

## LATE CRETACEOUS MACROFAUNA FROM THE HAUTES FAGNES AREA (NE BELGIUM)

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(1 figure, 1 table & 2 plates)

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**ABSTRACT.** Flints with fossil external and internal moulds have been collected from the Hautes Fagnes area (Liège, Belgium). The fauna studied yielded 18 bivalve taxa (all pteriomorphs), two brachiopods and three echinoids. The age of this fauna has been determined as Maastrichtian.

**KEYWORDS:** Upper Cretaceous, macrofauna, Belgium, Hautes Fagnes.

**RESUME.** Sur le plateau des Hautes Fagnes (Liège, Belgique) des silex avec des empreintes externes et internes de fossiles ont été récoltés. Dans cette faune, on a reconnu 18 espèces de bivalves (tous ptériomorphes), deux espèces de brachiopodes et trois d'échinides. Ce matériel est d'âge Maastrichtien.

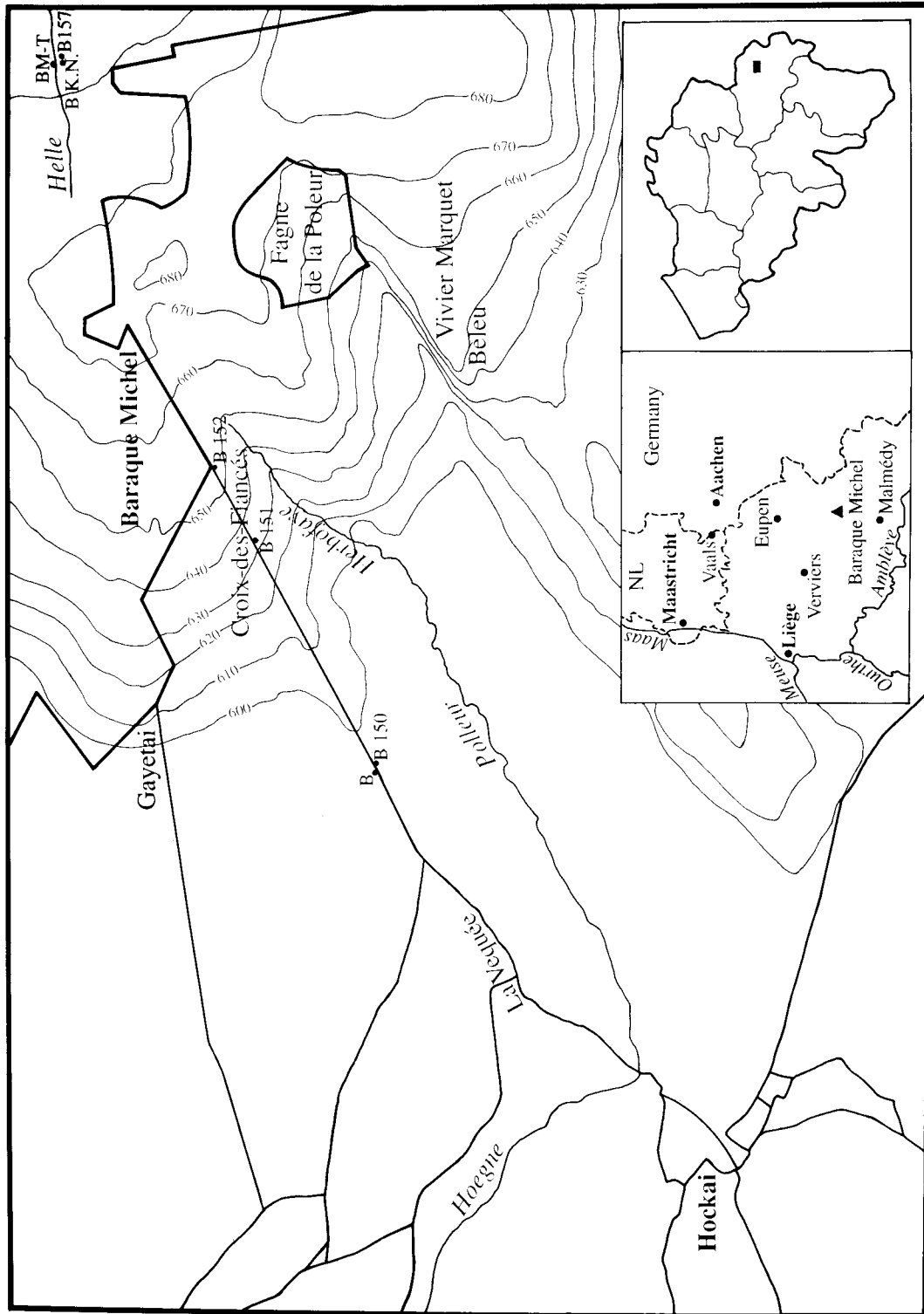
**MOTS-CLES:** Crétacé Supérieur, macrofaune, Belgique, Hautes Fagnes.

### 1. INTRODUCTION

The Upper Cretaceous strata of the Hautes Fagnes (Liège, NE Belgium) were first recorded in the last century. Some outcrops were then already described in detail, e.g. the railway cutting at Hockai (Dewalque, 1886). Some fossils found in flints scattered over the peat bogs, were deposited in the Institut royal des Sciences naturelles de Belgique in Brussels around 1890.

Subsequent to their discovery the actual conditions of deposition of these flints have been debated extensively. Lately several authors (W. M. Felder & Albers, 1980; Gullentops, 1987; Bless *et al.*, 1991; Bless & Felder, 1989; Bless & Fernandez Narvaiza, 1993) have discussed aspects of the Late Cretaceous (Campanian-Maastrichtian) of the Hautes Fagnes.

