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SYSTEMATIC REVISION
OF THE CHLAMYDINAE (PECTINIDAE, BIVALVIA, MOLLUSCA)
OF THE EUROPEAN CRETACEOUS
PART 3 : CHLAMYS AND MIMACHLAMYS

BY

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(with nine plates and two textfigures)

ABSTRACT

This paper is the third of a series dealing with the systematic revision of the European Cretaceous *Chlamydinæ* (*Pectinidae*, *Bivalvia*, *Mollusca*). Nine species of the genus *Chlamys* ROEDING, 1798 (*C. faujasi* (M. DEFRANCE, 1825), *C. dentata* (NILSSON, 1827), *C? elongata* (LAMARCK, 1819), *C? subacuta* (LAMARCK, 1819), *C? subdepressa* (D'ARCHIAC, 1847), *C? martiniana* (D'ORBIGNY, 1850), *C? archiaciana* (D'ORBIGNY, 1847), *C? goldfussi* (DESHAYES in LEYMERIE, 1843), *C? icaunensis* (COTTEAU, 1854) and six species of the genus *Mimachlamys* IREDALE, 1929 (*M. robinaldina* (D'ORBIGNY, 1847), *M. cretosa* (DEFRANCE, 1822), *M. mantelliana* (D'ORBIGNY, 1847), *M. henrici* nom. nov., *M. fissicosta* (ETHERIDGE, 1881), *M? undulata* (NILSSON, 1827)) are described.

M. henrici is a new name for *Pecten puzosianus* sensu WOODS non MATHÉRON.

RESUME

Ce travail est la troisième partie d'une série traitant de la révision systématique des *Chlamydinæ* (*Pectinidae*, *Bivalvia*, *Mollusca*) du Crétacé européen. Neuf espèces du genre *Chlamys* ROEDING, 1798 (*C. faujasi* (DEFRANCE, 1825), *C. dentata* (NILSSON, 1827), *C? elongata* (LAMARCK,

1819), *C?* *subacuta* (LAMARCK, 1819), *C?* *subdepressa* (D'ARCHIAC, 1847), *C?* *martiniana* (D'ORBIGNY, 1850), *C?* *archiaciana* (D'ORBIGNY, 1847), *C?* *goldfussi* (DESHAYES in LEYMERIE, 1843), *C?* *icaunensis* (COTTEAU, 1854) et six espèces du genre *Mimachlamys* IREDALE, 1929 (*M. robinaldina* (D'ORBIGNY, 1847), *M. cretosa* (DEFrance, 1822), *M. mantelliana* (D'ORBIGNY, 1847), *M. henrici* nom. nov., *M. fissicosta* (ETHERIDGE, 1881), *M?* *undulata* (NILSSON, 1827)) sont décrites.

M. henrici est un nom nouveau pour *Pecten puzosianus* sensu WOODS non MATHÉRON.

ZUSAMMENFASSUNG

Dieser Arbeit ist der dritte in einer Serie von systematischen Revisionen der europäischen Kreide-*Chlamydyinae* (*Pectinidae*, *Bivalvia*, *Mollusca*). Neun Arten der Gattung *Chlamys* ROEDING, 1798 (*C. faujasi* (DEFrance, 1825), *C. dentata* (NILSSON, 1827), *C?* *elongata* (LAMARCK, 1819), *C?* *subacuta* (LAMARCK, 1819), *C?* *subdepressa* (D'ARCHIAC, 1847), *C?* *martiniana* (D'ORBIGNY, 1850), *C?* *archiaciana* (D'ORBIGNY, 1847), *C?* *goldfussi* (DESHAYES in LEYMERIE, 1843), *C?* *icaunensis* (COTTEAU, 1854) und sechs Arten der Gattung *Mimachlamys* IREDALE, 1929 (*M. robinaldinus* (D'ORBIGNY, 1847), *M. cretosa* (DEFrance, 1822), *M. mantelliana* (D'ORBIGNY, 1847), *M. henrici* nom. nov., *M. fissicosta* (ETHERIDGE, 1881), *M?* *undulata* (NILSSON, 1827) sind beschrieben.

M. henrici ist ein neuer Name für *Pecten puzosianus* sensu WOODS non MATHÉRON.

INTRODUCTION

The present paper is the third of a series on the subfamily *Chlamydyinae* (cf. DHONDT, A. V. 1972a and b).

Chlamys ROEDING, 1798 and *Mimachlamys* IREDALE, 1929 are differentiated. For the genus *Chlamys* nine species and for the genus *Mimachlamys* six species and one subspecies are described.

The method and the aims are explained in DHONDT, A. V., 1972a, p. 2.

One species is renamed (*M. henrici*).

Palaeoecologically, two *Mimachlamys*-species are only known from very fine chalky sediments *M. fissicosta* (ETHERIDGE) and *M. mantelliana* (D'ORBIGNY), but all the Upper Cretaceous *Chlamys*-species only occur in coarser sediments.

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SYSTEMATIC DESCRIPTIONS

Abbreviations :

See in DHONDT, A. V., 1972a (p. 4).

Additional abbreviations :

R. M. : Roemer-Pelizaues Museum, Hildesheim (G. F. R.).

U. B. : Paläontologisches Institut, Rheinische Friedrich-Wilhelms Universität, Bonn (G. F. R.).

Signs in synonymy lists :

See in DHONDT, A. V., 1972a (p. 5).

Family Pectinidae RAFINESQUE

Subfamily Chlamydinae VON TEPPNER, 1922 em. SOBETZKI, 1961

Genus Chlamys ROEDING, 1798

Type-species : *Pecten islandicus* MUELLER, 1776 (HERRMANNSEN, 1846).

Discussion

In Palaeontology it has been customary to consider *Pectinidae* with strongly developed radial ribs, unequal auricles and an elongated ovoid shape as belonging to the genus *Chlamys*.

GLIBERT & VAN DE POEL, 1965, considered this genus as containing only those species which show a thimble-microsculpture (pl. 1, fig. 1).

With this characteristic it is easy to differentiate *Chlamys*-species from *Mimachlamys*-species. (*Mimachlamys* IREDALE, 1929 type-species *Pecten asperrimus* LAMARCK, 1819 O. D.).

On Recent and Tertiary specimens the microsculpture makes it possible for us to differentiate both genera, but on *Chlamys*-species from Cretaceous or older deposits the microsculpture, due to the state of preservation, is almost never visible (exception : *Chlamys faujasi* (DEFrance) from Maastricht and *C. dentata* (NILSSON) from Ivö). Because of the absence of the microsculpture other characteristics must be found to differentiate in *Chlamys* s.l. the two genera.

Such characteristics exists but numerically it seems impossible to express them. *Chlamys*-species are more elongated and have a narrower umbo than *Mimachlamys*-species; usually on *Chlamys*-species the ribs are broad, complex and few in number, whereas on *Mimachlamys*-species they are simple, very narrow and often very numerous.

Measures of A. A.

M. asperrima :

L. valves : between 87° and 105° ; av. 94.2° ($n = 13$);

R. valves : between 93° and 106° ; av. 98.2° ($n = 14$).

C. islandica :

L. valves : between 75° and 97° ; av. 86.9° ($n = 20$);

R. valves : between 76° and 97° ; av. 89.9° ($n = 20$).

Chlamys-species : Tertiary :*C. pesfelis* (LINNAEUS, 1758) :

L. valves : between 68° and 78° ; av. 73.1° ($n = 8$);

R. valves : between 72° and 82° ; av. 76.5° ($n = 20$).

Chlamys-species : Cretaceous :

C. faujasi (DEFrance) : between 62.5° and 83° ; av. 70° ($n = 29$).

C? elongata (LAMARCK) : between 60° and 84° .

C? subacuta (LAMARCK) : between 50° and 83° .

C? subdepressa (D'ARCHIAC) : between 75° and 85° .

Mimachlamys-species : Tertiary :*M. harmeri* (REGTEREN-ALTENA) :

L. valves from Oorderen : between 80° and 94° ; av. 85.8° ($n = 18$);

R. valves from Oorderen : between 86° and 94° ; av. 90.3° ($n = 21$);

L. valves from Austruweel : between 83° and 92° ; av. 86.2° ($n = 25$);

R. valves from Austruweel : between 81° and 92° ; av. 87.9° ($n = 14$).

M. varia (LINNAEUS) :

L. valves : between 82° and 100° ; av. 90.1° ($n = 8$);

R. valves : between 81° and 93° ; av. 88.5° ($n = 13$).

Mimachlamys-species : Cretaceous :

M. cretosa (DEFrance) : between 67° and 98° ; av. 84° ($n = 42$).

M. robinaldina (D'ORBIGNY) : between 65° and 92° ; av. 81° ($n = 108$).

M. fissicosta (ETHERIDGE) : between 78° and 115° ; av. 87° ($n = 39$).

M. mantelliana (D'ORBIGNY) : between 85° and 95° ; av. 89° ($n = 11$).

On average *Mimachlamys*-species have a wider apical angle, but this characteristic cannot be used for individual species since the values of the A. A. overlap between both genera.

Definition of *Chlamys* which can be used on Cretaceous species : *Chlamydinae* with U. P. D. > W, covered with 12 to 40 radial ribs which are at least as broad as the intercostal intervals, always well developed and elevated above the shell-surface, and often subdivided. The A. A. is narrower than 90° and the auricles are very unequal.

Chlamys faujasi (M. DEFRANCE, 1825)

(Pl. 1, fig. 2a-e)

- | | |
|---|---|
| . 1799 — | FAUJAS-SAINT-FOND, p. 153, pl. 24, f. 5. |
| 1825 — <i>Pecten Faujasii</i> Def. | M. DEFRANCE, p. 265 |
| v . 1833 — <i>Pecten Faujasii</i> DeFrance | A. GOLDFUSS, p. 57, pl. 93, f. 7 a-b. |
| 1841 — <i>Pecten Faujasii</i> Def. | F. A. ROEMER, p. 51. |
| . 1842 — <i>Pecten puzosianus</i> Math. (pro parte) | P. MATHÉRON, pp. 185-186, pl. 30, f. 1-3. |
| ? 1846 — <i>Pecten Faujasii</i> DeFrance | A. E. REUSS, p. 30. |
| v ? 1847 — <i>Pecten Marrotianus</i> d'Orbigny | A. D'ORBIGNY, pp. 612-613, pl. 438, f. 1-6. |
| v . 1847 — <i>Pecten royanus</i> d'Orbigny | A. D'ORBIGNY, p. 613, pl. 438, f. 7-12. |
| v . 1847 — <i>Pecten Espaillaci</i> d'Orbigny | A. D'ORBIGNY, p. 614, pl. 439, f. 1-4. |
| v . 1847 — <i>Pecten Puzosianus</i> Mathéron | A. D'ORBIGNY, p. 610, pl. 437, f. 1-4. |
| (1850) — <i>Pecten Puzosianus</i> Mathéron | A. D'ORBIGNY, p. 197, n° 160. |
| (1850) — <i>Pecten Faujasii</i> DeFr. | A. D'ORBIGNY, p. 252, n° 851. |
| (1850) — <i>Pecten Marrotianus</i> d'Orb. | A. D'ORBIGNY, p. 251, n° 831. |
| (1850) — <i>Pecten Royanus</i> d'Orb. | A. D'ORBIGNY, p. 251, n° 832. |
| (1850) — <i>Pecten Espaillaci</i> d'Orb. | A. D'ORBIGNY, p. 251, n° 833. |
| (1850) — <i>Pecten Faujasi</i> DeFrance | H. B. GEINITZ, p. 182. |
| (1861) — <i>Pecten Espaillaci</i> d'Orb. | W. GABB, p. 214. |
| (1861) — <i>Pecten Faujasii</i> DeFr. in Goldf. | W. GABB, p. 214. |
| (1861) — <i>Pecten Marrotianus</i> d'Orb. | W. GABB, p. 215. |
| (1861) — <i>Pecten Royanus</i> d'Orb. | W. GABB, p. 216. |
| (1866) — <i>Pecten Faujasi</i> DeFr. | C. GIEBEL, p. 48. |
| v . 1866 — <i>Pecten Royanus</i> d'Orb. | K. A. ZITTEL, p. 113, pl. 18, f. 1 a, b. |
| (1870) — <i>Pecten Marrotianus</i> d'Orb. | F. J. PICTET & G. CAMPICHE, p. 215. |
| (1870) — <i>Pecten Royanus</i> d'Orb. | F. J. PICTET & G. CAMPICHE, p. 215. |

- (1870) — *Pecten Espailiaci* d'Orb. F. J. PICTET & G. CAMPICHE, p. 215.
- (1870) — *Pecten Faujasi* (Defr.) Goldf. F. J. PICTET & G. CAMPICHE, p. 219.
- (1871) — *Pecten Marrotianus* d'Orb. F. STOLICZKA, p. 428.
- (1871) — *Pecten Royanus* d'Orb. F. STOLICZKA, p. 428.
- (1871) — *Pecten Espailiaci* d'Orb. F. STOLICZKA, p. 428.
- (1871) — *Pecten Faujasi* Goldf. F. STOLICZKA, p. 429.
- ? 1875 — *Pecten sectus* D. BRAUNS, p. 390.
- non 1833 *Pecten sectus* A. Goldfuss.
- ? 1875 — *Pecten Espailiaci* d'Orb. H. ARNAUD, p. 31.
- 1882 — *Pecten Faujasii* Dfr. H. SCHROEDER, p. 265.
- . 1887 — *Pecten elongatus* A. PÉRON, p. 163.
- non 1819 *Pecten elongatus* J. B. Lamarck.
- (1888) — *Pecten* ? *Faujasi* Defr. F. E. GEINITZ, p. 735.
- 1892 — *Pecten Faujasi* Goldf. F. VOGEL, pp. 59-60.
- . 1895 — *Pecten* (*Chlamys*) *Faujasi* F. VOGEL, p. 24, pl. 1, f. 22.
- . 1895 — *Pecten* (*Chlamys*) spec. F. VOGEL, p. 24, pl. 1, f. 23.
- 1898 — *Pecten dentatus* Nilss. (pro G. MUELLER, p. 31, pl. 5, f. 4. parte)
- . 1905 — *Pecten Faujasi* Defr. T. WEGNER, p. 173.
- ? 1905 — *Pecten muricatus* T. WEGNER, p. 171.
- non 1833 *Pecten muricatus* A. Goldfuss.
- ? 1911 — *Pecten* cfr. *Faujasii* Dfr. K. VOGEL VON FALCKENSTEIN, p. 551.
- (1916)b — *Pecten* cf. *Faujasi* Defr. J. BOEHM, p. 428.
- ? 1916 — *Pecten Royanus* (d'Orb.) Zittel F. FRECH, p. 276, pl. 14, f. 6.
- . 1920 — *Chlamys Puzosianus* Matheron F. ROMAN & P. MAZERAN, pp. 88-89, pl. 9, f. 8-9.
- (1924) — *Pecten Espailiaci* d'Orb. R. ABRARD, p. 643, 644, 645, 646, 648.
- v ? 1931 — *Pecten faujasi* Defr. W. HAENTZSCHER, p. 497.
- ? 1934 — *Pecten* (*Aequipecten*) cf. *royanus* d'Orb. M. BLANCKENHORN, p. 187, pl. 8, f. 20.
- ? 1934 — *Pecten* (*Chlamys*) *faujasi* Defr. H. ANDERT, pp. 159-161, pl. 9, f. 6, 7.
- ? 1937 — *Pecten* (*Chlamys*) cf. *faujasi* Defr. E. BEYENBURG, p. 303.
- (1939) — *Pecten marrotianus* d'Orb. E. BASSE, p. 41.
- v . 1939 — *Pecten* (*Chlamys*) *faujasi* Defr. E. DACQUÉ, p. 201, pl. 16, f. 9, 10, 21.
- 1947 — *Pecten* (*Chlamys*) *faujasi* Defrance R. HÄGG, p. 70.
- (1956) — *Pecten marrotianus* d'Orb. P. SÉNESSE, p. 166.
- . 1963 — *Chlamys* (*Chlamys*) *furci-costata* n. sp. V. ZAZVORKA, pp. 203-208, pls. 1, 2.
- (1964)a — *Pecten* (*Chlamys*) *faujasi* *faujasi* Defr. H. ARNOLD, p. 97, 98, 99, 101, 104.

- (1964)b — *Pecten (Chlamys) faujasi* H. ARNOLD, p. 207.
Defr.
(1964)c — *Pecten (Chlamys) faujasi* H. ARNOLD, p. 317.
Defr.
? 1967 — *Chlamys* cf. *royanus* d'Or- E. V. KOTETISHVILI, p. 35,
bigny pl. 1, f. 12.
1968 — *Pecten faujasi* Defr. B. BOUČEK, p. 14.
non 1842 *Pecten Faujasii* H. B. Geinitz, p. 83.
non 1846 *Pecten Faujasii* H. B. Geinitz, p. 468.
= 1819 *Pecten elongatus* Lamarck.
non 1902 *Pecten (Chlamys) Puzosianus* H. Woods, pp. 165-166, pl.
30, f. 9-12.

Location of the type-specimens

Holotype : the original of the figure in FAUJAS- SAINT-FOND, pl. 24, fig. 5, 1799. Where this specimen is kept cannot be ascertained; officially the FAUJAS collection is in the Muséum national d'Histoire naturelle in Paris, but the labels have been lost. However, it is not necessary to select a neotype : the figure in FAUJAS and the numerous topotypes leave no doubt as to the content of the species.

Pecten puzosianus : lost (fide F. ROMAN and P. MAZERAN, 1920).

Pecten marrotianus : Ecole des Mines (now Lab. Paléontologie stratigraphique, Faculté d'Orsay).

Pecten espaillaci : Muséum national d'Histoire naturelle, Paris, coll. D'ORBIGNY, n° 7600 A.

Pecten royanus : Muséum national d'Histoire naturelle, Paris, coll. D'ORBIGNY, n° 7614 E.

Chlamys (Chlamys) furcicostata : Geological-palaeontological Section of the National Museum, Prague, n° 0 1014.

Stratum typicum :

Couche craieuse de la Montagne de Saint-Pierre de Maëstricht (Upper Maastrichtian).

Pecten puzosianus : craie chloritée (Senonian) (fide F. ROMAN and P. MAZERAN).

Pecten marrotianus : étage de la craie (Turonian-Senonian).

Pecten espaillaci : étage sénonien (Senonian).

Pecten royanus : id.

Chlamys (Chlamys) furcicostata : Middle Turonian (layer IX cd) (Ierschichten in A. FRITSCH).

Locus typicus :

Sint Pietersberg, Maastricht (The Netherlands).

Pecten puzosianus : Martigues (Bouches du Rhône) (France) (chosen by F. ROMAN and P. MAZERAN).

Pecten marrotianus : La Chapelle-Montabourlet (Dordogne) (France).

Pecten espaillaci : Royan (Charente) (France).

Pecten royanus : id.

Chlamys (Chlamys) furcicostata : Desná u Litomyšle (mylně Bubovina, osada Dolánky).

Original descriptions

Coquille alongée (sic), aplatie, à oreilles inégales, portant sur chaque valve trente côtes écailleuses et striées longitudinalement. Longueur, deux pouces.

On la trouve dans la couche craieuse de la Montagne de Saint-Pierre de Maëstricht.

Pecten puzosianus

« P. testâ ovatâ, explanatâ, aequivalvi, transversim striatâ, longitudinaliter sulcatâ; costellis numerosissimis subinaequalibus, bisulcatis, adutorum subsquamosis, juvenum subconnexis minutissimè transversim lamelloso-squamosis; auriculis inaequalibus striato-decussatis; posticis minoribus, anticâ valvae dextrae profundè emmarginatâ (sic).

Ce pecten a beaucoup de rapports avec le *P. Faujasii* de LAMARCK; mais il en diffère par son plus grand nombre de côtes et par l'angle très obtus que fait, avec le bord de la coquille, le bord latéral de l'oreillette postérieure. Dans le *Pecten Faujasii*, cet angle est presque droit. Les côtes longitudinales sont divisées en trois petites côtes dont la médiane est la plus grande : c'est sur elle qu'on observe les aspérités sub-imbriquées.

Longueur 84 millim.; largeur 58 millim.

Craie chloritée 24 c. les Martigues, Uchaux, Mornas, Sault. M. Puzos a enrichi ma collection de deux échantillons trouvés dans le Grés-vert de Tournay. »

Pecten marrotianus

« P. testâ ovatâ, maximè depressâ, subaequalvi, radiatim tenuiter constatâ; costis inaequalibus, numerosis, transversim eleganter lamellosis, imbricatis, alteris elevatis (junior), simplicibus (adultus), tricostatis, intermediisque costis duabus minimis; auriculis magnis inaequalibus.

Dimensions. Largeur, 95 millim. — Par rapport à la largeur : longueur, 81/100; épaisseur, 23/100. — Angle apical, 80°.

Coquille ovale, oblongue, très-déprimée, ornée d'un grand nombre de côtes inégales, saillantes, arrondies, toutes ornées, à égale distance, de petites lames imbriquées annulaires. Jusqu'au diamètre de quarante millimètres il y a alternativement une côte plus élevée et deux plus petites; mais, au diamètre de cent millimètres, chaque grosse côte vient en former trois petites groupées ensemble, tandis que les deux petites intermédiaires du jeune âge restent simples. Les oreilles sont inégales.

Rapports et différences. Cette espèce, par sa forme et par ses côtes, se rapproche du *P. cretosus* de GOLDFUSS (non *cretosus*, DEFRANCE), mais elle s'en distingue par deux côtes intermédiaires au lieu d'une seule, et parce que l'âge adulte seulement offre le groupement des côtes du jeune âge du *cretosus*.

Localité. M. MARROT l'a recueillie aux environs de la Chapelle-Montabourlet (Dordogne), dans l'étagé de la craie. »

Pecten royanus

« P. testâ, ovatâ, depressâ, radiatim costatâ; costis (26) inaequalibus, in medio simplicibus, transversim lamellosis, lateribus complicatis, tribus fascicularibus.

Dimensions. Largeur, 60 millim.

Coquille ovale, déprimée, ornée d'environ vingt-six côtes inégales ainsi distribuées : au milieu, des côtes un peu anguleuses, simples, égales aux sillons qui les séparent; aux deux côtés, et surtout à la région anale, il naît d'abord une petite côte intermédiaire, puis enfin les côtes sont groupées par faisceaux de trois, une grosse et deux petites. Toutes ces côtes sont marquées en travers de petites côtes lamelleuses très-étroites.

Rapports et différences. Cette espèce, voisine par sa forme du *P. Espaillaci*, s'en distingue par ses côtes beaucoup moins nombreuses et plus inégales.

Localité. M. D'ARCHIAC et moi nous l'avons recueillie à Royan (Charente-Inférieure), dans la craie supérieure ou étage senonien. Elle y est rare. »

Pecten espaillaci

« *P. testâ* ovatâ, transversâ, depressâ, subaequalvi; valva inferiore convexo-planâ, radiatim costatâ; costis (36) aequalibus, rotundatis, transversim costato-lamellosis, sulcis transversim lamellosis; latere anali sublaevi, striato.

Dimensions. Largeur, 62 millim. — Par rapport à la largeur : longueur, 75/100; épaisseur, 24/100. — Angle apical, 78°.

Coquille transverse, oblique, déprimée, subéquivalve, la valve supérieure un peu plus bombée que l'autre. Valve inférieure ornée de trente-six côtes rayonnantes, simples, plus larges que les sillons qui les séparent, arrondies et pourvues, en travers, de petites côtes lamelleuses. Sur la région anale, une assez large surface est sans côtes, inégalement striée; sur la région buccale, il y a trois ou quatre petites côtes entre les autres.

Rapports et différences. Voisine, par sa forme et ses côtes simples, du *P. subacutus*, cette espèce s'en distingue par ses côtes plus nombreuses, non muriquées, et par l'espace sans côte de la région anale.

Localité. Propre à l'étage senonien, cette espèce a été recueillie, par M. D'ARCHIAC et par moi, à Royan (Charente-Inférieure); aux environs de Périgueux, à Montignac, à Colombier (Dordogne), par MM. QUERRY et MAROT. »

Additional description

Number of specimens studied : total : 79.

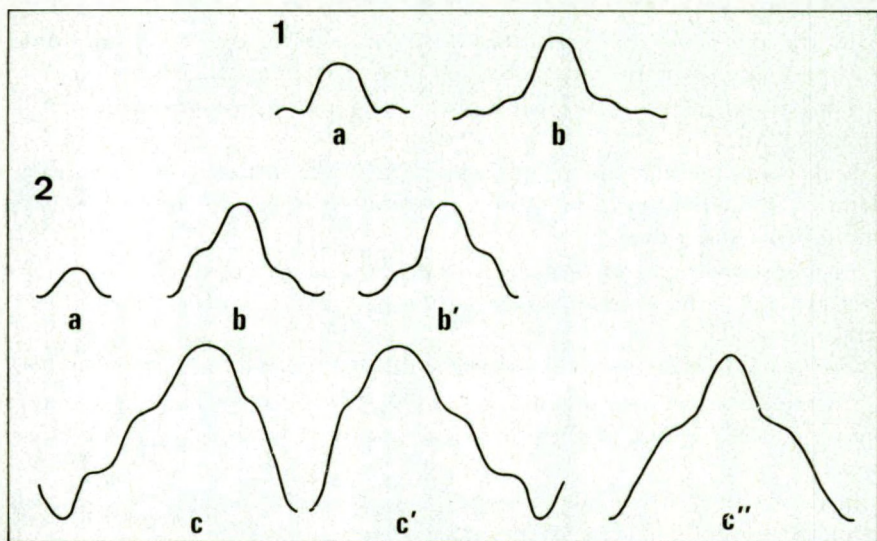
East German Turonian	8 specimens
French Turonian	2 specimens
West German Turonian	3 specimens
Austrian Turonian-Coniacian ...	3 specimens
French Senonian	15 specimens
West German Senonian	8 specimens
Belgian-Dutch Maastrichtian ...	40 specimens

Measurements :

	U. P. D. mm	W. mm	A. A.	ribnumber
Maastricht	10 to 80	7.5 to 68	62.5° to 83°	25 to 35
	av. 40	av. 43	av. 70°	av. 29
	(n = 33)	(n = 37)	(n = 32)	(n = 38)

Polenztal, Sachsen (6 specimens) : Ribnumber varies from 26 to 35.

Description :



Textfig. A. — *Chlamys faujasi* : Ribprofiles : 1 : Left valve, 1a : young valve, 1b : medium-sized valve; 2 : Right valve, 2a : very young valve, 2b : medium-sized valve, b left side of the valve, b' right side of the valve, 2c : large valve, c : left side of the valve, c' right side of the valve, c'' median rib.

Diagnosis. — *Chlamys*-species with tripartite ribs on right valves and with undivided ribs on small left valves and divided ribs on larger left valves; the ribnumber varies from 25 to 35.

The valves are elongated and prosocline, flattened, and the pallial margin is higher at the anterior disc side than at the posterior side.

Right valves : the macrosculpture differs in the various growthstages, but in all stages the ribs are steep and narrow and the intercostal intervals are deep.

- on very young (small) specimens the ribs are undivided and covered with large scales at regular intervals which cover almost the complete rib (textfig. A 2 a);
- on medium-sized specimens the ribs are asymmetrically tripartite : on the anterior disc side the side riblet nearest to the anterior disc margin is higher on the rib side than the side riblet on the rib side nearer to the middle of the disc; the rib in the middle of the shell is symmetrical : both side-riblets there are at the same height of the rib sides. The ribs are crossed by concentric striae which form scales on the three rib parts (textfigs. A 2 b, b');
- on large specimens the ribs are even more asymmetrical : in the anterior part of the disc the side riblet nearest to the anterior margin is divided into two superposed side riblets; the highest on the rib side

is placed at a lower level than the only side riblet on the rib side nearest to the middle of the disc (textfig. A 2 c).

In the posterior disc part the situation is reversed : the side riblet nearest to the posterior margin is divided, etc... (textfig. A 2 c').

The median rib has undivided side riblets and is symmetrical. (textfig. A 2 c'').

Scales are present on all rib parts; they are situated on concentric, slightly elevated lines. The scales are more pronounced on the rib top than on the side riblets.

In medium-sized and large valves the ribs in the anterior half of the disc are the perfect mirror-image of those in the posterior half (or vice-versa) (textfig. A 2 c, c').

The median rib is the only symmetrical one (textfig. A 2 c'').

Anterior auricle : elongated and winglike with deep byssal sinus, rather broad, covered with concentric elevated lines which bend along the byssal sinus.

Posterior auricle : smaller, triangular, acute-angled with 5 ribs diverging from the umbo to the outer margin.

Left valves : the macrosculpture depends on the size; the intercostal intervals are only half as broad as the ribs; in the intercostal intervals there are very narrow riblets : in small valves one riblet in each intercostal interval, but in larger specimens it is divided into three. All ribs are covered with spiny scales on concentric lines (textfig. A, 1 a, b).

Anterior auricle : acute-angled with 5 radial ribs diverging from the umbo to the outer margin.

Posterior auricle : smaller; macrosculpture is not clearly visible.

Description

Synonymy :

GOLDFUSS, 1833, described and figured a large right valve; his figure is more complete than his specimens and his additions were not all fortunate : the auricles as drawn by him are too broad and too short. The ribprofile (fig. 7b) is from the posterior half of a right valve. GOLDFUSS did not possess any left valves.

VOGEL, 1895, discussed *Pecten faujasi* in detail : he demonstrated the difference in macrosculpture between small and large valves. As he suggested, what he described as *Pecten (Chlamys)* spec. is the, till then, unknown left valve of *Chlamys faujasi*. For *Pecten puzosianus* MATHÉRON I adopt the interpretation of F. ROMAN and P. MAZERAN, 1920. According to MATHÉRON's description and figures and to those by these former authors as well, there is no doubt as to the identity of this taxon with *C. faujasi*. However, not all localities indicated by MATHÉRON are pos-

sible for *C. faujasi* and thus it is probable that the specimens from Tournai, Belgium, belong in fact to *C. elongata* (LAMARCK). The description by H. WOODS based on a figure in D'ORBIGNY concerns another species (see *Mimachlamys henrici*, n. sp., p. 99).

D'ORBIGNY described three taxa (*Pecten espaillaci*, *P. marrotianus* and *P. royanus*) which are very similar to *C. faujasi* : all three have the same shape, tripartite ribs and a ribnumber almost within the variability of *C. faujasi*.

P. marrotianus : D'ORBIGNY does not specify the ribnumber; on the figure I counted 38 which is just outside the variability of *C. faujasi*; the specimen itself is not very well preserved.

P. royanus : ribnumber according to D'ORBIGNY : 26; on the figure it is the same; on the original material counting is almost impossible due to the state of preservation.

P. espaillaci : ribnumber according to D'ORBIGNY : 36; on the figure 30; on the original material : 7600 A : right ? valve : 25 ribs, left ? valve : 24 ribs; 7600 C : 23-24 ribs.

This is almost within the variability established for *C. faujasi*; according to D'ORBIGNY, *P. espaillaci* has undivided ribs on the right valve and this is not possible in *C. faujasi*; it should be noted, however, that none of D'ORBIGNY's *P. espaillaci* specimens has auricles; thus it could be that instead of right valves they are left valves and on *C. faujasi* left valves have undivided ribs, even if the valves are medium-sized to large.

The three D'ORBIGNY's taxa can be considered as being very close and almost certainly in the range of *C. faujasi* if one takes into consideration their different sizes and sides (left and right valves).

In confirmation of this I saw in the Muséum d'Histoire naturelle in Geneva a specimen labelled *Pecten royanus* D'ORBIGNY from Royan. Its state of preservation is much better than on the specimens from the Muséum national in Paris and this specimen is undoubtedly a *C. faujasi*.

Pecten royanus as figured and described by ZITTEL, 1866 (specimens in the Geologische Bundesanstalt in Vienna) forms, in a similar way as the specimens from around Dresden, a transition between *Pecten elongatus* LAMARCK and *C. faujasi* (DEFrance).

Chlamys (Chlamys) furcicostata ZAZVORKA, 1963, seems to be identical with *C. faujasi*. The differences indicated by ZAZVORKA concern : a) the shape of the byssal sinus, b) the width of the apical angle; for both, ZAZVORKA's knowledge of *C. faujasi* seems to come exclusively from GOLDFUSS's figure which as stated above gives an erroneous idea of the auricles and automatically also of the byssal sinus. As for the apical angle, I do not entirely understand why ZAZVORKA gives values for *C. (C.) furcicostata* reaching from 90° to 110° when for the holotype on pl. 2 the value does not reach 80° and this falls within the *C. faujasi* variability.

Variability :

The variation for size, ribnumber and ribstructure are given in the description. Specimens of the same size can vary in the development of the rib scales : on some exceptional specimens they can be almost absent : then the ribs are divided into equal squares by concentric lines.

Differentiation :

The *Chlamys*-species in the Upper-Cretaceous *C. faujasi*, *C. dentata* (NILSSON) and *C. ? elongata* (LAMARCK) form a homogeneous group : from the oldest *C. ? elongata* specimens till the Upper Maastrichtian *C. faujasi* (and Upper Campanian *C. dentata* specimens) a continuous change can be noted towards greater regularity in ribdistribution, ornamentation and structure. It is difficult to decide where *C. ? elongata* stops and *C. faujasi* begins : after the *plenius*-zone almost all the ribs are subdivided but the ribs remain as one till the pallial margin, whereas in older specimens ribs subdivided near the umbo are divided into several undivided ribs at the pallial margin. The division into riblets is constant for all ribs after the *plenius*-zone, but this is not so in Cenomanian or stratigraphically older specimens. These differences, which are almost constant, appear to suffice for distinguishing *C. ? elongata* from *C. faujasi* and *C. dentata*.

C. dentata differs from *C. faujasi* in having a higher ribnumber and more developed spines rather than scales.

C. ? subacuta (LAMARCK) has sharper, undivided ribs which are covered by not very numerous scales or spines.

C. ? subdepressa (D'ARCHIAC) has fewer, undivided ribs and the scales are distributed in a different way.

Generic attribution :

On a few specimens from Maastricht the thimble-microsculpture is clearly visible. Thus *Pecten faujasi* DEFRANCE, 1825, should be named *Chlamys faujasi* (DEFRANCE, 1825).

Stratigraphical and geographical distribution

Turonian : FRANCE :

Meaulnes (Maine-et-Loire) (DR.)

G. D. R. :

Polenzthal, Hohnstein, Mühlbergstrasse and Wartenburgstrasse (DR.)

G. F. R. :

Rogging S. of Regensburg (Mü.)

Turonian-Coniacian : AUSTRIA :

Gosau-Formation : Dittelbach, Sankt Wolfgang (Geol. Bund. W., N. M. W.)

Senonian : FRANCE :

La Chapelle-Montabourlet, Dordogne (Ec. Mines, orig. D'ORBIGNY *Pecten marrotianus*)

Martigues (Musé. orig. D'ORBIGNY for *Pecten puzosianus* 6901 A)

Meschers, Charente-Maritime (Musé. coll. D'ORBIGNY)

Mirebeau, Charente (Musé. coll. D'ORBIGNY)

Pérignac, Charente (Musé. coll. D'ORBIGNY)

Royan, Charente (Mus. Gen., Musé also orig. D'ORBIGNY)

Talmont, Charente-maritime (Mus. Laus.)

Tours, Indre-et-Loire (Musé. coll. D'ORBIGNY)

Maastrichtian : BELGIUM - THE NETHERLANDS :

Geulhem (Ma.)

Maastricht (KO.)

Sint Pietersberg, Maastricht (B., I. R. Sc. N. B., Ma., Mus. Laus., U. B.)

Valkenburg (Ma.)

Chlamys dentata (S. NILSSON, 1827)

- | | |
|---|---|
| v . 1827 — <i>Pecten dentatus</i> | S. NILSSON, p. 20, pl. 10, f. 9. |
| (1870) — <i>Pecten dentatus</i> Nils. | C. SCHLUETER, p. 937. |
| v . (1882) — <i>Pecten dentatus</i> | J. DE MORGAN, p. 26, 27. |
| 1883 — <i>Pecten serratus</i> Nilss. | A. FRITSCH, p. 116. |
| 1893 — <i>Pecten serratus</i> Nilsson | A. FRITSCH, p. 101, f. 124 A-B. |
| 1897 — <i>Pecten dentatus</i> Nilsson | A. HENNIG, p. 51. |
| v . 1897 — <i>Pecten serratus</i> Nilsson | A. HENNIG, pp. 50-51, pl. 3, f. 15. |
| . 1898 — <i>Pecten dentatus</i> Nilss. p.p. | G. MUELLER, pp. 31-32, pl. 5, f. 3,5 (non fig. 4 = <i>Chlamys faujasi</i> DEFRA-
NCE). |
| (1904) — <i>Pecten dentatus</i> Nilsson | A. WOLLEMAN, p. 36. |
| 1905 — <i>Pecten dentatus</i> Nilss. | T. WEGNER, p. 174. |
| 1911 — <i>Pecten dentatus</i> Nilss. | K. VOGEL VON FALCKEN-
STEIN, p. 553. |
| (1919) — <i>Pecten dentatus</i> Nilsson | C. WIMAN, p. 312. |
| 1938 — <i>Pecten dentatus</i> Nilsson | J. G. CARLSSON, p. 9. |
| (1954) — <i>Pecten (Chlamys) dentatus</i> Nilsson | R. HÄGG, p. 40. |
| ? (1964)a — <i>Pecten (Chlamys) dentatus</i> Nilss. | H. ARNOLD, p. 97. |

- ? (1964)b — *Pecten (Chlamys) cf. dentatus* Nilss. H. ARNOLD, p. 307.
 ? (1964)c — *Pecten (Chl.) dentatus* Nilss. H. ARNOLD, p. 317.

