

# The genus *Arctica* Schumacher, 1817 (Bivalvia, Arctidae) in the Rupelian (Oligocene) of Belgium, with description of a new species

Ronald Pouwer

Naturalis Biodiversity Center, Darwinweg 2, 2333 CR Leiden, The Netherlands; email: ronald.pouwer@naturalis.nl

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The *Arctica* species of the Rupelian (Oligocene) of Belgium are reviewed. *Arctica rotundata* (Agassiz, 1845) displays an extreme variation in shape. *Arctica bergensis* nov. sp., a species with a remarkably large and heavy shell, is described as new. A paired specimen of the new species contained a large cyst pearl, possibly the first record of such a pearl in Arctidae.

KEY WORDS: *Arctica*, new species, pearl, Oligocene, Rupelian, North Sea Basin

## Introduction

In the northwestern European Cainozoic a limited number of species of the genus *Arctica* Schumacher, 1817 occurs, with *Arctica islandica* (Linnaeus, 1767) being the only surviving one. From Oligocene deposits only *Arctica rotundata* (Agassiz, 1845) has been documented (e.g. Neuffer, 1973). In the 1970s extensive collecting was carried out at various localities in Belgium by the staff of the former Rijksmuseum van Geologie en Mineralogie (nowadays part of Naturalis Biodiversity Center) and private collectors. Already at that time it became clear that two distinct species occurred in the Berg Member (Oligocene, Rupelian; Bilzen Formation). Neither species could be attributed to one of the known Oligocene or Eocene species. The first species has a tumid shell with a typically elongated posterior end. It was regarded to be an undescribed species by the museum staff and some private collectors. The other species has a remarkably large and heavy shell and was identified as *Arctica rotundata* in various collections (e.g. A.W. Janssen, F.A.D. van Nieulande, J.G.M. Raven) and publications (e.g. Hessel, 2018). In 1991 a series of shells of the first species was collected from the Rupelian Kerniel Member (Bilzen Formation) by the private collector Marcel Vervoenen, showing great variability in shape. This material, recently donated to Naturalis, proved to be crucial for this revision of the *Arctica* species of the Early Oligocene of Belgium.

## Abbreviations:

RGM Naturalis Biodiversity Center, collection Cainozoic Mollusca (Leiden, The Netherlands).  
L Length  
H Height  
S Semidiameter of a single valve (convexity).

## Systematic part

Family Arctidae R.B. Newton, 1891

Genus *Arctica* Schumacher, 1817

*Type species* – *Arctica vulgaris* Schumacher, 1817 [= *Arctica islandica* (Linnaeus, 1767)]

## *Arctica rotundata* (Agassiz, 1845)

Plates 1-3, figs 1-8

- 1836 *Cyprina islandicoïdes* Lamk. – Nyst, p. 147 (*partim*).
- 1843 *Cyprina Islandica* Linn. var. A – Nyst, p. 146, pl. XI, fig. 1 (*partim*).
- \*1845 *Cyprina rotundata* Braun – Agassiz, p. 53, pl. 14.
- 1863 *Cyprina rotundata* A. Braun – Sandberger, p. 313, pl. 25, fig. 1, 1a-b
- 1943 *Cyprina rotundata* Braun – Albrecht & Valk, p. 127, pl. 13, figs 423-426.
- 1944 *Cyprina rotundata* A. Braun – Heering, p. 28, pl. 3, figs 3-11.
- 1952 *Cyprina rotundata* Agassiz, 1845 – Görges, p. 38.
- 1954 *Cyprina rotundata* Braun, 1845 – Glibert & De Heinzelin, p. 330; p. 390, table XI.
- 1957 *Cyprina rotundata* (Braun) Agassiz, 1845 – Glibert, p. 31, pl. VI, fig. 18.
- 1973 *Arctica islandica rotundata* (Agassiz, 1845) – Neuffer, p. 73, pl. 8, figs 1a-b, 2.
- 1979 *Arctica islandica rotundata* (Agassiz, 1845) – Janssen, p. 118, pl. 4, fig. 64.
- 1995 *Arctica rotundata* – Vervoenen, figs 52 & 55.

- 2012 *Arctica islandica rotundata* (Agassiz, 1845) – Marquet *et al.*, pl. 20, fig. 3.  
 non 2018 *Arctica islandica rotundata* (Agassiz, 1845) – Hessel, pl. 1, figs 1 & 11 (= *Arctica bergensis* sp. nov.).

**Material** – **Vliermaal** (Kortesseem municipality, province of Limburg, Belgium), Mommen quarry (c. 50.838°N, 5.428°E); Oligocene, Rupelian; Bilzen Formation, Berg Member: RGM.1362971 (bivalved specimen) (Fig. 1), RGM.1362972 (right valve) (leg. F.A.D. van Nieulande, 1978); RGM.1362967.a (left valve), RGM.1362967.b (right valve) (leg. M. Vervoenen, 1976). **Vliermaal** (Kortesseem municipality, province of Limburg, Belgium), Mommen quarry (c. 50.838°N, 5.428°E); Oligocene, Rupelian; Bilzen Formation, Berg Member, Horizon with *Callista kickxi*: RGM.1404995 (left valve) (Fig. 2) (leg. A.W. Janssen, 1975). **Berg** (Bilzen municipality, province of Limburg, Belgium), temporary excavation in the Keistraat (50.8464°N, 5.5477°E); Oligocene, Rupelian; Bilzen Formation, Berg Member, horizon with *Astarte trigonella* (=upper shell layer): RGM.794167 (30 valves), RGM.1362968 (left valve), RGM.1362969 (right valve) (Fig. 3) (leg. M. van den Bosch & A.W. Janssen, 1971). **Kleine-Spouwen** (Bilzen municipality, province of Limburg, Belgium), temporary excavation in the Koestraat; Oligocene, Rupelian; Bilzen Formation, Berg Member, horizon with *Astarte trigonella* (=upper shell layer): RGM.1363096 (7 defect valves, 2 fragments) (leg. M. van den Bosch). **Gellik** (Lanaken municipality, province of Limburg, Belgium), earthworks for widening Albertkanaal; Oligocene, Rupelian; Bilzen Formation, Kerniel Member: RGM.1362974 (left valve) (Fig. 7), RGM.1362975 (left valve) (Fig. 6), RGM.1362976 (left valve), RGM.1362977 (right valve), RGM.1362978 (right valve), RGM.1362979 (right valve) (Fig. 5), RGM.1362980 (right valve), RGM.1362981 (left valve), RGM.1362982 (right valve) (Fig. 4), RGM.1362983 (4 left & 4 right valves, 1 juvenile paired specimen) (leg. M. Vervoenen, 1991). **Ruisbroek** (province of Antwerpen, Belgium), Rupeltunnel construction pit (51.0820°N, 4.3527°E); Oligocene, Rupelian; Bilzen Formation, Berg Member: RGM.1405517 (5 fragments) (leg. M. Vervoenen, 1973). **Temse** (province of Oost-Vlaanderen, Belgium), claypit; Oligocene, Rupelian; Rupel Formation, Boom Clay Member: RGM.1495518 (6 fragments) (leg. M. Vervoenen). **Schelle** (province of Oost-Vlaanderen, Belgium), claypit (c. 51.119°N, 4.350°E); Oligocene, Rupelian; Rupel Formation, Boom Clay Member: RGM.1495519 (12 fragments) (leg. M. Vervoenen).