For macrofossils, after Dewalque (1868) only Bless *et al.* (1991) published a preliminary list of Maastrichtian taxa from Beleu (Hautes Fagnes). In the present paper macrofossils preserved in flints found over the entire Hautes Fagnes area (Figure 1), are discussed. This has become possible thanks to Armand Petit and several friends, who have regularly roamed the moors and collected all the fossil-bearing flints - mainly along man-made drains in the peat bogs. The fossils found in these flints are generally preserved as composite moulds, showing a remarkably detailed ornamentation, often better preserved than on specimens from the coeval chalks and calcarenites from Liège and southern Limburg. A few of the macrofossils are good stratigraphic indicators. The material is assigned a Maastrichtian age mainly on the account of the faunal similarity with the Schreiebkreide fauna of NW Europe, *Microchlamys pulchella* being the commonest bivalve



**Fig. 1.** Map of the Hautes Fagnes area with indications of the localities mentioned in the text.  
 Carte d'une partie des Hautes Fagnes avec indication des localités mentionnées dans le texte.

species in this assemblage. In the Maastrichtian type area acmes of this species are known from the lower third of the "Vijlen" Member (Gulpen Formation) at Haccourt and Lixhe (Liège), top of Lixhe 1 Member and locally in the Lanaye Member (both Gulpen Formation), all of early Late Maastrichtian age. The co-occurrence of echinoids of the genera *Echinocorys* and *Diplodetus* if typical for the "Vijlen" Member at Haccourt, although rare representatives of the latter genus are known to accompany *Echinocorys* in the underlying Late Campanian Zeven Wegen Member. Finally, the craniid brachiopods from the Hautes Fagnes assemblage bear a strong resemblance to *costata*-group members from the Late Maastrichtian Lanaye Member and the basal part of the overlying Maastricht Formation.

Below (2.1.), the extension of the taxa recognised in other outcrops in the Maastrichtian type area (*s.l.*) is shown. Faunal diversification is limited since only bivalves with calcitic shells have been preserved.

## 2. DISTRIBUTION OF THE BIVALVES AND BRACHIOPOD SPECIES FROM THE HAUTES FAGNES STUDIED HEREIN

### 2.1. DETERMINATION TABLE

	1.	2.	3.	4.	5.	6.	7.	8.
<i>Botuloides intermedius</i>	?	+	?					
<i>Lima canalifera</i>					?			
<i>Limatula decussata</i>		+			+	+	+	
<i>Lim. semisulcata</i>	+			+				
<i>Plagiostoma cretaceum</i>	+						+	
<i>Pl. hoperi</i>	+	+		+	+	+	+	+
<i>Pycnodonte vesicularis</i>	+	+	?	+	+	+	+	+
<i>Placunopsis granulosa</i>			+		+			
<i>Atreta nilssoni</i>	+	+		+	+	+	+	
<i>Entolium membranaceum</i>	+	+	?	+	+	+		
<i>Camptonectes virgatus</i>	+					+	+	+
<i>Microchlamys campaniensis</i>	+				+	+	+	+
<i>Mic. pulchella</i>	+	+	+	+	+	+	+	+
<i>Mimachlamys cretosa</i>	+			+	+		+	+
<i>Merklinia variabilis</i>	+		+		+	+	+	
<i>Neithea sexcostata</i>	+	+		+	+	+	+	+
<i>Spondylus fimbriatus</i>	+	+		+	+	+	+	+
<i>Isocrania costata</i>	+			+	+	+	+	+
<i>Carneithyrus subcardinalis</i>	+	+	+	+	+			

Table 1. 1. Sint Pietersberg-Maastricht, late Late Maastrichtian; 2. "Vijlen" Member, early Late Maastrichtian; 3. Schneeberg, Aachen-Vaals, Maastrichtian; 4. Cibly (Hainaut, Belgium), Craie phosphatée, Early Maastrichtian; 5. Rügen, GFR, Early Maastrichtian; 6. Hemmoor, GFR, Late Maastrichtian; 7. Nagorzany - Lwow, Ukraine, Early Maastrichtian; 8. Paris Basin, France, Late Campanian.

### 2.2. COMPARISON OF THE BIVALVE TAXA FROM THE HAUTES FAGNES

17 species recognised, of which:

- 14 occur in type Maastrichtian, at the Sint Pietersberg.
- 9 occur in the «Vijlen» Member, at Hallembaye.

- 6 occur at the Schneeberg, near Vaals,
- 9 occur in the Craie phosphatée of Cibly, Hainaut
- 13 occur in the Lower Maastrichtian of Rügen, Germany
- 11 occur in the Upper Maastrichtian of Hemmoor, Germany
- 12 occur in Lwow-Nagorzany, Lower Maastrichtian, Ukraine
- 8 occur in the Paris Basin, Upper Campanian.

The closest affinities of the Hautes Fagnes bivalve fauna are, outside of the Liège-Limburg basin, mainly with the NW European Schreibkreide fauna and its extension onto the Russian Platform. The northern extension of the Paris Basin as found in the Hainaut or in the Champagne has fewer taxa in common with the Hautes Fagnes.

## 3. SYSTEMATIC PALAEOLOGY

The taxonomy largely follows that of Moore (1969, 1970) for bivalves but some changes introduced by Waller (1978) have been adopted; for brachiopods Steinich (1965), Johansen and Surlyk (1990), and Ernst (1984) and for echinoids mainly Smith and Wright (1989) have been followed.

### 3.1. BIVALVES

#### 3.1.1. Abbreviations used for bivalves

H: height; UPD: umbo pallial diameter (used for pectinaceans and limoids); W: width; S: side (= valve).

#### 3.1.2. Phylum Mollusca

Class Bivalvia Linné, 1758

Subclass Autobranchia Grobben, 1894

Order Mytiloidea Férussac, 1822

Superfamily Mytilacea Rafinesque, 1815

Family Mytilidae Rafinesque, 1815

Genus *Botuloides* Freneix, 1960

*Botuloides cf intermedius* (d'Orbigny, 1845).  
(Pl. 1, Fig. 1)

Compare:

v\* 1845 *Lithodomus intermedius* d'Orbigny: 296, pl. 345, figs. 9, 10.

. 1960 *Botuloides intermedius* (d'Orbigny); Freneix: 202.

. 1976 *Lithophaga intermedia* (Orbigny); Pojarkova: 94, pl. 48, figs. 4, 5.

**Material.** A single incomplete bivalved composite mould from Drain des Fiancés, H: (23 mm).

**Remarks.** Ornamentation is restricted to growth lines on the thin shell, some of which are more strongly developed and indicate growth interruptions. Although incomplete, this specimen is tentatively assigned to *Botulooides intermedius*. The specimens in the Paris Museum (d'Orbigny Coll.) from the Campanian of Royan (Charente-Maritime, France), which can be considered as the type material of *B. intermedius*, agree well with our specimen.

**Distribution.** Cenomanian to Maastrichtian, often in rudist-associated faunas.

Order Limoida Waller, 1978  
 Superfamily Limacea Rafinesque, 1815  
 Family Limidae Rafinesque, 1815  
 Genus *Lima* Bruguière, 1797

***Lima* cf. *canalifera* Goldfuss, 1835**

Compare:

- \* 1835 *Lima canalifera* Goldfuss: 89, pl. 104, fig. 1.
- v.1904 *Lima canalifera*, Goldfuss; Woods: 1, pl. 1 (cum syn.).
- .1934 *Lima canalifera* Goldf.; Andert: 145, pl. 8, fig. 6.