Location of type-specimen

Palaeontologiska Institutionen, University of Lund (Sweden) : LO 66 T.

Stratum typicum :

Not indicated by NILSSON; probably Campanian.

Locus typicus :

? Balsberg (Sweden).

Original description

« *P. testa ovata maxima, convexiuscula, plicato-costata, costis numerosis (36-40) medio dentibus serratis, utrinque stria angusta ornatis, & sulco concavo distinctis; auriculis transversim tenuiter striatis. Longit. 4 1/2; lat. 3 1/2 poll.*

Descript. Maxima sui generis species in formatione nostra cretacea obveniens. Quoad ad fornem oblongo ovata parum convexa, depressiuscula, angulo basali acuto. Tota superficies radiatim plicata, plicis circiter quadraginta; quarum singula in medio dorso ornatur serie dentium serratorum & utrinque stria laevi humiliore. Interstitiorum sulci concavi laeves vel longitudinaliter striati. Plicae paginae internae laeves sunt & minus distinctae.

Locus. Specimen depictum in Collectione Retziana Musei Lundensis sine loco asservatur. Petra autem adhaerens & petrificata quaedam parasitica (e. gr. *Spirorbis Glaebella* n. etc.) indicare videntur specimen esse e stratis montis Blasberg deportatum. In his stratis aliud multo majus, sed magis fractum ipsi postea legimus. »

Additional description

Number of specimens studied : total : 114.

German Senonian	...	...	...	...	...	...	12
Swedish Campanian	...	...	...	...	...	...	102

Measurements :

	U. P. D.	W.	A. A.	Ribnumber
Balsberg				
(Sweden) :	—	58.9 mm	—	38
	—	—	—	39

	U. P. D.	W.	A. A.	Ribnumber
Ignaberga :	13.0 mm	11.2 mm	77°	—
	—	30.6 mm	—	—
	—	48.1 mm	—	—

Ivö :

U. P. D.	varies from 10.3 mm to 129.0 mm; av. 74.95 mm (n = 13)			
W.	varies from 36.7 mm to 105.2 mm; av. 65.79 mm (n = 16)			
A. A.	varies from 63°	to 81°	; av. 74.1°	(n = 15)
Ribnumber	varies from 28	to 44	; av. 36	(n = 21)

Description :

Diagnosis. — Medium to large *Chlamys*-species with 27 to 45 often tripartite (particularly on the right valve) ribs, with scaly spines.

Right valve : ribs are mostly tripartite, and always so at the pallial margin; on top of the ribs are small spines, but no concentric striae.

Left valve : ribs undivided and with large spines of varying size; the scales which form the spines are very close to each other on the rib top.

The subdivision of the ribs is such that their transection is asymmetrical : towards the median part of the shell (the U. P. D. being considered as the middle of the disc) a riblet lies along the rib; the rib on the U. P. D. is symmetrical; the ribs on the left side of the valve have a riblet on their right side and vice versa. On larger shells the median rib is also tripartite but symmetrically so.

The auricles are very unequal :

- on the right valve the anterior auricle is wing-like, elongated and with a very deep byssal sinus; covered with radial ribs; posterior auricle much smaller, obtuse-angled and with a few radial riblets;
- on the left valve the anterior auricle is large, with acute angle and with very slight byssal sinus; also covered with radial ribs in fan-distribution; the posterior auricle is small, obtuse-angled and as on the right valve.

Discussion

Synonymy :

Pecten serratus as figured and described in A. HENNIG, 1897, is a left valve of *Pecten dentatus* NILSSON. *Pecten serratus* NILSSON is generally considered to be synonymous with *Mimachlamys cretosa* (DEFrance); whether this is correct can no longer be checked : the original of *Pecten serratus* LO 67 t cannot be found in the Palaeontological Collections of Lund University.

Whether *Pecten dentatus* is specifically different from *Chlamys faujasi* (DEFrance) is not easy to decide : both have the same disc and auricle shape, a similar rib-distribution, a similar rib shape and a similar stratigraphical distribution. They differ in :

- the rib number (*C. faujasi* : 25-35, av. 29; *C. dentata* : 25-44, av. 36);
- the rib ornamentation (*C. faujasi* has smaller spines and more subdivided ribs; *C. dentata* has large spines and more closely set scales on the left valves);
- the geographical distribution (*C. faujasi* is more widely distributed than *C. dentata* which is restricted to the Emscher of the Harz and to Swedish Campanian).

The differences existing between both species are slight but since there is a geographical and morphological difference it seems best, for practical purposes, to consider both as different species or subspecies.

Differentiation :

This species is so similar to *C. faujasi* that other *Chlamys* species can be differentiated from it on the same grounds as those mentioned for *C. faujasi*.

Generic attribution :

Pecten dentatus NILSSON, 1827, belongs undoubtedly to *Chlamys* ROEDING because two specimens from Ivö in the Collection of F. SURLYK, Mineralogisk Museum, Copenhagen, clearly show the thimble-microsculpture.

Stratigraphical and geographical distribution

Senonian : Lower Senonian : G. F. R. :

« Quadratensenon » : Gross Bülten (Harz) (GH.); Hoheneggelsen (Harz) (GH.)

Senonian : Upper Senonian: SWEDEN :

Ballingslöv (Lund)

Balsberg (B., KO., Lund also orig. NILSSON)

Balsvig (KO.)

Barnakälla (Lund)

Carlshamm (B., KO., Lund also orig. HENNIG, 1897, pl. III, fig. 15)

Ifö (B. M., GH., GR., KO., Lund)

Ifö, Blacksudden (B. M., Lund)

Ignaberga (GR., KO., Lund)

Kjuge (Lund)

Maltesholm (KO.)

Ringlestätt (KO.)

Tullstorp (Lund)

« Skåne » (KO., Musé. coll. J. DE MORGAN).

Chlamys ? elongata (J.-B. LAMARCK, 1819)

(Pl. 2)

- | | |
|--|---|
| . 1819 — <i>Pecten elongatus</i> | J. B. LAMARCK, p. 181, n° 10. |
| . 1822 — <i>Pecten obliquus</i> | J. SOWERBY, p. 95, pl. 370, f. 2. |
| 1825 — <i>Pecten elongatus</i> Lamk. | M. DEFRANCE, p. 265. |
| v . 1833 — <i>Pecten cretosus</i> | A. GOLDFUSS, p. 58, pl. 94, f. 2. |
| non 1822 <i>Pecten cretosus</i> M. Defrance. | |
| (1837) — <i>Pecten Obliquus</i> Sow. | A. D'ARCHIAC, p. 187. |
| v . 1839 — <i>Pecten cretosus</i> | H. B. GEINITZ, p. 22. |
| non 1822 <i>Pecten cretosus</i> M. Defrance. | |
| (1839) — <i>Pecten obliquus</i> Sow. | A. D'ARCHIAC, p. 294. |
| v . 1841 — <i>Pecten crispus</i> N. | F. A. ROEMER, p. 51. |
| v . 1841 — <i>Pecten comans</i> N. | F. A. ROEMER, p. 51, pl. 8, f. 6. |
| 1842 — <i>Pecten Faujasi</i> | H. B. GEINITZ, p. 83. |
| non 1825 <i>Pecten faujasi</i> M. Defrance. | |
| 1842 — <i>Pecten comans</i> Röm. | H. B. GEINITZ, p. 83. |
| (1846) — <i>Pecten Faujasi</i> | H. B. GEINITZ, p. 468. |
| non 1825 <i>Pecten faujasi</i> M. Defrance. | |
| 1846 — <i>Pecten crispus</i> Roemer | A. E. REUSS, p. 30. |
| v . 1847 — <i>Pecten elongatus</i> Lamarck | A. D'ORBIGNY, p. 607, pl. 436, f. 1-4. |
| . 1847 — <i>Pecten Raulinianus</i> d'Orbigny. | A. D'ORBIGNY, p. 595, pl. 433, f. 6-9. |
| (1850) — <i>Pecten Raulinianus</i> d'Orb. | A. D'ORBIGNY, p. 139, n° 276. |
| (1850) — <i>Pecten elongatus</i> Lam. | A. D'ORBIGNY, p. 169, n° 480. |
| (1850) — <i>Pecten crispus</i> Roem. | A. D'ORBIGNY, p. 169, n° 489. |
| (1850) — <i>Pecten comans</i> Römer | H. B. GEINITZ, p. 180. |
| (1850) — <i>Pecten elongatus</i> Lamarck | H. B. GEINITZ, p. 182. |
| v . 1853 — <i>Pecten Raulinianus</i> d'Orbigny | F. J. PICTET & W. ROUX, p. 510, pl. 46, f. 2. |
| (1854) — <i>Pecten elongatus</i> Lam. | J. MORRIS, p. 176. |
| (1854) — <i>Pecten Raulinianus</i> d'Orb. | J. MORRIS, p. 177. |
| 1854 — <i>Pecten Raulinianus</i> d'Orb. | D. SHARPE, p. 193. |
| (1861) — <i>Pecten elongatus</i> Lam. | W. GABB, p. 214. |
| (1861) — <i>Pecten obliquus</i> Sow. | W. GABB, p. 215. |

- | | |
|---|---|
| (1866) — <i>Pecten cretosus</i> sensu Goldfuss non DeFrance | C. GIEBEL, p. 48. |
| . 1870 — <i>Pecten obliquus</i> Sow. | F. J. PICTET & G. CAMPICHE, p. 214. |
| v . 1870 — <i>Pecten elongatus</i> Lam. | F. J. PICTET & G. CAMPICHE, p. 214, 218. |
| v . 1870 — <i>Pecten Raulinianus</i> d'Orbigny | F. J. PICTET & G. CAMPICHE, p. 202, 213, pl. 172, f. 5-7. |
| (1871) — <i>Pecten Raulinianus</i> d'Orb. | F. STOLICZKA, p. 428. |
| (1871) — <i>Pecten obliquus</i> Sow. | F. STOLICZKA, p. 428. |
| (1871) — <i>Pecten elongatus</i> Lam. | F. STOLICZKA, p. 428. |
| v . 1872 — <i>Pecten elongatus</i> Lamarck | H. B. GEINITZ, p. 195, pl. 44, f. 2-4. |
| 1877 — <i>Pecten Raulinianus</i> ? d'Orb. | A. J. JUKES-BROWNE, p. 501. |
| 1878 — <i>Pecten elongatus</i> Lam. | C. BARROIS, p. 318. |
| ? 1881 — <i>Pecten</i> cf. <i>elongatus</i> Lam. | J. KIESOW, p. 415, f. 11. |
| (1883) — <i>Pecten elongatus</i> Lamarck | W. KEEPING, p. 105. |
| . 1883 — <i>Pecten Raulinianus</i> d'Orbigny | W. KEEPING, p. 104. |
| ? 1885 — <i>Pecten elongatus</i> Lamarck | F. NOETLING, p. 20, pl. 3, f. 6. |
| 1887 — <i>Pecten elongatus</i> Lam. | A. PÉRON, p. 163. |
| (1890) — <i>Pecten elongatus</i> Lam. | M. BLANCKENHORN, p. 77. |
| (1893) — <i>Pecten elongatus</i> Lam. | R. MICHAEL, p. 235. |
| (1895) — <i>Pecten (Chlamys) elongatus</i> Lam. | E. TIESSEN, p. 468. |
| . 1896 — <i>Pecten elongatus</i> Lam. | A. J. JUKES-BROWNE & W. HILL, p. 151. |
| (1897) — <i>Pecten Raulinianus</i> | J. SIMIONESCU, p. 273. |
| (1898) — <i>Pecten Raulini</i> (laps. cal.) d'Orb. | J. SIMIONESCU, p. 43. |
| 1900 — <i>Pecten elongatus</i> | A. J. JUKES-BROWNE, p. 451. |
| (1901) — <i>Pecten elongatus</i> d'Orbigny | A. MICHALET, p. 582. |
| v . 1902 — <i>Pecten (Chlamys) elongatus</i> Lamarck | H. WOODS, pp. 170-174, pl. 31, f. 10-13, pl. 32, f. 1-3. |
| (1904) — <i>Pecten elongatus</i> | J. J. JAHN, p. 299. |
| (1905) — <i>Pecten elongatus</i> Lamk. | J. J. JAHN, p. 76. |
| . 1911 — <i>Pecten (Chlamys) elongatus</i> Lam. | B. BUJALSKI, p. 439. |
| ? 1911 — <i>Pecten (Chlamys)</i> cf. <i>cretosus</i> DeFr. | B. BUJALSKI, p. 440. |
| 1911 — <i>Pecten elongatus</i> Lamk. | A. FRITSCH, p. 45, f. 203. |
| v . 1925 — <i>Pecten (Chlamys) elongatus</i> Lam. | J. P. J. RAVN, p. 29, pl. 1, f. 4. |
| (1926) — <i>Pecten (Chlamys) elongatus</i> Lam. | L. NOETH, p. 476. |
| (1927) — <i>Pecten elongatus</i> Lam. | E. KAHRS, p. 633, 638. |
| (1931) — <i>Pecten elongatus</i> Lam. | A. MAZUREK, p. 476. |

- (1931) — *Pecten elongatus* Lam. B. KOKOSZYNSKA, p. 668.
 (1931) — *Pecten elongatus* A. BENOIT, p. 79, 80.
 (1933)a — *Pecten elongatus* A. BENOIT, p. 19, 22, 23, 24, 25.
 (1934) — *Pecten (Chlamys) aff. elongatus* Lam. V. ZAZVORKA & J. SOUKUP, p. 208.
 (1948) — *Chlamys elongata* (Lmk.) G. TAVANI, p. 97.
 (1953) — *Pecten (Chlamys) elongatus* J. DVORÁK, p. 533.
 (1956) — *Pecten elongatus* Lam. K. A. TROEGER, p. 32, 35, 38, 39, 42, 45, 51, 54, 56.
 (1958) — *Pecten Elegantus* L. CAYEUX, p. 12.
 . 1961 — *Chlamys (Chlamys) elongata* (Lamarck) V. A. SOBETSKI, pp. 33-35, pl. II, f. 14-15.
 . 1961 — *Chlamys elongatus* (Lamarck) N. N. BOBKOVA, pp. 106-107, pl. 3, f. 10.
 (1964)c — *Pecten (Chlamys) elongatus* Lam. H. ARNOLD, p. 317.
 . 1965 — *Pecten (Chlamys) elongatus* (Lamarck) S. CIEŚLINSKI, p. 30, pl. 3, f. 5.
 . 1968 — *Chlamys (Chlamys) elongata* (Lamarck) S. I. PASTERNAK et al., pp. 155-156, pl. 32, f. 8, 9.
 non 1833 *Pecten elongatus* A. Goldfuss, p. 59, pl. 94, f. 7 (a Tertiary species)
 non 1897 *Pecten elongatus* A. Péron, p. 163
 (= *Chlamys faujasi* (Defrance, 1825)).
 non 1845 *Pecten obliquus* E. Forbes, p. 249
 (= *Mimachlamys robinaldina* (d'Orbigny, 1847)).
 non 1846 *Pecten comans* A. E. Reuss, p. 29, pl. 39, f. 13.

Location of type-specimens

Pecten elongatus : probably lost; topotypical material is available and thus there is no need for a neotype.

Pecten obliquus : lost (fide WOODS, 1902).

Pecten crispus : Roemer-Museum, Hildesheim (G. F. R.).

Pecten comans : Roemer-Museum, Hildesheim (G. F. R.).

Pecten raulinianus : should be in Muséum national d'Histoire naturelle in Paris, but could not be found.

Stratum typicum :

Pecten elongatus : (Cenomanian).

Pecten obliquus : Upper Greensand (Cenomanian).

Pecten crispus : Hilsconglomerat (Cenomanian ?).

Pecten comans : Hilsconglomerat (Cenomanian ?).

Pecten raulinianus : étage albien.

Locus typicus :

Pecten elongatus : Environs du Mans, près de Coulaines, Sarthe (France).

Pecten obliquus : ? Devizes (Great Britain).

Pecten crispus : Essen (G. F. R.).

Pecten comans : Essen (G. F. R.).

Pecten raulinianus : Machéroménil, Meuse (France).

Original descriptions

« *P. testâ longitudinali, ovato-oblongâ; radiis 26 ad 30 tenuibus inaequalibus subdentulatis.*

Habite ... Fossile des environs du Mans, près de Coulaines. Cabinet de M. MENARD. Il acquiert au moins 75 millimètres de longueur. »

Pecten obliquus

« Spec. Char. Obliquely oval, convex on both sides; radii very numerous, roughened by semicircular imbricated scales; ears large, distinct. Every third ray is larger than the two intermediate ones, they are all close together, the larger amount to about 20. The two valves are not equally convex, but otherways they are similar; the breadth it about two thirds of the length. Drawn many years ago from a specimen in green sand belonging to my lamented friend Mr. CUNNINGTON. »

Pecten crispus

« Eirund, fast gleichseitig, bis 3" lang, gleichschalig, flach gewölbt, aussen mit 40-60 Längsrippen, innen kaum längsgefurcht und nur am Rande scharf wellenförmig. Die Rippen haben tiefe, concave, glatte Zwischenräume, bestehen aus mehren (sic) büschelförmige verwachsenen Längslinien, werden van einzelnen solchen begleitet und tragen dicht übereinander stehende, ziemlich aufrechte, scharfe, krause Schuppen. Das vordere Ohr der rechten Schale ist unten stark ausgeschnitten, und auf der oberen Hälfte ausstrahlend gerippt.

P. cretosus DEFR. ist sehr verschieden.

Hilsconglomerat bei Essen. »

Pecten comans

« Spitz eirund, sehr schief; rechte Schale flachgewölbt und von zahlreichen, ungleichen Längslinien bedeckt; die vordere Schlosskante ist etwas einwärts gebogen und reicht nur bis zu $\frac{1}{3}$ der ganze Länge; die hintere ist gerade, länger und geht allmählig in den Seitenrand über; das hintere Ohr is ziemlich gross und rechtwinkelig oder etwas stumpf; das vordere breiter, unten stark ausgeschnitten und anscheinend nur concentrisch gestreift. Die (etwa 60) stärkeren Längslinien wechseln immer mit zwei schwächere ab; auf dem Rücken liegen alle dicht beisammen, an der Seiten werden sie durch flache, schräg gestreifte, doppelbreite Zwischenräume getrennt und tragen hier die stärkeren Linien einzelne aufgerichtete Schuppen.

P. obliquus Sow. ist sehr ähnlich und hat gleiches Vorkommen, aber nur 20 stärkere Längslinien oder Rippchen.

Hilsconglomerat bei Essen. »

Pecten Raulinianus

« *P. testâ ovato-oblongâ, depressâ, subaequalvâ; valvâ superiore radiatim 40-costatâ; costis inaequalibus; alteris magnis, alteris minimis, elevatis, transversim imbricatis, squamosis; auriculis inaequalibus, radiatim costatis, squamosis.*

Dimensions. Largeur, 30 millim. — Par rapport à la largeur : longueur, 82/100; épaisseur, 38/100; longueur de la facette des oreilles, 45/100. — Angle apical, sans les oreillettes, 90°.

Description :

Diagnosis. — *Chlamys*-species covered with tripartite, often divided ribs crossed by concentric striae; the ribs are covered with small scales. The valves are slightly elongated, prosocline and flattened; the auricles are large and very unequal.

Macrosculpture. — The valves are covered with radial, often tripartite, ribs and covered with very small, closely set, scales transversal to the ribs. The intercostal intervals are as broad as the ribs, rounded near the pallial margin, but very narrow near the umbo. The ribs are numerous and difficult to count : near the umbo they are undivided and lying close to each other; past the umbonal area they are tripartite; small, equal riblets appear one at each side of the rib; near the pallial margin these side riblets have become ribs and are divided from the former head rib by an intercostal interval. These three rib development stages are seldom found on all the ribs and the last stage is only clearly visible on very large specimens. The ribnumber, usually counted at the pallial margin, will be extremely variable because, according to the growth stage, the ribs separated by intercostal intervals are less or more numerous.

Right valve :

- anterior auricle : large, with deep byssal sinus; covered with not very clearly developed radial ribs crossed by concentric growthlines which follow the curve of the byssal sinus;
- posterior auricle : smaller, with obtuse angle, covered with growthlines perpendicular to the hinge margin.

Left valve :

- anterior auricle : large, acute-angled, with radial ribs crossed by concentric striae;
- posterior auricle : as on the right valve.

Discussion

Variability :

As stated in the description, the development of the ribs varies very greatly, according to the size of the valve; amongst the ribs of one valve there can be a difference in the stage of development, and then some ribs are still tripartite when reaching the pallial margin, whereas others are divided into three ribs and others again have formed two ribs : one side riblet has become an independent rib but the other one is still attached to the original main rib. Exceptionally, ribs do not divide or subdivide and remain undivided even at the pallial margin.

The irregularity in rib distribution is more pronounced in older strata than in the Middle Cretaceous ones. There seems to be a trend towards greater regularity which continues in the Upper Cretaceous species *C. faujasi* (DEFRANCE) (see also H. WOODS, p. 173).

Synonymy :

Little can be added to what WOODS wrote, except for *Pecten elongatus* in D'ORBIGNY : the figure (pl. 436, fig. 1) is unfortunate and gives the impression of belonging to another species. This is probably due to a faulty reconstruction of a poorly preserved specimen which is, however, undoubtedly a *Pecten elongatus*.

Differentiation :

As stated by WOODS (1902, p. 173) : « *P. faujasi* DEFRANCE, from the *B. mucronata* Chalk of Maestricht, approaches very closely those forms of *P. elongatus* which have the triple arrangement of the ribs well developed, but appears to differ in having fewer ribs ». That both species are closely related seems to be beyond doubt; from the Saxonian Lower Turonian I saw several specimens in the Museum in Dresden which could almost be considered as being the transition between both species : they have a lower ribnumber and only subdivided ribs as in *C. faujasi*, but they do not have the largish scales typical for *C. faujasi* in Maastrichtian strata.

C? elongata differs from other *Chlamys*-species in having a rather irregular ribdistribution and a very high number of small scales on all ribs.

Generic attribution :

A thimble-microsculpture has never been seen on *Pecten elongatus* LAMARCK, but this is probably due to the generally poor state of preservation of Lower and Middle Cretaceous specimens. Considering the close relation which must have existed between *P. elongatus* and *C. faujasi* (DEFRANCE) it is almost certain that the former also belongs to the genus *Chlamys*. However, as long as it cannot be proved, it seems preferable to give *Pecten elongatus* LAMARCK the name *Chlamys? elongata* (LAMARCK).

Stratigraphical and geographical distribution

Aptian : GREAT BRITAIN :

Hythe (Kent) (B. M.)

Upware (Cambs.) (S. M.)

SWITZERLAND :

Noirvaux, Sainte-Croix (Vaud) (Mus. Laus.)

Albian : FRANCE :

- Clansayes (Basses-Alpes) (Mus. Gen.)
- Escragnolles (Var) (B. M.)
- Machéroménil (Meuse) (Mus. Gen.)
- Mont Saxonnex (Haute-Savoie) (Mus. Gen.)
- Perte-du-Rhône (Ain) (Mus. Gen.)
- Sainte-Ménéhould (Marne) (Musé. Coll. J. DE MORGAN)
- Vouvray (Ain) (Musé. Coll. D'ORBIGNY, 6003 A, sub *Pecten raulinianus*)

GREAT BRITAIN :

- Folkestone (Kent) (B. M., Geol. Sci., Mus. Gen. orig. PICTET & CAMPICHE, pl. 172, fig. 6, S. M. orig. WOODS B 31245, pl. 31, fig. 10, B 31246, pl. 31, fig. 11.
- Hartwell (Mus. Gen.)
- Leighton Buzzard, Munday's Hill Pit (Beds.) (B. M., S. M.)
- Shenley, Harris' Pit (Beds.) (B. M.)
- Shenley, 21 Acre Pit (Beds.) (B. M.)
- Ventnor (Isle of Wight) (S. M.)

SWITZERLAND :

- Col de la Cheville (Valais) (Mus. Gen., Mus. Laus.)
- Fleurier (Neuchâtel) (Mus. Laus.)
- La Goudinière (Vaud) (Mus. Gen.)
- La Presta, Val de Travers (Neuchâtel) (Mus. Gen.)
- Sainte Croix (Vaud) (Mus. Gen. orig. PICTET & CAMPICHE, pl. 172, fig. 7, Mus. Laus. orig. PICTET & CAMPICHE, pl. 172, fig. 5)
- Surchamp (Vaud) (Mus. Laus.)

Cenomanian : BELGIUM :

- Tourtia de Tournai :
- Montignies-sur-Roc (Ec. Min., I. R. Sc. N. B., R. U. G.)
- Tournai (B., I. R. Sc. N. B., KO., Mus. Gen., N. M. W., R. U. G.)

CZECHOSLOVAKIA :

- Teplíce (B.)

DENMARK :

- Bornholm : Madsegrav (KO. also orig. RAVN, 1925, pl. 1, fig. 4)

FRANCE :

- Le Mans (Sarthe) (Ec. Min., Mus. Gen., Musé. also orig. coll. D'ORBIGNY, 6452 bis : *Pecten elongatus* and 6454 : *Pecten obliquus*, N. M. W.)
- Rouen (Ec. Min., Mus. Gen.)
- Ste Croix (Sarthe) (Ec. Min.)

G. D. R. :

Kauscha (DR.)
 Koschütz (B., Halle)
 Langenberg, Westerhausen (B.)
 Plauen (B., DR., KO., Mus. Gen., N. M. W.)
 Zscheila, Meissen (B.)

G. F. R. :

Essen (B., DR., GH., Halle, KO., Mus. Gen., N. M. W., R. M.,
 S. M., U. B.)
 Pyrmont (B., coll. VON SCHLOTHEIM)

GREAT BRITAIN :

S. varians-zone :

Burwell (Cambs.) (S. M.)
 Dover (Kent) (B. M., Geol. Sci.)
 Folkestone (Kent) (B. M., Geol. Sci., S. M.)
 Norton Ferris, Mere (Wilts.) (Geol. Sci.)
 Rocken End, St. Catherine Point (Isle of Wight) (B. M.)
 Ventnor (Isle of Wight) (S. M.)
 Warminster (B. M., S. M.)

H. subglobosus-zone :

Arlesey (Beds.) (Totternhoe Stone) (S. M. also orig. WOODS :
 B 6226, pl. 31, fig. 13)
 Blue Bell Hill, Burham (Kent) (B. M.)
 Burwell (Cambs.) (S. M. also orig. WOODS : B 379, pl. 32, fig. 3 a-b,
 B 6227, pl. 32, fig. 2 a, b)
 Cherryhinton (Cambs.) (S. M.)
 Dover (Kent) (B. M.)
 Folkestone (Kent) (S. M.)
 Peter's Pit, Burham (Kent) (B. M.)
 Totternhoe Stone, Hitchin (Herts.) (Geol. Sci.)
 Ventnor (Isle of Wight) (S. M. also orig. WOODS B 209, pl. 31,
 fig. 12)

no zone indicated :

Bonchurch (Isle of Wight) (Mus. Gen.)
 Charlton (Kent) (S. M.)

Turonian : G. D. R. :

Plenus-zone :

Dohna (DR.)
 Döltzschen (DR.)
 Hackkuppe, Saupsdorf, Kleingriesshüble (DR.)
 Klein Naundorf, Bannewitz (DR.)

Oberau (DR.)
 Pennrich (DR.)
 Plauen (DR.)

Chlamys ? *subacuta* (J.-B. LAMARCK, 1819)

(Pl. 4)

- . 1819 — *Pecten subacutus* J. B. LAMARCK, p. 181, n° 11.
- v . 1842 — *Pecten acuminatus* m. H. B. GEINITZ, p. 84, pl. 21, f. 6.
- . 1845 — *Pecten acuminatus* Geinitz A. E. REUSS, p. 29, pl. 39, f. 20, 21.
- . 1847 — *Pecten acuminatus* Gein. A. D'ARCHIAC, pp. 309-310, pl. 16, f. 3 a, b.
- v . 1847 — *Pecten subacutus* Lamarck A. D'ORBIGNY, pp. 605-606, pl. 435, f. 5-10.
- (1850) — *Pecten acuminatus* Gein. H. B. GEINITZ, p. 182.
- (1855) — *Pecten subacutus* Lam. G. COTTEAU, p. 116.
- (1863) — *Pecten acuminatus* Gein. A. KUNTH, p. 725.
- (1870) — *Pecten subacutus* F. J. PICTET & G. CAMPI-CHE, pp. 214, 218.
- (1871) — *Pecten subacutus* Lam. F. STOLICZKA, p. 428.
- (1871) — *Pecten acuminatus* Gein. F. STOLICZKA, p. 428.
- v . 1872 — *Pecten acuminatus* Gein. H. B. GEINITZ, pp. 194-195, pl. 43, f. 16, pl. 44, f. 1.
- v . 1872 — *Pecten subacutus* Lamarck H. B. GEINITZ, p. 195, pl. 44, f. 5.
- . 1877 — *Pecten subacutus* A. J. JUKES-BROWNE, p. 501.
- . 1883 — *Pecten acuminatus* Geinitz A. FRITSCH, p. 116, f. 89 a-d.
- . 1890 — *Chlamys subacutus* (Lamarck) A. PÉRON, p. 233.
- ? 1890 — *Chlamys Desvauxi* (Coquand) A. PÉRON, p. 233-234.
- (1893) — *Pecten acuminatus* Gein. R. MICHAEL, p. 235.
- . 1896 — *Pecten subacutus* A. J. JUKES-BROWNE & W. HILL, p. 151.
- . 1897 — *Pecten acuminatus* Gein. R. LEONHARD, p. 26.
- (1897) — *Pecten acuminatus* Gein. J. V. ZELIŽKO, p. 175.
- (1901) — *Pecten subacutus* Lamk. A. MICHALET, p. 582.
- v . 1902 — *Pecten (Chlamys) subacutus* Lamarck H. WOODS, pp. 169-170, pl. 31, f. 7 a, b, 8 a-c, 9.
- (1905) — *Pecten acuminatus* Gein. J. J. JAHN, p. 76.
- ? 1908 — *Pecten (Chlamys) cf. subacutus* Lamarck F. L. KITCHIN, pp. 69-70, pl. 2, f. 6, 6 a.
- . 1911 — *Pecten acuminatus* Gein. A. FRITSCH, p. 44, f. 201.
- . 1912 — *Pecten (Chlamys) subacutus* Lamarck L. PERVINQUIÈRE, p. 141.

- ? 1914 — *Chlamys* sp. cf. *subacutus* E. LANGE, p. 208.
Lam.
- 1918 — *Pecten (Chlamys) acuminatus* Geinitz J. WOLDRICH, pp. 282-284, f. 1-2.
- (1924) — *Pecten subacutus* d'Orb. M. SCHLOSSER, p. 87.
- (1924) — *Pecten acuminatus* Gein. M. SCHLOSSER, p. 87.
- (1927) — *Chlamys acuminatus* (laps. cal.) Gein. E. KAHRS, p. 633.
- (1931) — *Pecten acuminatus* Geinitz A. MAZUREK, p. 476.
- . 1933 — *Pecten (Chlamys) acuminatus* Gein. W. HAENTZSCHEL, pp. 126-127.
- . 1939 — *Pecten (Chlamys) subacutus* Lam. E. DACQUÉ, p. 49.
- . 1939 — *Pecten (Chlamys) acuminatus* Gein. E. DACQUÉ, p. 50, pl. 2, f. 1.
- . 1939 — *Pecten (Chlamys) cfr. acuminatus* Gein. E. DACQUÉ, p. 50.
- ? 1939 — *Pecten (Chlamys) aff. acuminatus* Gein. E. DACQUÉ, p. 99.
- ? 1947 — *Chlamys* spec. J. V. L. RENNIE, p. 61, pl. 3, f. 29.
- (1953) — *Pecten (Chlamys) acuminatus* Gein. J. DVOŘÁK, p. 533.
- v . (1953) — *Pecten (Chlamys) acuminatus* Gein. H. PRESCHER, p. 253.
- (1954) — *Pecten (Chlamys) spec. aff. subacutus* Lamarck J. VILLATTE in CASTERAS & VILLATTE, p. 208.
- (1956) — *Pecten acuminatus* Gein. K. A. TROEGER, p. 42, 51.
- (1956) — *Pecten* cf. *subacutus* d'Orb. (laps. cal.) K. A. TROEGER, p. 51, 89.
- . 1965 — *Chlamys* sp. cf. *C. subacuta* (Lamarck) I. HAYAMI, p. 312, pl. 45, f. 1.
- (1966) — *Chlamys acuminata* J. SVOBODA et al., p. 493.

Location of type-specimens

Pecten subacutus : lost; there are many topotypes in the collection of the Muséum national d'Histoire naturelle in Paris.

Pecten acuminatus : Staatliches Museum für Mineralogie und Geologie, Dresden.

Stratum typicum :

(Cenomanian)

Pecten acuminatus : « Pläner » (Cenomanian).

Locus typicus :

Le Mans (France)

Pecten acuminatus : Tyssa (Tisa) (Czechoslovakia).

Original descriptions

« *P. testa longitudinali, ovato-cuneata, inferne subacuta; radiis 24 aequalibus, confertis, dorso-acutis.*

Habite ... Fossile des environs du Mans. Cabinet de M. MENARD. Il a de petites oreillettes, et paraît très-distinct du précédent (1), surtout par ses rayons. Longueur, 40 mm.

Pecten acuminatus

Eiförmig lang-zugespitzt, mässig gewölbt, mit 25-30 ziemlich regelmässigen, etwas stumpfen Rippen besetzt, über welche in einiger Entfernung Anwachslien hinweglaufen. Die vordere Seite ist ein wenig eingebogen. Die Ohren sind unregelmässig, beide dicht concentrisch und radial linirt. Das vordere ist stumpfwinkelig, oben und unten schwach einwärts, in der Mitte etwas auswärts gebogen; das hintere ist etwas schmaler, oben gerundet und in der Mitte etwas eingebogen (In der Zeichnung fehlt ein Stück des oberen Theiles dieses Ohres).

In Tyssa sehr häufig, aber auch in untersten Pläner. »

Additional description

Number of studied specimens : total : 160.

British Albion	...	3
Swiss Albion	...	1
Algerian Cenomanian	...	8
Austrian Cenomanian	...	1
Belgian Cenomanian	...	16
British Cenomanian	...	16
Czech Cenomanian	...	55
French Cenomanian	...	33
Israelian Cenomanian	...	2
Jordanian Cenomanian	...	6
Tunisian Cenomanian	...	1
German Cenomanian and Turonian	...	18

Measurements :

Area around Le Mans : topotypical material :

U. P. D.	W.	A. A.	Ribnumber
20.7 to 41.4 mm	14.6 to 28.9 mm	65° to 77°	20 to 28
av. 32.1 mm	av. 22.9 mm	av. 70°	av. 23.9
(n = 8)	(n = 8 but not always the same specimens as for U. P. D.)	(n = 13)	(n = 15)

(1) *Chlamys elongata* (LAMARCK).

Tourtia de Tournai (Belgium) :

U. P. D.	W.	A. A.	Ribnumber
33 to 81 mm	24 to 63 mm	65° to 70°	22 to 25
—	—	—	av. 23.5
(n = 5)	(n = 8)	(n = 4)	(n = 9)

English Cenomanian :

45.4 and 59.2 mm	332.8, 49.3,	72°, 75°, 67°	22, 24, 21
—	18.8 mm	—	—
(n = 2)	(n = 3)	(n = 3)	(n = 3)

Area around Dresden (G. D. R.) :

53.2 to 104.2 mm	46.1 to 85.3 mm	70° to 83°	19 to 28
(n = 4)	(n = 4)	(n = 3)	av. 21.7
			(n = 10)

Area around Korycany (Czechoslovakia) :

17.5 to 90.6 mm	12.3 to 69.7 mm	50° to 75.5°	21 to 30
av. 44.29 mm	av. 32.50 mm	av. 68.69°	av. 25.66
(n = 34)	(n = 33)	(n = 35)	(n = 35)

Velka Ves (Hungaria) (1 specimen) :

47.5 mm	36.5 mm	77°	25
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Description :

Diagnosis. — *Chlamys*-species with rather flattened valves covered with 19 to 28 well developed undivided ribs, which can bear spines or scales.

Both valves are covered with numerous concentric growthlines; on the top of the ribs these develop into spines or scales and particularly so on left valves. The auricles are well developed : the anterior one on the right valve is covered with very clear growthlines which are parallel to the byssal sinus; on the other auricles the radial ornamentation is more pronounced than the concentric; on left valves the radial riblets can bear spinules.

Discussion

Variability :

It is noteworthy that specimens from the type-locality and from the British Cenomanian are, on average, smaller than those from the Tourtia de Tournai, Dresden and Korycany; this is also the case in *Neithea* (*Neithea*) *aequicostata* (LAMARCK) and in *Chlamys elongata* (LAMARCK).

Preservation variability :

As in many species there is a marked difference between valves and Steinkernen. This difference is important because in certain areas the Steinkern preservation is the only or almost only occurrence of the fossils; if one does not realize that the differences between the two preservation types are due to the preservation alone one could consider both as belonging to different species.

Steinkernen have fewer ribs : the smaller ribs near the side-margins are not present on them and the areas appear to be smooth.

On Steinkernen all traces of spines and scales are gone; this is one of the reasons why many authors consider *Pecten acuminatus* to be different from *P. subacutus* : on the former the ribs are supposed to be smooth, whereas on the latter the ribs bear spines, and most authors have not understood that the « smooth » ribs are merely the result of a poor state of preservation.