**Description** – Solid, tumid, fairly thick-walled shell with a

length of up to 95 mm, usually clearly longer than high, but sometimes nearly as high as long. The prominent, slightly inwards curved umbo is situated close to the anterior margin, giving the shell a distinct oblique shape. The posterior end of the shell is usually elongate and biangular. The angle between the dorsal margin and the posterior margin is stronger than that between the posterior and ventral margin. In shells with a low length-height ratio the posterior end is hardly or not elongated and the angles in the posterior margin are weaker. The lunula is very poorly developed, not impressed and only in few specimens indicated by a faint circumference. The complete outer surface of the shell has a fine sculpture of commarginal lines of variable strength, maybe all being growth lines.

The base of the hinge plate is strongly curved. The right valve has three cardinal teeth. The anterior cardinal tooth is relatively small. The other two cardinals are interconnected by a concave, triangular field, forming what seems to be one very large bifid cardinal tooth. There is a thick, elongate posterior lateral tooth, situated just in front of the posterior muscle scar. In front of the cardinal teeth there is a small triangular field with a crenulated knob, which can be regarded as a reduced or modified anterior lateral tooth.

The left valve has one quite small but prominent triangular anterior cardinal tooth. Behind is a broad triangular depression to accommodate the composite cardinals of the right valve. Above this depression a long, thin posterior cardinal tooth is present. There is a posterior lateral tooth, which is fused with the shell margin and therefore hardly recognizable as such. In dorsal view this part of the shell margin is sticking out. This tooth fits in the groove between the posterior lateral and the dorsal margin in the right valve. In front of the anterior cardinal tooth there is a deep pit, and in front of that a small triangular field with a crenulated knob, equal to that in the right valve.

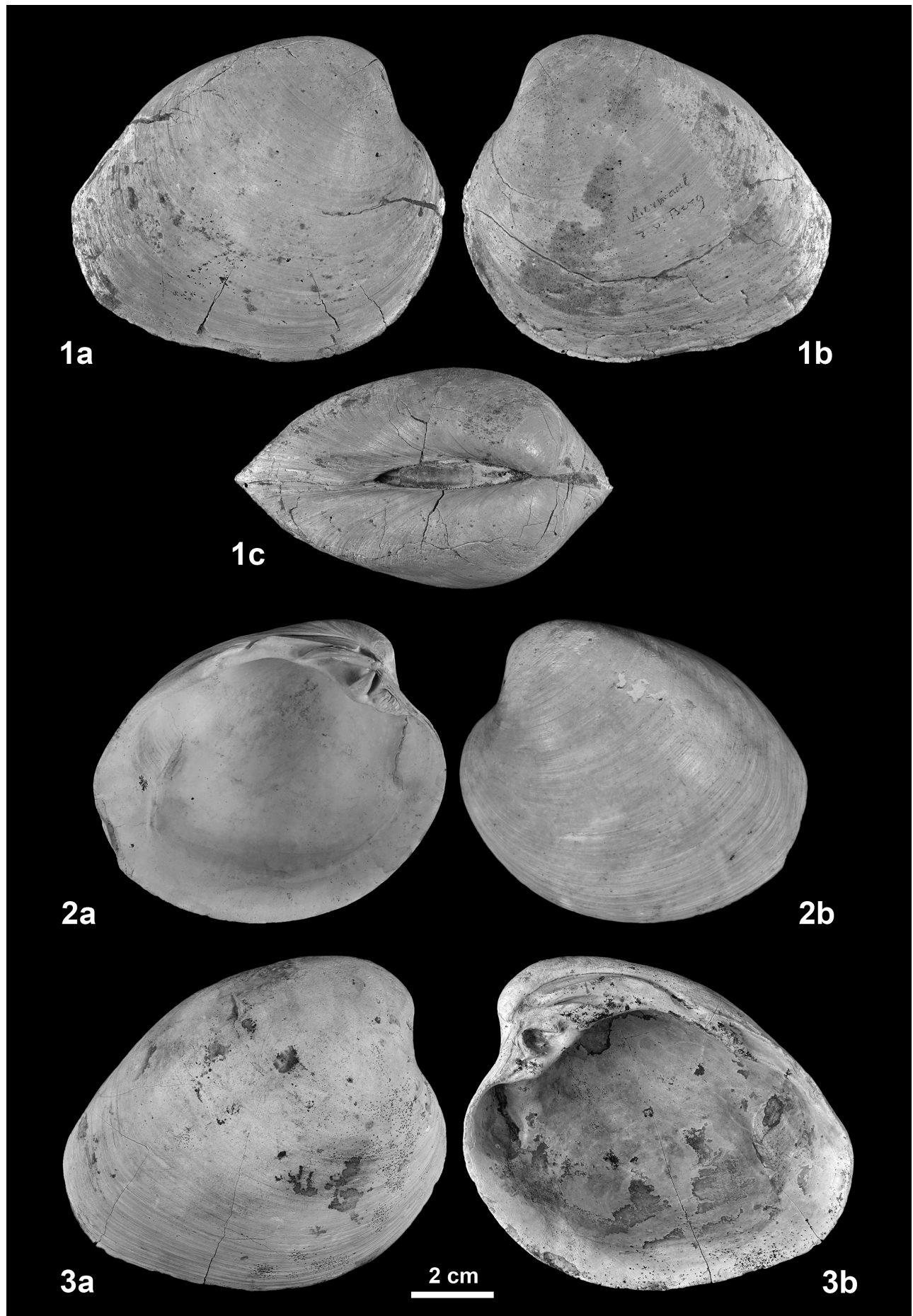
The nymph is long and elongated, slowly widening posteriorly. In a paired specimen the thick external ligament is preserved (Fig. 1).