**Material.** A single incomplete right valve, partial steinkern, from Borne 150, Dolne; UPD 14.5 mm.

**Distinctive feature.** Strongly developed straight ribs.

**Distribution.** *Lima canalifera* is a long-ranging species:

Cenomanian - Campanian, and probably also Maastrichtian from the present record. Generally the specimens are found in sandy deposits, but the species has not to our knowledge been recorded from the stratotypical Maastrichtian.

Genus *Limatula* Wood, 1839

***Limatula decussata* (Münster in Goldfuss, 1835).**  
 (Pl. 1, Figs. 2, 3)

- \* 1835 *Lima decussata* Münster; Goldfuss: 91, pl. 104, fig. 5.
- v.1904 *Lima (Limatula) decussata*, Goldfuss; Woods: 50, pl. 7, figs. 18-20 (cum syn.).
- v.1968 *Limatula (Limatula) decussata* (Münster); Pasternak *et al.* 84, pl. 37, figs. 13, 15, 16; pl. 38, fig. 1 (cum syn.).
- v? 1977 *Limatula decussata* (Goldfuss); Sobetski: 111, pl. 7, fig. 7.
- v. 1982 *Limatula decussata* (Goldfuss); Dhondt: 90 (cum syn.).
- non 1982 *Limatula decussata* (Goldfuss); Sobetski *et al.*: 125, pl. 12, fig. 10.

v. 1987 *Limatula decussata* (Goldfuss); Dhondt and Jagt: 84, fig. 4:3.

v. 1987 *Limatula decussata* (Goldfuss); Cleevely and Morris: 98, pl. 19, fig. 5.

**Material.** Excellent composite moulds from Drain Marquet and Drain des Fiancés, and a fragmentary composite mould from Drain Marquet.

**Dimensions.** UPD 16 mm, 17 mm; W 10 mm; 12 mm.

**Remarks.** Keeled, radial ribs are distributed over the complete shell, but are more strongly developed on the central part. On the areas, the commarginal ornamentation is equally or even more strongly developed than the radial.

**Distribution.** *Limatula decussata* is generally only known from white chalk facies, mainly in northern Europe, but reaching the Russian platform.

***Limatula* cf. *semisulcata* (Nilsson, 1827)**

A few poor moulds undoubtedly belong to *Limatula* sp. Their smooth areas and centrally placed ribs differentiate them from *L. decussata*; their poor preservation does not show neither the number nor the precise shape of their ribs, and therefore it is not possible to determine whether they belong to *L. semisulcata* (Nilsson, 1827: 25, pl. 9, fig. 2a-c) or to *L. kunradensis* Marquet, 1982 (13, pl. 1, fig. 1a-d).

Genus *Limea* Bronn, 1831

Subgenus *Pseudolimea* Arkell, 1832

***Limea (Pseudolimea) sp.***

An incomplete composite mould from D15. H: 7.8 mm. Rib ornamentation is invisible and therefore it cannot be decided whether the specimen belongs to *Limea (Pseudolimea) denticulata* (Nilsson, 1827) or to *L. (Ps.) granulata* (Nilsson, 1827). Both species are known from the Maastrichtian stratotypical area (Dhondt, 1990).

Genus *Plagiostoma* J. Sowerby, 1814

***Plagiostoma cretaceum* (Woods, 1904)**

v\* 1904 *Lima (Plagiostoma) cretacea* Woods: 22, pl. 4, figs. 13-15, pl. 5, figs. 1-4.

A single small incomplete right valve from drain, Borne 150. UPD 15 mm.

The differences described by Woods (1904) between *Plagiostoma cretaceum* and *Pl. hoperi* Mantell, 1822 apply.

***Plagiostoma hoperi* Mantell, 1822**

- \* 1822 *Plagiostoma Hoperi* Mantell: 204, pl. 26, figs. 2, 3, 15.  
 v.1904 *Lima (Plagiostoma) Hoperi*, Mantell; Woods: 17, pl. 4, figs. 7-12 (cum syn.).  
 v.1968 *Lima (Plagiostoma) hoperi hoperi* (Mantell); Pasternak *et al.*: 179, pl. 37, figs. 3-5.  
 .1974 *Lima hoperi* Mantell; Savczynskaja: 95, pl. 28, fig. 11.  
 v.1985 *Plagiostoma hoperi* Mantell; Dhondt: 49.  
 v.1987 *Plagiostoma hoperi* Mantell; Cleevely and Morris: 93, pl. 18, fig. 6,7.

A single incomplete valve interior, from Vivier Marquet, W: 17.5 mm.

**Distribution.** *Plagiostoma hoperi* is a typical white chalk species known from Cenomanian to Maastrichtian; it attains large sizes especially in the Campanian of Aquitaine (Dhondt, 1985).

Order Ostreoida Férussac, 1822  
 Suborder Ostreina Férussac, 1822  
 Superfamily Ostreacea Rafinesque, 1815  
 Family Gryphaeidae Vialov, 1936  
 Genus *Pycnodonte* Fischer de Waldheim, 1835

***Pycnodonte vesicularis* (Lamarck, 1806)**

**Material.** Composite internal mould of right valve from Vivier Marquet, small left valves from Dolne, B 151, from 23 and 25.

**Remarks.** *Pycnodonte vesicularis* is a highly variable species, and, depending on the species concept of authors, it is subdivided into subspecies or even species or considered as one long-ranging taxon. We prefer this latter approach, which is also that of Woods (1913: 360-374, text-figs. 143-182, pl. 55, figs. 4-9). The specimens from the Hautes Fagnes are small for the species (H less than 30 mm).

**Distribution.** *Pycnodonte vesicularis* is a widely distributed (virtually world-wide) species known from Albian (?) to Maastrichtian.

Superfamily Dimyacea P. Fischer, 1886  
 Family Terquemiidae Cox, 1964  
 Genus *Placunopsis* Morris and Lycett, 1853

**? *Placunopsis granulosa* (Roemer, 1841)**

Compare:

- \* 1841 *Anomia granulosa* Roemer: 49, pl. 8, fig. 4.  
 . 1986 *Placunopsis granulosa* (Roemer); Abdel-Gawad: 158, pl. 36, figs. 4-7 (cum syn.).

**Material.** A single, slightly worn specimen from Drain Veuée.

**Dimensions.** UPD 16.1 mm, W 14.5 mm.

**Remarks.** This specimen is tentatively identified as *Placunopsis granulosa*, because of the unusual placement of the umbo (which differs from *Dimyodon* and *Anomia*) and because of the fine diverging striation best visible near the margin.