Synonymy :

In connection with *Pecten acuminatus* H. WOODS wrote in 1902 : « It seems probable that the comparison of good series of specimens might show *P. acuminatus* and *P. subacutus* to be identical ». After studying a large number of specimens including the holotype of *P. acuminatus*, I can only confirm WOODS's hypothesis. There is no difference between both taxa except that according to most authors *P. acuminatus* does not bear spines; this is true of « Steinkernen », but A. FRITSCH, 1883 (p. 116) wrote : « ...wohlerhaltene rechter Schale weist schuppige Verzierungen ...auf ». WOODS considered *Pecten brongniarti* D'ARCHIAC from the Tourtia de Tournai as synonymous with *Pecten subacutus*. In the I. R. Sc. N. B. collection there is one specimen from Tournai which answers to the description of D'ARCHIAC : its ribs are more rounded, more numerous than on *P. subacutus* and its intercostal intervals narrower than or as broad as the ribs whereas on *P. subacutus* they are always broader than the ribs.

Differentiation :

C. ? subacuta can be differentiated from the other Cretaceous *Chlamys* and *Chlamys*?-species by its relatively low number of undivided, spine-bearing ribs.

Generic attribution :

Thimble-microsculpture has not been found on any of the studied *P. subacutus* specimens. However, the ribnumber, the general shape and the auricle shape seem to make a relation with the Upper Cretaceous *Chlamys*-species more probable than a relation with the *Mimachlamys*-species. Therefore the name *Pecten subacutus* LAMARCK has been replaced by *Chlamys ? subacuta* (LAMARCK).

Stratigraphical and geographical distribution

EUROPE :

Albian : GREAT BRITAIN :

Haldon (B. M., Geol. Sci. also orig. WOODS, pl. 31, fig. 8, n° 6683)

SWITZERLAND :

Col de la Cheville (Valais) (Mus. Laus.)

Cenomanian : AUSTRIA :

Kreuthgraben, Brandenburg (Tirol) (Mü.)

BELGIUM :

Montignies-sur-Roc (I. R. Sc. N. B., R. U. G.)

Tournai (B. M., I. R. Sc. N. B., R. U. G.)

CZECHOSLOVAKIA :

Bilin (DR.)

Grossdorf (N. M. W.)

Hradèk (Halle)

Kamajk, Časlau (Halle)

Korycany (Halle, KO., Musé., Mus. Gen., N. M. W.)

Lobkowitz (N. M. W.)

Tyssa (DR. also orig. H. B. GEINITZ for *Pecten acuminatus*, KO.)

FRANCE :

Le Mans and Sarthe-localities :

Beaumont (Mus. Gen.)

Fouletourte (Mus. Gen.)

Le Mans (B. M., DR., Ec. Min., Musé. also orig. D'ORBIGNY 6447, Mus. Gen., Mus. Laus.)

Neuville (N. M. W.)

La Raglasse (Mus. Gen., N. M. W.)

La Trugalle (Mus. Gen., Mus. Laus.)

Charente maritime :

Fouras (B.)

Ile d'Aix (B.)

Ile Madame (Musé.)

La Malle (Musé.)

Port-des-Barques (Musé.)

GREAT BRITAIN :

Beer Head (Devon) (B. M.)

Branscombe (Devon) (S. M.)

Dunscombe (Devon) (S. M. also orig. WOODS, pl. 31, fig. 7a, 7b : B 6217, pl. 31, fig. 9 : B 6218)

Hooken (Devon) (B. M.)

Ventnor (Isle of Wight) (B. M.)
Whitecliff (Devon) (B. M.)

G. D. R. :

Döltzschen, Dresden (DR.)
Dresden (B.)
Oberhäslich (DR.)
Plauen (DR., N. M. W.)
Tharander Wald (N. M. W.)

HUNGARY :

Velkà Ves (N. M. W.)

Turonian : G. D. R. :

Plenus-zone :
Dohna (DR.)
Plauen (DR. also orig. H. B. GEINITZ, Elbthal, pl. 44, fig. 5)

AFRICA :

Cenomanian : ALGERIA :

Ben Zoron (B. M.)
Tenoukla (B. M.)

TUNISIA :

Djebel ben Younès, Gafsa (B. M.)

ASIA :

Cenomanian : ISRAEL :

Kurnub (B. M.)

JORDAN :

Ain Sideir (W. Dead Sea) (Ain Dshidi?) (B. M.)
Wadi from Karak to Ellisan, 3 miles E. of Draa (B. M.)

Chlamys ? *subdepressa* (A. D'ARCHIAC, 1847)
(Pl. 3.)

- . 1847 — *Pecten subdepressus* nov. A. D'ARCHIAC, pp. 310-311,
sp. pl. 16, f. 1 a, b, 2 a.
? (1911) — *Pecten subdepressus* A. FRITSCH, p. 44, f. 199.
D'Arch.
(1927) — *Chlamys subdepressus* E. KAHRS, p. 633.
d'Arch.

Location of type-specimens

The D'ARCHIAC collection : according to the author : in the Société géologique de France; at present it is impossible to find, so the original

can be considered as lost. The description and the figure are sufficient for defining the species clearly; it is thus unnecessary to select a neotype. Furthermore, there are many topotypes known.

Stratum typicum :

Tourtia de Tournay (Upper Cenomanian).

Locus typicus :

Tournay (now : Tournai), Hainaut (Belgium).

Original description

« Coquille très-déprimée, sub-orbulaire, sub-équilatérale, sub-équivalve, ornée sur la valve droite de 19 côtes rayonnantes, égales, larges, élevées, divisées par une ou deux stries peu prononcées. Des sillons larges, égaux et profonds séparent ces côtes et présentent presque toujours vers le milieu une strie filiforme, continue dans toute leur étendue. Sur les côtés, cette strie devient plus prononcée, mais sans jamais atteindre la grosseur des côtes, quoique ces dernières diminuent dans cette partie du test. La surface de la valve est traversée, en outre, par un grand nombre de stries d'accroissement concentriques, très fines, très serrées, ondulées, lamelleuses et mêmes rugueuses ou formant de petits bourrelets, surtout vers les bords. Bord antérieur légèrement concave. Bord postérieur droit. Oreillettes commençant très bas. Angles des arêtes cardinales de 100°. Valve gauche présentant des côtes rayonnantes en même nombre que l'autre, mais simples, étroites, relevées et tranchantes. Les sillons qui les séparent, profonds et beaucoup plus larges, n'ont aucune trace de strie médiane. Les stries d'accroissement, semblables à celles de la valve droite, forment des bourrelets et des plis ondulés vers les bords. — (Crochets, oreillettes et charnière inconnus). — Hauteur probable, 102 millim.; largeur, 98; épaisseur, 18.

Cet espèce quoique incomplètement connue, offre cependant des caractères assez précis pour être décrite et figurée. Comme son nom l'indique, elle ressemble au *P. depressus* de MÜNST., GOLDF. (pl. 92, f. 4), mais elle s'en distingue par sa forme moins circulaire. Les côtés antérieur et postérieur très arrondis du *P. depressus* portent, en outre, neuf ou dix petites côtes différentes de celles du reste de la surface, qui sont triangulaires et se joignent au fond des sillons, lesquels sont aussi anguleux. Les stries d'accroissement ne semblent pas non plus produire de lamelles écailleuses à leur passage sur les côtes et encore moins de bourrelets. La valve gauche du *P. sub-depressus* a quelque ressemblance avec le *P. aequivalvis* Sow. de l'oolite inférieure. — Tournay. »

Additional description

Number of specimens studied :

24 from the Tourtia de Tournai near Tournai. Most are incomplete; 3 are undoubtedly right valves and 5 are left valves; the others are too incomplete for the side to be recognised.

Measurements :

U. P. D. varies from 80 mm to 140 mm.
W. varies from 73 mm to 125 mm.
A. A. varies from 75° to 85°.
Ribnumber : right valves : 16, 18, 17;
left valves : 16, 18, 18, 18, 19.

Description :

Diagnosis. — Very large *Chlamys*-species covered with 16 to 19 mostly undivided ribs; the valves are covered with well developed concentric, slightly elevated growthlines, which form scales on the ribs.

Right valve : the ribs are broad and not very elevated; the intercostal intervals are as wide as the ribs; the whole valve is covered with very numerous, slightly elevated above the shell-surface, concentric growthlines which are very clearly visible on the ribs. Sometimes near the palleal margin the growthlines form narrow tubercles (« bourrelets » in D'AR-CHIAIC's description) which can be seen as a structure over the complete rib-width.

Anterior auricles : large with deep byssal sinus; ornamentation consists of radial and concentric striae, but the concentric are the more developed and follow the sinus.

Posterior auricle : obtuse-angled with very long outer margin (reaches $\frac{1}{4}$ of total height).

Left valve : the ribs are narrow, steep and elevated; the intercostal intervals are wide; the valve is covered with very numerous concentric striae but on this valve the concentric striae do not form tubercles on the ribs.

Auricles : large; anterior auricle is acute-angled and covered by concentric elevated striae; posterior auricle as on the right valve.

Discussion

Variability :

Too few specimens are known for indications on variability.

Synonymy :

No problems in this species.

Differentiation :

This large *Chlamys*-species is unusual in its very restricted occurrence : it is only known from the Tourtia in Tournai. In localities with similar fossil-assemblages and similar facies, such as Essen/Ruhr and some Saxonian Upper-Cenomanian localities, no species directly comparable with *C.?* *subdepressa* is known. It could be that large poorly preserved Steinkernen determined as *C.?* *subacuta* are in fact specimens of *C.?* *subdepressa*. Indeed the ribnumber of *C.?* *subdepressa* is only slightly inferior to that of *C.?* *subacuta* and on a Steinkern the sharp ribs of *C.?* *subacuta* appear less so. On reasonably well-preserved specimens it is obvious that the rib-shape of *C.?* *subacuta* is different from *C.?* *subdepressa* : on right valves of the latter species the ribs are much broader and more flattened than on the former species. On left valves the difference in ribshape is

less obvious but the ribnumber is higher in *C.?* *subacuta*, and the apical angle is wider, and the auricles are relatively smaller.

Pecten desvauxi H. COQUAND, 1862 (p. 218, pl. 12, fig. 1 and 2) from the Cenomanian of Tenoukla, Algeria, is similar in size, shape and ribnumber to *Chlamys?* *subdepressa* but the original specimens kept in the Magyar állami földtani intézet in Budapest are too worn to permit a comparison of ornamentation between both species.

In the French and Swiss Neocomian there is a species which shows some similarity to *C.?* *subdepressa* : *C.?* *goldfussi* DESHAYES. Both species have the same shape and a similar ribnumber; the rib ornamentation is formed in the same way, but it is much more regular in *C.?* *goldfussi* than in *C.?* *subdepressa*.

The other Cretaceous *Chlamys*-species are generally smaller, have subdivided ribs which bear a large number of spines or spinules (f.i. *C. elongata* and *C. faujasi*). The *Mimachlamys*-species are much smaller, have a wider apical angle and far more ribs.

Generic attribution :

The thimble-structure which is characteristic of the genus *Chlamys* is not found on Cretaceous specimens which are not perfectly preserved. The characteristics given in the definition of *Chlamys* (narrower apical angle, oval-elongated shape, relatively fewer ribs) allow only a probable, not a definite, generic attribution. Therefore the correct name of *Pecten subdepressus* D'ARCHIAC becomes *Chlamys?* *subdepressa* (D'ARCHIAC).

Stratigraphical and geographical distribution

Cenomanian : BELGIUM :

Tourtia de Tournai; Tournai (B. M., I. R. Sc. N. B., N. M. W., R. U. G.)

(In the B. M. there is one specimen which according to its label is from Montignies-sur-Roc. It is a specimen bought from A. KRANTZ; but since no other specimen confirms this locality, I strongly doubt the authenticity of KRANTZ' indication).

Chlamys? *martiniana* (A. D'ORBIGNY, 1850)

- v . 1850 — *Pecten Martinianus* d'Orb. A. D'ORBIGNY, p. 107, n° 731.
- v . 1866 — *Pecten Urgonensis* de Lo- P. DE LORIOI, p 84, pl. E, f. 7, 8.
riol
- . 1869 — *Pecten landeronense* de Lo- P. DE LORIOI & V. GILLIÉ-
riol RON, p. 22, pl. 1, f. 19.

- v . 1870 — *Pecten urgonensis* de Loriol F. J. PICTET & G. CAMPICHE, pp. 186-187, pl. 169, f. 3-5.
- v . 1870 — *Pecten landeronensis* de Loriol F. J. PICTET & G. CAMPICHE, pp. 187-188, pl. 169, f. 6, 7.
- (1870) — *Pecten Martinianus* d'Orb. F. J. PICTET & G. CAMPICHE, p. 210.
- (1871) — *Pecten Urgonensis* Lor. F. STOLICZKA, p. 428.
- (1871) — *Pecten Lauderonensis* Lor. F. STOLICZKA, p. 428.
- . 1907 — *Chlamys urgonensis* de Loriol M. COSSMANN, p. 37, pl. 6, f. 5.
- ? 1912 — *Pecten (Chlamys) Urgonensis* de Loriol L. PERVINQUIÈRE, p. 140.
- . 1916a — *Chlamys urgonensis* (de Loriol) M. COSSMANN, p. 400-401, pl. 14, f. 1-4.
- 1932 — *Pecten (Chlamys) landeronensis* de Loriol E. ACKERMANN, pp. 22-23.
- (1960) — *Pecten landronensis* Lor. M. S. ERISTAVI, p. 62.

Location of type-specimens

Pecten martinianus : Muséum national d'Histoire naturelle, Paris.

Pecten urgonensis : Muséum d'Histoire naturelle, Geneva.

Pecten landeronensis : could not be located.

Locus typicus :

Martigues, Bouches-du-Rhône (France)

Pecten urgonensis : Grand Salève, au-dessus d'Essert, Haute-Savoie (France)

Pecten landeronensis : couche n° 7, Le Landeron, Neuchâtel (Switzerland).

Stratum typicum :

Couche à *Caprotina* (Barremian)

Pecten urgonensis : Néocomien (Barremian)

Pecten landeronensis : Urgonien inférieur (here : Upper Hauterivian).

Original description

« *Pecten martinianus*. Espèce déprimée, pourvue de vingt côtes rayonnantes simples, espacées. Martigues, couches à *Caprotina*. Néocomien. »

Pecten Urgonensis

« Dimensions (Moyennes) : Largeur 28 mm. Longueur par rapport à la largeur 0,79. Angle apical sans les oreillettes 90°.

Coquille ovale, transverse, très-aplatie. Valve inférieure ornée de 19 fortes côtes rayonnantes, un peu inégales, assez écartées au milieu, deux ou trois plus petites vien-

nent s'intercaler sur les côtés. Toutes sont couvertes de fortes rides concentriques rapprochées, saillantes, devenant presque épineuses sur quelques-unes; les intervalles sont également ridés, mais plus légèrement. La valve supérieure porte également 19 grosses côtes rayonnantes, mais qui sont généralement plus fortes, plus arrondies que celles de l'autre valve, leurs intervalles sont plus étroits et plus creusés, et elles sont coupées par des lamelles concentriques très-rapprochées, très-nombreuses, plus fines dans les intervalles. Oreillettes grandes, ridées et costulées.

Rapports et différences. Cette espèce, que je ne trouve décrite nulle part, est bien voisine du *Pecten Carteronianus*, D'ORB., dont elle diffère par ses côtes constamment beaucoup moins nombreuses (19 au lieu de 30), ce que j'ai pu vérifier sur plusieurs exemplaires bien conservés. Le *P. Archiacianus*, D'ORB., a les côtes beaucoup moins régulières.

Localité. Grand Salève, au-dessus d'Essert. Commun. Collection FAVRE. »

Pecten landeronense

« Dimensions. Largeur 45 mm; Longueur par rapport à la largeur 0,80.

Valva inferior subinflata, 16 costis radiantibus latis, convexis, aut subplanis medio parum elevatis, sulcis planis haud profundis vix angustioribus separatis striisque concentricis tenuibus, numerosissimis, ornata. Auriculæ inaequales, profunde rugatae.

Coquille dont la valve inférieure est assez bombée, très-transverse, ornée de 16 côtes rayonnantes très-larges, peu convexes, quelquefois relevées sur leur milieu par une ligne saillante, séparées par des sillons peu profonds, plans un peu plus étroits; toute la surface est en outre couverte de stries concentriques, onduleuses, extrêmement fines et très-nombreuses. Oreillettes très-inégales, fortement ridées en travers.

Rapports et différences. Cette espèce est voisine de plusieurs autres (*sic*), en particulier des *Pecten Goldfussi*, DESH., *Carteronianus*, D'ORB., *urgonensis*, DE LORIOI; elle se distingue de tous (*sic*) les trois par le petit nombre de ses côtes, par leur largeur et le peu de profondeur des sillons qui les séparent, si bien que vers le bord elles n'apparaissent que comme une série de légères ondulations.

Gisement. Couche n° 7. Coll. HISLEY et GILLIERON. »

Additional description

Number of specimens studied : total : 123.

Swiss Hautervivian	3
French Barremian	39
Swiss Barremian	79
Swiss Aptian	2

Measurements :

Mormont, Vaud :

U. P. D.	varies between 25.4 mm and 52.2 mm; av. 36.3266 (n = 15)
W.	varies between 18.7 mm and 41.7 mm; av. 29.7033 (n = 15)
A. A.	varies between 62° and 85°; av. 72.875 (n = 16)
Ribnumber	varies between 15 and 21; av. 17.18 (n = 32)

Essert, Salève, Haute-Savoie :

U. P. D.	varies between 16.3 mm and 36.3 mm; av. 26.0286 (n = 7)
W.	varies between 19.9 mm and 27.3 mm; av. 22.720 (n = 5)
A. A.	varies between 66° and 82°; av. 73.454 (n = 11)
Ribnumber	varies between 18 and 24; av. 20.71 (n = 11)

Description :

Diagnosis. — Medium-sized *Chlamys*? species with 14 to 24 straight rounded, mostly undivided, ribs and rather broad intercostal intervals. The shell is completely covered with concentric striae.

The disc is flattened; the ribs are rounded and sometimes subdivided on both valves and the intercostal intervals are as wide as the ribs. Discs and auricles are covered with numerous closely set concentric striae which can become concentric riblets, and, when crossing the ribs, sometimes form a small transverse ridge. Near the umbo, these concentric processes are well developed and the disc surface has a trellis-like appearance. On the areas near the side margins the concentric striae become oblique.

The right valve sometimes has subdivided ribs which can separate and thus increase the ribnumber. Anterior auricle : winglike, with a deep byssal sinus, covered with concentric striae which follow the sinus and of which a major number have become riblets. Posterior auricle small, obtuse-angled and covered with the continuation of the concentric striae which follow the outer margin.

The left valve has a similar ornamentation but when ribs are added it is by intercalation. Anterior auricle large and with a very shallow byssal sinus, covered with radial and concentric striae which give a trellis-like appearance. Posterior auricle small and obtuse-angled but covered with a similar ornamentation.

Discussion

Variability :

The ribnumber varies greatly for a species with so few ribs; its is however, impossible to divide the specimens into two specific groups as in DE LORIO. In fact, the variation lies between 15 and 21, which is a more usual distribution; the large groupe of specimens from Mormont gives a normal distribution.

Abnormally high ribnumbers are occasioned by the rare increase in ribnumber on the discs.

Synonymy :

DE LORIO's two « species » differ in so few characteristics that already PICTET & CAMPICHE (p. 187) wrote : « Ce peigne (*P. landeronensis*) est certainement très-voisin de l'*urgonensis*, et quelques échantillons intermédiaires nous ont quelquefois rendu leur séparation difficile... ». I have tried to separate the two groups but they form a compact block (14 R : 1 sp., 15 R : 9 sp., 16 R : 23 sp., 17 R : 19 sp., 18 R : 13 sp., 19 R : 8 sp., 20 R : 10 sp., 21 R : 6 sp., 24 R : 2 sp.). This asymmetrical distribution is due to the occasional increase of ribs.

P. martinianus was only described in the Prodrôme and thus probably escaped DE LORIOI's notice. PICTET & CAMPICHE considered it to be « insuffisamment décrite ».

Differentiation :

From the other Lower Cretaceous *Chlamys* ? species *C.?* *martiniana* can be differentiated on the following points :

- *C.?* *archiaciana* (D'ORBIGNY) has a similar ribnumber on some specimens, but then their distribution is irregular.
- *C.?* *goldfussi* (sensu D'ORBIGNY) is generally larger, has tripartite ribs on the right valve and fairly large scales on the ribs of both valves.
- *C.?* *icaunensis* (COTTEAU) has a particular ornamentation.
- *C.?* *elongata* (LAMARCK) has tripartite ribs.

Generic attribution :

Pecten martinianus D'ORBIGNY, 1850, has the disc and auricle shape, ribdistribution and number typical for *Chlamys* ROEDING. The thimble microsculpture has not been seen; it is probably worn off. Hence it seems preferable to name *Pecten martinianus*, *Chlamys?* *martiniana* (D'ORBIGNY).

Stratigraphical and geographical distribution

Hauterivian : SWITZERLAND :

Mormont, Vaud (Mus. Laus.)

Barremian : FRANCE :

Châtillon de Michaille, Ain (Mus. Gen.)

Essert, Salève, Haute-Savoie (Mus. Gen. also orig. DE LORIOI, 1866, pl. E, fig 7-8 and orig. PICTET & CAMPICHE, 1870, pl. 169, fig. 4, 5).

Longueville, Doubs (Mus. Gen.)

Marseille, Bouches-du-Rhône (Musé. orig. D'ORBIGNY)

Morteau, Doubs (Mus. Gen., Univ. Neuch.)

Orgon, Bouches-du-Rhône (Mus. Gen., Musé.)

Salève, Haute-Savoie (B.)

SWITZERLAND :

Allevays, La Sarraz, Vaud (Mus. Laus.)

Bôle, Boudry, Neuchâtel (Mus. Gen.)

Les Clées s/Orbe (Mus. Laus.)

Concise, Vaud (Univ. Neuch.)

Le Mail, Neuchâtel (Univ. Neuch.)

Mormont, Vaud (Mus. Gen. also orig. PICTET & CAMPICHE, pl. 169, fig. 7, Mus. Laus. Univ. Neuch.)

La Presta, Val de Travers, Neuchâtel (Mus. Gen.).

La Rusille, Vaud (Mus. Gen., Mus. Laus.)

Sainte-Croix, Vaud (Mus. Gen. also orig. PICTET & CAMPICHE, pl. 169, fig. 6).

Signal d'Orbe (Mus. Laus.)

Travers, Neuchâtel (Mus. Gen.)

Vaulion, Vaud (Mus. Gen.)

Aptian : SWITZERLAND :

La Presta, Val de Travers, Neuchâtel (Mus. Gen.)

Chlamys ? *archiaciana* (A. D'ORBIGNY, 1847)

(Pl. 9, fig. 2)

- v . 1847 — *Pecten Archiaciana* d'Orbigny A. D'ORBIGNY, pp. 583-584, pl. 429, f. 7-10.
- v . 1850 — *Pecten Archiacianus* d'Orb. A. D'ORBIGNY, p. 83, n° 384.
(1854) — *Pecten Archiacianus* d'Orb. G. COTTEAU, p. 115.
- v . 1868 — *Pecten Archiacianus* d'Orbigny P. DE LORIOI, p. 45, pl. 4, f. 1, 2, pl. 5, f. 1.
- v . 1870 — *Pecten Archiaci* d'Orbigny F. J. PICTET & G. CAMPICHE, pp. 181-183, pl. 168, f. 1 a-d, 2 a-d, 3, 4.
(1871) — *Pecten Archiacianus* d'Orb. F. STOLICZKA, p. 429.
1896 — *Pecten Archiacianus* d'Orb. A. WOLLEMAN, p. 839.
- . 1900 — *Pecten Archiacianus* d'Orbigny A. WOLLEMAN, pp. 46-47.
- ? 1907 — *Pecten Archiaci* d'Orb. N. I. KARAKASCH, p. 191.
- (1919) — *Pecten (Chlamys) Archiacianus* d'Orb. I. TOMITCH, p. 118.
- . 1921 — *Chlamys Archiaci* d'Orb. S. GILLET, pp. 90-91.
- 1923 — *Pecten (Chlamys ?) Archiaci* d'Orbigny V. K. PETKOVIĆ, p. 63.
- . 1924 — *Chlamys Archiaciana* d'Orb. S. GILLET, p. 47.
- ? 1931 — *Pecten* cf. *P. archiaci* d'Orbigny C. E. WEAVER, pp. 276-277.
- v . 1933 — *Pecten Archiaci* d'Orb. E. BONČEV, p. 235, pl. 3, f. 2.
(1934) — *Pecten Archiaci* d'Orb. ST. T. JELEV, p. 118.
- (1934) — *Chlamys Archiaci* d'Orbigny G. DENIZOT, p. 147.
- . 1948 — *Chlamys Archiaci* d'Orbigny R. P. CHARLES, pp. 6-7.
- (1949) — *Pecten archiacianus* d'Orb. B. KOKOSZYNSKA, p. 16.
- . 1955 — *Pecten archiaci* d'Orb. M. S. ERISTAVI, p. 21.
- (1960) — *Chlamys archiaci* d'Orb. M. S. ERISTAVI, p. 51, 55.
- . 1960 — *Chlamys archiacianus* Orbigny T. L. MUROMTSEVA & B. T. YANIN, p. 188, pl. 9, f. 7.

Location of type-specimen

Lectotype : Muséum national d'Histoire naturelle, Paris, D'ORBIGNY's collection, n° 5129 (here designated).

Stratum typicum :

Néocomien (Neocomian; in Prodrôme : Néocomien B. : Urgonien or Barremien).

Locus typicus :

Auxerre, Yonne (France).

Original description

« *P. testâ oblongâ, compressâ; valvâ inferiore radiatim inaequaliter 20- costatâ; costis lateribus magnis, alteris biradiatis, alteris simplicibus, transversim lamellosis; lamellis eiectis; auriculis inaequalibus, transversim longitudinaliterque costatis.*

Dimensions. Largeur, 45 millim. Par rapport à la largeur : longueur, 68/100, épaisseur, 24/100. Angle apical, sans les oreillettes, 78°.

Coquille oblongue, transverse, très-comprimée. Valve inférieure peu bombée, ornée de vingt côtes rayonnantes arrondies, très-inégales, les unes simples, les autres divisées en deux, bien plus larges sur les côtés qu'au milieu, sur lesquelles se remarquent des lames transversales, imbriquées, espacées, non interrompues. Les sillons qui séparent les côtes sont simples, un peu plus larges que les côtes et traversés seulement par des lames. Les oreilles sont grandes, très-inégales, ridées en travers et pourvues de quelques côtes rayonnantes.

Rapports et différences. Cette espèce, qui a quelques rapports de forme avec le *P. Goldfussii*, s'en distingue facilement par ses côtes inégales que traversent largement des lames non interrompues.

Localité. MM. D'ARCHIAC et BAUDOUIN DE SOLÈNE l'ont recueillie aux environs d'Auxerre (Yonne), où elle paraît être rare. »

(Note : D'ORBIGNY overrated the U. P. D. of this specimen : it is not more than 35 mm.)

Additional description

Number of specimens studied : total : 207.

Bulgarian Valanginian	...	...	...	...	...	3
French Hauterivian	...	...	...	...	...	36
Swiss Valanginian	...	...	...	...	...	28
French Valanginian	...	...	...	...	...	36
Swiss Hauterivian	...	...	...	...	...	50
Bulgarian Barremian	...	...	...	...	...	2
Swiss Barremian	...	...	...	...	...	3
French Neocomian	...	...	...	...	...	18
Iraqi Neocomian	...	...	...	...	...	15
Swiss Neocomian	...	...	...	...	...	15
Bulgarian Aptian	...	...	...	...	...	1

Measurements :

Auxerre, Yonne (Neocomian), topotypes :

U. P. D.	W.	A. A.	Ribnumber	Side
26.6 mm	21.3 mm	73°	19	L
26.6 mm	21.3 mm	74°	24	R

Sainte-Croix, Vaud (Neocomian) :

30.85 mm	22.25 mm	—	30	L
30.75 mm	22.00 mm	—	39	R

Marolles, Aube (Neocomian) :

—	27.9 mm	79°	26	R
—	27.8 mm	74°	28	L
47.5 mm	—	79°	22	L

Censeau, Jura (Hauterivian) :

29.2 mm	24.65 mm	78°	22	R
—	24.65 mm	—	23	L
—	28.25 mm	—	31	R
—	28.25 mm	—	25	L
—	—	—	25	R
20.75 mm	15.55 mm	70.5°	24	L
19.9 mm	15.5 mm	—	23	L

Description :

Diagnosis. — Small to medium-sized *Chlamys*? species with 19 to 39 often divided straight ribs, a narrow umbo and very unequal auricles. The ribnumber is usually higher on the right than on the left valve. Both valves are covered with concentric striae and/or riblets.

Flattened discs (left valves more convex than right) covered with radial ribs in varying number and with numerous concentric striae or riblets which can form scales or even spines on the primary ribs; when the concentric riblets are continuously developed the disc seems to be covered with a trellis-like ornamentation (particularly so near the umbo). The ribs are mostly rounded, but sometimes triangular in cross section. The ribdistribution varies : they can be almost equal in width, but in this case they often lie in pairs and then the intercostal intervals are alternately broader than the ribs and groove-like. Some of these primary ribs divide and thus the ribnumber is frequently slightly higher at the pallial margin than at the umbo. The primary ribs usually bear largish scales at the intersection points with the concentric riblets. In the intercostal intervals

secondary riblets often appear near the umbo; these are always smooth (no scales), but rarely regularly distributed. On some specimens, however, a secondary riblet alternates regularly with a primary pair of ribs.

The lunula can be recognized by the somewhat irregular striation perpendicular to the U. P. D. which covers it.

The right valve has a large winglike anterior auricle with a deep byssal sinus; the auricle is covered with numerous concentric striae and riblets which follow the curve of the sinus. The posterior auricle is very small, obtuse-angled and covered with the continuation of the concentric striation which ends perpendicularly to the hinge margin and parallel with the outer margin. Some of the striae have become riblets, thus giving the type-specimen seven riblets on its posterior auricle.

The left valve has a large anterior auricle with a very shallow byssal sinus; its concentric riblets are perpendicular to the hinge margin and form small bulbous structures when reaching this margin. This auricle is also covered with inconspicuous radial riblets which form small scales at the intersection points with the concentric riblets. The posterior auricle is as on the right valve.

Discussion

Variability :

The ribnumber is extremely variable and difficult to count because it is different at the umbo and at the pallial margin, and also because it is often difficult to decide whether the paired ribs are one rib with a shallow groove in it or two ribs divided by a shallow interval. As always when primary and secondary ribs are present it is difficult on poorly preserved specimens to decide which are primary ribs and which are secondary.

The aspect of the ornamentation is different near the umbo and near the pallial margin : near the umbo the discs often seem to have a trellis-like aspect due to equally developed radial and concentric elements, whereas near the pallial margin the radial element is always predominant.

Synonymy :

Though the ribnumber is extremely variable the relatively restricted occurrence of the species and the very thorough study made of it by PICTET & CAMPICHE might explain the lack of nomenclatorial problems concerning it.

The figure in D'ORBIGNY (pl. 429, fig. 7-10) are almost correct but the description not : « lames non interrompues » is an exaggeration of the concentric ornamentation which only near the umbo continuously covers ribs and intercostal intervals. Furthermore it is not true that « les côtes (sont) bien plus larges sur les côtés qu'au milieu ».

Differentiation :

The irregular ribdistribution makes it relatively easy to differentiate *C.?* *archiaciana* from the other Lower Cretaceous *Chlamys* ? and *Mimachlamys* species.

- *C.?* *martiniana* has fewer, mostly undivided and regularly distributed ribs.
- *C.?* *goldfussi* has generally fewer ribs, has larger valves, tripartite ribs on the right valve.
- *C.?* *icaunensis* has a very different type of sculpture.
- *C.?* *elongata* has tripartite ribs on both valves.
- *Mimachlamys robinaldina* has narrower ribs and is completely covered with very small spines.

Generic attribution :

Pecten archiacianus D'ORBIGNY, 1847, has not so far shown specimens with thimble-microsculpture but most specimens are fairly worn. Other characteristics of the species, such as the relatively narrow apical angle and the well delimited ribs, are more often found on *Chlamys* species; thus *Pecten archiacianus* is tentatively classified herein as *C.?* *archiaciana* (D'ORBIGNY).

Stratigraphical and geographical distribution

Valanginian : BULGARIA :

Teke dere, Kolarovgradsko (Univ. Sofia)

FRANCE :

Métabief, Doubs (Mus. Gen.)

Petite Gorge, Salève, Haute-Savoie (Mus. Laus.)

Vesancy, Gex, Ain (Mus. Gen.)

Villers-le-lac, Doubs (Mus. Gen., Univ. Neuch.)

SWITZERLAND :

Arzier, Vaud (Mus. Gen. also orig. DE LORIOI, 1868, pl. 4, fig. 1 et 2)

Auberson, Vaud (Mus. Laus., orig. PICTET & CAMPICHE, pl. 168, fig. 3)

Ballaigues, Vaud (Mus. Gen.)

Colas, Sainte Croix, Vaud (Mus. Laus.)

Côte-aux-Fées, Vaud (Mus. Laus., Univ. Neuch.)

Sainte-Croix, Vaud (Mus. Laus., Univ. Neuch.)

Hauterivian : FRANCE :

Censeau, Jura (Mus. Gen. also orig. PICTET & CAMPICHE, pl. 168, fig. 2a - 2d)

Morteau, Doubs (Univ. Neuch.)

Petite Gorge, Salève, Haute-Savoie (Mus. Gen.)
 Salève, Haute-Savoie (Mus. Gen.)
 Varappe, Salève, Haute-Savoie (Mus. Gen.)
 Villers-le-Lac (Doubs) (Univ. Neuch.)

SWITZERLAND :

Auberson, Vaud (Mus. Laus.)
 Chamblon, Vaud (Mus. Laus.)
 Colas, Sainte Croix, Vaud (Mus. Laus.)
 Le Locle, Neuchâtel (Univ. Neuch.)
 Sainte Croix, Vaud (Mus. Laus., Univ. Neuch.)
 Vaulion, Vaud (Mus. Laus.)

Barremian : BULGARIA :

s. Somovodere (Univ. Sofia)

SWITZERLAND :

La Rusille, Vaud (Mus. Gen.)

Neocomian : FRANCE :

Auxerre, Yonne (Mus. Gen., Musé. also orig. D'ORBIGNY, pl. 429,
 fig. 7-10, 5129, 5129 A)
 Escragnolles, Var (B.)
 Gy d'Evêque, Yonne (B., Mus. Gen.)
 Marolles, Aube (B., Mus. Gen. orig. PICTET & CAMPICHE, pl. 168,
 fig. 1a-d)

IRAQ :

Bekhme Gorge (B. M.)

SWITZERLAND :

Concise, Vaud (Univ. Neuch.)
 Sainte Croix, Vaud (Mus. Gen.)

Aptian : BULGARIA :

Orhanie (Univ. Sofia, orig. BONČEV, 1933, pl. 3, fig. 2)

Chlamys ? *goldfussi* (G. DESHAYES in A. LEYMERIE, 1843)
 (sensu D'ORBIGNY, 1847)
 (Pl. 5, fig. 1)

- | | |
|--|--|
| . 1843 — <i>Pecten Goldfussi</i> Desh. | A. LEYMERIE, p. 10, pl. 8,
f. 9 a, b. |
| v . 1847 — <i>Pecten Goldfussii</i> Deshayes | A. D'ORBIGNY, pp. 582-583,
pl. 429, f. 1-6. |
| v . 1850 — <i>Pecten Goldfussii</i> Desh. | A. D'ORBIGNY, p. 83,
n° 389. |
| (1854) — <i>Pecten Goldfussii</i> Deshayes | G. COTTEAU, p. 115. |

- v . 1861 — *Pecten Goldfussii* Deshayes P. DE LORIOI, pp. 99-100, pl. 13, f. 1, 2.
- ? 1868 — *Pecten Goldfussii* Deshayes F. J. PICTET, pp. 260-261.
- v . 1870 — *Pecten Goldfussii* Deshayes F. J. PICTET & G. CAMPICHE, pp. 178-180, pl. 177, fig. 1 a-e, 2.
- (1871) — *Pecten Goldfussii* Desh. F. STOLICZKA, p. 428.
- 1877 — *Pecten Goldfussii* Desh. G. BOEHM, p. 233.
- 1896 — *Pecten Goldfussii* Desh. A. WOLLEMAN, p. 839.
- 1896 — *Pecten lineato-costatus* A. Römer A. WOLLEMAN, p. 840.
- 1899 — *Pecten Goldfussii* Desh. G. MAAS, p. 249.
- (1899) — *Pecten Goldfussii* Desh. A. WOLLEMAN, p. 91.
- 1900 — *Pecten Goldfussii* Desh. A. WOLLEMAN, pp. 45-46.
- ? 1914 — *Pecten (Chlamys) cf. Goldfussii* Desh. M. MORAND, pp. 224-225.
- (1918) — *Chlamys Goldfussii* S. GILLET, p. 118.
- (1919) — *Pecten cf. Goldfussii* Desh. I. TOMITCH, p. 118.
- . 1921 — *Chlamys Goldfussii* Desh. S. GILLET, p. 90.
- . 1924 — *Chlamys Goldfussii* Desh. S. GILLET, p. 46, f. 22.
in Leym.
- . 1960 — *Chlamys goldfussii* T. L. MUROMTSEVA, B. T. YANIN, p. 188, pl. 9, f. 3-6.
Deshayes
- (1960) — *Camptonectes goldfussii* M. S. ERISTAVI, p. 51.
Des.
- (1960) — *Chlamys goldfussii* Des. M. S. ERISTAVI, p. 54.
- (1960) — *Camptonectes goldfussii* M. S. ERISTAVI, p. 55.
Des.
- (1962) — *Chlamys goldfussii* Desh. B. T. YANIN, p. 129.
- . 1962 — *Chlamys (Chlamys) goldfussii* (Deshayes) V. A. PROZOROVSKI, p. 39, 37, f. 1.