There are two muscle scars, the anterior one very clear and deeply impressed, the posterior one less prominent. The pallial line is not very clear. It bends slightly inwards below the posterior muscle scar, without forming a true sinus.

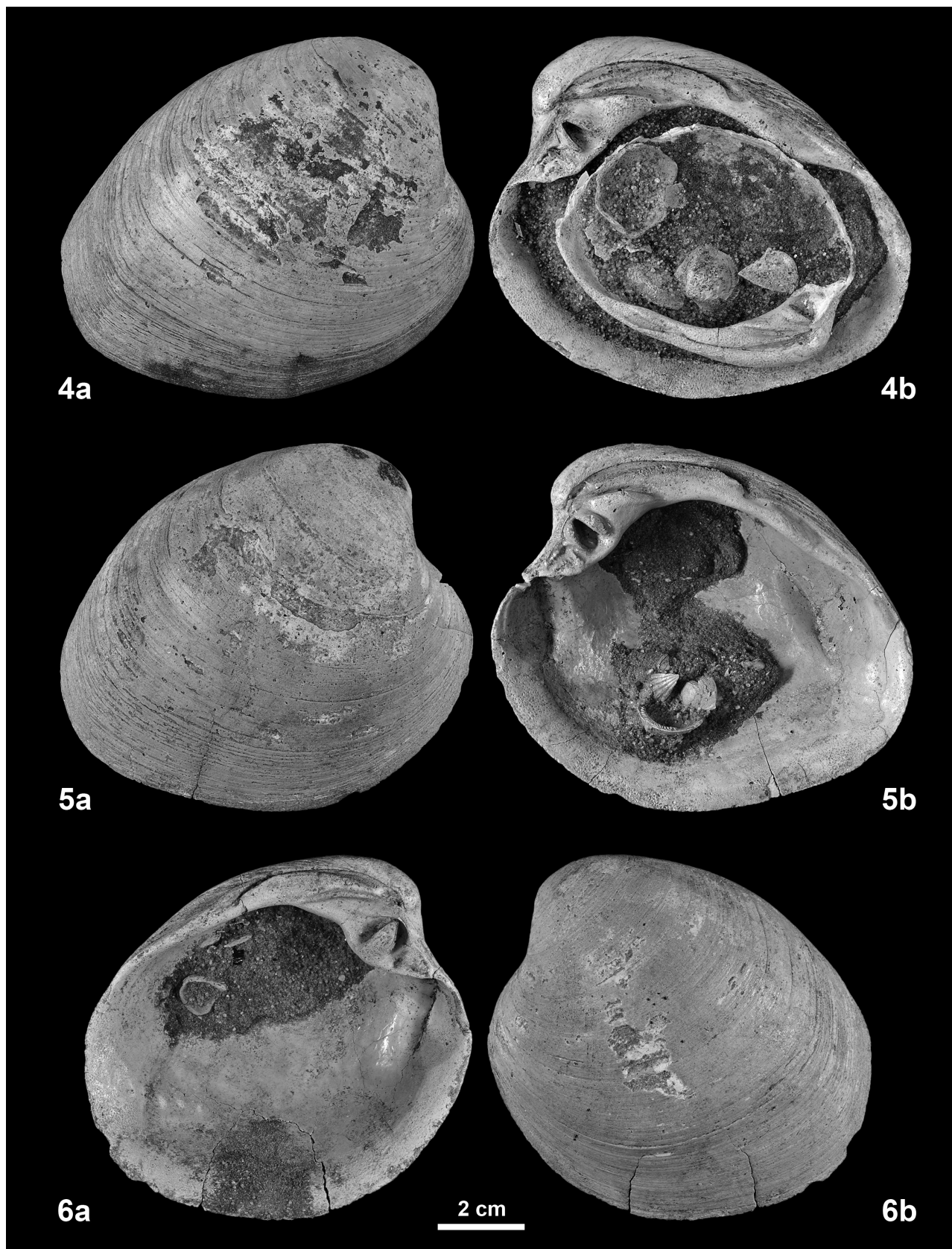
**Discussion** – In the Berg Member (early Rupelian) this species has a much more elongated outline than the specimens from the type area of the Mainz Basin (Germany), where it can be found in the Alzey Formation (late Rupelian) (Fig. 8). Soon after the discovery in 1971 of a large series of well-preserved specimens at an excavation

## Plate 1

1. *Arctica rotundata* (Agassiz, 1845). Vliermaal (Kortesseem municipality, province of Limburg, Belgium), Mommen quarry, leg. F.A.D. van Nieulande (1978); Bilzen Formation, Berg Member; Oligocene, Rupelian, RGM.1362971.
2. *Arctica rotundata* (Agassiz, 1845). Vliermaal (Kortesseem municipality, province of Limburg, Belgium), Mommen quarry, leg. A.W. Janssen (1975); Bilzen Formation, Berg Member, Horizon with *Callista kickxi*; Oligocene, Rupelian, RGM.1404995.
3. *Arctica rotundata* (Agassiz, 1845). Berg (Bilzen municipality, province of Limburg, Belgium), Keistraat, leg. M. van den Bosch & A.W. Janssen (1971); Bilzen Formation, Berg Member, horizon with *Astarte trigonella* (=upper shell layer); Oligocene, Rupelian, RGM.1362969.







