questionable whether *Spinucella* really is separable from *Nucella*. If not, doubtful specimens lacking axial ornament could be considered to be a subspecies of *N. lapillus*, as did van Regteren Altena *et al.* (1965), under the name of *N. l. vulgaris* (Wood, 1848). At Kallo, the species ranges from the Oorderen to the Kruisschans Member. In the Oorderen Member, it is moderately common. In Great Britain, a smaller form, possibly a subspecies, occurs, viz. *S. t. alveolata* (J. de C. Sowerby, 1825); it does not occur in the Pliocene of Belgium and The Netherlands.

Genus *Nucella* Röding, 1789

Nucella incrassata (J. de C. Sowerby, 1825)
Pl. 5, Fig. 5

1825 *Buccinum incrassatum* J. de C. Sowerby, p. 13, pl. 414, fig. 2.
1843 *Murex incrassatus* — Nyst, p. 548, pl. 43, fig. 3.
1848 *Purpura lapillus* Linn. var. *brevis* Wood, p. 36, pl. 4, fig. 6b.
1848 *Purpura lapillus* Linn. var. *elongata* Wood, p. 36, pl. 4, fig. 6c.
1848 *Purpura lapillus* Linn. var. *carinata* Wood, p. 36, pl. 4, fig. 6f.
1848 *Purpura lapillus* Linn. var. *imbricata* — Wood, p. 36, pl. 4, fig. 6g.
1848 *Purpura lapillus* Linn. var. *incrassata* — Wood, p. 36, pl. 4, fig. 6h.
1878 *Purpura lapillus* L. var. *imbricata* — Nyst, pl. 3, fig. 4c.
1878 *Purpura lapillus* L. — Nyst, pl. 3, fig. 4a, b.
1881 *Purpura lapillus* Linné — Nyst, p. 38.
1914 *Purpura lapillus* Linné var. *elongata* S.V. Wood — Harmer, p. 117, pl. 11, fig. 14.
1914 *Purpura lapillus* Linné var. *carinata* S.V. Wood — Harmer, p. 117, pl. 11, fig. 4.
1914 *Purpura lapillus* Linné var. *imbricata* Lamarck — Harmer, p. 117, pl. 11, fig. 3 (*non* fig. 9).
1914 *Purpura lapillus* Linné var. *incrassata* J. Sowerby — Harmer, p. 117, pl. 11, fig. 1.
1937 *Nucella lapillus incrassata* (J. Sowerby 1823) — van Regteren Altena, p. 34, pl. 1, figs 11-14.
1946 *Nucella (Nucella) lapillus* (Linné, 1758) — Beets, p. 70.
1959 *Nucella lapillus incrassata* Sowerby, sp. 1825 — Glibert, p. 9.
1965 *Thais (Polytropa) lapillus incrassata* (J. de C. Sowerby, 1823) — van Regteren Altena *et al.*, p. 29, pl. 11f, fig. 114a.
1979 *Nucella lapillus incrassatus* (Sowerby, 1825) — Geys & Marquet, p. 92, pl. 37, fig. 3.

1993 *Nucella incrassata* (J. de C. Sowerby, 1823) — Marquet, p. 91.

Dimensions — Height 49 mm, width 30 mm; height 47 mm, width 26 mm.
Description — Large, fusiform shell, consisting of about five teleoconch whorls. Aperture large, semicircular, with a short siphonal canal and a clear callus. The umbilicus is closed, but marked by a fold. The outer apertural lip has a shiny brown or grey colour, like the callus. It has about seven faint folds on the inside. The suture is mostly deep, but not invariably so. The ornament consists of about six primary spirals on the last whorl, with one secondary spiral in between. Near the siphonal canal, both become equally strong. In most specimens, a subsutural area without spirals is present. Axial ribs are absent, except for growth lines, which may become very conspicuous and may form short scales on the spirals.
Discussion — This species is clearly separated from the previous by its ornament, aperture and shell form. From the Recent *N. lapillus* (Linné, 1758), this species clearly differs, especially by its ornament. Rare specimens, which have a more or less intermediate type of ornament, all proved to have the labral spine, typical of the genus *Spinucella*, and thus belong to the previous species. The present species is fairly common in the Kruisschans Member at Kallo. All specimens are much larger than Recent *N. lapillus*, which would indicate a sheltered environment (Cambridge & Kitching, 1982).

Family Buccinidae Rafinesque, 1815
Genus and subgenus *Scalaspira* Conrad, 1862

Scalaspira (S.) alveolata (J. de C. Sowerby, 1829)
Pl. 6, Fig. 4

1829 *Fusus alveolatus* J. de C. Sowerby, p. 45, pl. 525, fig. 1.
1843 *Fusus alveolatus* Sow. — Nyst, p. 495, pl. 29, fig. 21.
1848 *Trophon alveolatum* J. Sow. — Wood, p. 49, pl. 6, fig. 8.
1914 *Searlesia alveolata* (J. Sowerby) — Harmer, p. 146.
1937 *Searlesia alveolata* (J. Sowerby, 1826) — van Regteren Altena, p. 36.
1959 *Trophonopsis (Pirgos) alveolata* Sowerby, sp. 1829 — Glibert, p. 7, pl. 3, fig. 4.
1965 *Pirgos alveolatus* (J. de C. Sowerby, 1826) — van Regteren Altena *et al.*, p. 32, pl. 12, fig. 128.
1968 *Scalaspira (Scalaspira) alveolata* (J. Sowerby, 1826) — Tembrock, p. 221, pl. 1, figs 6-8; pl. 3, fig. 8.

Dimensions — Height 25 mm, width 13 mm.
Description — Large, slender fusiform shell with rather short, left-pointing siphonal canal, consisting of about nine tumid teleoconch whorls. Protoconch not preserved in the available material. The aperture is elongate-oval. The spiral ornament consists of two ribs on the older whorls, about eleven ribs on the last whorl and the siphonal canal. These are crossed by seventeen weaker, irregular axial ribs. On the points of intersection with the adapical spiral, tubercles may develop.
Discussion — This species is very rare in the Kruisschans Member. Its close relative, *Trophon consocialis* Wood, 1848, from the Kattendijk Formation, was not found at Kallo.

Genus *Buccinum* Linné, 1758

Buccinum undatum Linné, 1758
Pl. 7, Fig. 6

1758 *Buccinum undatum* Linné, p. 740.
1843 *Buccinum tenerum* Sow. — Nyst, p. 571, pl. 43, fig. 9.
1848 *Buccinum undatum* Linn. — Wood, p. 35, pl. 3, fig. 12.
1878 *Buccinum undatum* L. — Nyst, pl. 2, fig. 3.
1881 *Buccinum undatum* L. — Nyst, p. 19.
1914 *Buccinum undatum* + var. Harmer, p. 90, pl. 6, figs 1, 2, 8, 9; pl. 8, figs 1, 2.
1946 *Buccinum (Buccinum) undatum* — Beets, p. 71.
1959 *Buccinum undatum* — Glibert, p. 17.
1965 *Buccinum undatum* — van Regteren Altena *et al.*, p. 33.

Dimensions — Height 98 mm, width 63 mm.
Description — Large, fusiform shell with deep suture, consisting of nine teleoconch whorls. The aperture is oval and large, with a callus and a short siphonal canal. The outer lip is sinuous. The ornament consists of about twenty primary spiral ribs on the last whorl and the siphonal canal, with four to five weak secondary ones in between. Specimens often lose, together with their outer layer their spiral ornament. Axial ornament consists of unclear, broad plicae, especially on the older whorls, which become obsolete near the aperture.
Discussion — This species occurs commonly in the Oorderen and Kruisschans members. Specimens are mostly larger and thinner shelled than Recent ones.

Genus *Liomesus* Stimpson, 1865

Liomesus dalei (J. de C. Sowerby, 1825)
Pl. 7, Fig. 3

1825 *Buccinum Dalei* J. de C. Sowerby, p. 139, pl. 486, figs 1, 2.
1843 *Buccinum crassum* Nyst, p. 569, pl. 44, fig. 7.
1848 *Buccinum Dalei* J. Sow. — Wood, p. 34, pl. 3, fig. 11a.
1878 *Buccinopsis dalei* var. *crassa* Nyst, pl. 2, fig. 1a, b.
1878 *Buccinopsis Dalei*, J. Sow. — Nyst, pl. 2, fig. 1c.
1881 *Buccinopsis Dalei*, J. Sowerby — Nyst, p. 17.
1920 *Liomesus dalei* (J. Sowerby) — Harmer, p. 520, pl. 45, figs 4-6.
1937 *Liomesus dalei* (J. Sowerby 1825) — van Regteren

Altena, p. 36.
1946 *Liomesus dalei* (Sowerby, 1825) — Beets, p. 73.
1959 *Liomesus dalei* (Sowerby, 1825) — Glibert, p. 11.
1965 *Liomesus dalei* (J. de C. Sowerby, 1825) — van Regteren Altena *et al.*, p. 31, pl. 12, fig. 122.
1979 *Liomesus dalei* (Sowerby, 1825) — Geys & Marquet, p. 72, pl. 29, fig. 4.
1985 *Liomesus dalei* Sowerby, 1825 — Bouchet & Warén, p. 185, fig. 490.

Dimensions — Height 68 mm, width 35 mm (Pl. 7, Fig. 3B); height 54 mm, width 34 mm (Pl. 7, Fig. 3A).
Description — Large, fusiform shell, consisting of about seven whorls, with deep suture. Some specimens are slender, others more tumid. The aperture is large, oval, with a broad callus and very short siphonal canal. The outer lip is straight, not thickened. The ornament may consist of very regular spiral ribs. Mostly, these are present only on the older whorls and near the aperture.
Discussion — This well-known species occurs commonly at Kallo in the Oorderen and Kruisschans members. A specimen found in the basal level of the Oorderen Member, covered with *Hydractinia* appears to have been reworked from the Kattendijk Formation. Glibert (1959) recorded a 'forma *ovum*' from the Belgian Pliocene. However, the Recent species *Liomesus ovum* (Turton, 1825), does not occur in the Belgian Pliocene.

Genus *Colus* Röding, 1798

Colus cordatus (Bell, 1871)
Pl. 7, Fig. 1

1848 *Trophon gracile* da Costa — Wood, p. 46, pl. 6, fig. 10b (*partim*).
1871 *Colus cordatus* Bell, p. 355.
1878 *Fusus gracilis*, da Costa — Nyst, pl. 1, fig. 10a (*partim*).
1881 *Fusus gracilis*, da Costa — Nyst, p. 15 (*partim*).
1914 *Sipho cordatus* (A. Bell) — Harmer, p. 185, pl. 22, fig. 5.
? 1914 *Sipho togatus* Mörch var. *minor* Harmer, p. 183, pl. 22, figs 7-9.
? 1914 *Sipho tortuosus* (Reeve) var. *lirata* Harmer, p. 192, pl. 24, figs 11-15.
1937 *Colus exiguus* (Harmer 1914) — van Regteren Altena, p. 37, pl. 2, figs 24, 25.
1959 *Sipho* (s.s.) *gregarius* Philippi, sp. 1845 — Glibert, p. 13.
1965 *Colus cordatus* (A. Bell, 1871) — van Regteren Altena *et al.*, p. 32, pl. 12, fig. 125.

Dimensions — Height 28 mm, width 11 mm, protoconch height 1.3 mm, width 1.4 mm.
Description — Fairly large, slender fusiform shell, consisting of eight teleoconch whorls. Protoconch with 2¼ tumid whorls; first 13/4 whorls smooth, last half whorl with five weak, narrow and widely spaced spiral ribs. The teleoconch ornament starts with eight much stronger and broader spirals. The suture is deep and the whorls are tumid. The aperture is oval, with a narrow callus and a long, slightly left-curving to nearly straight siphonal canal. The sculpture ornament of eight to nine clearly delimited spiral ribs on the penultimate whorl and 18 spirals on the last whorl above the siphonal canal. These ribs are broader than the spaces in between near the suture, but they become narrower near the siphonal canal.
Discussion — This species differs from the next one by its smaller size, by having spiral ribs covering the entire shell and by its nearly straight siphonal canal. The present species occurs in the Oorderen and Kruisschans members, but is mostly rarer than *C. curtus*. The species is also known from the Dutch and British Pliocene.

Colus curtus (Jeffreys, 1867)
Pl. 7, Fig. 2

1843 *Fusus corneus* Lin. — Nyst, p. 500, pl. 39, fig. 23.
1848 *Trophon gracile* Da Costa — Wood, p. 46, pl. 6, fig. 10a, c (*partim*).
1867 *Fusus curtus* Jeffreys, p. 336.
1878 *Fusus gracilis*, Da Costa — Nyst, pl. 1, fig. 10b (*partim*).
1881 *Fusus gracilis*, Da Costa — Nyst, p. 15 (*partim*).
1914 *Sipho curtus* Jeffreys + var. — Harmer, p. 178, pl. 21, figs 1-8.
? 1914 *Sipho Sabinii* (Gray) — Harmer, p. 182, pl. 23, fig. 3 (*non* figs 1, 2).
1914 *Sipho gracilis* (Da Costa) — Harmer, p. 175, pl. 20, fig. 4 (*non* fig. 3).
1914 *Sipho gracilis* (Da Costa) var. *Coulsoni* Jordan — Harmer, p. 177, pl. 20, fig. 5 (*non* fig. 6).
1914 *Sipho gracilis* (Da Costa) var. *elongata* Harmer, p. 177, pl. 20, fig. 7.
? 1914 *Sipho glaber* (Verkrüzen) — Harmer, p. 188, pl. 24, fig. 2 (*non* fig. 1).
? 1914 *Sipho Jeffreysianus* (Fischer) — Harmer, p. 196, pl. 24, fig. 4 (*non* fig. 3).
? 1914 *Sipho tortuosus* (Reeve) var. *attenuata* G.O. Sars — Harmer, p. 191, pl. 24, figs 5, 6.
? 1914 *Sipho sarsii* (Jeffreys) var. *crassa* Harmer, p. 198, pl. 24, fig. 9.
? 1914 *Sipho gracilis* (Da Costa) var. *convoluta* Jeffreys — Harmer, p. 178, pl. 25, fig. 6 (*non* fig. 7).
1937 *Colus curtus* (Jeffreys, 1867) — van Regteren Altena, p. 38, pl. 2, figs 20-23.
1946 *Sipho (Sipho) curtus* (Jeffreys, 1867) — Beets, p. 24.
1959 *Sipho* (s.s.) *curtus* Jeffreys, sp. 1867 — Glibert, p. 12.
1965 *Colus curtus* (Jeffreys, 1867) — van Regteren Altena *et al.*, p. 31, pl. 12, fig. 124.
1979 *Sipho curtus* (Jeffreys, 1867) — Geys & Marquet, p. 72, pl. 29, fig. 5.

Dimensions — Height 59 mm, width 26 mm.
Description — Large, slender, fusiform shell, consisting of nine teleoconch whorls. The suture is deep and the whorls are tumid. The aperture is oval, with a narrow callus and a long siphonal canal, which points strongly to the left. The ornament consists of about six unclear spiral ribs on the penultimate whorl. On the last whorl only near the aperture do some narrow spirals remain.
Discussion — This species is common in the Oorderen and

Kruisschans members. Its shell shape is rather variable in the Kallo material; specimens with more or less tumid whorls are present. Bouchet & Warén (1985) considered *C. curtus* to be a synonym of *C. stimpsoni* (Mörch, 1867). However, none of the specimens figured by these authors is similar to our fossil specimens, which is why these are heer considered to be a separate species.

Genus *Atractodon* Charlesworth, 1837

Atractodon elegans Charlesworth, 1837
Pl. 8, Fig. 1

1838 *Atractodon elegans* Charlesworth, p. 219, fig. 23.
1848 *Trophon elegans* Charlesworth — Wood, p. 46, pl. 2.
1874 *Trophon elegans* Charlesworth — Wood, p. 177, pl. 1, fig. 13.
1878 *Fusus elegans*, Charlesw. — Nyst, pl. 1, fig. 11.
1881 *Fusus elegans*, Charlesworth — Nyst, p. 16.
1918 *Atractodon elegans* Charlesworth + var. — Harmer, p. 364, pl. 37, figs 9-13.
1937 *Atractodon elegans* Charlesworth — Brakman, p. 14, fig.
1959 *Atractodon elegans* Charlesworth, 1837 — Glibert, p. 14, pl. 3, fig. 7.
1965 *Atractodon elegans* Charlesworth, 1837 — van Regteren Altena *et al.*, p. 32, pl. 12, fig. 127.

Dimensions — Height 122 mm, width 63 mm; height 69 mm, width 45 mm.
Description — Very large, slender fusiform shell, consisting of eight teleoconch whorls. The suture is deep, the whorls are not very tumid. The apex is blunt. The aperture has a fairly long siphonal canal, which points strongly to the left. A callus is present; it bears a single tubercle near the upper edge. The aperture is oval, pointed above. The ornament consists of about twenty spirals on the penultimate whorl, which continue onto the last whorl and siphonal canal. The ribs become coarser on the sipho. They are slightly irregular, narrow and unequally developed.
Discussion — At Kallo, this rather rare species is found in all beds of the Oorderen Member; from the Kattendijk Formation a specimen completely overgrown by *Hydractinia* sp., probably once inhabited by a pagurid, was collected. At Antwerp, the species appears earlier, in the 'Heterocetenzanden' of the Deurne Member (Diest Formation, late Miocene).

Genus and subgenus *Neptunea* Röding, 1798

Neptunea (N.) striata lyratodespecta Strauch, 1972
Pl. 7, Fig. 4

1848 *Trophon antiquum* Müll. var. *jugosum* Wood, p. 44, pl. 5, fig. 1a.
1848 *Trophon antiquum* Müll. var. *carinatum* Wood, p. 44, pl. 5, fig. 1b.
? 1872 *Trophon Berniciensis* ? King — Wood, p. 21, pl. 1, fig. 8a-c.
1879 *Trophon antiquus* Müll. var. *despectus* Wood, p. 2, pl. 1, fig. 9.
1878 *Fusus antiquus*, L. var. *dextre* Nyst, pl. 1, fig. 9d, e.
1878 *Fusus antiquus*, L. var. *dextre, tricarinata* Nyst, pl. 1, fig. 9b.
1881 *Fusus antiquus*, Müller — Nyst, p. 13 (*partim*).
1889 *Neptunea despecta* var. *carinata* — G. Vincent, p. 26.
1914 *Neptunea despecta* Linné var. *decemcostata* Say — Harmer, p. 161, pl. 17, figs 3, 4.
1914 *Neptunea despecta* Linné var. *carinata* Pennant — Harmer, p. 162, pl. 17, fig. 35.
1914 *Neptunea despecta* Linné var. *subantiquata* Maton & Rackett — Harmer, p. 163, pl. 17, figs 6, 7.
1914 *Neptunea despecta* Linné var. *intersculpta* Sowerby — Harmer, p. 166, pl. 18, fig. 5.
1914 *Neptunea despecta* Linné var. *curtispira* Harmer, p. 167, pl. 18, fig. 6.
1937 *Neptunea despecta* (Linné, 1758) — van Regteren Altena, p. 39, pl. 2, figs 26, 28-30 (*partim*).
1946 *Neptunea (Neptunea) despecta* (Linné, 1758) — Beets, p. 76.
1959 *Neptunea despecta carinata* Pennant, sp. 1777 — Glibert, p. 16.
1965 *Neptunea antiqua carinata* (Pennant, 1777) — van Regteren Altena *et al.*, p. 32, pl. 13, fig. 129a, b (*non* c).
1972 *Neptunea lyratodespecta lyratodespecta* Strauch, p. 42, pl. 1, figs 1-4, 9-13.
1972 *Neptunea lyratodespecta lyratodespecta* var. *anglica* Strauch, p. 43, pl. 1, figs 14-16.

Dimensions — Height 92 mm, width 55 mm.
Description — Very large, fusiform shell with two small protoconch and about eight teleoconch whorls. The suture is deep, the whorls are angular rather than tumid. The aperture is broad, nearly semicircular oval, with rather short, nearly straight siphonal canal and narrow callus. The ornament consists of four to six strong primary spirals on the last whorl; they become weaker near the siphonal canal. Between them, ten much weaker secondary spirals are present. The heavy adapical primary spiral gives the whorls an angular outlook.
Discussion — This subspecies differs from the next one by its shape, which is less slender, by its larger aperture and heavier primary ornament. Both intergrade, however, and it is clear that they cannot be considered to be separate species. This subspecies occurs very rarely in the Oorderen Member at Kallo. The ornament is completely different from that of *N. despecta* (Linné, 1758), a species having only a single primary spiral, which shows notches or even spines. Should *Murex striata* J. Sowerby, 1813 and *Neptunea lyratodespecta* Strauch, 1972 turn out to be subspecies of the same species, J. Sowerby's name obviously has priority.

Neptunea (N.) striata striata (J. Sowerby, 1813)
Pl. 7, Fig. 5

1813 *Murex striatus* J. Sowerby, p. 61, pl. 127.

1878 *Trophon antiquum* Müll. var. *striatum* Wood, p. 19, pl. 5, fig. 1c.
1878 *Fusus antiquus* L., var. *dextre* Nyst, pl. 1, fig. 9c (*non* b, d, e).
1881 *Fusus antiquus*, Müller — Nyst, p. 13 (*partim*).
1914 *Neptunea despecta* (Linné) var. *intermedia* Harmer, p. 165, pl. 17, fig. 2.
1914 *Neptunea antiqua* (Linné) — Harmer, p. 168, pl. 19, fig. 1.
1914 *Neptunea antiqua* (Linné) var. *subtornata* Harmer, p. 169, pl. 19, figs 2, 3.
1914 *Neptunea antiqua* (Linné) var. *striata* S.V. Wood — Harmer, p. 169, pl. 19, figs 7-10.
1937 *Neptunea despecta* — van Regteren Altena, p. 39, pl. 2, figs 27, 31 (*partim*).
1959 *Neptunea antiqua striata* Wood, sp. 1848 — Glibert, p. 16.
1965 *Neptunea antiqua carinata* (Pennant, 1777) — van Regteren Altena *et al.*, p. 32, pl. 13, fig. 129c (*partim*).
1972 *Neptunea lyratodespecta striata* (J. Sowerby, 1813) — Strauch, p. 43, pl. 2, figs 1-4.
1993 *Neptunea lyratodespecta striata* Strauch, 1972 — Marquet, p. 91.

Dimensions — Height 100 mm, width 51 mm.
Description — Very large, rather slender, fusiform shell, consisting of two small protoconch and about eight teleoconch whorls. The suture is deep, the whorls are rounded. Aperture smaller and narrower than in the previous subspecies, with rather short, nearly straight siphonal canal and narrow callus. The ornament consists of four to six unclear primary spirals on the last whorl; they become weaker near the siphonal canal. Between them, ten weaker secondary spirals are present. The primary and secondary spirals tend to become equally strong in the most typical *striata* specimens, but specimens with heavier ornament coexist with them.
Discussion — At Kallo, this subspecies is restricted to the Kruisschans Member, where it is fairly common, but rarely complete, because the shells are almost always empty instead of filled with sand. Although typical specimens occur most frequently, intermediate ones with the previous subspecies are present in the Kruisschans Member as well. They are always recognisable by their more slender shell and smaller aperture. *Neptunea antiqua* (Linné, 1758), with which this subspecies has often been confused, has a different ornament, with much finer spiral ribs; these can never be separated into primary and secondary ones. True *Neptunea antiqua* appears in Belgium in the Merksem Member (Berendrechtsluis, Antwerp, Marquet Collection).

Subgenus *Sulcosipho* Dall, 1916

Neptunea (Sulcosipho) angulata (Wood, 1848)
Pl. 7, Fig. 7

1843 *Fusus contrarius*, Linn. — Nyst, p. 499, pl. 41, fig. 1
1848 *Trophon antiquum* Müll. — Wood, p. 44 (*partim*).
1848 *Trophon antiquum porrectum* Wood, pl. 5, fig. 1d.
1848 *Trophon antiquum rugosum* Wood, pl. 5, fig. 1e.
1848 *Trophon antiquum ambulacrum* Wood, pl. 5, fig. 1f.
1848 *Trophon antiquum striatum* Wood, pl. 5, fig. 1g.
1848 *Trophon antiquum angulatum* Wood, pl. 5, fig. 1h.
1848 *Trophon antiquum sinistrostum* Wood, pl. 5, fig. 1i.
1848 *Trophon antiquum elongatum* Wood, pl. 5, fig. 1j.
1848 *Trophon antiquum carinatum* Wood, pl. 5, fig. 1k.
1872 *Trophon antiquus* var. *carinatum contrarius* — Wood, p. 19, pl. 1, fig. 10.
1878 *Fusus contrarius* L., var. sénestre Nyst, pl. 1, fig. 9a, f.
1881 *Fusus contrarius*, Linné — Nyst, p. 14.
1914 *Neptunea contraria* (Linné) — Harmer, p. 156, pl. 16, fig. 7.
1918 *Neptunea contraria* (Linné) — Harmer, p. 366, pl. 36, figs 30, 31; pl. 37, figs 3-5.
1937 *Neptunea contraria* (Linné 1771) — van Regteren Altena, p. 38, pl. 2, figs 32-39.
1946 *Neptunea (Neptunea) contraria* (Linné, 1771) — Beets, p. 76.
1959 *Neptunea contraria* Linné, sp. 1771 — Glibert, p. 15, pl. 3, fig. 8.
1965 *Neptunea contraria* Linnaeus, 1771 — van Regteren Altena *et al.*, p. 33, pl. 14, fig. 130.
1972 *Neptunea contraria* (Linné) — Strauch, pl. 3, figs 3-15.
1979 *Neptunea contraria* (Linné, 1771) — Geys & Marquet, p. 74, pl. 30, fig. 3.
1986 *Neptunea (S.) angulata* (S.V. Wood, 1848) — Nelson & Pain, p. 293, pl. 5, fig. 1h.
1993 *Neptunea contraria* (Linné, 1771) — Marquet, p. 91.

Dimensions — Height 102 mm, width 67 mm; height 43 mm, width 23 mm.
Description — Very large, sinistral fusiform shell, consisting of three smooth protoconch and seven teleoconch whorls. The protoconch is rather broad and has a shallow suture; its colour is white, while the adult shell is yellow or grey. The teleoconch has a deep suture and tumid whorls. The aperture is oval, with a callus and a long siphonal canal. The ornament consists of five primary spirals on the penultimate whorl; they continue onto the last whorl and siphonal canal, where they become less distinct from the secondary ribs. Between the primary spirals, three to ten secondary ones are present, some of which can become more prominent than the others; on the youngest whorls, third-order spirals occur.
Discussion — This well-known species is extremely common in the Oorderen Member and especially in the Kruisschans Member. Ornament as well as shell shape are fairly variable. Some specimens are slender, others more tumid. In the Oorderen Member, specimens tend to have more unequal spiral ribs, while in the Kruisschans Member the secondary and primary spirals become less distinct. In the *Cultellus* level of the Oorderen Member, specimens are commonly found which are covered completely by *Hydractinia* sp. and which show a wear mark on one side; these have probably been inhabited by pagurids. The Recent *Neptunea (S.) contraria* (Linné, 1771) differs from the present species in having equal spiral ribs, instead of primary, secondary and tertiary spirals. The specimen figured by Wood (1848, pl. 5, fig. 1h) differs from most

others in lacking spiral ornament.

Family Fasciolariidae Gray, 1853
Genus *Fusinus* Rafinesque, 1815

Fusinus longiroster (Brocchi, 1814)
Pl. 8, Fig. 2

1814 *Murex longiroster* Brocchi, p. 418, pl. 8, fig. 7.
1904 *Fusus longiroster* Brocchi — Sacco, p. 24, pl. 7, figs 5, 6.
1914 *Fusus longiroster* (Brocchi) — Harmer, p. 173, pl. 16, fig. 23.
1955 *Fusus (Fusinus) longiroster* (Brocchi, 1814) — Rossi Ronchetti, p. 234, fig. 124.
1992 *Fusinus (Fusinus) longiroster* (Brocchi, 1814) — Cavallo & Repetto, p. 103, fig. 235.