Location of type-specimens

The specimens of LEYMERIE have not been located; the DESHAYES collection which was in the Ecole des Mines (now Faculté d'Orsay) does not contain a specimen which could belong to *Chlamys goldfussii*.

Topotypical material is unknown and therefore it is impossible to check, at present, what exactly *Pecten goldfussii* DESHAYES in LEYMERIE is. Stratigraphically there is a discrepancy between LEYMERIE's indication and D'ORBIGNY's interpretation : in LEYMERIE, 1843 (p. 27)), *P. goldfussii* is stated to come from Les Croûtes, « Argile téguiline et Grés verts, i. » (which means the lower part of the stage). In LEYMERIE, 1842 (p. 318) it is noted that Les Croûtes deposits contain *Exogyra sinuata*. In LARCHER, RAT & MALAPRIS, 1965 (p. 240) « ...les argiles à *Exogyra sinuata*... que l'on rapporte maintenant à l'Aptien ». Thus the stratigraphical position of Les Croûtes is clearly Aptian, and even Upper Aptian. D'ORBIGNY only gives Neocomian localities. Whether *Pecten goldfussii* D'ORBIGNY

is the same as *Pecten goldfussi* DESHAYES cannot be said at present : DESHAYES's description is very brief and the figure of an incomplete specimen is clearly idealized.

Pecten goldfussi sensu D'ORBIGNY : D'ORBIGNY coll. 5125, Muséum national d'Histoire naturelle, Paris.

Stratum typicum :

Pecten goldfussi sensu D'ORBIGNY : Néocomien.

Locus typicus :

Pecten goldfussi sensu D'ORBIGNY : Auxerre, Yonne (France).

Original description

« Peigne à côtes rondes, imbriquées, et dont les écailles se relèvent à leur extrémité inférieure de manière à former comme de petits bourrelets; intervalles des côtes un peu plus larges que les côtes elles-mêmes, et couverts de stries transverses offrant peu de netteté. — Très voisin du *Pecten vimineus* SOW., mais plus déprimé, à côtes moins sail-lantes, plus chargées de bourrelets, et à stries intermédiaires moins marquées. Diffère du *Pecten Voltzii* par les côtes, qui sont plus aiguës et plus écartées dans ce dernier, qui d'ailleurs à ses stries intercostales bien plus nettes.

Hauteur présumée, 62 mm; largeur, 52. »

Pecten goldfussi in D'ORBIGNY

« P. testâ ovatâ, transversâ, depressâ, subaequalvi, valvâ inferiore radiatim 19 costatâ; costis aequalibus triradiatis, carinatis; carinâ transversim squamulosâ; interstitiis sulcis biimpressis, transversim striatis; valvâ superiore, costis convexis, rotundatis, transversim striatis, squamulosis; ariculis inaequalibus, transversim rugosis.

Dimensions. Largeur, 80 millim. — Par rapport à la largeur : longueur, 80/100; épaisseur, 23/100, longueur de la facette des oreilles, 48/100. — Angle apical, sans les oreillettes, 77°.

Coquille ovale, transverse, très-déprimée, la valve supérieure un peu plus bombée que l'autre. Valve inférieure ornée de dix-neuf côtes égales, rayonnantes, presque simples dans la jeunesse, mais formées chacune plus tard de trois côtes réunies, dont la médiane est carénée et pourvue de petits tubercules qui, sur les côtés représentent des saillies transverses imbriquées. Entre chacune de ces côtes complexes est un sillon marqué lui-même de deux sillons longitudinaux. Ce sillon ainsi que les côtes sont fortement striés en travers. La valve supérieure a des côtes simples formées d'une seule saillie à sommet arrondi, sur laquelle s'étend, de distance en distance, une lame en croissant imbriquée et saillante. On remarque de plus des stries profondes, transverses. Les oreilles sont très-grandes, fortement ridées en travers.

Rapports et différences. Cette espèce est remarquable par la différence énorme d'ornement de ses deux valves : l'une à trois côtes réunies, l'autre à côtes simples. C'est très-probablement le *Pecten crispus* de M. ROEMER, bien distinct du *Cretosus*.

Localité. Elle est propre à l'étage néocomien, et a été recueillie à Saint-Dizier et à La Gatine, près de Rupt (Haute-Marne), par MM. CORNUEL et TOMBECK, à Auxerre, à Saint-Sauveur (Yonne), par MM. ROBINEAU-DESVOIDY, COTTEAU et par moi. »

Additional description

Number of specimens studied : total : 48.

Bulgarian Valanginian	...	...	...	...	...	1
Swiss Valanginian	...	...	...	...	...	2
French Hauterivian	...	...	...	...	...	13

Swiss Hauterivian	... ..	1
Swiss Barremian	... ..	6
German Neocomian	... ..	2
French Neocomian	... ..	18
Swiss Neocomian	... ..	5

Measurements :

D'ORBIGNY's figured specimen (pl. 429, fig. 1) is slightly smaller than he states in his description : U. P. D. 74.9 mm, W. 60.0 mm, A. A. 84°, Ribnumber 19.

Few other specimens could be measured, because the state of preservation is mostly very poor :

Localities	Strat.	U. P. D.	W.	A. A.	Rib-number
Kotchmar (Bulg.)	Valanginian	75 mm	55 mm	72°	20
Auberson (Vaud)	Hauterivian	—	—	86°	19
Aiguille du Midi du Mont Vergy (Hte- Savoie)	Neocomian	100.3 mm	—	—	18
Fontenoy (Yonne)	Neocomian	—	49.1 mm	—	19
Gy l'Evêque (Yonne)	Neocomian	67.2 mm	—	73°	20
Gy l'Evêque (Yonne)	Neocomian	—	—	74°	19
Morancourt (Hte Marne)	Neocomian	—	—	—	15
Mormont (Vaud)	Neocomian	—	—	—	16

Description :

Diagnosis. — Medium to large *Chlamys* species with 15 to 22 ribs, which are undivided on left valves, but tripartite on right valves; on both valves the ribs bear scales. The auricles are very unequal.

Right valve : covered with straight, mostly tripartite ribs : the subdivision of the ribs occurs just below the umbonal area but is most clearly visible near the pallial margin; ribs near the side margin are, however, rarely subdivided; tripartite ribs bear a narrow riblet on top of the rib and one broader riblet at each side of the rib; in each intercostal interval lies one riblet, which starts below the umbonal area; near the pallial margin there sometimes seems to be more than one intercostal riblet : in this case the side riblet of one of the ribs seems to lie on the bottom of the interval instead of on the side of the rib.

Ribs and intervals are covered with numerous very closely set concentric striae; at regular intervals on the ribs one of the striae becomes a ridge

and thus forms a scale, sometimes only on the top riblet, but sometimes also on the side riblets; the intercostal riblet is always smooth.

The auricles are very unequal; the anterior has a deep byssal sinus, is winglike and covered with radial and concentric striae of varying development; the posterior auricle is much smaller, obtuse-angled and covered with concentric and fewer radial striae; the former are parallel with the outer margin.

Left valve : bears undivided, straight ribs; the disc is covered with close set concentric striae and in a similar way as on the right valve, scales appear at regular intervals on the ribs. The scales are larger than on the right valve, since they cover a complete ribsection; the intercostal intervals are smooth except for the concentric striae. The auricles are very unequal : the anterior one is large, right-angled and with a very slight byssal sinus and covered with concentric and a few slight radial striae; the posterior one is much smaller, obtuse-angled and also covered with concentric and radial striae.

Discussion

Synonymy :

As stated by PICTET & CAMPICHE, D'ORBIGNY rightly described, but wrongly figured the right valve of this species : his figure 1 is a right valve but the ornamentation drawn on the figure is that of a left valve. S. GILLET, 1924, p. 46, fig. 22, repeats exactly the same mistake : her figure is a right valve with a left valve ornamentation, yet she states that the figure represents a left valve.

Pecten lineato-ostatus ROEMER is an insufficiently described species; there is a discrepancy between ROEMER's own descriptions : in 1839 he states « ...zwölf runden ...Längslinien » but in 1841 « ...zahlreiche (16) feine Längslinien ».

Variability :

The very fragmentary material does not permit a discussion of the variability.

Differentiation :

Among the Lower Cretaceous *Chlamys*? species *Pecten goldfussi* is easily differentiated by its larger size and relatively low ribnumber, and by the unusual difference between left and right valves (a similar difference is found in *Chlamys faujasi* (DEFrance)).

Generic attribution :

Pecten goldfussi sensu D'ORBIGNY, 1847, is known from poorly preserved specimens, and therefore the thimble-microsculpture is not visible.

The similarity in ribdistribution with *C. faujasi* (see above) makes it likely that the species belongs to the genus *Chlamys*, and thus its name becomes *Chlamys* ? *goldfussi* (LEYMERIE, sensu D'ORBIGNY).

Stratigraphical and geographical distribution

Valanginian : BULGARIA :

s. Kotchmar, Tolbuchinsko (Univ. Sofia)

SWITZERLAND :

Sainte Croix, Vaud (Univ. Neuch.)

Hauterivian : FRANCE :

Grande Varappe, Salève, Haute-Savoie (Mus. Gen.)

Monnetier, Salève, Haute-Savoie (Mus. Gen.)

La Praz, Ain (Mus. Laus.)

Salève, Haute-Savoie (Mus. Gen. also orig. PICTET & CAMPICHE, pl. 167, fig. 1, 2, DE LORIO, 1861, pl. 13, fig. 2)

La Varappe, Salève, Haute-Savoie (Mus. Gen., Mus. Laus.)

Villers-le-Lac, Doubs (Univ. Neuch.)

SWITZERLAND :

Auberson (Mus. Laus.)

Barremian : SWITZERLAND :

Mormont, Vaud (Mus. Laus.)

Travers, Neuchatel (Univ. Neuch.)

Neocomian : G. F. R. :

Hilsconglomerat : Gross Vahlberg (B.)

FRANCE :

Auxerre (Yonne) (Musé. orig. D'ORBIGNY : pl. 429, fig. 1)

Bernouil, Yonne (Mus. Gen.)

Bettancourt, Haute-Marne (Musé. Coll. D'ORBIGNY)

Censeau, Jura (Mus. Gen., Musé. coll. D'ORBIGNY)

Fontenoy, Yonne (Musé. coll. D'ORBIGNY)

Gy d'Evêque, Yonne (Mus. Gen. also orig. PICTET & CAMPICHE, pl. 167, fig. 1a)

Morancourt, Haute-Marne (Mus. Laus.)

Saint-Dizier, Haute-Marne (Musé. coll. D'ORBIGNY)

SWITZERLAND :

Hauterive, Neuchâtel (Mus. Gen.)

Landeron, Neuchâtel (Mus. Gen.)

Neuchâtel, Neuchâtel (B., Mus. Gen.)

Chlamys ? icaunensis (G. COTTEAU, 1854)

(Pl. 9, fig. 1)

- . 1854 — *Pecten Icaunensis* G. COTTEAU, p. 115.
(non 1854 *Pecten Icaunensis* G. COTTEAU, p. 110 from
the Oxfordian of Etivey)
- v . 1868 — *Pecten Icaunensis* Cotteau P. DE LORIOI, p. 46, pl. IV,
f. 6.
- 1870 — *Pecten icaunensis* Cotteau F. J. PICTET & G. CAMPICHE,
p. 210.
- (1871) — (? *Pect.*) *icaunensis* Cott. F. STOLICZKA, p. 428.
- . 1921 — *Chlamys icaunensis* Cott. S. GILLET, pp. 89-90, pl. 5,
f. 4.
- v ? 1957 — « *Pecten* » *icaunensis* Cott. G. ROESSINGER, pp. 101-102,
text fig. 2.

Location of type-specimens

I have been unable to locate COTTEAU's original specimen.

Locus typicus :

Gy-l'Evêque, Yonne (France)

Stratum typicum :

Néocomien.

Original description

« Très-belle espèce, oblongue, comprimée, ornée de seize à dix-huit côtes droites et rayonnantes. Sillons intermédiaires larges et garnis de stries rayonnantes, fines, régulières, granuleuses, avec lesquelles se croisent d'autres stries concentriques. Oreillettes grandes et striées. Gy-l'Evêque. Etage néocomien. »

Description in de LORIOI, 1868

« Dimensions : Longueur probable et minimum : 60 à 70 mm.

Angle apical : 75°.

Je ne connais aucun exemplaire complet de cette espèce, je ne saurais donc en préciser la forme; elle était peu épaisse et peu inéquilatérale. Les ornements consistent en 16 côtes rayonnantes, élevées, saillantes, sans écailles, séparées par des intervalles plus larges, profonds et concaves. Toute la surface est en outre couverte de côtes longitudinales très-fines, très serrées, un peu granuleuses, coupées par de profondes stries concentriques de même dimension; le tout forme un treillis régulier très-fin, à mailles très-serrées, qui ne se voit bien qu'à la loupe. Il est probable que l'ornementation des deux valves était sensiblement la même, car on ne remarque aucune différence entre une douzaine d'individus incomplets que j'ai sous les yeux. Les oreillettes de la valve supérieure sont assez grandes et ridées en travers.

Rapports et différences. Les individus d'Arzier sont entièrement semblables aux exemplaires de cette espèce que j'ai recueillis à Gy-l'Evêque (Yonne) et qui ont été nommés par M. COTTEAU; leur détermination peut donc être regardée comme certaine. Ce beau *Pecten*, qui parvenait à une grande taille, est très-caractéristique à cause de

son ornementation particulière; il se distingue à première vue des *P. Goldfussi*, DESH. et *P. Euthymeï*, PICTET, qui ont, ainsi que lui, de grosses côtes rayonnantes et une forme analogue.

Gisement. Couche A, rare. Couche B, assez fréquente. »

Additional description

Number of specimens studied : total : 44.

Swiss Valanginian	... ..	26
Swiss Barremian	... ..	1
French Neocomian	... ..	15
Swiss Neocomian	... ..	1
Swiss Aptian	... ..	1

Measurements :

All specimens are fragmentary and measurements are mostly impossible to make; the limited information gained is all stated here.

Locality	Strat.	U. P. D.	W.	A. A.	Rib-number
Bernouil	Neocomian	—	—	—	17
Concise	Neocomian	—	—	—	18
Gy-l'Evêque	Neocomian	33 mm	—	74°	17
Gy-l'Evêque	Neocomian	47 mm	—	—	16
Gy-l'Evêque	Neocomian	55 mm	—	—	16
Gy-l'Evêque	Neocomian	—	—	77°	17
Gy-l'Evêque	Neocomian	39 mm	—	—	17
Marolles	Neocomian	—	—	—	16
Mormont	Barremian	—	—	86°	18
La Presta	Aptian	—	—	83°	18
Thieffrain	Neocomian	—	—	—	16

Description :

Diagnosis. — *Chlamys?* species of medium size, covered with 16-18 relatively broad radial ribs; the disc is completely covered with a trellis-like ornamentation consisting of very fine radial and concentric striae.

Ornamentation : the trellis-like ornamentation is the same on both valves; the striae are so fine that the discs look as if they were covered with little square cavities. On both valves the intercostal intervals are broad; on the right valve the ribs have a triangular, sharp, transection, whereas on the left valve they have a rounded transection. The auricles

are covered with the same ornamentation but the radial element is more pronounced than on the valves; the auricle shape is the same as on the other *Chlamys* species.

Discussion

The unusual ornamentation of *Chlamys? icaunensis* is very close to the thimble-microsculpture characteristic of the genus *Chlamys*, but the cavities present on the former form squares whereas those on the latter group form rhombs. As far as could be checked the square element is not known in any other *Chlamys* species from Cretaceous or Tertiary deposits.

I have not seen any complete specimen of this species. The ornamentation is so unusual that it is possible to recognize even fragmentary specimens of the species; however, this is a dangerous way of determination because in *Limacea* and *Spondylidae* certain ornamentation patterns are found which are similar to those on *Pectinidae* and the recognition of fragments could induce certain errors in this case. In the present species it seems possible that the very fragmentary specimens recorded as « *Pecten icaunensis* » from the Valanginian of Arzier, Vaud, (Switzerland) do in reality belong to *Lima russillensis* PICTET & CAMPICHE, 1870, or to *Lima nicoleti* PICTET & CAMPICHE, 1870 (this latter « species » only known from one incomplete specimen, could, according to PICTET & CAMPICHE, be identical with *Pecten icaunensis*).

G. ROESSINGER, 1957, p. 102, considers that his almost complete specimens from the Valanginian from Arzier could be Limids instead of Pectinids, but he does not draw a definite conclusion. I have seen most of the specimens he studied in the Muséum d'Histoire naturelle in Geneva, and amongst those some fragments very likely belong to a Limid, whereas some others have Pectinid characteristics; it does seem likely that two species with similar ornamentation are present.

Chlamys? icaunensis has a very restricted occurrence, which is unusual in Neocomian species. This could be due to the poor preservation of most Neocomian specimens, which very often are found as Steinkernen and such specimens of *Chl? icaunensis* would probably be classified as belonging to *Chl. goldfussi* (DESHAYES).

When the ornamentation is present it is easy to recognize *Chl? icaunensis*; without it it is impossible to differentiate the specimens from those of *Chl. goldfussi*.

Generic attribution :

The auricles of *Pecten icaunensis* COTTEAU, 1854 (p. 115 non 110) have never been seen satisfactorily; the general shape of the species is similar to that generally found in *Chlamys* species, but as long as the species is not better known it is preferable to leave the attribution as uncertain.

Stratigraphical and geographical distribution

Valanginian : SWITZERLAND :

Arzier, Vaud (Mus. Gen. orig. DE LORIO, 1868, pl. 4, fig. 6, Mus. Laus.)

Barremian : SWITZERLAND :

Mormont, Vaud (Mus. Laus.)

Neocomian (without specifications) : FRANCE :

Bernouil, Yonne (Mus. Gen.)

Bettancourt, Haute-Marne (Mus. Gen.)

Gy-l'Evêque, Yonne (B., Mus. Gen., Mus. Laus.)

Marolles, Aube (Mus. Gen.)

Thieffrain, Aube (Mus. Gen.)

SWITZERLAND : Concise, Neuchâtel (Univ. Neuch.)

Aptian : SWITZERLAND :

La Presta, Neuchâtel (Mus. Gen.)

Genus *Mimachlamys* IREDALE, 1929

Type-species : *Pecten asperrimus* LAMARCK, 1819. (O. D.)

Definition (for Cretaceous species) : *Chlamydinae* in which the U. P. D. equals W., or is slightly longer; shells covered with a very variable number of thin, undivided ribs slightly elevated above the disc surface; the intercostal intervals can be very wide but when the ribnumber is very high they can be of the same width as the ribs themselves.

The apical angle, in adult specimens, measures between 80° and 110°.

Minachlamys robinaldina (A. D'ORBIGNY, 1847)

(Pl. 7, fig. 2)

- | | | |
|----------|---|-----------------------------------|
| . 1833 | — <i>Pecten hispidus</i> nobis | A. GOLDFUSS, p. 59, pl. 94, f. 4. |
| non 1820 | <i>Pectinites hispidus</i> E. T. von Schlotheim, | p. 225. |
| ? 1836 | — <i>Pecten obliquus</i> | W. H. FITTON, p. 360. |
| non 1821 | <i>Pecten obliquus</i> J. Sowerby. | |
| . 1842 | — <i>Pecten interstriatus</i> | A. LEYMERIE, p. 10, pl. 13, f. 1. |
| non 1841 | <i>Pecten interstriatus</i> G. von Muenster, p. 72 (Beitr. zur Petref. (4), fide SHERBORN). | |

- v . 1847 — *Pecten robinaldinus* d'Orbigny A. D'ORBIGNY, p. 587, pl. 431, f. 1-4.
- ? 1847 — *Pecten interstriatus* Leymerie A. D'ORBIGNY, p. 594, pl. 433, f. 1-5.
- v . 1847 — *Pecten Dutemplei* d'Orbigny A. D'ORBIGNY, p. 596, pl. 433, f. 10-13.
- . 1847 — *Pecten Galliennei* d'Orbigny A. D'ORBIGNY, p. 608, pl. 436, f. 5-8.
- v ? 1847 — *Pecten rothomagensis* d'Orbigny A. D'ORBIGNY, p. 609, pl. 436, f. 9-11.
- . 1847 — *Pecten Passyi* nov. sp. A. D'ARCHIAC, p. 309, pl. 15, f. 9a.
- . 1847 — *Pecten subinterstriatus* nov. sp. A. D'ARCHIAC, p. 311, pl. 15, f. 10 a-b.
- (1850) — *Pecten Aptiensis* d'Orb. A. D'ORBIGNY, p. 119, n° 131.
- (1850) — *Pecten Dutemplei* d'Orb. A. D'ORBIGNY, p. 139, n° 275.
- (1850) — *Pecten Galliennei* d'Orb. A. D'ORBIGNY, p. 169, n° 481.
- (1850) — *Pecten hispidus* Goldf. A. D'ORBIGNY, p. 169, n° 490.
- v . (1850) — *Pecten Passyi* d'Archiac A. D'ORBIGNY, p. 169, n° 494.
- (1850) — *Pecten Rhotomagensis* d'Orb. A. D'ORBIGNY, p. 169, n° 495.
- (1850) — *Pecten hispidus* Goldf. H. B. GEINITZ, p. 182.
- 1850 — *Pecten subinterstriatus* J. DE CARLO SOWERBY in F. DIXON, p. 356, pl. 28, f. 19.
- (1851) — *Pecten Robinaldinus* J. CORNUEL, pp. 436, 443.
- (1852) — *Pecten Robinaldinus* BUVIGNIER, p. 473.
- v . 1853 — *Pecten Saxoneti* Pictet et Roux F. J. PICTET & W. ROUX, p. 513, pl. 46, f. 5.
- v . 1853 — *Pecten aptiensis* (non d'Orb.) F. J. PICTET & W. ROUX, p. 511, pl. 46, f. 3.
- v . 1853 — *Pecten Dutemplei* d'Orbigny F. J. PICTET & W. ROUX, p. 512, pl. 46, f. 4.
- (1854) — *Pecten interstriatus* Leym. J. MORRIS, p. 176.
- (1854) — *Pecten Robinaldinus* D'Orb. J. MORRIS, p. 177.
- (1854) — *Pecten subinterstriatus* d'Archiac J. MORRIS, p. 177.
- (1854) — *Pecten Robinaldus* d'Orb. G. COTTEAU, p. 115.
- (1854) — *Pecten Aptiensis* d'Orb. G. COTTEAU, p. 115.
- (1854) — *Pecten Galliennei* d'Orb. G. COTTEAU, p. 115.
- v . 1858 — *Pecten Dutemplei* d'Orbigny F. J. PICTET & E. RENEVIER, pp. 131-133, pl. 19, f. 3 a-e.
- v . 1861 — *Pecten Robinaldinus* P. DE LORIOI, p. 101, pl. 12, f. 9-10.

- v . 1861 — *Pecten Oosteri* P. DE LORIOI, p. 102, pl. 13, f. 4-8.
- ? 1861 — *Pecten Barretti* H. G. SEELEY, p. 118, pl. 6, f. 1.
- (1861) — *Pecten Aptensis* d'Orb. W. GABB, p. 213.
- (1861) — *Pecten Dutemplei* d'Orb. W. GABB, p. 214.
- (1861) — *Pecten Galliennei* d'Orb. W. GABB, p. 214.
- (1861) — *Pecten hispidus* Goldf. W. GABB, p. 214.
- (1861) — *Pecten interstriatus* Leym. W. GABB, p. 215.
not Munst.
- (1861) — *Pecten Passyi* d'Arch. W. GABB, p. 215.
- (1861) — *Pecten Rhotomagensis* d'Orb. W. GABB, p. 216.
- (1861) — *Pecten Robinaldinus* d'Orb. W. GABB, p. 216.
- (1861) — *Pecten Saxoneti* P. & R. W. GABB, p. 216.
- (1861) — *Pecten subinterstriatus* d'Arc. W. GABB, p. 217.
- (1866) — *Pecten hispidus* Gf. C. GIEBEL, p. 48.
- 1869 — *Pecten Robinaldinus* P. DE LORIOI & V. GILLIÉRON, p. 22.
- 1869 — *Pecten Oosteri* P. DE LORIOI & V. GILLIÉRON, p. 23, pl. 1, f. 18.
- v . 1870 — *Pecten Robinaldinus* d'Orbigny F. J. PICTET & G. CAMPICHE, pp. 188-192, pl. 170, f. 1-5.
- v . 1870 — *Pecten Oosteri* de Lorient F. J. PICTET & G. CAMPICHE, pp. 192-193, pl. 170, f. 6.
- v . 1870 — *Pecten Dutemplei* d'Orbigny F. J. PICTET & G. CAMPICHE, pp. 199-201, pl. 172, f. 1 a-b, 2, 3 a-b, 4.
- v ? 1870 — *Pecten Sanctae-Crucis* Pictet et Campiche F. J. PICTET & G. CAMPICHE, pp. 183-184, pl. 168, f. 5, 6.
- v . 1870 — *Pecten Lardyi* Pictet et Campiche F. J. PICTET & G. CAMPICHE, p. 194, pl. 171, f. 2.
- (1870) — *Pecten aptiensis* d'Orb. F. J. PICTET & G. CAMPICHE, p. 212.
- (1870) — *Pecten Saxoneti* Pictet et Roux F. J. PICTET & G. CAMPICHE, p. 212.
- (1870) — *Pecten interstriatus* Leym. F. J. PICTET & G. CAMPICHE, p. 212.
- (1870) — *Pecten Gaillenei* d'Orb. F. J. PICTET & G. CAMPICHE, p. 214.
- (1870) — *Pecten rotomagensis* d'Orb. F. J. PICTET & G. CAMPICHE, p. 215.
- (1870) — *Pecten Passyi* d'Archiac F. J. PICTET & G. CAMPICHE, p. 215.
- (1870) — *Pecten subinterstriatus* d'Archiac F. J. PICTET & G. CAMPICHE, p. 215.

- (1871) — *Pecten Robinaldinus* d'Orb. F. STOLICZKA, p. 428.
- (1871) — *Pecten Oosteri* Lor. F. STOLICZKA, p. 428.
- (1871) — *Pecten aptiensis* d'Orb. F. STOLICZKA, p. 428.
- (1871) — *Pecten Dutemplei* d'Orb. F. STOLICZKA, p. 428.
- (1871) — *Pecten Galliennei* d'Orb. F. STOLICZKA, p. 428.
- (1871) — *Pecten (Camptonectes) Rotomagensis* d'Orb. F. STOLICZKA, p. 428.
- (1871) — *Pecten Passyi* d'Arch. F. STOLICZKA, p. 428.
- (1871) — *Pecten subinterstriatus* d'Arch. F. STOLICZKA, p. 428.
- (1871) — *Pecten hispidus* Goldf. F. STOLICZKA, p. 428.
- v . 1872 — *Pecten Rhotomagensis* H. B. GEINITZ, p. 196, pl. 44, f. 8.
- v . 1872 — *Pecten Galliennei* H. B. GEINITZ, p. 196, pl. 44, f. 6.
- v . 1872 — *Pecten inserens* H. B. GEINITZ, p. 197, pl. 44, f. 7.
- v . 1872 — *Pecten hispidus* H. B. GEINITZ, p. 197, pl. 44, f. 9-10.
- (1877) — *Pecten aptiensis* A. J. JUKES-BROWNE, p. 500.
- ? (1877) — *Pecten Barretti* A. J. JUKES-BROWNE, p. 500.
- v ? 1883 — *Pecten Dutemplei* d'Orbigny W. KEEPING, p. 105.
- 1884 — *Pecten Robinaldinus* O. WEERTH, p. 53.
- ? 1893 — *Pecten* sp. cf. *hispidus* Goldf. R. MICHAEL, p. 236.
- 1895 — *Pecten Robinaldinus* d'Orb. G. MAAS, p. 269.
- 1896 — *Pecten Robinaldinus* d'Orb. A. WOLLEMAN, p. 840.
- (1896) — *Pecten interstriatus* Leymerie A. J. JUKES-BROWNE & W. HILL, p. 149.
- (1896) — *Pecten Dutemplei* d'Orb. and *Pecten Galliennei* d'Orb. A. J. JUKES-BROWNE & W. HILL, p. 150.
- (1896) — *Pecten Passyi* d'Arch. A. J. JUKES-BROWNE & W. HILL, p. 150.
- (1896) — *Pecten subinterstriatus* d'Arch. A. J. JUKES-BROWNE & W. HILL, p. 150.
- 1898 — *Pecten Sanctae-Crucis* E. BAUMBERGER & H. MOULIN, p. 171.
- (1899) — *Pecten Robinaldinus* d'Orb. G. MAAS, p. 252.
- . 1900 — *Pecten Robinaldinus* A. WOLLEMAN, p. 47.
- ? 1900 — *Pecten* cf. *Robinaldinus* G. MUELLER, p. 551.
- (1901) — *Pecten hispidus* J. CORNET, p. B 58.
- v . 1902 — *Pecten (Chlamys) Robinaldinus* d'Orbigny H. WOODS, pp. 181-185, pl. 34, f. 7-12, pl. 35, f. 1-10.
- 1903 — *Pecten* sp. L. PERVINQUIÈRE, p. 42.

- (1903) — *Pecten (Chlamys) Robinaldinus* d'Orb. G. W. LAMPLUGH & J. F. WALKER, p. 263.
- (1904) — *Pecten Gallinei* J. J. JAHN, p. 299.
- (1905) — *Pecten Gallinei* d'Orb. J. J. JAHN, p. 76.
- (1905) — *Pecten Aptiensis* A. PÉRON, p. 375.
- (1905) — *Pecten aptiensis* d'Orb. A. PÉRON, p. 364, 368, 375.
- (1905) — *Pecten interstriatus* Leym. A. PÉRON, p. 371, 373.
- ? 1907 — *Chlamys* cf. *Lardy* (Pict. & Camp.) M. COSSMANN, p. 38, pl. 5, f. 10.
- ? 1911 — *Pecten (Chlamys)* cf. *cretosus* Defr. B. BUJALSKI, p. 440, f. 6 & 9.
- . 1911 — *Pecten (Chlamys) Robinaldinus* d'Orb. B. BUJALSKI, p. 440.
- 1912 — *Pecten (Chlamys) Aptiensis* d'Orbigny L. PERVINQUIÈRE, p. 139.
- . 1912 — *Pecten (Chlamys) Dutemplei* d'Orbigny L. PERVINQUIÈRE, p. 140.
- 1914 — *Pecten (Chlamys) Sanctae-Crucis* Pict. et Camp. M. MORAND, p. 225.
- ? 1916b — *Chlamys Robinaldina* (d'Orbigny) M. COSSMANN, pp. 42-43.
- (1918) — *Pecten (Chlamys) Robinaldinus* W. KILIAN, p. 339.
- ? 1918 — *Pecten (Chlamys) comans* Roemer J. WOLDRICH, p. 281.
- 1918 — *Pecten (Chlamys) Galliennei* d'Orbigny J. WOLDRICH, pp. 281-282, pl. 4, f. 11.
- (1919) — *Pecten Robinaldinus* d'Orb. I. TOMITCH, p. 118.
- 1921 — *Chlamys Robinaldinus* (laps. cal.) d'Orb. S. GILLET, p. 90.
- 1923 — *Pecten (Chlamys) Robinaldinus* d'Orb. V. K. PETKOVIČ, p. 62.
- ? 1925 — *Pecten (Chlamys) Robinaldinus* d'Orb. J. P. J. RAVN, p. 29, pl. 1, f. 5.
- ? (1927) — *Chlamys Galliennei* d'Orb. E. KAHRS, p. 633.
- ? (1927) — *Chlamys rhotomagensis* d'Orb. E. KAHRS, p. 633.
- ? (1927) — *Chlamys subinterstriatus* (laps. cal.) d'Orb. E. KAHRS, p. 633.
- ? (1927) — *Chlamys insereus* (laps. cal.) Gein. E. KAHRS, p. 633.
- (1931) — *Pecten Galliennei* d'Orb. A. MAZUREK, p. 476.
- (1931) — *Pecten rhotomagensis* d'Orb. A. MAZUREK, p. 476.
- (1931) — *Pecten Robinaldinus* d'Orb. B. KOKOSZYNSKA, p. 668.
- (1931) — *Pecten Galliennei* d'Orb. B. KOKOSZYNSKA, p. 668.
- . 1931 — *Pecten (Chlamys) robinaldinus* C. E. WEAVER, pp. 279-280, pl. 28, f. 152-154.
- (1931) — *Pecten hispidus* A. BENOIT, p. 79.

- (1931) — *Pecten Rotomagensis* A. BENOIT, p. 90.
 ? 1933 — *Pecten (Chlamys) hispidus* W. HAENTZSCHEL, p. 127.
 1933 — *Pecten (Chlamys) rhotomagensis* W. HAENTZSCHEL, p. 128.
 (1933) — *Pecten Robinaldinus* A. HEIM, E. BAUMBERGER, S. FUSSENEGGER, p. 209.
 (1933)a — *Pecten Aptiensis* A. BENOIT, p. 9.
 (1933)a — *Pecten Galliennei* A. BENOIT, p. 19, 23.
 (1934) — *Pecten Robinaldinus* ST. T. JELEV, p. 117.
 ? 1937 — *Pecten (Chlamys) cfr. Robinaldinus d'Orb.* N. SHALEM, p. 38, pl. 1, f. 44.
 v . 1937 — *Pecten hispidus* L. LEHNER, p. 186, pl. 23, f. 4, 10.
 v . 1937 — *Pecten hispidus* L. LEHNER, p. 187, pl. 23, f. 5, pl. 26, f. 7.
 var. *stutchburiana*
 . 1939 — *Pecten (Chlamys) robineau (laps. cal.) d'Orbigny* R. MARLIÈRE, p. 95, pl. 6, f. 2.
 (1939) — *Pecten hispidum (laps. cal.) Goldfuss* E. BASSE, p. 37.
 v . 1939 — *Pecten (Chlamys) hispidus* E. DACQUÉ, p. 47, pl. 1, f. 1, 5.
 (1939) — *Chlamys Dutemplei* J. HOUDARD, p. 629.
 (1942) — *Chlamys robinaldina (d'Orb.)* C. W. & E. V. WRIGHT, p. 86.
 . 1948 — *Chlamys Robineau (laps. cal.) (d'Orbigny)* R. P. CHARLES, p. 7.
 ? 1948 — *Chlamys Carteroni (laps. cal.) (d'Orbigny)* R. P. CHARLES, pp. 7-8.
 ? 1948 — *Chlamys robinaldina (d'Orb.)* G. TAVANI, pp. 96-97.
 1954 — *Pecten (Chlamys) cf. robineau (laps. cal.)* J. VILLATTE in CASTERAS & VILLATTE, p. 208.
 (1956) — *Pecten inserens* K. A. TROEGER, p. 35, 42.
 (1956) — *Pecten rhotomagensis* K. A. TROEGER, p. 35, 42, 52, 90.
 (1956) — *Pecten galliennei* K. A. TROEGER, p. 90.
 1956 — *Chlamys robinaldinus (d'Orb.) (laps. cal.)* B. KOKOSZYNSKA, p. 40.
 (1958) — *Pecten Dutempleanus (laps. cal.)* L. CAYEUX, p. 12.
 ? (1958) — *Pecten cf. cretosus* J. FÜLÖP, p. 82, 90.
 (1960) — *Pecten aptiensis* M. S. ERISTAVI, p. 62.
 (1960) — *Chlamys robinaldini (laps. cal.)* M. S. ERISTAVI, p. 51, 52.
 (1960) — *Pecten dutemplei* M. S. ERISTAVI, p. 65.
 (1960) — *Camptonectes robinaldinus* M. S. ERISTAVI, p. 79.
 . 1961 — *Chlamys (Chlamys) robinaldina (Orbigny)* V. A. SOBETSKI, pp. 36-37, pl. III, f. 5-6.

- . 1962 — *Chlamys (Chlamys) robinaldina* (d'Orbigny) V. A. PROZOROVSKI, p. 38, pl. 46, f. 3 a, b.
- (1964) — *Pecten dutemplei* d'Orbigny G. KRUSE, p. 103.
- ? (1964)a — *Pecten (Chlamys) robal-dinus* Orb. (= *hispidus* Glf.) (laps. cal.) H. ARNOLD, p. 99.
- . 1965 — *Chlamys robinaldina* (d'Orbigny) I. HAYAMI, pp. 310-311, pl. 44, f. 5-7.
- (1967) — *Pecten (Chlamys) cf. robinaldinus* Orbigny H. WACHENDORF, p. 27.
- . 1968 — *Chlamys (Chlamys) robinaldina* var. *galliennei* (Orbigny) S. I. PASTERNAK et al., pp. 153-154, pl. 31, f. 3-5.
- . 1968 — *Chlamys (Chlamys) hispida* (Goldfuss) S. I. PASTERNAK et al., p. 154, pl. 31, f. 6-10.