**Plate 2**

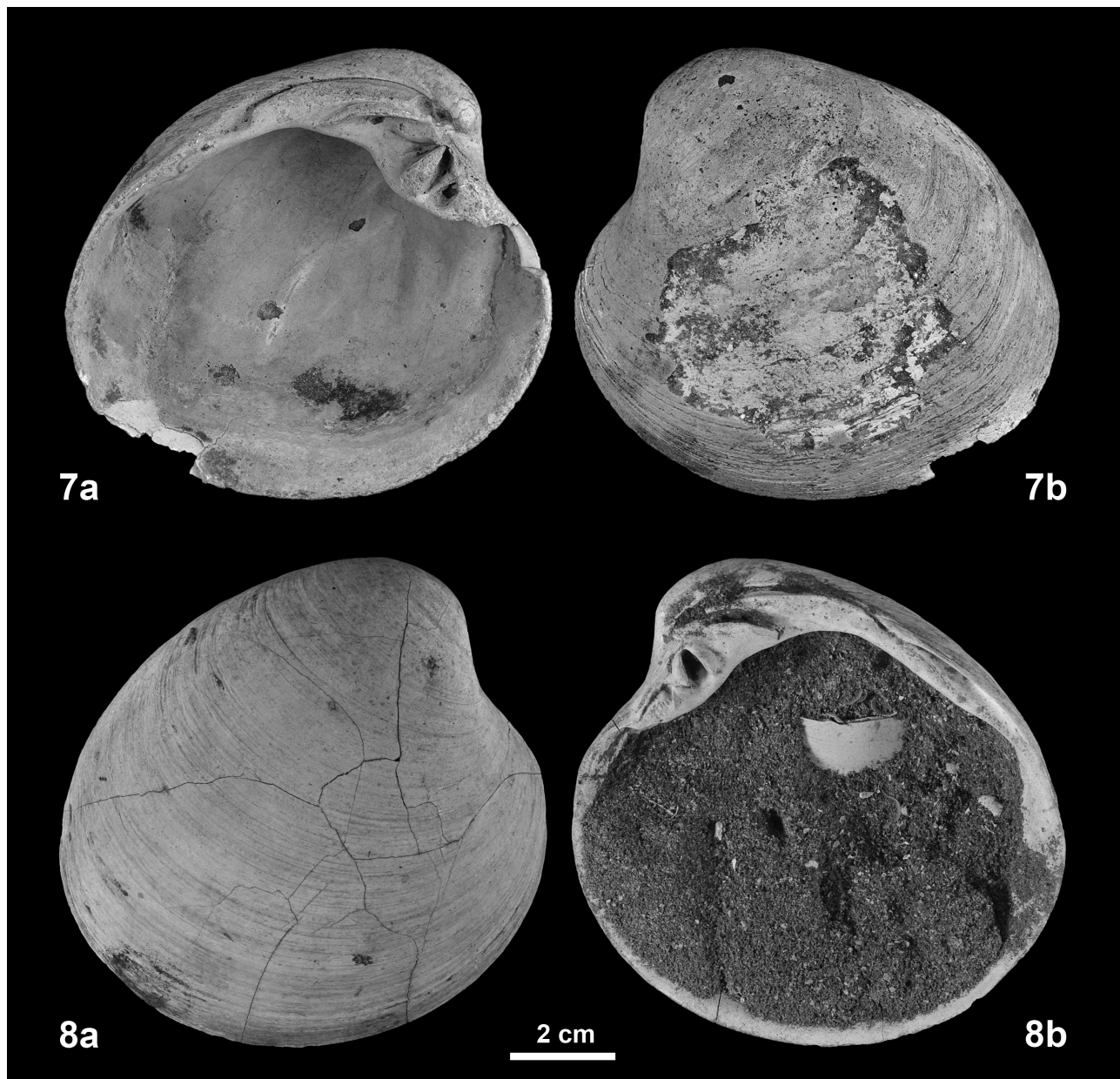
4-6. *Arctica rotundata* (Agassiz, 1845). Gellik (Lanaken municipality, province of Limburg, Belgium), earthworks for widening Albertkanaal, leg. M. Vervoenen (1991); Bilzen Formation, Kerniel Member; Oligocene, Rupelian. 4. RGM.1362982; 5. RGM.1362979; 6. RGM.1362975.



in the Keistraat in Berg (Fig. 3), the Belgian form was thought to be distinct subspecies of *Arctica islandica* by Arie W. Janssen, curator at the Rijksmuseum van Geologie en Mineralogie (Leiden, The Netherlands), but it was never formally described. The specimens show some variation in shape, especially height-width ratio, but all have the characteristic biangular posterior margin. With only these specimens at hand description of a new subspecies or species would have been logical. However, in 1991 new specimens were discovered in the Kerniel Member (early Rupelian) during construction works for the expansion of the Albertkanaal near Gellik

(province of Limburg, Belgium). These specimens show a wide range in morphology (Figs 4-7), some equal to those from the Berg Member (compare Fig. 4 from Gellik with Fig. 3 from Berg) and some nearly equal to those from the Mainz Basin (compare Fig. 7 from Gellik with Fig. 8 from Alzey). There is a striking but continuous evolution in shell morphology from the Berg Member to the slightly younger Kerniel Member and Alzey Formation. Specimens from all these deposits have therefore to be regarded as conspecific.

Some authors, e.g. Neuffer (1973) and Marquet *et al.* (2012), regard *A. rotundata* being a subspecies of *A. islandica*.



### Plate 3

7. *Arctica rotundata* (Agassiz, 1845). Gellik (Lanaken municipality, province of Limburg, Belgium), earthworks for widening Albertkanaal, leg. M. Vervoenen (1991); Bilzen Formation, Kerniel Member; Oligocene, Rupelian, RGM.1362974.
8. *Arctica rotundata* (Agassiz, 1845). Alzey (Landkreis Alzey-Worms, Rheinland-Pfalz, Germany), unspecified excavation, unknown collector; Alzey Formation; Oligocene, late Rupelian, RGM.1363092.

*dica*. The recent species has a less heavy shell with a less prominent umbo. I support the view of many other authors and regard *Arctica rotundata* to be a separate species.

**Distribution** – *Arctica rotundata* is known from the Rupelian of Belgium (Berg and Kerniel Members) (this study), the Rupelian (Alzey Formation) (Neuffer, 1973) and Chat-tian (Kassel Formation) of Germany (Janssen, 1979) and the Late Oligocene of the Netherlands (Heering, 1944).

