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BULLETIN

SYSTEMATIC REVISION OF ENTOLIUM, PROPEAMUSSIUM (AMUSIIDAE) AND SYNCYCLONEMA (PECTINIDAE, BIVALVIA, MOLLUSCA) OF THE EUROPEAN BOREAL CRETACEOUS

BY

Annie DHONDT (Brussels)

(With 4 plates)

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SUMMARY

The present paper contains a systematic revision of the genera *Entolium* and *Propeamussium (Amusiidae)* and *Syncyclonema (Pectinidae, Bivalvia, Mollusca)* in European Cretaceous boreal seas.

In *Entolium* two species are described, in *Propeamussium* one, and in *Syncyclonema* eight of which one *(S. hagenowi)* is new to science, two *(S. gamsensis* and *S. haggi)* are renamed and a former variety is given specific status *(S. haldonensis)*.

Stress is laid on redefining the species, mostly along biological lines. Material has been studied from as many localities as possible; a nomenclatorial critical revision is undertaken; type-specimens have been located; type-strata and type-localities are indicated.

RESUME

La présente étude contient la révision systématique des genres *Entolium* et *Propeamussium (Amusiidae)* et *Syncyclonema (Pectinidae, Bivalvia, Mollusca)* qui ont vécu dans les mers boréales du Crétacé d'Europe.

Pour le genre *Entolium,* deux espèces sont décrites; pour le genre *Propeamussium,* une espèce est décrite; pour le genre *Syncyclonema* huit espèces sont décrites : de celles-ci une est nouvelle *(S. hagenowi),* deux autres ont reçu un nouveau nom *(S. gamsensis & S. haggi)* et une der-

nière considérée jusqu'ici comme variété est élevée au rang d'espèce *(S. haldonensis)*.

Les espèces sont redéfinies d'après des critères biologiques; les spécimens étudiés viennent d'autant de localités que possible; une révision critique de la nomenclature a été faite; les types ont été recherchés; les localités-types avec leur niveau stratigraphique sont indiquées.

A. INTRODUCTION

The aim of the present paper is to revise the European Cretaceous « smooth » pectinids : the genera *Entolium* and *Propeamussium (Amusiidae)* and *Syncyclonema (Pectinidae)*.

The « smooth » pectinids have occasioned very widespread confusion in Cretaceous palaeontological literature, due to their apparent lack of morphological characteristics and to the insufficient descriptions of the genus *Syncyclonema*.

Two main problems were solved previously :

1. the differentiation on macroscopical characteristics of *E. membranaceum* and *S. nilsoni* by D. WOLANSKY, 1932;

2. the redescription of *Syncyclonema* based on the type-species by I. G. SPEDEN, 1967.

All the species known from the European Cretaceous are redefined, and their content is reassessed on as many specimens as were available. Thus the variability within the species may now be established.

For each species a critical synonymy list is added for taxonomical reasons; the location of the type-specimens, the type-strata, the type-locality and the original description are also given.

The stratigraphical and geographical distribution is based on personally studied specimens which makes the list of localities rather incomplete for some Eastern European countries.

At generic level the microsculpture of *Syncyclonema* is discussed.

For palaeoecology it is noteworthy that the smooth pectinid genera seem to be restricted to boreal seas.

B. ACKNOWLEDGMENTS

To the numerous people who have so kindly assisted me during the course of this work, I wish to express my appreciation and sincere gratitude.

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Dr. G. MONTAGNE, Natuurhistorisch Museum, Maastricht.

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Prof. W. MATTHES, Geologisch-paläontologisches Institut der Martin-Luther Universität, Halle-Wittenberg.

Prof. R. DEHM and Dr. P. WELLNHOFER, Institut für Paläontologie und historische Geologie (Bayerische Staatssammlung), Universität München.

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C. DESCRIPTIONS

1. Explanation of abbreviations

a. morphological and nomenclatorial terms

A. A. : apical angle.
L : left.
O. D. : by original designation.
R : right.
S. D. : by subsequent designation
spec. : specimen(s)
U. P. D. : umbo-pallial diameter (= height : H).
W. : width.

b. collections

B. : Paläontologisches Institut und Museum der von Humboldt Universität, Berlin.
B. M. : British Museum (Natural History), London.
DR. : Staatliches Museum für Geologie und Mineralogie, Dresden.
Ec. Min. : Ecole des Mines, now in Faculté d'Orsay near Paris.
Geol. Bund. : Geologische Bundesanstalt, Vienna.
Geol. Sci. : Geological Sciences Institute, London.
GH. : Geologisches Staatsinstitut, Hamburg.
GR. : Geologisch-paläontologisches Institut der Ernst-Moritz-Arndt Universität, Greifswald.
Halle : Geologisch-paläontologisches Institut der Martin-Luther Universität Halle-Wittenberg, Halle an der Saale.
I. R. Sc. N. B. : Institut royal des Sciences naturelles de Belgique, Brussels.
KO. : Mineralogisk Museum, Copenhagen.
K. U. L. : Katholieke Universiteit Leuven.
Lund : Palaeontologiska Institutionen, Universitet, Lund.
Ma. : Natuurhistorisch Museum, Maastricht.
Mü. : Institut für Paläontologie und historische Geologie, Bayerische Staatssammlung, München.
Musé. : Muséum national d'Histoire naturelle, Paris.
Mus. Gen. : Muséum d'Histoire naturelle, Geneva.
Mus. Laus. : Musée géologique, Lausanne.
N. M. W. : Naturhistorisches Museum, Vienna.
R. U. G. : Rijksuniversiteit, Ghent.
S. M. : Sedgwick Museum, Cambridge.
Univ. Neuch. : Laboratoire de Géologie, Université de Neuchâtel.
Univ. Sofia : Katedra de Paleontologia, Kliment Ochridski University Sofia.

2. Explanations of signs in synonymy-lists

1870 — There is no reason to doubt that this reference belongs to the discussed species, but there is not sufficient proof to be certain of it.

? 1870 — The specific attribution of this author seems questionable.

. 1870 — The specific attribution of this author is undoubtedly correct.

v . 1870 — I have studied the original to the description by this author and I am convinced that it belongs in the species here discussed.

v ? 1870 — I have studied the original to the description of this author and I doubt the specific attribution.

(1870) — The species is mentioned in a list; the correctness of the specific attribution cannot be checked.

3. Systematic descriptions

Family *Amusiidae* RIDEWOOD, 1903.

Subfamily *Entoliinae* VON TEPPNER, 1922.

Genus *Entolium* MEEK, 1865.

Subgenus *Entolium*.

Subgenus *Cteniopleurium* FELDTMANN, 1951.

Subfamily *Amusiinae* THIELE, 1935, em. GLIBERT & VAN DE POEL, 1965.

Genus *Propeamussium* DE GREGORIO, 1884.

Subgenus *Parvamussium* SACCO, 1897.

Family *Pectinidae* RAFINESQUE, 1815.

Subfamily *Chlamydinae* VON TEPPNER, 1922, em. SOBETSKI, 1961.

Genus *Syncyclonema* MEEK, 1864.

Discussion

The classification proposed in this paper is different from that used in the « Treatise on Invertebrate Paleontology », and it is based only on morphological characteristics.

RIDEWOOD proposed *Amusiidae* for a group of species with special soft parts anatomical features (COX, 1952, p. 33). This of course is lost for fossils.

GLIBERT & VAN DE POEL, 1965 based their division of *Pectinacea* on the presence of a *Camptonectes*-like microsculpture in *Pectinidae* and on the absence of the same microsculpture in *Amusiidae*.

In Cretaceous deposits three genera of « smooth » *Pectinidae* s.l. are known : *Entolium*, *Propeamussium* and *Syncyclonema*.

Entolium and *Propeamussium* have really smooth shells : the outside of the shell can bear a concentrical ornamentation of various nature but never a diverging radial one. These two genera have therefore been classified with the *Amusiidae*.

Syncyclonema has a « smooth » appearance but all species have a more or less developed radial very fine *Camptonectes*-like ornamentation. Hence the classification of *Syncyclonema* in the *Pectinidae*.

Family AMUSIIDAE RIDEWOOD, 1903

Subfamily *ENTOLIINAE* VON TEPPNER, 1922
(= *Pernopectininae* NEWELL, 1938
= *Entoliinae* KOROBKOV, 1960)

Genus Entolium MEEK, 1865

Type-species (O. D.) : *Pecten demissus* PHILIPS, 1829 (« as figured by QUENSTEDT, Der Jura, pl. 48, figs. 6, 7 »).

= *Entolium corneolum* (YOUNG & BIRD, 1828) (ARKELL, 1935a, p. XI) (objective synonym of *Entolium : Protamusium* VERRILL, 1897).

Subgenus Entolium

Diagnosis

Shell subequivalve, suborbicular, acline. Surface smooth and shining on both valves or with fine concentric ridges on the left valve. Auriculae well developed and subequal, byssal sinus obsolete or absent. Interior of shell smooth except for two diametrically disposed auricular crurae. These auricular crurae diverge from the umbo, forming acute angles with the auricular margins.

Discussion

Byssal sinus

Right valves have a byssal sinus in most species but it is often difficult to see it on the outside of the shell. The auricles are subequal; the auricular margin of the anterior auricle curves inwards where it reaches the disc. On the inside of the valve this is more easily recognized : the auricular crurae end before reaching the shell margins on both auricles of the left valve and on the posterior auricle of the right valve; on the anterior auricle however, it reaches the margin.

This characteristic was checked on several specimens of *E. orbiculare* (SOWERBY) (fig. B.) and on one specimen of *E.* cf. *corneolum* (YOUNG & BIRD) (*) (fig. A.).

Fig. A. — *Entolium* spec. close to *E. corneolum* from the English Upper Jurassic; right valve; (B. M. ,× 2) a.c. : auricular crurae.

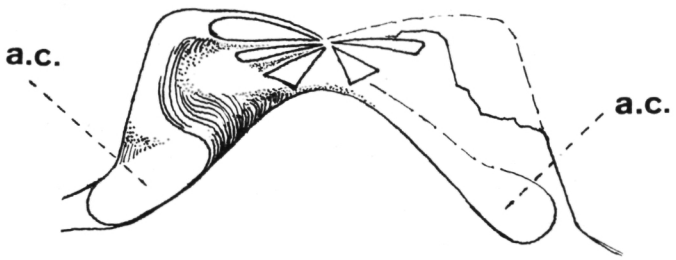

Fig. B. — *Entolium orbiculare* (SOWERBY) Burnham, Blue Bell Hill; Upper Cenomanian; right valve : hinge; (B. M. L 10376 ,× 4) a.c. auricular crurae.

On *E. membranaceum* (NILSSON) the byssal sinus seems to be absent : the auricles are almost perfectly equal. Whether the auricular crurae reach the margin on anterior right valve auricles could not be checked : the preservation state of most specimens is such that the interior shell layer is eroded and this layer forms most of the crurae.

Subgenus Cteniopleurium FELDTMANN, 1951

Type species : *Syncyclonema subreticulatus* FELDTMANN, 1951 (O. D.).

For detailed description see original publication and Treatise Mollusca 6, p. N 347. This subgenus differs mainly from *Entolium* s.s. by having a spinose radial ornamentation, which is not recorded otherwise in the *Entoliinae*.

(*) The specimen of *E. corneolum* was uncovered by Mr. A. E. RIXON (Dep. Paleontology, British Museum, Natural History) to whom I would like to express my sincere gratitude.

The shell inside figured by FELDTMANN, pl. 1, f. 8, is an almost perfect replica of the interior of *E. orbiculare* (SOWERBY) and this proves that *Cteniopleurium* is a subgenus of *Entolium*, and not of *Syncyclonema*, since the latter genus does not have strongly developed auricular crurae.

Stratigraphical range

Jurassic to Upper Cretaceous.

Geographical distribution

Entolium (Entolium) : cosmopolitan, but only in non-Tethyan deposits during the Cretaceous.
Entolium (Cteniopleurium) : restricted to Australia.

Entolium orbiculare (SOWERBY, 1817)
(Pl. I, fig. 1 a, b)

v . 1817	— *Pecten orbicularis*	J. SOWERBY, p. 193, pl. 186.
. 1819	— *Pecten orbicularis*	J. B. LAMARCK, p. 182, n° 16.
. 1822	— *Pecten laminosus*	G. MANTELL, p. 128, pl. 26, f. 8, 22.
. 1825	— *Pecten orbicularis* Sow.	M. DEFRANCE, p. 252.
v . 1836	— *Pecten laminosus* Mant.	A. GOLDFUSS, p. 76, pl. 99, f. 9.
v . 1839	— *Pecten laminosus* (pro parte)	H. B. GEINITZ, p. 23.
. 1839	— *Pecten circularis*	H. B. GEINITZ, p. 23.
non 1836	*Pecten circularis* A. Goldfuss.	
(1839)	— *Pecten laminosus*	A. D'ARCHIAC, p. 278.
(1841)	— *Pecten orbicularis*	A. LEYMERIE, p. 323.
. 1841	— *Pecten orbicularis* Sow.	F. A. ROEMER, p. 49.
. 1841	— *Pecten laminosus* Mant.	F. A. ROEMER, p. 49.
. 1843	— *Pecten orbicularis* Sow.	H. B. GEINITZ, p. 16.
(1843)	— *Pecten orbicularis*	A. LEYMERIE, p. 27.
v . 1845	— *Pecten orbicularis* Sowerby (pro parte)	A. D'ORBIGNY, p. 439, pl. 6, f. 18-20.
(1845)	— *Pecten orbicularis*	E. FORBES, p. 249.
? 1846	— *Pecten orbicularis* Sowerby	A. E. REUSS, p. 27, pl. 41, f. 28.
. 1846	— *Pecten laminosus* Mantell	A. E. REUSS, p. 27, pl. 39, f. 5.
v . 1847	— *Pecten orbicularis* Sowerby (pro parte)	A. D'ORBIGNY, p. 597, pl. 433, f. 14-16.
(1849)	— *Pecten orbicularis* So.	H. G. BRONN, p. 928.

	1850	— *Pecten orbicularis* Sow.	H. B. GEINITZ, p. 180.
v .	(1850)	— *Pecten Darius* d'Orb.	A. D'ORBIGNY, p. 139, n° 277.
v .	(1850)	— *Pecten orbicularis* Sow.	A. D'ORBIGNY, p. 169, n° 482.
v .	(1850)	— *Pecten Calypso* d'Orb.	A. D'ORBIGNY, p. 169, n° 484.
v .	(1850)	— *Pecten Neptuni* d'Orb.	A. D'ORBIGNY, p. 169, n° 483.
non	1841	*Pecten Neptuni* F. A. Roemer.	
	1852	— *Pecten orbicularis* Sow.	R. KNER, p. 315.
	(1852)	— *Pecten orbicularis* Sowb.	C. G. GIEBEL, p. 359.
.	1854	— *Pecten orbicularis* Sow.	J. MORRIS, p. 177.
	(1854)	— *Pecten orbicularis* Sow.	G. COTTEAU, p. 115.
	(1854)	— *Pecten Darius* d'Orb.	G. COTTEAU, p. 115.
	(1861)	— *Pecten orbicularis* Sow.	W. GABB, p. 215.
	(1861)	— *Pecten Calypso* d'Orb.	W. GABB, p. 213.
	(1861)	— *Pecten Darius* d'Orb.	W. GABB, p. 214.
	1863	— *Pecten orbicularis* Sow.	D. STUR, p. 55.
	1863	— *Pecten orbicularis* Sow.	A. VON STROMBECK, p. 108.
?	(1863)	— *Pecten orbicularis* Nils.	R. DRESCHER, p. 353.
	(1866)	— *Pecten laminosus* Mant.	C. GIEBEL, p. 50.
.	1868	— *Pecten laminosus* Mant.	E. EICHWALD, p. 423.
.	1868	— *Pecten orbicularis* Sow. (pro parte)	E. EICHWALD, p. 423, pl. 20, f. 4 a-b.
v .	1869	— *Pecten sublaminosus* E. Favre	E. FAVRE, pp. 143-144, pl. 13, f. 1.
v .	1870	— *Pecten orbicularis* Sow.	F. J. PICTET & G. CAMPICHE, p. 206.
?	1870	— *Pecten membranaceus*	F. A. ROEMER, p. 333, pl. 26, f. 5.
non	1827	*Pecten membranaceus* S. Nilsson.	
	1870	— *Pecten orbicularis*	W. A. OOSTER, p. 57.
	(1871)	— *Pecten (Syncyclonema) orbicularis* Sow.	F. STOLICZKA, p. 428.
?	1871	— *Amusium sulcatellum* Stoliczka	F. STOLICZKA, p. 436, pl. 31, f. 12, 17.
v .	1872	— *Pecten laminosus* Mant.	H. B. GEINITZ, p. 192, pl. 43, f. 14.
.	1873	— *Pecten opercularis* (laps. cal.)	W. DAMES, p. 68.
.	1874	— *Pecten (Amusium) orbicularis* Sow.	W. DAMES, p. 763.
?	1874	— *Pecten laminosus* Mantell.	W. DAMES, p. 763.
.	1874	— *Pecten (Amusium) balticus* nov. sp.	W. DAMES, p. 762, pl. 21, f. 1.
	(1876)a	— *Pecten laminosus* Mant.	C. BARROIS, p. 4.
	(1876)b	— *Pecten laminosus* Mant.	C. BARROIS, p. 147.
.	1877	— *Pecten laminosus* Mant.	A. FRITSCH, p. 136, f. 126.