Dimensions — Height 66 mm, width 39 mm (fragment).
Description — Large, very slender fusiform shell with, in complete specimens, a very long, straight siphonal canal. The Kallo specimen consists of seven whorls, which are tumid and slightly angular; the suture is deep. On the oldest whorls, up to eight axial ribs are present; these are slightly narrower than the intercostal areas and not well delimited. From the fifth whorl onwards, they become obsolete. The ornament then consists of about twelve spiral ribs, which are clearly delimited and as broad as the intercostal spaces. The four adapical spirals are weak, then follow three stronger ribs, each time with one or two weaker ones in between. The aperture is not preserved in the Kallo specimen. In complete shells, it is oval, with a callus.
Discussion — It was a great surprise to find this species in the North Sea Basin Pliocene; a single fragment was collected by A. Janse from the Oorderen Member (*Atrina* level) at Kallo. Until that time, it was known only from the Mediterranean and from the Isle of Man. The two shells from the latter locality were found in derived Pliocene strata according to Harmer (1914). No other Pliocene species from Belgium resembles it. Glibert mentioned in his 1958b list, but not in the 1958a text, *Fusus* cf. *lamellosus* [= *Fusinus lamellosus* (Borson, 1821)], from the Kattendijk Formation (IRScNB collections). This, however, is a smaller species with stronger axial ornament and more, as well as less unequal, spiral ribs.

Family Nassariidae Iredale, 1916
Genus *Amyclina* Iredale, 1918

Amyclina labiosa (J. de C. Sowerby, 1825)
Pl. 7, Fig. 8

1825 *Buccinum labiosum* J. de C. Sowerby, p. 122, pl. 477, fig. 3.
1843 *Buccinum labiosum* Sow. — Nyst, p. 557, pl. 43, fig. 14.
1848 *Nassa labiosa* J. Sow. — Wood, p. 28, pl. 3, fig. 8.
1878 *Nassa labiosa*, J. Sow. — Nyst, pl. 2, fig. 13.
1881 *Nassa labiosa*, J. Sow. — Nyst, p. 31.
1914 *Nassa labiosa* (J. Sowerby) — Harmer, p. 72.
1918 *Nassa (Amycla) labiosa* (J. Sowerby) — Harmer, p. 330, pl. 34, figs 20, 21.
1937 *Nassarius labiosus* (J. Sowerby, 1824) — van Regteren Altena, p. 42.
1946 *Nassarius labiosus* (Sowerby, 1824) — Beets, p. 81.
1959 *Amyclina labiosa* Sowerby, sp. 1825 — Glibert, p. 17, pl. 3, fig. 9.
1965 *Nassarius (Amyclina) labiosus* (J. de C. Sowerby) — van Regteren Altena *et al.*, p. 33, pl. 14, fig. 133.
1979 *Amyclina labiosa* (Sowerby, 1824) — Geys & Marquet, p. 74, pl. 30, fig. 5.
1993 *Amyclina labiosa* (J. de C. Sowerby, 1824) — Marquet, p. 92.

Dimensions — Height 21 mm, width 9 mm; height 23 mm, width 20 mm (with *Hydractinia* sp.).
Description — Medium-sized, fusiform shell, consisting of nine teleoconch whorls. The suture is shallow, the whorls are flattened. The aperture is pointed oval, with an extremely short siphonal canal and a broad callus, which extends far to the left of the aperture. The outer lip falls back below. It has about thirteen teeth on the inside of the outer lip. The ornament consists of fifteen spiral ribs on the last whorl; these are very regular, slightly coarser near the siphonal canal and broader than the intercostal spaces.
Discussion — At Kallo, this species is extremely common in the Oorderen Member. In the Kruisschans Member, only fragments were found, which are probably reworked. Specimens overgrown with *Hydractinia* sp. occur frequently in the Oorderen Member. The present species is a North Sea Basin middle Pliocene taxon although Harmer (1918) mentioned doubtful records from Italy.

Genus *Nassarius* Duméril, 1806
Subgenus *Phrontis* H. & A. Adams, 1853

Nassarius (Phrontis) kennardi (Harmer, 1914)
Pl. 7, Fig. 9

1914 *Nassa Kennardi* Harmer, p. 87, pl. 5, fig. 11.
1914 *Nassa Kennardi* var. *elongata* Harmer, p. 87, pl. 5, figs 12, 13.
1918 *Nassa Kennardi* Harmer — Harmer, pl. 35, figs 4, 5.
1946 *Nassa kennardi* Harmer, 1914 var. *elongata* (Harmer, 1914) — Beets, p. 81, pl. 4, figs 1-10.
1959 *Nassarius (Phrontis) kennardi* Harmer, sp. 1914 — Glibert, p. 18, pl. 3, fig. 14.
1993 *Phrontis kennardi* (Harmer, 1914) — Marquet, p. 92.
1995 *Nassarius kennardi* (Harmer, 1914) — Gili *et al.*, p. 107, pl. 2, figs 5-8.

Dimensions — Height 15 mm, width 7 mm.
Description — Medium large, fusiform shell, consisting of eight teleoconch whorls. The suture is shallow and the whorls are flattened. The aperture is small, oval, with a short siphonal canal and a narrow callus. The spiral ornament consists of fourteen very regular ribs on the last

whorl. They are broader than the intercostal spaces. The spirals are crossed by nine broad, rather vague, slightly opisthocline axial ribs. These are best delimited near the suture and become less distinct abapically, near the siphonal canal.
Discussion — This characteristic species appears to be rare everywhere in its distribution area. At Kallo only a single specimen was collected from the Kruisschans Member. It is a middle Pliocene species of the North Sea Basin and the Atlantic, reaching south to Portugal (Gili *et al.*, 1995), but it has not yet been found in the Dutch Pliocene.

Subgenus *Tritonella* A. Adams, 1853

Nassarius (Tritonella) consociatus (Wood, 1848)

1843 *Buccinum elegans* Leathes — Nyst, p. 576, pl. 43, fig. 13.
1848 *Nassa consociata* Wood, p. 31, pl. 3, fig. 7.
1878 *Nassa consociata*, S. Wood — Nyst, pl. 2, fig. 5.
1879 *Nassa consociata* S. Wood — Wood, p. 4, pl. 4, fig. 13.
1881 *Nassa consociata*, S. Wood — Nyst, p. 24.
1914 *Nassa consociata* S.V. Wood — Harmer, p. 75, pl. 4, figs 17, 18.
1937 *Nassarius consociatus* (S. Wood, 1848) — van Regteren Altena, p. 41.
1946 *Nassa consociata* (Wood, 1848) — Beets, p. 79.
1959 *Hinia (Tritonella) consociata* Wood, sp. 1848 — Glibert, p. 18, pl. 3, fig. 10 (*partim*).
1965 *Nassarius (Hinia) consociatus* (S.V. Wood, 1848) — van Regteren Altena *et al.*, p. 35, pl. 15, fig. 138.
1965 *Nassarius (Hinia) consociatus* (S.V. Wood, 1848) forma *belgica* (Harmer, 1914) — van Regteren Altena *et al.*, p. 35.
1979 *Hinia consociata* (Wood, 1848) — Geys & Marquet, p. 74, pl. 30, fig. 1.
1993 *Hinia consociata* (Wood, 1848) — Marquet, p. 92, pl. 4, figs 1, 2.

Dimensions — Height 18 mm, width 8 mm.
Description — Medium large, slender fusiform shell, consisting of two and a half protoconch and seven teleoconch whorls. The protoconch consists of two and a half smooth, tumid whorls with a shallow suture. It is separated from the teleoconch by a prosocline ridge; the first teleoconch whorl is lower than the last one of the protoconch. The teleoconch has a deep suture and less tumid whorls than the protoconch. The aperture is small, oval to nearly circular, with a broad callus and a very short siphonal canal. The outer lip bears five to eight rather heavy teeth. On the adapical side of the aperture, on the parietal as well as on the outer part, a tooth is present. These two teeth together form a small gutter in the adapical part of the aperture. The spiral ornament consists of eleven ribs on the last whorl. They are much weaker than the thirteen axial ribs. These are slightly narrower than the intercostal spaces and continue on the entire last whorl. The spirals run over the axial ribs.
Discussion — This species is extremely common in the Oorderen Member at Kallo and much rarer in the Kruisschans Member. It differs from the next species in being narrower, in having less widely spaced and thicker axial ribs, in having heavier teeth on the outer apertural lip and in having a gutter in the adapical part of the aperture. Some specimens, however, are difficult to assign to either species. *Nassarius consociatus* may be another species which is restricted to the North Sea Basin Pliocene, but Harmer (1914) recorded it also from the Isle of Man. Specimens from Kallo were illustrated by Marquet (1993).

Nassarius (Tritonella) elegans
(J. de C. Sowerby, 1825)

1825 *Buccinum elegans* J. de C. Sowerby, p. 121, pl. 477, fig. 1.
1848 *Nassa elegans* Leathes — Wood, p. 30, pl. 3, fig. 1.
1878 *Nassa elegans*, Leathes — Nyst, pl. 2, fig. 11.
1881 *Nassa elegans*, Leathes — Nyst, p. 28.
1914 *Nassa elegans* (Leathes, MS.) (J. Sowerby) — Harmer, p. 76, pl. 4, figs 19, 20.
1914 *Nassa granulata* (J. Sowerby) — Harmer, p. 77, pl. 5, fig. 1.
1914 *Nassa granulata* (J. Sowerby) var. *elongata* Harmer, p. 78, pl. 5, fig. 2.
1959 *Hinia (Tritonella) consociata* Wood, sp. 1848 — Glibert, p. 18 (*partim*).
1965 *Nassarius (Hinia) elegans* (J. de C. Sowerby) — van Regteren Altena *et al.*, p. 35, pl. 15, fig. 137.
1993 *Hinia elegans* (J. de C. Sowerby) — Marquet, p. 92, pl. 4, figs 3, 4.

Dimensions — Height 18 mm, width 9 mm.
Description — Medium large, rather broad, fusiform shell, consisting of about two protoconch and six to seven teleoconch whorls. The protoconch is smooth, the whorls are not very tumid. The teleoconch suture is deep and the whorls are rather tumid. The aperture is small, oval to nearly circular, with a narrow callus and a very short siphonal canal. The outer lip is often thickened on the outside. On the inside, about eleven weak teeth are present. On the parietal part of the aperture, a weak tooth may be present, but it never forms a gutter with a tooth on the outer lip. The axial ornament consists of fifteen ribs on the last whorl; two varices may be present. The ribs are much narrower than the intercostal spaces. Twelve spiral ribs occur on the last whorl. They are only slightly less developed than the axials.
Discussion — This species almost replaces the previous in the Kruisschans Member, where some typical and indigenous *N. consociatus* do occur, which means that they cannot be considered subspecies. *Nassarius elegans* occurs in the North Sea Basin Pliocene and possibly on the Isle of Man (Harmer, 1914).

Nassarius (Tritonella) dollfusi (Harmer, 1914)
Pl. 7, Fig. 12

1843 *Buccinum granulatum* — Nyst, p. 575, pl. 43, fig.

11a, c.
1848 *Nassa granulata* J. Sow. — Wood, p. 29, pl. 3, fig. 3.
1872 *Nassa angulata* ? — Wood, p. 4, pl. 4, fig. 14.
1878 *Nassa granulata* J. Sow. — Nyst, pl. 2, fig. 6a, b.
1879 *Nassa granulata* var. *nana* Wood, p. 4, pl. 4, fig. 12.
1881 *Nassa granulata* J. Sow. — Nyst, p. 24.
1914 *Nassa granulata* (J. Sowerby) var. *gracilis* Harmer, p. 77, pl. 5, fig. 3.
1914 *Nassa granulata* (J. Sowerby) var. *fenestrata* Harmer, p. 78, pl. 5, fig. 4.
1914 *Nassa Dautzenbergi* Harmer, p. 79, pl. 5, figs 5-8.
1914 *Nassa Dollfusi* Harmer, p. 80, pl. 5, figs 9, 10.
1914 *Nassa Woodwardi* Harmer, p. 83, pl. 5, fig. 21 (? 20).
? 1914 *Nassa pumila* Harmer, p. 87, pl. 5, fig. 24.
1946 *Nassarius granulatus* (Sowerby, 1815) — Beets, p. 80, pl. 3, figs 26-29.
1959 *Hinia (Tritonella) dollfusi* Harmer, 1914 — Glibert, p. 19, pl. 3, fig. 11.
1965 *Nassarius (Hinia) dollfusi* Harmer, 1914 — van Regteren Altena *et al.*, p. 36, pl. 15, fig. 141.
1979 *Hinia dollfusi* (Harmer, 1914) — Geys & Marquet, p. 74, pl. 30, fig. 4.

Dimensions — Height 11 mm, width 6 mm.
Description — Medium-sized, broad to rather slender fusiform shell, consisting of three smooth protoconch and five teleoconch whorls. The teleoconch suture is shallow and the whorls are flattened. The aperture is small, rounded oval, with a very short siphonal canal and a broad callus. The outer lip is thickened externally and has six large teeth, the uppermost of which forms a gutter with a parietal tooth. On the ultimate whorl, the spiral ornament consists of ten ribs. They are narrower than the intercostal spaces and run on the last whorl over fifteen axial ribs. At the points of intersection, rectangular tubercles occur. The axials are slightly narrower than the intercostal spaces and thicker than the spiral ribs.
Discussion — This species is fairly common in the Oorderen Member, and occurs also, but is rarer, in the Kruisschans and Merksem members. *Nassarius dollfusi* is rather variable in height/width ratio; some specimens are markedly more elongate, the majority more tumid. The species resembles *N. consociatus* but is always broader (even slender specimens are), with a less deep suture and denser axial ornament. A large number of specific and varietal names were applied by Harmer (1914) for this species. One of these other names, *Nassa Dautzenbergi*, has page priority over the name *Nassa Dollfusi* but is preoccupied by *Nassa dautzenbergi* de Gregorio, 1892. In Great Britain, the present species ranges from the middle Pliocene to Pleistocene.

Subgenus *Telasco* H. & A. Adams, 1854

Nassarius (Telasco) lamellilabrus (Nyst, 1835)
Pl. 7, Fig. 10

1835 *Buccinum lamellilabrum* Nyst, p. 33, pl. 5, fig. 48.
? 1872 *Nassa pulchella* Andrzejowski — Wood, p. 12, pl. 6, fig. 7.
1878 *Nassa lamellilabra*, Nyst — Nyst, pl. 28, fig. 10.
1881 *Nassa lamellilabra*, Nyst — Nyst, p. 31.
1914 *Nassa lamellilabra* Nyst — Harmer, p. 83, pl. 4, figs 11-13.
1914 *Nassa lamellilabra* Nyst var. *elegantula* (S.V. Wood, MS.) — Harmer, p. 84, pl. 4, figs 14-16.
1924 *Nassa lamellilabra* Nyst — Schlesch, p. 24.
1946 *Nassarius lamellilabrus* (Nyst, 1835) — Beets, p. 82, pl. 4, figs 11-16.
1959 *Hinia (Telasco) lamellilabra* Nyst, sp. 1835 — Glibert, p. 20, pl. 3, fig. 12a, b.
1959 *Hinia (Telasco) lamellilabra* var. *subflexuosa* Orbigny, 1852 — Glibert, p. 21, pl. 3, fig. 12c.
1965 *Nassarius (Amyclina) lamellilabrus* (Nyst, 1835) — van Regteren Altena *et al.*, p. 33, pl. 14, fig. 134.

Dimensions — Height 16 mm, width 7 mm.
Description — Fairly large, fusiform shell, consisting of two protoconch and six teleoconch whorls. The suture is extremely shallow and the whorls are flat. The aperture is pointed oval, with a rather narrow callus and very short siphonal canal. The outer lip is not thickened and has fifteen long, narrow teeth on the inside. A fold is present abapically on the columellar lip. Spiral ornament consists of about twelve very broad and flat ribs, which are much broader than the intercostal spaces and which narrow near the siphonal canal. Twenty-two axial ribs are present on the last whorl. They may be missing on portions of the shell and become obsolete near the siphonal canal. They are much broader than the intercostal spaces.
Discussion — This species is confined to the Oorderen Member, where it is not really common. It is easily distinguished by its very shallow suture and characteristic ornament. The species occurs in the Pliocene of the North Sea Basin and Iceland (Schlesch, 1924).

Subgenus *Hinia* Gray, 1847

Nassarius (Hinia) propinquus
(J. de C. Sowerby, 1825)
Pl. 7, Fig. 11

1825 *Buccinum propinquum* J. de C. Sowerby, p. 121, pl. 477, fig. 2.
1843 *Buccinum propinquum* Leathes — Nyst, p. 574, pl. 43, fig. 10.
1848 *Nassa propinqua* J. Sow. — Wood, p. 30, pl. 3, fig. 2.
1878 *Nassa propinqua*, J. Sow. — Nyst, pl. 2, fig. 9.
1881 *Nassa propinqua*, J. Sow. — Nyst, p. 27.
1914 *Nassa propinqua* (J. Sowerby) — Harmer, p. 73.
1918 *Nassa (Hinia) propinqua* (J. Sowerby) — Harmer, p. 322, pl. 34, figs 18, 19.
1937 *Nassarius propinquus* (J. Sowerby 1824) — van Regteren Altena, p. 40.
1946 *Nassarius propinquus* (Sowerby, 1824) — Beets, p. 83.
1959 *Hinia* (s.s.) *propinqua* Sowerby, sp. 1835 — Glibert, p. 21, pl. 3, fig. 13.
1965 *Nassarius (Hinia) propinquus* (J. de C. Sowerby, 1824) — van Regteren Altena *et al.*, p. 36, pl. 15, fig. 142.

1993 *Hinia propinqua* (J. de C. Sowerby, 1824) — Marquet, p. 92.

Dimensions — Height 19 mm, width 10 mm.
Description — Medium large, fusiform shell, consisting of three smooth protoconch and seven teleoconch whorls. The suture is shallow, but marked by a slightly separated upper row of subsutural tubercles. The whorls are flat. The aperture is rounded oval, with a broad callus and very short siphonal canal. The outer lip is not thickened. Only near the siphonal canal and on the adapical part are tubercles present. The adapical tubercle forms a gutter with a parietal tooth. Ornament consists of ten spiral ribs on the last whorl, which are broader than the intercostal spaces. No real axial ribs are present, but the upper three to four spirals show tubercles, which are arranged axially. The abapical spirals lack tubercles.
Discussion — At Kallo, this species occurs only in the Kruisschans Member, where it is common. It is easily distinguished by its ornament. Its variation is slight. It is found in the Pliocene and Pleistocene of the North Sea Basin.

Subgenus *Uzita* H. & A. Adams, 1853

Nassarius (Uzita) spectabilis vandewouweri (Glibert, 1959)

1878 *Nassa pygmaea*, Lk. — Nyst, pl. 2, fig. 8.
1881 *Nassa pygmaea*, Lamarck — Nyst, p. 26.
1959 *Hinia (Uzita) vandewouweri* Glibert, p. 23, pl. 3, fig. 17.
1976 *Nassarius spectabilis vandewouweri* — Adam & Glibert, p. 43, pl. 2, fig. 5; pl. 6, figs 7, 8.

Discussion — This species, illustrated and described in detail by Adam & Glibert (1976), in general is a very rare species; only a single specimen is known from Kallo, but this was collected *ex situ*. It is distinguished by its shell form, small size, aperture and ornament. There are no records from outside the Pliocene of Belgium.

Nassarius (Uzita) scaldisianus Adam & Glibert, 1976

? 1848 *Nassa prismatica* Broc. — Wood, p. 32, pl. 3, fig. 6.
1878 *Nassa prismatica*, Brocchi — Nyst, pl. 2, fig. 10.
1881 *Nassa prismatica*, 1814, Brocchi — Nyst, p. 28.
1914 *Nassa serrata* (Brocchi) — Harmer, p. 70, pl. 3, figs 5, 6.
1914 *Nassa clathrata* (Born) — Harmer, p. 66, pl. 3, fig. 3.
1920 *Nassa (Uzita) reticosa* (J. Sowerby) var. *woodi* Harmer, p. 518, pl. 46, fig. 6.
1946 *Nassarius serratus* (Brocchi, 1814) — Beets, p. 87.
1959 *Hinia (Uzita) serrata* Brocchi, sp. 1814 — Glibert, p. 23, pl. 3, fig. 16.
1965 *Nassarius (Hinia) reticosus* (J. Sowerby, 1815) forma *woodi* Harmer, 1920 — van Regteren Altena *et al.*, p. 34 (*non* fig. 135c).
1976 *Nassarius scaldisianus* Adam & Glibert, p. 48, pl. 2, fig. 7; pl. 5, fig. 11.
1993 *Hinia scaldensis* [*sic*] (Adam & Glibert, 1976) — Marquet, p. 92.

Discussion — This species was illustrated and discussed in detail by Adam & Glibert (1976) as well; it is rare in the Oorderen Member, slightly less so in the Kruisschans Member. It differs from *N. spectabilis vandewouweri* in having a larger aperture relative to shell height, more teeth on the outer apertural lip and more spiral as well as axial ribs. The species has not been recognised in Dutch beach material, although it occurs in dredged material from the Westerscheldt, dumped at Yerseke (Marquet Collection). Van Regteren Altena *et al.* (1965) probably lumped the present species with forma *woodi* of *N. reticosus*, since they listed '*Nassa serrata* Harmer' as a synonym of this form. Moerdijk *et al.* (1992) probably lumped it with *N. ligusticus* (Bellardi, 1882) or with *N. reticosus* as well.

Nassarius (Uzita) reticosus (J. Sowerby, 1816)
Pl. 12, Fig. 5

1816 *Buccinum reticosum* J. Sowerby, p. 17, pl. 110, fig. 2.
1843 *Buccinum elongatum* Sow. — Nyst, p. 572, pl. 45, figs 1-3.
1848 *Nassa reticosa* J. Sow. — Wood, p. 33, pl. 3, fig. 10.
1878 *Nassa reticosa*, J. Sow. — Nyst, pl. 2, fig. 4.
1881 *Nassa reticosa*, J. Sow. — Nyst, p. 22.
1914 *Nassa reticosa* (J. Sowerby) — Harmer, p. 61, pl. 3, figs 4, 14-19.
1920 *Nassa (Uzita) reticosa* (J. Sowerby) — Harmer, p. 517, pl. 46, figs 1-7, 9-11.
1946 *Nassarius reticosus* (Sowerby, 1815) — Beets, p. 85.
1959 *Hinia (Uzita) reticosa* Sowerby, sp. 1818 — Glibert, p. 24.
1965 *Nassarius (?Hinia) reticosus* (J. Sowerby, 1815) — van Regteren Altena *et al.*, p. 33, pl. 14, fig. 135 (*partim*).
1976 *Nassarius reticosus* (Sowerby, 1818) — Adam & Glibert, p. 56, pl. 2, fig. 9; pl. 6, fig. 6.
1979 *Hinia reticosa* (Sowerby, 1818) — Geys & Marquet, p. 74, pl. 30, fig. 2.
1993 *Hinia reticosa* (J. Sowerby, 1818) — Marquet, p. 92.

Dimensions — Height 50 mm, width 26 mm; height 39 mm, width 19 mm; height 3.0 mm, width 2.2 mm, protoconch width 0.8 mm.
Description — Large, slender turriculate species, consisting of one protoconch and eight teleoconch whorls. The apex is flat. The protoconch I consists of half a whorl; it is smooth and separated from protoconch II by a ridge; its shape is ellipsoid, not round. Protoconch II also occupies half a whorl and is also smooth. The teleoconch starts behind a ridge with six broad spiral ribs, with very narrow intercostal areas; axial ornament starts a whorl later. The teleoconch suture is deep, the whorls are relatively flat. The aperture is large in relation to shell height, rounded oval, with a narrow callus and very short siphonal canal. The outer lip is thickened and bears up to seventeen narrow teeth in adult specimens. The ornament is very variable.

Some specimens possess eleven spirals and up to 40 axials on the last whorl, which are all equally weak. Between the spirals, two secondary spirals may occur. These shell are mostly slender. Other specimens have 28 more or less equal spirals on the last whorl, while the axials, which are well developed on earlier whorls, are missing from the last one. This is the commonest shell type. The forma *tiara* Wood, 1848 has only eight very broad spirals, which are restricted to the abapical part of the last whorl, and ten prominent, broad axials, which become vague near the aperture. These specimens are also relatively broad. Shells may have the characteristics of one form on the older whorls and of another form on the last one.
Discussion — This species is rare in the Merksem Member, common in the Oorderen Member and especially so in the Kruisschans Member. In the last-named unit the forma *tiara* becomes commoner. The species differs from the previous two in reaching a larger size, in being more slender and in having a larger aperture. It is known from the Pliocene of the North Sea Basin and from localities on the Atlantic coast of Great Britain.

Family Columbellidae Swainson, 1840
Genus *Mitrella* Risso, 1826
Subgenus *Columbellopsis* Bucquoy, Dautzenberg & Dollfus, 1882

Mitrella (Columbellopsis) scaldensis
(van Regteren Altena, 1956b)
Pl. 8, Fig. 3

1878 *Columbella subulata*, Brocc. — Nyst, pl. 3, fig. 3.
1881 *Columbella subulata*, Brocchi — Nyst, p 36.
1914 *Columbella subulata* (Brocchi) — Harmer, p. 56, pl. 2, figs 11, 12.
1937 *Pyrene subulata* (Brocchi 1814) — van Regteren Altena, p. 36.
1946 *Pyrene (Atilia) subulata* (Brocchi, 1814) — Beets, p. 72.
1956b *Pyrene (Columbellopsis) scaldensis* van Regteren Altena, p. 79.
1959 *Mitrella (Columbellopsis) scaldensis* Regteren Altena, sp. 1956 — Glibert, p. 10.
1965 *Mitrella (Columbellopsis) scaldensis* van Regteren Altena, 1956 — van Regteren Altena *et al.*, p. 31, pl. 11, fig. 121.

Dimensions — Height 12 mm, width 4 mm.
Description — Fairly large, very slender, fusiform shell, consisting of eight teleoconch whorls. The whorls are flat, the suture is shallow. It often deepens by the loss of shell material, giving rise to a narrow sutural depression. The last whorl is angular at the periphery. The aperture has a short siphonal canal and a narrow callus. The outer lip is thickened. Seven teeth are present on the inside of the outer apertural lip. The abapical tooth develops into a broader tubercle. The shell is smooth, except for twelve spiral ribs in the siphonal fasciole.
Discussion — This well-known species occurs at Kallo rather rarely and ranges from the Oorderen to Merksem members, although not yet known from the Kruisschans Member. The specimen figured by Harmer (1914, pl. 2, fig. 8) under the name of *Columbella scripta* (Linné, 1758) could well belong to *Mitrella scaldensis* too but is too worn for definite identification. The present species is a North Sea Basin Pliocene species.

Genus *Anachis* H. & A. Adams, 1853

Anachis anglica (Bell *in* Wood, 1874)
Pl. 8, Fig. 6

1874 *Lachesis Anglica* A. Bell *in* Wood, p. 175, addendum plate, fig. 7.

Dimensions — Height 7 mm, width 3 mm.
Description — Small, elongate fusiform shell with short siphonal canal. Seven flat-sided whorls with shallow suture are present in the available juvenile specimen. The protoconch consists of 1¼ smooth whorls; the first one is strongly tumid, the second less. Protoconch and teleoconch are clearly separated. The teleoconch ornament starts with irregular axial ribs. Slightly later, an abapical spiral appears, which delimits a slight subsutural depression on later whorls. In this depression, only fine axial striae are present. On the penultimate whorl, three strong continuous spirals are found. The central one is the weakest and lies close to the abapical spiral. The last whorl together with the siphonal canal show fifteen spirals. The last whorl bears fourteen strong, fairly clearly delimited axial ribs, which run from the adapical suture to the subsutural depression. The aperture is elongate oval, with a narrow callus. In adult specimens, such as the one figured by Wood (1874), clear tubercles are present inside the outer apertural lip.
Discussion — This very rare species was previously known only from the British Coralline Crag; a specimen was collected by L. Ceulemans from the *Petaloconchus* bed at Kallo. It certainly does not belong to the genus *Lachesis* Risso, 1826 (*non* Daudin, 1803 = *Chauvetia* Monterosato, 1884).

Family Costellariidae MacDonald, 1860
Genus *Vexillum* Röding, 1798
Subgenus *Pusia* Swainson, 1840

Vexillum (Pusia) ebenus (Lamarck, 1811)
Pl. 8, Fig. 7

1811 *Mitra ebenus* Lamarck, p. 216.
1857 *Mitra ebenus* Lam. — Wood, p. 310, pl. 31, fig. 7.
1918 *Mitra ebenus* Lamarck — Harmer, p. 310, pl. 33, fig. 4.
1960 *Mitra ebenus* Lamarck, 1811 — Glibert, p. 1.

Dimensions — Height 20 mm, width 8 mm (incomplete).
Description — Fairly large, slender, fusiform shell, with

long, straight siphonal canal. The outer apertural lip is not thickened; a large number of narrow teeth is present on the inside in complete specimens. Columella with four plicae, which become smaller below; the last one is barely visible. The whorls are not tumid, but often turriculate, so that the suture becomes deep. Spiral ornament is absent or consists of a single subsutural band. The axial ornament comprises about thirteen weak, not clearly delimited ribs, which are as broad as the intercostal spaces and become nearly obsolete near the aperture.