**Distribution.** Campanian-Maastrichtian of northern Europe, including The Netherlands.

Superfamily Dimyacea Fischer, 1886  
 Family Dimyidae Fischer, 1886  
 Genus *Atreta* Etallon, 1862

***Atreta nilssonii* (von Hagenow, 1842)**

- \* 1842 *Ostrea Nilssonii* v. Hagenow: 546.  
 . 1986 *Atreta nilssonii* (v. Hagenow); Abdel-Gawad: 158, pl. 36, figs. 1-3 (cum syn.).  
 v. 1987 *Atreta nilssonii* (von Hagenow); Dhondt and Jagt: 82, fig. 4:8.  
 . 1987 *Atreta nilssonii* (Hagenow); Cleevely and Morris: 92, pl. 20, fig. 11.

**Material.** A single, well-preserved internal mould from Drain des Fiancés (8).

**Remarks.** This specimen clearly shows the internal, raised ventral margin and the internal radial ribs. Other specimens from the «Vijlen» Member (Maastrichtian) at Hallembaye show more characteristics confirming that the genus *Atreta* Etallon reached the Maastrichtian and that the species *A. nilssonii* (von Hagenow) lived attached not only to echinoids but also to other bivalves. This is an extension to what was stated by Hodges (1991).

**Distribution.** Albian to Maastrichtian, mainly in fine-grained sediments.

Suborder Pectinina Waller, 1978  
 Superfamily Pectinacea Rafinesque, 1815  
 Family Pectinidae Rafinesque, 1815  
 Genus *Entolium* Meek, 1865

***Entolium membranaceum* (Nilsson, 1827)  
(Pl. 1, Fig. 10)**

- \* 1827 *Pecten membranaceus* Nilsson: 23, pl. 9, fig. 16.  
 v. 1971 *Entolium membranaceum* (Nilsson); Dhondt: 27, pl. 1, fig. 2 (cum syn.).

- v. 1977 *Entolium membranaceum* (Nilsson); Sobetski: 37, pl. 2, figs. 16-17.  
 v? 1982 *Entolium membranaceum* (Nilsson); Sobetski: 99, pl. 6, fig. 22, pl. 31, figs. 3-4.  
 v? 1982 *Entolium transcasicum* Sobetski: 100, pl. 6, fig. 23.  
 v. 1982 *Entolium membranaceum* (Nilsson); Dhondt: 80.  
 . 1986 *Entolium membranaceum* (Nilsson); Abdel-Gawad: 149, pl. 33, fig. 10.  
 v. 1987 *Entolium membranaceum* (Nilsson); Dhondt and Jagt: 81, fig. 3:3.  
 v. 1987 *Entolium membranaceum* (Nilsson); Cleavelly and Morris: 91, pl. 19, fig. 2.

**Material.** A single complete composite mould, from B. 151 at Dolne, one incomplete composite mould from Drain Croix des Fiancés, one questionable fragment from Drain des Fiancés.

**Dimensions.** UPD 31.8 mm, W (30) mm.

**Remarks.** Although generally poorly preserved the complete specimen has well-preserved auricles which permit definite specific identification.

**Distribution.** Cenomanian to latest Maastrichtian; also in the Maastrichtian stratotype.

Genus *Camptonectes* Agassiz in Meek, 1864

***Camptonectes virgatus*** (Nilsson, 1827)  
(Pl. 2, Fig. 1)

- v\* 1827 *Pecten virgatus* Nilsson: 22, pl. 9, fig. 15.  
 v. 1972a *Camptonectes (Camptonectes) virgatus* (S. Nilsson); Dhondt: 18, pl. 2, fig. 1. (cum syn.)  
 v. 1977 *Camptonectes virgatus* (Nilsson); Sobetski: 65, pl. 4, fig. 16.  
 v. 1977 *Camptonectes perlucidus* Sobetski: 66, pl. 4, fig. 17.  
 . 1981 *Camptonectes (Camptonectes) virgatus* (Nilsson); Tzankov: 101, pl. 45, fig. 1.  
 v. 1982 *Camptonectes virgatus* (Nilsson); Dhondt: 81.  
 v? 1982 *Camptonectes curvatus* (Geinitz); Sobetski: 113, pl. 11, fig. 19.  
 . 1985 *Camptonectes (Camptonectes) virgatus* (Nils.); Freneix and Viaud: 203, pl. 1, fig. 10.  
 . 1986 *Camptonectes (Camptonectes) virgatus* (Nilsson); Abdel-Gawad: 151, pl. 32, fig. 16.  
 v. 1987 *Camptonectes virgatus* (Nilsson); Dhondt: 67, pl. 3, fig. 3.

**Material.** A single external cast, from Drain Vequée.

**Dimensions.** UPD 11.5 mm, W 9.8 mm.

**Remarks.** The typical diverging ornamentation is beautifully preserved on this specimen.

**Distribution.** From Cenomanian to latest Maastrichtian, virtually world-wide, but generally more common in coarser than in finer sediments, also found in the Maastrichtian stratotypical area.

Genus *Microchlamys* Sobetski, 1977

***Microchlamys campaniensis*** (d'Orbigny, 1847)  
(Pl. 1, Fig. 9)

- v\* 1847 *Pecten campaniensis* d'Orbigny: 620, pl. 440, figs. 12-16.  
 v. 1902 *Pecten (Aequipecten) campaniensis* d'Orbigny; Woods: 192, pl. 37, figs. 4-8 (cum syn.).  
 v. 1902 *Pecten fenestratus* Ravn: 85, pl. 1, figs. 14-16.  
 v. 1908 *Pecten Puggaardi* Ravn: 72.  
 v. 1972b *Lyropecten (Aequipecten) campaniensis* (A. d'Orbigny); Dhondt: 9, pl. 1, fig. 1 (cum syn.).  
 ? 1974 *Chlamys campaniensis* (Orbigny); Savczinskaja: 90, pl. 26, figs. 8-10.  
 v. 1977 *Chlamys (Microchlamys) puggaardi* (Ravn); Sobetski: 61, pl. 4, fig. 12.  
 v. 1982 *Lyropecten (Aequipecten) campaniensis* (d'Orbigny); Dhondt: 81, pl. 3, figs. 4-7.  
 . 1986 *Lyropecten (Aequipecten) campaniensis* (d'Orbigny); Abdel-Gawad: 153, pl. 33, figs. 6-7.  
 . 1986 *Lyropecten (Aequipecten) wisniowskii* (Pasternak); Abdel-Gawad: 153, pl. 32, figs 1, 2.  
 v. 1987 *Lyropecten (Aequipecten) campaniensis* (d'Orbigny); Cleavelly and Morris: 84, text-fig. 5.3a, pl. 17, fig. 5.