	(1877)	— *Pecten orbicularis* Sow.	G. BOEHM, p. 233.
	? 1882	— *Pecten orbicularis* Sowerby	J. KIESOW, p. 415.
v	. 1882	— *Pecten Darius* d'Orbigny	P. DE LORIOL, pp. 84-85, pl. 10, f. 6.
	1882	— *Pecten* cf. *orbicularis* Sow.	R. WINDMOELLER, p. 20.
v	. (1883)	— *Pecten orbicularis* Sowerby var. *magnus* var. nov.	W. KEEPING, p. 106, pl. 5, f. 1.
	(1885)	— *Pecten (Syncyclonema) orbicularis* Sowerby	F. NOETLING, p. 19, pl. 3, f. 4, 5.
	(1885)	— *Pecten (Syncyclonema) laminosus* Mantell	F. NOETLING, p. 19, pl. 3, f. 3.
	(1885)	— *Pecten (Entolium) balticus* Dames	F. NOETLING, p. 17, pl. 2, f. 7.
	? 1885	— *Syncyclonema sublaminosa* E. Favre	J. BOEHM, p. 83.
	(1888)	— *Pecten laminosus* Mant.	F. E. GEINITZ, p. 728.
	1893	— *Pecten orbicularis* Sow.	R. MICHAEL, p. 236.
	1893	— *Pecten laminosus* Mant.	R. MICHAEL, p. 235.
	(1893)	— *Pecten* sp. cf. *laminosus* Mant.	R. MICHAEL, p. 207.
	? 1895	— *Pecten Cottaldinus*	G. MAAS, p. 269.
non	1847	*Camptonectes cottaldinus*	(A. d'Orbigny)
	. 1896	— *Pecten orbicularis* Sow. var. *Lohmanni* n. var.	A. WOLLEMANN, p. 839, pl. 21, f. 1.
	. 1896	— *Pecten (Syncyclonema) Losseriensis* spec. nov.	F. VOGEL, pp. 54-55, pl. 3, f. 14, 15.
	(1897)	— *Pecten laminosus* Mant.	G. RADKEWITSCH, p. 100.
	(1897)	— *Pecten orbicularis* Sow.	G. RADKEWITSCH, p. 100.
?	(1897)	— *Pecten balticus* Dames	G. RADKEWITSCH, p. 100.
	(1897)	— *Pecten (Amussium) orbicularis* (Mant.)	W. F. HUME, p. 548, 549, 551, 553, 555, 559.
	? 1897	— *Pecten orbicularis*	U. SOEHLE, p. 40, pl. 4, f. 8.
	1897	— *Syncyclonema orbicularis*	R. B. NEWTON, p. 84, pl. 3, f. 9.
	(1898)	— *Pecten orbicularis* Sow.	A. J. JUKES-BORWNE & J. MILNE, p. 30.
	(1899)	— *Pecten germanicus* Wollemann	G. MAAS, p. 252.
	(1899)a	— *Pecten* cf. *orbicularis* Sow.	A. WOLLEMANN, p. 64.
	(1899)b	— *Pecten orbicularis* Sow.	A. WOLLEMANN, p. 85.
	(1899)c	— *Pecten orbicularis* Sow.	A. WOLLEMANN, p. 91.
	(1900)	— *Pecten orbicularis* Sby.	G. DIBLEY, p. 494.

.	1900	— *Pecten Germanicus* n. sp.	A. WOLLEMANN, pp. 41-44, pl. 8, f. 13-19.
.	1900	— *Pecten Losseriensis* Vogel	A. WOLLEMANN, p. 44.
.	1901	— *Pecten orbicularis*	J. CORNET, p. B 56, B 58.
v .	1902	— *Pecten (Syncyclonema) orbicularis* Sowerby (pro parte)	H. WOODS, pp. 145-152, pl. 17, textf. 1 non pl. 17, f. 4 (var. haldonensis).
	(1903)	— *Pecten (Syncyclonema) orbicularis* Sow.	G. W. LAMPLUGH & J. F. WALKER, p. 263.
	(1905)	— *Pecten laminosus* Nilss. (sic)	J. J. JAHN, p. 76.
	(1905)	— *Pecten orbicularis* d'Orb. (sic)	J. J. JAHN, p. 76.
.	1905	— *Pecten orbicularis* Sow.	E. HARBORT, pp. 38-40.
.	1906	— *Pecten orbicularis* Sow.	A. WOLLEMANN, pp. 267-268.
?	1906	— *Pecten (Syncyclonema)* aff. *sublaminosus Favre*	J. PETHÖ, pp. 212-213, pl. 15, f. 5.
	(1907)	— *Pecten (Syncyclonema) orbicularis* Sowerby	W. D. LANG, p. 154.
?	(1907)	— *Pecten* cf. *laminosus* Goldfuss	H. SCUPIN, p. 697.
.	1908	— *Pecten (Syncyclonema) orbicularis* J. Sowerby	F. L. KITCHIN, p. 65, pl. 2, f. 2, 3.
	(1908)	— *Pecten orbicularis* Sow.	G. W. YOUNG, p. 454.
	(1908)	— *Pecten Darius*	F. BESTEL, p. 125.
	1909	— *Pecten (Entolium) membranaceus*	K. WANDERER, p. 32, pl. 5, f. 11.
	1909	— *Pecten (Entolium) Nilssoni*	K. WANDERER, p. 32, pl. 5, f. 12.
	(1910)	— *Pecten orbicularis* Sowerby	E. PÉROUX, p. 60.
	(1910)	— *Pecten orbicularis*	C. R. BOWER & J. R. FARMERY, p. 346, 348, 349, 351.
	1911	— *Pecten laminosus* Mant.	A. FRITSCH, p. 43, f. 198.
.	1911	— *Pecten (Syncyclonema) orbicularis* Sow.	B. BUJALSKI, p. 439.
	1911	— *Pecten (Syncyclonema) orbicularis* Sow.	B. BUJALSKI, p. 439.
	1912	— *Pecten (Syncyclonema) Germanicus* Wllm.	A. WOLLEMANN, p. 156.
	1912	— *Pecten (Syncyclonema) orbicularis*	C. LOPUSKI, p. 214.
?	1913	— *Pecten orbicularis* Sow.	P. N. TSCHIRWINSKY, p. 40.

1913	— *Pecten (Syncyclonema)* conf. *laminosus* Goldf.	H. SCUPIN, p. 219, pl. 12, f. 14.
1914	— *Pecten (Syncyclonema)* cf. *orbicularis* Sow.	M. MORAND, pp. 225-226.
. 1914	— *Pecten (Syncyclonema) orbicularis* Sowerby	E. LANGE, p. 210, pl. 16, f. 2.
. 1914	— *Pecten (Syncyclonema)* aff. *Losseriensis* Vogel	E. LANGE, pp. 211-212, pl. 16, f. 3.
1915	— *Pecten germanicus* Woll.	E. JEKELIUS, p. 125.
v . 1916	— *Pecten (Syncyclonema) orbicularis*	J. P. J. RAVN, p. 27, pl. 5, f. 6-7.
(1917)	— *Pecten (Syncyclonema) orbicularis* J. Sow.	H. A. ALLEN, p. 83.
(1918)	— *Pecten orbicularis*	G. E. DIBLEY, p. 87.
? 1918	— *Pecten (Syncyclonema) orbicularis* Sowerby	J. WOLDRICH, p. 288, pl. 5, f. 2 a, b.
(1920)	— *Pecten (Syncyclonema) orbicularis* J. Sow.	F. L. KITCHIN & J. PRINGLE, p. 54.
(1923)	— *Pecten orbicularis* Sow.	J. CORNET, p. B 140.
(1924)	— *Pecten orbicularis* Sow.	M. SCHLOSSER, p. 87.
v . 1925	— *Pecten (Syncyclonema) orbicularis* Sow.	J. P. J. RAVN, pp. 30-31.
? 1926	— *Pecten (Syncyclonema) orbicularis* Sow.	L. NOETH, p. 476.
(1931)	— *Pecten laminosus*	A. BENOIT, p. 79, 80, 81.
(1931)	— *Pecten orbicularis* Sow.	B. KOKOSZYNSKA, p. 668.
. 1931	— *Pecten (Entolium) orbicularis* Sow.	D. SOKOLOV & W. BODYLEVSKY, pp. 52-53, pl. 4, f. 2.
? 1931	— *Pecten (Entolium)* spec. A	D. SOKOLOV & W. BODYLEVSKY, p. 53.
? 1931	— *Pecten (Entolium)* spec. C	D. SOKOLOV & W. BODYLEVSKY, p. 54.
. 1931	— *Pecten (Camptonectes)* cf. *cinctus* Sow.	D. SOKOLOV & W. BODYLEVSKY, pp. 57-58, pl. 4, f. 9.
(1933)	— *Pecten laminosus*	A. BENOIT, p. 10, 13, 14, 17, 22.
. 1933	— *Pecten orbicularis* Sow.	N. POLUTOFF, p. 26.
(1936)	— *Pecten orbicularis* Sow.	A. LUNIEWSKI, p. 121, 128.
(1936)	— *Pecten (Syncyclonema) orbicularis* Sow.	M. KOBYLECKI, p. 48.
(1937)	— *Pecten* cf. *orbicularis*	S. Z. ROZYCKI, p. 31.
(1937)	— *Pecten (Entolium) orbicularis* Sow.	H. FREBOLD & E. STOLL, p. 33.
v . 1937	— *Pecten (Entolium)* cf. *orbicularis* Sow.	H. FREBOLD & E. STOLL, p. 34.

v .	1937	— *Pecten (Syncyclonema) orbicularis* Sowerby (pro parte)	L. LEHNER, p. 181, pl. 26, f. 5, p. 183.
v .	1939	— *Pecten (Syncyclonema) orbicularis* Sow.	E. DACQUÉ, p. 51, pl. 1, f. 4, pl. 4, f. 1.
.	1940	— *Syncyclonema orbicularis* Sow.	G. TAVANI, p. 49.
	(1942)	— *Syncyclonema orbiculare* (sic) (J. Sow.)	C. W. & E. V. WRIGHT, p. 117.
v .	(1947)	— *Entolium orbiculare* (J. Sow.)	C. W. & E. V. WRIGHT, p. 165.
	1948	— *Syncyclonema orbicularis* (Sow.)	G. TAVANI, p. 98.
	(1949)	— *Pecten* cf. *orbicularis* Sow.	W. MAYNC, p. 244, 258.
?	1949	— *Syncyclonema* cf. *orbicularis* Sow.	E. NALDINI, p. 88.
.	1953	— *Entolium* cf. *orbicularis* (laps. cal.) (J. Sowerby)	D. T. DONOVAN, p. 96.
	(1956)	— *Entolium orbiculare* (J. Sow.)	R. CASEY, p. 232.
	(1956)	— *Pecten laminosus* Man.	K. A. TROEGER, p. 89.
	(1957)	— *Pecten germanicus*	W. HALLER, p. 133.
	(1957)	— *Pecten germanicus* var. *lohmanni*	W. HALLER, p. 133, pl. 20, f. 2.
	(1957)	— *Entolium* cf. *orbicularis* (laps. cal.) (J. Sowerby)	D. T. DONOVAN, p. 210.
	(1957)	— *Pecten Orbicularis*	L. CAYEUX, p. 13.
?	(1958)	— *Chlamys suborbicularis*	L. CAYEUX, p. 12.
	(1964)	— *Pecten (Syncyclonema) orbicularis* Sow.	H. ARNOLD & K. H. TASCH, p. 642.
	(1964)c	— *Pecten (Sync.) orbicularis* Sow.	H. ARNOLD, p. 317.
	(1964)c	— *Pecten orbicularis magnus* Keeping	H. ARNOLD, p. 317.
	(1966)	— *Entolium orbiculare*	J. S. BIBBY, p. 25.
	(1968)	— *Syncyclonema orbicularis*	M. V. TITOVA, L. A. TVERSKAJA & N. B. BEKASOVA, p. 46.
	(1968)	— *Entolium balticum* (Dam.)	S. I. PASTERNAK, V. I. GAVRILISHIN, Yu. N. SENKOVVSKY, p. 971.
non	1827	*Pecten orbicularis* = *Syncyclonema nilsoni* (Goldfuss)	S. NILSSON, p. 23, pl. 10, f. 12.

non 1859 *Pecten orbicularis* J. T. BINKHORST VAN DEN BINKHORST, p. 154.

non 1921 *Pecten (Syncyclonema) orbicularis* J. P. J. RAVN, p. 22.
= *Entolium membranaceum* (Nilsson)

Location and designation of type-specimens

lost (fide WOODS, 1962).
Pecten laminosus : Id.
Pecten darius : Muséum national d'Histoire naturelle, Coll. D'ORBIGNY 6002 A.
Pecten calypso : same collection 6449.
Pecten neptuni : same collection 6450.
Pecten sublaminosus : Naturhistorisches Museum, Vienna.
Pecten balticus : has not been located.
Pecten losseriensis : Paleontologisch Instituut, University of Leiden.
Pecten germanicus : lost during World War II (Technische Hochschule in Brunswick).

Stratum typicum :

Greensand (Upper Greensand : Cenomanian).
Pecten laminosus : Grey Chalk Marl (Upper Cenomanian).
Pecten darius : Albien.
Pecten calypso : Cénomanien.
Pecten neptuni : id.
Pecten sublaminosus : has not been designated by the author.
Pecten balticus : Cenoman.
Pecten losseriensis : Neocomsandstein (Neocomian).
Pecten germanicus : Neocom.

Locus typicus :

Devizes (Great Britain) (O. D.).

Pecten laminosus : Hamsey (Great Britain) (O. D.).
Pecten darius : Varennes (Meuse) (France) (chosen here).
Pecten calypso : Le Mans (Sarthe) (France) (O. D.).
Pecten neptuni : Le Mans (Sarthe) (France) (O. D.).
Pecten sublaminosus : Nagorzany (*) (Ukraïne, U. S. S. R.) (O. G.).

(*) According to W. ROGALA, 1909 p. 693 the specimen described by FAVRE as coming from the Upper Senonian Nagorzany strata comes actually from the Cenomanian strata in Podolia. After FAVRE's paper its impact must have been very strong : in several old museums (Ec. Min., KO., N. M. W.) specimens of *E. orbiculare* labelled Nagorzany are found.

Pecten balticus : on « Geschiebe », but no locality designated.

Pecten losseriensis : Losser (G. F. R.) (O. D.).

Pecten germanicus : Grenzler Burg. b. Salzgitter (G. F. R.) (chosen here).

Original descriptions

« Spec. Char. Orbicular, much depressed, concentrically striated; striae elevated, sharp; one valve smooth; ears nearly equal, broadest at the base.

A thin tender shell; the striae are many, a line distant from each other; the length and breadth are equal; the ears rather large.

One of the tender products of the green sand of the Devizes canal, preserved by Mrs. GENT. It appears to be unfrequent, as I have seen but one individual.

Pecten laminosus

Suborbicular, much depressed, concentrically laminated, ears nearly equal.

This shell so closely resembles *P. orbicularis* of SOWERBY (Min. Conch. tab. 186) that at first I was induced to consider it as belonging to that species : a more careful examination has however detected differences which appear to be specific.

The striae in *P. orbicularis*, are described as elevated and sharp; but in the shell before us they are very slight, and are produced by the termination of concentric laminae. The shell is very thin, and possesses a glossy appearance; the width and length are nearly equal.

Localities. Hamsey, Stoneham. »

Description of topotypes

Specimens. — 5 specimens from the collections of the B. M. (Nat. Hist.).

Left valve : 24 219.

Right valves : 41 681; 88 925 (2 specimens); L 6 371.

Measurements :

U. P. D. varies from 42.1 mm to 46.4 mm; av. 43.7 mm

W. varies from 39.3 mm to 45.6 mm; av. 43.3 mm

A. A. varies from 96° to 111°; av. 105°

angle between the hinge margins of the auricles : varies from 132° to 147°; av. 141°.

Description :

Right valve : slightly more convex than the left valve; smooth, except for microscopic growthlines. Auricles are relatively small; projected above the hinge-line, but in a lesser degree than on the left valve. An obsolete byssal sinus can be seen.