Discussion — This species, which appears in the Parathetys Badenian and in the French Pontilevien and Redonien (Glibert, 1960; Brébion, 1964) occurred only for a brief period in the North Sea Basin early Pliocene, where it is always extremely rare; at the present day it is restricted to the Mediterranean. At Kallo, it occurs in the *Petaloconchus* bed of the Kattendijk Formation. The sole specimen collected, however, is so fragmentary that a shell from Antwerp (Kattendijk Formation) is here illustrated. The species is extremely variable in height/width ratio, suture depth and ornament, which is illustrated for Recent specimens by Parenzan (1970, figs 762-764).

Family	Volutidae Rafinesque, 1815
Subfamily	Scaphellinae H. & A. Adams, 1858
Genus and subgenus	*Scaphella* Swainson, 1832

Scaphella (S.) lamberti (J. Sowerby, 1816)
Pl. 8, Fig. 5

1816 *Voluta Lamberti* J. Sowerby, p. 65, pl. 129.
1835 *Voluta Lamberti*, Sow. — Nyst, p. 34.
1842 *Voluta Lamberti* J. Sow. — Wood, p. 543.
1843 *Voluta Lamberti*, J. Sow. — Nyst, p. 587, pl. 45, fig. 4.
1848 *Voluta Lamberti* J. Sow. — Wood, p. 20, pl. 2, fig. 3.
1874 *Voluta Lamberti* J. Sow. — Wood, p. 173, pl. 2.
1878 *Voluta lamberti*, J. Sow. — Nyst, pl. 4, fig. 1.
1881 *Voluta lamberti*, J. Sow. — Nyst, p. 56.
1920 *Voluta lamberti* J. Sowerby — Harmer, p. 512, pl. 45, fig. 3.
1937 *Voluta lamberti* (J. Sowerby, 1816) — van Regteren Altena, p. 42, pl. 3, figs 40-47.
1946 *Scaphella lamberti* (Sowerby, 1816) — Beets, p. 90.
1960 *Scaphella lamberti* Sowerby, sp. 1816 — Glibert, p. 1.
1965 *Scaphella lamberti* (J. Sowerby, 1816) — van Regteren Altena *et al.*, p. 37, pl. 16, fig. 145.
1979 *Scaphella lamberti* (Sowerby, 1816) — Geys & Marquet, p. 76, pl. 31, fig. 3.
1986 *Scaphella lamberti* (Sowerby, 1816) — Marquet, p. 76, text-fig.

Dimensions — Height 130 mm, width 35 mm; height 157 mm, width 74 mm; height 105 mm, width 45 mm.

Description — Very large, slender fusiform shell, with a long siphonal canal and a siphonal fasciole. Spire relatively low in comparison to the height of the last whorl: the ratio of total height/spire height is between 4.3 and 7.4, with a mean of 5.4 (measured on 10 specimens). Protoconch large, paucispiral, pointed, smooth and clearly separated from the teleoconch by a groove. The teleoconch consists of six to seven whorls. The suture is very shallow. The aperture may be wide or narrower, with a sinuous outer lip. The callus is broad and shows often irregular tubercles, where objects, such as barnacles, have been overgrown. Four well- developed columellar plicae are present; the abapical one turns to nearly parallel to the direction of the columnella. The ornament consists of irregular, often well-developed growth lines, crossed by numerous, extremely fine spiral lines.

Discussion — This species is variable in height/width ratio, this character varying between 2.1 and 2.7 (mean 2.4, measured on 10 specimens). In the Miocene species *Scaphella bolli* (Koch, 1862) it varies between 2.80 and 3.14 (mean 2.96, measured on 10 specimens). Wood and Nyst split their material into an α (narrow) and a β (broad) variety. At Kallo, the narrow form seems to be twice as common as the broad one, so that the possibility of sexual dimorphism appears slight. The present species is very rare in the Kattendijk Formation, common in the Oorderen and Kruisschans members. A single sinistral specimen was found in the Oorderen Member. The frequency of this anomaly was estimated at 1:30,000 by Marquet (1986). The species ranges from the late Miocene Redonien of Bretagne (France; Brébion, 1964) to the Merksem Member (Berendrecht-Antwerp; Marquet Collection). It is very rare in the early Pliocene of Lucena del Puerto (province Huelva, Spain; Marquet Collection). According to Darragh (1988), the European Cainozoic *Scaphella* species belong not to the subgenus *Scaphella* but to *Aurinia* H. & A. Adams, 1853. *Aurinia* is characterised by the absence or reduction of the columellar plicae and the absence of a siphonal fasciole (Olsson & Harbison, 1953; Darragh, 1988). However, the columellar plicae in particular are well developed in the Kallo specimens of this species, which is why they are considered to be assignable to *Scaphella (Scaphella)*. However, *S. bolli* has much weaker plicae and invariably lacks a fasciole.

Superfamily	Cancellaroidea Gray, 1853
Family	Cancellariidae Gray, 1853
Subfamily	Cancellariinae Gray, 1853
Genus	*Cancellaria* Lamarck, 1799
Subgenus	*Merica* H. & A. Adams, 1854

Cancellaria (Merica) harmeri Glibert, 1960
Pl. 8, Fig. 4

1872 *Cancellaria contorta* Basterot — Wood, p. 46, pl. 6, fig. 19.
1918 *Merica contorta* (Basterot) — Harmer, p. 395, pl. 40, figs 5-7.
1937 *Cancellaria contorta* Basterot 1825 — van Regteren Altena, p. 42.
1960 *Cancellaria (Merica) harmeri* Glibert, p. 2, pl. 4, fig. 1.

1965 *Cancellaria contorta* Basterot, 1825 — van Regteren Altena *et al.*, p. 37, pl. 15, fig. 146.

Dimensions — Height 19 mm, width 10 mm.
Description — Medium large, fusiform shell, with a short siphonal canal and with seven teleoconch whorls (protoconch always lacking in the material studied). The suture is deep. The aperture is obliquely oval, pointed above, with ten long, narrow teeth on the inside of the outer lip. The inner lip lacks a callus and has three strong plicae, which are oblique to the columnella; the two uppermost lie close to each other, the abapical one forms the adapical part of the siphonal canal. The ornament consists of ten strong spiral ribs, which are narrower than the intercostal spaces; a weaker secondary rib can occur in between. These are crossed by seventeen weaker prosocline axial ribs, which are rather vague.
Discussion — This is a very rare species everywhere. At Kallo, a few specimens were collected from the *Atrina* level of the Oorderen Member. The species is known also from the British Red and Coralline Crags and from Dutch beach material.

Genus *Sveltia* Jousseaume, 1887

Sveltia jonkairiana (Nyst, 1835)
Pl. 8, Fig. 8

1835 *Cancellaria jonkairiana* Nyst, p. 29, pl. 5, fig. 28.
1843 *Cancellaria varicosa* Brocchi — Nyst, p. 475, pl. 38, fig. 20.
1848 *Cancellaria coronata* Wood, p. 64, pl. 7, fig. 18.
1857 *Cancellaria scalaroides* S. Wood — Wood, p. 316, pl. 31, fig. 9.
1878 *Cancellaria Lajonkairei*, Nyst — Nyst, pl. 1, fig. 6a, b.
1881 *Cancellaria Lajonkairei*, Nyst — Nyst, p. 9.
1918 *Sveltia Lajonkairei* (Nyst) — Harmer, p. 397, pl. 40, figs 18-21.
1937 *Cancellaria jonkairiana* Nyst 1835 — van Regteren Altena, p. 42.
1946 *Sveltia (Sveltia) jonkairiana* Nyst, 1835 — Beets, p. 91.
1960 *Narona (Sveltia) jonkairiana* Nyst, sp. 1835 — Glibert, p. 3.
1965 *Cancellaria jonkairiana* Nyst, 1835 — van Regteren Altena *et al.*, p. 37, pl. 15, fig. 17.
1979 *Narona jonkairiana* (Nyst, 1835) — Geys & Marquet, p. 74, pl. 30, fig. 6.

Dimensions — Height 26 mm, width 18 mm.
Description — Medium large, very slender fusiform shell, without siphonal canal, consisting of seven teleoconch whorls. The suture is deep. The aperture is oval, with straight upper margin and narrow, but clear callus. No teeth were observed on the outer lip in our material, but they may be present (see van Regteren Altena *et al.*, 1965, fig. 147). The columellar lip has two fairly large, oblique plicae. The ornament consists primarily of eleven strong, prosocline axial ribs on the last whorl, which are narrower than the intercostal space. Between them, numerous very fine, irregular spirals can be seen in well-preserved material.
Discussion — This species is rather rare at Kallo. It was found in the *Atrina* and *Cultellus* levels of the Oorderen Member and in the Kruisschans Member. At other localities, specimens are recorded from the Kattendijk Formation upwards. In Great Britain, it occurs in Coralline as well as in Red Crag deposits. In the Mediterranean Pliocene, *Sveltia varicosa* (Brocchi, 1814) is found, a less slender species with stronger spirals and weak spines on the axial ribs. The subspecies *S. varicosa paucicostata* (Peyrot, 1928) is found in the North Sea Basin Miocene. A specimen of this subspecies was figured by Harmer (1918, pl. 40, fig. 17) from 'Antwerp, Scaldisian'; it probably originated from Miocene deposits. Harmer's fig. 1b, a poorly preserved Waldringfield specimen of *S. varicosa*, is not really convincing. All this means that *S. varicosa* does not occur in the North Sea Basin Pliocene.

Genus *Trigonostoma* de Blainville, 1827

Trigonostoma umilicare umbilicare
(Brocchi, 1814)
Pl. 8, Fig. 10

1814 *Voluta umbilicaris* Brocchi, p. 312, pl. 3, figs 10, 11.
1843 *Cancellaria umbilicaris* Brocchi — Nyst, p. 482, pl. 39, fig. 16.
1874 *Cancellaria umbilicaris* ? Brocchi — Wood, p. 182, addendum plate, fig. 10.
1878 *Cancellaria umbilicaris*, Brocc. — Nyst, pl. 1, fig. 5, pl. 28, fig. 8.
1881 *Cancellaria umbilicaris*, Brocchi — Nyst, p. 8.
1918 *Trigonostoma ampullacea* (Brocchi) — Harmer, p. 399.
1918 *Trigonostoma umbilicare* (Brocchi) — Harmer, p. 400, pl. 40, figs 3, 4.
1946 *Trigonostoma umbilicare* (Brocchi, 1814) — Beets, p. 91.
1952 *Cancellaria umbilicaris* (Brocchi) — Glibert, pl. 9, fig. 13.
1955 *Cancellaria (Trigonostoma) umbilicaris* (Brocchi, 1814) — Rossi-Ronchetti, p. 255, fig. 137.
1960 *Trigonostoma umbilicare* Brocchi, sp. 1814 — Glibert, p. 2.
1965 *Trigonostoma umbilicare* (Brocchi, 1814) — van Regteren Altena *et al.*, p. 37, pl. 15, fig. 148.

Dimensions — Height 14 mm, width 14 mm.
Description — Fairly large, short fusiform shell, consisting of six teleoconch whorls that are strongly angular at the periphery, which extremely deepens the suture. The umbilicus may be wide open to nearly closed. The aperture is triangular, with the narrowest side abapically. The outer lip has ten narrow teeth on the inside in complete specimens. The columellar lip is covered by a narrow callus and possesses two plicae deep in the aperture, which run nearly perpendicular to the columnella. Ornament consists of thirteen slightly prosocline axial ribs, which may form spines on the peripheral angle. These are crossed by about

ten narrow, weaker and irregular spiral ribs. Also in the umbilicus spirals are present, but they lack above the peripheral angle.
Discussion — At Kallo, this species is extremely rare, only a single specimen having been collected *ex situ*. In Belgium, it is known from the Kattendijk Formation, and the Luchtbal and Austruweel members, but is invariably rare. It is also known in the North Sea Basin from Great Britain (Red Crag) and The Netherlands. It first occurs in the Miocene with the subspecies *T. u. pluricostatum* Kautsky, 1925, and is commoner in the Mediterranean Pliocene, especially in Italy. Harmer (1918) considered Nyst's (1881, pl. 28, fig. 8) specimen to belong to *T. ampullacea* (Brocchi, 1814). There seems to be little reason to distinguish this specimen from *T. umbilicare*, since the shape of the aperture is quite unlike that of *T. ampullacea* (see Rossi Ronchetti, 1955, fig. 139).

Genus *Babylonella* Conrad, 1865

Babylonella fusiformis subangulosa (Wood, 1848)
Pl. 9, Fig. 1

1842 *Cancellaria subangulosa* Wood, p. 538 (*nomen nudum*).
1848 *Cancellaria subangulosa* S. Wood — Wood, p. 66, pl. 7, fig. 20.
1872 *Cancellaria subangulosa* S. Wood — Wood, p. 47, pl. 3, fig. 27.
1918 *Admete (Babylonella) subangulosa* (S.V. Wood) — Harmer, p. 409.
1992 *Babylonella fusiformis* (Cantraine, 1836) — Cavallo & Repetto, p. 124, fig. 324.

Dimensions — Height 2 mm, width 2 mm (fragment), protoconch height 0.64 mm.
Description — Small, fusiform shell with five tumid, slightly angular whorls and very short siphonal canal. The suture is deep. The last whorl takes more than half of the total height, the aperture about half. The protoconch consists of two and a half tumid whorls. The nucleus is ornamented with very fine, irregular spiral striae; it is separated from the remainder of the protoconch by an axial ridge. After this ridge, irregular axial striae appear, which are interconnected at irregular intervals by spiral striae. After slightly less than two whorls, the axials become stronger, more regular and sinuous. Between them, dense fine spiral striae are present. Protoconch and teleoconch are clearly separated. The teleoconch whorls bear eighteen strong, straight axial ribs, which are much narrower than the intercostal spaces. The axials are crossed by eight fine spiral ribs on the older whorls. The aperture is not preserved in the Kallo specimens. It is rounded oval, with lyrations on the inside of the outer lip and two to three columellar plicae in fully-grown specimens.
Discussion — Of this rare species, which is new for the Belgian Pliocene, only fragments were collected, which, however, are easily recognised by their protoconch ornament. Until now, the species was known only from the British Coralline Crag and from the Italian Pliocene. It differs from Miocene *B. f. fusiformis* (Cantraine, 1835) by the relatively higher last whorl and aperture, but those features are highly variable in the much commoner Miocene material. These two types are not separated in the Italian Pliocene material described by Cavallo & Repetto (1992). Verhecken (1986) expressed doubts over the presence of the genus *Babylonella* in the European Cainozoic. The distinguishing features of this genus include the presence of lyrations and of two columellar plicae in the aperture, a smooth protoconch and rounded whorls. The last feature, however, is too variable, even within a single species, to distinguish genera. The initial whorl of the protoconch is indeed smooth in our material and the very fine striae, which appear later, are easily worn. The youngest protoconch part, with clear axials, could be considered to belong to the teleoconch. Because of the overall resemblance, the species is here retained in the genus *Babylonella*, at least until a well-preserved protoconch of the type species of the genus, *B. elevata* (Lea, 1833) is figured.

Babylonella gracilenta (Wood, 1872)
Pl. 8, Fig. 9

1872 *Cancellaria (Admete) gracilenta* Wood, p. 46, pl. 3, fig. 23.
1918 *Admete (Babylonella) gracilenta* (S.V. Wood) — Harmer, p. 410, pl. 39, figs 51, 52.
1946 *Admete (Babylonella) gracilenta* (Wood, 1872) — Beets, p. 92, pl. 4, figs 21, 22.
1960 *Babylonella gracilenta* Wood, sp. 1872 — Glibert, p. 5, pl. 4, fig. 4.
1965 *Admete gracilenta* (S.V. Wood, 1872) — van Regteren Altena *et al.*, p. 38, pl. 15, fig. 151.

Dimensions — Height 12 mm, width 6 mm.
Description — Small, slender fusiform shell, consisting of three smooth, tumid protoconch and five teleoconch whorls, with very short siphonal canal. The suture is deep. The aperture is oval, with the broadest part adapical and with a sinuous outer lip. In adult specimens, numerous very faint teeth are present at the edge of the outer lip. A narrow callus may be seen on the columnellar side of the aperture. It also bears three faint, obtuse plicae, the uppermost of which is the weakest. The ornament consists firstly of 17 clearly delimited spiral ribs on the last whorl. They are half as wide as the intercostal spaces. Between them run 24 less clearly delimited, sinuous primary axial ribs. These are clearest on the adapical part of the whorls. Near the aperture, they may become obsolete. In the squares formed by spiral and axial ornament elements and on the spirals five very fine secondary axial ribs may be observed.
Discussion — This species is fairly common in the *Cultellus* and *Atrina* levels of the Oorderen Member. At other localities, it appears already in the Luchtbal Member. The species appears to be restricted to the North Sea Basin Pliocene. At Kallo, two congeners common in the Luchtbal Member, were not found. *Babylonella wouweri* (Harmer,

1916) and *B. veneranda* (Beets, 1946) differ primarily by the absence of axial ornament and by the more numerous spirals, especially in the former species. At some localities (Antwerpen-Noordkasteel) these three species co-occur in the Luchtbal Member, which proves that they are indeed full species. The attribution of this species to the genus *Babylonella* is even more uncertain than that of the previous one. It shows some resemblance to species of *Iphinopsis* Dall, 1924, which were transferred to the Cancellariidae by Bouchet & Warén (1985). The species of that genus, however, seem to have a relatively higher last whorl and fewer protoconch whorls while they lack axial ornament.

Subfamily Admetinae Troschel, 1866
Genus *Admete* Kröyer *in* Möller, 1842

Admete viridula (Fabricius, 1780)

1848 *Cancellaria costellifera* J. Sow. — Wood, p. 66, pl. 7, fig. 24.
1874 *Cancellaria (Admete) viridula* Fabricius — Wood, p. 206.
1878 *Cancellaria (Admete) viridula*, O. Fabr. — Nyst, pl. 1, fig. 7.
1881 *Cancellaria (Admete) viridula*, Fabricius — Nyst, p. 11.
1918 *Admete viridula* (Fabricius) — Harmer, p. 406, pl. 32, figs 42-47.
1946 *Admete (Admete) viridula* (Fabricius, 1780) — Beets, p. 92.
1960 *Admete viridula* Fabricius, sp. 1780 — Glibert, p. 6, pl. 4, fig. 5.
1965 *Admete viridula* (Fabricius, 1780) — van Regteren Altena *et al.*, p. 38, pl. 15, fig. 150.
1993 *Admete viridula* (Fabricius, 1780) — Marquet, p. 92, pl. 3, fig. 7.

Description — Medium large, very slender, fusiform shell, with very short siphonal canal, consisting of seven teleoconch whorls. The protoconch comprises two and a half whorls. The shell width matches less than to half the total height, the spire is about 60 % of the shell height. The aperture is oval, pointed above and below, with ten narrow, very long teeth on the inside of the outer apertural lip. The inner lip has a callus and four oblique plicae. A very narrow umbilical slit may be present. The ornament consists at first of ten to twelve clear spiral ribs on the last whorl, which are half as broad as the intercostal space. They are crossed by ten poorly defined, slightly prosocline axial ribs, which are faintest abapically and become obsolete near the aperture. Their development shows a wide individual variation. Growth lines may be conspicuous on well-preserved shells.
Discussion — A specimen from Kallo was figured by Marquet (1993). Recent specimens of this species figured by Bouchet & Warén (1985) and Graham (1988) and specimens from Faxefloi (Iceland; Marquet Collection) differ markedly from Kruisschans Member specimens by their lower spire and broader shell. This was also remarked by Harmer (1918) for the British Pliocene (Red Crag) material. Furthermore, Recent specimens have a paucispiral protoconch and their columellar plicae are weaker. The Recent shell type was figured by Harmer (1918, p. 524, pl. 49, fig. 9) under the names of *Admete sheppardi* Bell, 1919 and *A. contabulata* Friele, 1879 (p. 524, pl. 49, fig. 10); these specimens originated from the Pleistocene Bridlington Crag. His supposed Coralline Crag specimens, which were figured as forma *couthouyi* Jay, 1839, probably belong to *Babylonella veneranda* Beets, 1946, as pointed out by Glibert (1960). Beets (1946, p. 91, pl. 4, figs 23-26) also mentioned the Recent type of shell, as var. *couthouyi*. These specimens originated also from Pleistocene ('younger than Icenian') deposits. Thus the type found in the Antwerp Pliocene appears restricted to the latest Pliocene (Red Crag, perhaps Norwich Crag and Kruisschans Member), while the Recent type appears later, during the Pleistocene. Because the present species is reputed to be a very variable species, especially in regard to ornament, the Pliocene shells are not described here as a separate (sub)species.

Superfamily Conoidea Rafinesque, 1815

Pliocene members of this superfamily have recently been described by Marquet (1997a).

Family Terebridae Mörch, 1852
Genus *Terebra* Bruguière, 1789

Terebra inversa harmeri Glibert, 1960
Pl. 9, Fig. 2

1878 *Terebra inversa* Nyst, var. *dextre* Nyst, pl. 2, fig. 2d.
1881 *Terebra inversa* Nyst, var. *dextre* Nyst, p. 20.
1914 *Terebra inversa* Nyst var. *costata* Harmer, p. 54, pl. 2, fig. 7.
1914 *Terebra canalis* S.V. Wood var. *costata* Harmer, p. 53, pl. 2, fig. 2.
1960 *Terebra (Terebrellina) inversa* Nyst, 1843 subsp. *harmeri* Glibert, p. 18, pl. 4, fig. 21a, b.
1965 *Terebra (Terebrellina) inversa* Nyst, 1835 — van Regteren Altena *et al.*, p. 43, pl. 19, fig. 178 right.

Dimensions — Height 21 mm, width 8 mm.
Description — Very slender, medium large, sinistral turriculate shell with short siphonal canal. The protoconch is not preserved in the Kallo material. There are six slightly tumid teleoconch whorls. A subsutural depression may occur, but not always. The aperture is oval, pointed above, with a callus. The outer lip is sinuous. Only axial ornament is present, consisting of fourteen strong, poorly delimited ribs on the last whorl, which are slightly narrower than the intercostal spaces. They are orthocline on the adapical part of the shell. On younger whorls, they are sinuous. Rather coarse growth lines run between and over the ribs.
Discussion — This subspecies grades into the next one,

especially in the Luchtbal Member, but may be distinguished by its broader shell and coarser axial ornament. The present subspecies is rare in the Kattendijk Formation at Kallo, being restricted to the North Sea Basin early Pliocene. Dextral specimens do occur; they differ in ornament from *Terebra canalis*, a species which is never sinistral.

Terebra inversa inversa Nyst, 1843
Pl. 9, Fig. 4

1835 *Terebra inversa* Nyst, p. 34, pl. 5, fig. 49.
1843 *Terebra inversa* Nyst — Nyst, p. 581, pl. 44, fig. 9.
1848 *Terebra inversa* Nyst — Wood, p. 26, pl. 4, fig. 3.
1878 *Terebra inversa*, Nyst — Nyst, pl. 2, fig. 2a-c.
1881 *Terebra inversa*, Nyst — Nyst, p. 20.
1914 *Terebra inversa* Nyst — Harmer, p. 53, pl. 2, fig. 6.
1937 *Terebra inversa* Nyst 1835 — van Regteren Altena, p. 45.
1946 *Terebra (Myurella) inversa* Nyst, 1835 — Beets, pp. 109, 110.
1960 *Terebra (Terebrellina) inversa* Nyst, 1835 subsp. *inversa* var. *subharmeri* Glibert, pp. 19, 20, pl. 4, fig. 21d.
1965 *Terebra (Terebrellina) inversa* Nyst, 1835 — van Regteren Altena *et al.*, p. 43, pl. 19, fig. 178 left.
1979 *Terebra inversa* Nyst, 1835 — Geys & Marquet, p. 76, pl. 31, fig. 6.

Dimensions — Height 19 mm, width 6 mm.
Description — Medium large, very slender, sinistral, turriculate shell with shallow suture and short siphonal canal. The protoconch consists of two smooth, tumid whorls. The teleoconch has ten rather flat-sided whorls. A depression occurs below the suture. The aperture is as in *T. inversa harmeri* (see above). The ornament consists of growth lines and of 25 axial ribs on the last whorl. The ribs are vaguely delimited, especially on the last whorl, and in some specimens they are nearly absent. The axials are almost as wide as the intercostal spaces, orthocline on the older whorls, sinuous on the younger. The turning point lies just below the depression.
Discussion — This very characteristic subspecies is common in the Oorderen Member at Kallo, rare in the Kruisschans Member. The species is known from the English and the Dutch Pliocene; it is endemic to the middle and late Pliocene North Sea Basin.

Terebra canalis Wood, 1848
Pl. 9, Fig. 3

1848 *Terebra canalis* Wood, p. 26, pl. 4, fig. 4.
1872 *Terebra canalis* S.V. Wood — Wood, p. 8, pl. 4, fig. 1.
1914 *Terebra canalis* S.V. Wood — Harmer, p. 52, pl. 2, fig. 1.
1914 *Terebra exilis* A. Bell — Harmer, p. 53, pl. 2, fig. 4.
1960 *Terebra (Terebrellina) inversa* Nyst, 1835 subsp. *inversa* s.s. — Glibert, p. 19, pl. 4, fig. 21c.
1965 *Terebra (Terebrellina) canalis* S.V. Wood, 1848 — van Regteren Altena *et al.*, p. 43, pl. 19, fig. 176.

Dimensions — Height 14 mm, width 5 mm.
Description — Medium large, very slender, dextral, turriculate shell with shallow suture and short siphonal canal. The protoconch is not preserved in the material studied. No subsutural depression is present, suture shallow. Aperture as in *T. inversa harmeri*. The ornament consists of growth lines and of few or no axial ribs on the last whorl.
Discussion — Of this very rare species, only a single *ex situ* fragment was collected at Kallo. It is here considered to be a separate species, because of the lack of a subsutural depression and the near-absence of axial ornament. The species was previously known only from the Pliocene of Britain, The Netherlands and other Belgian localities.

Subclass	Heterobranchia Gray, 1840
Order	Heterostropha Fischer, 1885
Superfamily	Pyramidelloidea Gray, 1840
Family	Pyramidellidae Gray, 1840
Subfamily	Pyramidellinae Gray, 1840
Genus	*Pyramidella* Lamarck, 1799

Pyramidella laeviuscula Wood, 1842
Pl. 9, Figs 7, 8

1842 *Pyramidella laeviuscula* Wood, p. 77, pl. 9, fig. 2.
1848 *Pyramidella laeviuscula* S. Wood — Wood, p. 77, pl. 9, fig. 2.
1878 *Pyramidella plicosa*, Bronn — Nyst, pl. 6, fig. 1.
1881 *Pyramidella plicosa*, Bronn — Nyst, p. 71.
1920 *Pyramidella laeviuscula* S.V. Wood — Harmer, p. 558, pl. 49, fig. 8.
1958a *Pyramidella laeviuscula* Wood, 1842 — Glibert, p. 21, pl. 2, fig. 18.

Dimensions — Height 4 mm, width 2 mm; height 4,5 mm, width 2 mm.
Description — Small, rather broad turriculate shell without siphonal canal. The whorls are nearly flat-sided. The suture is mostly rather deeply incised, less frequently shallow. The protoconch is heterostrophic and sideways paucispiral with only two smooth whorls. The teleoconch consists of eight whorls. The aperture is broadly oval, pointed above. The outer lip has up to six teeth deep on the inside; the abapical ones are weaker. Three columellar teeth are present. The adapical tooth is strong, both lower ones are much weaker and more oblique in relation to the columnella. The shell surface seems smooth, but a very fine reticulate micropattern may be observed on perfectly preserved specimens.
Discussion — This species is rare in the Kattendijk Formation at Kallo; from the Oorderen Member, a single questionable specimen was collected (Ratinckx Collection). This species is commoner in the *Ditrupa* level, which is missing at Kallo. At this level, it is the only *Pyramidella* represented. The original diagnosis of Wood, 'differs from ... *P. plicosa* in having only three plicae, one large and two

small' does not present sufficient ground for separation, because *Pyramidella plicosa* Bronn, 1838 also has three columellar teeth, although they are often weaker.

Pyramidella plicosa Bronn, 1838
Pl. 9, Figs 5, 6

1838 *Pyramidella plicosa* Bronn, p. 1026, pl. 40, fig. 24.
1944 *Pyramidella plicosa* Bronn — van Voorthuysen, p. 39, pl. 13, figs 18, 19.
1952 *Pyramidella plicosa* Bronn, sp. 1838 — Glibert, p. 62, pl. 4, fig. 17.
1964 *Pyramidella plicosa* (Bronn, 1838) — Anderson, p. 329, pl. 50, fig. 293.
1984 *Pyramidella (Voluspa) plicosa* (Bronn, 1838) — Janssen, p. 353, pl. 14, figs 17, 18.