**Material.** Several incomplete composite moulds from the Drain des Fiancés, Drain Vequée and from Vier Marquet.

**Dimensions.** UPD 11 mm; W 11 mm.

**Remarks.** The specimens assigned here to *Microchlamys campaniensis* have fewer, more irregular ribs than those belonging to *M. pulchella*. The commarginal striation typical of *M. campaniensis* is not clearly visible on the moulds.

**Distribution.** Turonian to latest Maastrichtian, mainly in white chalk facies, but also found in the Maastrichtian stratotype.

***Microchlamys pulchella*** (Nilsson, 1827).  
(Pl. 1, Figs. 4 - 8)

- \* 1827 *Pecten pulchellus* Nilsson: 22, pl. 9, fig. 12.  
 v. 1902 *Pecten (Aequipecten) pulchellus* Nilsson; Woods: 194, pl. 37, figs. 12-15 (cum syn.).  
 v. 1972b *Lyropecten (Aequipecten) pulchellus* (S. Nilsson); Dhondt: 16, pl. 1, fig. 2 (cum syn.).

- v. 1982 *Lyropecten (Aequipecten) pulchellus* (Nilsson); Dhondt: 82, pl. 3, figs. 8,9.  
 v. 1982 *Chlamys (Microchlamys) pulchella* (Nilsson); Sobetski: 110, pl. 11, figs. 13,14.  
 . 1986 *Lyropecten (Aequipecten) pulchellus* (Nilsson); Abdel-Gawad: 152, pl. 33, figs. 8,9 (cum syn.).  
 v. 1987 *Lyropecten (Aequipecten) pulchellus* (Nilsson); Dhondt & Jagt: 81, figs. 4: 4,5.

**Material.** Moulds and composite moulds from Drain Vequée, Croix des Fiancés, Drain des Fiancés, Dolne (Borne 151 and 152), Helle, Herbofaye, Hoegne, Drain Marquet; perfect composite mould of right valve from Drain Vivier Marquet. Very common.

Dimensions	UPD	W	S
D. Fiancés 10	(12)	12.3	R
D. Fiancés 12	15	14.4	L
D. Fiancés 7/88	20	19.6	R
Vivier Marquet 6	13.2	12.2	L
Vivier Marquet	10.8	10.5	R
D. Vequée 14	14.5	13.5	R
D. Vequée 13	23.6	23.0	L
F. Dolne, B.152	12.2	11.6	L
F. Dolne, B.152	13.7	12.8	R
Helle	18.8	19.0	R
Hoegne	17.6	17.8	R

**Remarks.** These specimens are identical with those described from the Campanian white chalks in England (Woods, 1902) and from Orp-le-Grand (Dhondt, 1972b). On the well-preserved moulds the typical diverging camptonectid microstriation is beautifully visible, much more clearly than on most specimens from the Maastricht Fm. near Maas-tricht.

**Distribution.** *Microchlamys pulchella* is known from Turonian to latest Maastrichtian, also from the Maastrichtian stratotype.

Genus *Mimachlamys* Iredale, 1928

***Mimachlamys cretosa*** (Defrance, 1822)

- \* 1822 *Pecten cretosus* Defrance in Brongniart: 251, 598, pl. 3, figs. 7a, b.  
 v.1902 *Pecten (Chlamys) cretosus* Defrance; Woods: 174, pl. 32, figs. 4-6; pl. 33, figs. 1-12 (cum syn.).  
 v.1973a *Mimachlamys cretosa* (M. Defrance in A. Brongniart); Dhondt: 77, pl.6, fig. 2; pl. 7, fig. 1 (cum syn.).  
 .1974 *Chlamys cretosa* (Defrance); Savczinskaja: 90, pl. 26, figs. 5, 6.  
 v.1977 *Chlamys (Chlamys) marrotiana* (Orbigny); Sobetski: 43, pl. 3, fig. 5.

- v.1977 *Chlamys (Chlamys) cretosa* (Defrance); Sobetski: 44, pl. 3, fig. 6.  
 ?1981 *Chlamys (Chlamys) cretosa* (Defrance in Brongniart); Tzankov: 103, pl. 45, fig. 6.  
 v.1982 *Chlamys (Chlamys) nitida* (Mantell); Sobetski: 103, pl. 6, fig. 28.  
 v.1982 *Chlamys (Chlamys) cretosa* (Defrance); Sobetski: 104, pl. 11, figs. 1-2; pl. 31, fig. 6.  
 v?1982 *Chlamys (Chlamys) undulata* (Nilsson); Sobetski: 104, pl. 11, fig. 3.  
 v.1982 *Chlamys (Chlamys) serrata* (Nilsson); Sobetski: 105, pl. 11, fig. 5.  
 v.1984 *Mimachlamys cretosa* (Defrance); Dhondt: 39.  
 .1986 *Mimachlamys cretosa* (Defrance in A. Brongniart); Abdel-Gawad: 154, pl. 34, figs. 1, 2.  
 v.1987 *Mimachlamys cretosa* (Defrance); Cleevly and Morris: 80, pl. 17, figs. 7, 8; text-figs. 5.1e, 5.2a.

**Material.** Small, somewhat worn, slightly silicified, left valve from Drain Croix des Fiancés and small inside of right valve from Vivier Marquet.

**Dimensions.** Drain Fiancés: UPD 14.3 mm; W 12.7 mm, LV

Vivier Marquet: UPD 11.2 mm; W 8.3 mm, RV

**Remarks.** The Vivier Marquet specimen shows an unusual ornamentation of commarginal growth lines and radial riblets of the same development, giving a cancellated aspect. A similar ornamentation is figured by Woods (1902, pl. 33, fig. 12) for English specimens from the Lower Maastrichtian at Trimingham, Norfolk.