Left valve : bears concentric ridges separated by shallow furrows. The auricles are equal, triangular and obtuse-angled, though more or less rounded; they are projected dorsally.

Additional description

Number of studied specimens : total : 483.

British Berriasian	12 specimens
British Valanginian	2 specimens
British Hauterivian	27 specimens
British Barremian	2 specimens
West German Neocomian	15 specimens
French Neocomian	3 specimens
Swiss Neocomian	8 specimens
British Aptian	17 specimens
Belgian Albian	8 specimens
British Albian	82 specimens
French Albian	35 specimens
Norwegian Albian	2 specimens
Polish Albian	2 specimens
West German Albian	2 specimens
Swiss Albian	1 specimen
Belgian Cenomanian	26 specimens
British Cenomanian	56 specimens
Danish Cenomanian	13 specimens
French Cenomanian	47 specimens
Irish Cenomanian	5 specimens
Iraqi Cenomanian	7 specimens
East German Cenomanian	12 specimens
Polish Cenomanian	7 specimens
Czech Cenomanian	7 specimens
West German Cenomanian ...	34 specimens
Ukrainian Cenomanian	5 specimens
Belgian Turonian	15 specimens
British Turonian	31 specimens

Measurements :

BERRIASIAN : Spilsby sandstone, *Acre Ho* (Lincs.) (B. M.)

U. P. D. mm	W. mm	A. A.	auricular A.	Index	Side
—	—	—	—	—	—
44.7	44.1	114°	131°	1.0136	—
23.2	20.3	94°	136°	1.1428	—

ALBIAN : *Black Fenn* (Dorset) (B. M.)

18.6	15.9	101°	—	1.1698	L
16.4	15.0	88°	—	1.0933	L
12.7	11.7	84°	—	1.0855	L

U. P. D. mm	W. mm	A. A.	auricular A.	Index	Side
—	—	—	—	—	—
	Bonchurch (Isle of Wight) (B. M.)				
40.5	38.8	107°	144°	1.0438	L
	Burghelere (Hants.) (B. M.)				
28.6	26.1	96°	—	1.0958	L
20.6	—	100°	—	—	
	Folkestone (Kent) (B. M.)				
7.6	6.9	88°	131°	1.0251	13 L
to	to	to	to	to	—
35.3	33.6	114°	157°	1.1955	5 R
av.	av.	av.	av.	av.	—
24.1	19.5	99°	145°	1.1035	
	Froyle (B. M.)				
34.4	33.2	98°	133°	1.0361	R
26.6	—	111°	140°	—	L
14.2	12.9	89°	—	1.1008	L
—	34.6	95°	—	—	R
	Melbury Abbass, Shaftesbury (Dorset) (B. M.)				
26.9	23.9	89°	146°	1.1255	L
	Ventnor (Isle of Wight) (B. M., S. M.)				
20.0	17.2	91°	—	1.0073	—
to	to	to		to	3 R
55.9	55.2	112°	—	1.1628	5 L
av.	av.	av.		av.	—
45.2	43.5	102°	—	1.0551	—
	Warminster (B. M.)				
30.9	27.7	92°	137°	0.9927	—
to	to	to	to	to	4 R
54.7	55.1	105°	147°	1.1959	8 L
av.	av.	av.	av.	av.	—
39.3	36.4	98°	143°	1.0988	—
CENOMANIAN : *Burwell* (Cambs.) (S. M.) — Chalk Marl					
27.1	24.7	98°	—	1.0146	—
to	to	to		to	6 R
62.2	59.4	116°	—	1.0977	3 L
av.	av.	av.		av.	—
40.5	36.3	107°	—	1.0590	—

U. P. D. mm	W. mm	A. A.	auricular A.	Index	Side
—	—	—	—	—	—
				— Lower Chalk	
26.4	17.8	101°	—	1.0179	—
to	to	to		to	3 R
33.4	31.8	112°	—	1.1330	8 L
av.	av.	av.		av.	—
30.5	27.2	105°	—	1.0703	—
		Cambridge (S. M.) — Lower Chalk			
16.5	14.8	90°	—	1.1149	L
29.6	26.9	103°	131.5°	1.1004	L
33.5	30.9	102°	123°	1.0841	R
		Cherryhinton (Cambs.) (S. M.) — Totternhoe Stone			
32.1	32.1	111°	130°	1.0000	L
61.4	61.4	111°	—	1.0000	L
				— Lower Chalk	
25.7	22.5	102°	—	1.0612	—
to	to	to		to	4 R
36.9	33.4	112°	—	1.1223	2 L
av.	av.	av.		av.	—
29.8	27.5	106°	—	1.1036	—
		Dover-Folkestone — Grey Chalk			
11.3	10.5	92°	—	1.0074	—
to	to	to		to	27 R
36.4	33.3	114°	—	1.1826	9 L
av.	av.	av.		av.	—
31.8	26.9	105°	—	1.0723	—
			— Chalk Marl		
16.1	14.3	106°	—	1.0229	—
to	to	to		to	4 R
75.8	74.1	118°	—	1.1259	1 L
av.	av.	av.		av.	—
31.8	30.5	110°	—	1.0657	—
			— *A. rhotomagensis* — zone		
14.6	13.6	92°	—	1.0466	—
to	to	to		to	2 R
28.8	26.9	108°	—	1.1826	6 L
av.	av.	av.		av.	—
19.2	17.8	101°	—	1.0913	—

U. P. D. mm	W. mm	A. A.	auricular A.	Index	Side
—	—	—	—	—	—
		Hunstanton (Norfolk) (B. M.) — Totternhoe Stone			
32.5	29.2	89°	132°	1.1130	—
		Maiden Bradley (S.M.) — Chloritic Marl			
25.7	24.3	103°	146°	1.0576	L
		Mere (Wilts.) (Dead Maid Quarry) (B. M.) — Chloritic Marl			
11.8	10.9	94°	—	1.0826	L
35.6	34.8	104°	135°	1.0230	R
		Meule de Bernissart (I. R. Sc. N. B.)			
29.0	26.5	96°	—	1.049	—
to	to	to		to	—
47.2	40.5	98°	—	1.094	4 spec.
av.	av.	av.		av.	—
37.3	32.5	97°	—	1.069	—
		Tourtia de Tournai (I. R. Sc. N. B.)			
29.2	26.2	97°	—	1.1145	—
		Tourtia de Mons			
20.0	18.5	87°	—	1.081	—
to	to	to		to	—
29.0	26.5	105°	—	1.106	10 spec.
av.	av.	av.		av.	—
24.5	22.3	96°	—	1.095	—

Description :

The concentric ridges on the left valve vary greatly in number and disposition. Some valves are covered with narrow and numerous concentric ridges (I counted 40 on a specimen from the Upper Greensand in Froyle (SOWERBY Coll.)), others only bear a limited number of broad ribs (11 on a Lower Chalk specimen from Cambridge) and on a few (such as those from the Upper Greensand of Ventnor (Isle of Wight) only parts of the valve bear concentric ridges.

The concentric ridges continue past the apical margins on the auricles. Hence, on well-preserved specimens, the auricles are covered with numerous striae.

The apical margins are usually straight, but on a single large valve from the Upper Greensand of the Isle of Wight they are curved.

On the inside of the valves are the strongly developed unbonal edges and the crurae.

Discussion

This species has a very long geological range (from Berriasian to Upper Cenomanian) but it does not vary much with time and space. The specimens from some localities are sligthly different, so e.g. in Ventnor (Isle of Wight) the left valves are partly smooth.

Synonymy :

The specimens from the GOLDFUSS-MUENSTER collection in the Bayerische Staatssammlung in Munich, from the Cenomanian of Essen/Ruhr and labelled *Pecten laminosus* clearly belong to *Entolium orbiculare*. They have the typical concentric macro-sculpture but not the excessively large auricles drawn on GOLDFUSS' figure.

A. D'ORBIGNY (1847 & 1850) described *Pecten orbicularis*, and several other species which he considered to be closely related to *P. orbicularis*.

In his collection in the Museum national d'Histoire naturelle in Paris the following specimens are present :

— *Entolium orbiculare :*

6453 from Le Hâvre
6453 A from Rouen
6453 B from Lamnay (Sarthe)
6453 C from Mareuil (Dordogne)
6453 D from La Malle (Var)

all specimens with the typical concentric macrosculpture and subequal auricles.

— *Pecten darius :*

6002 A from Varennes (Meuse)
6002 from Géraudot (Aube)

specimens with concentric *E. orbiculare* ornamentation, but in poor state of preservation. The D'ORBIGNY collection contains *Pecten darius* specimens from other Albian localities not mentioned in the Prodrome :

6002 C from Le Hâvre;
6002 B from Machéroménil (Ardennes);
6002 E from St.-Ménehould (Haute-Marne) (also numbered B 14639).

— *Pecten calypso :*

6449 from Le Mans (Cenomanian)

represented by only one specimen in the D'ORBIGNY collection. It is very poorly preserved. D'ORBIGNY described it as being completely smooth: on the few remaining shell parts it is possible to distinguish the typical *E. orbiculare* concentric macrosculpture.

— *Pecten neptuni* :

6450 from Le Mans (Cenomanian)

represented by one incomplete specimen in the collection. It is flattened, A.A. = 114°, surface concentrically ridged as in a typical *E. orbiculare*. All these species occur in the localities which D'ORBIGNY cited for *E. orbiculare* in « Paléontologie française » but those localities in the Prodrome yield 4 species, each occurring in some of the localities.

H. WOODS, 1902 gave a very detailed description and discussion of *E. orbiculare*. I have studied the specimens he discussed (B.M.-collection, S.M.-coll., Geol. Sci. coll.) and, though I agree with most of his description, it seems that he mistook right valves for left ones and vice versa. The left valve, being the upper valve, is more ornamented and bears the concentric ridges. The obsolete byssal sinus present on the smooth valves proves beyond doubt that these are right valves (H. WOODS, pl. 37, f. 7 c.).

Syncyclonema orbicularis var. haldonensis (nov. var. WOODS, 1902) from the Chert Beds of Haldon does not belong in *E. orbiculare* : the auricles are unequal and the inside does not carry the prominent crurae. It is a separate species (see further : *Syncyclonema haldonensis* (WOODS)).

Differentiation :

E. orbiculare (SOWERBY) differs from *E. membranaceum* (NILSSON) in having macroscopical concentric ridges on its left valves and more dorsally elevated auricles. The apical angle is sligtly narrower in *E. orbiculare* (84°-118°; *E. membranaceum* 94°-122°). The U.P.D./W. index variation is practically the same : 0.936-1.211 for *E. membranaceum* and 0.958-1.196 for *E. orbiculare*. The smoothness of both valves in *E. membranaceum* is the only easily usable distinctive characteristic.

E. orbiculare and *E. membranaceum* are undoubtedly closely related. Chronologically they follow each other : when *E. orbiculare* disappears in the late Cenomanian it is replaced by *E. membranaceum*. It could be that the first evolved into the second : indeed the specimens from Ventnor (Isle of Wight) by having a partly smooth left valve seem to lose the *E. orbiculare*-characteristics. The same happens in *Entolium noetlingi* from the Middle Cenomanian Dniester Deposits as described by SOBETZKI, 1960. This species, according to the author, is supposed to be very similar to *E. membranaceum*. He keeps both species separated because they have different measurements; however, those given by him for *E. noetlingi* fall within the variability of both *E. orbiculare* and *E. membranaceum*. Also the statement that *E. noetlingi* has smooth valves is denied by the figure (pl. 8, fig. 2) which shows an only partly smooth valve. The ridges on it are few but they are present. It is thus very likely that *E. noetlingi* is a late variety of *E. orbiculare*. From the Carpathian Senonian of Premysl (Poland) T. WISNIOWSKI described in 1919 *Pecten (Syncyclonema) woodrowwilsoni*. This species is a typical *Entolium* : it

has the subequal auricles and the auricular crurae, and the smooth shell-surface with ridges. It is different from *E. orbiculare* because the auricles are much more dorsally projected, almost as in *Pernopecten* WINCHELL, 1865 (*). From *E. membranaceum* it differs by the auricle shape and by the ridges on the shell surface.

Generic attribution :

The smooth right valves, the concentrically ridged left valves, the subequal auricles, the obsolete byssal sinus, the thick crurae diverging from the umbo are all *Entolium* characteristics, and they are present on *Pecten orbicularis* SOWERBY, 1817.

Stratigraphical and geographical distribution

Berriasian : GREAT BRITAIN :

Spilsby Sandstone :

Acre Ho (Lincs.) (B. M.)
Donnington (Lincs.) (S. M.)
Epping (Essex) (erratic boulder) (B. M.)
Holton (Lincs.) (B. M.)
Nettleton (Lincs.) (B. M.)
Toynton Pit near Spilsby (Lincs.) (B. M.)

Valanginian : GREAT BRITAIN :

Hundleby Clay :

Hundleby Brickyard (Lincs.) (B. M.)

Speeton Clay, zone D 4 :

Speeton (Yorks.) (B. M.)

Hauterivian : GREAT BRITAIN :

Claxby Ironstone :

Benniworth (Lincs.) (B. M., S. M.)
Nettleton (Lincs.) (B. M.)
Tealby (Lincs.) (S. M.)

Tealby Ironstone :

Claxby (Lincs.) (B. M.)
Normanby (B. M.)
North Willingham (Lincs.) (S. M.)

Speeton Clay, zone C 4 :

Speeton (Yorks.) (B. M.)

(*) See E. PHILIPPI, 1900, p. 79 : « ...man hat wohl das gelegentliche Auftreten dieser spitzen Ohren bei mesozoischen Arten als Rückschlagerscheinung aufzufassen ».

Barremian : GREAT BRITAIN :

Speeton Clay :

Speeton (Yorks.) (B. M.)

Neocomian : FRANCE :

Censeau (Jura) (Mus. Gen.)
Rérex, base du Môle (Mus. Gen.)

G. F. R. :

Oelinghausen, Bielefeld (B.)
Salzgitter, Hannover (N. M. W.)

SWITZERLAND :

Le Dat s. Semsales (Mus. Laus.)

Aptian : GREAT BRITAIN :

Atherfield Clay :

Binscombe (Isle of Wight) (B. M.)

Lower Greensand :

Atherfield (B. M.)
Bargate Stone, Littleton (Surrey) (B. M.)
Faringdon (Berks.) (B. M.)
Folkestone (B. M.)
Hunstanton (nodules from Snettisham Clay, Norfolk) (B. M.)
Nutfield (Surrey) (B. M.)
Sandown (B. M.)
Sevenoaks (Kent) (B. M.)
Shanklin (Isle of Wight) (B. M., Mus. Gen.)
Upware (Cambs.) (S. M.)

Albian : BELGIUM :

Meule de Bracquegnies :

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

FRANCE :

Meule de Bracquegnies :

Thivencelles (Nord) (I. R. Sc. N. B.)

without zonal specification :

Cap de la Hève (Musé., Ec. Min.)
Cauville-lez-Octeville (Musé.)
« Gault » de la Nièvre (Mus. Gen.)
Le Hâvre (orig. D'ORBIGNY, Musé.)
Machéroménil (Ec. Min.)
Novion (Ec. Min.)
Saint-Florentin (Ec. Min.)
Saint-Ménehould (Musé.)
Varennes (Ec. Min.)

G. F. R. :

Langenstein (B.)

GREAT BRITAIN :

tardefurcata-zone :

Barn Pit Leighton (Beds.) (B. M.)
Harris' Pit (S. M.), Garside's Pit 2 (B. M.), Munday's Hill Pit (S. M.) : all three on Shenley Hill, Leighton Buzzard (Beds.).

mammillatum-zone :

Ford Place, Wrotham (Kent) (B. M.)
W. of Reigate (Surrey) B. M.)

dentatus-zone :

Folkestone (B. M., S. M.)
Osmington (S. Dorset) (B. M.)

Albian, without zonal specification

Alton (Hants.) (B. M.)
Billington, level crossing, S. of Leighton Buzzard (Beds.) (B. M.)
Blackdown (Devon) (B. M., S. M.)
Black Fenn (Dorset) (B. M.)
Bonchurch (Isle of Wight) (B. M.)
Burghelere (Hants.) (B. M.)
Charmouth (Fairy Dell, Dorset) B. M., S. M.)
Didling (Bugshill lane, Sussex) (B. M.)
Froyle (SOWERBY Colln.) (B. M.)
Godstone (Marden Castle S. E. of Surrey) (B. M.)
Lyme Regis (B. M., S. M.)
Melbury Abbass, Shaftesbury (Dorset) (B. M.)
Niton (Isle of Wight) (S. M.)
Okeford Fitzpaine (Dorset) (B. M.)
Ponchydown (Blackdown) (S. M.)
Talmadge nr. Watlington (Oxon.) (B. M.)
Ventnor (Isle of Wight) (B. M., S. M.)
Warminster (B. M., S. M.)
Woolboro' Hill (Devon) (B. M.)
Wrecclesham, S. W. of Farnham, (Surrey) (B. M.)