Location of type-specimens

- Pecten hispidus* GOLDFUSS : Paläontologisches Institut der Universität, Bonn (G. F. R.).
- Pecten interstriatus* LEYMERIE : probably lost.
- Pecten robinaldinus* D'ORBIGNY : lectotype : chosen here : coll. D'ORBIGNY 5128 D, Muséum national d'Histoire naturelle, Paris.
- Pecten galliennei* D'ORBIGNY : lost; the specimens in the D'ORBIGNY collection are not from the localities cited by D'ORBIGNY in the Paléontologie française.
- Pecten dutemplei* D'ORBIGNY : lectotype : chosen here : coll. D'ORBIGNY 6601, Muséum national d'Histoire naturelle, Paris.
- Pecten rothomagensis* D'ORBIGNY : lectotype : chosen here : coll. D'ORBIGNY 6900, Muséum national d'Histoire naturelle, Paris.
- Pecten aptiensis* D'ORBIGNY : could not be found in the collections of the Muséum national d'Histoire naturelle, Paris.
- Pecten passyi* et *P. subinterstriatus* D'ARCHIAC : lost.
- Pecten inserens* GEINITZ : Staatliches Museum für Mineralogie und Geologie, Dresden (G. D. R.).
- Pecten saxoneti* PICTET et ROUX : Muséum d'Histoire naturelle, Geneva (Switzerland).
- Pecten aptiensis* non D'ORBIGNY in PICTET et ROUX : Muséum d'Histoire naturelle, Geneva (Switzerland).
- Pecten oosteri* DE LORIOLE : Muséum d'Histoire naturelle, Geneva (Switzerland).
- Pecten sanctaecrucis* PICTET et CAMPICHE : Coll. CAMPICHE 17631, Musée géologique, Lausanne (Switzerland).
- Pecten lardyi* PICTET et CAMPICHE : Coll. CAMPICHE 21672, Musée géologique, Lausanne (Switzerland).

Stratum typicum :

- Pecten hispidus* : Grünsande (Cenomanian).
Pecten interstriatus : (Albian).
Pecten robinaldinus : néocomien.
Pecten dutemplei : « gault ou terrain albien » (Albian).
Pecten rothomagensis : turonien moyen (in fact Cenomanian).
Pecten galliennei : « couches les plus inférieures de l'étage turonien » (Cenomanian).
Pecten passyi et *P. subinterstriatus* : Tourtia (Middle Cenomanian).
Pecten inserens : Unteren Quaders (*Plenus*-zone ?)
Pecten saxoneti : grés verts (Albian).
Pecten oosteri : néocomien moyen.
Pecten sanctaecrucis : Valangien (Valanginian)
Pecten lardyi : Hauterivien.

Locus typicus :

- Pecten hispidus* : Essen/Ruhr (G. F. R.)
Pecten interstriatus LEYMERIE (= *Pecten aptiensis* D'ORBIGNY) : Les Croûtes, Aube (France).
Pecten robinaldinus : Saint-Dizier, Haute Marne (France).
Pecten dutemplei : Cluse, Savoie (France).
Pecten rothomagensis : Montagne Sainte-Catherine, Rouen (France).
Pecten passyi et *P. subinterstriatus* : Tournai (Belgium).
Pecten inserens : Oberau (G. D. R.).
Pecten saxoneti : Mont Saxonet, Haute-Savoie (France).
Pecten oosteri : Mont Salève, Haute-Savoie (France).
Pecten sanctaecrucis : Auberson, Sainte-Croix, Vaud (Switzerland).
Pecten lardyi : Auberson, Sainte-Croix, Vaud (Switzerland).

Original descriptions

Pecten hispidus

« *Pecten* testa ovata subconvexa, costulis numerosissimis planis conformibus squamoso-hispidis, interstitiis planis laevibus, auriculis inaequalibus striatis.

Occurrit in arena viridi et in creta chloritea Westphaliae. M. B.

Ist eyförmig, etwas convex und wie der vorhergehende Art (2) mit zahlreichen, schmalen Rippen besetzt, so dass sie derselben sehr ähnlich ist. Ihre Rippen sind jedoch ganz gleichförmig, niedriger, etwas breiter und mit rinnenförmigen, emporgerichteten Schuppen besetzt, die weiter und regelmässig von einander entfernt stehen. Die flachen Zwischenräume sind nur doppelt breiter als die Rippen, und lassen Wachstumsstreifen bemerken. Die ungleichen, grossen Ohren zeigen gedrängte, concentrische Streifen. Kommt im Grünsande bei Essen an der Ruhr und in der grünlichen Kreide bei Lemförde vor. »

Pecten interstriatus (strié entre les côtes)

« Assez allongé, peu convexe; côtes longitudinales assez étroites, imbriquées et portant régulièrement de courtes épines qui terminent inférieurement les écailles; les

(2) *Pecten serratus* NILSSON.

intervalles des côtes sont plus larges que les côtes elles-mêmes et sont couverts de stries serrées, nettes et arrondies, longitudinales au milieu de la coquille, et devenant de plus en plus obliques à mesure qu'elles s'approchent des bords. Oreillettes inégales, striées en deux sens et portant aussi de très courtes épines. Le test est ordinairement de couleur noire. Ce peigne est assez voisin du *Pecten hispidus* GOLDF. pl. 94, f. 4; mais celui-ci ne porte pas les stries intermédiaires si caractéristiques de notre espèce, dont il diffère d'ailleurs par les oreillettes. Le *Pecten interstriatus* ressemble aussi, pour les détails de sa surface et pour ses proportions, à la *Lima spathulata*, DESH., pl. 43; cependant cette dernière coquille a ses stries intercostales obliques même au milieu, et ses côtes plus rapprochées.

Hauteur, 48 millim.; largeur, 38. »

Pecten robinaldinus

« P. testâ ovatâ, depressâ, subaequalvli; valvâ superiore radiatim 53-costatâ; costis subaequalibus, obliquè striatis, tuberculis transversim imbricatis, squamosis, lateribus extensis; valva inferiore subaequaliter costatâ; auriculis magnis inaequalibus, transversim costato-lamellosis, radiatim costatis.

Dimensions. Largeur, 50 millim. Par rapport à la largeur : longueur, 85/100; épaisseur, 26/100; longueur de la facette des oreillettes, 45/100. Angle apical, sans les oreillettes, 83°.

Coquille ovale, transverse, très-déprimée, les deux valves également bombées. Valve supérieure ornée d'environ cinquante-trois côtes rayonnantes, presque égales, à peine marquées, pourvues de distance en distance, de tubercules allongés, transverses, qui s'étendent beaucoup de côté au-delà des côtes, et deviennent presque confluent sur les côtés. Les côtes et l'intervalle étroit qui les sépare sont couverts de stries obliques, très-prononcées; la valve inférieure, avec les même côtes, les montre un peu plus étroites. Les oreilles sont grandes; l'oreille buccale supérieure est fortement costulée en travers, et légèrement traversée par des côtes rayonnantes.

Rapports et différences. D'après la synonymie de M. FORBES, on voit qu'il a confondu trois espèces sous le nom d'*Obliquus*; le *Pecten obliquus* de SOWERBY, propre à la craie chloritée, le *Pecten interstriatus* de M. LEYMERIE, spécial à l'étage aptien, et celui qui m'occupe, propre à l'étage néocomien. En voulant ainsi, d'après un examen trop superficiel, confondre toutes les espèces les plus tranchées en une seule, non seulement on détruira les véritables rapports zoologiques, mais encore on embrouillera de plus en plus les faunes géologiques. L'espèce qui m'occupe se distingue, d'après mes observations, du *P. interstriatus*, par sa valve supérieure à cinquante-trois côtes au lieu de vingt-trois, par ses tubercules confluent s'étendant bien au delà des côtes, et par son oreille costulée et rayonnée en travers et en long, tandis qu'elle est striée obliquement dans l'autre. Elle se distingue du *P. obliquus*, qui n'a réellement, aucun rapport avec elle, par ses côtes égales, au lieu d'en avoir une plus grosse de trois en trois, et par la présence de stries obliques dont M. SOWERBY ne parle nullement. Ce dernier rapprochement de M. FORBES est donc absolument fautif.

Une autre espèce de l'étage turonien se rapproche plus de celle-ci par ses côtes et par ses stries obliques, mais elle s'en distingue par ses côtes seulement au nombre de trente-trois, inégales, moins tuberculeuses, et par ses oreilles sans côtes transverses.

Localité. Cette espèce est propre à l'étage néocomien où elle n'est pas très rare. Elle a été recueillie à Saint-Sauveur, à Auxerre (Yonne), par MM. ROBINEAU-DESVOIDY, D'ARCHIAC et BAUDOUIN DE SOLÈNE; à Renaud-du-Mont (Doubs), par M. CARTERON; à Vallerest, près de Saint-Dizier (Haute-Marne), par M. CORNUÉL; à Brillon (Meuse), par M. MOREAUX; à Gréoux (Basses-Alpes), par M. COQUAND. »

Pecten dutemplei

« P. testâ ovato-oblongâ, transversâ, subaequalvli; valvâ superiore radiatim 40-costatâ; costis rotundatis, approximatis, transversim squamis imbricatis; intermediis costis angustatis, simplicibus; sulcis obliquè stratis; auriculis inaequalibus.

Dimensions. Largeur, 40 millim. Par rapport à la largeur : longueur, 82/100; épaisseur, 25/100; longueur de la facette des oreilles, 42/100. Angle apical, sans les oreillettes, 87°.

Coquille ovale, transverse, déprimée; les deux valves également bombées. Valve supérieure ornée d'environ quarante côtes rayonnantes, assez saillantes, rapprochées, sur lesquelles sont des lames imbriquées. Entre chacune de ces côtes, mais non régulièrement, on voit une autre petite côte simple, linéaire. L'intervalle compris entre les côtes est obliquement strié en travers.

Rapports et différences. Voisine, par ses côtes et par leur intervalle obliquement strié, des *P. Robinaldinus* et *interstriatus*, cette espèce s'en distingue par ses côtes intermédiaires simples, qui s'ajoutent aux autres, et en portent le nombre de soixante-dix à quatre-vingts.

Localité. Elle est spéciale au gault ou terrain albien, et a été recueillie à Sainte Ménéhould (Marne), par M. DUTEMPLE; à Novion, à Sauce-au-Bois (Ardennes), par M. RAULIN et par moi; à Dienville et à la Guillotière (Aube), par MM. DE VIBRAYE et CLÉMENT MULLET; à Cluse (Savoie), par M. HUGARD; à Mont-Blainville (Meuse), par M. MOREAU. »

Pecten galliennei

« *P. testâ ovato-depressâ; valvâ superiore radiatim 33 costatâ; costis inaequalibus, angustatis, laevigatis, tuberculis transversis, angustatis, imbricatis; interstitiis oblique striatis; auriculis inaequalibus, buccali superiore radiatim costatâ, tuberculatâ, oblique striatâ.*

Dimensions. Largeur, 42 millim. Par rapport à la largeur : longueur, 85/100; épaisseur, 21/100; longueur de la facette des oreillettes, 40/100. Angle apical, 86°.

Coquille ovale, transverse, très-déprimée; valve supérieure ornée d'environ trente-trois côtes rayonnantes, étroites, inégales, peu élevées, lisses, sur lesquelles on voit, de distance en distance, surtout latéralement, des tubercules transverses, imbriqués, qui ne s'étendent pas au-delà de la largeur des côtes. L'oreille buccale de la valve supérieure a quelques côtes rayonnantes, à tubercules et des stries obliques très-prononcées.

Rapports et différences. Comme je l'ai dit au *P. Robinaldinus*, cette espèce s'en distingue par ses côtes moins nombreuses, lisses, inégales, par ses tubercules plus circonscrits, ainsi que par ses oreilles non costulées en travers. Elle se distingue du *P. interstriatus* par ses côtes plus nombreuses en dessus, et par ses deux valves égales. Voisine du *P. hispidus*, GOLDF., elle s'en distingue par ses côtes inégales.

Localité. Elle est propre aux couches les plus inférieures de l'étage turonien et a été recueillie à Coudrecieux (Sarthe), par M. GALLIENNE; à Villers (Calvados), par moi. »

Pecten rothomagensis

« *P. testâ subrotundatâ, depressâ; radiatim tenuissimè sulcatâ, lateribus oblique striatâ; auriculis inaequalibus.*

Dimensions. Largeur, 45 millim. Par rapport à la largeur : longueur, 90/100; épaisseur 17/100. Angle apical, 100°.

Coquille ovale, arrondie, très-déprimée; valve inférieure presque plane, ornée de sillons rayonnans, inégalement espacés, laissant entre eux des côtes planes, rayées obliquement sur les côtés par des stries obliques assez prononcées. Les oreilles sont inégales.

Rapports et différences. Cette espèce, qui, par ses stries obliques, est voisine du *P. virgatus*, s'en distingue par ses sillons rayonnans. Elle se distingue du *P. Galliennei* par le manque de côtes inégales élevées.

Localité. Je l'ai recueillie dans les couches de l'étage turonien moyen à la montagne Sainte-Catherine, près de Rouen (Seine-Inférieure), où elle est rare. »

Pecten aptiensis

« *P. interstriatus* LEYMERIE, 1842, D'ORB. Paléont., franç. 3, p. 594. pl. 433, f. 1-5 (non Münster, 1841). St. Gilde, Nancy, Les Croûtes, Saint Dizier. »

Pecten passyi

« *Coquille* très-allongée dans le sens de la hauteur, équivalve, subéquilatérale, très-déprimée. Oreillettes presque égales; l'antérieure, paraissant plus élargie que l'autre est ornée de plis divergents du crochet et traversée par des stries verticales, écailleuses et ondulées à leur passage sur les plis. Angle au sommet de 83°. Crochet pointu. Bord inférieur semi-elliptique. Surface couverte de plis rayonnans, réguliers, droits, inégaux, plus larges vers le milieu que sur les côtés. Les sillons larges et peu profonds qui les séparent sont ornés de stries très-déliées, très-serrées, rayonnantes, droites ou légèrement ondulées sur la partie médiane de la coquille; mais à mesure que l'on se rapproche des bords, elles deviennent de plus en plus obliques à la direction des sillons, se bifurquent et s'anastomosent quelque-fois; enfin, sur les bords mêmes, elles sont tout à fait

transverses ou perpendiculaires aux plis, et se prolongent encore sur les oreillettes jusqu'à une certaine distance de leur base. Hauteur, 40 millim., largeur, 34; épaisseur de la valve gauche (la seule que nous connaissions), 7.

Cette espèce ressemble beaucoup au *P. acuminatus* GEIN., du moins par sa forme; mais ce dernier a les côtes plus épaisses, anguleuses, contiguës, moins nombreuses et ne laissant pas entre elles de sillons larges et plats, ornés de stries, comme celles que nous venons de décrire et que l'on observe dans les *P. Galliennei* D'ORB. et *Dutemplei* id. Celui-ci, dont le *P. Passyi* se rapprocherait assez, s'en distingue cependant par ses côtes un peu flexueuses, écailleuses ou noduleuses, et surtout par les oreillettes qui manquent de plis divergents du crochet. — Tournay. »

Pecten subinterstriatus

« Coquille ovalaire, très aplatie. Bord antérieur court. Bord supérieur plus long et droit. Oreillette postérieure droite, courte, striée perpendiculairement à son bord postérieur. Bord inférieur formant les trois quarts d'une ellipse assez régulière. Angle des arêtes cardinales droit. Surface couverte de côtes rayonnantes, filiformes, inégales, ondulées, croisées par des stries d'accroissement concentriques très fines, serrées et également espacées dans la région du sommet où elles produisent un grillage très régulier, inégales ensuite et plus ou moins espacées, vers le centre de la valve et jusqu'aux bords. A leur passage sur les côtes divergentes, elles produisent de très petites écailles, courtes, surtout vers les bords antérieur et postérieur. Depuis le milieu de la valve jusqu'aux bords, on remarque, entre les côtes filiformes qui s'élargissent et s'écartent, des stries beaucoup plus délicates et plus serrées, courtes, très obliques et allant d'une côte à l'autre. Ces stries tendent à devenir transverses à mesure qu'elles se rapprochent des bords, et à la naissance des oreillettes, elles se trouvent perpendiculaires aux bords et aux côtes voisines.

Hauteur, 45 millim.; largeur, 33; épaisseur, 7.

Cette espèce est très voisine du *P. interstriatus* LEYM. mais elle en diffère par l'angle apical de 87 à 90°, au lieu de 73, par ses côtes divergentes, inégales, plus fines, plus flexueuses et beaucoup moins écailleuses. Peut-être des individus plus complets permettraient-ils de la réunir plus tard au *P. interstriatus*, dont les deux valves ne sont probablement pas semblables. Celle que M. LEYMERIE a figurée et décrite étant la valve gauche, quoiqu'il ne le dise pas, il se pourrait que la nôtre, qui est une valve droite, en fût encore plus voisine que nous ne l'avons supposé. »

Pecten saxonetii PICTET & ROUX

« *P. testâ ovato-oblongâ, transversâ, depressâ, subaequali valvi; valvâ inferiore concentricâ costatâ, radiatim 42-45 decussatim costatâ; costis tenuibus, approximatis.*

Dimensions. Largeur : 32 millim. Par rapport à la largeur : longueur : 0,88. Par rapport à la largeur : épaisseur : 0,30. Angle apical : 84°.

Coquille ovale, transverse, déprimée, les deux valves à peu près également convexes. Valve inférieure ornée de 42 à 45 côtes rayonnantes, petites, égales entre elles, et de côtes concentriques de même apparence, formant de petites saillies lamelleuses à leurs points d'entrecroisement avec les premières. Nous ne connaissons pas le test de la valve supérieure, et nos échantillons ont les oreillettes cassées.

Moule lisse ou marqué de très-faibles traces de côtes rayonnantes.

Rapports et différences. Cette espèce ne saurait se confondre avec les deux précédentes (3); elle en diffère par l'absence de stries obliques entre les côtes, qui sont en outre plus fines.

Localité. Elle a été trouvée au Saxonet; collection du Musée Académique. »

Pecten oosteri

« *Dimensions.* Largeur 33 mm. Longueur par rapport à la largeur 0,82. Angle apical 80°.

Coquille très-comprimée, aplatie. Valve supérieure un peu plus bombée, du reste semblable à l'inférieure. Elles sont ornées d'environ trente-cinq côtes rayonnantes très-étroites, très-fines et cependant bien marquées, pourvues de petites écailles de même largeur, sauf vers les bords où elles sont quelquefois un peu confluentes. Les inter-

(3) *Pecten aptiensis* D'ORBIGNY and *P. dutemplei* D'ORBIGNY : both synonyms of *Mimachlamys robindaldina* (D'ORBIGNY).

valles sont au moins deux fois aussi larges que les côtes et couverts de fines stries obliques fort rapprochées, croisées par des lignes concentriques d'une grande finesse, formant un réseau très-léger, sur lequel se détachent nettement les côtes. Moule entièrement lisse.

Rapports et différences. Le Peigne que je viens de décrire appartient à un petit groupe d'espèces assez difficile à distinguer, ornées de côtes rayonnantes nombreuses et de stries obliques dans les intervalles. A ce groupe appartiennent les *Pecten Robinaldinus*, D'ORB., *interstriatus*, LEYM., *Aptiensis*, D'ORB., *Dutemplei*, D'ORB., etc.

Le *Pecten Oosteri* se distingue :

- 1° Du *Pecten Robinaldinus* par ses côtes moins nombreuses, plus fines, dont les écailles sont à peine confluentes, et par ses stries obliques confinées dans les intervalles intercostaux qui sont beaucoup plus larges.
- 2° Du *Pecten Aptiensis*, D'ORB., (in PRODR.), *interstriatus*, D'ORB. (Pal. fr.), lequel, comme le font observer MM. PICTET et RENEVIER (Foss. du terr. aptien de la Perte du Rhône, p. 132), n'est pas le *P. interstriatus*, LEYMERIE, par sa valve supérieure ornée d'au moins trente-cinq côtes au lieu de vingt-trois, et semblable à la valve inférieure.
- 3° Du *Pecten interstriatus*, LEYM. (dont le nom devra être changé, parce qu'il y a un *P. interstriatus*, MÜNSTER, qui a la priorité), parce que ses côtes sont beaucoup plus fines, moins nombreuses avec des intervalles beaucoup plus larges.
- 4° Du *Pecten Dutemplei*, D'ORB., en ce qu'il ne présente pas de petites côtes intermédiaires, et que le nombre des côtes principales n'est pas de soixante ou quatre-vingts, mais de quarante au plus.

Observations. Cette espèce, qui est abondante au Salève, ne m'a pas présenté de variations bien sensibles. Les côtes rayonnantes sont plus ou moins rapprochées suivant les individus. Leur caractère constant est d'être extrêmement étroites, et cependant bien marquées. Dans quelques exemplaires leur finesse est si grande, qu'elles se détachent à peine sur le réseau formé par les stries obliques et concentriques. Peut-être est-ce là seulement le fait de l'usure des exemplaires.

Localités. La Varappe, la Grande-Gorge. Commune. »

Pecten sanctaecrucis

« *Dimensions.* Longueur : 40 mm. Par rapport à la longueur, largeur : 1,25. Par rapport à la longueur, épaisseur : 0,33. Par rapport à la longueur, longueur de la facette ligamentaire : 0,55. Angle apical : 80°.

Description. Coquille plus large que longue, assez comprimée, pas très-inéquivale. Valve supérieure un peu plus bombée que l'autre. Oreillette anale triangulaire, peu développée; oreillette buccale plus grande dépassant en s'arrondissant le niveau du sommet; celle de la petite valve fortement échancrée.

Les deux valves sont ornées de côtes rayonnantes; sur la supérieure on en compte environ 16 principales, arrondies, peu saillantes et coupées par des lignes d'acroissement qui y déterminent des écailles relevées. Entre chacune de ces côtes on en compte de 5 à 8 petites, serrées, arrondies, remplissant les intervalles qui sont larges et plats. Sur la valve inférieure les côtes principales sont un peu plus nombreuses (18 à 19), plus minces, à lames moins saillantes; elles sont séparées de même par de larges intervalles plats, portant de 3 à 7 petites côtes inégales. L'oreillette anale est marquée de plis perpendiculaires, de suture et de stries rayonnantes. L'oreillette buccale de la grande valve a des plis arqués; celle de la petite des plis sinueux en forme d'S, parallèles au bord échancré.

Variations. Nous trouvons quelques différences dans le nombre des côtes et dans leurs dimensions proportionnelles. Quelques échantillons acquièrent quelques côtes principales aux dépens d'un certain nombre de petites. Ils font ainsi une transition au *P. Archiaci*; mais je n'ai vu aucun cas où cette circonstance pût faire hésiter sur les limites des deux espèces.

D'autres échantillons, dont nous figurons un fragment de test, a les côtes principales un peu plus grosses et les intermédiaires plus confuses.

Rapports et différences. Cette espèce rappelle sous beaucoup de points de vue le deuxième type du *P. Archiaci*. Nous estimons cependant qu'elle en est bien distincte :

- 1° Les intervalles sont beaucoup plus grands par rapport aux grosses côtes et munies de petites côtes bien plus nombreuses;
- 2° Les oreillettes sont plus arquées en dehors, plus grandes, et la buccale de la valve plate n'y est point divisée en deux areas par un sillon.

Gisement à Sainte-Croix. L'étage Valangien où elle est rare.

Autres gisements observés. L'étage valangien de Comte (Jura (salinois), faciès à Ptérocères et Nérinées. »

Pecten lardyi.

« *Dimensions* : Longueur : 37 millim. Par rapport à la longueur, largeur : 1,15. Angle apical : 85°.

Description. Coquille ovale, plus longue que large, déprimée; oreillettes inconnues. Cette coquille est ornée d'environ 55 côtes très-peu saillantes, séparées par des intervalles beaucoup plus larges qu'elles et coupées par des faibles lignes d'accroissement, qui y déterminent de très-petites écailles. Quelques-unes de ces lignes sont plus fortes et produisent des arrêts un peu irréguliers. On ne voit aucune trace de stries obliques.

Rapports et différences. Cette espèce constitue un type particulier, qui se rapprocherait du *P. Robinaldinus*, si les stries obliques ne manquaient pas tout à fait. La faiblesse des côtes et leurs larges intervalles sont caractéristiques.

Gisement à Sainte Croix. L'étage néocomien inférieur, probablement les marnes à bryozoaires. Un seul échantillon. »

Additional description

Number of specimens studied : total : 757.

French Valanginian	12
Swiss Valanginian	19
French Hauterivian	34
Swiss Hauterivian	20
British Barremian	1
French Barremian	18
Swiss Barremian	16
French Neocomian	61
Swiss Neocomian	20
West German Neocomian	4
British Aptian s.l. (L. G. S.)	153
East German Aptian	4
French Aptian	16
Swiss Aptian	35
West German Aptian	6
Belgian Albian	12
British Albian s.l. (U. G. S.)	65
French Albian	30
Swiss Albian	32
Algerian Cenomanian	5
Belgian Cenomanian	60
British Cenomanian	39
Czech Cenomanian	4
Danish Cenomanian	3
French Cenomanian	55
East German Cenomanian	12
Soviétrussian Cenomanian	2
West German Cenomanian	11
German Turonian	8

Measurements :

Belgian Cenomanian :

U. P. D. varies from 14.5 mm to 48.5 mm
W. varies from 12.5 mm to 39.5 mm
A. A. varies from 65° to 87°

British Aptian :

U. P. D. varies from 16.8 mm to 48.2 mm
W. varies from 13.3 mm to 39.9 mm
A. A. varies from 75° to 83°

British Albion :

U. P. D. varies from 21.2 mm to 42.3 mm
W. varies from 17.2 mm to 36.8 mm
A. A. varies from 70° to 90°

British Cenomanian :

U. P. D. varies from 24.2 mm to 47.4 mm
W. varies from 16.7 mm to 40.6 mm
A. A. varies from 75° to 92°

Description :

Diagnosis. — Medium-sized *Mimachlamys*-species covered with radial ribs in variable numbers (from 15 to about 80) and mostly covered with spinules. In the intercostal intervals there are numerous concentric striae which become oblique near the side margins. The auricles are well developed. The shells are elongated and flattened with a straight hinge line and straight posterior apical margins.

Macrosculpture : numerous radial, narrow, slightly elevated ribs; the intercostal intervals are broad and flattened; their width depends on the ribnumber which varies greatly (H. WOODS, 1902, p. 182).

The number, shape and size of the spinules is variable.

Right valve : flattened, with more ribs than on the left valve. Anterior auricle : broad with a deep and wide sinus, concentric striae reaching the hinge-line at right angles, curving along the sinus. The radial riblets cross them. Posterior auricle : smaller, obtuse-angled, covered with concentric and radial striae.

Left valve : more convex and with fewer ribs. Between the ribs starting at the umbo thin ribs are intercalated further down the disc. These secondary ribs usually do not bear spinules; if they bear spinules those are very small.

Anterior auricle : large, with radial ribs crossed by concentric striae
posterior auricle : as on the right valve.

Discussion

Variability :

This species is very variable in ribnumber, spinule number, spinule size and spinule presence or absence.

The variability is not the result of the evolution within the species : specimens of the same stratigraphical age but from different localities can vary strongly : for instance, well developed regularly placed spinules, on a relatively low ribnumber are found on « *P. hispidus* » from the Cenomanian in Essen/Ruhr and at the same stratigraphical moment in Tournai specimens with numerous almost smooth ribs of variable thickness are found on « *P. subinterstriatus* ».

The ribnumber varies greatly, and this even more so because there are ribs of different growth stages; according to the system of counting the ribnumber will be very different especially if one counts all the ribs (primary, secondary and eventually tertiary); for the same valve the difference will be less if only the primary ribs are counted.

The ribshape varies too : they are always narrower than the intercostal intervals, but they can be from half as wide as the intervals to almost linear and in the latter case the secondary ribs are little more than radial striae.

Synonymy :

The wide variability and long stratigraphical range of the species are the origin of the confused nomenclature. A detailed discussion is to be found in WOODS, 1902, p. 184. For most of the taxa which he considers to be « closely-related to (and probably identical with) », I entirely agree as to the identity after studying original material or topotypes : this is for *Pecten passyi* and *P. subinterstriatus* D'ARCHIAC, *P. dutemplei* D'ORBIGNY, *P. galliennei* D'ORBIGNY, *P. aptiensis* D'ORBIGNY (*P. interstriatus* LEYMERIE non MUENSTER), *P. oosteri* DE LORIO, *P. barretti* SEELEY : « the differences » between those taxa as indicated by the different authors depend on a lower or higher ribnumber (the following figures are found in literature : *P. robinaldinus* 53 ribs, *P. aptiensis* 23 ribs, *P. dutemplei* : 40, 60, 80, *P. galliennei* 33, *P. oosteri* 35).

For *Pecten rothomagensis* D'ORBIGNY, I cannot reach a definite conclusion, though WOODS did; the only specimen in the Muséum national d'Histoire naturelle in Paris is very poorly preserved and does not give any definite proof. In order to decide definitely topotypes should be collected in Rouen, if this is still possible.

WOODS does not mention taxa from PICTET et ROUX and PICTET et CAMPICHE as possible synonyms of *Pecten robinaldinus*. The only dif-

ferences between the D'ORBIGNY species and *Pecten saxoneti* is, according to the authors, the absence of oblique striae and narrower ribs in the latter species; the first characteristic may be due to the poor state of preservation of the specimens from the Mont Saxonet, and as far as the width of the ribs is concerned, this is such a variable characteristic that it is almost impossible to rely on it for any specific differentiation.

Pecten lardyi is in the same way as *P. passyi* D'ARCHIAC covered with very thin ribs. Its very poor state of preservation certainly explains why the oblique striae are no longer visible.

Pecten sanctaecrucis has a macrosculpture consisting of a relatively small number of primary ribs (20-30) with, in the primary intercostal intervals, riblets in a varying number. The oblique striae are invisible, not because of the state of preservation, but because the complete interval is filled with riblets. A certain doubt prevails as to the identity between both species. PICTET et CAMPICHE considered *P. sanctaecrucis* to be closely related to *P. archiacianus* D'ORBIGNY, but I cannot agree with this : in the Swiss taxon the concentric striae are the origin of real spines and spinules, whereas in *P. archiacianus* the concentric lines are more continuous and form scales; also the ribs are at least as broad as the intercostal intervals and few in number.

Considering that only few specimens are known of *P. sanctaecrucis* and that the only difference between this and *P. robinaldinus* does not seem important enough to keep both taxa entirely separated, it seems preferable to see in *P. sanctaecrucis* a slightly unusual local variety of *P. robinaldinus*.

Differentiation :

In the Cretaceous *Mimachlamys* stock *M. robinaldina* and *M. cretosa* (DEFrance) seem to form a homogeneous group. Both species have a large number of characteristics in common, but *M. cretosa* is further evolved : the valves are more flattened and the spinules which are well developed on almost all morphological variations of *M. robinaldina* (in « *P. passyi* » they are the least developed) are in *M. cretosa* at most visible as little scales and often they are not more than small ridges across the ribs. These are also the differences between the two species.

The other *Mimachlamys* species differ in their ribnumber or in the absence of spines and spinules.

Generic attribution

The similarity in shape, macrosculpture and auricles between *Pecten asperimus* LAMARCK and *Pecten robinaldinus* D'ORBIGNY is so complete that there can be little doubt that the D'ORBIGNY species belongs to *Mimachlamys* IREDALE and that its correct name should be *Mimachlamys robinaldina* (D'ORBIGNY, 1847).

Stratigraphical and geographical distribution

Valanginian : FRANCE :

Villers-le-Lac, Doubs (Mus. Gen., Univ. Neuch.)

SWITZERLAND :

Auberson, Sainte-Croix, Vaud (Mus. Laus. also orig. PICTET et CAMPICHE, pl. 170, fig. 1, 2 : 17649, sub *P. sanctaecrucis*, pl. 168, fig. 5, 6 : 17631, sub *P. lardyi*, pl. 171, fig. 2 : 21762; Univ. Neuch.)

Hauterivian : FRANCE :

Auxerre, Yonne (Mus. Gen. also orig. PICTET et CAMPICHE, pl. 170, fig. 3a-c)

Grande Varappe, Salève, Haute-Savoie (Mus. Gen. also orig. DE LORIO, Invert. foss. Salève : pl. 12, fig. 9, 10, pl. 13, fig. 4, 5, 7)

Salève, Haute-Savoie (Mus. Gen. also orig. PICTET et CAMPICHE, pl. 170, fig. 6)

Villers-le-Lac, Doubs (Univ. Neuch.)

SWITZERLAND :

Auberson, Sainte-Croix, Vaud (Mus. Laus.)

Chamblon, Sainte-Croix, Vaud (KO., Mus. Laus.)

Colas, Sainte-Croix, Vaud (Mus. Laus.)

Hauterive, Neuchâtel (Univ. Neuch.)

Landeron, Neuchâtel (Univ. Neuch.)

Sainte-Blaise, Vaud (S. M.)

Sainte-Croix, Vaud (S. M.)

Le Voisinage près du Locle (Mus. Gen.)

Barremian : FRANCE :

Châtillon-de-Michaille, Ain (Mus. Gen.)

Grande Varappe, Salève, Haute-Savoie (Mus. Gen.)

Longueville, Doubs (Mus. Gen.)

Salève, Haute-Savoie (Mus. Gen.)

GREAT BRITAIN :

Sandown Bay, Isle of Wight (B. M.)

SWITZERLAND :

Les Alleveys, La Sarraz, Vaud (Mus. Laus.)

Mormont, Vaud (Mus. Laus., Univ. Neuch.)

La Presta, Val de Travers, Neuchâtel (Mus. Gen.)

La Rusille, Vaud (Mus. Gen.)

Sainte-Croix, Vaud (Mus. Gen.)

Travers, Neuchâtel (Univ. Neuch.)

Neocomian (no further specification) : FRANCE :

Auxerre, Yonne (Musé. coll. D'ORBIGNY, Mus. Gen., Mus. Laus.)
 Bernouil, Yonne (Mus. Gen.)
 Bettancourt, Haute-Marne (Mus. Gen.)
 Censeau, Jura (Mus. Gen.)
 La Clape, Aude (Mus. Gen.)
 Gy-l'Evêque, Yonne (Mus. Laus.)
 Marolles, Aube (Mus. Gen., Mus. Laus.)
 Mièges, Jura (Mus. Gen.)
 Pontarlier, Doubs (Mus. Gen.)
 Renaud-du-Mont, Doubs (Musé., coll. D'ORBIGNY)
 Saint-Dizier, Haute-Marne (Musé.)
 Saint-Sauveur, Yonne (Musé.)
 Thieffrain, Aube (Mus. Gen.)
 Varappe, Salève, Haute-Savoie (Mus. Laus.)
 Villers-le-Lac, Doubs (Mus. Gen.)

G. F. R. :

Schöppenstedt (Braunschweig) (S. M.)

SWITZERLAND :

Cressier, Neuchâtel (Mus. Gen.)
 Hauterive, Neuchâtel (Univ. Neuch.)
 Landeron, Neuchâtel (Mus. Gen.)
 Mail, Neuchâtel (Univ. Neuch.)
 La Rusille, Vaud (Mus. Gen.)
 Sainte-Croix, Vaud (KO., Mus. Gen.)
 Vaulion, Vaud (Mus. Laus.)

Aptian : AUSTRIA :

Bezeck, Bezau, Vorarlberg, (Mü.)

FRANCE :

Bailly, Haute-Marne (Mus. Laus.)
 Marolles, Aube (Mus. Laus.)
 Perte-du-Rhône, Ain (Mus. Gen., Mus. Laus.)
 Saint-Dizier, Haute-Marne (Mus. Gen., Mus. Laus.)
 Vandœuvre, Aube (Mus. Gen. also orig. PICTET et CAMPICHE,
 pl. 170, fig. 4a, b)

G. D. R. :

Hellweg, Quedlinburg (B.)

G. F. R. :

Berklingen, Braunschweig (B.)

GREAT BRITAIN :

— Atherfield Clay, *Perna* Bed :
 Atherfield, Isle of Wight (B. M.)

— Folkestone Beds :

Nutfield, Surrey (B. M.)

— Ferruginous Sands :

Shanklin, Isle of Wight (B. M.)

— Lower Greensand (no zones indicated) :

Atherfield, Isle of Wight (B. M., Geol. Sci., Mus. Gen., Mus. Laus.)

Blackgang Chine, Isle of Wight (B. M., S. M.)

Borough Green (B. M., S. M.)

Bowood (Geol. Sci.)

Bradbury Hill (S. M.)

Folkestone, Kent (B. M.)

Hartwell (Mus. Gen. also orig. PICTET et CAMPICHE, pl. 172, fig. 1a-b)

Hythe, Kent (Geol. Sci.)

Little Coxwell (S. M.)

Lockwell Head (Geol. Sci.)

Nutfield, Surrey (Geol. Sci.)

Potton Beds (S. M.)

Sandown, Isle of Wight (B. M., Mus. Gen.)

Seend (Geol. Sci.)

Sevenoaks, Kent (B. M.)

Shanklin, Isle of Wight (B. M., S. M.)

Ventnor, Isle of Wight (B. M., Mus. Gen.)

Whale Chine, Isle of Wight (S. M.)

SWITZERLAND :

Boveresse, Val de Travers, Neuchâtel (Mus. Gen.)

Mietet, Vallorbe, Vaud (Mus. Laus.)

Noirvaux-dessus, Sainte-Croix, Vaud (Mus. Laus. also orig. PICTET et CAMPICHE, pl. 170, fig. 5)

Perriblanco d'Argentine, Vaud (Mus. Laus.)

Perriblanco de Bovonnaz, Vaud (Mus. Laus.)

Le Pont, Vallée de Joux, Vaud (Mus. Laus. also orig. PICTET et RENEVIER, pl. 19, fig. 3a)

La Presta, Neuchâtel (Mus. Gen., Univ. Neuch.)

Sainte-Croix, Vaud (Mus. Gen., Mus. Laus.)

Albian : BELGIUM :

Meule de Bracquegnies : Bracquegnies (I. R. Sc. N. B.)

FRANCE :

Auxerre, Yonne (B., Ec. Min.)

Cluse, Haute-Savoie (Musé. coll. D'ORBIGNY)

Cosne, Nièvre (Mus. Gen.)