***Arctica bergensis* sp. nov.**

Plates 4-5, figs 9-13

- 1836 *Cyprina scutellaria* Desh. – Nyst, p. 147.
- 1843 *Cyprina scutellaria* Desh. – Nyst, p. 145, pl. VII, fig. 5, pl. VIII, fig. 1.
- 1954 *Cyprina rotundata* Braun, 1845 – Glibert & De Heinzelin, p. 330; p. 390, table XI. (*partim*)
- 2018 *Arctica islandica rotundata* (Agassiz, 1845) – Hessel, pl. 1, figs 1 & 11 (*non* Agassiz, 1845).

**ZooBank registration** – urn:lsid:zoobank.org:act:1A624770-CAF4-4F02-B7AB-39318C75B187

**Type material** – **Holotype**: RGM.1357700, right valve, L=141 mm, H=131 mm, S=43 mm; Berg (Bilzen municipality, province of Limburg, Belgium), temporary excavation in the Keistraat (50.8464°N, 5.5477°E); Oligocene, Rupelian; Bilzen Formation, Berg Member, horizon with *Callista kickxi* (= lowest shell layer); leg. M. van den Bosch & A.W. Janssen (1972) (Fig. 9). **Paratypes 1-3**: from Berg (Bilzen municipality, province of Limburg, Belgium), temporary excavation in the Keistraat (50.8444°N, 5.5464°E); Oligocene, Rupelian; Bilzen Formation, Berg Member, unspecified bed; leg. A.C. Janse (1975-1980): paratype 1, RGM.1363089.a, right valve, L=147 mm, H=140 mm, S=42 mm; paratype 2, RGM.1363089.b, left valve, L=145 mm, H=128 mm, S=40 mm (Fig. 10); paratype 3, RGM.1363089.c, left valve, L=137 mm, H=123 mm, S=39 mm. **Paratype 4**: Vliermaal (Kortessem municipality, province of Limburg, Belgium), temporary excavation for petrol station; Oligocene, Rupelian; Bilzen Formation, Berg Member; leg. M. Vervoenen (1976): RGM.1405523 (1 paired specimen with large pearl inside), L=147 mm, H=138 mm, S=46 mm; pearl 12.0 mm long (Figs 11-13).

**Other material** – **Berg** (Bilzen municipality, province of Limburg, Belgium), temporary excavation in the Keistraat (50.8464°N, 5.5477°E); Oligocene, Rupelian; Bilzen Formation, Berg Member, horizon with *Astarte trigonella* (=upper shell layer): RGM.800032 (36 valves) (leg. M. van den Bosch & A.W. Janssen, 1971). **Vliermaal** (Kortessem municipality, province of Limburg, Belgium), Mommen quarry (c. 50.838°N, 5.428°E); Oligocene, Rupelian; Bilzen Formation, Berg Member, horizon with *Callista kickxi* (=lower shell layer): RGM.393647 (7 right & 5 left valves), RGM.1357614 (4 right & 1 left valve) (leg. A.W. Janssen, 1975); 2 left valves in collection J.G.M. Raven (coll.nr. F203). **Vlier-**

**maal** (Kortessem municipality, province of Limburg, Belgium), Mommen quarry (c. 50.838°N, 5.428°E); Oligocene, Rupelian; Bilzen Formation, Berg Member: RGM.1363094 (3 left & 1 right valve) (leg. H.P.J. Keukelaar); RGM.1363095 (1 left & 1 right valve) (leg. W. Groeneveld, 1979-1981); RGM.1405520 (4 left & 2 right valves) (leg. A.C. Janse); RGM.1405521 (9 left & 12 right valves, 4 paired specimens) (leg. F.A.D. van Nieu-lande). **Vliermaal** (Kortessem municipality, province of Limburg, Belgium), temporary excavation for petrol station; Oligocene, Rupelian; Bilzen Formation, Berg Member: RGM.1405522 (5 left & 3 right adult valves, 1 juvenile left valve, 1 adult paired specimen) (leg. M. Vervoenen, 1976). **Kleine-Spouwen** (Bilzen municipality, province of Limburg, Belgium), unspecified locality; Oligocene, Rupelian; Bilzen Formation, Berg Member: RGM.1363093 (1 left valve) (leg. P. Buurman). **Lubbeek** (province of Vlaams-Brabant, Belgium), Roelants sand pit (c. 50.868°N, 4.817°E); Oligocene, Rupelian; Bilzen Formation, Berg Member, upper shell level at 1-2 m below the top of the Berg Member: RGM.1427186 (1 left and 1 right valve) (leg. M. Roosen).

**Type locality** – Berg (Bilzen municipality, province of Limburg, Belgium), temporary excavation in the Kei-straat (50.8464°N, 5.5477°E).