NORWAY :

Spitzbergen : Festungsprofil, niveau 40 (GR.)

POLAND :

Silesia : Altwasser (Ec. Min.)

SWITZERLAND :

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

Cenomanian : BELGIUM :

Meule de Bernissart :

Bernissart (I. R. Sc. N. B.)
Harchies (I. R. Sc. N. B.)

Tourtia de Tournai :

Tournai, Chercq (Carrière le Cornet) (I. R. Sc. N. B.)

CZECHOSLOVAKIA :

Kreitschwitz (S. M.)
Raspenau (Koryzaner Schichten) (DR.)

DENMARK :

Bornholm :

Arnager (KO.)
Madsegrav (KO. mentioned RAVN, 1925 and figured RAVN, 1916, pl. 5, f. 6, 7)

FRANCE :

Meule de Bernissart :

Onnaing-lez-Valenciennes (Nord) (I. R. Sc. N. B.)

Cenomanian (without zonal specification) :

Le Hâvre (DR., Mus. Gen.)
Le Mans (Musé, coll. D'ORBIGNY, N. M. W.)
Rouen (Ec. Min., DR., KO., Mus. Gen.)
Vaches Noires (Calvados) (B.)
Vimoutiers (Orne) (Mus. Laus.)

G. F. R :

Bückenmühle, Gernroda (B.)
Essen (B., DR. orig. H. B. GEINITZ, pl. 43, f. 14, Elbthal I, Mü. orig. GOLDFUSS sub *Pecten laminosus,* N. M. W., S. M.)
Ettal (Lichtenstättgraben) (Mü.)
Kaiserberg, Oberhausen (Mü.)
Kapfelberg, Kelheim (Mü.)
Langenstein (B.)
Lüneburg (Zeltberg) (GH.)
Urschelau (Mü.)

G. D. R. :

Dohna (DR.)
Oberau (DR.)
Quedlinburg (B.)

GREAT BRITAIN : England :

Schloenbachia varians-zone

Burham (Blue Bell Hill & Margetts' Pit) (B. M.)
Burwell (Cambs.) (S. M.)

Dover (B. M.) (Grey Chalk)
Folkestone (B. M., S. M.) (Grey Chalk)
Hunstanton (Norfolk) (B. M.)
Mere (Dead Maid Quarry, Wilts.) (B. M.)
Merstham (Surrey) (B. M.)

Holaster subglobosus-zone

Barrington (Eastwood Cement Co., Cambs.) (S. M.)
Burwell (Cambs.) (Totternhoe Stone) (S. M.)
Cherryhinton (Cambs.) (S. M.)
Hunstanton (Norfolk) (B. M.)
Louth (Lincs.) (S. M.)
Punfield (Dorset) (B. M.)

Cenomanian (without specification) :

Cambridge (S. M.)
Devizes (B. M., S. M.)
Dorking (Dorking Pit) (B. M.)
Folkestone-Dover (B. M.)
Hamsey (B. M.)
Hunstanton (B. M.)
Pewsey (B. M.)
Undercliff (Isle of Wight) (Univ. Neuch.)
Ventnor (Isle of Wight) (Mus. Gen.)

Northern Ireland :

Antrim (S. M.)

IRAQ :

Bekhme Gorge (Kurdistan) (B. M.)

POLAND :

Bromberg (B.)
Frytlant (Mus. Gen.))
Jaryszow (B. M.)
Löwenberg (Silesia) (B.)

U. S. S. R. :

« An der Volga bei Turbino » (GR.)
Kursk (B.)

Turonian : BELGIUM

Tourtia de Mons, Assise de Saint-Aybert :

Anderlues (Hainaut) (I. R. Sc. N. B.)

FRANCE :

Tourtia de Mons, Assise de Saint-Aybert :

Assevent (Nord) (I. R. Sc. N. B.)
Boussières (Nord) (I. R. Sc. N. B.)
Gussignies (Nord) (I. R. Sc. N. B.)

GREAT BRITAIN :

Burham (Kent) (B. M.)
Kiplingcotes (Yorks.) (B. M.)
Cretaceous Drift :
Coney Ceston, Barmingham (Suffolk) (B. M.)

Entolium membranaceum (Nilsson, 1827)
(Pl. I, fig. 2 a, b)

.	1799	— *Pecten pleuronectes*	Faujas-Saint-Fond, p. 149, pl. 23, f. 4.
non		*Pecten pleuronectes* Lamarck, 1818 = *Ostrea pleuronectes* Linnaeus, 1758	
.	1825	— *Pecten fragilis*	M. Defrance, p. 251.
non		*Pecten fragilis* G. Montagu, 1808 Test. Brit. Suppl., p. 62 (fide Sherborn)	
non		*Pectinites fragilis* E. T. von Schlotheim, 1820, p. 225.	
v .	1827	— *Pecten membranaceus*	S. Nilsson, p. 23, pl. 9, f. 16 (inferior).
.	1835	— *Pecten membranaceus* Nilsson	A. Goldfuss, p. 75, pl. 99, f. 7.
	(1839)	— *Pecten membranaceus*	A. d'Archiac, p. 269.
	(1839)	— *Pecten laminosus*	A. d'Archiac, p. 269.
non	1822	*Pecten laminosus* G. Mantell.	
.	1839	— *Pecten membranaceus* Nils.	H. B. Geinitz, p. 23.
.	1839	— *Pecten Nilsoni*	H. B. Geinitz, p. 23.
non	1835	*Pecten Nilsoni* A. Goldfuss.	
	1841	— *Pecten membranaceus*	F. A. Roemer, p. 49.
v .	1842	— *Pecten laevis* (pro parte)	F. von Hagenow, p. 553.
v .	1842	— *Pecten membranaceus* Nilss. (pro parte)	F. von Hagenow, p. 553.
v .	1842	— *Pecten rotundus* nob.	F. von Hagenow, p. 554.
v .	1842	— *Pecten latus* nob.	F. von Hagenow, p. 554.
?	(1843)	— *Pecten Membranaceus ?* Nilson	A. Leymerie, p. 27.
.	1846	— *Pecten membranaceus* Nilss.	H. B. Geinitz, p. 467.
?	1846	— *Pecten membranaceus* Nilsson	A. E. Reuss, p. 26, pl. 39, f. 4.
.	1846	— *Pecten Nilssoni* (pro parte)	A. E. Reuss, p. 26, pl. 39, f. 2-3.
.	1847	— *Pecten laminosus*	J. Mueller, p. 31.
non	1822	*Pecten laminosus* G. Mantell	

? 1847	— *Pecten membranaceus* Nils.	J. MUELLER, p. 32.
? 1847	— *Pecten Nilssoni*	J. MUELLER, p. 32.
(1849)	— *Pecten membranaceus* Nilss.	H. G. BRONN, p. 927.
(1850)	— *Pecten membranaceus* Nilsson	H. B. GEINITZ, p. 178.
1850	— *Pecten membranaceus* Nils.	R. KNER, p. 28.
1850	— *Pecten membranaceus* Nils.	A. ALTH, p. 245, pl. 12, f. 28.
. 1852	— *Pecten membranaceus*	C. PUGGAARD, p. 16, f. 30.
? 1852	— *Pecten membranaceus* Nils (pro parte)	R. KNER, p. 315, non pl. 16, f. 28.
(1852)	— *Pecten membranaceus* Nils.	C. G. GIEBEL, p. 358.
(1854)	— cf. *Pecten membranaceus*	A. E. REUSS, p. 61.
(1860)	— *Pecten membranaceus*	J. BOSQUET, n° 475.
(1861)	— *Pecten membranaceus* Nilss.	W. GABB, p. 159.
? 1863	— *Pecten membranaceus* Nils.	S. PLACHETKO, p. 20.
? 1863	— *Pecten membranaceus*	A. VON STROMBECK, p. 154.
. 1866	— *Pecten membranaceus* Nilss.	K. A. ZITTEL, p. 107, pl. 17, f. 3.
1869	— *Pecten membranaceus* Nilsson	E. FAVRE, pp. 140-142.
(1870)	— *Pecten membranaceus*	C. SCHLUETER, p. 951.
v . 1870	— *Pecten membranaceus*	OTTMER, p. 453.
(1871)	— *Pecten (Syncyclonema) membranaceus* Nilss.	F. STOLICZKA, p. 428.
? 1871	— *Amusium? membranaceus* Nilsson	F. STOLICZKA, p. 436, pl. 32, f. 5, pl. 41, f. 7, 8.
v . 1872	— *Pecten membranaceus* Nilss.	H. B. GEINITZ, p. 191, pl. 43, f. 8-10, 11 ?
1875	— *Pecten Nilssoni*	H. B. GEINITZ, p. 33, pl. 9, f. 15-18.
non 1836	*Pecten Nilsoni* A. Goldfuss	
. 1877	— *Pecten Nilssoni*	A. FRITSCH, p. 134, f. 124.
non 1836	*Pecten Nilsoni* A. Goldfuss	
? 1882	— *Pecten membranaceus* Nilss.	R. WINDMOELLER, p. 21.
(1882)	— *Pecten membranaceus* (Nilss.)	J. DE MORGAN, p. 18, 38.
? 1882	— *Pecten membranaceus* Nilss.	H. SCHROEDER, p. 270.

	1883	— *Pecten Nilssoni*	A. FRITSCH, p. 115, f. 88.
non	1835	*Pecten Nilsoni* A. Goldfuss	
	(1888)	— *Pecten membranaceus*	F. E. GEINITZ, p. 734, 735, 737, 743.
	. 1889	— *Pecten laminosus*	E. HOLZAPPEL, pp. 231-232.
non	1822	*Pecten laminosus* G. Mantell	
	? 1889	— *Pecten spatulatus* (laps. cal.) Roem.	E. HOLZAPPEL, p. 233, pl. 26, f. 3, 5.
	(1889)	— *Pecten Nilssoni*	A. FRITSCH, p. 84.
non	1835	*Pecten Nilsoni* A. Goldfuss	
v	. 1891	— *Syncyclonema spatulata* Ad. Römer sp.	J. BOEHM, p. 85, pl. 3, f. 37 a-b.
?	(1893)	— *Pecten membranaceus*	R. MICHAEL, p. 236.
	(1893)	— *Pecten Nilssoni*	A. FRITSCH, p. 100.
non	1835	*Pecten Nilsoni* A. Goldfuss	
?	1895	— *Pecten membranaceus*	E. TIESSEN, p. 470.
	. 1895	— *Pecten (Pseudamusium) membranaceus* Nilss.	F. VOGEL, p. 22, pl. 1, f. 18-19.
?	1897	— *Pecten* cfr. *membranaceus*	U. SOEHLE, p. 40.
	1897	— *Pecten (Entolium) membranaceus* Nilss.	O. REIS, p. 97.
	(1897)	— *Pecten membranaceus*	O. REIS, p. 75.
	(1897)	— *Pecten membranaceus* Nilss.	G. RADKEWITSCH, p. 100.
	(1897)	— *Pecten Nilssoni*	A. FRITSCH, p. 68.
non	1835	*Pecten Nilsoni* A. Goldfuss	
v	. 1897	— *Pecten membranaceus* Nilss.	A. HENNIG, p. 37, pl. 3, f. 6-8.
?	1897	— *Pecten membranaceus* Nilss.	R. LEONHARD, p. 26.
?	(1899)	— *Pecten membranaceus* Nilss.	G. BODE, p. 155.
?	1900	— *Pecten membranaceus* Nilsson	C. GAGEL & F. KAUNHOWEN, p. 231.
	. 1901	— *Pecten spathulatus* A. Römer	H. IMKELLER, p. 30.
?	1902a	— *Pecten membranaceus*	A. WOLLEMANN, p. 62.
	(1904)	— *Pecten spatulatus*	W. PETRASCHECK, p. 5.
	(1906)	— *Pecten* cf. *membranaceus*	W. KOEHNE, p. 332.
	(1907)	— *Pecten membranaceus*	W. CHIMENKOW, p. 124.
v	. 1910	— *Syncyclonema orbiculare*	R. B. NEWTON, p. 61, pl. 3, f. 3-4.
non	1819	*Pecten orbicularis* J. Sowerby	
	(1911)	— *Pecten membranaceus* Nilss.	A. SLOUDSKY, p. 369, 375.
	. 1911	— *Pecten Nilssoni*	A. FRITSCH, p. 43, f. 197.

? 1916	— *Pecten* sp. ex aff. *P. membranacei*	J. BOEHM, p. 418, 420.
? 1917	— *Pecten (Syncyclonema) membranaceus* Nilsson	H. WOODS, p. 25, pl. 11, f. 3-5.
1918	— *Pecten (Entolium) membranaceus* Nilsson	J. WOLDRICH, p. 280.
v . 1921	— *Pecten (Syncyclonema) membranaceus* Nilss.	J. P. J. RAVN, p. 22, pl. 1, f. 6.
? (1926)	— *Pecten membranaceus* Nilss.	B. BESCHOREN, p. 90, 93.
1930	— *Pecten (Syncyclonema) membranaceus* Nilsson	R. HÄGG, pp. 40-41.
? 1931	— *Pecten membranaceus* (Nilsson)	V. TZANKOV, p. 54, pl. III, f. 2.
(1931)	— *Pecten membranaceus*	A. BENOIT, p. 81.
? 1931	— *Pecten membranaceus* Nilss.	L. RIEDEL, p. 668.
v . 1932	— *Pecten (Syncyclonema) membranaceus* Nilsson	D. WOLANSKY, p. 18, pl. 2, f. 12.
. 1933	— *Pecten (Entolium) membranaceus* Nilsson	W. HAENTZSCHEL, pp. 125-126, pl. 4, f. 14.
? 1933	— *Pecten submembranaceus*	A. BENOIT, p. 25.
(1934)	— *Pecten* cf. *membranaceus* Nils.	E. BONČEV & B. KAMENOV, p. 86.
(1934)	— *Pecten membranaceus* Nils.	ST. T. JELEV, p. 125.
. 1934	— *Pecten membranaceus* Nilss.	H. ANDERT, pp. 166-167, pl. 9, f. 12.
v . 1935	— *Pecten (Syncyclonema) membranaceus* Nilsson	R. HÄGG, p. 34.
. 1937	— *Pecten (Syncyclonema) orbicularis* (pro parte)	L. LEHNER, p. 181, pl. 36, f. 5.
(1938)	— *Pecten membranaceus* Nilss.	W. POZARYSKI, p. 23.
? 1939	— *Pecten (Entolium) membranaceus* Nilsson	E. DACQUÉ, p. 81.
? 1940	— *Syncyclonema membranaceus* (laps. cal.) Nillson (sic)	V. TZANKOV, p. 487, pl. 6, f. 6.
(1942)	— *Aequipecten membranaceus* Nilss.	H. PUTZER, p. 371.
1946	— *Pecten (Syncyclonema) membranaceus* Nilss.	J. P. J. RAVN, p. 22.
1947	— *Pecten (Syncyclonema) membranaceus* Nilsson	R. HÄGG, p. 68.

(1953)	— *Pecten (Entolium) membranaceum* Nilss.	H. PRESCHER, p. 254.
(1954)	— *Pecten (Syncyclonema) membranaceus* Nilsson	R. HÄGG, p. 39.
(1954)	— *Pecten* cfr. *membranaceus* Nils.	R. GIVULESCU, p. 208.
(1956)	— *Pecten membranaceus* Nilss.	K. A. TROEGER, p. 42, 54, 89.
. 1960	— *Entolium (Entolium) membranaceum* (Nilsson).	S. FRENEIX, p. 28, pl. 2, f. 1, 2.
(1960)	— *Entolium membranaceum* (Nilss.)	K. A. TROEGER & L. WOLF, p. 291.
1962	— *Entolium membranaceus* (laps. cal.) Nils.	I. PREDA, p. 70, pl. 3, f. 3.
non 1889	*Pecten (Entolium) membranaceus* = *Syncyclonema nilsoni* (Goldfuss, 1835)	O. GRIEPENKERL, p. 47.

Location and designation of type-specimens

Pecten fragilis DEFRANCE, 1825 : lost (destruction of Caen during World War II).

Pecten membranaceus NILSSON, 1827 : Palaeontologiska Institutionen (LO 78 t) Lund in Sweden.

Stratum typicum :

Pecten fragilis : couche craieuse de la Montagne de Saint Pierre (Upper Maastrichtian).

Pecten membranaceus : in calce arenosa et carbonifera (Upper Campanian).

Locus typicus :

Pecten fragilis : Montagne de Saint-Pierre de Maëstricht (Sint Pietersberg, Maastricht, The Netherlands) (O. D.).

Pecten membranaceus : Köpinge (Sweden) (chosen here).