Dimensions — Height 8 mm, width 2 mm (fragment); height 6 mm, width 2 mm.
Description — Small, slender turriculate shell without siphonal canal. The whorls are tumid. The suture is mostly rather deeply incised, less often shallow. The protoconch is heterostrophic and sideways paucispiral with two whorls. The teleoconch consists of ten whorls. The aperture is broadly oval, pointed adapically. The outer lip has up to six teeth deep on the inside; the abapical ones are weaker. Three columellar teeth are present, which may be very weak. The adapical one is strongest, both lower ones are much weaker and more oblique in relation to the columnella. The shell surface appears smooth, but a very fine reticulate microsculpture may be observed on pristine specimens.
Discussion — Species of the genus *Pyramidella* are notoriously difficult to identify. In the North Sea Basin Pliocene, the previous is the commoner, but a few specimens from the *Petaloconchus* bed would seem to belong to *P. plicosa*. The Miocene species is very well illustrated by Anderson (1964) and van Voorthuysen (1944). The differences, given in the original description of the previous species, are insignificant. Both species, however, differ constantly in the broader shell and less tumid whorls of *P. laeviuscula* and the rounder shell base and relatively shorter last whorl of *P. plicosa*. Because both co-occur in the same layer, they are here interpreted as full species, but with a new definition for the former. For the moment, it is impossible to determine the stratigraphic distribution of these species. Cavallo & Repetto's (1992) fig. 423 of *Pyramidella obtusior* (Semper, 1861) more closely resembles Miocene *P. plicosa*, while their fig. 424 of *P. plicosa* comes closer to *P. laeviuscula*.

Subfamily Chrysallidinae Nordsieck, 1972
Genus *Chrysallida* Carpenter, 1857

Chrysallida indistincta (Montagu, 1808)

1914 *Parthenina indistincta* (Montagu) — Cerulli-Irelli, p. 261, pl. 22, figs 72-74.
1914 *Parthenina indistincta* (Montagu) var. *transiens* Cerulli-Irelli, p. 262, pl. 22, figs 75, 76.
1965 *Chrysallida (Parthenina) indistincta* (Montagu, 1808) — van Regteren Altena *et al.*, p. 114, pl. 19, fig. 185.
1986 *Chrysallida indistincta* (Montagu, 1808) — Fretter *et al.*, p. 564, fig. 381.
1988 *Chrysallida indistincta* (Montagu, 1808) — Graham, p. 552, fig. 237.
1992 *Chrysallida indistincta* (Montagu, 1808) — Cavallo & Repetto, p. 152, fig. 425.
1992 *Chrysallida indistincta* (Montagu, 1808) — van der Linden & Eikeboom, p. 31, figs 11, 12, 43-45.
1993 *Chrysallida indistincta* (Montagu, 1808) — Marquet, p. 94, pl. 4, figs 7, 8.

Dimensions — Height 4.0 mm, width 1.5 mm.
Description — Diminutive, elongate shell, without siphonal canal, with a very narrow umbilical slit. The protoconch is paucispiral, tucked in; the visible part is smooth. The teleoconch consists of five to six whorls; the older ones are flat-sided, the younger ones are slightly tumid. The suture is shallow. The aperture is oval, pointed above, with a columellar tooth, which lies often too deep to be visible. The ornament consists of 25 to 30 axial ribs on the last whorl. They are orthocline on the older whorls; on the younger whorls, they are sinuous. They fade near the base of the shell. Between the axial ribs, four to six spirals may be seen on the abapical half of the last whorl.
Discussion — The species is rather rare in the Oorderen and Kruisschans members at Kallo, and is easily distinguished from *Ch. stefanisi* (Jeffreys, 1869), the only other representative of this genus in the Belgian Pliocene, by the much less tumid whorls and by the spiral ornament, which does not cover the entire last whorl in *Ch. indistincta*. The species seems to be unknown from the British Pliocene. It has been recorded from Dutch beach material, but van Regteren Altena *et al.* (1965) assumed thes specimens to be of Pleistocene age. The Recent distribution extends from the Mediterranean to northern Norway (Graham, 1988). A specimen from Kallo was illustrated by Marquet (1993).

Chrysallida stefanisi (Jeffreys, 1869)
Pl. 9, Fig. 12

1848 *Rissoa costulata* Wood, p. 106, pl. 11, fig. 12.
1869 *Rissoa Stefanisi* Jeffreys, p. 208, pl. 6, fig. 31.
1871 *Menestho Jeffreysi* Bell, p. 360.
1874 *Menestho Jeffreysi* Bell — Wood, pp. 185, 208.
1878 *Rissoa Stephanisi*, Jeffr. — Nyst, pl. 28, fig. 10.
1881 *Rissoa Stephanisi*, Jeffr. — Nyst, p. 96.
1920 *Menestho Jeffreysi* A. Bell — Harmer, p. 584, pl. 50, fig. 6.
1952 *Chrysallida jeffreysi* Bell, sp. 1871 — Glibert, p. 55, pl. 4, fig. 7.
1958a *Chrysallida (Pyrgulina) jeffreysi* Bell, sp. 1871 — Glibert, p. 17.
1965 *Chrysallida (Pyrgulina) jeffreysi* (A. Bell, 1871) — van Regteren Altena *et al.*, p. 45, pl. 20, fig. 187.
1992 *Chrysallida stefanisi* (Jeffreys, 1869) — van der Linden & Eikeboom, p. 42, figs 51, 52.

Dimensions — Height 2.5 mm, width 1.5 mm.
Description — Diminutive, more or less cylindrical turriculate shell with deep suture and tumid whorls. In the specimen studied, which seems to be juvenile, one protoconch and four teleoconch whorls are present. The spire occupies one third of the total height, the aperture between one third and half. The protoconch is smooth and tucked in. The teleoconch ornament starts with spiral ribs, axial ornament starts half a whorl later. The last whorl possesses twenty spiral ribs, which are broader than the intercostal spaces, and twenty axial ribs. The axials cover older whorls completely and end at the height of the aperture on the last whorl. The umbilicus is nearly closed. The aperture is oval, with an unclear columellar tooth in adult specimens.
Discussion — This species is very rare in the Kattendijk Formation (*Petaloconchus* bed) at Kallo (A. Janse Collection). The species differs slightly from the Miocene *Ch. pygmaea* (de Grateloup, 1827), and occurs in the Pliocene of Belgium, The Netherlands and Great Britain. A possibly identical form is present in the Redonien of Gourbesville. Van der Linden & Eikeboom (1992) discussed the nomenclature and the Recent distribution of the species. Jeffreys' name has priority, since the name *Ch. costulata* (Wood, 1848) is preoccupied by *C. costulata* Alder, 1844. Bell's name is unnecessary, because Recent and Pliocene specimens belong to the same species; there also exists *Ch. jeffreysiana* (Monterosato, 1884). Recent records include the western Mediterranean and Madeira, the Canary Islands and the Azores.

Subfamily Eulimellinae Nordsieck, 1972
Genus and Subgenus *Eulimella* Forbes & Macandrew, 1846

Eulimella (E.) laevis (Brown, 1827)
Pl. 9, Fig. 9

1827 *Pyramis laevis* Brown, pl. 50, figs 51, 52.
1848 *Chemnitzia similis* Forbes — Wood, p. 84, pl. 10, fig. 11.
1872 *Eulimella acicula* Phil. — Wood, p. 67.
1921 *Eulimella acicula* (Philippi) — Harmer, p. 845, pl. 64, fig. 30.
1952 *Eulimella acicula* Philippi, sp. 1836 — Glibert, p. 56, pl. 4, fig. 2.
1958a *Eulimella acicula* Philippi, sp. 1836 — Glibert, p. 19.
1965 *Eulimella (Eulimella) laevis* (Brown, 1827) — van Regteren Altena *et al.*, p. 46, pl. 21, fig. 197.
1984 *Eulimella (Eulimella) acicula* (Philippi, 1836) — Janssen, p. 346, pl. 16, fig. 6.
1986 *Eulimella laevis* (Brown, 1827) — Fretter *et al.*, p. 626, fig. 436.
1988 *Eulimella laevis* (Brown, 1827) — Graham, p. 614, fig. 268.
1991 *Eulimella laevis* (Brown, 1827) — Warén, p. 113, figs 37E, 38A, B, 39E, F.
1992 *Eulimella acicula* (Philippi, 1836) — Cavallo & Repetto, p. 156, fig. 434.

Dimensions — Height 4 mm, width 1 mm.
Description — Small, very slender turriculate shell with deep suture. The protoconch is paucispiral and sideways heterostrophic. Seven slightly convex teleoconch whorls, which may be flattened at the periphery, are present. The last whorl is rounded. The aperture is oval, pointed adapically, with one very slight columellar tooth deep in the aperture. No ornament is visible, but spiral microsculpture and growth lines do occur.
Discussion — The Kallo specimens differ from Miocene shells, figured by Glibert (1952) and Janssen (1984) in being less slender and less convex, but the range of variation of this species seems to be wide, as can be seen in Warén's (1991) illustrations. In the Kattendijk Formation (*Ditrupa* level) of Antwerp, a larger species with flat whorls appears to be present; this could be conspecific with *Eulimella (E.) scillae* (Scacchi, 1835), but the material is too incomplete to determine this. Shells of this type have not been found at Kallo. The present species was collected from the *Atrina* level and the Kruisschans Member at Kallo. It is also known from the British, Dutch and Italian Pliocene and in the North Sea Basin Miocene. At the present day, it occurs from the Black Sea and the Mediterranean to southern Scandinavia, but is absent from the southern North Sea; with records between depths of 20 to 400 m (Graham, 1988).

Genus *Anisocycla* Monterosato, 1880

Anisocycla nitidissima (Montagu, 1803)
Pl. 9, Fig. 13

1848 *Chemnitzia nitidissima* (?) Mont. — Wood, p. 80, pl. 10, fig. 4.
1965 *Eulimella (Ebala) nitidissima* (Montagu, 1803) — van Regteren Altena *et al.*, p. 46, pl. 21, fig. 199.
1983 *Anisocycla nitidissima* (Montagu, 1803) — van Aartsen *et al.*, p. 50, fig. 243.
1986 *Ebala nitidissima* (Montagu, 1803) — Fretter *et al.*, p. 629, figs 439, 440.
1988 *Ebala nitidissima* (Montagu, 1803) — Graham, p. 618, fig. 270.

Dimensions — Height 1.25 mm, width 0.4 mm.
Description — Very small, slender turriculate shell with deep suture. The protoconch is paucispiral, sideways heterostrophic and large in comparison with the adult shell. The teleoconch consists of six tumid whorls. The aperture is square oval, not pointed adapically and lacks teeth. The ornament comprises fine spirals and growth lines.
Discussion — This species is easily recognised by its extremely small size, relatively large protoconch and tumid whorls. It is new for the Pliocene fauna of Belgium. Specimens were collected from the sediment fill of larger shells from the *Atrina* level at Kallo. It is also known from Dutch and British Pliocene deposits, and at present occurs from the Mediterranean to southern Norway, mostly at depths between 5 and 50 m (Graham, 1988).

Subfamily Odostomiinae Pelseneer, 1928
Genus *Menestho* Möller, 1842

Menestho britannica Bell, 1871
Pl. 9, Fig. 10

1871 *Menestho Britannica* Bell, p. 360.
1874 *Menestho Britannica* A. Bell — Wood, p. 185, addendum plate, fig. 21.
1920 *Menestho britannica* A. Bell — Harmer, p. 585, pl. 50, figs 7, 8.
1946 *Menestho britannica* Wood, 1874 — Beets, p. 51, pl. 3, figs 4, 5.
1965 *Menestho (Menestho) britannica* A. Bell, 1871 — van Regteren Altena *et al.*, p. 45, pl. 20, fig. 191.

Dimensions — Height 4.0 mm, width 1.5 mm.
Description — Small, rather broad turriculate shell with deep suture. The apex is blunt. The teleoconch comprises seven slightly convex whorls; they are often incised at the suture, but not always. The incision continues on the last whorl as a slight carina. The aperture is rounded oval, pointed above, with the abapical part clearly out turned. A very shallow umbilical groove may be present. Very faint growth lines and spirals may be observed.
Discussion — Bell's original description mentions 'apex styliform and turned towards one side', while Harmer described the same shell as 'somewhat compressed at the apex'; Harmer is followed here in the interpretation of the present species. It is new for the Pliocene of Belgium, and appears to be an endemic North Sea Basin Pliocene species, found in Great Britain in the Coralline Crag and in The Netherlands. At Kallo, it is rare in the Oorderen Member.

Genus *Brachystomia* Monterosato, 1884

Brachystomia eulimoides (Hanley, 1844)

1920 *Odostomia eulimoides* Hanley — Harmer, p. 602, pl. 50, fig. 35.
1965 *Odostomia (Brachystomia) eulimoides* Hanley, 1844 — van Regteren Altena *et al.*, p. 46, pl. 20, fig. 193.
1983 *Odostomia eulimoides* (Hanley, 1844) — van Aartsen *et al.*, p. 53, fig. 252.
1986 *Brachystomia eulimoides* (Hanley, 1844) — Fretter *et al.*, p. 601, figs 414, 415.
1988 *Brachystomia eulimoides* (Hanley, 1844) — Graham, p. 586, figs 252 (9), 253, 255.
1993 *Odostomia (Brachystomia) eulimoides* (Hanley, 1844) — Marquet, p. 94, pl. 4, figs 13, 14.

Dimensions — Height 2.2 mm, width 1.0 mm.
Description — Very small, more or less rectilinear conical shell with deep suture. The apex is flattened, the protoconch tucked in. There are up to six slightly tumid teleoconch whorls present. The body whorl is rounded and occupies more than half of the total height. The aperture is elongated oval, pointed above, with a prominent columellar tooth. A narrow umbilical slit is present. The ornament consists of straight, prosocline growth lines.
Discussion — A Kallo specimen of this species was figured by Marquet (1993). The three *Brachystomia* species occurring at Kallo may be distinguished from *Odostomia* by their flattened apex with tucked-in protoconch. The present species is rare in the Oorderen Member at Kallo and slightly commoner in the Kruisschans Member. As a fossil, it is known from the British St Erth beds and from Dutch beach material. Nowadays, it occurs from the Mediterranean to the Arctic, but not in the southern North Sea.

Brachystomia albella (Lovén, 1846)
Pl. 9, Fig. 11

1874 *Odostomia albella* Lovén — Wood, p. 184, addendum plate, fig. 15.
1925 *Odostomia albella* (Lovén) — Harmer, p. 829, pl. 64, fig. 5.
1986 *Brachystomia albella* (Lovén, 1846) — Fretter *et al.*, p. 604, fig. 416.
1988 *Brachystomia albella* (Lovén, 1846) — Graham, p. 588, figs 252 (8), 253, 256.

Dimensions — Height 2.2 mm, width 1.1 mm.
Description — Very small, nearly rectilinear conical shell with shallow suture. The apex is flat, the protoconch tucked in. Five very slightly convex teleoconch whorls are present. The last whorl occupies more than half of the total height. The aperture is relatively low, rounded oval and pointed adapically. A narrow umbilical groove may be present. The columellar tooth is barely visible in front apertural view. The growth lines are strongly prosocline and slightly sinuous. The body whorl is rounded.
Discussion — This species is narrower than the previous one, less tumid, with a relatively smaller aperture and a weaker columellar tooth; it is very rare in the Oorderen Member at Kallo. It is new for the Belgian Pliocene. It was already known from the British St Erth and Coralline Crag Pliocene, but not from the Dutch Pliocene. Recent specimens occur from the Mediterranean to southern Norway, but not in the southern North Sea, from near the low tide mark to a depth of 70 m (Graham, 1988).

Brachystomia cerullii nov. nom.
Pl. 10, Fig. 1

1914 *Odontostomia lineolata* Cerulli-Irelli, p. 256, pl. 22, fig. 45 (*non* Sandberger, 1859).

Dimensions — Height 2.6 mm, width 0.6 mm.
Description — Very small, conical shell, consisting of six whorls. The whorls are flat-sided and rounded adapically, which deepens the suture. Protoconch tucked in. The spire occupies less than half of the total height; the last whorl

broadens considerably. The umbilicus is deep and clearly visible. The shell is glossy, with a very fine spiral ornament. The aperture is high, elongate oval, not thickened, without plicae and with a weak columellar tooth.
Discussion — The specimens from Kallo, which originate from the *Cultellus* level (basal crag), resemble the Italian type, which was known previously only from the type locality, by their protoconch, weak spirals, weak tooth, umbilicus and general shell form, although the last whorl is relatively larger in the material from Kallo. Cerulli-Irelli's (1914) name, however, is preoccupied by *Odostomia (Colpodostomia) lineolata* Sandberger, 1859, from the middle Oligocene of the Mainz Basin (Germany).

Genus and subgenus *Odostomia* Fleming, 1813

Odostomia (O.) unidentata (Montagu, 1803)

1850 *Odostomia unidentata* Mont. — Wood, p. 317, pl. 31, fig. 11.
1914 *Odontostomia unidentata* (Montagu) — Cerulli-Irelli, p. 255, pl. 22, figs 38, 39.
1925 *Odostomia unidentata* (Montagu) — Harmer, p. 830, pl. 64, figs 6, 7.
1965 *Odostomia (Odostomia) unidentata* (Montagu, 1803) — van Regteren Altena *et al.*, p. 46, pl. 20, fig. 195.
1986 *Odostomia unidentata* (Montagu, 1803) — Fretter *et al.*, p. 614, figs 425, 426.
1988 *Odostomia unidentata* (Montagu, 1803) — Graham, p. 604, figs 252 (7), 258, 263.
1992 *Odostomia (Odostomia) unidentata* (Montagu, 1803) — Cavallo & Repetto, p. 158, fig. 445.
1993 *Odostomia (O.) unidentata* (Montagu, 1803) — Marquet, p. 94, pl. 4, figs 11, 12.

Description — Very small, nearly rectilinear, high conical shell with shallow, often incised suture. The protoconch is heterostrophic, paucispiral and perpendicular to the shell axis. There are six strongly flattened teleoconch whorls. The last whorl possesses a carina and occupies about half of the total height. The aperture measures slightly more than one third of the total height. It is oval, pointed adapically, with a narrow callus and a clear columellar tooth on the adapical part of the aperture. A narrow umbilical groove is present. The growth lines are prosocline.
Discussion - This species is fairly common in the Oorderen Member, but less so than the next species, and very common in the Kruisschans Member. It is known from the entire British Pliocene, from Dutch beach material and from the Italian Pliocene. At present, it occurs from the Mediterranean to the Arctic. It is found mostly on boulders, which is not the case for the Oorderen and Kruisschans members, from near-littoral to 100 m deep (Fretter *et al.*, 1986).

Subgenus *Megastomia* Monterosato, 1884

Odostomia (Megastomia) aff. Conoidea (Brocchi, 1814)

1814 *Turbo conoidea* Brocchi, p. 660, pl. 16, fig. 2.
1843 *Tornatella conoidea* Brocchi — Nyst, p. 428, pl. 37, fig. 27.
1872 *Odostomia conoidea* Brocchi — Wood, p. 63.
1878 *Odostomia conoidea*, Broc. — Nyst, pl. 6, fig. 2.
1881 *Odostomia conoidea*, Broc. — Nyst, p. 71.
1920 *Odostomia conoidea* (Brocchi) — Harmer, p. 599, pl. 50, fig. 33.
1946 *Odostomia (Megastomia) conoidea* (Brocchi, 1814) — Beets, p. 52.
1955 *Odostomia conoidea* (Brocchi, 1814) — Rossi-Ronchetti, p. 152, fig. 77.
1958a *Odostomia (Megastomia) conoidea* Brocchi, sp. 1814 — Glibert, p. 18 (*partim*).
1986 *Odostomia conoidea* (Brocchi, 1814) — Fretter *et al.*, p. 616, figs 427, 428.
1988 *Odostomia conoidea* (Brocchi, 1814) — Graham, p. 600, figs 252 (2), 258, 261.
1992 *Odostomia (Megastomia) conoidea* (Brocchi, 1814) — Cavallo & Repetto, p. 160, fig. 454.
1993 *Odostomia (O.) conoidea* (Brocchi, 1814) — Marquet, p. 94, pl. 4, figs 9, 10.

Description — Very small, rather broad, nearly rectilinear conical shell with shallow suture. The protoconch is heterostrophic, paucispiral and perpendicular to the shell axis. The teleoconch comprises five flat-sided whorls. The last whorl occupies more than half of the total height, the aperture slightly less. The aperture is oval, pointed adapically, with a narrow callus and a prominent columellar tooth. On the inside of the outer lip, five to seven narrow teeth are present in most specimens. The growth lines are slightly prosocline and curved.
Discussion — This species is usually recognised by the presence of teeth on the outer apertural lip. This character, however, does not occur in all specimens and appears to be absent in the holotype (see fig. 77/77a in Rossi-Ronchetti, 1955). Specimens without teeth differ always from the previous species by their broader shell, relatively higher last whorl and higher aperture and by the absence of a carina on the last whorl. The species is found rarely in the Kattendijk Formation at Kallo, more commonly in the Oorderen Member and rather rarely in the Kruisschans and Merksem members. In the North Sea Basin it ranges from the Miocene upwards, although some Belgian Miocene records probably belong to other species. It is known from the entire British, Dutch and Italian Pliocene. Recent specimens are recorded from the Mediterranean to Norway, but not from the North Sea, at depths between 10 and 150 m (Graham, 1988).

Genus *Ondina* A. Adams, 1860

Ondina divisa (J. Adams, 1797)
Pl. 10, Fig. 3

1872 *Odostomia insculpta* Montagu — Wood, p. 62, pl. 4,

fig. 18.
1923 *Odostomia (Ondina) insculpta* (Montagu) — Harmer, p. 839, pl. 64, fig. 20.
1988 *Evalea divisa* (J. Adams, 1797) — Graham, p. 566, fig. 244.

Dimensions — Height 2 mm, width 1 mm.
Description — Very small, blunt turriculate shell with deep suture and tumid whorls. The shell consists of one protoconch whorl and four teleoconch whorls. The aperture occupies slightly more than one third of the total height, the spire slightly less than half. The protoconch is smooth and tucked in. The first teleoconch whorl has only very slight reticulate microsculpture. Later whorls possess four spiral grooves on their abapical side. On the base of the last whorl, ten grooves are present, which are much narrower than the spaces in between. The aperture is oval, pointed adapically and extends abapically to below the shell base. A very narrow umbilical cleft remains. The columellar tooth is very inconspicuous. The outer lip possesses a slight anal sinus.
Discussion — This species is extremely rare in the Kattendijk Formation (*Petaloconchus* bed) at Kallo (A. Janse Collection). It is new for the Belgian Pliocene fauna, and is easily recognised by its rather tumid whorls and abapical spiral ornament. The species is known from the British Coralline Crag and St Erth beds, but not from the Dutch Pliocene. At the present day, it occurs from the Bay of Biscay to northern Norway, but not in the southern North Sea, between 18 and 200 m (Graham, 1988).

Ondina obliqua (Alder, 1844)
Pl. 10, Fig. 2

1844 *Odostomia obliqua* Alder, p. 327.
1983 *Evalea obliqua* (Alder, 1844) — Rolan Mosquera, p. 320, text-fig.
1986 *Evalea obliqua* (Alder, 1844) — Fretter *et al.*, p. 585, fig. 399.
1988 *Evalea obliqua* (Alder, 1844) — Graham, p. 570, fig. 246.
1991 *Ondina obliqua* (Alder, 1844) — Warén, p. 104, fig. 34D.

Dimensions — Height 2.6 mm, width 1.2 mm.
Description — Very small, thin shelled, coeloconoid species, consisting of four tumid teleoconch whorls. The protoconch is relatively large, heterostrophic and oblique in relation to the first teleoconch whorl. The suture is deep and incised. The last whorl occupies two thirds of the total height, the aperture less than half. The ornament consists of very fine spirals and growth lines, which are nearly invisible. The aperture is elongate oval and pointed adapically. A very narrow callus is present. On the abapical part of the columellar side, a slight fold may be observed. The aperture reaches slightly below the columnella. The outer lip is not straight, but shows a very slight anal sinus and a peripheral bulge. The umbilical groove is nearly covered by the apertural columellar lip.
Discussion — A specimen of this species was collected by Y. Butaye from the Oorderen Member at Kallo. It is new for the North Sea Basin Pliocene. Its aperture is relatively smaller than that of Recent specimens. The species may be distinguished from *O. divisa* by the much slighter ornament and by the protoconch, which is not sunken. At present, it occurs from the Bay of Biscay to Scandinavia, between 30 and 600 m (Graham, 1988).

Subfamily Turbonillinae Brown, 1849
Genus *Turbonilla* Risso, 1826
Subgenus *Pyrgolidium* Monterosato, 1884

Turbonilla (Pyrgolidium) internodula
(Wood, 1848)
Pl. 10, Fig. 4

1848 *Chemnitzia internodula* Wood, p. 81, pl. 10, fig. 6.
1878 *Turbonilla internodula*, S. Wood — Nyst, pl. 6, fig. 3.
1879 *Turbonilla internodula* S. Wood — Wood, p. 24, pl. 2, fig. 12.
1881 *Turbonilla internodula*, S. Wood — Nyst, p. 73.
1914 *Turbonilla internodula* S. Wood — Cerulli-Irelli, p. 277, pl. 23, figs 68, 69.
1920 *Turbonilla (Pyrgolidium) internodula* S.V. Wood — Harmer, p. 572, pl. 49, fig. 34.
1946 *Turbonilla (Pyrgolidium) internodula* (Wood, 1848) — Beets, p. 53.
1958a *Turbonilla (Pyrgolidium) internodula* Wood, sp. 1848 — Glibert, p. 19, pl. 2, fig. 14.
1965 *Turbonilla (Pyrgolidium) internodula* (Wood, 1848) — van Regteren Altena *et al.*, p. 47, pl. 21, fig. 201.
1993 *Turbonilla internodula* (Wood, 1848) — Marquet, p. 95.

Dimensions — Height 12 mm, width 3 mm.
Description — Small, very slender turriculate shell with shallow suture. The protoconch is smooth, paucispiral and sideways heterostrophic. The teleoconch consists of twelve glossy, flat-sided whorls. The aperture is square and pointed adapically. The outer lip is slightly sinuous. A small tooth may occur on the adapical side of the aperture. The ornament comprises fourteen strong, clearly delimited axial ribs, which are twice as broad as the intercostal spaces. They run opisthoclinally, the lower part being more obtuse in relation to the shell axis. In the intercostal spaces, two depressions occur. The base of the last whorl is smooth.
Discussion — This is a common species in the Kattendijk Formation, Oorderen and Kruisschans members; it is also common in the entire British and Dutch Pliocene and appears to occur in the Mediterranean at the present day (Sabelli *et al.*, 1990), although some authors have expressed doubts as to the conspecificity of fossil and Recent representatives.

Subgenus *Pyrgiscus* Philippi, 1841

Turbonilla (Pyrgiscus) senistriata (Wood, 1879)
Pl. 10, Fig. 6

1879 *Chemnitzia senistriata* Wood, p. 24, pl. 2, fig. 20.
1920 *Turbonilla (Pyrgostyla) similis* (S.V. Wood) — Harmer, p. 570, pl. 49, fig. 31.
1920 *Turbonilla (Pyrgostyla) similis* (S.V. Wood) var. *ecostata* Harmer, p. 570.
1946 *Turbonilla (Pyrgiscus) similis* (Wood, 1848) var. *ecostata* Harmer, 1920 — Beets, p. 53, pl. 3, figs 8, 9.
1958a *Turbonilla (Pyrgiscus) senistriata* Wood, sp. 1879 — Glibert, p. 20.
1965 *Turbonilla* (? *Pyrgiscus*) *senistriata* (S.V. Wood, 1879) — van Regteren Altena *et al.*, p. 47, pl. 21, fig. 203.
1993 *Turbonilla senistriata* (Wood, 1879) — Marquet, p. 95.

Dimensions — Height 4 mm, width 1 mm.
Description — Small, slender turriculate shell with shallow suture. The protoconch is smooth, paucispiral and sideways heterostrophic. The teleoconch consists of six slightly tumid whorls. The aperture is rounded square, pointed adapically, with a weak columellar tooth. The ornament consists of five very broad spirals on the penultimate whorl, with narrow intercostal spaces. The abapical part of the last whorl is covered with five weaker spirals. No axial ornament is present.
Discussion — This species is smaller than the previous one and is easily recognised by the presence of spiral ornament only. *Chemnitzia similis* Wood, 1848 was never well illustrated, which makes it unrecognisable. Harmer's (1920, pl. 49, fig. 32) specimen possesses axial ornament and thus belongs to another species. The present species is rare in the Oorderen Member, and appears to occur only in the North Sea Basin Pliocene, having been recorded from Britain (Coralline Crag) and The Netherlands (beach material).