**Distribution.** Turonian to Maastrichtian, virtually worldwide; known from the Maastrichtian stratotype.

Genus *Merklinia* Sobetski, 1960

***Merklinia variabilis*** (von Hagenow, 1842)  
(Pl. 1, Fig. 12)

- \* 1842 *Pecten variabilis* von Hagenow: 552.  
 v. 1976 *Merklinia variabilis* (F. von Hagenow); Dhondt: 18, pl. 1, fig. 2; pl. 2, fig. 1 (cum syn.).  
 v. 1977 *Chlamys (Merklinia) triformis* Sobetski: 56, pl. 4, fig. 6.  
 v. 1982 *Merklinia variabilis* (von Hagenow); Dhondt: 84, pl. 2, fig. 12.  
 v. 1982 *Chlamys (Chlamys) trisulca* (Hagenow); Sobetski: 106, pl. 11, fig. 6.  
 v. 1982 *Chlamys (Chlamys) armata* (Griepenkerl); Sobetski: 106, pl. 11, fig. 7.  
 v. 1982 *Merklinia pexata* (Woods, 1903); Sobetski: 112, pl. 11, fig. 17.  
 . 1986 *Merklinia variabilis* (v. Hagenow); Abdel-Gawad: 155, pl. 32, fig. 15.

v. 1987 *Merklinia variabilis* (von Hagenow); Cleevely and Morris: 83, text-fig. 5.1a, pl. 17, figs. 13, 14.

**Material.** Composite moulds from Drain Croix des Fiancés, B. 151 at Dolne, Hautes Fagnes (unspecified).

**Dimensions.** UPD 18.7 mm, 23.5 mm; W 14.5 mm, 19 mm.

**Remarks.** This small pectinid is relatively common in the Hautes Fagnes area, and even as a mould it can be recognised by its specific subdivided trifid rib structure and oblique habitus.

**Distribution.** Turonian to Maastrichtian of Eurasia (temperate seas, not found in Tethys), occurs in the stratotypical Maastrichtian.

Genus *Neithea* Drouet, 1824

***Neithea sexcostata*** (Woodward, 1833)  
(Pl. 1, Fig. 11)

\* 1833 *Pecten sexcostatus* Woodward: 48, pl. 5, fig. 9.

v. 1903 *Pecten (Neithea) sexcostatus* Woodward; Woods: 214, pl. 40, figs. 10-12, pl. 41, figs. 1-10.

v. 1973b *Neithea (Neithea) sexcostata* (Woodward); Dhondt: 44, pl. 5, figs. 2a, b (cum syn.).

. 1986 *Neithea (Neithea) sexcostata* (Woodward); Abdel-Gawad: 156, pl. 32, figs. 3-4 (cum syn.).

v. 1987 *Neithea (Neithea) sexcostata* (S. Woodward); Cleevely and Morris: 86, pl. 19, fig. 7-9.

**Material.** A single composite mould of a left valve from Drain Vivier Marquet.

**Remarks.** This left valve shows the typical, fairly complex rib structure of the taxon, with the many subdivisions; the specimen itself is relatively large for the species.

**Dimensions.** UPD: 17.8 mm; W: 17.0 mm.

**Distribution.** Cenomanian to Maastrichtian of northern and eastern Europe, including the Maastrichtian stratotype; also recorded from North Africa.

Family Spondylidae Gray, 1826  
Genus *Spondylus* Linné, 1758

***Spondylus* cf. *fimbriatus*** Goldfuss, 1835.

Compare:

√\* 1835 *Spondylus fimbriatus* Goldfuss: 97, pl. 106, fig. 2.

. 1847 *Spondylus Dutempleanus* d'Orbigny: 672, pl. 460, figs. 6-11.

v. 1901 *Spondylus Dutempleanus*, d'Orbigny; Woods: 125, pl. 22, figs. 11-14 (cum syn.).

. 1968 *Spondylus fimbriatus* Goldfuss; Pasternak *et al.*: 188, pl. 38, fig. 10.

. 1968 *Spondylus dutempleanus* Orbigny; Pasternak *et al.*: 189, pl. 58, figs. 12-14.

. 1974 *Spondylus dutempleanus* Orbigny; Savcinskaja: 94, pl. 28, figs. 4, 5.

. 1975 *Spondylus fimbriatus* Goldfuss; Nestler: 56, text-fig. 73.

. 1977 *Dianchora dutempleana* (Orbigny); Sobetski: 84, pl. 5, fig. 13.

? 1981 *Spondylus (Spondylus) dutempleanus* d'Orbigny; Tzankov: 112, pl. 50, fig. 8.

v. 1982 *Spondylus dutempleanus* d'Orbigny; Dhondt: 85, pl. 2, figs. 1 - 4; pl. 4, fig. 5.

? 1985 *Spondylus* affin. *dutempleanus* (d'Orb.); Freneix and Viaud: 203.

. 1986 *Spondylus dutempleanus* d'Orbigny; Abdel-Gawad: 156, pl. 35, figs. 1-3 (cum syn.).

. 1987 *Spondylus dutempleanus* d'Orbigny; Cleevely and Morris: 88, pl. 16, fig. 3.

v. 1987 *Spondylus dutempleanus* d'Orbigny; Dhondt and Jagt: 82, fig. 3:7.

v. 1990 *Spondylus fimbriatus* Goldfuss; Dhondt and Dieni: 169, pl. 1, fig. 1; pl. 3, figs. 1-6; text-figs. 2, 3, 8, 9 (cum syn.).

**Material.** A single incomplete, but clear composite mould of a left valve (24 AP), and an incomplete composite mould of an attached valve from Drain Vivier Marquet.

**Dimensions.** UPD (25)mm, 23.5 mm; W 18.5 mm, (20) mm.

**Remarks.** The specimens from the Hautes Fagnes agree with the detailed description of Dhondt and Dieni (1990).

**Distribution.** Cenomanian to Maastrichtian, widely distributed, but mainly in chalk facies, rare in the Maastrichtian stratotype.

### 3.2. BRACHIOPODA

Phylum Brachiopoda

Order Acrotretida Kuhn, 1949  
Suborder Craniidina Waagen, 1885  
Superfamily Craniacea Menke, 1828  
Family Craniidae Menke, 1828  
Genus *Isocrania* Jaekel, 1902

***Isocrania* gr. *costata*** (J. de C. Sowerby, 1823).  
(Pl. 2, Fig. 2)



Compare:

- \* 1823 *Crania costata* J. de C. Sowerby: pl. 35, fig. 6.
- 1859 *Crania Egnabergensis* var. *paucicostata* Bosquet: 15, pl. 1, figs. 5, 6.
- 1969 *Crania ignabergensis* Retzius; Krøytzer: 30, figs. 12, 13.
- 1973 *Isocrania costata* (Sowerby 1823); Surlyk: 233, text-figs. 1, 2, 5-10, 12; pl. 1, figs. 1-11, 16-19; pls. 3, 4; pl. 6, fig. 2.
- 1979 *Isocrania costata* (Sowerby, 1823); Bitner and Pisera: 70, fig. 2.
- 1984 *Isocrania costata* (Sowerby); Ernst: 65, pl. 6, figs. 3, 4; pl. 7, figs. 1-6; pl. 8, figs. 1, 2, 9-11.
- 1987 *Isocrania paucicostata* (Bosquet); Owen in Smith and Owen: 51, pl. 9, figs. 1a, b.
- 1990 *Isocrania costata* (J. de C. Sowerby, 1823); Johansen and Surlyk: 836, pl. 1, figs. 3, 4.