Original descriptions

Pecten fragilis :

« Coquille orbiculaire, très mince et très fragile, sans côtes, à oreilles égales. Largeur, quinze lignes. On la trouve dans la couche craieuse de Maëstricht. »

Pecten membranaceus :

« P. testa ovali-rotunda, depressa, nitida, tenuissima, laevi; auriculis aequalibus, parvis, obtusangulis, basi latioribus, striâ margini parallela notatis.

Longit. 25 lat. 21 mm.
17 — 15 —

Descript. — *Tenuissima, planiuscula s. convexo-plana, ovali-rotunda, nitida,* oculo nudo laevissima, armato autem tenuissime & concentrice-striata. Auriculae satis parvae, quoad forman & magnitudimen aequales, obtusangulae, inferus latiores, striae longitudinali duplici vel triplici, margine parallela, notatae.

Locus. — In calce arenosa & carbonifera ad Köpinge, Kåseberga & c vulgaris. »

Additional description

Number of studied specimens : total : 429.

British Turonian	18 specimens
Czech Turonian	6 specimens
East German Turonian	22 specimens
Polish Turonian	3 specimens
West German Turonian	3 specimens
Austrian Senonian	7 specimens
Czech Senonian	23 specimens
Danish Senonian	20 specimens
East German Senonian	19 specimens
French Senonian	6 specimens
West German Senonian	32 specimens
Senonian from Zululand	3 specimens
Polish Campanian	2 specimens
Swedish Campanian	11 specimens
West German Campanian	12 specimens
Ukrainian Campanian — Maastrichtian	8 specimens
Belgian-Dutch Maastrichtian ...	135 specimens
British Maastrichtian	4 specimens
Danish Maastrichtian	36 specimens
East German Maastrichtian ...	44 specimens
West German Maastrichtian ...	15 specimens

Description of topotypes of *Pecten fragilis* DEFRANCE

This description is based on 60 specimens from the Sint Pietersberg, Maastricht (11 belong in the Natuurhistorisch Museum in Maastricht and 49 in I. R. Sc. N. B.).

Measurements :

umbo pallial diameter	: varies from	13.8 mm	to	50.0 mm;	av.	30.8 mm
width	: varies from	11.4 mm	to	50.0 mm;	av.	29.2 mm
apical angle	: varies from	92°	to	122° ;	av.	107°
index U. P. D./W.	: varies from	0.9355	to	1.2110 ;	av.	1.0696

Description of the valves :

They are so similar that one description suffices for both.

Outside and inside the valves are smooth; the outside is also shining. On some valves concentric growth lines can be seen; they lie very closely together and can sometimes, when many are close, form concentric ribbons on the disc and have a different colour-shade.

The auricles are almost perfectly equal and the byssal sinus is absent. The hinge-margin is sometimes straight but, on other valves, the auricles are projected dorsally. The apical margins are straight. When visible the auricular and cardinal crurae and the umbonal edges are strongly developed. U. P. D. is generally superior to the width, but this is less pronounced on larger than on smaller valves.

Discussion

In Cretaceous palaeontological literature two problems appear where *E. membranaceum* is concerned :

1. differentiation of *E. membranaceum* from *Syncyclonema nilsoni* (GOLDFUSS);
2. differentiation of *E. membranaceum* from *E. orbiculare* (SOWERBY) (for this problem see above, sub *E. orbiculare*).

The differentiation of *E. membranaceum* and *S. nilsoni* has been the origin of great confusion in the systematics of Cretaceous pectinids.

The confusion started with S. NILSSON : he described *E. membranaceum* correctly, but on plate 9, two figures bear number 16. The lower one is *E. membranaceum*, the upper one is *Pecten corneus* NILSSON (non SOWERBY) (= *Pecten cretaceus* NYST, 1843, p. 299), and this last species could be related to *S. nilsoni*.

In S. NILSSON another unfortunate picture is that for *Pecten orbicularis* (NILSSON, non SOWERBY) (= *S. nilsoni* (GOLDFUSS)) : it depicts a left valve, which valve is very difficult to distinguish from *E. membranaceum*. The description of this species by NILSSON is also inaccurate : the auricles are unequal and NILSSON states that they are equal.

The confusion caused by these inaccurate and faulty descriptions was ended by D. WOLANSKY : she states clearly that *E. membranaceum* is characterized by equal auricles and straight apical margins, whereas *S. nilsoni* has unequal auricles, a clearly developed byssal sinus on the right valve, and curved apical margins. Though both species belong to different families it took palaeontologists a century to differentiate them easily. However, this confusion is understandable because :

— both species have smooth valves without macrosculpture;
— the U. P. D./W ratios vary in a very similar way, even though the ranges of variation do not fully overlap;
— the apical angles have similar values.

The only good differentiating character is the shape of the auricles, but on most specimens they are broken off and then the shells cannot be determined with certainty. There can sometimes be a slight difference in the U. P. D./W ratio but this only for specimens which are situated at the end of the variation-range. The shell-thickness is slightly different too : *E. membranaceum* has a thinner and thus more breakable shell than *S. nilsoni;* this is a character that can only be used if one possesses a large series of specimens from the same locality. The difference in apical margins can be used with much success on larger valves of both species, because on large *S. nilsoni*-specimens the curving is more accentuated than on smaller specimens.

On well preserved fragments a differentiation is possible by using the microsculpture :

S. nilsoni bears a radial, diverging *Camptonectes*-like striation which is absent on *E. membranaceum*. This sculpture, unfortunately, is hardly visible on worn specimens.

E. membranaceum is the only species of the genus known to reach the Maastrichtian in Europe. No *Entolium* is known to have lived after the Maastrichtian.

Generic attribution :

Equal auricles, smooth inside and outside of the shell, the presence of well developed auricular crurae prove that *Pecten membranaceus* NILSSON belongs to *Entolium*.

Stratigraphical and geographical distribution

Turonian : CZECHOSLOVAKIA :

Korycany (N. M. W.)
Tyssa (DR., KO.)

G. D. R. :

Plenus-zone :

Dohna (DR.)
Ockerwitz (DR.)
Upper Turonian :
Strehlen (DR., Halle, KO., Mus. Gen.)

G. F. R. :

Ringelberg, Salzgitter (B.)

POLAND :

Löwenberg (Silesia) (B.)

Senonian : CZECHOSLOVAKIA :

Brezno (DR.)
Kreibitz (Mus. Gen.)
Luschitz (B., DR.)

DENMARK : Bornholm :

Arnager (KO.)
Bavnodde (KO.)
Blykobbe Aa (KO.)
Forchhammers Klint (KO.)
Forchhammers Odde (KO.)
Horsemyreodde (KO.)

FRANCE :

Dieu-le-Fît (Drôme) (B.)
Orglandes (Manche) (Ec. Min.)

G. D. R. :

Bannewitz b. Dresden (N. M. W.)
Koschütz (DR.)
Quedlinburg, Galgenberg (B.)
Quedlinburg, Salzberg (B.)
Strehlen (B., DR., Musé., Mus. Gen.)

G. F. R. :

Ahlten (GH.)
Braunschweig (B.)
Haldem (B., S. M.)
Lemförde (N. M. W.)
Lüneburg (B.)
Osnabrück (DR.)
Pattenauer Stollen (Mü.)
Siegsdorf (Oberbayern) (B., B. M., Mü., N. M. W.)
Wertha, Bielefeld (DR.)

Senonian : Campanian :

G. F. R. :

Aachen (B., DR., I. R. Sc. N. B.., Mus. Gen.)

POLAND :

Wolaybychavska (B. M.)

SWEDEN :

Köpinge (KO., Lund, orig. NILSSON, HENNIG)
Kullemølla (Lund, orig. HÄGG, 1935)
Lund (KO.)
Lyckås (KO., Lund)

Maastrichtian :

BELGIUM - THE NETHERLANDS :

Ciply (Ec. Min., I. R. Sc. N. B.)
Maastricht (B., I. R. Sc. N. B., Ma., Musé. Coll. D'ORBIGNY 7612 C)

BULGARIA :

Pleven (Univ. Sofia)
Shumen (Univ. Sofia)

DENMARK :

Aalborg (KO.)
« Dania », Mariagerfjord (KO.)
Freilev, Aalborg (KO.)
Hillerslev, Thy (KO.)
Kongsdal (KO.)
Mjels II (KO.)
Møens Klint (KO.)
Nørre Flødal (KO.)
Nørre Uttrup (KO.)
Rørdal, Aalborg (KO.)
Stevns Klint (GR., KO.)
Svinkløven (KO.)

G. D. R. :

Rügen (B. orig. VON HAGENOW, GR.)

G. F. R. :

Hemmoor (GH.)

GREAT BRITAIN :

Trimingham (Geol. Sci. S. M.)

U. S. S. R. :

Ukraïne : Nagorzany (DR., Ec. Min., KO., N. M. W.)

Upper Cretaceous :

S. A. U. :

Manuan Creek, Zululand (B. M. : L 22048)

Subfamily *AMUSIINAE* THIELE, 1935 (em. GLIBERT & VAN DE POEL, 1965).

Genus Propeamussium DE GREGORIO, 1884.

Type-species *Pecten ceciliae* DE GREGORIO, 1884 (O. D.).

Subgenus Parvamussium Sacco, 1897.

Type-species *Pecten duodecimlamellatus* Bronn, 1831 (O. D.).

Propeamussium (Parvamussium) inversum (Nilsson, 1827)

v . 1827	— *Pecten inversus*	S. Nilsson, p. 24, pl. 9, f. 18 a-c.
. 1835	— *Pecten Squamula*	A. Goldfuss, p. 75, pl. 99, f. 6 a-c.
? 1839	— *Pecten Squamula*	H. B. Geinitz, p. 23.
. 1841	— *Pecten squamula*	F. A. Roemer, p. 50.
. 1842	— *Pecten squamula* var. *octosulcatus* m.	H. B. Geinitz, p. 83, pl. 21, f. 8.
. 1846	— *Pecten squamula*	A. E. Reuss, p. 27, pl. 39, f. 12.
(1850)	— *Pecten subsquamula* d'Orb.	A. d'Orbigny, p. 253, n° 878.
(1850)	— *Pecten squamula*	H. B. Geinitz, p. 180.
(1866)	— *Pecten squamula*	C. Giebel, p. 50.
. 1889	— *Pecten (Amusium) inversus* Nilsson	O. Griepenkerl, p. 45.
. 1889	— *Pecten squamula*	A. Fritsch, p. 84, f. 79.
v . 1891	— *Amussium inversum* (Nilsson)	J. Boehm, p. 83, pl. 3, f. 36 a, b.
1893	— *Pecten squamula*	A. Fritsch, p. 100.
(1896)	— *Amussium inversum* Nils.	O. Reis, p. 9.
v . 1897	— *Pecten inversus* Nilss.	A. Hennig, p. 37, pl. 2, f. 15-16.
v. 1899	— *Pecten inversus* Nilss.	A. Hennig, p. 12.
(1899)	— *Pecten squamula*	J. V. Želižko, p. 538, 541.
(1901)	— *Pecten squamula*	K. Hinterlechner, p. 474.
. 1901	— *Amussium inversum* (Nilsson)	H. Imkeller, p. 31.
. 1902	— *Pecten inversus* Nilsson	J. P. J. Ravn, p. 94.
(1905)	— *Pecten squamula*	J. J. Jahn, p. 89.
(1911)	— *Pecten (? Pseudoamusium) inversus* Nilss.	W. Rogala, p. 493.
? 1920	— *Pecten (Amussium) inversus* ? Nilsson	A. Rosenkrantz, pp. 33-34.
. 1923	— *Pecten (Amussium) inversus* Nilss. ?	A. Jessen & H. Ødum, pp. 37-38.
? 1926	— *Pecten (Amussium) inversus* Nils. ?	H. Ødum, p. 180.
v . 1930	— *Pecten (Amussium) inversus* Nilsson	R. Hägg, pp. 42-43.

.	1935	— *Pecten (Amussium) inversus* Nilsson	R. HÄGG, p. 39.
v .	1939	— *Variamussium inversum* (Nilsson)	L. R. COX, pp. 19-20, pl. 1, f. 14.
.	1954	— *Pecten (Amussium) inversus* Nilsson	R. HÄGG, p. 41.
?	1962	— *Pecten* cf. *(Amusium) inversum* Nilsson	V. TEMKOVA, p. 111.
	(1964)	— *Pecten inversus* Nilsson	G. KRUSE, p. 103.
non	1819	*Pecten squamula* J. B. Lamarck, p. 183.	
non	1936	*Amussium inversum* Lamk. F. Traub, p. 13.	
non	1937	*Amussium inversum* Lamk. K. Goetzinger, p. 231.	

Location of type-material

Pecten inversus NILSSON : NILSSON never selected a type-specimen, but in the NILSSON-collection at the Palaeontologiska Institutionen at Lund University there are several specimens which are topotypes and make clear what NILSSON understood as *Pecten inversus*.

Pecten inversus NILSSON in HENNIG, 1897 : Palaeontologiska Institutionen, Lund : LO 1234 T.

Locus typicus :

Köpinge, Sweden : here designated.

Stratum typicum :

in arena viridi (Campanian).

Original description

« P. testa pusilla orbiculari, extus laevissima, intus costis 12-16 distantibus radiata margine laevi; auriculis inaequalibus, latis.

Diam. 4-6 mm.

Obs. Ad *Pectinem squamulam* Lam. Hist. anim. s. vert. VI, I, p. 183 & Annales du Mus. VIII, p. 354 proxime accedere, sed costarum numero majore differe videtur.

Descript. — Testa minima, orbicularis, extus tota laevis, intus vero 15-16 costis compressis radiantibus, ante marginem testae desinentibus, ornata. Auriculae latissimae, ita ut margo cardinalis & latitudo testae fere aequales sint.

Locus. — Ad Sventorpsmölla, & ad Köpinge in arena viridi atque in calce arenosa & carbonifera haud raro. »

Additional description

Material : total : 61

British Turonian	6 specimens
British Senonian	2 specimens

Czech Senonian	2 specimens
Swedish Campanian	28 specimens
West German Campanian	12 specimens
Danish Maastrichtian	7 specimens
West German Maastrichtian ...	4 specimens

Measurements :

1. topotypical specimens from collections in Lund and Copenhagen :
   U. P. D. varies between 5.2 mm to 7.7 mm; av. 6.79 mm (n = 11);
   W. varies between 5.3 mm to 7.7 mm; av. 6.68 mm (n = 11);
   A. A. could only be measured twice : 86°, 88°;
   R. number varies between 11 and 17; av. 13.9 (n = 10);
2. Danish Maastrichtian specimens : (KO.)
   smaller : on average : 4.5 mm to 6.0 mm;
   R. number : 6-9;
3. English Turonian : *H. planus*-zone-specimens (B. M.)
   W. varies from 4.5 mm to 6.0 mm (n = 5);
   R. number from 7 to 16 (n = 5);
4. Campanian around Königslutter (after GRIEPENKERL) :
   U. P. D. = W. : varies between 5 and 8 mm;
   R. number : varies between 10 and 13.

Description :

Diagnosis : Small, orbicular *Propeamussium*-species with 6 to 17 internal ribs, and an exterior shell which is, when well preserved, covered with concentric folds The auricles are relatively large and there is a well-developed byssal sinus on the right anterior auricle.

For a complete description see : GRIEPENKERL, 1889, p. 45.

Discussion

Variability :

The ribnumber seems to vary greatly; this is due to the presence of primary and secondary and even, on some specimens, of tertiary internal ribs. Unless the specimen is extremely well preserved it is almost impossible to differentiate between these three rib-types. On very small specimens only primary ribs are present and this could explain the lower rib number recorded from the Maastrichtian of Denmark.

The variability of the other characteristics, particularly of those related to the preservation state, has been discussed by GRIEPENKERL. In one respect, however, I do not agree with him : *Pecten semiplicatus* ALTH is not a badly preserved *P. inversus* but a well-defined *Syncyclonema* species.

Distribution :

The geographical distribution is rather unusual : British and Czech Upper Turonian and Lower Senonian (Coniacian); Swedish and Northern German Campanian, Danish, Northern German and Bavarian Maastrichtian.

Its absence in some strata could be due to it being overlooked since it is such a very small species, but it still seems to have been more common in certain localities than in others : there is the relative abundance in the Swedish Campanian and in the Campanian around Braunschweig as recorded by GRIEPENKERL (1889, p. 46).

In Danish Maastrichtian strata where extensive collecting has been undertaken very few specimens have been found and the same is true for English Cretaceous strata.

Differentiation :

No other Upper Cretaceous European species can be compared to *P. inversus*. From the Upper Cretaceous of Jordan I saw several specimens of *Propeamussium samariensis* (CONRAD, 1852) (B. M. L 67450, 67462 from Djenin) which are very similar to *P. inversus* NILSSON; they have 8-12 internal ribs, large unequal ears, a very long straight hinge-line which are also *P. inversus* characteristics. Between the ribs they seem to have very close concentric ornamentation which I do not known on *P. inversus*.