Subgenus *Mormula* A. Adams, 1864

Turbonilla (Mormula) kendalli
Bell *in* Harmer, 1920
Pl. 10, Fig. 5

1920 *Turbonilla Kendalli* Harmer, p. 561, pl. 49, fig. 12.
1958a *Turbonilla (Mormula) kendalli* Bell *in* Harmer, 1920 — Glibert, p. 21, pl. 2, fig. 17.

Dimensions — Height 3 mm, width 1 mm.
Description — Very slender, small, turriculate shell with deep suture. Protoconch smooth, paucispiral and sideways heterostrophic. Teleoconch consisting of seven tumid whorls. The aperture is rounded square, pointed above, with a narrow callus and a nearly invisible columellar tooth. The ornament is composed of twenty axial ribs on the last whorl. They are slightly opisthocline to nearly orthocline, sharply delimited and slightly narrower than the intercostal spaces. On the last whorl, they end on the adapical half of the aperture. Between them, about twelve spiral striae may be present on the penultimate whorl. The shell base has no axials, but ten spirals are present.
Discussion — This species differs from congeners occurring at Kallo by the presence of spiral as well as axial ornament. It differs from *T. filosa* Wood, 1842, a species from the *Ditrupa* level of the Kattendijk Formation, by having stronger axials than spirals. At Kallo, it is found rarely in the Kattendijk Formation. In England, it occurs in the St Erth beds, but it has not yet been recognised in The Netherlands.

Family Amathinidae Ponder, 1988
Genus *Phasianema* Wood, 1842

Phasianema zelandicum (Bloklander, 1949)
Pl. 10, Fig. 7

1949 *Amauropsis zelandica* Bloklander, p. 37, figs 1, 2.
1956a *Phasianema zelandica* (Bloklander) — van Regteren Altena, p. 64.
1958a *Phasianema zelandicum* Bloklander, sp. 1949 — Glibert, p. 18, pl. 2, fig. 13.
1965 *Phasianema zelandica* (Bloklander, 1949) — van Regteren Altena *et al.*, p. 45, pl. 20, fig. 189.

Dimensions — Height 13 mm, width 11 mm.
Description — Rather large, globose, turbiniform shell with deep suture. The Kallo specimen does not preserve the protoconch. The teleoconch consists of four very tumid whorls. The last whorl occupies two thirds of the total height, the aperture slightly less. The aperture is large, pointed adapically, with a callus and with a very slight columellar plica. A narrow umbilical slit is present. The ornament consists of twenty sharply delimited primary spiral ribs, covering the complete last whorl. They are as broad as or broader than the intercostal spaces. These ribs may be composed of two to three secondary spirals.
Discussion — Only a single specimen was collected from the Oorderen Member. It was previously known only from Dutch beach material and from the Kattendijk Formation and Luchtbal Member in Belgium (Antwerp area).

Subclass Opisthobranchia Milne Edwards, 1848
Order Cephalaspidea Fischer, 1883
Superfamily Acteonoidea d'Orbigny, 1835
Family Acteonidae d'Orbigny, 1835
Genus *Acteon* de Montfort, 1810

Acteon noae J. de C. Sowerby, 1823
Pl. 10, Fig. 8

1823 *Actaeon Noae* J. de C. Sowerby, p. 101, pl. 374.
1843 *Actaeon Noae* Sow. — Nyst, p. 424, pl. 37, fig. 22.
1848 *Actaeon Noae* J. Sow. — Wood, p. 169, pl. 19, fig. 6.
1878 *Tornatella Noae*, J. Sow. — Nyst, pl. 7, fig. 18.
1881 *Tornatella Noae*, J. Sow. — Nyst, p. 129.

1923 *Actaeon Noae* J. Sowerby — Harmer, p. 781, pl. 62, fig. 15.
1950 *Actaeon noae* J. Sowerby — van der Burg, p. 24, pl. 3, fig. 9.
1960 *Actaeon noae* Sowerby, sp. 1822 — Glibert, p. 20, pl. 4, fig. 22.
1965 *Acteon noae* J. Sowerby, 1822 — van Regteren Altena *et al.*, p. 43, pl. 19, fig. 179.

Dimensions — Height 21 mm, width 12 mm.
Description — Fairly large, globose, fragile shell with deep, sunken suture. The top is flattened. About seven rather tumid teleoconch whorls are present. The spire equals one fifth of the total height, the aperture two thirds. A small umbilical slit may be present. The aperture is strongly elongated, oval and pointed adapically. A clear callus is present. The abapical part of the aperture shows a strong columellar plica. On the inside of the outer lip a large number of narrow, weak teeth are present in adult specimens. Forty spirals cover the last whorl. They are clearly delimited and about twice as broad as the intercostal spaces. The axial ornament consists of growth lines. In the intercostal spaces, a pattern of small depressions is present. The shell is often decorticated, causing partial disappearance of the ornament.
Discussion — This species occurs commonly in the Oorderen and Kruisschans members at Kallo. It is known only from the Pliocene North Sea Basin, from Great Britain and The Netherlands.

Acteon tornatilis (Linné, 1578)
Pl. 10, Fig. 9; Pl. 11, Fig. 1

1758 *Voluta tornatilis* Linné, p. 728.
1848 *Actaeon tornatilis* Linn. — Wood, p. 170, pl. 19, fig. 5.
1878 *Tornatella tornatilis*, L. — Nyst, pl. 7, fig. 19.
1881 *Tornatella tornatilis*, L. — Nyst, p. 127.
1923 *Actaeon tornatilis* (Linné) — Harmer, p. 782, pl. 62, figs 13, 14.
1946 *Acteon (Acteon) tornatilis* (Linné, 1758) — Beets, p. 111.
1960 *Actaeon tornatilis* Linné, sp. 1766 — Glibert, p. 21, pl. 4, fig. 23.
1965 *Acteon tornatilis* (Linnaeus, 1758) — van Regteren Altena *et al.*, p. 44, pl. 19, fig. 180.
1978 *Acteon tornatilis* (Linneo, 1758) — d'Angelo & Gargiullo, p. 156, text-fig.
1988 *Acteon tornatilis* (L., 1758) — Thompson, p. 26, fig. 4.

Dimensions — Height 9 mm, width 4 mm.
Description — Rather small, fragile globose shell. The suture is shallow in intact specimens, but often the upper part of the whorls peels off, leaving a deeply incised suture. Seven slightly tumid teleoconch whorls are present. The spire equals one quarter of the total height, the aperture two thirds. A small umbilical slit may occur. The aperture is strongly elongate oval and pointed adapically. A callus is present. In the abapical part of the aperture, a clear columellar plica occurs. The ornament consists of spiral ribs and growth lines. The spirals are often divided over two areas, with a smooth part in between, but this is not always the case; on the same shell, some whorls may be completely covered with spirals, while others have a smooth area. Typical specimens have on the last whorl six spirals below the suture and 25 spirals on the shell base. In others, 40 spirals are present over the entire last whorl. The ribs are broader than the narrow intercostal areas. Between them, a pattern of small pits may be observed.
Discussion — This species differs from *A. noae* by the slightly higher spire, the narrower shell, the shallow suture, the less coarse ribs and the possible presence of a smooth area. The present species is rare at Kallo in the Kattendijk Formation. It is known from the Pliocene North Sea Basin and from the Italian Pliocene. Nowadays, it occurs from Iceland to the Mediterranean, in sheltered sandy bays (Thompson, 1988). The specimens figured by Cavallo & Repetto (1992) under the name of *A. semistriatus* (Férussac, 1822) could also belong to *A. tornatilis*. Miocene North Sea Basin *A. semistriatus* nearly always lack the spirals near the suture.

Acteon subulatus Wood, 1842
Pl. 11, Fig. 2

1842 *Actaeon subulatus* Wood, p. 537.
1848 *Actaeon subulatus* S. Wood — Wood, p. 170, pl. 19, fig. 7.
1872 *Actaeon subulatus* S. Wood — Wood, p. 94, pl. 5, fig. 16.
1881 *Tornatella levidensis* ? S. Wood — Nyst, p. 128.
1923 *Actaeon subulatus* S.V. Wood — Harmer, p. 784, pl. 62, fig. 16.
1946 *Acteon (Acteon) batavus* Beets, p. 110, pl. 4, figs 37-39.
1960 *Actaeon subulatus* Wood, 1842 — Glibert, p. 21, pl. 4, fig. 24.

Dimensions — Height 4 mm, width 2 mm.
Description — Small, elongate globose, fragile shell. The suture is deep and incised. The protoconch is heterostrophic. There are five rather tumid teleoconch whorls. The spire equals slightly more than one third of the total height, the aperture less than half. The aperture is elongate oval, pointed adapically; a callus is present. A very weak columellar plica may occur. The ornament consists of 30 spirals on the last whorl. These spirals are broader than the intercostal areas. The intercostal areas are free of pits. The spirals become less clearly delimited in the middle of the last whorl, but they never disappear.
Discussion — The species is easily distinguished from the other acteonids of Kallo by its higher spire, narrower shell, unclear columellar plica and weaker ornament. *Acteon levidensis* Wood, 1848 has more or less the same form, but stronger and fewer spirals. The present species was collected at Kallo from the Kattendijk Formation; it is also known from the British Red Crag and from the Dutch Pliocene, but not from beach material. It is restricted to the North Sea Basin Pliocene.

Acteon levidensis Wood, 1842
Pl. 10, Fig. 10

1842 *Actaeon levidensis* Wood, p. 537.
1848 *Actaeon levidensis* S. Wood — Wood, p. 71, pl. 19, fig. 4.
1872 *Actaeon levidensis* S. Wood — Wood, p. 94.
1923 *Actaeon levidensis* S.V. Wood — Harmer, p. 784, pl 62, fig. 17.
1960 *Actaeon levidensis* Wood, 1842 — Glibert, p. 22, pl 4, fig. 25.
1965 *Acteon levidensis* S.V. Wood, 1848 — van Regteren Altena *et al.*, p. 44, pl. 19, fig. 181.

Dimensions — Height 3 mm, width 1 mm.
Description — Small, elongate, globose shell, consisting of one protoconch and four teleoconch whorls. The protoconch is tumid, smooth and sideways heterostrophic. The teleoconch whorls are slightly tumid, with deeply incised suture. The spire equals one third of the total height, the aperture less than half. The aperture is narrow, elongate oval, pointed adapically, with a callus and a clear columellar tooth, low in the aperture. The ornament consists of seventeen broad spiral ribs, separated by narrow intercostal areas; between the spirals discontinuous axial lines are present. The spirals cover the whorls completely. They become slightly narrower near the abapical end.
Discussion — Previously, this species was known only in Belgium from the Kattendijk Formation and the Luchtbal Member. At Kallo, it occurs very rarely in the basal crag of the *Cultellus* level, the *Pygocardia* bed. The Kallo specimens are juvenile and not entirely typical of the species. They resemble Italian records figured by Cavallo & Repetto (1992, p. 164, fig. 471), belonging to *Acteonidea achatina* Sacco, 1897, which has a higher and narrower aperture than typical *A. levidensis*. Harmer (1923) recorded *A. levidensis* from the Italian Pliocene; it is possible that he actually meant *A. achatina*.

Subfamily Diaphanoidea Odhner, 1914
Family Diaphanidae Odhner, 1914
Genus *Diaphana* Brown, 1827

Diaphana minuta Brown, 1827
Pl. 12, Fig. 1

1827 *Diaphana minuta* Brown, pl. 38, fig. 7.
1848 *Bulla nana* S. Wood — Wood, p. 178, pl. 21, fig. 13.
1923 *Diaphana hyalina* (Turton) — Harmer, p. 810, pl. 63, fig. 21.
1965 *Diaphana minuta* Brown, 1827 — van Regteren Altena *et al.*, p. 47, pl. 21, fig. 204.
1983 *Diaphana minuta* Brown, 1827 — Rolan Mosquera, p. 274, text-fig.
1984 *Diaphana minuta* Brown, 1827 — Janssen, p. 377, pl 19, fig. 7.
1988 *Diaphana minuta* Brown, 1827 — Thompson, p. 28, fig. 5a-d.

Dimensions — Height 1.5 mm, width 1 mm.
Description — Very small, extremely fragile, globose shell with very short spire and deep suture. The shell consists of two and a half whorls, which are very tumid. Protoconch for the largest part tucked in. Only the basal side of half a whorl is visible. This part is smooth and separated from the teleoconch by a ridge. Near the suture of the teleoconch the whorls are angular. The last whorl and the aperture equal 90 % of the total shell height. The aperture is more or less rectangular, angular adapically, rounded and broader abapically, with a clearly delimited callus. A very narrow umbilical slit is present. A microsculpture of small pits is present; these are arranged along spiral lines.
Discussion — This species is new for the Pliocene of Belgium; it is extremely rare, and specimens were collected from sediment fill of *Scaphella* shells from the Oorderen Member. The species was previously known from the Miocene of the North Sea Basin, and occurs also in British and Dutch Pliocene deposits. Recent specimens are found from Greenland and New England to the Mediterranean (Thompson, 1988).

Superfamily Retusoidea Thiele, 1931
Family Retusidae Thiele, 1931
Genus *Cylichnina* Monterosato, 1884

Cylichnina elongata conuloidea (Wood, 1851)
Pl. 11, Fig. 5

1848 *Bulla conulus* Desh. — Wood, p. 173, pl. 21, fig. 2.
1851 *Bulla conuloidea* Wood, p. 322.
1878 *Cylichna umbilicata*, Mont. — Nyst, pl. 7, fig. 22.
1881 *Cylichna umbilicata*, Mont. — Nyst, p. 134.
1923 *Cylichna conuloides* (S.V. Wood) — Harmer, p. 800, pl. 63, fig. 8.
1946 *Retusa (Cylichnina) umbilicata* (Montagu, 1803) — Beets, p. 114.
1960 *Retusa (Cylichnina) elongata conuloidea* Wood, 1851 — Glibert, p. 23, pl. 4, fig. 26.
1965 *Retusa (Cylichnina) subcylindrica* (Brown, 1827) — van Regteren Altena *et al.*, p. 48, pl. 21, fig. 206.

Dimensions — Height 4 mm, width 2 mm.
Description — Small, involute shell. The protoconch is internal and sinistral. The teleoconch consists of three whorls, of which only the last one is visible. The apex of the shell shows a funnel-shaped umbilicus, delimited by a rather sharp carina. The shell broadens regularly from top to base. The basal part is rounded. The aperture is as high as the total shell. It is narrow and widens abapically, from one third of the shell height above the base onwards. The outer lip is nearly straight. A callus is present and a weak columellar plica occurs in the abapical part of the aperture. The ornament consists of seventeen spiral striae. These are broad, with very narrow intercostal areas. The spirals are clearest near the apical umbilicus and especially near the shell base. They are crossed by numerous fine, but clear growth lines.
Discussion — The name *C. e. conuloidea* is here used for Pliocene specimens; Miocene *C. e. elongata* (von Eich-

wald, 1830) differ by their smaller mean size and by the outer lip of the aperture, which, in most Miocene specimens, reaches higher than the keel of the apical umbilicus. The present species is rather rare in the Kattendijk Formation, common in the Oorderen Member and rare in the Kruisschans Member. It is known from the British and Dutch Pliocene and it appears restricted to the Pliocene of the North Sea Basin. Its range, however, is difficult to establish fully, on account of the intraspecific variability and the slight differences between species of the genus *Cylichnina*.

Cylichnina concinna (Wood, 1839)
Pl. 11, Fig. 4

1839 *Bulla concinna* Wood, p. 463, pl. 7, fig. 7.
1848 *Bulla concinna* S. Wood — Wood, p. 176, pl. 21, fig. 6.
1921 *Cylichna concinna* (S.V. Wood) — Harmer, p. 802, pl. 63, fig. 10.

Dimensions — Height 3 mm, width 1.5 mm.
Description — The general shape of this species is the same as that of the previous one, but it is slightly smaller and widens less below, so that the shell is more cylindrical. The most important difference, however, is the presence of 23 clear spiral ribs over the complete last whorl, which are not more conspicuous near the apex or the shell base. The ribs are broader than the very narrow intercostal spaces and are crossed by much weaker growth lines.
Discussion — This species is new for the Belgian Pliocene, where it occurs in the *Petaloconchus* bed, being commoner there than the previous species. The differences between both are slight, but since typical specimens co-occur, while only *C. elongata conuloidea* ranges into the Oorderen Member, *C. concinna* is here given the rank of a full species. It was previously recorded only from the British Coralline Crag.

Genus *Retusa* Brown, 1827

Retusa sp.

1993 *Retusa* sp. — Marquet, p. 95.

Dimensions — Height 2 mm, width 1 mm.
Description — Diminutive involute shell. Protoconch for the largest part internal, sinistral. The teleoconch consists of two whorls. The top of the shell is a very regular conical umbilicus. The edges of the apertural umbilicus are rather rounded. The last whorl is regularly cylindrical and slightly tumid. The basal part of the shell is rounded. The aperture is narrow, widening below. A narrow umbilical slit and a callus are present. The only ornament consists of growth lines.
Discussion — A single incomplete shell was collected from the Kruisschans Member. Unfortunately, the upper part of the aperture is missing, which is why it cannot be determined whether or not the specimen may be assigned to *R. truncatula* (Bruguière, 1792), in which the aperture extends above the apertural umbilicus, or to *R. obtusa* (Montagu, 1803), in which the aperture does not.

Genus *Volvulella* Newton, 1891

Volvulella acuminata (Bruguière, 1792)
Pl. 11, Fig. 7

1843 *Bulla acuminata* Brug. — Nyst, p. 457, pl. 39, fig. 11.
1848 *Bulla acuminata* Brug. — Wood, p. 174, pl. 21, fig. 7.
1878 *Bulla acuminata*, Brug. — Nyst, pl. 28, fig. 5.
1881 *Bulla acuminata*, Brug. — Nyst, p. 135.
1923 *Volvula acuminata* (Bruguière) — Harmer, p. 799, pl. 63, fig. 7.
1946 *Volvulella acuminata* (Bruguière, 1789) — Beets, p. 115.
1952 *Volvula acuminata* Bruguière, sp. 1789 — Glibert, p. 144.
1960 *Volvula acuminata* Bruguière, sp. 1789 — Glibert, p. 23, pl. 4, fig. 28.
1965 *Rhizorus acuminatus* (Bruguière, 1792) — van Regteren Altena *et al.*, p. 48, pl. 21, fig. 207.
1983 *Rhizorus acuminatus* (Bruguière, 1792) — Rolan Mosquera, p. 278, text-fig.
1984 *Volvulella (Volvulella) acuminata* (Bruguière, 1792) — Janssen, p. 380, pl. 18, fig. 13.
1988 *Rhizorus acuminatus* (Bruguière, 1792) — Thompson, p. 38, fig. 10.
1992 *Volvulella acuminata* (Bruguière, 1792) — Cavallo & Repetto, p. 166, fig. 477.

Dimensions — Height 3.5 mm, width 1.5 mm.
Description — Small, involute, spindle-shaped shell. The protoconch is internal and sinistral. Only the last whorl of the shell is visible. It is pointed above and rounded at the shell base. The length of the aperture equals total shell height. It is very narrow and it widens gradually abapically. The columellar lip is slightly turned over abapically. The shell is nearly smooth. Only abapically are fifteen irregular spiral striae visible.
Discussion — This easily recognisable species occurs at Kallo in the Oorderen Member. It is known in the North Sea Basin from Miocene deposits upwards; it occurs in the British Coralline Crag and in the Dutch Pliocene, being also known from the Italian Pliocene. Recent specimens are found from Norway to the Mediterranean and southwards to Angola, in depths of up to 800 m (Thompson, 1988).

Superfamily Ringiculoidea Philippi, 1853
Family Ringiculidae Philippi, 1853
Genus *Ringicula* Deshayes, 1838

Ringicula buccinea (Brocchi, 1814)

Pl. 11, Fig. 3

1814 *Voluta buccinea* Brocchi, p. 319, pl. 4, fig. 9.
1848 *Ringicula buccinea* J. Sow. — Wood, p. 22, pl. 4, fig. 2.
1878 *Ringicula buccinea*, Broc. — Nyst, pl. 7, fig. 20c, d.
1881 *Ringicula buccinea*, Brocchi — Nyst, p. 131.
1923 *Ringicula buccinea* (Brocchi) — Harmer, p. 811, pl. 63, fig. 23.
1923 *Ringicula Searlesi* (Etheridge & Bell) — Harmer, p. 812, pl. 63, fig. 22.
1923 *Ringicula ovalis* A. Bell — Harmer, p. 815, pl. 63, fig. 25.
1946 *Ringicula (Ringiculella) ovalis* Bell, 1898 — Beets, p. 113, pl. 6, figs 38-48.
1946 *Ringicula (Ringiculella) buccinea* (Brocchi, 1814) — Beets, p. 113.
1960 *Ringicula (Ringiculina) buccinea* Brocchi, sp. 1814 — Glibert, p. 22.
1965 *Ringicula (Ringiculina) ovata* Etheridge & Bell, 1898 — van Regteren Altena *et al.*, p. 44, pl. 19, fig. 182.
1979 *Ringicula buccinea* (Brocchi, 1814) — Geys & Marquet, p. 76, pl. 31, fig. 4.
1983 *Ringicula buccinea* (Brocchi, 1814) — Rolan Mosquera, p. 280, text-fig.

Dimensions — Height 9 mm, width 5 mm.
Description — Small, globular shell with deep suture and extremely short siphonal canal. The protoconch comprises one and a half whorls and is not clearly delimited. The teleoconch consists of six tumid whorls. The spire equals one third of the total shell height, the aperture more than half. The aperture is square, with rounded edges and elongated adapically. The outer lip is strongly thickened. A well- developed callus and two strong, obtuse columellar plicae are present. The adapical part of the columellar lip of the aperture shows a ridge, parallel to the columnella, which forms a gutter together with the outer lip of the elongated part of the aperture. The shell is smooth, except for growth lines, which may become very conspicuous on the thickened outer apertural lip.
Discussion — This species is fairly common in the Kattendijk Formation at Kallo. Pliocene *R. buccinea* from Italy and the North Sea Basin differ considerably from allegedly conspecific Miocene shells. The Miocene specimens are half the size of the Pliocene shells, more fragile, with a less thickened outer lip and a shallow suture. The Miocene shell type also occurs, albeit rarely, in the Kattendijk Formation (Antwerp-Schijnpoort; Marquet Collection), but these shells may have been reworked from the underlying Antwerp Member; they were not found at Kallo. Another species, the rare *R. ventricosa* (J. de C. Sowerby, 1824), has not yet been found at Kallo either. It is larger than *R. buccinea* and possesses spiral ornament. A large number of specific names have been applied to the variable Cainozoic *Ringicula* species of Europe, especially by Morlet (1878, 1880) for Miocene specimens. Berger (1954) reduced these to two species for the Miocene Vienna Basin, viz. *R. auriculata* (Ménard de la Groye, 1811) and *R. costata* (von Eichwald, 1830). However, he distinguished in the former seven 'subspecies' and in the latter two, which mostly occur at the same localities. The only Recent Mediterranean species, according to Sabelli *et al.* (1992), is *R. auriculata*, which is small, very tumid, with a low apex. It thus differs considerably from Miocene North Sea Basin and Vienna Basin congeners. The taxa *R. acutior* Morlet, 1878, *R. paulucciae* Morlet, 1878 and *R. laevigata* (von Eichwald, 1830), all illustrated by Berger (1954) as subspecies of *R. auriculata* have small size, high spire and relatively weak outer apertural lip in common and are probably conspecific. *Ringicula elongata* Morlet, 1878, *R. exilis* (von Eichwald, 1829), *R. buccinea* and *R. auriculata dentata* Berger, 1954 are on average twice as large as the species of the first group; their spire is also relatively high and the outer lip is strongly thickened. The first type is the common species from the North Sea Basin Miocene; it should bear the oldest available name, *R. laevigata* (von Eichwald, 1830). The second type, occurring in the Miocene Vienna Basin, in the Italian Pliocene and in the North Sea Basin Pliocene, is *R. buccinea*. Recent *R. buccinea* occurs in the Atlantic (Rolan Mosquera, 1983), but no longer in the Mediterranean. *Ringicula costata* (von Eichwald, 1830) is an entirely different species, which is also known from the Belgian Miocene (Antwerp Member; Marquet Collection).

Superfamily Philinoidea Gray, 1850
Family Philinidae Gray, 1850
Genus *Philine* Ascanius, 1772

Philine scabra (Müller, 1776)
Pl. 12, Fig. 4

1848 *Bullaea scabra* Müll. — Wood, p. 181, pl. 21, fig. 12.
1888 *Philine scabra* Müller — E. Vincent, p. xviii.
1923 *Philine scabra* (Müller, 1776) — Harmer, p. 810, pl. 63, fig. 20.
1952 *Philine scabra* (Müller, 1776) — van der Burg, p. 52, pl. 3, figs 8-10.
1960 *Philine scabra* Müller, sp. 1776 — Glibert, p. 25, pl. 4, fig. 29.
1988 *Philine scabra* (Müller, 1776) — Thompson, p. 65, fig. 24.
1992 *Philine scabra* (Müller, 1776) — Cavallo & Repetto, p. 168, fig. 486.

Dimensions — Height 9 mm, width 5 mm.
Description — Fairly large, very fragile, elongate-triangular, involute shell. The teleoconch consists of two whorls; the body whorl encloses the older whorls, but these remain visible at the apex, where they protrude slightly. The aperture is rounded triangular, very broad and equalling more than 90 % of the total shell height. A clear callus is present, starting at about a third from the apertural base. Where the callus occurs, the columellar apertural lip is folded. The basal part of the aperture possesses saw-tooth like projections in complete specimens. The ornament consists of 80 spiral rows of dots, giving it a chain-like appearance. Growth lines are clearly visible and widely spaced.
Discussion — This species is very rare in the Oorderen

Member at Kallo, being known also from the Kattendijk Formation and the Italian Pliocene. At the present day, it is found near Iceland, in the Mediterranean, along the West African coast and off Madeira, to depths of 1,500 m (Thompson, 1988).

Philine quadrata (Wood, 1839)

1839 *Bullaea quadrata* Wood, p. 461, pl. 7, fig. 1.
1848 *Bullaea quadrata* S. Wood — Wood, p. 179, pl. 21, fig. 9.
1952 *Philine quadrata* (Wood, 1839) — van der Burg, p. 52, pl. 3, fig. 11.
1960 *Philine quadrata* Wood, sp. 1839 — Glibert, p. 25, pl. 4, fig. 30.
1988 *Philine quadrata* (Wood, 1839) — Thompson, p. 64, fig. 23.
1995 *Philine quadrata* (S. Wood, 1839) — van der Linden, p. 75, figs 18, 22-23.

Description — The description is based on shells from Antwerp-Schijnpoort (Kattendijk Formation, *Ditrupa* bed); shell fairly large, very fragile, nearly square involute shell. Only one teleoconch whorl is visible. On the upper third of this whorl, a slight depression may be observed. The apex is sunken in the body whorl. The aperture occupies slightly less than half of the total height; it is very broad, triangular, with a nearly straight outer lip and base. A clear callus is present, starting at about halfway above the shell base. The ornament consists of 90 fine spiral rows of dots, giving it a chain-like appearance. Few growth lines are visible.
Discussion — Of this rare species, only a fragment was collected from the Kattendijk Formation. It is recognisable by its square shape and relatively fine ornament. The species is known from the Coralline Crag in Great Britain, but not from The Netherlands. At present, it occurs from Greenland and Iceland to the Mediterranean and the Azores and further south to St Helena and New England, to depths of 2,150 m (Thompson, 1988; van der Linden, 1995).

Philine ventrosa (Wood, 1839)
Pl. 12, Fig. 3

1839 *Bullaea ventrosa* Wood, p. 462, pl. 7, fig. 5.
1848 *Bullaea ventrosa* S. Wood — Wood, p. 182, pl. 21, fig. 11.
1923 *Philine ventrosa* (S.V. Wood) — Harmer, p. 808, pl. 53, fig. 18.
1993 *Philine* sp. — Marquet, p. 85.

Dimensions — Height 5.5 mm, width 4 mm.
Description — Rather small, very fragile, oval, involute shell. Only one whorl of the teleoconch is visible. The apex is sunken. The aperture is higher than the apex, very broad, oval and narrowing above, because the upper part of the body whorl protrudes strongly into the aperture. No callus. The columellar lip is slightly turned back. The umbilical cleft is very narrow. Spiral ornament consists of 80 clear spiral ribs, which are not composed of dots. Some specimens show, on the entire last whorl or only on part of this, equally strong axial ribs, giving rise to a reticulate ornament.
Discussion — This species is new for the Belgian Pliocene, being rather rare in the Oorderen Member. Records from the Kruisschans Member refer to juvenile specimens, the identification of which is not beyond doubt. Previously the species was known only from the British Coralline Crag. It is recognised by its rounded shape and typical ornament.