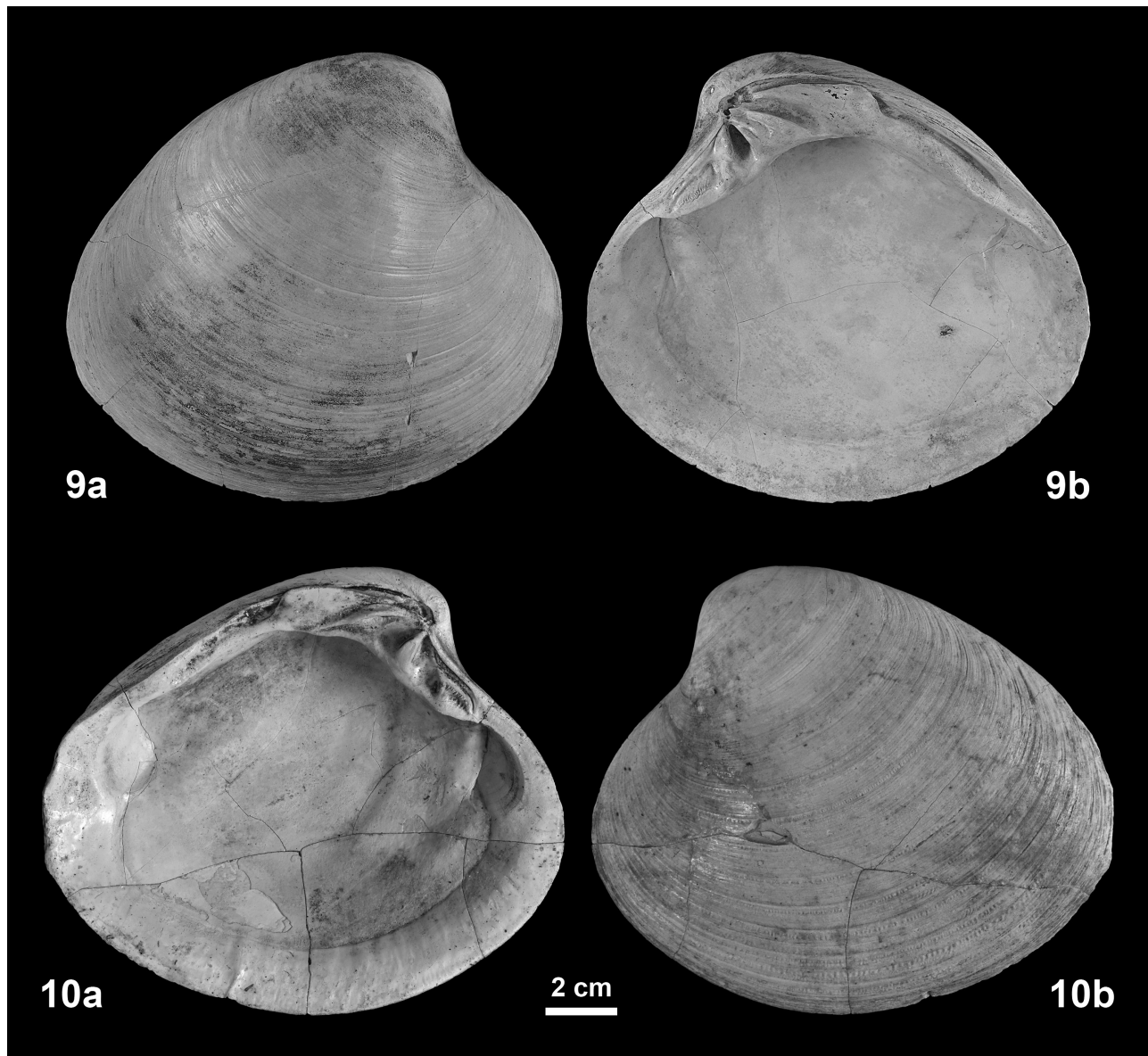
**Type stratum** – Oligocene, Rupelian; Bilzen Formation, Berg Member, Horizon with *Callista kickxi* (= lowest shell layer).

**Etymology** – Named after the Berg Member, the type stratum of this species. The Berg Member is named after the hamlet Berg near Kleine-Spouwen (Bilzen municipality), the type locality of the species.

**Diagnosis** – Very large species of *Arctica* with extremely thick-walled shell, slightly longer than high, the prominent umbo located on the anterior half, anterior lateral tooth in both valves reduced to an elongated crenulated knob, short nymph which rapidly widens in posterior direction.

**Description** – Very large and heavy shell with an oval-triangular outline and a length of up to 147 mm. The shell is c. 8-13% longer than high. The maximum convexity of a valve is only 28-30% of its length, giving the shell a fairly flat appearance. The wall of the shell is very thick and reaches extreme values in full-grown specimens. At the point of the maximum semidiameter of the holotype (42 mm) the wall is c. 16 mm thick (38%). The prominent umbo is situated in the anterior half of the shell at c. 1/3 to 1/4 from the anterior margin. The posterior margin is weakly bent in two places. Often one of those bends is not visible at all. The lunula is visible as a weak depression. The area behind the umbo is flattened, but the character is different in both valves. The left valve has a wide flattened area which is separated from the rest of the outer surface by a conspicuous rounded ridge; the area is clearly bent towards the hinge. The area of the right valve is less clear, lacks a ridge which separates it from the rest of