From the Paleocene of Copenhagen and from the Calcaire d'Eysden supérieur in Eysden (Limburg, Belgium) a species which resembles the Cretaceous species has been described : *Propeamussium (Parvamussium) bisculptum* (VON KOENEN, 1885). The ribnumber is almost the same as in *P. inversus* but the other characteristics are different : in *P. bisculptum* the exterior of one of the valves bears a radial and a concentric ornamentation.

Unlike *Entolium* and *Syncyclonema* which die out at the Cretaceous-Paleocene boundary *Propeamussium* crosses that boundary and seems to be hardly affected by it.

Generic attribution :

Pecten inversus NILSSON, 1827 is very similar to *Parvamussium duodecimlamellatum* (BRONN, 1831), hence its correct name is *Propeamussium (Parvamussium) inversum* (NILSSON, 1827).

Stratigraphical and geographical distribution

Turonian : GREAT BRITAIN :

H. planus-zone :

Guildford, Godalming Bypass, Surrey. (B. M., figured L. R. Cox, 1939)

Westerham, Kent (B. M.)

Senonian : GREAT BRITAIN :

M. cortestudinarium-zone :

Millington Dale, E. Yorkshire (B. M. refd. to in L. R. Cox, 1939)

Coniacian : CZECHOSLOVAKIA :

Luschitz, Praha (N. M. W.)
Postelberg, Praha (N. M. W.)

Campanian : G. F. R. :

Lauingen, Königslutter (Halle, N. M. W.)
Siegsdorf, Obb. (B., N. M. W.)

GREAT BRITAIN :

A. quadratus-zone :

½ mile N. E. of Huntow, S. S. E. of Speeton (Yorks) (B. M.)

SWEDEN :

Köpinge (B., KO., Lund orig. NILSSON & HENNIG)
Svenstorp (Lund)
Tosterup (Lund)

Maastrichtian : DENMARK

Lindholm (KO.)
Nörre Flødal (KO.)
Nörre Uttrup (KO.)
Skovbakken, Aalborg (KO.)
Stevns Klint (KO.)

G. F. R. :

Gerhardtsreiter Graben, Obb. (Mü, orig. BOEHM, 1891)
Hemmoor (GH.)

Family PECTINIDAE RAFINESQUE, 1815

Subfamily *CHLAMYDINAE* VON TEPPNER, 1922 em. SOBETSKI, 1961 (= *Chlamysinae* KOROBKOV, 1960)

Genus Syncyclonema MEEK, 1864

Type species : *Pecten rigida* HALL & MEEK, 1856 (non SOWERBY, 1818) (O. D.)

(= *Pecten halli* GABB, 1861)

Generic diagnosis : the « emended » diagnosis in I. G. SPEDEN, 1967 (p. 7) is perfectly suited for European *Syncyclonema*-species, if one omits the first word (small) from it.

Discussion

a. Generic nature :

The problems concerning the existence of *Syncyclonema* as a taxon have been definitely solved by I. G. SPEDEN, 1967. By redescribing the type-species he simplified a number of obscure points resulting from HALL & MEEK's 1856 and MEEK's, 1864 rather incomplete and confused descriptions

b. Family placement :

Syncyclonema is fairly different from *Chlamys* ROEDING but it has several characteristics in common with *Camptonectes* AGASSIZ in MEEK, 1864 and with *Eburneopecten* CONRAD, 1865. As indicated by SPEDEN, 1967 *Eburneopecten* has a ctenolium and at least some vestigial macroscopical radial ornamentation. Some species look smooth (f. i. *E. gerardi* (NYST, 1835) and *E. solea* (DESHAYES, 1830) and the radial *Camptonectes*-like ornamentation is then very clearly visible (see M. GLIBERT, 1945, pl. IV, f. 3c). This typical ornamentation is similar to what can be seen in *Syncyclonema* (pl. III, f. 1 b *Syncyclonema hagenowi* n. sp.) but the number of striae is higher in *Syncyclonema* (35 to 60 a mm) than in *Eburneopecten (E. gerardi* : 15 a mm, *E. solea* : 25 a mm). In most *Syncyclonema*-species the radial *Camponectes*-like vermiculations are not clearly visible without a magnification of at least × 25.

Stratigraphical range

Restricted to the Cretaceous : in Europe from Aptian to Upper Maastrichtian.

Geographical distribution

Cosmopolitan but not in Tethyan deposits.

Syncyclonema greppini (PICTET & RENEVIER, 1858)

v . 1858	— *Pecten Greppini* Pictet et Renevier	F. J. PICTET & E. RENEVIER, p. 134, pl. 19, f. 4a, 4b.
v . 1870	— *Pecten Greppini* Pictet & Renevier	F. J. PICTET & G. CAMPICHE, p. 198-199.
(1871)	— *Pecten (? Syncyclonema) Greppini* P. and Renev.	F. STOLICZKA, p. 428.
v . 1882	— *Pecten Darius*	P. DE LORIOL, p. 84, pl. 10, f. 6.

non (1850) *Pecten darius* d'Orbigny (= *Entolium orbiculare* Sowerby)
1923 — *Pecten (Camptonectes?) Greppini* Pict. et Renv. V. K. PETKOVIC, p. 61.
(1927) — *Pecten Greppini* Pictet et Renevier A. JAYET, p. 167.

Holotype :

Musée géologique, Lausanne, Switzerland (coll. RENEVIER).

Stratum typicum :

Marne jaune (Aptien supérieur) (Upper Aptian).

Locus typicus :

Perte du Rhône (Ain) (France).

Original description

« Dimensions :

Largeur : 13 mm.
Par rapport à la largeur : longueur : 0,80-0,85.
Par rapport à la largeur : épaisseur : 0,25.
Angle apicial : 90°.

Coquille ovale transverse; les deux valves très peu et presque également bombées. Leur surface est lisse, marquée seulement de quelques lignes concentriques très peu apparentes, et de stries rayonnantes, arquées comme dans le *P. virgatus,* mais beaucoup moins visibles, plus irrégulières, plus espacées et non accompagnées de points. Les oreillettes sont petites, inégales et lisses.

Rapports et différences. Parmi les espèces décrites, celle qui a le plus de rapport avec la nôtre est le *P. alpinus,* mais celui-ci est beaucoup plus orbiculaire, son angle apicial est bien plus ouvert, et ses stries concentriques, plus fortes et plus rapprochées, forment avec les stries rayonnantes un treillis bien différent de la surface lisse du *P. Greppini.* Le *P. orbicularis,* qui se rapproche beaucoup de notre espèce par ses valves lisses et très aplaties, s'en différencie par sa forme plus orbiculaire, ses oreillettes égales, ses stries concentriques plus fortes et plus régulières, et ses stries rayonnantes, par contre encore moins apparentes. Le *P. Cottaldinus* se distingue non moins facilement du *P. Greppini* par son épaisseur bien plus grande, ses stries concentriques plus fortes et plus régulières et ses stries rayonnantes obliques et interrompues. Quant aux *P. striato-punctatus* et *P. virgatus,* ils sont clairement caractérisés par leurs lignes de points enfoncés. Le *P. calvus* Goldf. du Lias d'Allemagne, qui a aussi quelque analogie avec le nôtre, s'en distingue par ses stries concentriques plus accusées et plus régulières, par ses stries rayonnantes beaucoup plus fortes et non arquées.

Localités. Le *P. Greppini* est plutôt rare à la Perte du Rhône, où il ne se trouve que dans la marne jaune (h). Musée de Genève et collection Renevier. Le seul autre gisement où nous avons pu le constater jusqu'ici est le lower greensand d'Atherfield (Crackers), où il est très rare et d'où nous avons trois bons échantillons sous les yeux. (Collection Renevier). »

Additional description

Number of studied specimens : total 15

French	Aptian	4 specimens
Swiss	Aptian	8 specimens
French	Albian	3 specimens

Measurements :

	U. P. D.	W.	A. A.	S.	
	—	—	—	—	
Holotype	14.3 mm	13.6 mm	102°	R.	Mus. Laus.
Sp. type-series	13.7 mm	11.9 mm	94°	R.	
	10.6 mm	8.4 mm	85°	R.	
	13.4 mm	13.0 mm	94°	R.	Mus. Gen.

Those 4 specimens from La Perte du Rhône (Ain) (Aptian).

Orig. DE LORIOL	17.9 mm	15.9 mm	89°	R.	Mus. Gen.
Orig. DE LORIOL	11.7 mm	10.1 mm	88°	R.	Mus. Gen.

Those 2 specimens are from Cosne (Nièvre) (Albian).

Description :

Diagnosis. — Small *Syncyclonema*-species with well developed, relatively large auricles, a byssal sinus, long apical margins and clear concentric growth lines near the pallial margin.

The discs are smooth except for concentric growth lines near the pallial margin.

The auricles are also covered with concentric lines.

The hinge-margin is long : more than $\frac{2}{3}$ of the width of the disc; the apical margins are straight and about $\frac{1}{2}$ as long as the U. P. D.

The auricles are relatively large : on the right valve the anterior auricle along the hinge-margin equals $\frac{1}{2}$ the W. of the disc. It is acute-angled and smooth except for concentric growth lines. The posterior auricle is obtuse — angled and is almost isosceles. On the left valve the anterior auricle is much larger than the posterior, with an acute angle but with a straight outer margin (no byssal sinus on this valve); the posterior auricle is as on the right valve.

Discussion

Variability :

Since the number of studied and known specimens is very small, little can be said about their variability. The apical angle is wider on the holotype than on the other specimens but one can consider this as being the result of the variation.

Synonymy :

In the collections of the Musée géologique in Lausanne and of the Musée d'Histoire naturelle in Geneva I have been unable to trace the specimens which, according to PICTET & RENEVIER, belong to *P. grep-*

pini and come from the Lower Greensand of Atherfield (Isle of Wight). In the British collections I never saw specimens which could belong to *P. greppini* from Atherfield or any other locality.

The specimens from the Gault-strata of the Nièvre described as *Pecten darius* (D'ORBIGNY) by DE LORIOL also belong with *S. greppini* : the auricles are, as is clearly visible on DE LORIOL's figure, very unequal (thus there is no doubt that they cannot belong to *Pecten darius* which is *Entolium orbiculare*). The specimens from the Nièvre have the same disc-auricle shape and ornamentation as the type-specimen of *S. greppini* and are certainly conspecific with it.

Differentiation :

Syncyclonema greppini is one of the small European *Syncyclonema* species; it can be compared in size with *S. haggi* and *S. gamsensis; S. haggi* differs in having longer apical margins, a more slender shape and smaller posterior auricles and its average size is smaller. *S. gamsensis* is more convex, has a more orbicular shape (U. P. D. $\pm$ = W.), shorter apical margins and smaller auricles.

Generic attribution :

Pecten greppini PICTET & RENEVIER has a smooth shell, except for concentric growth lines, and, on the right valve, a well developed byssal sinus; it is thus very similar with *S. halli* GABB, 1861 and its correct name is *Syncyclonema greppini* (PICTET & RENEVIER).

Stratigraphical and geographical distribution

Aptian : FRANCE :

Perte du Rhône (Ain) (Mus. Gen. orig. PICTET & CAMPICHE, Mus. Laus. orig. PICTET & RENEVIER, pl. 19, f. 4)

SWITZERLAND :

Creux de Tête, Pegnaz (Mus. Laus.)
Perriblanc de Bovonnaz (Mus. Laus.)

Albian : FRANCE

Cosne (Nièvre) (Mus. Gen. also orig. DE LORIOL 1882, pl. 10, f. 6)

Syncyclonema haldonensis (Woods, 1902)

v . 1902 — *Pecten (Syncyclonema) orbicularis* var. *haldonensis* H. Woods, p. 150, 151, pl. 27, f. 4.

non 1939 *Pecten (Syncyclonema) orbicularis* var. *haldonensis* = *Entolium orbiculare* (Sowerby) R. Marlière, p. 95, pl. 6, f. 2.

Location and designation of type-specimens

Lectotype : 991, Practical Geology Coll., Geological Sciences Institute, London designated by R. Marlière, 1939.

Stratum typicum :

Blackdown Beds, Upper Greensand (Upper Albian).

Locus typicus :

Haldon (Great Britain).

Description

Number of studied specimens :

from Haldon and Kingskerswell : 57
from Le Mans : 5

Measurements :

U. P. D. varies from 10.6 mm to 36.7 mm; av. 24.9 mm (n = 32).
W. varies from 9.3 mm to 32.6 mm; av. 21.4 mm (n = 29).
A. A. varies from 78° to 92.5°; av. 86° (n = 43).

index $\frac{H}{W}$ varies from 1.0402 to 1.2911; av. 1.1414

Description :

Diagnosis : relatively flat valves covered with fine concentric ridges; large auricles and long, straight apical margins; the hinge margin is straight on both valves.

right valve : covered with very fine microscopical concentric striae, which continue on the auricles.

anterior auricle : almost equilaterally triangular, byssal sinus is present but not very well developed, the auricle surface is covered with numerous concentric striae.

non (1850) *Pecten darius* d'Orbigny (= *Entolium orbiculare* Sowerby)
1923 — *Pecten (Camptonectes?) Greppini* Pict. et Renv. V. K. PETKOVIC, p. 61.
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	U. P. D.	W.	A. A.	S.	
	—	—	—	—	
Holotype	14.3 mm	13.6 mm	102°	R.	Mus. Laus.
Sp. type-series	13.7 mm	11.9 mm	94°	R.	
	10.6 mm	8.4 mm	85°	R.	
	13.4 mm	13.0 mm	94°	R.	Mus. Gen.

Those 4 specimens from La Perte du Rhône (Ain) (Aptian).

Orig. DE LORIOL	17.9 mm	15.9 mm	89°	R.	Mus. Gen.
Orig. DE LORIOL	11.7 mm	10.1 mm	88°	R.	Mus. Gen.

Those 2 specimens are from Cosne (Nièvre) (Albian).

Description :

Diagnosis. — Small *Syncyclonema*-species with well developed, relatively large auricles, a byssal sinus, long apical margins and clear concentric growth lines near the pallial margin.

The discs are smooth except for concentric growth lines near the pallial margin.

The auricles are also covered with concentric lines.

The hinge-margin is long : more than $\frac{2}{3}$ of the width of the disc; the apical margins are straight and about $\frac{1}{2}$ as long as the U. P. D.

The auricles are relatively large : on the right valve the anterior auricle along the hinge-margin equals $\frac{1}{2}$ the W. of the disc. It is acute-angled and smooth except for concentric growth lines. The posterior auricle is obtuse — angled and is almost isosceles. On the left valve the anterior auricle is much larger than the posterior, with an acute angle but with a straight outer margin (no byssal sinus on this valve); the posterior auricle is as on the right valve.

Discussion

Variability :

Since the number of studied and known specimens is very small, little can be said about their variability. The apical angle is wider on the holotype than on the other specimens but one can consider this as being the result of the variation.

Synonymy :

In the collections of the Musée géologique in Lausanne and of the Musée d'Histoire naturelle in Geneva I have been unable to trace the specimens which, according to PICTET & RENEVIER, belong to *P. grep-*

posterior auricle : smaller, with very long outer margin but short hinge margin, obtuse angled.

left valve : covered with fine macroscopic concentric ridges with varying number (20 to 56) on the disc and on the auricles.

both auricles are large and with a very long hinge margin : 2/3 of W; anterior auricle is rectangular; hinge margin equals outer margin in length; posterior auricle is slightly smaller and obtuse angled.

Discussion

This is a separate species and not a variety from *E. orbiculare* (SOWERBY) because :

1. the auricles are unequal and a byssal sinus is present.
2. the apical angle is narrower and the auricles are never dorsally projected.
3. the species is found in localities where *E. orbiculare* is unknown.

Specimens described by R. MARLIÈRE as belonging to var. *haldonensis* are in reality perfectly normal but smaller specimens than usually found of *E. orbiculare;* the narrower apical angle is easily explained by the small size of the specimens. As can be seen on page 16 *E. orbiculare* specimens from Black Fenn (Dorset) have A. A. which are as narrow as those found by MARLIÈRE on Belgian specimens.

S. haldonensis shows some similarity with *S. hagenowi* : they are both covered with concentric ridges and have the same disc shape. Their auricles are different. There is another similarity : according to Dr. N. J. MORRIS (B. M. N. H.) (verbal communication) Haldon is the only British locality where *Alveolina* (Foraminifera) has been found and this indicates a warm and brackish environment. Ciply and neighbourhood where *S. hagenowi* lived was situated in a sea which was becoming brackish by partial isolation.