Ervy, Aube (Mus. Gen. also orig. PICTET et CAMPICHE, pl. 172, fig. 3b)

Fondouille, Pas des Lanciers, Bouches-du-Rhône (N. M. W.)
 Marolles, Aube (B.)
 Mont Saxonet, Haute-Savoie (Mus. Gen. also orig. PICTET et ROUX, pl. 46, fig. 5)
 Nods, Doubs (N. M. W.)
 Perte-du-Rhône, Ain (Mus. Gen. also orig. PICTET et CAMPICHE, pl. 172, fig. 3a sub *P. dutemplei*, S. M.)
 Sainte-Ménehould, Marne (Musé. orig. D'OBIGNY)
 Sancerre, Cher (Mus. Gen.)
 Thones, Haute-Savoie (Mus. Gen. also orig. PICTET et CAMPICHE, pl. 172, fig. 4 sub *P. dutemplei*)
 Vallée des Bornes, Haute-Savoie (Mus. Gen.)

GREAT BRITAIN :

Shenley Limestone :

Acre Pit, Shenley Hill, Beds. (B. M.)
 Munday's Hill Pit, Leighton Buzzard, Beds. (B. M., S. M.)
 Pratt's Pit, Billington Crossing, Leighton Buzzard, Beds. (S. M.)
 Shenley Hill, Beds. (Geol. Inst., S. M.)

Upper Greensand :

Anstey, Dorset (S. M.)
 Blackdown, Devon (B. M.)
 Evershott, Dorset (B. M.)
 Folkestone, Kent (B. M.)
 Haldon, Devon (B. M.)
 Hunstanton Cliffs, Norfolk (B. M.)
 Lyme Regis, Dorset (Geol. Sci. also orig. WOODS : pl. 35, fig. 10, 7408)
 Merstham, Surrey (Geol. Sci.)
 Niton, Isle of Wight (S. M.)
 Punfield, Dorset (B. M.)
 Rocken End, St. Catherine's, Isle of Wight (B. M.)
 St. Lawrence, Isle of Wight (B. M.)
 Telegraph Hill, Sidmouth, Devon (B. M.)
 Ventnor, Isle of Wight (B. M., S. M. also orig. WOODS, pl. 35, fig. 3, 7 : B 62514 - 5)
 Warminster (B. M. also orig. WOODS 67734, pl. 35, fig. 1, KO., S. M. also orig. WOODS B 46994, pl. 35, fig. 2)
 Worbarrow Bay, Dorset (B. M., Mus. Laus.)

SWITZERLAND :

Boveresse, Val de Travers, Neuchâtel (Mus. Gen.)
 Col de la Cheville, Valais (Mus. Laus.)
 Landeron, Neuchâtel (Mus. Gen.)
 La Rusille, Vaud (Mus. Gen.)
 Sainte-Croix, Vaud (Mus. Gen., Mus. Laus.)

Cenomanian : ALGERIA :

Batna (B. M.)

Bou Zoran (B. M.)

BELGIUM : Tourtia de Tournai :

Chercq (I. R. Sc. N. B.)

Montignies-sur-Roc (Ec. Min., I. R. Sc. N. B., R. U. G.)

Tournai (DR., I. R. Sc. N. B., KO., Mus. Gen., N. M. W., R. U. G.)

no zone indicated :

Hautrage, Hainaut (I. R. Sc. N. B.)

CZECHOSLOVAKIA :

Korycaný (N. M. W.)

DENMARK :

Bornholm : Madsegrav (KO. orig. RAVN, 1925 sub *Pecten* sp., pl. 1, fig. 5)

FRANCE :

Boussières, Nord (Tourtia de Mons, Assise de Saint-Aybert) (I. R. Sc. N. B.)

Cap de la Hève, Le Havre (B. M., Mus. Gen.)

Censeau, Jura (Mus. Laus.)

Fécamp, Seine maritime (Ec. Min.)

Le Havre, Seine maritime (Mus. Laus.)

Le Mans, Sarthe (Musé. coll. D'ORBIGNY, Mus. Gen.)

Neuville, Sarthe (Ec. Min.)

Rouen, Seine-Maritime (DR., Musé. coll. D'ORBIGNY, Mus. Gen.)

Saint-Léonard, Fécamp, Calvados (Mus. Gen.)

Trouville, Calvados (Musé. coll. D'ORBIGNY)

Vaches Noires, Villers, Calvados (B., Mus. Gen.)

Val au Clair, Fécamp, Calvados (Mus. Gen.)

Vimoutiers, Orne (Oxf. Univ.)

G. D. R. :

Elbstollen, Dresden (B., DR.)

Eutschütz, Dresden (DR.)

Humprichsberg, Lahn (DR.)

Oberau (DR. also orig. GEINITZ, Elbthal, pl. 44, fig. 7 sub *Pecten inserens*)

Pennrich (DR.)

Plauen, Dresden (B., DR., also orig. GEINITZ, Elbth. I, pl. 44, fig. 6, 6a sub *P. gallienae* and pl. 44, fig. 8 sub *P. rothomagensis*, N. M. W)

G. F. R. :

Bochum (B.)

Essen/Ruhr (B., DR., also orig. GEINITZ, Elbth., pl. 44, fig. 9; 10 sub *P. hispidus*)

Kapfelberg, Kelheim (Mü.)
 Konsteiner Sandgrube (Mü, orig. LEHNER)
 Mörsheim (Mü., orig. LEHNER)
 Neukelheim (Mü.)
 Regensburg (DR.)

GREAT BRITAIN :

S. varians-zone :

Beer Head, Devon (B. M., Oxf. Univ.)
 Cambridge (B. M., S. M. *P. barretti* SEELEY)
 Culver Cliff, Isle of Wight (coll. C. JEANS)
 Devizes, Wilts. (B. M.)
 Dunscombe, Devon (S. M.)
 Maiden Bradley (Geol. Sci.)
 Melbury, Dorset (Geol. Sci.)
 Mulberry Hill, Shaftesbury, Dorset (B. M.)
 Norton Ferris, Mere, Wilts. (Geol. Sci.)
 Rocken End, Saint Catherine Point, Isle of Wight (B. M.)
 Shanklin, Isle of Wight (Mus. Gen.)
 Undercliff, Isle of Wight (Univ. Neuch.)
 Ventnor, Isle of Wight (B. M., Mus. Gen.)
 Wilmington, Devon (B. M.)
 Northern Ireland :
 Glen Collin, Belfast (B. M.)

U. S. S. R. :

On the Volga near Turbino (GR.)

Turonian : G. D. R. :

Plenus-zone :

Pennrich (DR.)
 Plauen (DR.)

Mimachlamys cretosa (M. DEFRANCE in A. BRONGNIART, 1822)
 (Pl. 6, fig. 2; Pl. 7, fig.1)

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|--|--|
| . 1799 | FAUJAS-SAINT-FOND, p. 156,
pl. 25, f. 8. |
| . 1822 — <i>Pecten cretosus</i> Defr. | M. DEFRANCE in A. BRONGNIART, p. 251, 598, pl. 3,
f. 7 A-B. |
| . 1822 — <i>Pecten arachnoides</i> Defr. | M. DEFRANCE in A. BRONGNIART, p. 251, 599, pl. 3,
f. 8. |
| . 1822 — <i>Pecten nitida</i> | G. MANTELL, p. 202, pl. 26,
f. 4, 9, 1 ? |

- 1823 — *Pecten nitidus* J. SOWERBY, p. 130, pl. 394, f. 1.
- . 1825 — *Pecten cretosus* Def. M. DEFRANCE, p. 267.
- . 1825 — *Pecten arachnoides* Def. M. DEFRANCE, p. 266.
- v . 1827 — *Pecten undulatus* (pro parte) S. NILSSON, p. 21, pl. 10, f. 10B.
- ? 1839 — *Pecten cretosus* Defr. H. B. GEINITZ, p. 22.
- ? (1839) — *Pecten cretosus* A. D'ARCHIAC, p. 301.
- 1841 — *Pecten nitidus* Mant. F. A. ROEMER, p. 52.
- 1842 — *Pecten nodoso-costatus* nob. F. VON HAGENOW, p. 550.
- ? (1843) — *Pecten Cretosus* ? Defr. A. LEYMERIE, p. 27.
- ? 1845 — *Pecten undulatus* A. D'ORBIGNY in MURCHISON, DE VERNEUIL & KEYSERLING, p. 490, pl. 53, f. 8-10.
- non 1827 *Pecten undulatus* S. Nilsson.
- 1846 — *Pecten nitidus* Mantell A. E. REUSS, p. 28.
- v . 1847 — *Pecten cretosus* Defrance A. D'ORBIGNY, p. 617, pl. 440, f. 1-7.
- 1847 — *Pecten cretosus* Defrance J. MUELLER, p. 67.
- (1849) — *Pecten nitidus* Mant. H. G. BRONN, p. 927.
- (1850) — *Pecten cretosus* Defrance H. B. GEINITZ, p. 182.
- (1850) — *Pecten cretosus* Defrance A. D'ORBIGNY, p. 251, n° 836.
- (1850) — *Pecten nitidus* Sow. A. D'ORBIGNY, p. 252, n° 862.
- v . 1850 — *Pecten Zeiszneri* m. A. ALTH, p. 249, pl. 12, f. 36.
- 1850 — *Pecten arcuatus* A. ALTH, p. 245, pl. 12, f. 29.
- non 1818 *Pecten arcuatus* SOWERBY.
- 1850 — *Pecten subinterstriatus* F. DIXON, p. 356, pl. 28, f. 19.
- non 1842 *Pecten subinterstriatus* D'ARCHIAC (= *Mimachlamys robinaldina* D'ORBIGNY).
- (1852) — *Pecten cretosus* Defr. C. G. GIEBEL, p. 352.
- 1852 — *Pecten nitidus* Mant. C. PUGGAARD, p. 16, f. 28.
- (1854) — *Pecten nitidus* Mant. J. MORRIS, p. 176.
- (1854) — *Pecten cretosus* Defr. J. MORRIS, p. 176.
- 1857 — *Pecten cretosus* Defr. G. COTTEAU, p. 116.
- (1860) — *Pecten cretosus* Defr. J. BOSQUET, n° 479.
- (1861) — *Pecten cretosus* Defr. W. GABB, p. 214.
- (1861) — *Pecten nitidus* Sow. W. GABB, p. 215.
- v . 1866 — *Pecten cretosus* Defr. K. A. ZITTEL, p. 112, pl. 18, f. 2.
- v . 1869 — *Pecten Zeiszneri* Alth E. FAVRE, pp. 146-148, pl. 13, f. 2.
- 1870 — *Pecten cretosus* Defr. F. ROEMER, p. 316, pl. 37, f. 6.
- 1870 — *Pecten cretosus* Defr. F. J. PICTET & G. CAMPICHE, pp. 216, 218.

- (1871) — *Pecten cretosus* Defr. F. STOLICZKA, p. 428.
 (1871) — *Pecten nitidus* Mant. F. STOLICZKA, p. 428.
 v . 1875 — *Pecten cretosus* Defrance H. B. GEINITZ, p. 34, pl. 10,
 f. 5, 6.
 1882 — *Pecten cretosus* Dfr. H. SCHROEDER, p. 265.
 1882 — *Pecten cretosus* Dfr. H. SCHROEDER, p. 266.
 var. *nitida* Sow.
 . 1887 — *Pecten cretosus* Defrance A. PÉRON, p. 164.
 (1888) — *Pecten cretosus* Defr. F. E. GEINITZ, p. 743.
 ? 1889 — *Pecten undulatus* E. HOLZAPFEL, p. 235, pl. 1,
 f. 15.
 non 1827 *Pecten undulatus* NILSSON.
 1889 — *Pecten cretosus* Defr. O. GRIEPENKERL, p. 41.
 (non Goldfuss)
 ? 1889 — *Pecten cretosus* Defr. A. FRITSCH, p. 85.
 v . 1892 — *Pecten Irnichensis* spec. F. VOGEL, p. 62, pl. 1, f. 15.
 nov.
 1892 — *Pecten (Chlamys) cretosus* E. STOLLEY, p. 239.
 Defrance
 (1895) — *Pecten cretosus* Brongn. F. VOGEL, p. 25.
 ? 1896 — *Pecten undulatus* O. M. REIS, p. 7.
 1897 — *Pecten cretosus* Defrance R. LEONHARD, p. 45.
 . 1897 — *Pecten cretosus* Defr. A. HENNIG, p. 49.
 *var. *nitida* Sow. (Schröder)
 (1897) — *Pecten nitidus* Mant. W. F. HUME, p. 546.
 . 1898 — *Pecten cretosus* Defr. G. MUELLER, p. 31, pl. 5,
 f. 1.
 . 1898 — *Pecten (Chlamys) Zeiszneri* var. *Hachauensis* O. REIS, p. 95, pl. 2, f. 1,
 pl. 3, f. 4, 5.
 (1899) — *Pecten cretosus* Defr. N. KRISCHTAFOVITSCH, p. 9.
 (1899) — *Pecten Zeiszneri* Alth N. KRISCHTAFOVITSCH, p. 9,
 10.
 (1899) — *Pecten cretosus* Defr. A. W. ROWE, p. 364.
 (1900) — *Pecten nitidus* Mant. G. E. DIBLEY, p. 494.
 (1900) — *Pecten arachnoides* Defr. G. E. DIBLEY, p. 494.
 1900 — *Pecten cretosus* Defr. C. GAGEL & F. KAUNHOVEN,
 var. *Zeiszneri* Alth p. 229.
 . 1901 — *Pecten Barthi* n. sp. A. WOLLEMAN, pp. 17-18,
 f. 1, 1 a-b.
 1901 — *Pecten cretosus* Defrance A. WOLLEMAN, p. 16.
 v . 1902 — *Pecten cretosus* Defrance J. P. J. RAVN, p. 88, pl. 1,
 f. 11, 18.
 v . 1902 — *Pecten cretosus* Defrance J. P. J. RAVN, p. 88, pl. 1,
 var. *nitida* (Sow.), f. 12, 13, 21.
 Schroeder
 v . 1902 — *Pecten (Chlamys) cretosus* H. WOODS, pp. 174-179, pl.
 Defrance 32, f. 4-6, pl. 33, f. 1-12.
 (1902)d — *Pecten cretosus* Defr. A. WOLLEMAN, p. 59.
 ? (1902)d — *Pecten Barthi* Woll. A. WOLLEMAN, p. 59.
 (1903) — *Pecten cretosus* A. J. JUKES-BROWNE, p. 93.

- (1903)a — *Pecten cretosus* Defr. A. W. ROWE, p. 50.
 (1903)b — *Pecten cretosus* Defr. A. W. ROWE, p. 295.
 (1904) — *Pecten cretosus* Defr. G. J. HINDE, p. 485.
 (1905) — *Pecten cretosus* Defr. H. J. O. WHITE & L. TREA-
 CHER, p. 470, 476.
 1905 — *Pecten cretosus* Defrance T. WEGNER, p. 174.
 (1908) — *Pecten cretosus* Defr. A. W. ROWE, p. 339.
 (1908) — *Pecten cretosus* Defr. G. W. YOUNG, p. 454.
 (1909) — *Pecten cretosus* Defrance B. RYDZEWSKI, p. 193.
 var. *Zeischneri* (laps.
 cal.) Alth
 . 1909a — *Pecten (Chlamys) cretosus* W. ROGALA, p. 694, pl. 28,
 Defr. f. 3.
 ? 1909b — *Pecten (Chlamys) cf.* W. ROGALA, p. 744.
 Zeiszneri Alth
 (1911) — *Pecten (Chlamys) cretosus* W. ROGALA, p. 493.
 Defr.
 (1911) — *Pecten (Chlamys) Zeiszne-* W. ROGALA, p. 493.
 ri Alth
 (1911) — *Pecten cretosus* Dfr. K. VOGEL VON FALCKEN-
 STEIN, pp. 555-556.
 (1911) — *Pecten (Chlamys) cretosus* M. LERICHE, p. 305.
 (1918) — *Pecten (Chlamys) cretosus* G. E. DIBLEY, p. 93.
 ? 1918 — *Pecten (Chlamys) cretosus* J. P. J. RAVN, p. 27.
 Defr.
 1921 — *Pecten (Chlamys) cretosus* J. P. J. RAVN, p. 21.
 Defr.
 1923 — *Pecten (Chlamys) cretosus* A. JESSEN & H. ØDUM, p.
 Defr. 36.
 (1924) — *Pecten cretosus* Defr. H. D. HEWITT, p. 241.
 (1924) — *Pecten cretosus* Defr. C. T. A. GASTER, p. 110.
 (1926) — *Pecten (Chlamys) cretosus* H. ØDUM, p. 180.
 Defr.
 (1929) — *Pecten cretosus* Defr. A. W. ROWE, p. 429, 433.
 1930 — *Pecten (Chlamys) cretosus* R. HÄGG, p. 38.
 Defrance f. *typica*
 1930 — *Pecten (Chlamys) cretosus* R. HÄGG, p. 38.
 Defrance var. *nitida*
 (Sowerby) Schroeder
 1930 — *Pecten (Chlamys) cretosus* R. HÄGG, p. 38.
 Defrance
 (1931) — *Pecten cretosus* Defr. B. KOKOSZYNSKA, p. 668.
 v . (1931) — *Pecten cretosus* Defr. V. TZANKOV, Tabl. III.
 1931 — *Pecten cretosus* Defr. L. RIEDEL, p. 667.
 v . 1932 — *Pecten (Chlamys) cretosus* D. WOLANSKY, p. 16.
 Defr.
 (1933)a — *Pecten cretosus* A. BENOÎT, p. 36.
 (1933) — *Pecten cretosus* E. SCHOENFELDER, p. 103.
 (1934) — *Pecten cretosus* Defr. ST. T. JELEV, p. 125.
 1935 — *Pecten (Chlamys) cretosus* R. HÄGG, p. 35.
 Defrance var. *nitida*
 (Sowerby) Schroeder

- 1937 — *Pecten (Chlamys) cretosus* E. BEYENBURG, p. 320.
Defr.
- (1938) — *Pecten cretosus* Defr. J. G. CARLSSON, p. 8.
- . 1940 — *Chlamys cretosus* Defrance (laps. cal.) V. TZANKOV, p. 487.
- ? 1940 — *Pecten densicostatus* n. sp. V. TZANKOV, p. 488, pl. 6, f. 8.
- ? 1941 — *Pecten (Chlamys) cretosus* E. STOLL, p. 93, pl. 2, f. 11.
Defr.
- (1942)b — *Chlamys cretosus* (laps. cal.) (Defrance) C. W. & E. V. WRIGHT, p. 117.
- (1945) — *Pecten cretosus* Defr. A. JESSEN, p. 13.
- . 1946 — *Pecten (Chlamys) cretosus* J. P. J. RAVN, p. 23.
Defr.
- 1947 — *Pecten (Chlamys) cretosus* R. HÄGG, p. 69.
Defrance
- ? 1948 — *Chlamys* cfr. *cretosa* G. TAVANI, p. 97.
(Defrance)
- v ? (1953) — *Pecten cretosus* Defr. H. PRESCHER, p. 256.
- 1954 — *Pecten (Chlamys) cretosus* R. HÄGG, p. 40.
Defrance
- (1964) — *Pecten (Chlamys)* cf. *cretosus* Defr. H. ARNOLD & K. H. TASCH, p. 642.
- (1964)a — *Pecten (Chlamys) cretosus* Defr. H. ARNOLD, p. 97, 104.
- (1964)b — *Pecten (Chlamys) cretosus* Defr. H. ARNOLD, p. 207.
- (1964)c — *Pecten (Chlamys) cretosus* Defr. in Brongn. H. ARNOLD, p. 317.
- . 1968 — *Chlamys (Chlamys) cretosae zeiszneri* (Alth) S. I. PASTERNAK et al., p. 156, pl. 32, f. 10-12, pl. 33, f. 1.
- . 1968 — *Chlamys (Chlamys) cretosae nitida* (Mantell) S. I. PASTERNAK et al., p. 156, pl. 32, f. 13, pl. 33, f. 2.
- non 1833 *Pecten cretosus* A. Goldfuss, p. 58, pl. 94, f. 9.
- = 1818 *Chlamys ? elongata* (Lamarck).
- non 1958 *Pecten (Chlamys)* aff. *cretosus* W. Barber, p. 18, pl. 6, f. 3.
= *Camptonectes* sp. aff. *Camptonectes virgatus* (Nilsson, 1827).

Location of type-specimens

Pecten cretosus : lost during the destruction of Caen, Normandy, in World War II. The species is well known and there is no need for choosing a neotype.

Pecten arachnoides : idem.

Pecten nitida : lost (fide WOODS, 1902).

Pecten nodoso-costatus : lost during the destruction of Szczecin in World War II.

Pecten zeiszneri : Naturhistorisches Museum, Vienna, n° 1862 V 273.

Pecten irnichensis : University of Bonn, Paläontologisches Institut.

Pecten barthi : collection WOLLEMAN : where this collection is at present I have not been able to discover.

Pecten densicostatus : lost; should be in the Geological Survey in Sofia, but could not be found.

Stratum typicum :

Pecten cretosus : Craie de Meudon (Campanian — ? Lower Maastrichtian)

P. arachnoides : id.

P. nitida : Upper Chalk (Senonian).

P. nodoso-costatus : Lower Maastrichtian.

P. zeiszneri : Kreidemergel (Maastrichtian).

P. irnichensis : Ober-Senon (Upper Senonian).

P. barthi : Senon (Senonian).

P. densicostatus : Danien (more recent publications give a Maastrichtian age).

Locus typicus :

Pecten cretosus : Meudon, Seine-et-Oise (France).

P. arachnoides : id.

P. nitida : Lewes, Sussex (Great Britain)

P. nodoso-costatus : Rügen (G. D. R.)

P. zeiszneri : Lemberg (Lwow, Ukraina, U. S. S. R.).

P. irnichensis : Irnich (G. F. R.)

P. barthi : Biewende (G. F. R.)

P. densicostatus : Somovit (Bulgaria).

Original description

Pecten cretosus

« Il est plat, les deux valves sont égales ainsi que les oreilles, il est marqué de côtes très nombreuses, très fines, un peu ondulées, qui portent vers leur extrémité marginale des espèces de petites lames relevées, imbriquées. L'interstice entre les côtes n'offre aucun travail particulier. Ce peigne paroît très voisin de celui qui se trouve dans la craie tufau à Maestricht, et qui est figuré dans l'ouvrage de M. FAUJAS, sur la montagne de Saint-Pierre, pl. 25, fig. 8.

L'individu figuré vient de Meudon et de la collection de M. DEFANCE. »

Pecten arachnoides

« Il ressemble beaucoup au précédent, mais ses côtes sont lisses, et on remarque dans l'intervalle qui est entre elles, des stries qui leur sont perpendiculaires. Cette disposition est assez semblable à celle des fils dans une toile d'araignée. »

Pecten nitida

« Obovate, rather oblique, longitudinally striated; striae numerous, radiating; upper valve flat; lower valve slightly convex. A remarkably neat shell, much depressed, and rather oblique. The upper valve is perfectly flat; the lower one slightly convex. The striae are prominent, and regular, radiating from the hinge line to the margin; about fifty on each valve. These are crossed by fine lines, which are scarcely visible to the naked eye. The margin is slightly crenulated, the ears are small, and placed obliquely; the lines of increase few, and indistinct; the length and width of the shell nearly equal. »

Pecten nodosocostatus

« Der vorigen 4) ähnlich, jedoch etwas kleiner, schmaler und stärker gewölbt. Starke und schwache ausstrahlenden Rippen wechseln regelmässig ab; ihre Zahl beträgt am Rande 118; nur die starken erreichen den Wirbel; alle sind mit elliptischen Knoten sehr gedrängt besetzt. Zwischenräume sind kaum vorhanden. Kräftige Wachsthum-Absätze treten häufig, aber in unregelmässigen Zwischenräumen vor. Beide stumpfwinkeligen Ohren senken sich mit ihren Spitzen etwas und bilden eine gekrümmte Schloss-Linie; sie sind ausstrahlend gerippt und quergefurcht. Das vordere Ohr ist zweimal so gross wie das hintere. Länge 1"4"6"', Breite 1"2"'. »

Pecten Zeisneri

« P. testa ovata, maxime compressa, radiatim costulata. Costulis numerosissimis (140) linearibus, inaequalibus, per numerosas strias concentricas nodulosis, imbricatis, rostro acuto, marginibus ejus inaequalibus, longiore recto, brevior excavato, auriculis inaequalibus, majore basi excavata concentrice rugosa, minore rectangula, radiatim imbricato-costulata.

Dim. Länge 40 Mill. Breite 47 Mill. Länge der Schlosskanten 23 und 21 Mill. Schlosskantenwinkel 90°. Länge der Schlosslinie 20 Mill. Länge des einen Ohrs von der Mitte des Buckels an gerechnet 9 Mill., des andern 11 Mill.

Schale eirund, etwas schief, fast ganz flach, radial gerippt. — Die Radialrippen sehr zahlreich (bis 140), ungleich, linienförmig mit etwas breitem Zwischenräumen, durch sehr zahlreiche concentrische Linien mit feinen spitzigen Schuppen bedeckt, die gegen den Wirbel verschwinden. Schlosskanten etwas ungleich, die längere gerade, die kürzere etwas concav, Schlosslinie gerade, lang, Ohren sehr ungleich, das Grössere von der Schlosslinie bis zu $\frac{2}{3}$ seiner Höhe etwas bogenförmig, dann bis zum Schlossrande tief ausgeschnitten, bloss concentrisch gerunzelt, besonders stark am Ausschnitte und nur undeutlich radial liniert, das kleinere rechtwinklig, und wie die Schale mit feinen knotigen Radialrippen bedeckt.

Diese schöne Species fand sich bis nun nur einmal, aber in einem sehr schön erhaltenen Exemplare im Kreidemergel von Lemberg. »

Additional description

Number of specimens studied: total: 1.025.

British Turonian	...	...	...	...	...	5
Danish Turonian	...	...	...	...	...	40
East German Turonian	...	...	...	...	...	7
Austrian Senonian	...	...	...	...	...	7
Belgian Senonian	...	...	...	...	...	123
British Senonian : Coniacian	...	...	...	...	...	23
Santonian	...	...	...	...	...	83
Campanian	...	...	...	...	...	165
Senonian s.l.	...	...	...	...	...	65

(4) *Pecten denticulatus* VON HAGENOW.

Czech Senonian	9
Danish Senonian	30
Dutch Senonian : Campanian	11
East German Senonian	17
French Senonian	44
Polish Senonian	1
Swedish Senonian	64
West German Senonian	35
Belgian Maastrichtian	64
British Maastrichtian	8
Danish Maastrichtian	52
East German Maastrichtian	125
Ukrainian Maastrichtian	15
West German Maastrichtian	32

Measurements :

— specimens from the Senonian (Campanian) in Hainaut (Belgium) :

U. P. D. varies from 13.3 mm to 44.4 mm; av. 30.1 mm
(n = 22 R and 18 L)

W. varies from 11.6 mm to 40.8 mm; av. 25.4 mm
(n = 23 R and 20 L)

U. P. D./W. varies from 1.055 mm to 1.424 mm; av. 1.184 mm

A. A. varies from 67° to 98°; av. 84°

— specimens from the Upper Turonian in Arnager, Bornholm (Denmark) :

U. P. D.	W.	A. A.	U. P. D./W.	Side
35.4 mm	31.1 mm	—	1.1309	R
—	28.6 mm	—	—	L
44.8 mm	38.5 mm	82°	1.1637	R
—	21.0 mm	—	—	L
41.7 mm	35.9 mm	74°	1.1616	L

— specimens from the Senonian (*M. coranguinum*-zone) of Bromley (Great Britain) :

23.3 mm	19.4 mm	83°	1.0913	4 L
to	to	to	to	&
47.1 mm	41.4 mm	90°	1.2460	4 R

— specimens from the Senonian (*M. coranguinum*-zone) of Charlton (Great Britain) :

21.6 mm	18.9 mm	81°	1.1065	9 L
to	to	to	to	&
50.4 mm	44.6 mm	89°	1.2049	11 R

— specimens from the Senonian (*M. coranguinum*-zone) of Gravesend (Great Britain) :

U. P. D.	W.	A. A.	U. P. D./W.	Side
24.2 mm	19.7 mm	82°	1.1263	4 L
to	to	to	to	&
38.4 mm	33.3 mm	92°	1.2284	3 R

— specimens from the Senonian (*G. quadratus*-zone) from East Harnham Salisbury (Great Britain) :

26.7 mm	21.3 mm	80°	1.0754	15 L
to	to	to	to	&
55.2 mm	50.9 mm	98°	1.2535	11 R

— specimens from the Senonian (*B. mucronata*-zone) from Norwich (Great Britain) :

20.1 mm	16.6 mm	77°	1.0950	26 L
to	to	to	to	&
60.0 mm	50.3 mm	100°	1.2534	37 R

— specimens from the Senonian of Hoheneggelsen (G. F. R.) :

17.9 mm	13.4 mm	80°	1.1696	4 L
to	to	to	to	&
33.1 mm	28.3 mm	90°	1.3358	1 R

— a specimen from the Senonian at Rouen (France) :

46.5 mm	39.5 mm	—	1.1772	R
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— a specimen from the Lower Maastrichtian in Rügen (G. D. R.) :

19.6 mm	16.2 mm	81°	1.2098	L
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— specimens from the Maastrichtian in Lägerdorf (G. F. R.) :

21.9 mm	18.7 mm	82°	1.0335	10 L
to	to	to	to	&
40.0 mm	38.7 mm	90°	1.2389	12 R

Description :

Diagnosis. — Medium to large *Mimachlamys* species with flattened ribs; valves are covered with a very variable number of ribs which can bear small scales at the intersection with the concentric growthlines. The auricles are well developed.

Macrosculpture : the radial ribs on the discs are very variable in number, thickness and ornamentation : sometimes they bear rounded scales, exceptionally spinules.

Right valve : numerous ribs of varying thickness : all transitions between very narrow ribs with wide intervals to broad ribs with intervals which are narrower than the ribs themselves. In the intercostal intervals are concentric striae which sometimes have become concentric ridges present on the whole disc-surface but are most clearly visible near the umbo. Their distribution is not even : in the umbonal region they are much nearer to each other than at the pallial margin.

In the intercostal intervals new ribs are formed by intercalation. Near the side margins the rib density is lower but there are fine striae which are perpendicular to the margin. Anterior auricle : large, with broad and deep byssal sinus; on the lower auricle part there are 2 to 5 spinule bearing ribs. Posterior auricle : smaller and obtuse-angled; 6 to 8 radial ribs with small scales.

Left valve : more convex than the right valve, macrosculpture as on the right valve, but with fewer ribs, and the whole ornamentation has a coarser aspect. The concentric striae are less clearly visible.

Anterior auricle : curved outer margin; 7 to 12 spinule bearing ribs.

Posterior auricle : as on the right valve.

Discussion

Variability :

The variability in number and thickness of the ribs is very great and this had led several authors to consider varieties such as *Pecten cretosus* var. *nitida* SCHROEDER, *P. cretosus* f. *typica* HÄGG, *Chlamys* (*Chlamys*) *cretosa zeiszneri* PASTERNAK; the differences between the « varieties » are in the ribs : some specimens have very thin, almost linear, ribs (var. *nitida*) or broader ribs with narrower intervals and well developed scales on the ribs (f. *typica* and var. *zeiszneri*). The first « variety » can be seen in WOODS, pl. 33, fig. 6a, b (there are specimens with even thinner and fewer ribs) and the second on pl. 33, fig. 1a, b, c.

I agree with WOODS (1902, p. 178) that these varieties do not have any specific importance : they are based on the relative width of the intercostal intervals as compared with the ribs, and this, as stated in the description, changes according to the valve, even when the variability is not taken into account.

Synonymy :

To WOODS' considerations I would like to add the following points :

- The type-specimen of *Pecten zeiszneri* ALTH in the Naturhistorisch Museum in Vienna is for all the details of sculpture a normal *M. cretosa* with a high rib number.

- *Pecten nodosocostatus* VON HAGENOW is described as if it were a *M. cretosa* with many ribs and well developed scales (« elliptische Knoten »).
- *Pecten undulatus* NILSSON : it is generally accepted that pl. 9, fig. 10, in NILSSON, 1827 is a figure of the species described by NILSSON, whereas pl. 10, fig. 10a, b, b (*sic*) is in fact a *Pecten cretosus*.
- *Pecten irnichensis* VOGEL has been created for very small specimens (18/15 mm) which have a macrosculpture that can be compared with what DEFRANCE described as « *Pecten arachnoides* ». There does not seem to be any difference with *M. cretosa* : the prominent concentric striae noted by VOGEL for his specimens are also visible on specimens from Hainaut and Limburg Maastrichtian.
- *Pecten barthi* WOLLEMAN has been erected for a fragment with a slightly unusual macrosculpture : broad ribs with very narrow intercostal intervals. An identical specimen is in the I. R. Sc. N. B. collections from the Maastrichtian of Hainaut and this macrosculpture though at the extremes of the variability still belongs to *M. cretosa*.

Differentiation :

Mimachlamys cretosa is closely related to *M. robinaldina* (D'ORBIGNY). Some Upper Cenomanian specimens can be considered as transitory between the species.

The older of the two species is more convex, bears spines instead of scales, has generally fewer ribs, and the whole disc is covered with striae which are clearly visible near the side margins as oblique striae. Most *M. robinaldina* specimens have a narrower umbo than in *M. cretosa*, but this cannot be used as a differentiating characteristic.

The other Upper Cretaceous *Mimachlamys*-species have fewer ribs and do not bear scales. *Pecten serratus* NILSSON, which is often considered as belonging to *M. cretosa*, cannot be definitely said to do so : the type-specimen is lost, but what HENNIG states as *P. serratus* are left valves of *Chlamys dentata* NILSSON (see p. 17).

Generic attribution :

There is sufficient similarity between *Pecten asperrimus* LAMARCK, type species of *Mimachlamys*, and *Pecten cretosus* DEFRANCE to enable us to be certain that the latter species also belongs to *Mimachlamys*; thus its correct name becomes *Mimachlamys cretosa* (DEFRANCE).

Stratigraphical and geographical distribution

Turonian : DENMARK :

Bornholm : Arnager (GR., KO. also orig. RAVN, 1902, pl. 1, fig. 11, 18)

Muleby Aa (KO.)

G. D. R. :

Nelle, Rothenfelde (DR.)
 Polenztal, Hohnstein (RD.)
 Quedlinburg (B.)

GREAT BRITAIN :

Borstal, Manor Pit, Rochester, Kent (B. M.)

H. planus-zone :

Guildford Bypass, Surrey (B. M.)

Senonian : AUSTRIA :

Brandenberg, Tirol : Nederberggraben Höhe 1340 (Mü.)
 Gosau, Oberösterreich : St. Lorenzen, Neunkirchen (Geol. Bund.
 also orig. ZITTEL, pl. 18, fig. 2d)
 St. Wolfgang (Geol. Bund. also orig.
 ZITTEL, pl. 18, fig. 2c)

BELGIUM :

Bonne Espérance, Liège (Ma.)
 Cuesmes, Hainaut (I. R. Sc. N. B.)
 Grez-Doiceau, Brabant (I. R. Sc. N. B.)
 Nouvelles, Hainaut (I. R. Sc. N. B.)
 Obourg, Hainaut (I. R. Sc. N. B.)
 Orp-le-Grand, Brabant (I. R. Sc. N. B.)

CZECHOSLOVAKIA :

Brežno (DR.)
 Tuchowitz (N. M. W. coll. REUSS)

DENMARK :

Bornholm : Bavnodde Grønsand :
 Arnager (B., GR.)
 Bavnodde (KO.)
 Blykobbe Aa (KO.)
 Forchhammers Klint (KO.)
 Horsemyreodde (KO.)
 Risenholm, Blykobbe Aa (KO.)

FRANCE :

Beauvais, Oise (Ec. Min.)
 Bougival, Seine-et-Oise (Ec. Min.)
 Césane (Musé., Mus. Gen.)
 Chaumont, Loir-et-Cher (Mus. Gen.)
 Chavot, Marne (Musé.)
 Issy-les-Moulineaux, Seine (Musé., Mus. Gen.)
 Meudon, Seine-et-Oise (B., Ec. Min., GR., I. R. Sc. N. B., Musé.,
 Mus. Gen., Mus. Laus., R. U. G., U. C. L.)
 Rouen, Seine-maritime (GH.)

Saint Clair (B.)
 Sancerre, Cher (Mus. Gen.)

G. D. R. :

Gussow, Mecklenburg (B. coll. SCHLOTHEIM)
 Plauen (B.)
 Strehlen (B., DR., KO., Mus. Gen., N. M. W.)
 Sussberg, Veckenstedt (B.)

G. F. R. :

Ahlten, Hannover (B., Halle)
 Gross Bülden (GH.)
 Haldem (B., DR., Halle, Mus. Gen., Mü., N. M. W.)
 Hoheneggelsen (GH.)
 Krons Moor (GH.)
 Lägerdorf (DR., GH., GR.)
 Lauingen, Königslutter (B.)
 Lemförde (DR.)
 Lüneburg (B.)
 Quenstedt? (GH.)
 Stemmer Berg (B.)
 Wahrburg, Ilseburg (DR.)

GREAT BRITAIN :

M. cortestudinarium-zone :

Beachy Head, Sussex (B. M.)
 Chatham, Kent (B. M.)
 Dover, Kent (B. M.)
 Luton, Chatham, Kent (B. M.)
 St. Margaret's Bay, Kent (KO.)