Philine denticulata (J. Adams, 1800)
Pl. 12, Fig. 2

1800 *Bulla denticulata* J. Adams, p. 1, pl. 1, figs 3-5.
1867 *Philine nitida* Jeffreys, p. 456.
1965 *Philine denticulata* (J. Adams, 1800) — van Regteren Altena *et al.*, p. 48, pl. 22, fig. 211.
1988 *Philine denticulata* (Adams, 1800) — Thompson, p. 56, fig. 19C, D.

Dimensions — Height 5.5 mm, width 5 mm.
Description — Small, very fragile, rounded oval, involute shell. Only one whorl is visible, the apex is sunken. The aperture is very broad and oval and it reaches extends above the apex; the aperture is pointed above in complete specimens. The adapical part of the outer lip is straight, the abapical part rounded. A small umbilical groove is present. Part of the columellar lip is turned out. Above this part, a clear callus is present. No macrosculpture is visible, with the exception of conspicuous growth lines.
Discussion — This species is also new for the Belgian Pliocene. Only a single specimens was collected from the Oorderen Member at Kallo. The species is easily recognised by the absence of spiral ornament. It is also known in fossil beach material from The Netherlands, but not from Great Britain. Recent specimens appear to be much smaller (up to 2 mm); found from Norway to the Mediterranean, in shallow water (Thompson, 1988).

Family Cylichnidae H. & A. Adams, 1854
Genus and subgenus *Roxania* Leach *in* Gray, 1847

Roxania (R.) utriculus (Brocchi, 1814)
Pl. 11, Fig. 9

1814 *Bulla utricula* Brocchi, p. 633, pl. 1, fig. 6.
1843 *Bulla utricula* Broc. — Nyst, p. 457, pl. 39, fig. 9.
1888 *Atys utriculus* Brocchi — E. Vincent, p. xciii.
1946 *Sabatia (Damoniella) utriculus* (Brocchi, 1814) — Beets, p. 116.
1952 *Sabatia (Damoniella) utriculus* Brocchi, sp. 1814 — Glibert, p. 145, pl. 10, fig. 16.
1960 *Sabatia (Damoniella) utriculus* Brocchi, sp. 1814 — Glibert, p. 24.
1965 *Roxania utriculus* (Brocchi, 1814) — van Regteren Altena *et al.*, p. 48, pl. 22, fig. 209.

1984 *Roxania (Roxania) utriculus* (Brocchi, 1814) — Janssen, p. 373, pl. 19, fig. 2.
1988 *Roxania utriculus* (Brocchi, 1814) — Thompson, p. 48, fig. 15.

Dimensions — Height 11 mm, width 7 mm.
Description — Small, regularly oval, involute shell with rounded, conical apical umbilicus. Only the tumid last whorl is visible. The aperture extends above the apex, narrow, widening below, with a narrow callus. A small umbilicus is present. The ornament consists of twenty broad spirals on the adapical part of the last whorl, with deep, narrow intercostal lines, consisting of rows of small depressions. The central part has 30 spirals, which are much less clear, because the intercostal lines are much shallower. The basal part possesses fifteen spirals, again with deeper incised rows of pits. The ornament is often lost by decortication. Growth lines are present.
Discussion — This characteristic and well-known species occurs at Kallo commonly in the Oorderen Member, more rarely in the Kattendijk Formation. It is present in the Miocene and Pliocene of Belgium, Germany and The Netherlands, but appears not to have been found in the British Pliocene. It is known from the Italian Pliocene. Extant specimens range from northwest Europe to the Mediterranean and the Canaries, to depths of 1,500 m (Thompson, 1988).

Genus and subgenus *Cylichna* Lovén, 1847

Cylichna (C.) cylindracea (Pennant, 1777)
Pl. 11, Fig. 8

1848 *Bulla cylindracea* Penn. — Wood, p. 175, pl. 21, fig. 1.
1878 *Cylichna cylindracea*, Brug. — Nyst, pl. 7, fig. 21.
1881 *Cylichna cylindracea*, Brug. — Nyst, p. 132.
1923 *Cylichna cylindracea* (Pennant) — Harmer, p. 803, pl. 63, fig. 12.
1937 *Cylichna cylindracea* (Pennant 1777) — van Regteren Altena, p. 47.
1946 *Cylichna cylindracea* (Pennant, 1777) — Beets, p. 115.
1960 *Cylichna cylindracea* Pennant, sp. 1777 — Glibert, p. 24.
1965 *Cylichna cylindracea* (Pennant, 1777) — van Regteren Altena *et al.*, p. 48, pl. 21, fig. 208.
1979 *Cylichna cylindracea* (Pennant, 1777) — Geys & Marquet, p. 76, pl. 31, fig. 5.
1983 *Cylichna cylindracea* (Pennant, 1777) — Rolan Mosquera, p. 291, text-fig.
1988 *Cylichna cylindracea* (Pennant, 1777) — Thompson, p. 46, fig. 14.
1992 *Cylichna cylindracea* (Pennant, 1777) — Cavallo & Repetto, p. 170, fig. 489.

Dimensions — Height 11 mm, width 3 mm.
Description — Fairly large, very regular cylindrical involute shell. Only the last whorl is visible. A shallow apical umbilicus is present; it is delimited by a carina; the outer apertural lip is prolonged as a second carina on the inside of the umbilicus. The aperture extends above the apex, is very narrow, widens only in the basal quarter of the shell. A callus is present. It broadens abapically and bears a very slight columellar plica. The surface is very smooth, shiny and not decorticating. A large number of fine, often undulating spiral striae are present over the entire surface in well-preserved specimens.
Discussion — At Kallo, this species is very common in the Oorderen Member, rare in the Kruisschans Member and Kattendijk Formation. Most specimens in the Oorderen Member fell victim to naticid predation, displaying holes at about half the shell height, near the aperture. The species occurs in the Italian, British and Dutch Pliocene. At present, it is known from Iceland, the Atlantic, the Mediterranean, to the Azores and the Canary Islands, sublittorally in sand (Thompson, 1988).

Genus *Scaphander* de Montfort, 1810

Scaphander lignarius (Linné, 1758)
Pl. 11, Fig. 6

1848 *Bulla lignaria* Linn. — Wood, p. 173, pl. 21, fig. 8.
1878 *Scaphander lignaria*, L. — Nyst, pl. 7, fig. 23.
1881 *Scaphander lignaria*, Linné — Nyst, p. 137.
1923 *Scaphander lignarius* (Linné) — Harmer, p. 806, pl. 63, figs 14, 15.
1946 *Scaphander lignarius* (Linné, 1758) — Beets, p. 116.
1960 *Scaphander lignarius* Linné, sp. 1758 — Glibert, p. 24.
1965 *Scaphander lignarius* (Linnaeus, 1758) — van Regteren Altena *et al.*, p. 48, pl. 22, fig. 210.
1979 *Scaphander lignarius* Linné, 1758 — Geys & Marquet, p. 76, pl. 31, fig. 7.
1983 *Scaphander lignarius* (Linné, 1758) — Rolan Mosquera, p. 289, text-fig.
1988 *Scaphander lignarius* (L., 1758) — Thompson, p. 50, fig. 16.
1992 *Scaphander lignarius* (L., 1758) — Cavallo & Repetto, p. 170, fig. 491.

Dimensions — Height 30 mm, width 19 mm.
Description — Large, triangular-oval, fragile, involute shell. Only one whorl is visible. The apex is a shallow umbilicus with rounded margins. The aperture reaches above the apex. The adapical part is narrow, the abapical two thirds broaden strongly on the left side. The outer apertural lip is straight. A callus is present, an umbilicus not. The surface of the last whorl is completely covered by sixty broad, unequal spiral ribs, which are more oblique on the shell base than on the adapical part. Between the ribs narrow intercostal areas occur, consisting of rows of pits. Fairly strong growth lines are present. The inside of the aperture is glossy and shows the spiral ribs of the outside.
Discussion — At Kallo, this species occurs fairly commonly in the Oorderen Member, rarely in the Kruisschans Member and Kattendijk Formation. It is known from the

British, Dutch and Italian Pliocene. Nowadays, it occurs from Iceland to the Mediterranean and the Canaries, from sublittoral to depths of 700 m, in sand (Thompson, 1988).

Order	Thecosomata de Blainville, 1824
Suborder	Euthecosomata Meisenheimer, 1905
Superfamily	Limacinoidea de Blainville, 1823
Family	Limacinidae de Blainville, 1823
Genus	*Limacina* Bosc, 1817

Limacina atlanta (Mörch, 1874)
Pl. 11, Fig. 12

1956 *Spiratella atlanta* — Rasmussen, p. 105, pl. 10, fig. 7.
1965 *Spiratella* sp. — van Regteren Altena *et al.*, p. 49, pl. 22, fig. 212.
1968 *Spiratella atlanta* — Rasmussen, p. 243, pl. 27, figs 8-10.

Dimensions — Height 0.5 mm, width 0.4 mm.
Description — Diminutive, sinistral, extremely fragile, nearly planorboid shell. The shell consists of three and a half tumid whorls. The apex is strongly flattened, but the suture is deep. The aperture is elongate-oval and reaches lower than the shell base. A clear umbilicus is present. The shell surface is glossy, lacks ornament, except for growth lines.
Discussion — Due to its extreme fragility and small size, this species is collected only rarely and exclusively from the sediment fill of large gastropod shells. Specimens are known to date from the Kattendijk Formation and Oorderen Member, and represent a new record for the Pliocene of Belgium. Previous records include the late Miocene of Denmark and Dutch beach material. Sorgenfrei's (1958) middle Miocene records are doubtful, since there occurs a closely related middle Miocene species and since Sorgenfrei did not illustrate his specimens.

Subclass	Pulmonata Cuvier, 1817
Order	Archaeopulmonata Morton, 1955
Superfamily	Ellobioidea A. Adams, 1855
Family	Ellobiidae A. Adams, 1855
Subfamily	Ellobiinae A. Adams, 1855
Genus	*Ellobium* Röding, 1798

Ellobium pyramidale (J. de C. Sowerby, 1823)
Pl. 11, Fig. 10

1823 *Auricula pyramidalis* J. de C. Sowerby, p. 109, pl. 379, fig. 12.
1843 *Auricula pyramidalis* Sow. — Nyst, p. 473, pl. 39, fig. 12.
1848 *Conovulus pyramidalis* J. Sow. — Wood, p. 11, pl. 1, fig. 13.
1878 *Conovulus pyramidalis*, J. Sow. — Nyst, pl. 7, fig. 17.
1881 *Conovulus pyramidalis*, J. Sow. — Nyst, p. 125.
1923 *Melampus pyramidalis* J. Sowerby + var. — Harmer, p. 785, pl. 62, figs 19- 22.
1946 *Melampus pyramidalis* (Sowerby, 1822) — Beets, p. 117.
1960 *Melampus pyramidalis* Sowerby, sp. 1822 — Glibert, p. 25.
1965 *Ellobium pyramidale* (J. Sowerby, 1824) — van Regteren Altena *et al.*, p. 49, pl. 22, fig. 213.

Dimensions — Height 22 mm, width 12 mm.
Description — Large, globular shell with shallow suture. The teleoconch consists of eight flat-sided whorls. The spire is regular conical, and occupies slightly less than half of the total height. The aperture is elongate-oval, pointed adapically, with two prominent columellar teeth and a callus. The umbilicus is deep. Ornament is absent, except for growth lines.
Discussion — At Kallo, this characteristic species is found rarely in the Oorderen Member, viz. in the basal crag, the *Cultellus* level and the *Angulus benedeni* bed. Thus it cannot be considered to be typical of any single horizon, although at other localities it is commoner in the Austruweel Member. It is known from the entire British and Dutch Pliocene, but has not been recorded from outside the North Sea Basin.

Order	Stylommatophora A. Schmidt, 1856
Suborder	Sigmurethra Pilsbry, 1900
Superfamily	Helicoidea Rafinesque, 1815
Family	Helicidae Rafinesque, 1815
Subfamily	Helicinae Rafinesque, 1815
Genus and subgenus	*Cepaea* Held, 1837

Cepaea (C.) haesendoncki (Nyst, 1843)
Pl. 11, Fig. 11

1843 *Helix Haesendoncki* Nyst, p. 464, pl. 38, fig. 17.
1878 *Helix Haesendoncki*, Nyst — Nyst, pl. 7, fig. 16.
1981 *Helix Haesendoncki*, Nyst — Nyst, p. 123.
1889 *Helix nemoralis* L. — G. Vincent, p. 26.
1914 *Helix nemoralis* Linné — Harmer, p. 15, pl. 1, fig. 3 (*partim*).
1960 *Helix nemoralis* Linné, sp. 1758 — Glibert, p. 25.

Dimensions — Height 18 mm, width 19 mm.
Description — This is based on specimens from Antwerp-Wijnegem from the Austruweel Member. Large, low-spired, globular shell with deep suture. Four to five tumid whorls are present. The spire occupies one sixth of the total height. The aperture is oval, elongated in the direction of the columnella, with a callus and a thickened outer lip. An umbilicus is present in juveniles, but it closes completely in adults. The ornament consists of growth lines and irregular, shallow depressions. Mostly one to three dark spirals remain of the colour pattern.
Discussion — A single specimen was collected by M. Grigis from the Oorderen Member at Kallo. This terrestrial

species is much commoner in the Austruweel Member of Antwerp; Glibert (1960) lumped it with *Cepaea (C.) nemoralis* (Linné, 1758), from which it differs by its larger and much flatter shell and by the presence of an ornament consisting of depressions.

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SPECIES	K	Kb	K*P*		O	Ob	O.*1*	O*C*	O.*1b*		Ks		M
Aporrhais scaldensis			r			c	c	a	a		r		
Aporrhais pespelecani quadrifidus					r								
Calyptraea chinensis			r				a	a	a		c		
Capulus ungaricus			r				c	c	c				
Capulus unguis							c	c	c				
Brocchia sinuosa								r					
Xenophora deshayesi scaldensis						d							
Petaloconchus glomeratus			a					r			r		
Bivonia triqueter			r										
Simnia leathesi scaldisia							r	r					
Lamellaria perspicua								e					
Velutina virgata													
Capulacmaea kalloensis			r			r	c	r			r		
Trivia coccinelloides parvula			r										
Trivia c. coccinelloides							c	c			r		
Trivia retusa													
Trivia testudinella				?									
Erato cypraeola brittanica													
Erato pernana								e					
Euspira c. cirriformis						r	r	r			r		
Euspira c. gottschei			e										
Euspira catenoides											r		
Euspira catena			r			a	a	a	a		r		
Euspira exvarians							e						
Euspira helicina hemiclausa			r			a	a	a	a		r		
Natica crassa						a	a	a	a		a		r
Cryptonatica operculata							e						
Ficus conditus subintermedius	e												
Galeodea bicatenata	e					c	c	c	c		r		
Phalium laevigatum	?												
Cerithiopsis barleei			r										
Cerithiopsis subulata			c				r	r					
Cerithiopsis nana			e										
Cerithiopsis keukelaari								e					
Krachia zelandica			r										
Seila trilineata			r										
Laiocochlis sinistratum			e										
Marshallora adversa			r				r						
Norephora pliocaenica			c										
Triphora radiospirata			c										
Metaxia metaxa			r										
Aclis ascaris								e					
Acirsa penepolaris	?												
Opalia obtusicostata													
Cirsotrema f. fimbriosum			r										
Cirsotrema f. exfimbriosum							r	r					
Cirsotrema funiculus	?												
Amaea woodi													
Epitonium frondiculum						c	c	c	r				
Epitonium subulatum			c										
Epitonium foliaceum								r					
Epitonium clathratulum minutum						c	c				r		
Epitonium hennei													
Eulima glabra			r			c	c	c			r		

Melanella alba			e										
Vitreolina philippii					e								
Crinophteiros collinsi					e								
Pterynopsis binominatus			e				r	r					
Pterynopsis canhami							e						
Trophon muricatus							c	c			c		
Trophon barvicensis			e										
Spinucella t. tetragona						c	c	c	r				
Nucella incrassata											c		

Table 1. Stratigraphic distribution of gastropod species (Buccinidae to Helicidae) from the Belgian Pliocene (Kallo sections) known to date.

Abbreviations: **K** - Kattendijk Formation (unspecified); **Kb** - Kattendijk Formation base; **KP** - Kattendijk Formation, *Petaloconchus* bed; **O** - Oorderen Member (unspecified); **Ob** - Oorderen Member base; **OA** - Oorderen Member, *Atrina* level; **OC** -Oorderen Member, *Cultellus* bed; **OAn** - Oorderen Member, *Angulus benedeni* bed; **Ks** - Kruisschans Member; **M** - Merksem Member; **?** -stratigraphic provenance uncertain; **d** - derived/reworked; **e** - extremely rare (fewer than 10 specimens known); **r** - rare (10- 99 specimens); **c** - common (100-*c.* 1,000 specimens); **a** - abundant (more than 1,000 specimens).

SPECIES	K	Kb	K*P*		O	Ob	O*A*	O*C*	O*Ab*		Ks		M
Scalaspira alveolata											e		
Scalaspira consociale													
Buccinum undatum							c	c	c		r		
Liomesus dalei						c	c	c	c		r		
Volutopsis norvegicus													
Colus cordatus							r	r	r		r		
Colus curtus							r	r	r		c		
Atractodon elegans	e					e	e	e					
Neptunea striata lyratodespecta							e	e					
Neptunea striata striata											c		
Neptunea angulata						c	a	a	a		a		
Fusinus longiroster							e						
Fusinus lamellosus													
Amyclina labiosa						c	a	a	a		d		
Nassarius kennardi											e		
Nassarius consociatus						c	a	a	a		r		
Nassarius elegans											c		
Nassarius dollfusi							a	a			r		e
Nassarius lamellilabrus							c	c					
Nassarius propinquus											c		
Nassarius spectabilis vandewouweri				?									
Nassarius ligusticus													
Nassarius scaldensis							e	e	r		r		
Nassarius reticosus						c	a	a	a		a		e
Mitrella scaldensis							r	r	r				e
Mitrella sulcata													
Anachis anglica			e										
Vexillum ebenus			e										
Scaphella lamberti			r			c	a	a	c		r		
Cancellaria harmeri							e						
Sveltia jonkaireana							r	r			r		
Trigonostoma u. umbilicare				?									
Babylonella fusiformis subangulosa			e										
Babylonella gracilenta							c	c					
Babylonella wouweri													
Babylonella veneranda													
Brocchinia mitraeformis parvula													
Admete viridula											c		
Cerodrillia nysti						r	c	c					
Spirotropis c. confusa			e										
Gemmula stoffelsi			e										
Gemmula antwerpiensis						c	c	c	c				
Fusiturris porrecta													
Acamptogenotia intorta nysti	e												
Asthenotoma bipunctula							a	a	r				
Asthenotoma icenorum													
Asthenotoma ratinxcki							e						
Asthenotoma pliocenica													
Bela gliberti								r					
Bela neerlandica													
Bela antwerpiensis			e			c	a	a					
Bela consimilis													

Bela keepingi											a		
Bela belgica							e						
Bela tenuistriata							e				e		
Comarmondia gracilis								r					
Cytharella costatostriata											a		e
Cytharella substriolata			e			c	a	a	c				
Cytharella vandewouweri							e						
Cytharella beetsi													
Cytharella plicatella													
Mangelia gracilior								r					
Lusitanops n. spec.							e						
Raphitoma hystrix auct.			e				r	r			e		
Raphitoma perpulchra							c	c					
Philbertia leufroyi auct.							r	r					
Terebra inversa harmeri			e										
Terebra i. inversa						c	a	a			r		
Terebra canalis				?									
Pyramidella laeviuscula			r										
Pyramidella plicosa			r										
Chrysallida indistincta						r	r				c		
Chrysallida stefanisi			e										
Eulimella laevis			r				r				r		
Anisocycla nitidissima							r						
Menestho britannica						r	r	r					
Brachystomia eulimoides							r				c		
Brachystomia albella						r		r					
Brachystomia cerullii								e					
Odostomia unidentata							c				c		
Odostomia aff. *conoidea*			r			c	c	c			c		
Ondina divisa			e										
Ondina obliqua							e						
Turbonilla internodula			r			r	c	c			c		
Turbonilla senistriata							r	r					
Turbonilla kendalli			e										
Turbonilla filosa													
Phasianema zelandicum								e					
Phasianema sulcatum													
Acteon noae							c	c			c		
Acteon tornatilis			r										
Acteon subulatus			r										
Acteon levidensis								r					
Diaphana minuta							e						
Cylichnina elongata conuloidea			r				a	a			r		
Cylichnina concinna			r										
Retusa sp.											e		
Volvulella acuminata							r	r					
Ringicula buccinea			r										
Philine scabra								r					
Philine quadrata			e										
Philine ventrosa							e	e					
Philine denticulata							e						
Philine intricata													
Roxania utriculus			r				a	a					
Cylichna cylindracea			r				a	a	r		r		
Scaphander lignarius			r				c	c			r		
Limacina atlanta			r				r	r					

Ellobium pyramidale						r		r	r				
Cepaea haesendoncki									?				

Table 2. Stratigraphical distribution of gastropod species (Aporrhaidae to Muricidae) from the Belgian Pliocene (Kallo sections) known to date.

Abbreviations: **K** - Kattendijk Formation (unspecified); **Kb** - Kattendijk Formation base; **KP** - Kattendijk Formation, *Petaloconchus* bed; **O** - Oorderen Member (unspecified); **Ob** - Oorderen Member base; **OAt** - Oorderen Member, *Atrina* level; **OC** - Oorderen Member, *Cultellus* level; **OAn** - Oorderen Member, *Angulus benedeni* bed; **Ks** - Kruisschans Member; **M** - Merksem Member; **?** - stratigraphic provenance uncertain; **d** - derived/reworked; **e** - extremely rare (fewer than 10 specimens known); **r** - rare (10-99 specimens); **c** - common (100-*c.* 1,000 specimens); **a** - abundant (more than 1,000 specimens).

PLATE 1

Fig. 1. *Aporrhais pespelecani quadrifida* da Costa, 1778, Kallo (Vrasenedok), Lillo Formation (Oorderen Member), x 2.5 (Marquet Collection).

Fig. 2. *Aporrhais scaldensis* van Regteren Altena, 1954, Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 2.5 (Marquet Collection).

Fig. 3. *Calyptraea chinensis* (Linné, 1758), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 1.4 (Marquet Collection).

Fig. 4. *Capulus ungaricus* (Linné, 1758), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 1.1 (Marquet Collection).

Fig. 5. *Capulus unguis* (J. Sowerby, 1816), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), a - typical specimen, x 1.1; b - var. *fallax*, x 3.2; c - var. *obliquus*, x 1.7 (Marquet Collection).

Fig. 6. *Brocchia sinuosa* (Brocchi, 1814), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 1.9 (Marquet Collection).

Fig. 7. *Xenophora scaldensis* Glibert, 1958, Kallo Tunnel, Lillo Formation (Oorderen Member, basal crag), x 0.6 (van Nieulande Collection).

Fig. 8. *Petaloconchus glomeratus* (Linné, 1758), Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 2.1 (a) (Marquet Collection), protoconch, same locality and layer, x 50 (b); x 160 (c); x 500 (d) (SEM), KBIN collections, no. IRScNB IST 6263.

Fig. 9. *Bivonia triqueter* (Bivona-Bernardi, 1832), Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 7.1 (Marquet Collection).

Fig. 10. *Neosimnia leathesi scaldisia* Schilder, 1933b, Kallo (Vrasenedok), Lillo Formation (Oorderen Member, *Atrina* level), x 2.7 (Marquet Collection).

PLATE 1

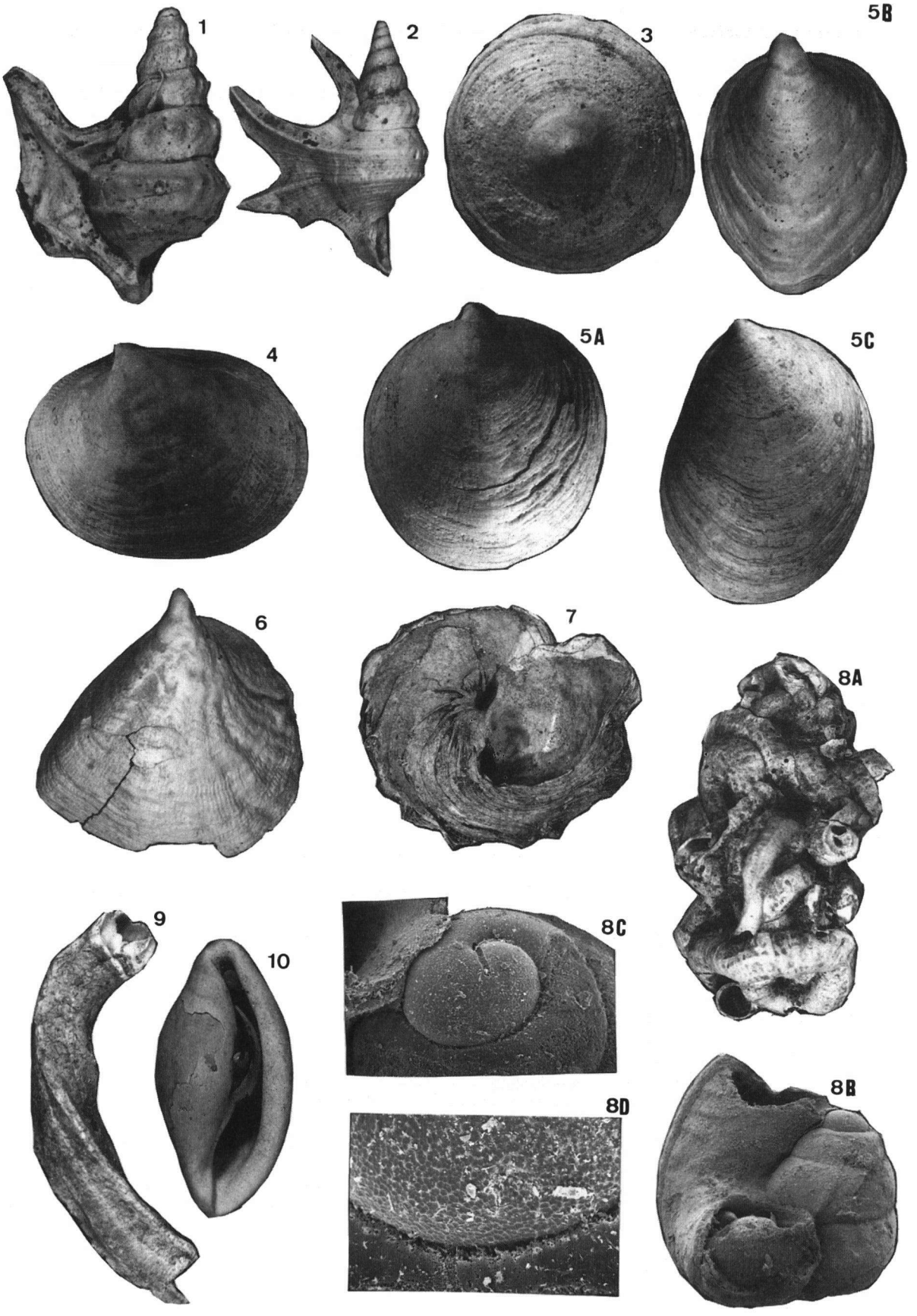

PLATE 2

Fig. 1. *Lamellaria perspicua* (Linné, 1758), Kallo (Vrasenedok), Lillo Formation (Oorderen Member), x 3.8 (a); x 3.6 (b) (H. Keukelaar Collection).

Fig. 2. *Capulacmaea kalloensis* Marquet, 1993, a - Kallo (Verrebroekdok), Lillo Formation (Kruisschans Member), x 3.9, KBIN collections, no. IRScNB IST 6129 (**holotype**); b - Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 5.6 (Marquet Collection).

Fig. 3. *Trivia (Sulcotrivia) testudinella* Wood, 1842, Kallo (Vrasenedok), Pliocene, x 2.5 (Marquet Collection).

Fig. 4. *Trivia (T.) c. coccinelloides* (J. de C. Sowerby, 1823), Kallo (Vrasenedok), Lillo Formation (Oorderen Member, *Atrina* level), x 4.3 (Marquet Collection).

Fig. 5. *Trivia (T.) c. parvula* Schilder, 1933b, Kallo (Vrasenedok), Kattendijk Formation (*Similipecten* level), x 6.1 (Marquet Collection).