**Material.** Two moulds of the external surface of ventral valves, one of them incomplete, from Drain Vequée.

**Discussion.** *Isocrania costata* is a long-ranging species; Surlyk (1973) recorded a range from the late Late Campanian to the late Late Maastrichtian. The specimens at hand were compared with material of Krøytzer's (1969) *I. egnabergensis* (non Retzius, 1781) from the Late Maastrichtian (Gulpen Formation, Lanaye Member) of Eben-Emael-Bassenge (Liège). Krøytzer's form appears to occur first in the Lanaye Member, although he recorded a single specimen from the Late Campanian Zeven Wegen Member at Haccourt (Liège); this latter specimen is better referred to as *I. campaniensis* H. Ernst, 1984, for the time being. The Hautes Fagnes specimens clearly belong in the *costata* group (*sensu* H. Ernst, 1984), and correspond well with Maastrichtian specimens illustrated by Ernst. Only careful analyses of populations with strong stratigraphic control along Ernst's lines promises reliable results. Ernst (1984) described a lineage from *I. campaniensis* (late Late Campanian) over *I. praecostata* (Early Maastrichtian, *pseudobtusa* and *obtusa* Zones) to *I. costata* (Early to Late Maastrichtian, *sumensis* to *junior* Zones).

Genus *Carneithyris* Sahni, 1925

*Carneithyris* gr. *subcardinalis* Sahni, 1925

**Material.** Two internal moulds from Drain Vivier Marquet and Drain des Fiancés.

**Discussion.** These specimens are assigned to a group of terebratulid brachiopods which is widely distributed throughout NW and NE Europe and which has been recorded from Upper Campanian and Maastrichtian strata (Asgaard, 1975; Steinich, 1965; Johansen & Surlyk, 1990).

Although poorly preserved, the specimens compare well with material known from the lower Upper Maastrichtian "Vijlen" Member and the upper Upper Maastrichtian Lanaye Member of the Gulpen Formation, as exposed in the Maastrichtian type area.

**Distribution.** Upper Campanian and Maastrichtian of Denmark, northern Germany, Poland, eastern England, and the stratotypical Maastrichtian.

### 3.3. ECHINOIDS

Phylum Echinodermata  
Order Cidaroida Claus, 1880  
Family Cidaridae Gray, 1825  
? Subfamily Cidarinae Gray, 1825  
? Tribe Stereocidarini Mortensen, 1928

*Cidaroida* indet.  
(Pl. 2, Fig. 3)

**Material.** A single incomplete primary spine, external mould, from B. 150 at Vequée.

**Description.** Length preserved 15 mm, greatest preserved diameter 6.4 mm. Its fusiform shape recalls that of representatives of the genus *Balanocidaris* Lambert, 1910, but these normally have less well-developed rows of tubercles, and rather isolated patches of tubercles of various sizes. Other fusiform primary spines are found in representatives of the genus *Hirudocidaris* Smith & Wright, 1989, especially the type species, *H. hirudo* (Sornet, 1850), but in these the ribs are clearer and generally less tuberculate. Cidarid echinoids from the Campanian Maastrichtian of the Maastrichtian type area comprise representatives of the genera *Temnocidaris* Cotteau, 1863 and *Temnocidaris* (*Stereocidaris*) Pomel, 1883; *Hirudocidaris* being unknown.

Because of the poor preservation and lack of comparative material from the area, the present specimen will have to remain indeterminate.

Order Holasteroida Durham and Melville, 1957  
Family Holasteridae Pictet, 1857  
Genus *Echinocorys* Leske, 1778

*Echinocorys* sp.  
(Pl. 2, Fig. 4)

**Material.** External and internal moulds of fragmentary test material from Croix des Fiancés and from B. 152 near Gayetay.

**Discussion.** The main interest of this material lies in the fact that it shows that the strata yielding it pre-date deposition of the Lanaye Member (Gulpen

Formation) of the Maastrichtian type-area. In that unit, the typically boreal/temperate members of the genus *Echinocorys* are replaced by the Tethyan genus *Hemipneustes* Agassiz, 1836. The numerous *Echinocorys* species of Early Campanian to Late Maastrichtian age that occur in the Maastrichtian type area are in need of revision. The present form is of moderate size for the genus and has a thick test.

Order Spatangoida Claus, 1876  
Family Brissidae Gray, 1847  
Genus *Diplodetus* Schlüter, 1900

*Diplodetus* sp.  
(Pl. 2, fig. 5)

**Material.** A fragmentary internal mould preserving part of an ambulacrum from Croix des Fiancés at B. 151.

**Discussion.** Because of the poor preservation, this specimen cannot be referred to a species and, in fact, is assigned to the genus *Diplodetus* with a query. The only spatangoid echinoids of *Micraster*-habitus to occur in the Maastrichtian of the type-area are species of *Diplodetus*, and various species have been recorded from the different lithostratigraphic units. In the Lanaye Member of the Gulpen Formation and its correlatives, *Diplodetus* is particularly well represented (van der Ham *et al.*, 1987).

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## PLATE 1

Fig. 1 . *Botuloides* cf. *intermedius* (d'Orbigny, 1845)  
 Drain des Fiancés, Hautes Fagnes, Liège  
 TCMi IRScNB 10650 x 2.5

Fig. 2 . *Limatula decussata* (Münster in Goldfuss, 1835)  
 Drain des Fiancés, Hautes Fagnes, Liège  
 TCMi IRScNB 10651, silicone cast, x 2.5

Fig. 3 . *Limatula decussata* (Münster in Goldfuss, 1835)  
 Drain Vivier Marquet, Hautes Fagnes, Liège  
 TCMi IRScNB 10652, silicone cast, x 2.5

Fig. 4 . *Microchlamys pulchella* (Nilsson, 1827)  
 Drain Vequée, Hautes Fagnes, Liège  
 TCMi IRScNB 10653, external cast of left valve, x 2

Fig. 5 . *Microchlamys pulchella* (Nilsson, 1827)  
 Helle, Hautes Fagnes, Liège  
 TCMi IRScNB 10654, silicone cast of right valve, x 3.  
 (the small pits are casting artifacts)