Generic attribution :

Pecten orbicularis var. haldonensis WOODS (non SOWERBY) has discs covered with concentric ridges but otherwise macroscopically smooth, unequal auricles with byssal sinus on the right valve and thus its correct name should be *Syncyclonema haldonensis* (WOODS).

Stratigraphical and geographical distribution

Upper Albian : GREAT BRITAIN :

Haldon (Devon) (B. M., Geol. Sci., S. M.)
Kingskerswell (B. M., Geol. Sci. orig. WOODS)

Cenomanian : FRANCE :

Le Mans (Sarthe) (B. M. Purchd. L. Saemann, Ec. Min., Mus. Gen.)

Syncyclonema haggi nom. nov.
(Pl. II)

.	1827	— *Pecten laevis*	S. NILSSON, p. 24, pl. 9, f. 17.
v .	(1842)	— *Pecten laevis* Nilss. (pro parte)	F. VON HAGENOW, p. 554.
	(1842)	— *Pecten laevis* Nilss.	H. B. GEINITZ, p. 83, pl. 31, f. 8.
	1842	— *Pecten pulchellus*	P. MATHERON, p. 186, pl. 30, f. 4-6.
non	1827	*Pecten pulchellus* S. Nilsson	
?	1846	— *Pecten laevis* Nilsson	A. E. REUSS, p. 26, 117, 124, pl. 38, f. 22-23.
	1847	— *Pecten laevis* Nilsson	J. MUELLER, p. 34.
	(1849)	— *Pecten laevis* Nilsson	H. G. BRONN, p. 926.
	(1850)	— *Pecten laevis* Nilsson	H. B. GEINITZ, p. 178.
?	1850	— *Pecten pusillus* m.	A. ALTH, p. 244, pl. 12, f. 27.
non	1835	*Pecten pusillus* Muenster in Goldfuss	p. 72, pl. 98, f. 8 a-c.
	(1852)	— *Pecten laevis* Nils.	C. G. GIEBEL, p. 358.
	(1852)	— *Pecten laevis*	C. PUGGAARD, p. 16.
	(1854)	— *Pecten laevis* Nilss.	A. E. REUSS, p. 11, 40.
	(1860)	— *Pecten laevis*	J. BOSQUET, n° 474.
	1861	— *Pecten laevis*	C. W. GUEMBEL, p. 570.
?	1863	— *Pecten laevis* Nilss.	R. DRESCHER, p. 353.
?	(1863)	— *Pecten laevis* Nils.	D. STUR, p. 55.
v .	1866	— *Pecten laevis* Nilsson	K. A. ZITTEL, p. 108, pl. 17, f. 4.
	1868	— *Pecten laevis*	C. W. GUEMBEL, p. 756.
	1869	— *Pecten pusillus* Alth	E. FAVRE, p. 145.
.	1870	— *Pecten membranaceus*	F. ROEMER, p. 356, pl. 39, f. 11-12.
non	1827	*Pecten membranaceus* S. Nilsson	
	(1871)	— *Pecten (?Syncyclonema) laevis* Nils.	F. STOLICZKA, p. 428.
.	1872	— *Pecten laevis* Nilss.	H. B. GEINITZ, p. 192, pl. 43, f. 12, 13.
	(1875)	— *Pecten laevis* Nilss.	H. B. GEINITZ, p. 33.
.	1877	— *Pecten laevis* Nilss.	A. FRITSCH, p. 134, f. 125.
	1881	— *Pecten laevis* Nilss.	C. GERSTER, p. 49.
	(1882)	— *Pecten laevis* Nilss.	J. DE MORGAN, p. 38.
	1883	— *Pecten laevis* Nilss.	A. FRITSCH, p. 115.
	(1883)	— *Pecten laevis* Nilss.	B. LUNDGREN, p. 617.
	1885	— *Syncyclonema laevis* Nilsson sp.	J. BOEHM, p. 83.

.	1887	— *Pecten laevis* Nilsson	A. PÉRON, p. 164.
(1888)		— *Pecten laevis* Nilss.	F. E. GEINITZ, p. 735.
(1888)		— *Pecten* cf. *laevis* Nilss.	F. E. GEINITZ, p. 736.
?	1889	— *Pecten (Entolium) pusillulus* n. nom.	O. GRIEPENKERL, p. 47.
.	1889	— *Pecten laevis* Nilss.	E. HOLZAPFEL, p. 232, pl. 26, f. 4.
	1891	— *Syncyclonema laevis* Nilsson sp.	J. BOEHM, p. 87.
	1893	— *Pecten laevis* Nilss.	A. FRITSCH, p. 101.
.	1894	— *Pecten laevis* Nilsson	A. HENNIG, p. 518.
(1895)		— *Pecten laevis* Nilsson	F. VOGEL, p. 25.
(1896)		— *Pecten laevis*	H. MUNTHE, p. 26.
(1896)		— *Pecten laevis* Nilss.	A. RUTOT, p. 30.
v .	1897	— *Pecten laevis* Nilss.	A. HENNIG, p. 36, pl. 2, f. 25, 26.
(1897)		— *Pecten laevis* Nilss.	G. RADKEWITSCH, p. 100.
(1899)		— *Pecten membranaceus*	G. GAGEL & F. KAUNHOWEN, p. 232.
non	1827	*Pecten membranaceus* S. Nilsson	
(1900)		— *Pecten laevis* Nilsson	J. V. ZELIŽKO, p. 534.
v .	1902	— ? *Pecten laevis* Nilss.	J. P. J. RAVN, p. 93.
v .	1902	— *Pecten spathulatus*	J. P. J. RAVN, p. 93, pl. 2, f. 6-7.
?	1902	— *Pecten laevis* Nilss.	M. VON PALFY, p. 275.
(1906)		— *Pecten laevis* Nilss.	W. PETRASCHECK, p. 425.
	1909	— *Pecten pusillulus* O. Griepenkerl	W. ROGALA, p. 693.
	1911	— *Pecten laevis* Nilss.	K. VOGEL VON FALCKENSTEIN, p. 554.
(1924)		— *Pecten* cfr. *laevis* Nilss.	M. SCHLOSSER, p. 87.
(1924)		— *Pecten laevis* Nilss.	L. LEHNER, p. 177, 180.
	1925	— *Pecten laevis* Nilsson	R. HÄGG, p. 9.
	1930	— *Pecten laevis* Nilsson	R. HÄGG, pp. 36-37.
(1931)		— *Pecten laevis* Nilss.	B. MUELLER, p. 93.
v .	1932	— *Pecten (Syncyclonema) laevis* Nilsson	D. WOLANSKY, p. 19.
.	1934	— *Pecten laevis* Nilss.	H. ANDERT, pp. 165-166, pl. 9, f. 11.
v .	1935	— *Pecten (Syncyclonema) laevis*	R. HÄGG, p. 33.
(1935)		— *Pecten laevis* Nilss.	H. KATSCHTHALER, p. 175.
v .	1937	— *Pecten (Syncyclonema) laevis* Nilsson	L. LEHNER, p. 184, pl. 23, f. 1.
.	1939	— *Pecten (Syncyclonema) laevis* Nilsson	E. DACQUÉ, p. 126.

. 1943	— *Pecten (Syncyclonema) laevis* Nilsson	W. J. M. VAN DER WEIJDEN, p. 84, pl. 7, f. 8-10.
v . 1946	— *Pecten (Syncyclonema) laevis* Nilss.	J. P. J. RAVN, p. 22.
1947	— *Pecten (Syncyclonema) laevis* Nilsson	R. HÄGG, p. 68.
1952	— *Pecten (Syncyclonema) laevis* Nilss.	H. ØDUM, p. 17.
(1953)	— cf. *Pecten laevis* Nilss.	J. DVOŘAK, p. 531.
1954	— *Pecten (Syncyclonema) laevis* Nilsson	R. HÄGG, pp. 38-39.
(1956)	— *Pecten laevis* Nilss.	K. A. TROEGER, p. 42, 89.
(1961)	— *Pecten laevis* Nilsson	L. B. CZABALAY, p. 422.
(1964)b	— *Pecten (Syncyclonema) laevis* Nilss.	H. ARNOLD, p. 307.
(1964)c	— *Pecten (Sync.) laevis* Nilss.	H. ARNOLD, p. 317.
(1966)	— *Pecten laevis* Nilss.	S. L. BENKÖ, p. 73.
non 1777	*Pecten laevis*	T. PENNANT, Brit. Zool. ed. 4, IV, p. 102 (fide SHERBORN).
non 1825	*Pecten laevis*	M. DEFRANCE, p. 251.
non 1841	*Pecten spathulatus* Roemer (= *Syncyclonema nilsoni* (Goldfuss))	

Derivatio nominis

For Dr. R. HÄGG who worked, for many years, on Swedish Cretaceous Molluscs and Brachiopods.

Location and designation of type-specimens

Palaeontologiska Institutionen, Lund LO 79 t : though recorded in the Original Samling the specimen is at present lost. There are enough topotypes known to make the eventual choice of a neotype unnecessary.
Pecten pusillus ALTH : lost.

Stratum typicum :

In calce arenosa et carbonifera (Campanian) (chosen here).
Pecten pusillus ALTH : Kreidemergel (Upper-Maastrichtian).

Locus typicus :

Köpinge, Sweden (chosen here).

Pecten pusillus ALTH : Lemberg (Lwow, U. S. S. R.) (O. D.).

Original descriptions

« P. testa suborbiculari convexiuscula, tenui, nitida, laevi; auriculis inaequalibus, minori obtusangula, majori extus rotundata; rostro basali rectangulo, marginibus utrinque rectis.

Diam. 8-10 mm.

Descript. — Satis tenuis, parum convexa, fere orbicularis, oculo nudo plane laevis & nitida; armato autem tenuissime transversim striata; in speciminibus quibusdam vestigia observantur striarum radiantium punctis minutissimis consistentium.

Obs. — Ad *Pectinem arcuatum* proxime accedit; differt vero marginibus rostri rectis, & defectu striarum arcuatum infra auriculas.

Locus. — In calce arenosa et carbonifera ad Köpinge & ad Svenstorpsmölla vulgaris est species; obvenit etiam in arena viridi ad Köpingemölla; in lapide arenaceo regionis ad Yngsjö & c. »

Pecten pusillus

« P. testa laevissima nitida, suborbiculari, compressa, linea cardinis recta, marginibus cardinis rectis, ad medietatem testae decurrentibus, angulo cardinis subrecto, auriculis subaequalibus, altera rectangula, altera obtusa, duobus sulcis linearibus radiantibus circa lineam cardinis ornata.

Dim. : Länge 3 Mill. Breite 3 ½ Mill. Länge des Schlossrandes 2 Mill.

Ei-kreisförmig, flach, glatt und glänzend, selbst mit bewaffnetem Auge weder concentrische noch Radialstreifen sichtbar, nur in der Nähe des Stirnrandes eine tiefe Anwachsfurche. Der Schlossrand gerade, die Schlosskanten gerade, bis zur Hälfte der Breite herabreichend, dann ohne einen Winkel zu binden, in den halbkreisförmigen Stirnrand übergehend. Schlosskantenwinkel ein rechter, die Ohren ungleich, das eine rechtwinklig bis zu ⅔ des Schlosskante herabreichend, das zweite an der Schlosslinie stumpfwinklig, dann in einem wenig concaven Bogen längs der Schlosskante bis fast zu ihrem Ende herablaufend. Dieses Ohr zeigt zugleich in der Nähe der Schlosslinie zwei genäherte vertiefte Radiallinien, sonst ist die Oberfläche beider Ohren ganz glatt. Von *P. laevis* Nils, dem diese Species sehr nahe steht, unterscheidet sie sich durch die noch viel geringere Grösse, den Mangel jeder concentrischen Streifung, die Gestalt der Ohren, und die zwei vertieften Radiallinien des einen Ohres.

Sehr selten im Kreidemergel von Lemberg. »

Additional description

Number of studied specimens : total : 438

Czech Cenomanian	4 specimens
Czech Turonian	10 specimens
East German Turonian	3 specimens
West German Turonian	2 specimens
Austrian Senonian	8 specimens
Belgian-Dutch Senonian	76 specimens
Danish Senonian	7 specimens
East German Senonian	4 specimens
French Senonian	3 specimens
Swedish Senonian	43 specimens
West German Senonian	6 specimens
Belgian-Dutch Maastrichtian ...	160 specimens
Danish Maastrichtian	51 specimens
East German Maastrichtian ...	34 specimens

Swedish Maastrichtian	3 specimens
Ukrainian Maastrichtian	8 specimens
West German Maastrichtian ...	16 specimens

Measurements :

— Vaals : Hervian specimens : n = 59

U. P. D. : 5.2 mm to 10.3 mm, av. 7.1 mm

W. : 4.5 mm to 9.3 mm, av. 6.2 mm

$$\text{index } \frac{H}{W} = 1.1075 \text{ to } 1.1818; \text{ av. } 1.1443$$

— Maastricht : Maastrichtian specimens : n = 62

U. P. D. : 3.2 mm to 10.5 mm; av. 6.2 mm

W. : 3.1 mm to 9.1 mm; av. 6.0 mm

$$\text{index } \frac{H}{W} = 1.0323 \text{ to } 1.1538; \text{ av. } 1.0930$$

A. A. : 75° to 97°; av. 85°

Description of the valves :

Diagnosis. — Small, smooth, acline, with semi-circular complete pallial margin, long, straight apical margins and a straight or almost straight hinge-margin. Apical margins reach ⅔ of the height of the disc. The concentric growth lines are strongly marked on the large anterior auricles.

right valve : anterior auricle : deep byssal sinus; large hinge-margin can reach half the total width of the disc.

posterior auricle : much smaller than the anterior, completely smooth and obtuse-angled.

left valve : anterior auricle : large, with acute or right angle.

posterior auricle : as on the right valve.

Discussion

Synonymy :

Some of the specimens in the VON HAGENOW collection labelled by that author as *Pecten laevis* NILSSON are in fact *Entolium membranaceum* (NILSSON); this explains the use of (pro parte). Whether *Pecten pusillus* ALTH is really synonymous with *S. haggi* is difficult to decide without the original ALTH-material. In Dresden I saw specimens from Nagorzany which undoubtedly belong to *S. haggi* so it is likely that both taxa are synonymous.

Differentiation :

S. haggi differs from all other European *Syncyclonema*-species by its long apical margins, large auricles and small size.

S. halli (GABB) is similar with *S. haggi;* on the figures in SPEDEN, 1967 it seems that the American species has smaller auricles than the European one, and some of the figured specimens seem to have shorter apical margins.

Generic attribution :

S. haggi (nom. nov. for *Pecten laevis* NILSSON) has a smooth shell a well-developed byssal sinus and is so similar with *S. halli* that there is little doubt it belongs to *Syncyclonema.*

Stratigraphical and geographical distribution

Cenomanian : CZECHOSLOVAKIA :

Korycany (Halle, N. M. W.)

Turonian : CZECHOSLOVAKIA :

Briesnitz/Elbe (DR.)
Kystra (N. M. W.)
Lindenau, Böhmisch Zwickau (DR., KO.)
Zschernitz (DR.)

G. D. R. :

Plauen (DR.)

G. F. R. :

Hartmannshofer Sandstein, Fürnried (Mü.)

Senonian : AUSTRIA :

Gosau, Finstergraben (Mü., N. M. W.)
Gosau, Tiefengraben (Geol. Bund. Wien)

BELGIUM - THE NETHERLANDS :

Geulhem (Ma.)
Vaals (I. R. Sc. N. B., Musé.)

DENMARK : (Bornholm) :

Arnager Fiskerleie (GR.)
Blykobbe Aa (KO. orig. RAVN 1902, 1946)

FRANCE :

Dieu-le-Fît (Drôme) (B.)

G. D. R. :

Plauen (DR.)
Strehlen (DR.)

G. F. R. :

Hoheneggelsen (GH.)
Lüneburg (B.)

SWEDEN :

Köpinge (B., KO., Lund orig. HENNIG, 1897, pl. 2, f. 26)
Kullemölla (Lund orig. HÄGG, 1935)
Lund (KO.)
Östra Sönnarslöv (KO.)
Svenstorp (Lund)
Sventorpsmölla (KO.)

Maastrichtian : BELGIUM - THE NETHERLANDS :

very common in the Limburg deposits (I. R. Sc. N. B., KO.)
rare in the Hainaut deposits (I. R. Sc. N. B.)

DENMARK :

Aalborg (KO.)
Bjerre Thy (KO.)
Eerslev (KO.)
Kastrup (KO.)
Møens Klint (KO.)
Nörholm (KO.)
Skovbakken, Aalborg (KO.)
Stevns Klint, also many specimens in « Grå kridt » (KO.)
Störedal (KO.)
Svinklöven, Fjerritslev (KO.)

G. D. R. :

Rügen (GR. coll. VON HAGENOW, orig. WOLANSKY)

G. F. R. :

Hemmoor (GH.)