Fig. 6. *Euspira c. cirriformis* (J. de C. Sowerby, 1825), Kallo (Vrasenedok), Lillo Formation (Oorderen Member, *Atrina* level), x 1.7 (a); x 1.5 (b) (Marquet Collection).

Fig. 7. *Euspira catenoides* (Wood, 1842), Kallo (Vrasenedok), Lillo Formation (Kruisschans Member), x 1.8 (Marquet Collection).

Fig. 8. *Euspira c. gottschei* (Kautsky, 1925), Antwerp (Noordkasteel), Kattendijk Formation (*Ditrupa* level), x 1.5 (a); x 1.3 (b) (Marquet Collection).

Fig. 9. *Erato (Eratopsis) pernana* Sacco, 1894, Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 10.5 (Marquet Collection).

Fig. 10. *Euspira exvarians* (Sacco, 1891), Kallo (Vrasenedok), Lillo Formation (Oorderen Member, *Atrina* level), x 1.1 (Marquet Collection).

Fig. 11. *Euspira catena* (da Costa, 1778), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 1 (Marquet Collection).

Fig. 12. *Euspira helicina hemiclausa* (J. de C. Sowerby, 1824), a - Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 3.5 (van Nieulande Collection); b-e - Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 1.1 (b); x 2.0 (c); x 1.1 (d); x 1.8 (e) (Marquet Collection).

PLATE 2

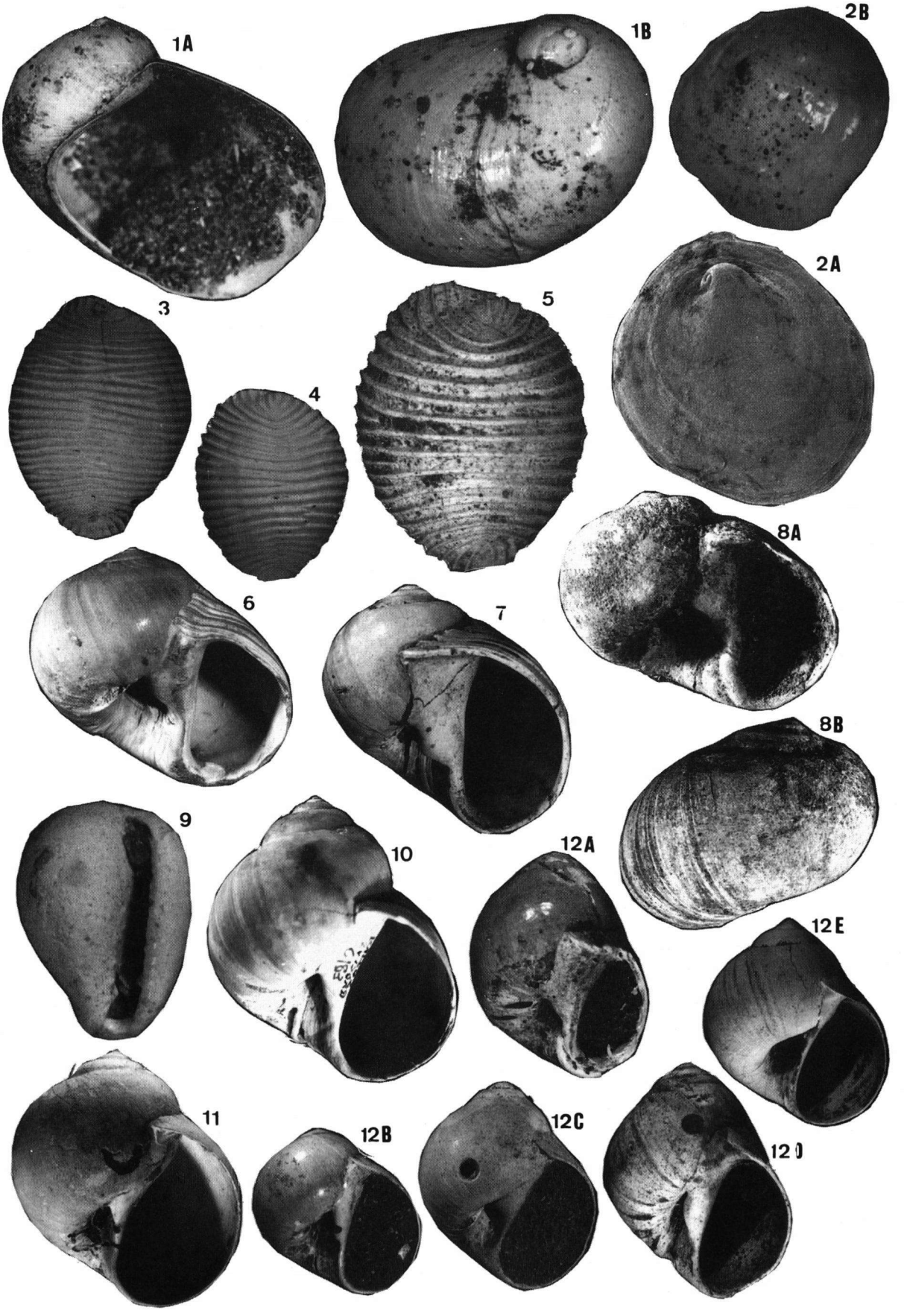

PLATE 3

Fig. 1. *Cryptonatica operculata* (Jeffreys, 1885), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Atrina* level), x 2, KBIN collections, no. IRScNB IST 6253.

Fig. 2. *Natica crassa* Nyst, 1843, Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 2.0 (a); x 2.3 (b) (Marquet Collection).

Fig. 3. *Ficus conditus subintermedius* (d'Orbigny, 1852), Kallo (Vrasenedok), Kattendijk Formation, x 1 (K. Peeters Collection).

Fig. 4. *Galeodea bicatenata* (J. Sowerby, 1816), a - Kallo (Vrasenedok), Lillo Formation (Oorderen Member, *Atrina* level), x 0.6 (Marquet Collection); var. *ecatenata*, Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 0.65 (b); x 0.6 (c) (Marquet Collection).

Fig. 5. *Semicassis (S.) l. laevigata* (Defrance, 1817), Kallo (Vrasenedok), Kattendijk Formation ? (*ex situ*), x 2.0 (a); x 1 (b) (Marquet Collection).

Fig. 6. *Krachia zelandica* (Beets, 1946), Antwerp, new docks 1905, 'Diestien' (= Kattendijk Formation ?), x 13 (a); x 42 (b) (SEM), KBIN collections, no. IRScNB IST 6322.

Fig. 7. *Cerithiopsis subulata* (Wood, 1848), a - Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 12 (a); x 120 (b) (SEM), KBIN collections, no. IRScNB IST 6255.

Fig. 8. *Cerithiopsis keukelaari* n. sp., Kallo (Verrebroekdok), Lillo Formation (Oorderen Member), x 13 (a); x 26 (b); x 170 (c) (**holotype**, SEM), Nationaal Natuurhistorisch Museum (Leiden) collections, no. RGM 396 197.

Fig. 9. *Krachia zelandica* (Beets, 1946), Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 9 (a); x 25 (b) (SEM), KBIN collections, no. IRScNB IST 6254.

PLATE 3

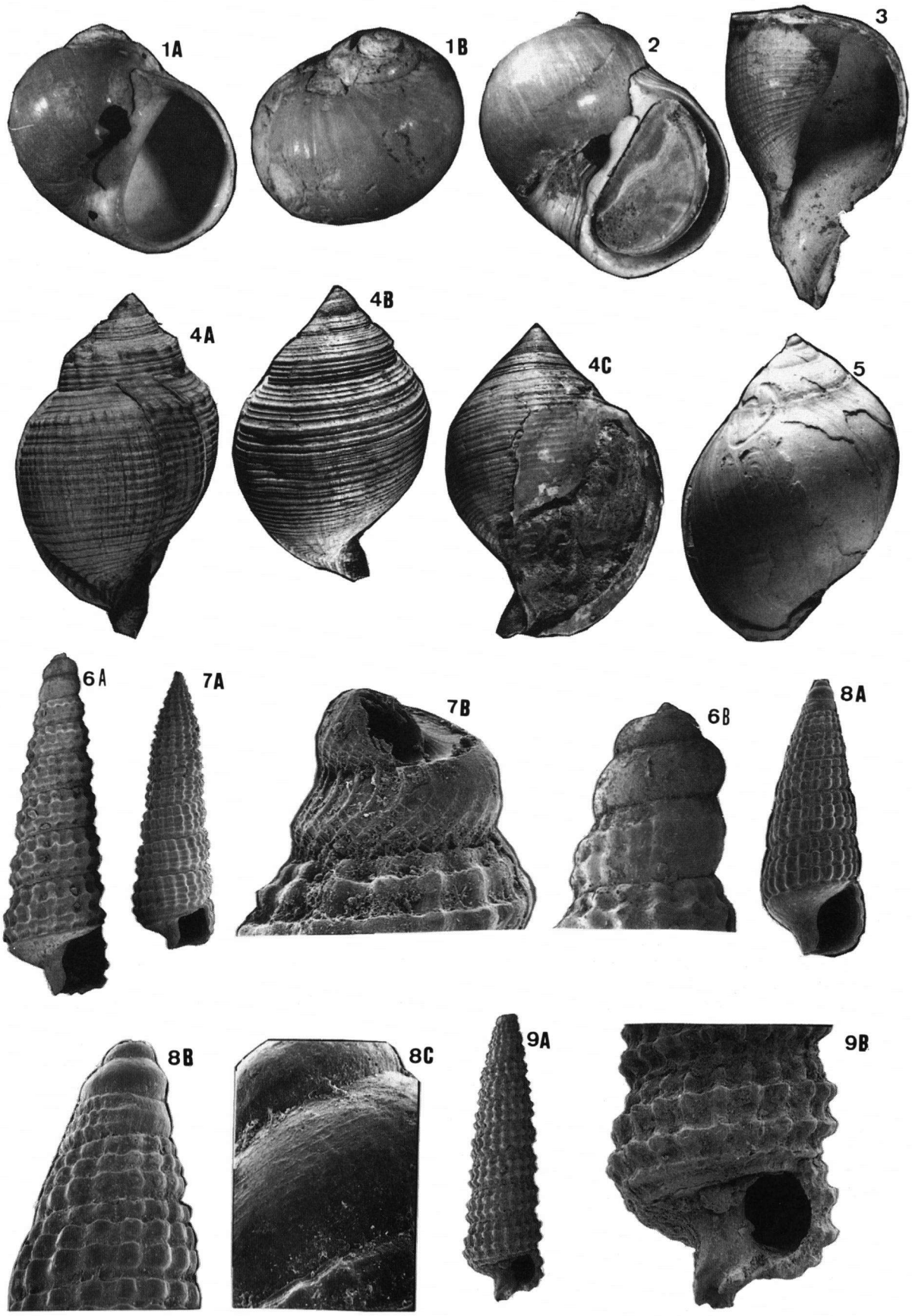

PLATE 4

Fig. 1. *Laiocochlis (L.) sinistrata* (Nyst, 1835), Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 3.5 (a) (van Nieulande Collection), x 36 (b) (SEM), KBIN collections, no. IRScNB IST 6258; same locality and layer.

Fig. 2. *Aclis ascaris* (Turton, 1819), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member), x 50 (SEM), KBIN collections, no. IRScNB IST 6259.

Fig. 3. *Acirsa (Hemiacirsa)* aff. *penepolaris* (Wood, 1872), Kallo (Vrasenedok), Kattendijk Formation ? (*ex situ*), x 5.4 (A. Ratinckx Collection).

Fig. 4. *Cirsotrema (C.) f. fimbriosum* (Wood, 1842), Kallo (Vrasenedok), Kattendijk Formation (*Similipecten* level), x 2.1 (Marquet Collection).

Fig. 5. *Cirsotrema (C.) funiculus* (Wood, 1872), Kallo (Vrasenedok), *ex situ*, x 2.5 (Marquet Collection).

Fig. 6. *Cirsotrema (C.) f. exfimbriosum* Sacco, 1891, Kallo (Vrasenedok), Lillo Formation (Oorderen Member, *Atrina* level), x 2.8 (Marquet Collection).

Fig. 7. *Epitonium f. frondiculum* (Wood, 1842), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 1.8 (Marquet Collection).

Fig. 8. *Epitonium subulatum* (J. de C. Sowerby, 1823), Kallo (Vrasenedok), Kattendijk Formation (*Similipecten* level), x 3 (Marquet Collection).

Fig. 9. *Epitonium foliaceum* (J. de C. Sowerby, 1823), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 2.6 (Marquet Collection).

Fig. 10. *Epitonium clathratulum minutum* (J. de C. Sowerby, 1823), Kallo (Zeesluis), Lillo Formation (Oorderen Member, *Atrina* level), x 2.6 (Marquet Collection).

Fig. 11. *Eulima (E.) glabra* (da Costa, 1778), Kallo (Verrebroekdok), Oorderen Sand (*Cultellus* level), x 4 (SEM), KBIN collections, no. IRScNB IST 6260.

Fig. 12. *Melanella alba* (da Costa, 1778), Kallo (Vrasenedok), *ex situ*, x 4 (Marquet Collection).

Fig. 13. *Vitreolina philippii* (Rayneval & Ponzi, 1854), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member), x 31 (SEM) (H. Keukelaar Collection).

Fig. 14. *Crinophteiros collinsi* (Sykes, 1903), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member), x 46 (SEM) (H. Keukelaar Collection).

PLATE 4

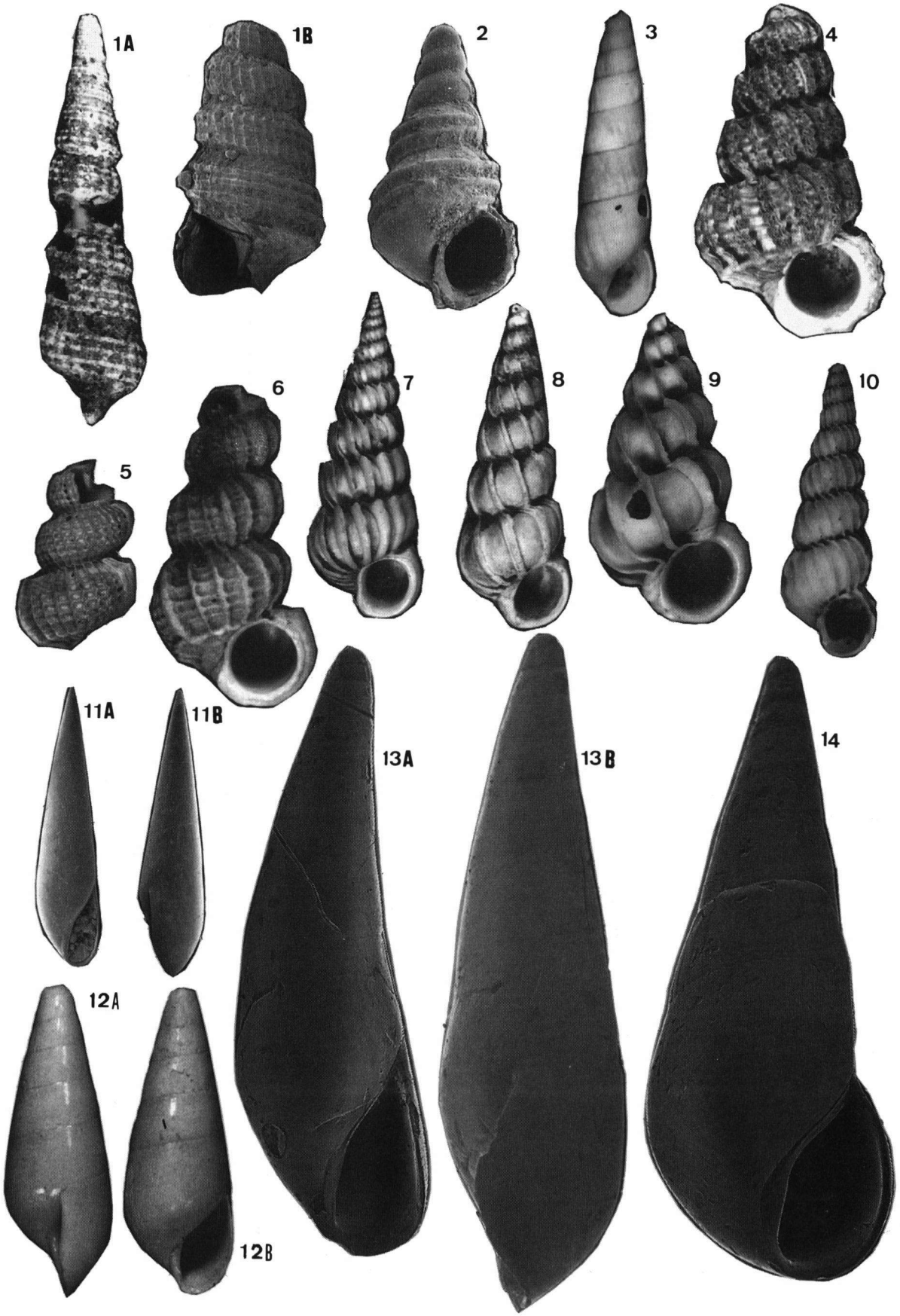

PLATE 5

Fig. 1. *Cerithiopsis barleei* Jeffreys, 1867, Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 85 (a, b); x 15 (c) (SEM), KBIN collections, no. IRScNB IST 6256.

Fig. 2. *Cerithiopsis nana* (Wood, 1848), Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 13 (a); x 110 (b); x 100 (c) (SEM), KBIN collections, no. IRScNB IST 6323.

Fig. 3. *Seila trilineata* (Philippi, 1836), Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 8 (a); x 38 (b) (SEM),

Fig. 4. *Pterynopsis binominatus* (Staadt *in* Cossmann, 1909), Kallo (Verrebroekdok), Lillo Formation (Oorderen Sand, *Cultellus*

Fig. 5. *Pterynotus canhami* (Wood, 1872), Kallo (Vrasenedok), Lillo Formation (Oorderen Sand, *Atrina* level), x 2 (a-c) (Marquet Collection).

PLATE 5

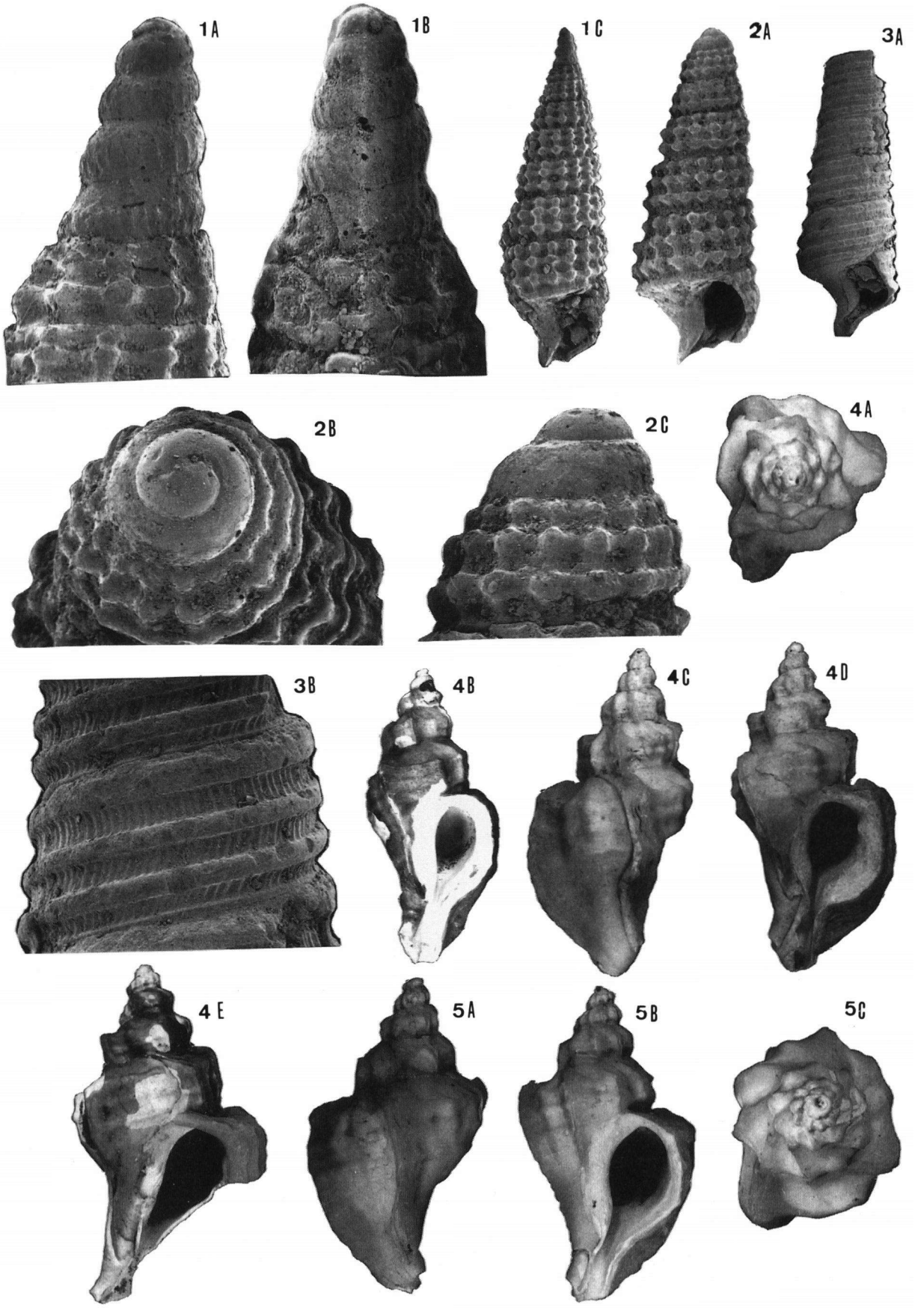

PLATE 6

Fig. 1. *Spinucella tetragona* (J. de C. Sowerby, 1825), a-c/f - Kallo (Vrasenedok), Lillo Formation (Oorderen Sand, *Atrina* level), x 1.3 (a-c); x 0.9 (f) (Marquet Collection); d, e - var. *vulgaris*, Kallo Verrebroekdok (*Cultellus* level), x 1.5 (d); x 1.3 (e) (Marquet Collection).

Fig. 2. *Trophon barvicensis* (Johnston, 1825), Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 4.6 (van Nieulande Collection).

Fig. 3. *Trophon muricatus* (Montagu, 1803), Kallo (zeesluis), Lillo Formation (Oorderen Sand, *Atrina* level), x 4.8 (Marquet Collection).

Fig. 4. *Scalaspira (S.) alveolata* (J. de C. Sowerby, 1829), Kallo (Vrasenedok), Lillo Formation (Kruisschans Member), x 2.2 (a); x 2.1 (b) (Marquet Collection).

Fig. 5. *Nucella incrassata* (J. de C. Sowerby, 1825), Kallo (Vrasenedok), Lillo Formation (Kruisschans Member), x 1.2 (a, b); x 1.1 (c) (Marquet Collection).

PLATE 6

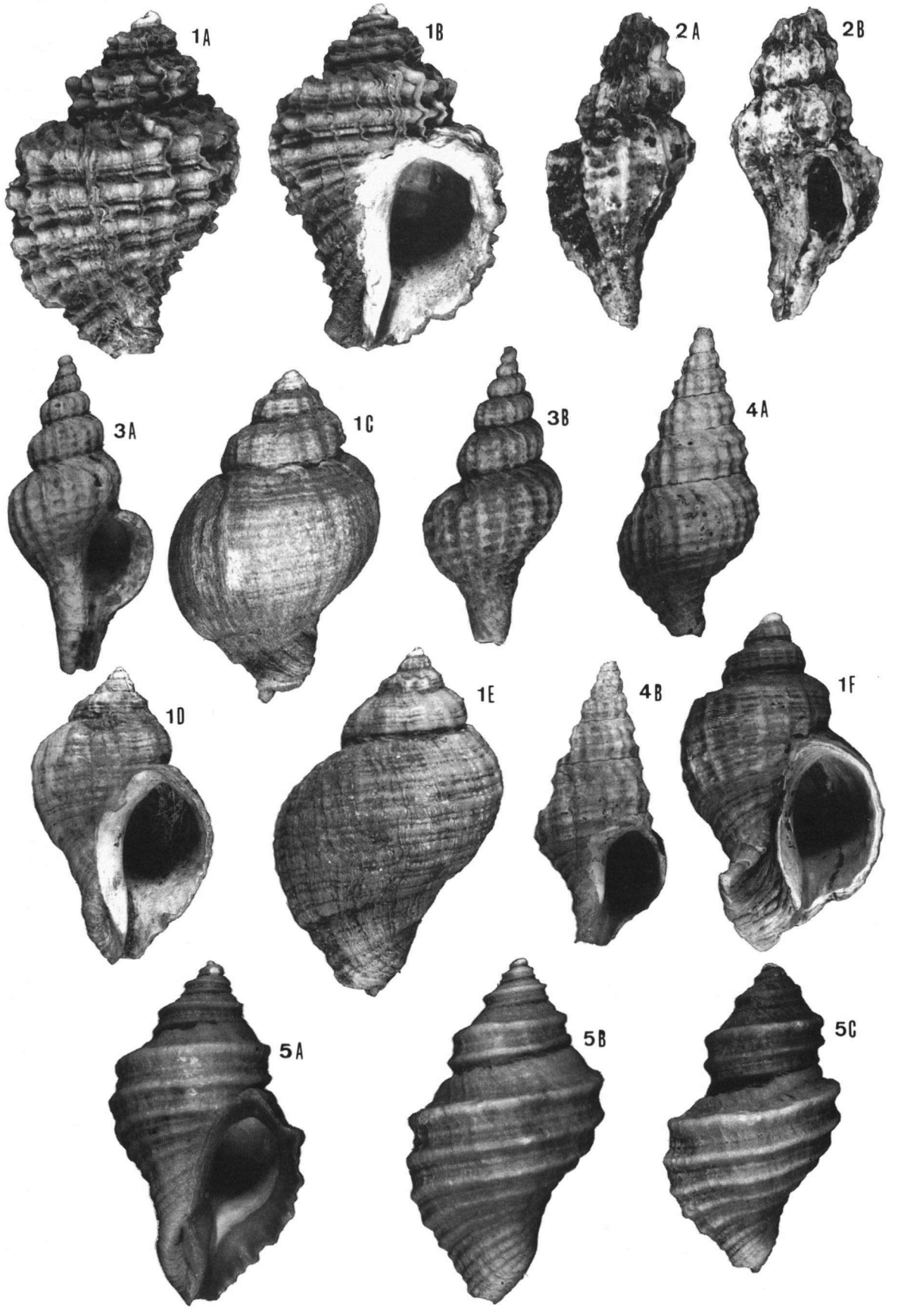

PLATE 7

Fig. 1. *Colus cordatus* (Bell, 1871); a - Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 2.3 (Marquet Collection); b - Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Atrina* level), x 18 (SEM), KBIN collections, no. IRScNB IST 6344.

Fig. 2. *Colus curtus* (Jeffreys, 1867), Kallo (Verrebroekdok), Lillo Formation (Kruisschans Member), x 1.1 (Marquet Collection).

Fig. 3. *Liomesus dalei* (J. de C. Sowerby, 1825), Kallo (Vrasenedok), Lillo Formation (Oorderen Member, *Atrina* level), x 1.1 (a) and x 0.8 (b) (Marquet Collection).

Fig. 4. *Neptunea (N.) striata lyratodespecta* Strauch, 1972, Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 0.7 (Marquet Collection).

Fig. 5. *Neptunea (N.) striata striata* (J. Sowerby, 1813), Kallo (Verrebroekdok); Lillo Formation (Kruisschans Member), x 0.7 (Marquet Collection).

Fig. 6. *Buccinum undatum* Linné, 1758, Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 0.6 (Marquet Collection).

Fig. 7. *Neptunea (Sulcosipho) angulata* (Wood, 1848), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level); a - adult specimen, x 0.62; b - juvenile specimen preserving protoconch, x 1.3 (Marquet Collection).

Fig. 8. *Amyclina labiosa* (J. de C. Sowerby, 1825), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 2.4 (a) and x 1.8 (b) (Marquet Collection).

Fig. 9. *Nassarius (Phrontis) kennardi* (Harmer, 1914), Kallo (Verrebroekdok), Lillo Formation (Kruisschans Member), x 3.3 (Marquet Collection).

Fig. 10. *Nassarius (Telasco) lamellilabrus* (Nyst, 1835), Kallo (Verrebroekdok); Lillo Formation (Oorderen Member, *Cultellus* level), x 3.4 (Marquet Collection).

Fig. 11. *Nassarius (Hinia) propinquus* (J. de C. Sowerby, 1825), Kallo (Verrebroekdok), Lillo Formation (Kruisschans Member), x 2.8 (a) and x 2.4 (b) (Marquet Collection).