M. coranguinum-zone :

Bromley, Kent (S. M.)
 Charlton, Kent (B. M.)
 Foot's Gray, S. of Dartford, Kent (B. M.)
 Gravesend, Kent (B. M., also orig. Woods, pl. 33, fig. 6, L. 31 527, Geol. Sci. S. M.)
 Grays, Essex (B. M.)
 High Down, Isle of Wight (B. M.)
 Lewisham, Loam Pit Hill (KO.)
 Michelclever, Hants. (B. M.)
 Northfleet, Kent (B. M.)
 Ospringe, Faversham, Kent (B. M.)
 Porton, Salisbury, Wilts. (B. M., also orig. to Woods, pl. 33, fig. 4, L. 64 204)
 Quidhampton, Hants. (B. M.)
 Ruxley, S. of Dartford, Kent (B. M.)
 South Croydon, Haling Pit, Surrey (B. M.)
 South Landing (B. M.)

Swanscombe, Kent (B. M.)
 Thanet Coast (B. M.)
 Tolhurst Pit, Gravesend, Kent (B. M.)
 Upper Basildon, Pangbourne, Berks. (B. M.)
 Wanborough, Surrey (B. M.)

Uintacrinus-band :

Highfield, Hants. (B. M.)
 Kingsgate, Margate, Kent (B. M.)
 Margate, Kent (B. M.)
 Thanet Coast (B. M.)
 Westgate, Kent (B. M.)

Marsupites-zones :

Brighton, Sussex (B. M.)
 Margate, Foreness Point, Kent (B. M., KO.)
 Northdown, Margate, Kent (B. M.)
 Witherington, Salisbury, Wilts. (B. M. orig. Woods, pl. 33, fig. 5 L 64205)

O. pillula-zone, *Hagenowia*-horizon :

S. E. Lower Bannings, E. of Salt Clean (B. M.)
 West Harnham, Salisbury, Wilts. (B. M.)

quadratus-zone :

Arish Mell, Dorset (B. M.)
 Bessing, Yorks. (B. M.)
 Brighton, Cliffs E. of, Sussex (B. M.)
 Claydon, Suffolk (B. M.)
 East Harnham, Salisbury, Wilts. (B. M. also orig. Woods : pl. 32, fig. 4 L 64197, pl. 32, fig. 6 L 64200, pl. 33, fig. 1 L 64201, pl. 33, fig. 3 L 64202, pl. 33, fig. 2 L 64203)
 Fareham, Hants. (S. M.)
 Rottingdean, Sussex (KO.)
 West Harnham, Salisbury, Wilts. (B. M.)
 Whaddon, Salisbury, Wilts. (B. M.)
 under railway arch from Salisbury to Alderbury (B. M.)

B. mucronata-zone :

Ballard Head, Dorset (B. M.)
 Bowerbank, Norwich (B. M.)
 Bramford, Suffolk (S. M.)
 Catton, Norwich, Norfolk (B. M.)
 Clarendon, Salisbury, Wilts. (B. M.)
 Cunnell's Pit, Newmarket Road, Norwich, Norfolk (B. M.)
 Harford Bridges, Norwich (B. M.)
 Hellesdon, Norwich, Norfolk (B. M.)
 Mousehold, Norwich (B. M.)
 Norwich, Norfolk (B. M., KO., S. M.)

Studland Bay, Dorset (B. M.)

Swanage, Dorset (B. M.)

no zone indicated :

Bonstead, Hants. (S. M.)

Brighton, Sussex (B. M., Geol. Sci., S. M.)

Bromley, Kent (B. M., Geol. Sci., S. M.)

Charlton, Kent (B. M., S. M.)

Compton, Winchester, Hants. (S. M.)

Gravesend, Kent (Geol. Sci.)

Haldon Hills (derived in Eocene gravels) (B. M.)

Lewes, Sussex (S. M.)

Lewisham, Kent (S. M.)

Lulworth, Dorset (B. M.)

Maidstone, Kent (S. M.)

Northfleet, Kent (Geol. Sci.)

Purley (S. M.)

Silkstead, Dorset (S. M.)

Worthing, Sussex (B. M.)

Northern Ireland :

Cave Hill, Antrim (B. M.)

Scotland :

Peterhead, Aberdeenshire (B. M.) (chalk flint in drift Senonian)

NETHERLANDS :

Vaals (I. R. Sc. N. B.)

POLAND :

Silesia : Kieslingswalde (DR.)

SWEDEN :

Balsberg (KO.)

Balsvig (KO.)

Barnakälla (Lund)

Hanaskog (KO.)

Harting (Musé. coll. J. DE MORGAN)

Ignaberga (Lund)

Ivö (KO.)

Karlshamm (KO., Lund)

Kåseberga (Lund)

Köpinge (Lund also orig. NILSSON sub *P. undulatus* forma depressa,
pl. 10, fig. 10 B)

Kullemölla (Lund)

Lund (KO.)

Lyckås (KO.)

Svenstorp (Lund)

Valleberga (Lund)

Maastrichtian : BELGIUM - THE NETHERLANDS :

Boirs, Liège (I. R. Sc. N. B., Ma.)
 Ciply (Ec. Min., I. R. Sc. N. B.), Hainaut
 Harmignies (I. R. Sc. N. B., R. U. G.), Hainaut
 Maastricht (B., I. R. Sc. N. B., Musé.)

DENMARK :

Aalborg (KO.)
 Bjerre Thy (KO.)
 « Dania », Mariagerfjord (KO.)
 Erslev Grube (KO.)
 Freilev, Aalborg (KO.)
 Hanstholm (KO.)
 Hillerslev Thy (KO.)
 Kastrup (KO.)
 Kirkevigen (KO.)
 Lindholm (KO.)
 Magle vandsfald (KO.)
 Møen (KO.)
 « Norden », Aalborg (KO.)
 Nørre Flødal (KO.)
 Rørdal, nye grav (KO.)
 Skovbakken (KO.)
 Smidie (KO.)
 Stevns Klint (KO.)
 Vive (KO.)

G. D. R. :

Rügen (DR., GR.)

G. F. R. :

Hemmoor (GH.)

GREAT BRITAIN :

Ostrea lunata-zone :

Trimingham, Norfolk (B. M., S. M. also orig. Woods, pl. 23,
 fig. 12, B 34018)

non-*lunata*-reef :

Trimingham, Norfolk (B. M., Geol. Sci.)

U. S. S. R. :

Ukraine :

Lwow (N. M. W. also orig. ALTH *Pecten zeiszneri* 1862 V 273,
 1862 V 285, 1862 V 286)
 Nagorzany (DR., Ec. Min., KO.)

Mimachlamys cretosa
 subspecies **denticulata** (F. VON HAGENOW, 1842)
 (Pl. 8)

- 1841 — *Pecten denticulatus* v. Hag. F. A. ROEMER, p. 52.
 . 1842 — *Pecten denticulatus* nob. F. VON HAGENOW, p. 429.
 ? 1846 — *Pecten denticulatus* v. A. E. REUSS, p. 30.
 Hagenow
 (1850) — *Pecten denticulatus* v. H. B. GEINITZ, p. 182.
 Hagenow
 v . 1932 — *Pecten (Chlamys) denticu-* D. WOLANSKY, p. 16, pl. 2,
 latus v. Hagenow f. 23-25.

Location of type-specimen

Lectotype : Sektion geologische Wissenschaften, University of Greifswald.

Stratum typicum :

Lower Maastrichtian.

Locus typicus :

Rügen (G. D. R.).

Original description

Pecten denticulatus v. HAG. (in ROEMER, 1841)

Breit eirund, etwas schief, flach gewölbt; liniirt; Schlosskanten rechtwinkelig, hintere Ohren, stumpfwinkelig, vordere grösser und rechtwinkelig; die Linien sind sehr fein, auf einer Breite von 3''' liegen 25 beisammen-ungleich, fast ohne Zwischenräume und bestehen nur aus kleinen, aufgerichteten, gewölbten, dachziegelförmigen Schuppen, welche dicht auf-einander folgen.

Obere Kreide auf Rügen. »

Pecten denticulatus (VON HAGENOW, 1842)

« Fast kreisrund, fast unmerklich schief, gleichschalig und schwach gewölbt; die Rundung der Schale verläuft mit sanftem Bogen in die hintere gerade Schloss-Kante, bildet jedoch mit der vorderen, etwas eingebuchteten einen ziemlich starken Winkel; der Schlosskanten-Winkel ist ein spitzer. Sehr zahlreiche, mit feinen schuppigen Zähnen besetzte Rippen strahlen hinten und in der Mitte der Schalen geradlinig und gedrängt, vorne aber etwas gebogen aus; jüngere, schwächere Rippen mit spitzigeren Zähnen schieben sich allenthalben ein und füllen die Zwischenräume fast gänzlich aus. Auf drei Linien Breite zählt man 20 bis 30 Rippen, und die Gesamtzahl derselben eines nicht völlig ausgewachsenen Exemplars beträgt am Rande 278. Die Zähne der seitlichen Rippen sind mehr abgerundet und treten stärker und gedrängter vor, als die der mittleren Rippen. Starke und schwache Rippen wechseln entweder ab oder sind zu fünf oder neun geordnet; nur wenige, etwa 20, erreichen den Wirbel und bilden dort mit den spärlich die durchkreuzenden Anwachs-Linien ein zartes Gitter. Die Schloss-Linie ist gerade; das vordere Ohr tritt Flügel-förmig vor und ist am vorderen Rande S-förmig geschweift; das hintere Ohr läuft gerade empor und ist rechtwinkelig; beide sind mit ausstrahlenden, starken, scharf gezahnten Rippen besetzt. Länge 1"8'''

Breite 1"6". Die Abbildung bei GOLDF. 98, 12, a ist am ähnlichsten. Kommt mit viel kürzeren, abgerundeteren Zähnen auch in England vor, was aus einem von Brighton erhaltenen Exemulare hervorzugehen scheint. »

Additional description and discussion

Number of specimens studied : total : 216.

Holstein : Maastrichtian	... ..	24
Rügen : Maastrichtian	... ..	160
Denmark : Maastrichtian	... ..	32

Diagnosis. — *Mimachlamys cretosa* (DEFrance) specimens with a very high ribnumber and the ribs covered with minute sharp scales.

Pecten denticulatus as described by ROEMER and VON HAGENOW is undoubtedly conspecific with *Mimachlamys cretosa* : the general shape, the auricle shape and the ribdistribution are the same; the ribnumber is in the variability range of the species, and the stratigraphical distribution falls within that of the species. The difference is that specimens of *M. cretosa* which have a very high ribnumber usually have almost smooth ribs. Since stratigraphically and geographically « *Pecten denticulatus* » is strictly limited it can be considered a subspecies of *Mimachlamys cretosa* found in the Lower Maastrichtian of the Northern European Schreibeide.

Stratigraphical and geographical distribution

Lower Maastrichtian : G. D. R. :

Rügen (GR.)

G. F. R. :

Holstein : Hemmoor (GH.)
Kronsmoor (GH.)
Lägerdorf (GH.)

Maastrichtian : DENMARK :

Møen (KO.)
Skovbakken, Aalborg (KO.)
Stevns Klint (KO.)

Mimachlamys mantelliana (A. D'ORBIGNY, 1847)

(Pl. 6, fig. 1)

1833 — <i>Pecten concentricus</i>	S. WOODWARD, p. 48, pl. 5, f. 27-28.
v. 1847 — <i>Pecten mantellianus</i> d'Orbigny	A. D'ORBIGNY, p. 619, pl. 440, f. 8-11.

- (1850) — *Pecten Mantellianus* d'Orb. A. D'ORBIGNY, p. 251, n° 837.
- (1854) — *Pecten concentricus* D'Orb. J. MORRIS, p. 176.
- (1870) — *Pecten Mantellianus* d'Orb. F. J. PICTET & G. CAMPICHE, p. 215.
- (1871) — *Pecten Mantellianus* (= *concentricus* Woodw.) d'Orb. F. STOLICZKA, p. 428.
- 1879 — *Pecten* cf. *concentricus* C. BARROIS, p. 452.
- . 1889 — *Pecten Mantelli* d'Orb. E. HOLZAPFEL, p. 235, pl. 26, f. 6.
- 1892 — *Pecten (Chlamys) Mantellianus* d'Orb. E. STOLLEY, p. 237.
- . 1902a — *Pecten Mantellianus* d'Orbigny A. WOLLEMAN, p. 59.
- (1902)b — *Pecten* cf. *Mantelli* d'Orb. A. WOLLEMAN, p. 32.
- (1902)c — *Pecten Mantellianus* d'Orb. A. WOLLEMAN, p. 93.
- v . 1902 — *Pecten (Chlamys) Mantellianus* d'Orbigny H. WOODS, pp. 179-181, pl. 34, f. 1 a, b, 2, 3a-c, 4-6.
- 1910 — *Pecten Mantelli* d'Orb. B. RYDZEWSKI, p. 193.
- ? 1948 — *Chlamys mantelliana* (d'Orb.) G. TAVANI, p. 96.
- non 1822 *Pecten concentricus* T. Say, Journ. Acad. Nat. Sci. Philadelphia. 2, p. 259.
- non 1825 *Pecten concentricus* M. DeFrance, p. 253.
- non 1837 *Pecten concentricus* F. C. L. Koch & W. Dunker, Beitr. nord-deutsch. Oolith-geb., p. 43, pl. 5, f. 8.
- non 1844 *Pecten concentricus* E. Forbes, 13 Rept. Brit. Ass., p. 192 (fide SHERBORN).

Location of type-specimens

Pecten concentricus WOODWARD : lost (fide WOODS, 1902).

Pecten mantellianus : Muséum national d'Histoire naturelle, Paris : D'ORBIGNY coll. n° 7613.

Stratum typicum :

Pecten concentricus WOODWARD : Upper Chalk (Norwich) (Campanian).

P. mantellianus : craie blanche ou étage sénonien le plus supérieur (Upper Campanian - ? Lower-Maastrichtian).

Locus typicus :

Pecten concentricus WOODWARD : Harford Bridges, Norwich, Nortfolk (Great Britain).

P. mantellianus : Chavot, Marne (France).

Original description

Pecten concentricus

(No description but a locality and two figures.)

Pecten mantellianus

« *Pecten* MANTELL, 1822, pl. 25, f. 6; pl. 26, f. 7.

P. testâ ovatâ, transversâ; maximè depressâ, radiatim 18-costatâ; costis subcomplanatis, angustatis, interstitiisque latis, complanatis, transversim costatis, punctatis; auriculis inaequalibus.

Dimensions. Largeur, 35 mm. — Par rapport à la largeur : longueur 89/100; épaisseur, 20/100. Angle apical, 90°.

Coquille ovale, transverse, très-déprimée, mince, fragile, ornée de dix-huit côtes rayonnantes, à peine saillantes, étroites, entre lesquelles sont de larges espaces unis, striés en travers, et comme granulés par des points en relief. Au bord les côtes disparaissent et sont remplacées par de très forts plis concentriques d'accroissement.

Rapport et différences. Cette espèce est voisine, par sa forme, du *P. nitidus*, mais elle s'en distingue par ses côtes plus égales, moins nombreuses et plus largement espacées.

Localité. M. DUTEMPLE a recueilli cette jolie espèce à Chavot (Marne), dans la craie blanche ou l'étage sénonien le plus supérieur. »

Additional description

Number of specimens studied : total : 98.

British Senonian : <i>M. coranguinum</i> -zone ...	3
<i>G. quadrata</i> -zone	1
<i>B. mucronata</i> -zone ...	43
French Senonian	4
German Senonian	37
Belgian Maastrichtian	3
British Maastrichtian	1
British Upper Cretaceous	5
Ukrainian Upper Cretaceous	1

Measurements :

Lägerdorf (G. F. R.) :

U. P. D. varies from 20.6 mm to 46.8 mm; av. 34.17 mm (n = 14)

W. varies from 14.5 mm to 38.2 mm; av. 29.98 mm (n = 17)

A. A. varies from 85° to 95°; av. 89.45° (n = 11)

British Senonian :

Left valves :

U. P. D. varies from 24.4 mm to 49.4 mm; av. 36.64 mm (n = 5)

W. varies from 20.5 mm to 41.8 mm; av. 31.91 mm (n = 10)

A. A. varies from 80° to 87°; av. 84.2° (n = 5)

Right valves :

U. P. D. varies from 22.6 mm to 42.7 mm; av. 32.59 mm (n = 11)

W. varies from 17.3 mm to 40.2 mm; av. 28.29 mm (n = 26)

A. A. varies from 80° to 98°; av. 87.87° (n = 8)

Description :

Diagnosis. — Medium-sized, very flattened *Mimachlamys* species covered with 11 to 30 narrow, flattened radial ribs and with a few concentric growth elevations.

To Woods' description little needs to be added; his measurements are not quite broad enough, as can be seen on the values he gives for the A. A. and those indicated above taken on almost the same specimens.

The same applies to the ribnumber, which seems to be extremely variable; this is partly due to the state of preservation : right valves are more worn than left valves and thus their rib number seems to be lower. On left valves I counted ribs on 17 specimens : the number varies from 11 to 30 with an average of 19.4. The number of concentric growth-elevations is variable too : on British specimens from 0 to 5 with an average of 2.4.

Discussion

Variability :

See « Description ».

Synonymy :

S. WOODWARD's name is pre-employed and thus the correct name is the one by D'ORBIGNY. That both taxa are synonymous is so obvious that it has never been doubted.

Differentiation :

Mimachlamys mantelliana differs from the other Cretaceous *Mimachlamys* species in being flatter, particularly the right valve, in having well developed concentric growth elevations and in having few narrow flat radial ribs. Also typical is that on the auriculae the concentric structures are more pronounced than the radial ones.

M. cretosa (DEFrance) and *M. mantelliana* are probably closely related. On those specimens of the former species which have few radial ribs there is a similarity with the latter species, but the latter never bears scales and is always flatter than the former. On specimens of *M. cretosa* which have approximately the same ribnumber as *M. mantelliana* there are no concentric growth elevations.

The other *Chlamys* and *Mimachlamys* species from the Cretaceous have a very different rib-pattern which makes confusion impossible.

Palaeoecology :

All the specimens which I have studied of *M. mantelliana* were found in a very fine white chalk (« Schreibkreide »); the species seems to have lived on a very fine sediment.

Generic attribution :

Pecten mantellianus D'ORBIGNY is very similar and thus probably closely related to *Mimachlamys cretosa* (DEFrance); the arguments which were used for the generic attribution of the second species are also valid for the first. Thus the correct name of this first species becomes *Mimachlamys mantelliana* (D'ORBIGNY, 1847).

Stratigraphical and geographical distribution

Senonian : FRANCE :

Chavot, Marne (Musé. coll. D'ORBIGNY)

G. F. R. :

Lägerdorf, Holstein (B. M., GH., GR.)

GREAT BRITAIN :

M. coranguinum-zone :

Haling Pit, South Croydon, Surrey (B. M.)

Luton, Chatham, Kent (B. M.)

G. quadrata-zone :

Whaddon, Salisbury, Wilts. (B. M.)

B. mucronata-zone :

Catton, Norwich, Norfolk (B. M.)

Clarendon, Salisbury, Wilts. (B. M.)

Cunnell's Pit, Norwich, Norfolk (B. M.)

Hartford Bridges, Norwich, Norfolk (B. M., S. M.)

Norwich, Norfolk (B. M., KO., S. M. also orig. Woods, pl. 34, fig. 3)

Stone Hill, Dereham Road, Norwich, Norfolk (B. M.)

Between Tyneham and Lulworth, Dorset (B. M.)

Maastrichtian : BELGIUM :

Obourg, Hainaut (I. R. Sc. N. B.)

GREAT BRITAIN :

Liostrea lunata-zone :

Trimingham, Norfolk (S. M.)

Upper Cretaceous (Chalk) : GREAT BRITAIN :

Kent (B. B.)

Sussex (B. M., S. M.)

U. S. S. R. :

Crimea (Musé. coll. D'ORBIGNY)

Mimachlamys henrici nom. nov.

(Pl. 5, fig. 2)

- | | | |
|------------|---|--|
| . 1896 — | <i>Pecten</i> cf. <i>Puzosianus</i> | A. J. JUKES-BROWNE & W. HILL, p. 151. |
| v . 1902 — | <i>Pecten</i> (<i>Chlamys</i>) <i>Puzosianus</i> | H. WOODS, pp. 165-166, pl. 30, f. 9 a, b, 10 a, b, 11, 12. |
| ? (1927) — | <i>Chlamys</i> <i>Puzosi</i> | E. KAHRS, p. 633. |
| . 1961 — | <i>Chlamys</i> (<i>Chlamys</i>) <i>puzosianus</i> | V. A. SOBETSKI, pp. 29, pl. 2, f. 1, 2. |
| . 1968 — | <i>Chlamys</i> (<i>Chlamys</i>) <i>puzosiana</i> | S. I. PASTERNAK et al., p. 155, pl. 32, f. 1-2. |
| non 1842 | <i>Pecten puzosianus</i> Mathéron = <i>Chlamys faujasi</i> (De-france). | |

Derivatio nominis :

For Henry WOODS. The trivial name has been formed on this famous palaeontologist's first name, because twice already a « *Pecten* » *woodsii* has been erected (5).

Location of type-specimen

Sedgwick Museum, Cambridge (Coll. Meijer).

Stratum typicum :

Cenomanian.

Locus typicus :

Wilmington, Devon (G. B.)

(5) *Pecten* (*Neithea*) *woodsii* in J. WOLDRICH, 1918, p. 285, pl. 4, fig. 13 and *Camptonectes woodsii* G. TAVANI, 1940, p. 50, pl. 1, fig. 3.

Description

Number of specimens studied : total : 28.

British Cenomanian	26
Belgian Cenomanian	1
French Cenomanian	1

Measurements :

U. P. D.	varies from 29.9 mm to 38.7 mm (n = 7)
W.	varies from 24.4 mm to 33.5 mm (n = 6)
A. A.	varies from 75° to 90° (n = 8)
Ribnumber	varies from (24, 27) 32 to 42 (n = 7)

Diagnosis. — Medium-sized *Mimachlamys*-species, relatively flattened, covered with numerous smooth ribs separated by narrow grooves.

To WOODS's description nothing significant can be added.

Discussion

As stated under *Chlamys faujasi* DEFRANCE, *Pecten puzosianus* MATHERON belongs to that species. The confusion which started with A. J. JUKES-BROWNE has been occasioned by D'ORBIGNY's poor figure, which is indeed similar to the British specimens. However, D'ORBIGNY's description is similar to MATHERON's, and the specimens agree with the description and not with the figure. Hence A. J. JUKES-BROWNE and W. HILL, and H. WOODS figured and described a species which has never been named.

The species under discussion is closely related to *Mimachlamys robinaldina* (D'ORBIGNY). The disc shape is identical and as far as the ornamentation is concerned, pl. 30, fig. 12, in WOODS, 1902, is very close to a typical *M. robinaldina* ornamentation. It could be that *Pecten rothomagensis* D'ORBIGNY, which has been tentatively placed with *M. robinaldina*, has an ornamentation which is close to that described for *M. henrici*.

At present it is impossible to decide whether the differences between *M. robinaldina* and *M. henrici* are of specific or subspecific level. *M. henrici* is restricted to the Anglo-Parisian Basin.

Variability :

As in most *Mimachlamys*-species the ribnumber is extremely variable. Unfortunately the number of specimens on which the ribs could be counted is small and does not give an idea of the complete variability in the species.

Differentiation :

See under *M. robinaldina*.

Generic attribution :

On the small number of specimens known of *Pecten puzosianus* JUKES-BROWNE and HILL non MATHERON no characteristics are present which are non-*Mimachlamys*-characteristics. *Pecten robinaldinus* D'ORBIGNY which is very closely related to the species under discussion certainly belongs to *Mimachlamys*. Hence I consider that *Pecten puzosianus* JUKES-BROWNE and HILL non MATHERON should bear the new name *Mimachlamys henrici*.

Stratigraphical and geographical distribution

Restricted to the Cenomanian of the Anglo-Parisian Basin.

BELGIUM :

Montignies-sur-Roc (Mus. Gen.)

FRANCE :

Rouen, Seine-Maritime (KO.)

GREAT BRITAIN :

Beer Head, Devon (S. M.)

N. of Beer Head, Devon (S. M. also orig. H. WOODS, B 199, pl. 30, fig. 9)

Blue Bell Hill, Burham, Kent (B. M.)

Brighton, Sussex (B. M.)

Charmouth, Dorset (B. M.)

Culver Cliff, Isle of Wight (Coll. C. JEANS)

Dunscombe, Devon (S. M.)

Hooken Cliff, Beer, Devon (B. M.)

Melbury, Dorset (S. M. orig. WOODS, B 6211-6212, pl. 30, fig. 12)

Pinhay, Devon (B. M.)

Whitecliff, Devon (B. M.)

Wilmington, Devon (B. M., S. M.)

Mimachlamys fissicosta (R. ETHERIDGE, 1881)

v . 1822 — *Pecten*

G. MANTELL, p. 129, pl. 26, f. 7.

v . 1881 — *Pecten fissicosta*

R. ETHERIDGE in W. H. PENNING & A. J. JUKES-BROWNE, p. 141, pl. 2, f. 1, pl. 3, f. 1.

- v . 1902 — *Pecten (Chlamys) fissicosta* Etheridge H. WOODS, pp. 163-165, pl. 30, f. 3, 4, 5 a-b, 6 a-c, 7, 8.
- (1910) — *Pecten (Chlamys) fissicosta* Eth. C. R. BOWER & J. R. FARMERY, p. 357.
- ? 1961 — *Chlamys (Chlamys) fissicosta* (Etheridge) V. A. SOBETSKI, pp. 31-33, pl. 2, f. 3-13.
- ? (1964)c — *Pecten (Chlamys) fissicosta* Eth. H. ARNOLD, p. 317.
- ? 1968 — *Chlamys (Chlamys) fissicosta* (Etheridge) S. I. PASTERNAK et al., p. 154, pl. 32, f. 3-7.
- . 1970 — *Chlamys fissicosta* (Etheridge) C. J. WOOD in P. I. MANNING et al., p. 80, pl. 5, f. 2.

Location of type-specimen

Sedgwick Museum : n° B 277, Cambridge, Great Britain.

Stratum typicum :

Totternhoe Stone (Upper Cenomanian).

Locus typicus :

Burwell, Cambs. (Great Britain).

Original description

In W. H. PENNING & A. J. JUKES-BROWNE.

Additional description

Number of specimens studied : total : 85.

British Cenomanian	79
Danish Cenomanian	6

Measurements :

All the British specimens are considered — not differentiating them according to localities — but only as far as they are complete enough for measuring.

Left valves :

U. P. D. varies between 23.4 mm and 57.8 mm; av. 41.31 mm (n = 24)
 W. varies between 19.9 mm and 51.2 mm; av. 34.94 mm (n = 25)
 A. A. varies between 78° and 115°; av. 84.25° (n = 16)

Right valves :

U. P. D. varies between 26.5 mm and 57.8 mm; av. 42.58 mm ($n = 31$)

W. varies between 23.3 mm and 47.6 mm; av. 34.22 mm ($n = 33$)

A. A. varies between 81° and 111° ; av. 90.33° ($n = 23$)

Description :

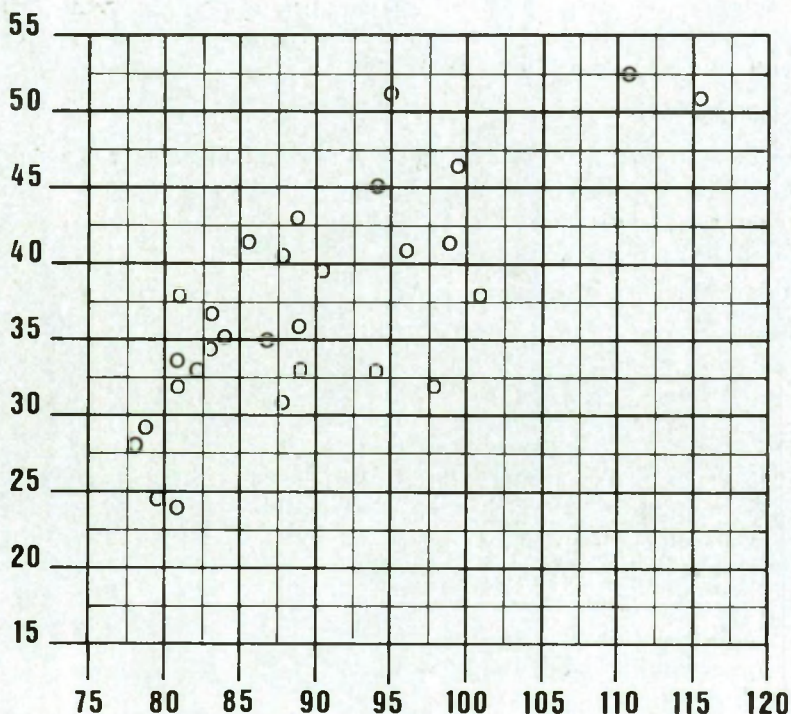
Diagnosis. — Medium-sized *Mimachlamys*-species covered with 11 to 23 broad ribs. Occasionally these ribs divide after a strongly developed growth ridge.

To WOODS' description nothing important can be added, except that the ribnumber varies between 11 and 23, but that most valves have 11 to 18 ribs.

Discussion

Variability :

I disagree with WOODS when he states : « Apical angle about 90° , but larger (sometimes 100°) in small specimens ». In reality the A. A. increases when the shell grows and when the U. P. D. and W. are larger (see textfigure B : A.A. and W. are proportional).



Textfig. B. — *Mimachlamys fissicosta* : absciss : A. A., ordinate : W; the correlation is proportional.

Synonymy :

SOBETSKI's interpretation of *P. fissicosta* is somewhat different from the Western European one : he states that right valves bear 20 to 40 radial ribs and left valves 16 to 21 to which 5-8 secondary ribs must be added, and furthermore that the auricles bear riblets with spinules. I consider it likely that the Pridnestrovian (and West Ukrainian) specimens belong to a closely related but different species or subspecies.

Differentiation :

M. fissicosta differs from the other Middle Cretaceous *Mimachlamys*-species in the smoothness of its ribs. *M. henrici* has smooth ribs too but they are far more numerous and the intercostal intervals are practically non-existent.

Generic attribution :

Pecten fissicosta ETHERIDGE in PENNING and JUKES-BROWNE, 1881, belongs to the *Chlamydiae* because of its general shape, the presence of well developed radial ribs, the large auricles and the *Camptonectes* like-striation near the side margins. The absence of the typical *Chlamys*-microsculpture make it probable that it belongs to the genus *Mimachlamys*. The correct name is *Mimachlamys fissicosta* (ETHERIDGE in PENNING & JUKES-BROWNE, 1881).

Stratigraphical and geographical distribution

Cenomanian : DENMARK :

Bornholm : Arnager (GR.)
Madsegrav (KO.)

GREAT BRITAIN :

S. varians-zone :

Burham, Kent : Blue Bell Hill (B. M.)
Margett's Pit (B. M.)
Peter's Pit (B. M.)
Cambridge (?), Cambs. (Univ. Neuch.)
Chiseldon Camp (B. M.)
Culver, Isle of Wight (B. M.)
Eggerdon Hill, Dorset (S. M.)
Folkestone, Kent (S. M.)
Hunstanton, Norfolk (B. M.)
Punfield, Dorset (B. M.)
Reach, Cambs. (S. M.)
Wouldham, Kent (B. M.)

— Grey Chalk, Totternhoe Stone :

Arlesey (orig. WOODS, S. M. B 6193)

Burwell, Cambs. (B. M., Mus. Laus., S. M. also orig. ETHERIDGE B 277-278, orig. WOODS B 6191, 6192, 6194)

Cherryhinton, Cambs. (S. M.)

Dover (B. M., KO., S. M.)

Folkestone (B. M.)

Hamsey (B. M. type MANTELL, pl. 26, fig. 7)

— Lower Chalk, without specification :

Dover (B. M.)

Maidstone (B. M.)

« Sussex » (B. M.)

Mimachlamys ? undulata (S. NILSSON, 1827)

- v . 1827 — *Pecten undulatus* (pro parte) S. NILSSON, p. 21, pl. 9, f. 10 (non pl. 10, f. 9 = *M. cretosa* (DEFRANCE)).
- v . 1833 — *Pecten undulatus* Nilsson A. GOLDFUSS, pp. 50-51, pl. 91, f. 7 a-b.
- 1841 — *Pecten undulatus* Nilsson F. A. ROEMER, p. 52.
- 1882 — *Pecten undulatus* Nilss. H. SCHROEDER, p. 266, 268.
- (1888) — *Pecten undulatus* Nilss. F. E. GEINITZ, p. 735.
- v . 1897 — *Pecten undulatus* Nilss. A. HENNIG, p. 48, pl. 3, f. 9-11.
- 1911 — *Pecten undulatus* Nilss. K. VOGEL VON FALCKENSTEIN, pp. 556-557.
- . 1930 — *Pecten undulatus* Nilsson R. HÄGG, pp. 37-38.
- (1935) — *Pecten (Chlamys) undulatus* Nilsson R. HÄGG, p. 36.
- v . 1954 — *Pecten (Chlamys) undulatus* Nilsson R. HÄGG, p. 40, pl. 6, f. 57.
- non 1839 *Pecten undulatus* Nils. H. B. Geinitz, p. 21.
- non 1875 *Pecten undulatus* ? Nilss. Goldf. H. B. Geinitz, p. 35, pl. 10, f. 7 (belongs probably to *M. cretosa* DeFrance, but the preservation is too poor for a definite opinion).
- non 1888 *Pecten undulatus* Nilss. E. Holzapfel, pp. 235-236, pl. 26, f. 1, 2 (= *M. cretosa* (DeFrance)).

Location of type-specimen

Lund, Palaeontologiska Institutionen, LO 68 T.

Stratum typicum :

Calce arenosa et carbonifera (Campanian).

Locus typicus :

Kåseberga (Sweden).

Original description

« P. testa ovata convexa, costulis numerosissimis, inaequalibus, subflexuosis, plano-convexis, transversim striatis; sulcis parum impressis; rostro acuto, margine altero recto, altera concavo; auriculis inaequalibus.

Descript. Inter mediocres Pectinum species in formatione nostra cretacea obvenientes. Longit. 1-1 6/8 poll. Differt ab insequente specie formâ magis oblongâ & ovatâ, angulo basali acuto, & sulcis intercostalibus minus profundis. Interdum tamen in lapide depressa reperitur testa, tumque magis rotundata est & fere circularis, angulo basali recto, ut in tab. IX fig. 10 exprimitur. Cum vero formam naturalem conservavit, magis ovata est & convexa; angulus basalis, recto minor, includitur sub auricula minore a linea recta & sub majore a linea subinflexa. Tota superficies radiatim costulata; costulis numerosissimis inaequalibus, aliquantum flexuosis, transversim striatis, fere planis, sulcisque angustis & parum profundis distinctis. Auriculae inaequales, majore ad basin sinu notata, minore pone angulum plerumque incisa.

Locus : In calce arenosa & carbonifera ad Köpinge, Kåseberga & c. haud raro. Cum testa sit satis crassa, bene plerumque conservata est. »

Additional description

Number of specimens studied : total : 23.

Danish Senonian	1
North German Senonian	7
Swedish Campanian	15

Measurements :

	U. P. D.	W.	A. A.		U. P. D./W.
Holotype :	44.5 mm	42.1 mm	113°	Kåseberga	1.0570
Fig. spec.					
HÄGG, 1954 :	46.0 mm	43.85 mm	101°	Köpinge	1.0490
Fig. spec.					
A. HENNIG (LO 1248 T)	—	45.2 mm	—	Tosterup	—
(B)	51.2 mm	46.4 mm	83°	Tosterup	1.1034
Fig. spec.					
GOLDFUSS	58.8 mm	56.5 mm	112°	Haldem	1.0407
(B)	59.6 mm	55.0 mm	108°	Ahlten	1.0407
(GH.)	55.5 mm	47.6 mm	—	Kronsmoor	1.1659
(GH.)	—	48.8 mm	—	Kronsmoor	—
(GH.)	52.1 mm	46.2 mm	—	Kronsmoor	1.1277

Description :

Diagnosis. — Medium to large *Mimachlamys* ? species, disc shape rounded, small auricles, relatively convex valves; ornamentation consisting of thin radial riblets, closely set, crossed by concentric, irregularly placed striae.

The remarkable fact about this species is the rounded, convex valve shape. The ornamentation consists of narrow radial riblets, mostly undivided, but sometimes divided and crossed by concentric striae. The radial riblets lie so close to each other that the intercostal intervals are reduced to grooves.

The auricles are relatively small; the posterior one is an equilateral triangle on both valves; the anterior one is approximately isosceles and with a deep byssal sinus on the right valve, and right or acute angled on the left valve. They are covered with the same radial riblets as the disc, but with more pronounced concentric striae.

Discussion

Synonymy :

The confusion in this species is due to the original description by NILSSON in which *Mimachlamys cretosa* (pl. 10, fig. 9 a-c) and *M. ? undulata* (pl. 9, fig. 10) were put into the same species. HENNIG, 1897, set things in order, but most references without descriptions from before that year cannot be used.

Variability :

There seems, even on the small number of specimens studied, to be a variability in disc proportion : some specimens have U. P. D. and W. almost equal but others are more ovate in shape. However, the index U. P. D./W. on the measured specimens remains below the values found for specimens of the same size in *M. cretosa* (see p. 84-85) (6). On some shells one has the impression that the marginal parts (near the pallial margin) are almost smooth. Whether this is due to the preservation state or to the ornamentation being less pronounced there, cannot be said on so few specimens.

Differentiation :

M. ? undulata differs from all the other *Mimachlamys* species by its very convex discs and orbicular shape. The ornamentation of the shell is not very different from that found on certain *M. cretosa* specimens which have lost their spinules. If the fragment is not large enough to display either the convexity or the auricles it is in fact impossible to make the difference.

(6) This is less convincing in Kronsmoor than in the Swedish localities.

Generic attribution :

Pecten undulatus NILSSON, 1827, has an ornamentation which is typical of *Mimachlamys*, but it does not have the ovate shape and relative flatness found in that genus. Some doubt therefore remains as to the attribution and *Pecten undulatus* is named *Mimachlamys ? undulata* (NILSSON, 1827).