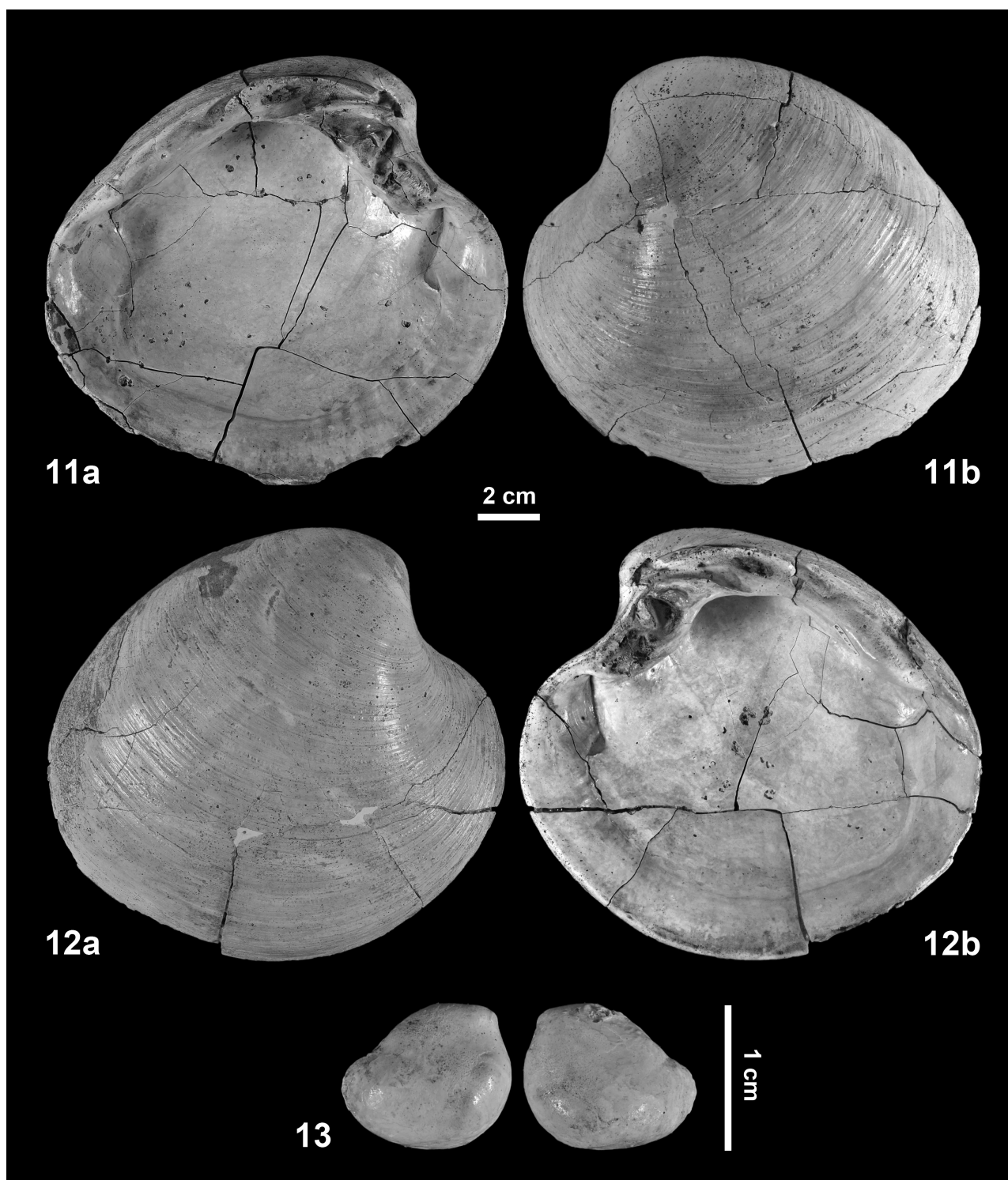
#### Plate 4

9. *Arctica bergensis* nov. spec. Berg (Bilzen municipality, province of Limburg, Belgium), temporary excavation in the Keistraat, coordinates 50.8464°N, 5.5477°E, leg. M. van den Bosch & A.W. Janssen (1972). Bilzen Formation, Berg Member, Horizon with *Callista kickxi* (= lowest shell layer); Oligocene, early Rupelian; **Holotype**, RGM.1357700.
10. *Arctica bergensis* nov. spec. Berg (Bilzen municipality, province of Limburg, Belgium), temporary excavation in the Keistraat, coordinates 50.8444°N, 5.5464°E, leg. A.C. Janse (1975-1980); Bilzen Formation, Berg Member, unspecified bed; **Paratype 2**, RGM.1363089.b.

the outer surface and is much less bended inwards. The complete outer surface of the shell has a fine sculpture of commarginal lines of variable strength, maybe all being growth lines. At the posterior side of the shell the lines suddenly become stronger. In many specimens radiating undulations are visible, concentrated in commarginal bands of varying width and interspacing (Fig. 10).

The base of the hinge plate is strongly curved. The right valve has three cardinal teeth. The anterior cardinal tooth is relatively small, pointing a little backwards and does not reach the edge of the hinge plate. Behind this tooth there is a deep pit, followed by another, slightly stronger

cardinal tooth. This second tooth is connected with the long posterior cardinal tooth by a concave, triangular field, forming an apparent very large bifid cardinal tooth. The strong, elongate posterior lateral tooth begins at some distance from the nymph and ends just before the posterior muscle scar. On the dorsal side grains and crenulations are visible. In front of the cardinal teeth there is an elongated, triangular field which a long knob with crenulations on the dorsal side. This knob can be regarded as a reduced or modified anterior lateral tooth. Above the knob lies a shallow pit, elongate and often sharply bending and continuing downwards at its posterior end.



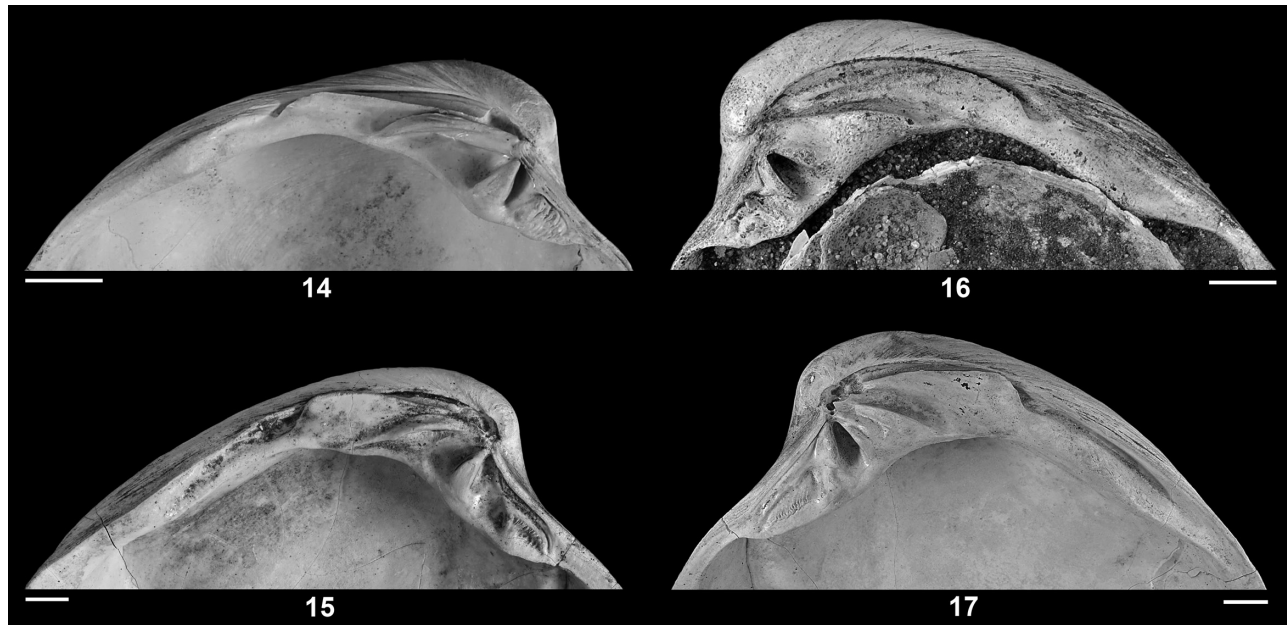
**Plate 5**

11-13. *Arctica bergensis* nov. spec. Vliermaal (Kortesseem municipality, province of Limburg, Belgium), temporary excavation for petrol station, leg. M. Vervoenen (1976); Bilzen Formation, Berg Member; Oligocene, Rupelian; **Paratype 4**, RGM.1405523 (1 paired specimen with large pearl inside).