Fig. 6 . *Microchlamys pulchella* (Nilsson, 1827)  
 Drain Vivier Marquet, Hautes Fagnes, Liège  
 TCMi IRScNB 10655, silicone cast of left valve, x 3

Fig. 7 . *Microchlamys pulchella* (Nilsson, 1827)  
 Drain Vivier Marquet, Hautes Fagnes, Liège  
 TCMi IRScNB 10656, silicone cast of left valve, x 3

Fig. 8 . *Microchlamys pulchella* (Nilsson, 1827)  
 Drain Vivier Marquet, Hautes Fagnes, Liège  
 TCMi IRScNB 10657, silicone cast of right valves, x 4

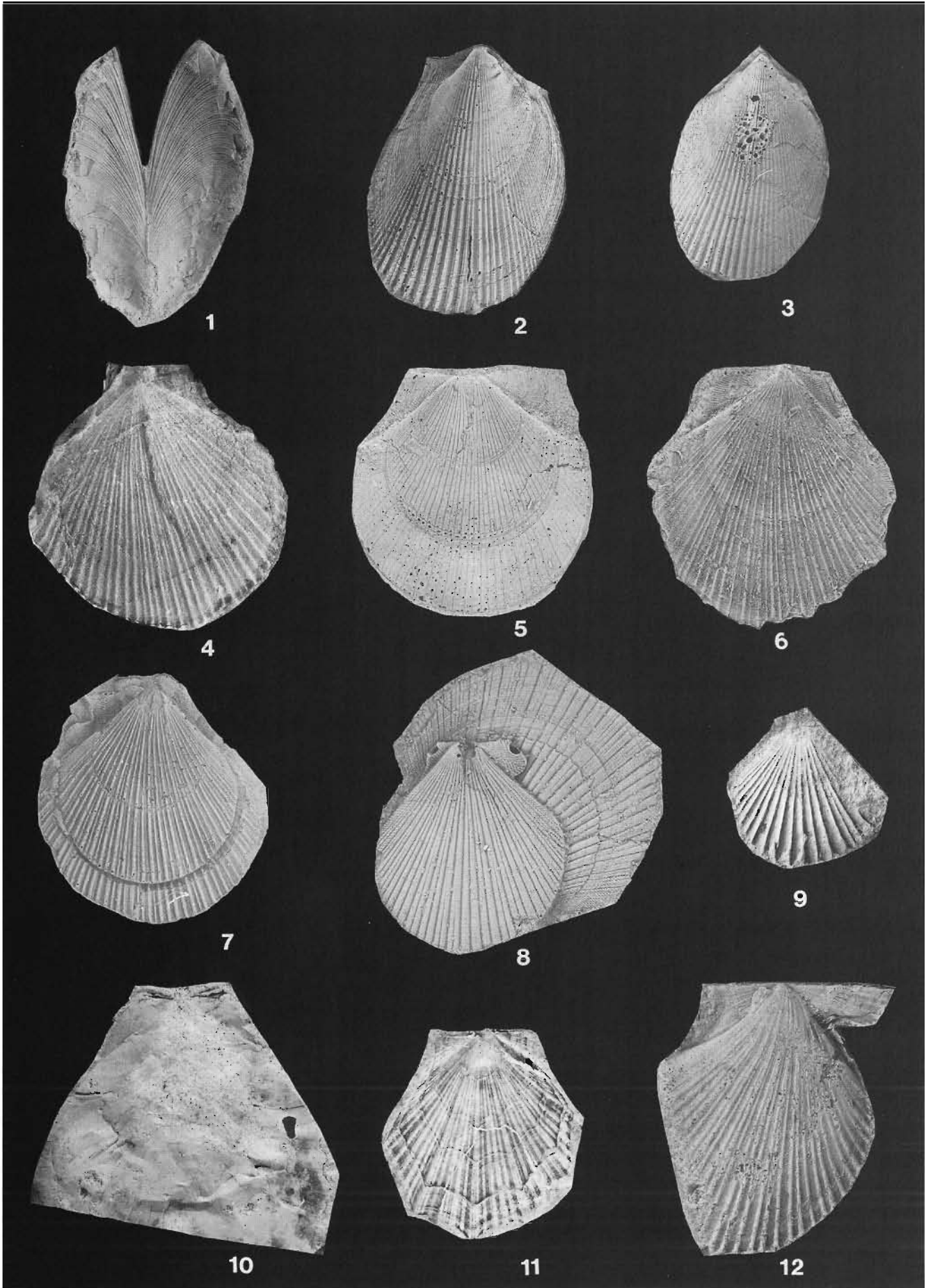
Fig. 9 . *Microchlamys campaniensis* (d'Orbigny, 1847)  
 Drain Croix des Fiancés, Hautes Fagnes, Liège  
 TCMi IRScNB 10658, silicone cast, x 4

Fig. 10 . *Entolium membranaceum* (Nilsson, 1827)  
 B 151, Hautes Fagnes, Liège  
 TCMi IRScNB 10659, x 2

Fig. 11 . *Neithea sexcostata* (Woodward, 1833)  
 Drain Vivier Marquet, Hautes Fagnes, Liège  
 TCMi IRScNB 10660, flat valve, external cast, x 2

Fig. 12 . *Merklinia variabilis* (von Hagenow, 1842)  
 Drain Croix des Fiancés, Hautes Fagnes, Liège  
 TCMi IRScNB 10661, right valve, external cast, x 3

PLATE 1



**PLATE 2**

Fig. 1. *Camptonectes virgatus* (Nilsson, 1827)  
Drain Vequée, Hautes Fagnes, Liège  
TCMI IRScNB 10662 left valve, external cast, x 7

Fig. 2. *Isocrania* gr. *costata* (J. de C. Sowerby, 1823)  
Drain Vequée, Hautes Fagnes, Liège  
TCMI IRScNB 10663, ventral valve, external surface,  
silicone cast, x 6

Fig. 3. cidaroid spine  
B. 150 at Vequée, Hautes Fagnes, Liège.  
IRScNB TCMI 10664, incomplete primary spine, sili-  
cone cast, x 6

Fig. 4. *Echinocorys* sp.  
Croix des Fiancés, Hautes Fagnes, Liège.  
IRScNB TCMI 10665, external mould, fragmentary  
test material, x 1.5

Fig. 5. *Diplodetus* sp.  
Croix des Fiancés at B. 151, Hautes Fagnes, Liège.  
IRScNB TCMI 10666, silicone cast, x 7.

PLATE 2