Stratigraphical and geographical distribution

Senonian : DENMARK :

Bornholm : Vest fra Bavnodde (KO.)

G. F. R. :

Ahlten (B., Halle)

Haldem (Mü. orig. GOLDFUSS, pl. 91, fig. 7 a, b)

Kronsmoor (GH.)

Campanian : SWEDEN :

Kåseberga (Lund also orig. NILSSON)

Köpinge (Lund, also orig. R. HÄGG, 1954, pl. 6, fig. 57 L03803 T)

Tosterup (Lund, also orig. HENNIGO, 1897, pl. 3, fig. 10 LO 1248 T)

Ystad (KO.)

Mimachlamys spec.

(Pl. 9, fig. 3)

Description

One specimen from the Tourtia of Tournai in Tournai, Belgium, is figured. The ornamentation consists of 21 broad ribs separated by narrower intervals. The ribs are subdivided in a varying number of riblets. Ribs and intervals are covered with minute spines.

This specimen cannot be compared with any other species from the Cenomanian or other Cretaceous deposits. It is too incomplete to erect a new species for it and is figured here for the sake of completeness.

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EXPLANATION OF PLATES

All figured specimens, except when otherwise indicated, in the collections of I. R. Sc. N. B., Department of Paleontology, Section of Mesozoic and Caenozoic Invertebrates (T. C. M. I. : Type Collections of Mesozoic Invertebrates; T. C. C. I. : Type Collections of Caenozoic Invertebrates).

PLATE 1

Fig. 1. — *Chlamys (Manupecten) puymoriae* (C. MAYER-EYMAR, 1857); from the Pontilevien of Pontlevoy, France; detail of right valve ornamentation; $\times 6$ (T. C. C. I. 1416).

Fig. 2. — *Chlamys faujasi* (M. DEFRANCE, 1825); from the Upper Maastrichtian of the Sint-Pietersberg near Maastricht, the Netherlands;

a : left valve; $\times 3/2$ (T. C. M. I. 9834).

b : right valve; $\times 1$ (T. C. M. I. 9826).

c : detail of young right valve; $\times 4$ (T. C. M. I. 9877).

d : detail of right valve; $\times 4$ (T. C. M. I. 9876).

e : detail of right valve; $\times 4$ (T. C. M. I. 9826).

PLATE 2

- Fig. 1. — *Chlamys* ? *elongata* (J. B. DE LAMARCK, 1818).
 a-b : left and right valve from the Cenomanian of the Cap de la Hève near Le Havre, France; $\times 3/2$ (T. C. M. I. 9832).
 c : from the Cenomanian (Tourtia de Tournai) of Montignies-sur-Roc, Hainaut, Belgium; right valve; $\times 1$ (T. C. M. I. 9822).
 d : right valve; $\times 1$ (T. C. M. I. 9823).
 e : detail of 1d; $\times 4$.

PLATE 3

- Fig. 1. — *Chlamys subdepressa* (A. D'ARCHIAC, 1847) from the Cenomanian (Tourtia de Tournai) of Tournai (carrière Delwart), Hainaut, Belgium.
 a : left valve; $\times 3/4$ (T. C. M. I. 9818).
 b : right valve; $\times 3/4$ (T. C. M. I. 9817).

PLATE 4

- Fig. 1. — *Chlamys* ? *subacuta* (J. B. DE LAMARCK, 1818).
 a-b : from the Cenomanian (Tourtia de Tournai) of Montignies-sur-Roc, Hainaut, Belgium.
 a : left valve; $\times 1$ (T. C. M. I. 9820).
 b : left valve; $\times 1$ (T. C. M. I. 9821).
 c : from the Cenomanian (Tourtia de Tournai) of Tournai, Hainaut, Belgium, left valve; $\times 3$ (T. C. M. I. 9870).
 d : from the Cenomanian of the Cap de la Hève, Le Havre, France, right valve; $\times 3/2$ (T. C. M. I. 9848).
 e : from the Cenomanian of Le Mans, Sarthe, France, detail of left valve; $\times 4$ (T. C. M. I. 9875).

PLATE 5

- Fig. 1. — *Chlamys* ? *goldfussi* (G. P. DESHAYES in A. LEYMERIE, 1843) from the Neocomian of the Haute-Marne, France.
 a : right valve; $\times 1$ (T. C. M. I. 10.096).
 b and c : detail of the right side and median pallial region.
- Fig. 2. — *Mimachlamys henrici*; nom. nov. from the Cenomanian (Tourtia de Tournai) of Tournai, Hainaut, Belgium.
 a : left valve; $\times 3/2$ (T. C. M. I. 9851).
 b : right valve; $\times 3/2$ (T. C. M. I. 9851).

PLATE 6

- Fig. 1. — *Mimachlamys mantelliana* (A. D'ORBIGNY, 1847) from the Campanian (Craie d'Obourg).
 a : of Harmignies, Hainaut, Belgium, left valve; $\times 3/2$ (T. C. M. I. 9842).
 b : of Cuesmes, Hainaut, Belgium, right valve; $\times 3/2$ (T. C. M. I. 9845).
- Fig. 2. — *Mimachlamys cretosa* (M. DEFRANCE, 1822) from the Campanian (Craie d'Obourg) of Harmignies, Hainaut, Belgium;
 a : left valve; $\times 3/2$ (T. C. M. I. 9836).
 b : right valve; $\times 3/2$ (T. C. M. I. 9837).
 c : detail of left valve; $\times 4$ (T. C. M. I. 9836).

PLATE 7

- Fig. 1. — *Mimachlamys cretosa* (M. DEFRANCE, 1822) from the Campanian (Craie d'Obourg) of Harmignies, Hainaut, Belgium.
 a : right valve; $\times 3/2$ (T. C. M. I. 9828).
 b : detail of right valve; $\times 4$ (T. C. M. I. 9828).
- Fig. 2 : *Mimachlamys robinaldina* (A. D'ORBIGNY, 1847) from the Cenomanian (Tourtia de Tournai) of Tournai, Hainaut, Belgium.
 a : left valve; $\times 3/2$ (T. C. M. I. 9833).
 b : detail of left valve; $\times 4$ (T. C. M. I. 9833).
 c : detail of large right valve; $\times 4$ (T. C. M. I. 9878).

PLATE 8

- Fig. 1. — *Mimachlamys cretosa* subsp. *denticulata* (F. VON HAGENOW, 1842).
 a : left valve from the Lower Maastrichtian of Arkona, Rügen (G. D. R.); coll. D. WOLANSKY in University of Greifswald; $\times 2.5$.
 b : incomplete right valve from the Lower Maastrichtian of Rügen (G. D. R.); VON HAGENOW coll. in University of Greifswald; $\times 2$.
 c : incomplete right valve from the Lower Maastrichtian of Rügen (G. D. R.); University of Greifswald coll.; $\times 2$.

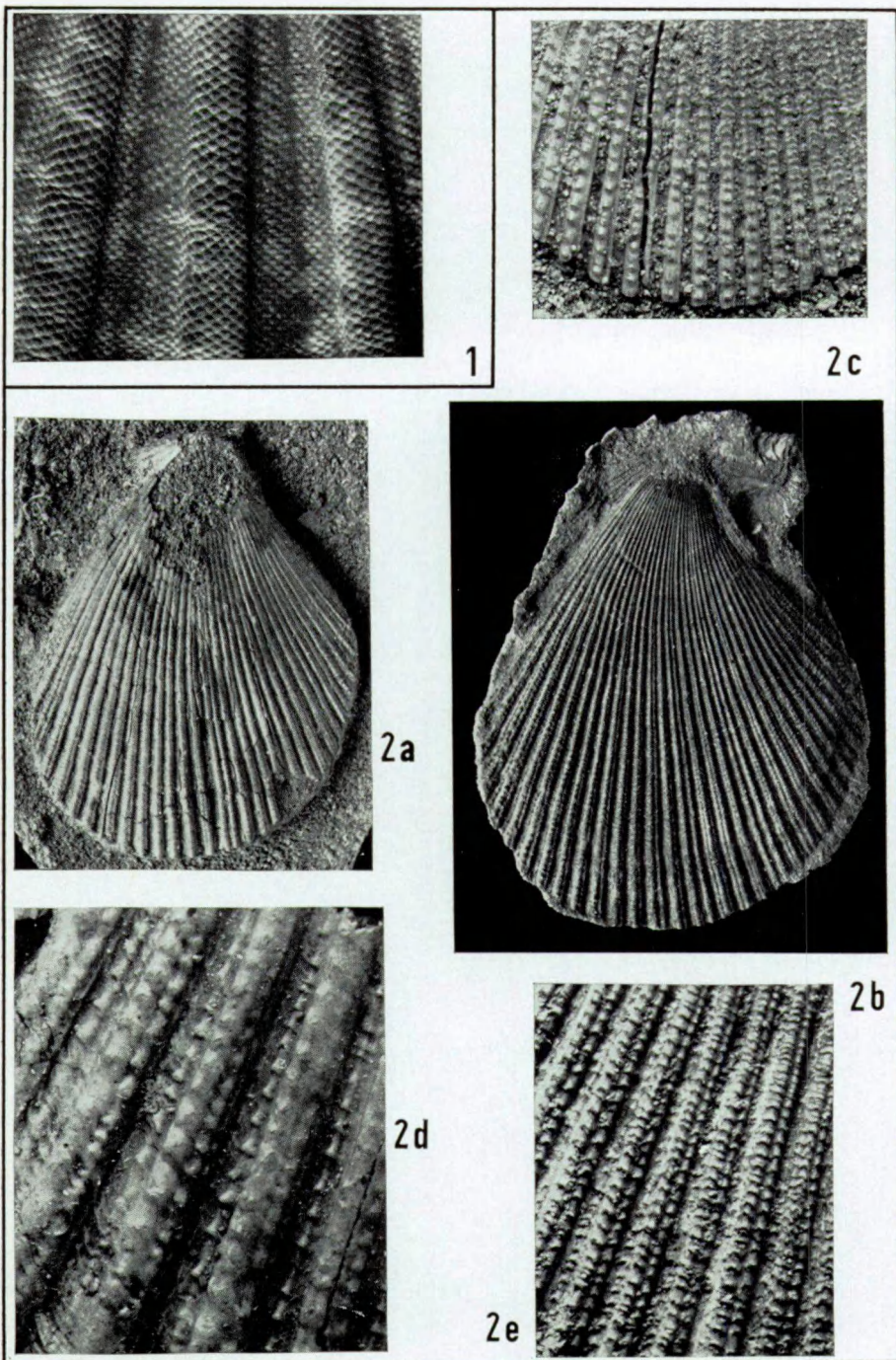
PLATE 9

- Fig. 1. — *Chlamys* ? *icaunensis* (G. COTTEAU, 1854) from the Collections of the Museum für Naturkunde, Humboldt University, Berlin (G. D. R.).
 a : incomplete left valve, lower part from the Neocomian of Gy l'Evêque, Yonne (France), $\times 3$.
 b : umbonal part of the same specimen, $\times 3$.
- Fig. 2. — *Chlamys* ? *archiaciana* (A. D'ORBIGNY, 1847) from the Collections of the Museum für Naturkunde, Humboldt University, Berlin (G. D. R.); left valve from the Neocomian of Marolles, Aube (France), $\times 1$.
- Fig. 3. — *Mimachlamys* spec. from the Tourtia de Tournai, Cenomanian, in Tournai, Hainaut (Belgium), incomplete right valve, $\times 1$ (T. C. M. I. 9824).

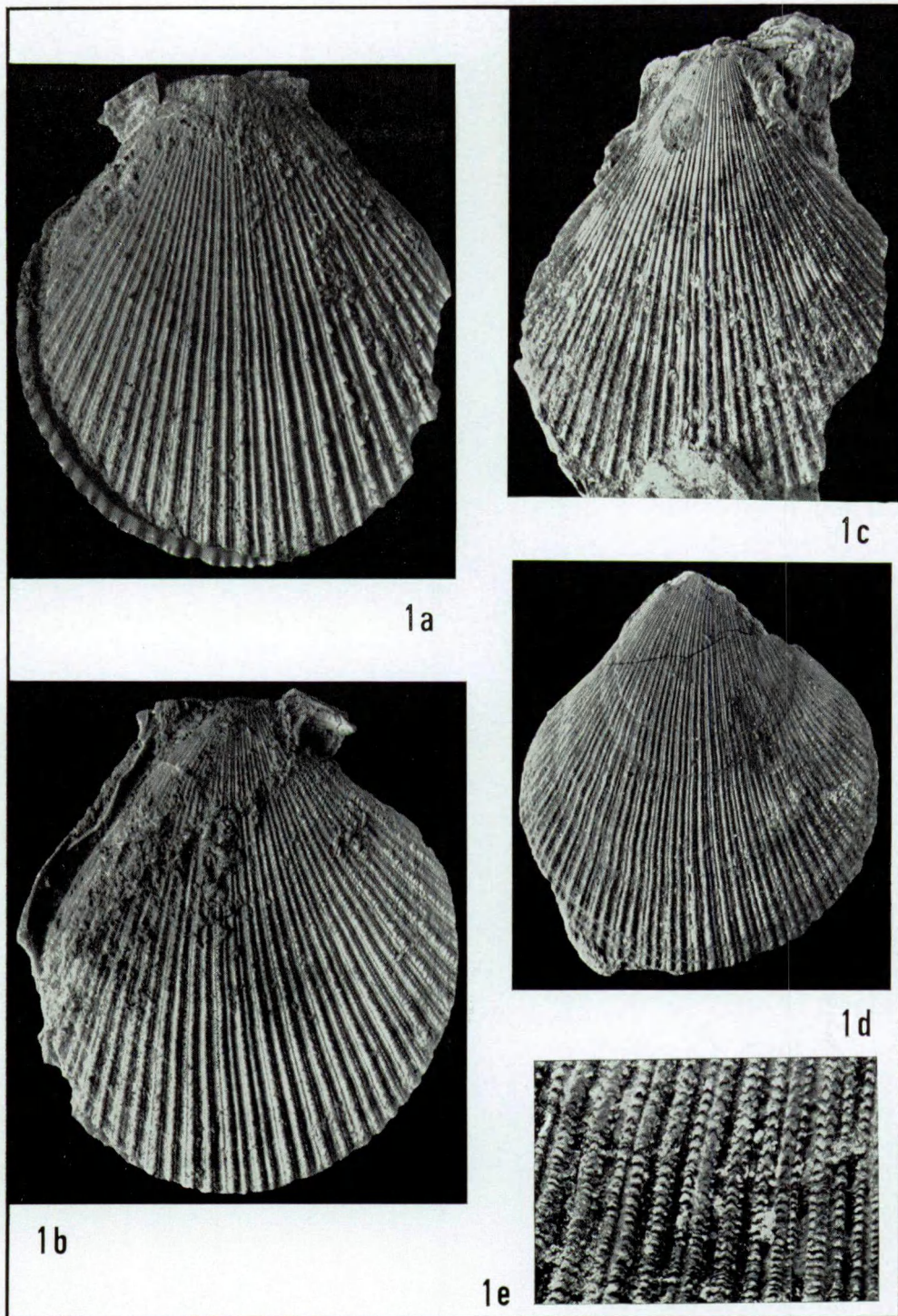
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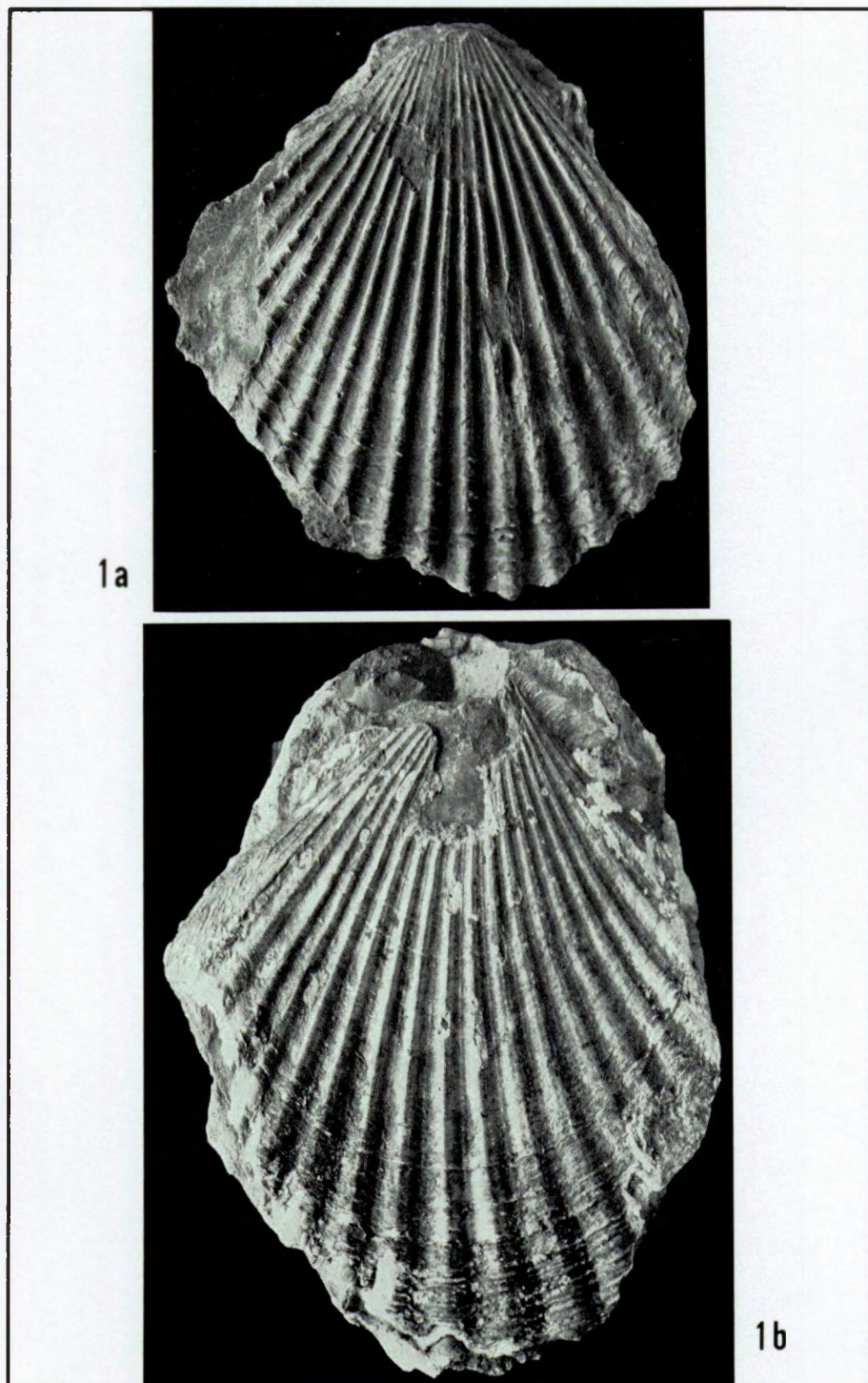
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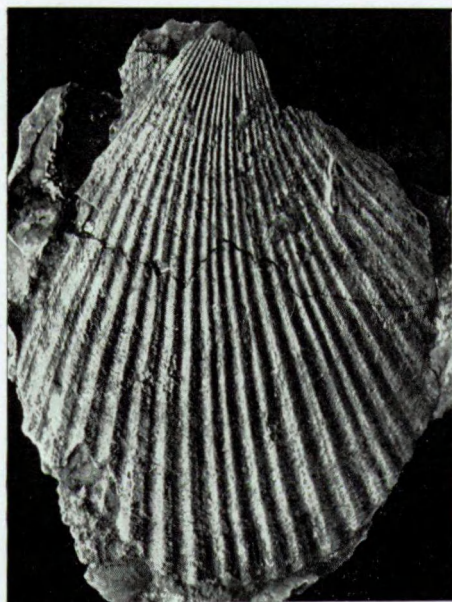
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 Part 3 : *Chlamys* and *Mimachlamys*.



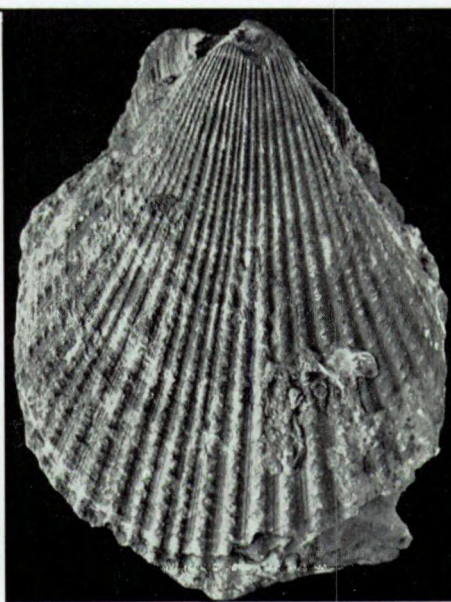
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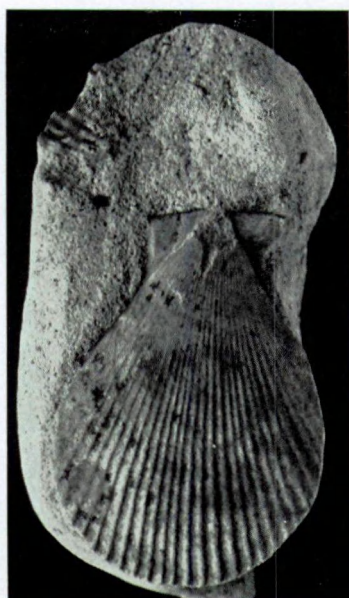
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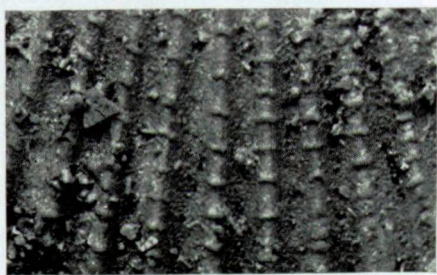
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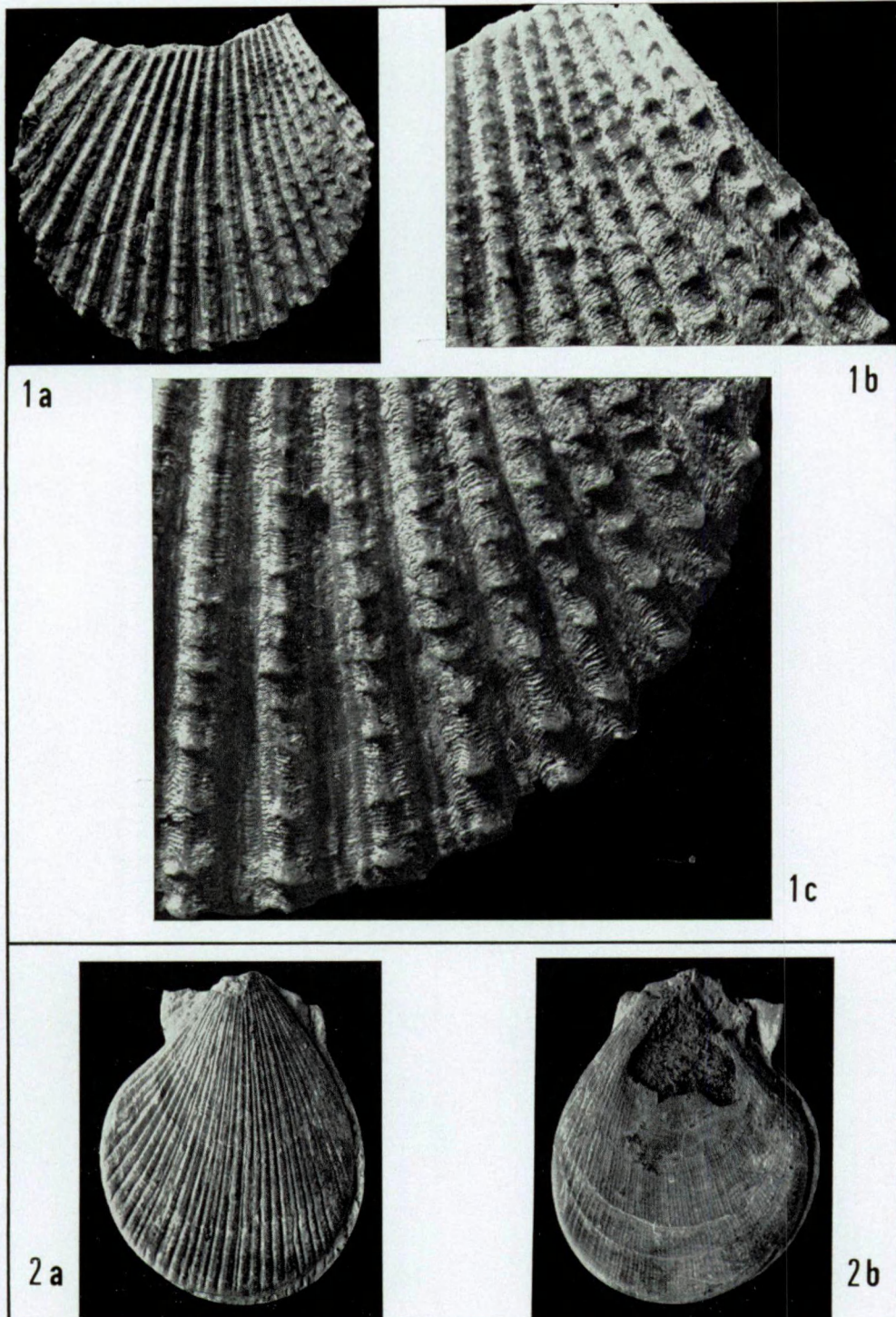


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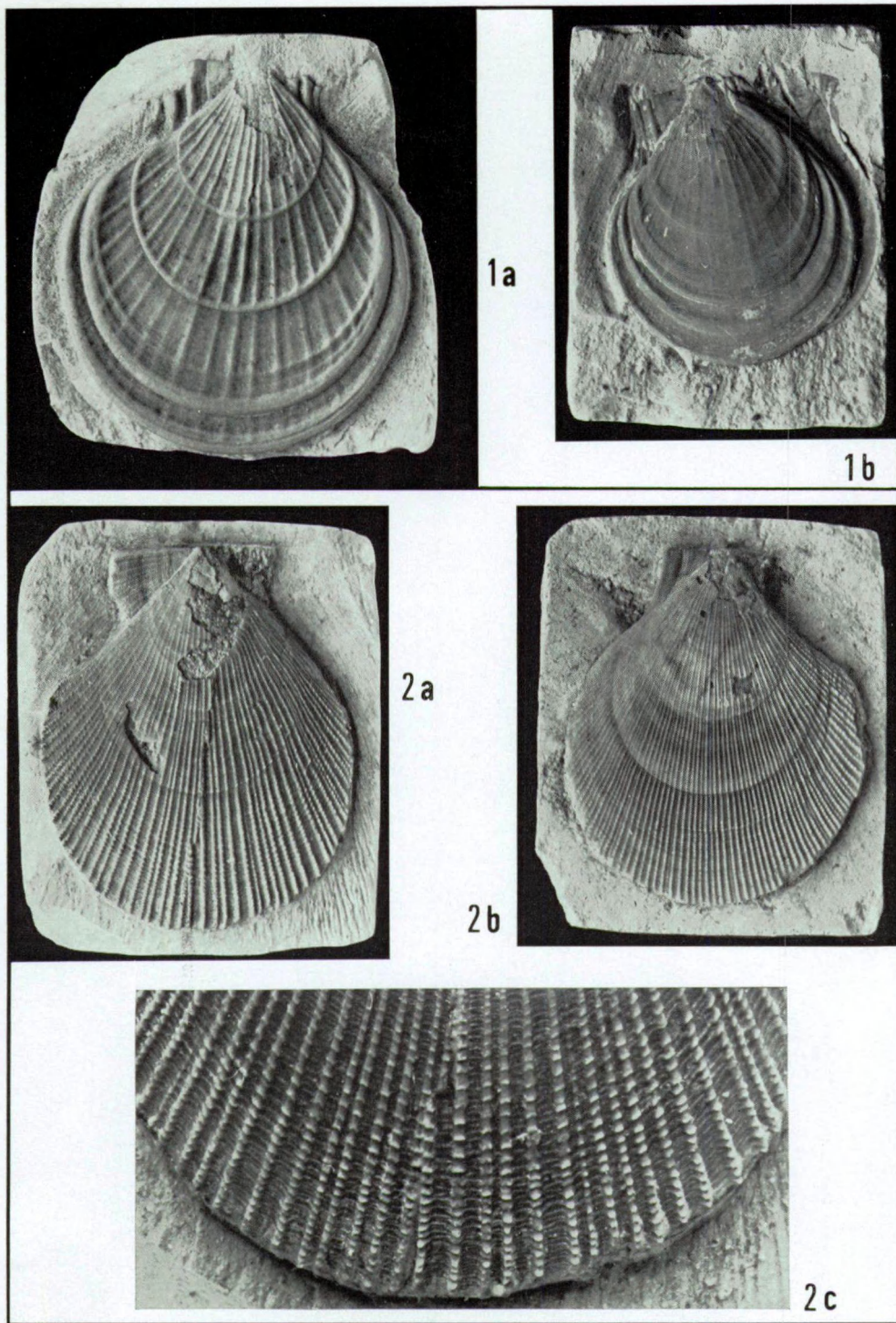


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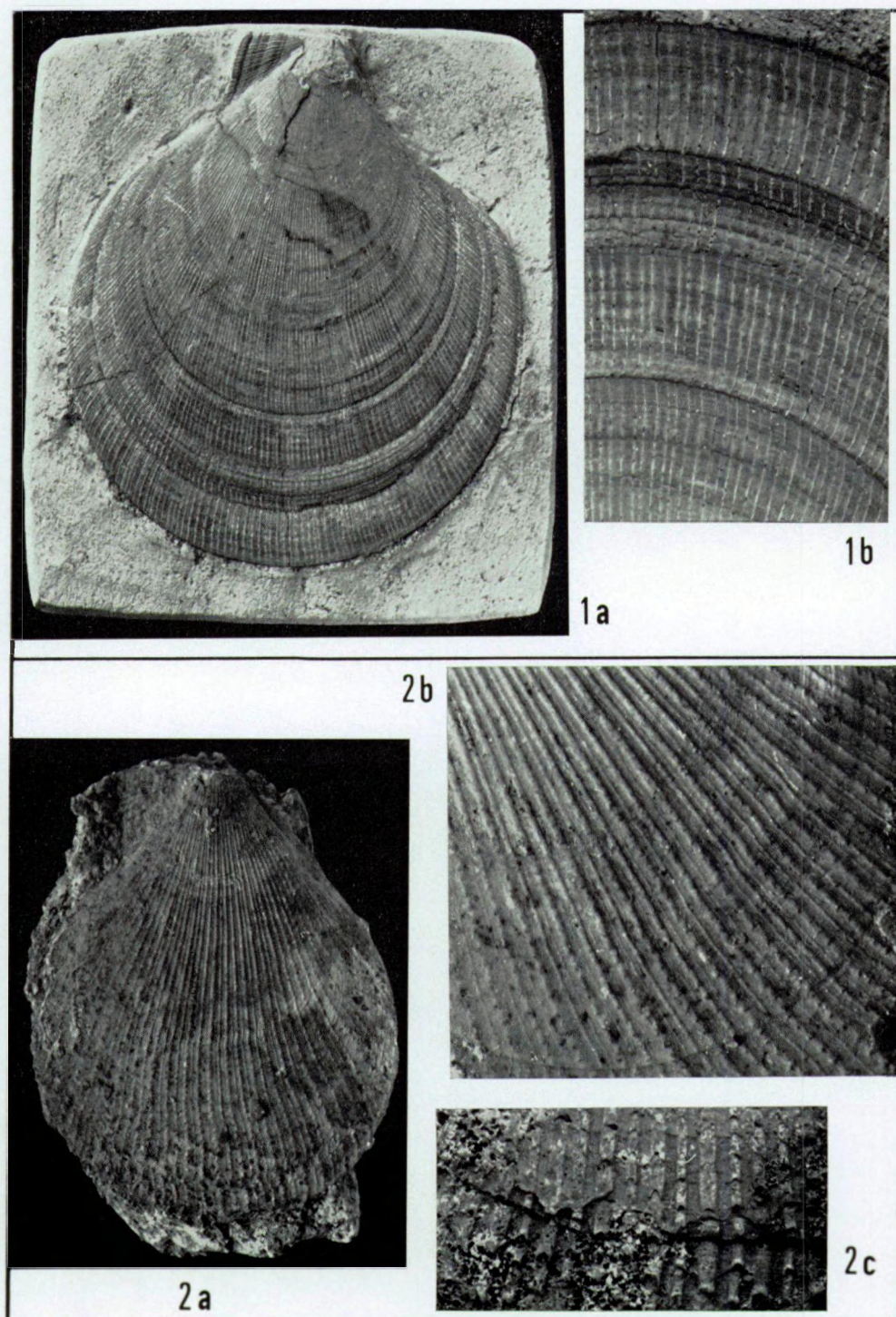
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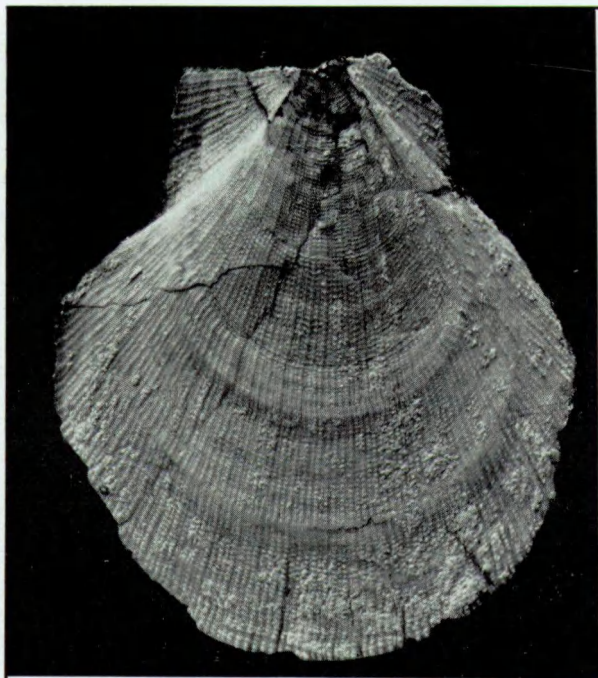
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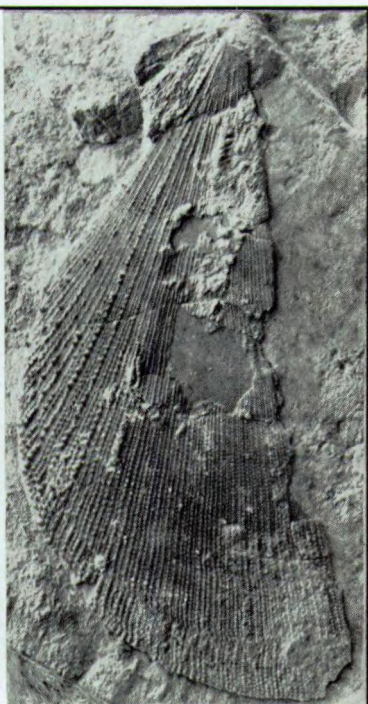
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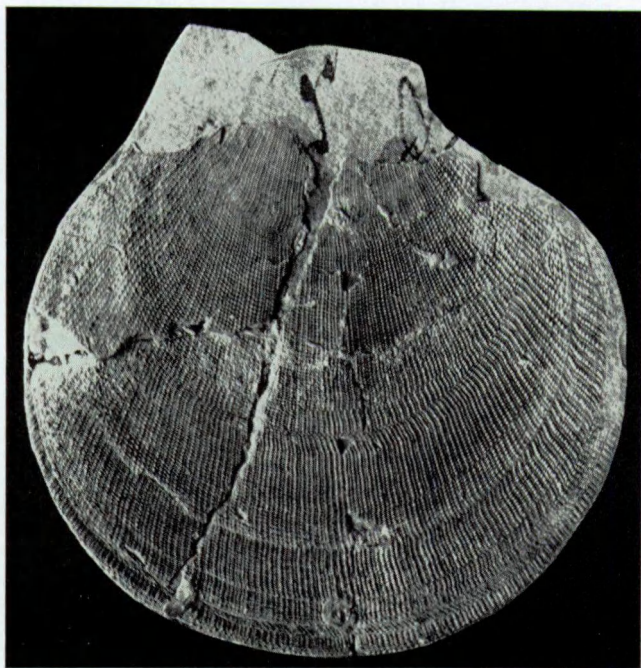
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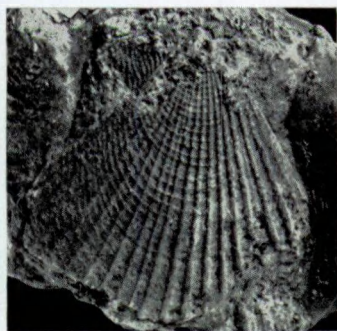


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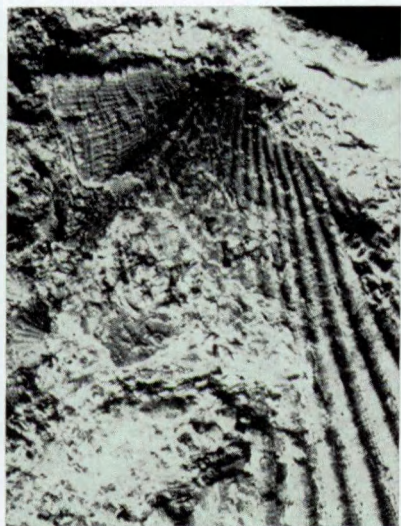
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