The left valve has one quite small but nevertheless prominent, triangular anterior cardinal tooth. Behind is a broad triangular depression to accommodate the composite cardinals of the right valve. Above this depression a long, thin posterior cardinal tooth is present. This tooth

stretches from directly below the umbo to the edge of the hinge plate, the last part being less conspicuous. The posterior lateral tooth is situated just in front of the posterior muscle scar. It is fused with the shell margin, forming a short, thick bulge. In dorsal view this part of the shell





# Plate 6

14-17. Comparison of the hinges of *Arctica rotundata* and *Arctica bergensis* sp. nov. 14. Left valve of *A. rotundata* (RGM.1404995); 15. Left valve of *A. bergensis* (Paratype 2, RGM.1363089.b); 16. Right valve of *A. rotundata* (RGM.1362982); 17. Right valve of *A. bergensis* (Holotype, RGM.1357700).

margin is making a curve, forming a tooth-like protrusion. It fits in the groove between the posterior lateral and the shell margin in the right valve. This is why the area of the left valve is more bended inward than that of the other valve. In front of the anterior cardinal tooth there is a deep pit, and in front of that an elongate, triangular field. This field bears a long, crenulated knob which often continues downwards with a sharp bend at its posterior end. This knob is the modified anterior lateral tooth.

The nymph is short and rapidly widens in posterior direction. It often extends beyond the dorsal edge. From the highest point the nymph suddenly ends with a steep angled drop.

There are two muscle scars in each valve. The anterior one is very clear and deeply imprinted at the posterior side. In most specimens the posterior scar is clearly visible but hardly imprinted. Only a few specimens have a clearly imprinted posterior muscle scar. The pallial line is clear. It is truncated below the posterior muscle scar, without forming a true sinus. In many specimens the field between the pallial line and the ventral margin shows more or less visible radiating undulations.

It is striking that nearly all known adult specimens of this species are broken, despite their very solid shell. The only juvenile shell (Vliermaal), with a less thick walled shell than the adults, is undamaged.

Paratype 4, a paired specimen from Vliermaal, contained a large, irregular free formed cyst pearl (Fig. 13). In the literature I have not found other observations of cyst pearls in the genus *Arctica* or other genera in the Arctidae.

**Discussion** – This remarkable large and heavy species can easily be distinguished from *Arctica rotundata* (Agassiz,

1845), the other *Arctica*-species in the Berg Member. The shell of *A. rotundata* is smaller, less heavy and more swollen, and the umbo is situated closer to the anterior margin. Specimens of *A. rotundata* from the Berg Member are usually more elongate and have a clearly biangular posterior margin. The hinge also shows clear differences (Plate 6, figs 14-17). In *A. rotundata* the triangular field in front of the cardinal teeth, and the anterior lateral tooth placed on it, are far less elongate. The fused cardinals form a less stretched triangle. The nymph is much longer, becomes wider less fast, reaching less width compared to the length and does not end in a sudden drop.

Nyst (1836) mentions the species *Arctica scutellaria* (Lamarck, 1806) from the Oligocene of Kleine-Spouwen. A few years later Nyst (1843) also mentions Hoesselt as locality and the species is described comprehensively and illustrated very well. Without doubt this is *A. bergensis* sp. nov. and not *A. scutellaria*. The Palaeocene (Thanetian) species *A. scutellaria* from the Paris Basin differs from *A. bergensis* sp. nov. in having a thinner shell, and more elongated posterior and anterior ends.

Glibert & De Heinzelin (1954) list *A. rotundata* from the Berg Member. It is very likely that this partly comprises *A. bergensis* sp. nov.

*Arctica roffiaeni* (Nyst, 1873) from the late Lutetian to early Rupelian Grimmeringen Member in Belgium (Marquet *et al.*, 2012) and *Arctica bergensis* sp. nov. are closely related. The plesiotypes of *A. roffiaeni*, designated and illustrated by Glibert (1936, p. 97, pl. III, fig. 7; IRSNB 00068 and IRSNB 00069) have been consulted online (Virtual collections KBIN, 2024). Both species have a comparable oval-triangular outline and an elongated triangular field with a long crenulated lateral tooth in

front of the cardinal teeth. But the nymph of *A. roffiaeni* is very weakly developed, and not at all widened as in *A. bergensis* sp. nov. Besides this, the shell of *A. roffiaeni* has a much more swollen umbo and smaller dimensions (c. 83 mm long). Glibert (1936) writes that *A. rotundata* and *A. roffiaeni* are closely related and that he would not be surprised if *A. rotundata* appeared to be a direct descendant of *A. roffiaeni*. I conclude that both species are related, but that there seems to be a direct evolutionary line from *A. roffiaeni* to *A. bergensis* sp. nov. and a less clear one from *A. roffiaeni* to *A. rotundata*. Possibly *Arctica rotundata* is a new evolutionary branch in the evolution of the genus *Arctica*.

*Distribution* – *Arctica bergensis* sp. nov. is only known from the Berg Member (Rupelian) of Belgium.

## Discussion

The co-occurrence of two species of *Arctica* in the Berg Sands is remarkable, considering the less than 10 species known from the Western-European Cainozoic. Most of those species where the only *Arctica* in their fauna. There must have been good conditions during the Rupelian in Belgium for two species of *Arctica* to develop and live simultaneously. Both *A. rotundata* as *A. bergensis* sp. nov. went extinct at the end of the Oligocene.

## Acknowledgements

This work would not have been possible without the careful collecting and preparation of the often broken shells by Maarten van den Bosch, Peter Buurman, the late Wim Groeneveld, the late Anton C. Janse, the late Arie W. Janssen, Hans P.J. Keukelaar, Freddy A.D. van Niculande, Han Raven, Marijn Roosen and Marcel Vervoenen. The suggestions and comments of the reviewers Frank Wesselingh and Ronald Janssen have considerably improved the manuscript. Thanks also to the late Jos Lenaerts, who encouraged me to write this paper.

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