Fig. 12. *Nassarius (Tritonella) dollfusi* (Harmer, 1914), Kallo (Vrasenedok), Lillo Formation (Oorderen Member, *Atrina* level), x 5.0 (a); x 5.0 (b) and x 27 (c), KBIN collections, no. IRScNB IST 6339.

PLATE 7

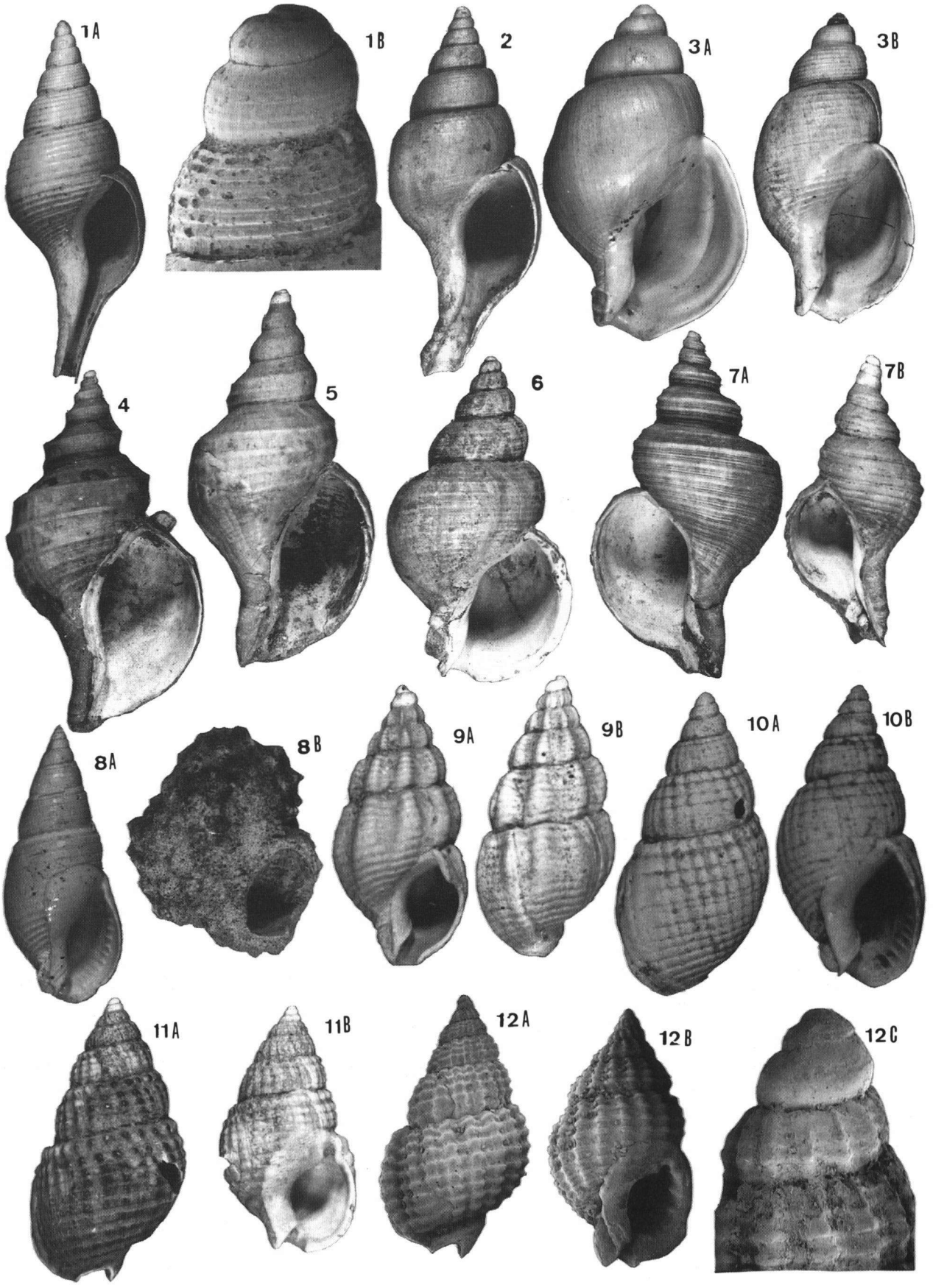

PLATE 8

Fig. 1. *Atractodon elegans* Charlesworth, 1837; a - Kallo (Vrasenedok), Lillo Formation (Oorderen Member, *Atrina* level), x 0.56 (Marquet Collection); b - Kallo (Vrasenedok), Kattendijk Formation, x 1 (Marquet Collection).
Fig. 2. *Fusinus longiroster* (Brocchi, 1814), Kallo (Vierde Havendok), Lillo Formation (Oorderen Member, *Atrina* level), x 0.9 (A. Janse Collection).
Fig. 3. *Mitrella scaldensis* (van Regteren Altena, 1956b), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 4.2 (Marquet Collection).
Fig. 4. *Cancellaria (Merica) harmeri* Glibert, 1960, Kallo (Vrasenedok), Lillo Formation (Oorderen Member, *Atrina* level), x 2.6 (Marquet Collection).
Fig. 5. *Scaphella (S.) lamberti* (J. Sowerby, 1816), Kallo (Vrasenedok), Lillo Formation (Oorderen Member; a - basal crag; b - *Cultellus* level; c - level unknown, x 0.4, x 0.67 and x 0.7, respectively) (Marquet Collection).
Fig. 6. *Anachis anglica* (Bell *in* Wood, 1874), Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 16 (SEM) (L. Ceulemans Collection).
Fig. 7. *Vexillum (Pusia) ebenus* (Lamarck, 1811), Antwerp (Noordkasteel), Kattendijk Formation (*Ditrupa* level), x 2.4 (Marquet Collection).
Fig. 8. *Sveltia jonkairiana* (Nyst, 1835), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 2 (Marquet Collection).
Fig. 9. *Babylonella gracilenta* (Wood, 1872), Kallo (Vrasenedok), Lillo Formation (Oorderen Member, *Atrina* level); x 60 (a); x 4.6 (b, c); x 80 (d), KBIN collections, no. IRScNB IST 6338.
Fig. 10. *Trigonostoma u. umbilicare* (Brocchi, 1814), Kallo (Vrasenedok), *ex situ*, x 3 (Marquet Collection).

PLATE 8

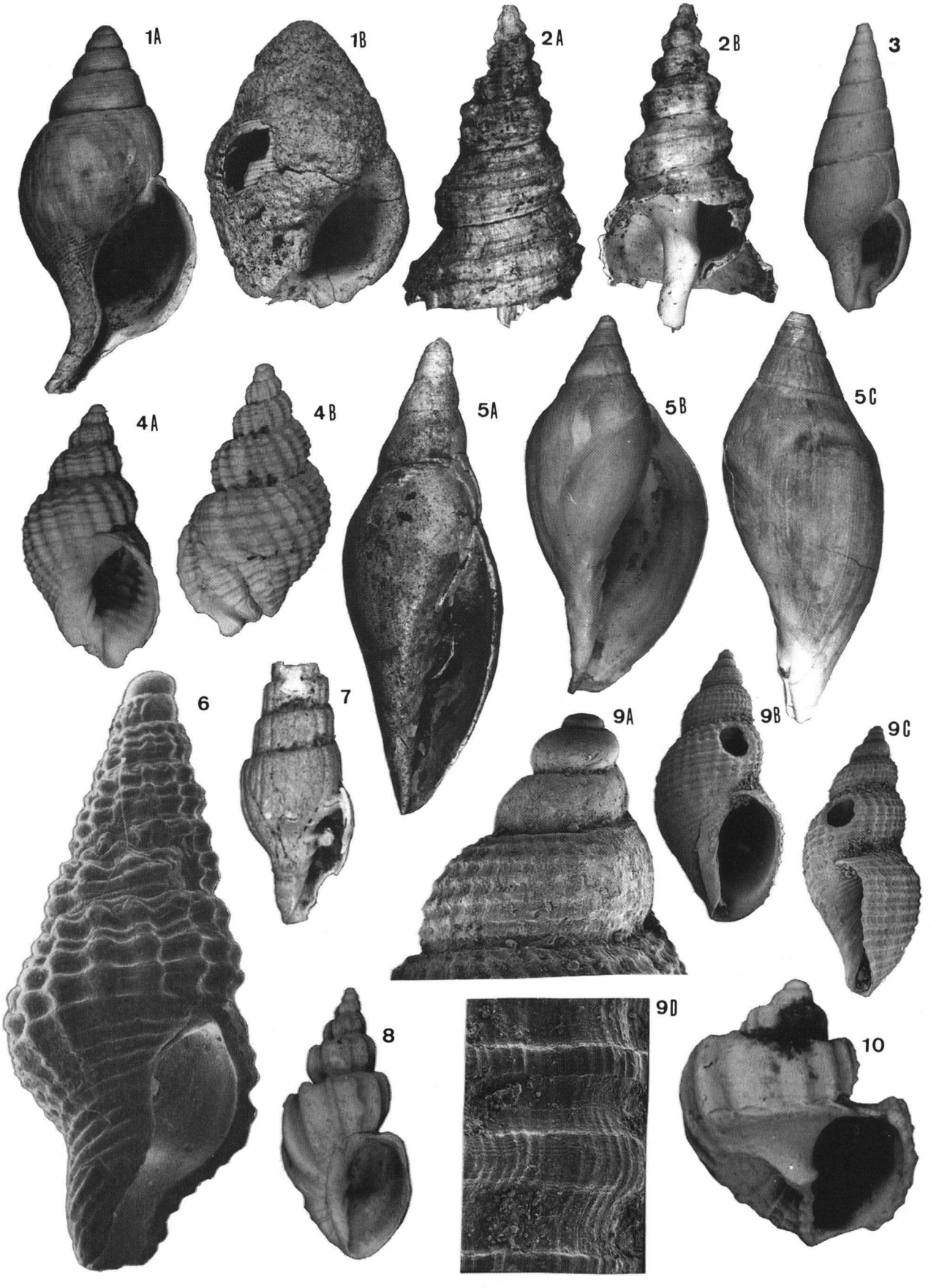

PLATE 9

Fig. 1. *Babylonella fusiformis subangulosa* (Wood, 1848), Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 25 (a); x 70 (b) and x 130 (c) (SEM), KBIN collections, no. IRScNB IST 6337.
Fig. 2. *Terebra inversa harmeri* Glibert, 1960, Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 2.5 (Marquet Collection).
Fig. 3. *Terebra canalis* Wood, 1848, Kallo (Vrasenedok), Lillo Formation (Oorderen Member, *ex situ*), x 3.7 (Marquet Collection).
Fig. 4. *Terebra i. inversa* Nyst, 1843, Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 2.5 (Marquet Collection).
Fig. 5. *Pyramidella plicosa* Bronn, 1838, Zonderschot (Heist-op-den-Berg, province of Antwerp), Berchem Formation, Miocene (Zonderschot Member), x 9 (SEM), KBIN collections, no. IRScNB IST 6345.
Fig. 6. *Pyramidella plicosa* Bronn, 1838, Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 7 (SEM), KBIN collections, no. IRScNB IST 6346.
Fig. 7. *Pyramidella laeviuscula* Wood, 1842, Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 11 (SEM), KBIN collections, no. Coll. IRScNB IST 6347.
Fig. 8. *Pyramidella laeviuscula* Wood, 1842, Antwerp (Schijnpoort), Kattendijk Formation (*Ditrupa* level), x 11 (SEM), KBIN collections, no. IRScNB IST 6348.
Fig. 9. *Eulimella (E.) laevis* (Brown, 1827), Kallo (Vrasenedok), Lillo Formation (Oorderen Member, *Atrina* level), x 13 (a); x 100 (b) (SEM), KBIN collections, no. IRScNB IST 6349.
Fig. 10. *Menestho britannica* Bell, 1871, Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 14 (a, b); x 80 (c); x 37 (d) (SEM), KBIN collections, no. IRScNB IST 6350.
Fig. 11. *Brachystomia albella* (Lovén, 1846), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 22 (a); x 40 (b)(SEM), KBIN collections, no. IRScNB IST 6351.
Fig. 12. *Chrysallida stefanisi* (Jeffreys, 1869), Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 19 (a); x 70 (b) (SEM), KBIN collections, no. IRScNB IST 6341.
Fig. 13. *Anisocycla nitidissima* (Montagu, 1803), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Atrina* level), x 150 (a); x 30 (b) (SEM), KBIN collections, no. IRScNB IST 6352.

PLATE 9

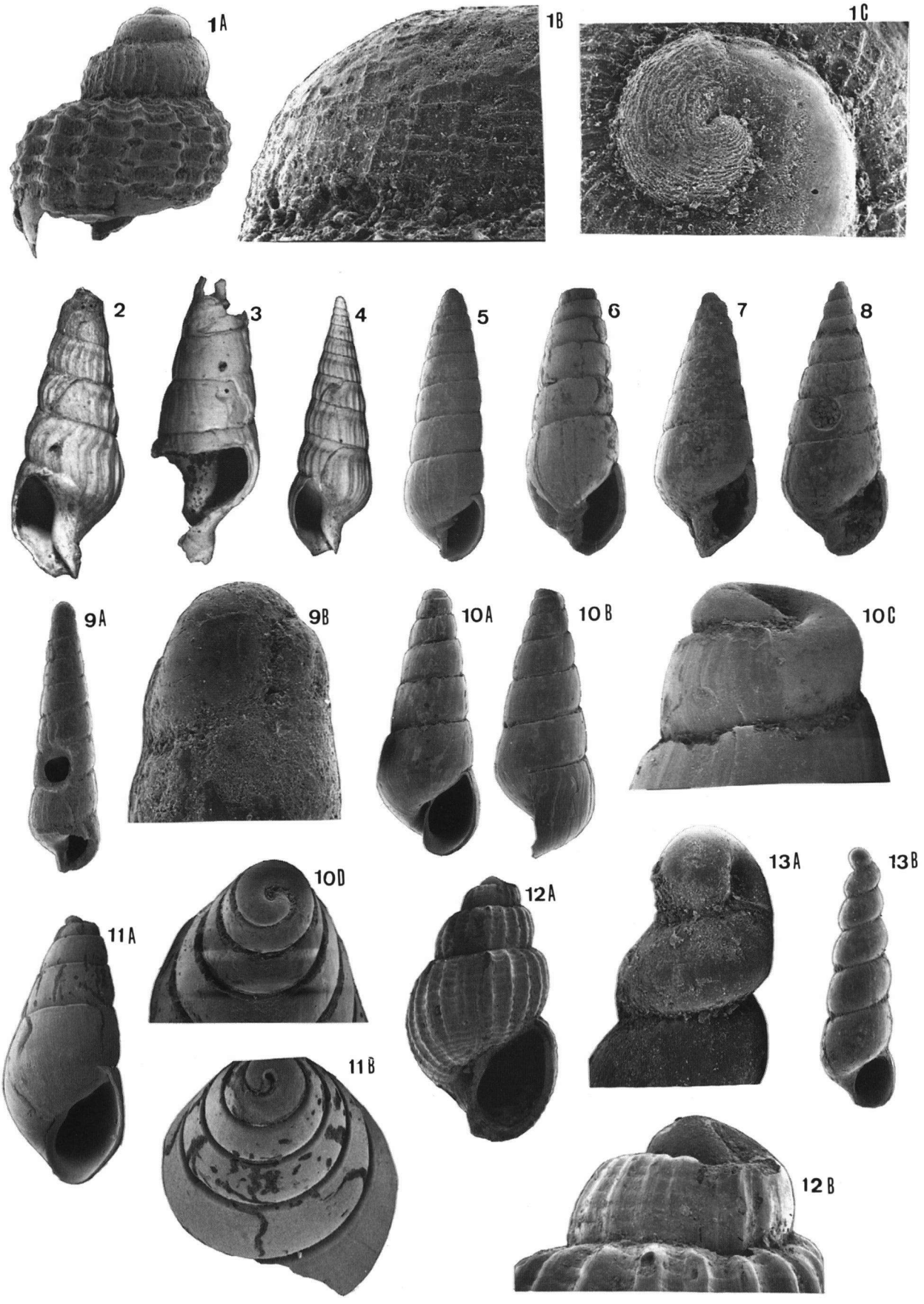

PLATE 10

Fig. 1. *Brachystomia cerullii* nov. nom., Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level, basal crag), x 29 (a, b); x 80 (c, d) (SEM), KBIN collections, no. IRScNB IST 6342.

Fig. 2. *Ondina obliqua* (Alder, 1844), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member), x 80 (a); x 60 (b), x 35 (c, d) (SEM), KBIN collections, no. IRScNB IST 6353.

Fig. 3. *Ondina divisa* (J. Adams, 1797), Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 29 (a, b); x 60 (c) (SEM), KBIN collections, no. IRScNB IST 6340.

Fig. 4. *Turbonilla (Pyrgolidium) internodula* (Wood, 1848), Kallo (Vrasenedok), Lillo Formation (Oorderen Member, *Atrina* level), x 5 (a); x 70 (b) (SEM), KBIN collections, no. IRScNB IST 6333.

Fig. 5. *Turbonilla (Mormula) kendalli* Bell *in* Harmer, 1920, Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 15 (SEM), KBIN collections, no. IRScNB IST 6354.

Fig. 6. *Turbonilla (Pyrgiscus) senistriata* (Wood, 1879), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 14 (a); x 70 (b) (SEM), KBIN collections, no. IRScNB IST 6355.

Fig. 7. *Phasianema zelandicum* (Bloklander, 1949), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 4.1 (Marquet Collection).

Fig. 8. *Acteon noae* J. de C. Sowerby, 1823, Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level, x 2.2 (Marquet Collection).

Fig. 9. *Acteon tornatilis* (Linné, 1758), Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 6 (SEM), KBIN collections, no. IRScNB IST 6356.

Fig. 10. *Acteon levidensis* Wood, 1842, Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level, basal crag), x 70 (a, b); x 20 (c) (SEM), KBIN collections, no. IRScNB IST 6336.

PLATE 10

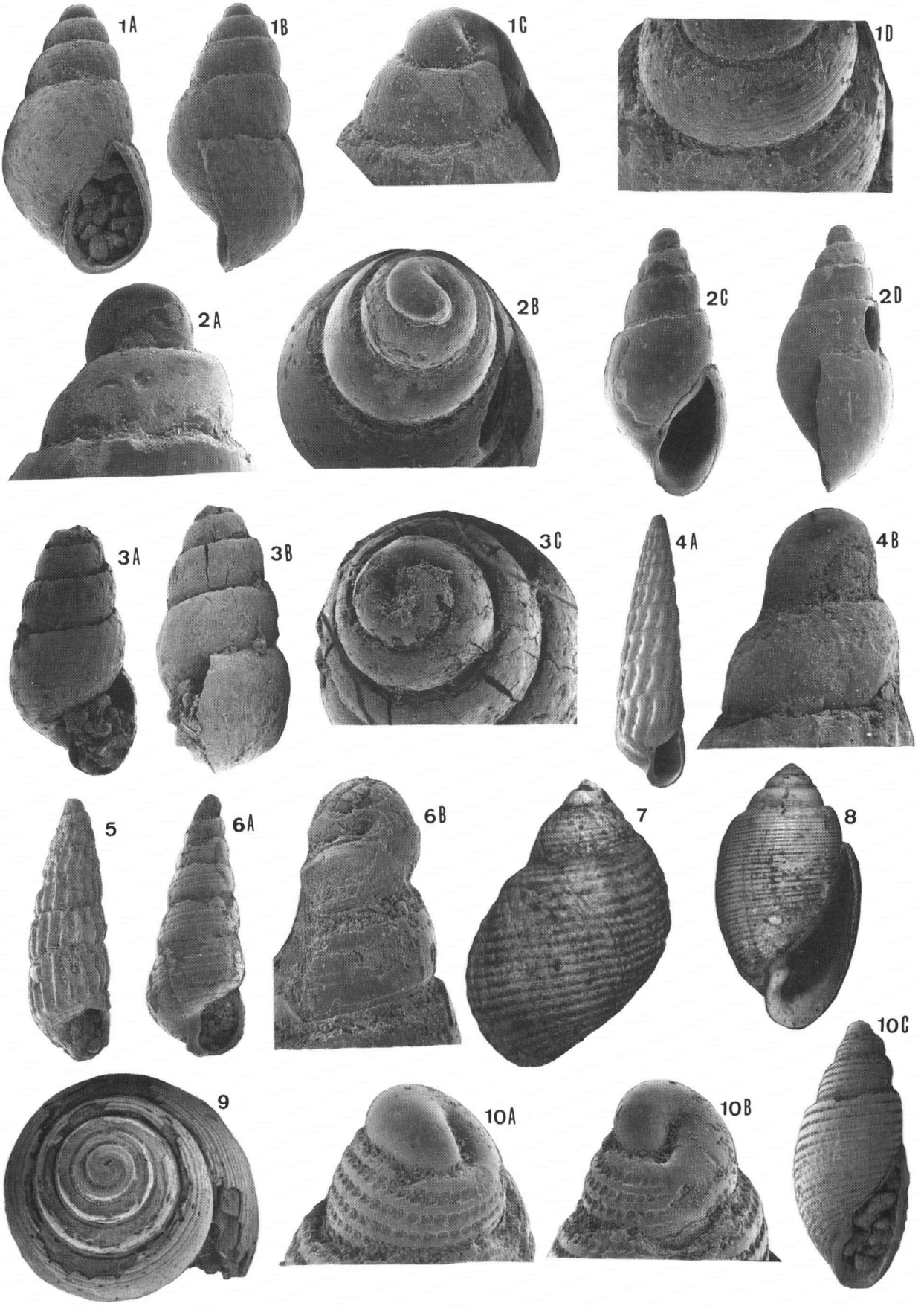

PLATE 11

Fig. 1. *Acteon tornatilis* (Linné, 1758), Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 7 (SEM), KBIN collections, no. IRScNB IST 6356.

Fig. 2. *Acteon subulatus* Wood, 1842, Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 7 (a); x 12 (b)(SEM), KBIN collections, no. IRScNB IST 6357.

Fig. 3. *Ringicula buccinea* (Brocchi, 1814), Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 6 (SEM), KBIN collections, no. IRScNB IST 6335.

Fig. 4. *Cylichnina concinna* (Wood, 1839), Kallo (Vrasenedok), Kattendijk Formation (*Petaloconchus* bed), x 18 (a); x 20 (b) (SEM), KBIN collections, no. IRScNB IST 6358.

Fig. 5. *Cylichnina elongata conuloidea* (Wood, 1851), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 13 (a); x 30 (b) (SEM), KBIN collections, no. IRScNB IST 6359.

Fig. 6. *Scaphander lignarius* (Linné, 1758), Kallo (Vrasenedok), Lillo Formation (Oorderen Member, *Atrina* level), x 6 (Marquet Collection).

Fig. 7. *Volvulella acuminata* (Bruguière, 1792), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 15 (a); x 38 (b) (SEM), KBIN collections, no. IRScNB IST 6360.

Fig. 8. *Cylichna (C.) cylindracea* (Pennant, 1777), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 5 (a); x 25 (b); x 125 (c) (SEM), KBIN collections, no. IRScNB IST 6332.

Fig. 9. *Roxania (R.) utriculus* (Brocchi, 1814), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 30 (a); x 5 (b) (SEM), KBIN collections, no. IRScNB IST 6334.

Fig. 10. *Ellobium pyramidale* (J. de C. Sowerby, 1823), Kallo (Zeesluis), Lillo Formation (Oorderen Member, basal crag), x 2 (Marquet Collection).

Fig. 11. *Cepaea (C.) haesendoncki* (Nyst, 1843), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member), x 9.6 (a); x 3.4 (b) (Marquet Collection).

Fig. 12. *Limacina atlanta* (Mörch, 1874), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 70 (SEM), KBIN collections, no. IRScNB IST 6361.

PLATE 11

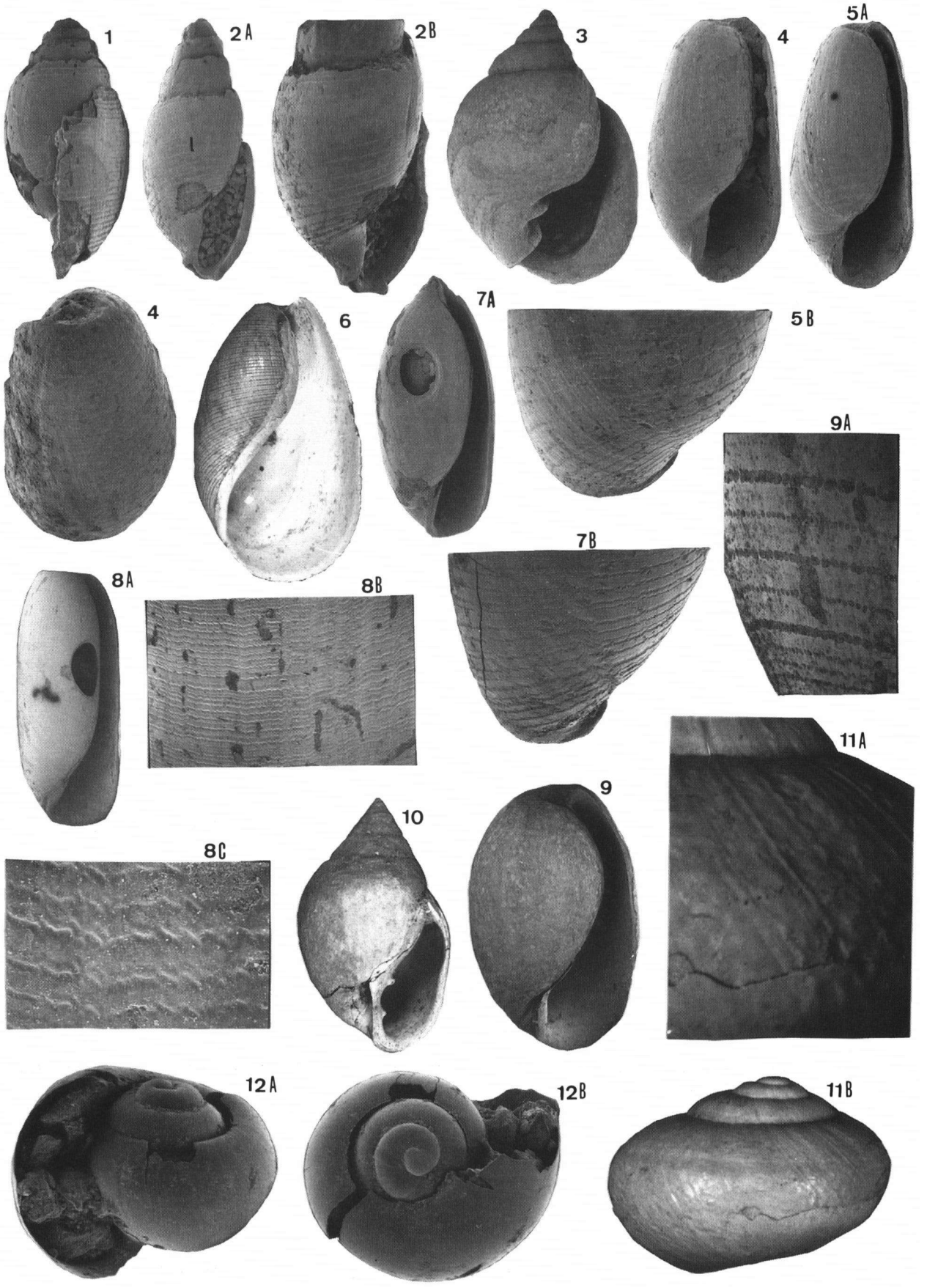

PLATE 12

Fig. 1. *Diaphana minuta* Brown, 1827, Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Atrina* level), x 40 (a); x 60 (b); x 100 (c); x 230 (d), KBIN collections, no. IRScNB IST 6362.

Fig. 2. *Philine denticulata* (J. Adams, 1800), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Atrina* level), x 10 (a); x 11 (b) (SEM), KBIN collections, no. IRScNB IST 6363.

Fig. 3. *Philine ventrosa* (Wood, 1839), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 10 (a, b); x 13.5 (c); x 37 (d) (SEM), KBIN collections, no. IRScNB IST 6364.

Fig. 4. *Philine scabra* (Müller, 1776), Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Cultellus* level), x 5.8 (A. Ratinckx Collection).

Fig. 5. *Nassarius (Uzita) reticosus* (J. Sowerby, 1816), a - Kallo (Verrebroekdok), Lillo Formation (Oorderen Member, *Atrina* level), x 1.1 (Marquet Collection); b - Kallo (Verrebroekdok), Lillo Formation (Kruisschans Member), x 2.0 (Marquet Collection); c-e - Kallo (Verrebroekdok), Lillo Formation (Kruisschans Member), x 16, x 27 and x 23, respectively (SEM), KBIN collections, no. IRScNB IST 6343.

PLATE 12