SWEDEN :

Åhus (Lund)

U. S. S. R. :

Ukraïne : Nagorzany (DR.)

Syncyclonema nilsoni (GOLDFUSS, 1835)
(Pl. IV.)

v . 1827 — *Pecten orbicularis* S. NILSSON, p. 23, pl. 10, f. 12.
non 1817 *Pecten orbicularis* J. Sowerby
. 1835 — *Pecten Nilsoni* m. A. GOLDFUSS, p. 76, pl. 98, f. 8 a-b.

?	1931	— *Pecten Nilssoni* Goldf.	L. RIEDEL, p. 668.
v .	1932	— *Pecten Nilssoni* Goldfuss	V. TZANKOV, p. 54, pl. 2, f. 3.
v .	1932	— *Pecten (Syncyclonema) nilssoni* Goldfuss	D. WOLANSKY, p. 17, pl. 2, f. 9-11.
v ?	1932	— *Pecten (Syncyclonema) nilssoni* Goldfuss var. *abbreviata* von Hagenow	D. WOLANSKY, p. 18, pl. 2, f. 13.
.	1934	— *Pecten (Entolium-Camptonectes) Nilssoni*	M. BLANCKENHORN, pp. 188-189, pl. 8, f. 21.
(1934)		— *Pecten Nilssoni* Goldf.	P. GOČEV, p. 36.
(1934)		— *Pecten Nilssoni* Gldf.	ST. T. JELEV, p. 123, 124, 125.
?	1934	— *Pecten Nilssoni* Goldf.	H. ANDERT, pp. 163-165, pl. 9, f. 10.
(1934)		— *Pecten (Syncyclonema) nilssoni* Goldf.	V. ZAZVORKA & J. SOUKUP, p. 209.
(1935)		— *Syncyclonema spatulata* A. Roem.	H. KATSCHTHALER, p. 175.
	1937	— *Pecten (Syncyclonema) nilssoni* Goldf.	E. BEYENBURG, pp. 303-304.
v .	1937	— *Pecten (Syncyclonema) nilssoni* Goldf.	L. LEHNER, p. 183, pl. 23, f. 3 (non f. 2).
(1938)		— *Pecten Nilssoni* Goldf.	W. POZARYSKI, p. 23.
v .	1939	— *Pecten (Camptonectes) nilssoni* Goldf.	E. DACQUÉ, p. 100, pl. 6, f. 15.
.	1939	— *Pecten (Camptonectes) nilssoni* Goldf.	E. DACQUÉ, p. 100, pl. 6, f. 18.
	1939	— *Pecten (Syncyclonema) nilssoni* Goldf.	E. DACQUÉ, p. 202.
?	1943	— *Pecten latus* nov. sp.	W. J. M. VAN DER WEIJDEN, pp. 84-85, pl. 8, f. 1-3.
non	1842	*Pecten latus* F. von Hagenow	
?	1943	— *Pecten (Syncyclonema)* cf. *spatulatus* Roemer	W. J. M. VAN DER WEIJDEN, p. 86, pl. 8, f. 5.
	1947	— *Pecten (Syncyclonema) nilssoni* Goldfuss	R. HÄGG, p. 68.
.	1952	— *Pecten (Syncyclonema) nilssoni*	H. ØDUM, p. 16.
(1953)		— *Pecten Nilssoni* Goldf.	H. PRESCHER, p. 256.
(1953)		— *Pecten Nilssoni* Goldf.	J. F. DVOŘAK, p. 528, 531, 533.
v .	1954	— *Pecten (Syncyclonema) nilssoni* Goldfuss	R. HÄGG, p. 39.

v . 1954 — *Pecten concentrice-punctatus* R. HÄGG, p. 39, pl. 5, p. 56.
(1960) — *Entolium nilssoni* Goldf. K. A. TROEGER & L. WOLF, p. 291.
(1964)a — *Pecten (Syncyclonema) nilsoni* Glf. H. ARNOLD, p. 97.
(1964)b — *Pecten (Syncyclonema) nilssoni* Goldf. H. ARNOLD, p. 207.
(1964)c — *Pecten (Sync.) nilsoni* Glf. H. ARNOLD, p. 317.
(1965) — *Pecten (Syncyclonema)* nilssoni Goldf. S. CIESLINSKI, p. 120.
non 1836 *Pecten Nilssoni* G. P. Deshayes *in* Lamarck : Hist. Nat. Anim. sans Vert. éd. 2, VII, p. 168 (fide Sherborn).
non 1839 *Pecten Nilsoni* H. B. Geinitz, p. 23.
non 1846 *Pecten Nilssoni* (p. p.) A. E. Reuss, p. 26.
non 1847 *Pecten Nilssoni* J. Mueller, p. 31.
non 1875 *Pecten Nilssoni* H. B. Geinitz, p. 33.
non 1877 *Pecten Nilssoni* A. Fritsch, p. 134, f. 124.
non 1883 *Pecten Nilssoni* A. Fritsch, p. 115, f. 88.
non 1889 *Pecten Nilssoni* A. Fritsch, p. 84.
non 1893 *Pecten Nilssoni* A. Fritsch, p. 100.
non 1897 *Pecten Nilssoni* A. Fritsch, p. 68.
non 1911 *Pecten Nilssoni* A. Fritsch, p. 43, f. 197.
non 1937 *Pecten (Syncyclonema) nilssoni* L. Lehner, pl. 13, f. 2. = *Entolium membranaceum* (Nilsson, 1827)
non 1869 *Pecten Nilssoni* E. Favre, pp. 142-143 (fide Rogala, 1909, p. 693).

Location and designation of type-specimens

Palaeontologiska Institutionen Lund : Original Samling LO 77 t.
Pecten nilsoni : Paläontologisches Institut, University of Bonn, G. F. R.

Stratum typicum :

In calce arenosa et carbonifera (Campanian).
Pecten nilsoni : Kreidetuff (Upper Maastrichtian).

Locus typicus :

Köpinge (Sweden) (chosen here)
Pecten nilsoni : Maastricht (The Netherlands) (O. D.).

	. 1841	—	*Pecten spathulatus* F. A. ROEMER, p. 50, pl. 8, f. 5.
	1841	—	*Pecten Nilssoni* F. A. ROEMER, p. 50.
	(1842)	—	*Pecten Nilssoni* Goldf. F. VON HAGENOW, p. 554.
v	. 1842	—	*Pecten membranaceus* Nilss. (pro parte) F. VON HAGENOW, p. 553.
	1846	—	*Pecten Nilssoni* Goldf. (pro parte) A. E. REUSS, p. 26, pl. 39, f. 1.
	. 1846	—	*Pecten Nilssoni* Goldf. H. B. GEINITZ, p. 468.
	. 1847	—	*Pecten Nilssoni* Goldfuss A. D'ORBIGNY, p. 616, pl. 39, f. 12-14.
	(1849)	—	*Pecten Nilssoni* Gf. H. G. BRONN, p. 927.
	(1850)	—	*Pecten Nilssoni* Goldf. H. B. GEINITZ, p. 178.
	(1850)	—	*Pecten Nilssoni* Goldf. A. D'ORBIGNY, p. 251, n° 835.
	. 1852	—	*Pecten Nilssoni* C. PUGGAARD, p. 16, f. 31.
	(1854)	—	*Pecten Nilssoni* Goldf. A. E. REUSS, p. 40.
	(1860)	—	*Pecten Nilssoni* J. BOSQUET, n° 476.
	(1861)	—	*Pecten Nilssoni* Goldf. W. GABB, p. 159.
	(1861)	—	*Pecten spathulatus* Roem. W. GABB, p. 160.
	(1870)	—	*Pecten Nilssoni* Goldf. F. ROEMER, p. 343.
v	. 1874	—	*Pecten (Amusium)* sp. W. DAMES, p. 764, pl. 21, f. 2.
	1875	—	*Pecten (Pseudamusium) Nilssoni* Goldfuss D. BRAUNS, p. 389.
	(1878)	—	*Pecten Nilssoni* Goldf. G. BEHRENS, p. 259.
	(1882)	—	*Pecten Nilssoni* Nilss. J. DE MORGAN, p. 38.
	(1888)	—	*Pecten Nilssoni* F. E. GEINITZ, p. 735, 743, 747.
	1889	—	*Pecten (Entolium) membranaceus* O. GRIEPENKERL, p. 47.
non	1827		*Entolium membranaceus* (Nilsson)
	1889	—	*Pecten (Entolium) Nilssoni* Goldf. O. GRIEPENKERL, p. 47.
	. 1895	—	*Pecten Nilssoni* Goldf. F. VOGEL, p. 21, pl. 1, f. 17.
	(1896)	—	*Pecten spathulatus* O. REIS, p. 7.
	(1897)	—	*Pecten (Entolium) Nilssoni* O. REIS, p. 97.
v	. 1897	—	*Pecten Nilssoni* Goldfuss A. HENNIG, p. 67, pl. 3, f. 18-19.
	(1897)	—	*Pecten Nilssoni* Goldf. J. V. ZELIŽKO, p. 175.
	? 1897	—	*Pecten Nilssoni* Goldf. R. LEONHARD, p. 46.
	(1899)	—	*Pecten Nilssoni* Goldf. N. KRISCHTAFOVITSCH, p. 9.
	(1900)	—	*Pecten Nilssoni* Goldf. J. V. ZELIŽKO, p. 534, 536, 541, 543.
	(1901)	—	*Pecten Nilssoni* W. PETRASCHECK, p. 277.
	? 1901	—	*Pecten spathulatus* W. PETRASCHECK, p. 405.

? 1901	— *Pecten* cf. *spathulatus* A. Roemer	A. WOLLEMAN, p. 18.
(1901)	— *Pecten Nilssoni* Goldf.	K. HINTERLECHNER, p. 474.
v . 1902	— *Pecten Nilssoni* Goldf.	H. WOODS, p. 152, 226, pl. 42, f. 9, 10.
v . 1902	— *Pecten* sp. cf. *Nilssoni* Goldf.	H. WOODS, p. 226.
? 1902a	— *Pecten Nilssoni* Goldfuss	A. WOLLEMANN, p. 63.
(1902)d	— *Pecten* cf. *spathulatus* A. Roemer	A. WOLLEMANN, p. 59.
(1902)e	— *Pecten Nilssoni* Goldf.	J. J. JAHN, p.86, 89.
v . 1902	— *Pecten Nilssoni* Goldf.	J. P. J. RAVN, p. 91, pl. 2, f. 3-5.
(1904)	— *Pecten Nilssoni*	W. PETRASCHECK, p. 5.
(1904)	— *Pecten Nilssoni* Goldf.	J. J. JAHN, p. 321.
(1905)	— *Pecten Nilssoni* Goldf.	H. J. O. WHITE & L. TREACHER, p. 473.
(1905)	— *Pecten Nilssoni* Goldf.	J. J. JAHN, p. 86, p. 89.
? 1905	— *Pecten* cf. *spatulatus* A. Roemer	T. WEGNER, p. 174.
(1906)	— *Pecten Nilssoni*	W. PETRASCHECK, p. 410.
. 1909	— *Pecten (Syncyclonema) Nilssoni*	W. ROGALA, p. 693.
(1911)	— *Pecten (Syncyclonema) Nilssoni*	W. ROGALA, p. 493.
? 1913	— *Pecten (Syncyclonema) spatulatus* Roem.	H. SCUPIN, p. 221, pl. 12, f. 18.
1915	— *Pecten* cf. *spathulatus*	F. SCHNITTMANN, p. 214.
v . 1918	— *Pecten (Syncyclonema) Nilssoni* Goldf.	J. P. J. RAVN, p. 27.
? 1923	— *Pecten (Syncyclonema) Nilssoni*	A. JESSEN & H. ØDUM, p. 34.
(1924)	— *Pecten Nilssoni* (Goldf.) Orb.	L. LEHNER, p. 177.
(1925)	— *Pecten nilssoni*	R. POTONIÉ, p. 618.
? (1926)	— *Pecten (Syncyclonema) spathulatus* Roem.	H. ØDUM, p. 178.
(1926)	— *Pecten (Syncyclonema) Nilssoni* Goldf.	H. ØDUM, p. 178.
(1926)	— *Pecten Nilssoni* Goldf.	B. BESCHOREN, p. 101.
(1928)	— *Pecten (Syncyclonema) nilssoni* Goldf.	J. MACHAČEK, p. 447, 449, 451.
1930	— *Pecten (Syncyclonema) Nilssoni* Goldfuss	R. HÄGG, pp. 41-42.
. (1931)	— *Pecten Nilssoni* Goldf.	V. TZANKOV, tabl. III.
? 1931	— *Pecten (Syncyclonema) nilssoni* Goldf.	L. NOETH, p. 335.

Original descriptions

« P. testa orbiculari tenuissima, concentrice striata, depressa, rostri dorso subelato; auriculis aequalibus majusculis, basi latioribus.

Pecten orbicularis Sow. Min. conch. Tab. 186 ?

Descript. — Testa suborbicularis, tenuissima & fere membranacea, striis concentricis inaequalibus ornata, valde depressa & medio tantum anguli seu rostri basalis elevato-convexo; auriculae aequales, rectangulae, vel inferius aliquantum latiores.

Locus. — In calce arenosa & carbonifera ad Köpinge rarius, etiam in silice variegata ad Årup observata. »

Pecten Nilsoni

« Pecten testa subaequivalvi aequilaterali subsemicirculari tenuissima laevi nitida, striis concentricis subtilissimis, auriculis rhomboidalibus difformibus, anteriore valvae dextrae elongata basi profunde sinuata.

E creta topphina montis St. Petri. M. B.

Gleichklappig, gleichseitig, fast halbkreisförmig, sehr flach und dünn, glatt und glänzend, mit sehr feinen, fast verwischten, gedrängten concentrischen Streifen. Die Ohren sind mässig gross, parallel etwas schief abgeschnitten; das vordere der rechten Schale ist verlängert und ausgebuchtet.

Findet sich im Kreidetuff bei Mastricht. »

Additional description

Number of studied specimens : total 495

Upper Maastrichtian topotypical specimens (have been measured) :

I. R. Sc. N. B.	35 specimens	
Natuurh. Museum Maastricht ...	6 specimens	
von Humboldt Universität Berlin (coll. Binkhorst)	17 specimens	
West German Cenomanian ...	7 specimens	
Danish Turonian	9 specimens	
East German Turonian	8 specimens	
West German Turonian	9 specimens	
Belgian-Dutch Senonian	34 specimens	
British Senonian	2 specimens	
Czech Senonian	2 specimens	
Danish Senonian	4 specimens	
East German Senonian	18 specimens	
Swedish Senonian	7 specimens	
West German Senonian	6 specimens	
Belgian-Dutch Maastrichtian ...	38 specimens	(excluding topotypes)
British Maastrichtian	3 specimens	
Bulgarian Maastrichtian	16 specimens	
Danish Maastrichtian	143 specimens	
East German Maastrichtian ...	122 specimens	
West German Maastrichtian ...	9 specimens	

Measurements of Maastrichtian topotypical specimens :

U. P. D. varies from 14 mm to 128 mm; av. 54,4 mm (n = 41)
W. varies from 13.8 mm to 128 mm; av. 54.7 (n = 43)
A. A. varies from 93° to 123°; av. 111° (n = 38)

index $\frac{\text{U. P. D.}}{\text{W}}$ varies from 0.9101 to 1.0904; av. 0.9912

Description :

Diagnosis. — Large, smooth flattened *Syncyclonema* with concave apical margins and hinge margins sometimes curved and forming an angle.

Ornamentation. — Limited to concentric growth lines; however, on certain specimens from Maastricht in the von Humboldt Universität in Berlin, near the side and pallial margins there is a diverging striation of white lines; this striation lies in the uppermost shell layer and does not have any real thickness.

right valve : anterior auricle : large, winglike with deep byssal sinus; posterior auricle : smaller, sometimes with acute, usually with right, seldom with obtuse angle.

left valve : anterior auricle : large, almost rectangular; posterior auricle : smaller, usually with obtuse angle.

Discussion

Variability :

The topotypes from Maastricht when compared with the Lower Maastrichtian specimens from Rügen as described by D. WOLANSKY, 1932 (in the collections of the University in Greifswald) seem slightly different :

— the complete shells (well enough preserved to be measured) are smaller in Rügen : the largest specimen mentioned by WOLANSKY has U. P. D. 36 mm and W. 38 mm.

— the index $\frac{\text{U. P. D.}}{\text{W}}$ varies in the same way as in Maastricht, between 0.9032 and 1.1428.

— the apical angles are larger : 100° to 130°.

The difference might be due to environmental factors but also to the extreme brittleness of the shells in the « Schreibkreide » which makes it very difficult to prepare complete large specimens in these Lower Maastrichtian strata. That large specimens of comparable sizes with those found in Maastricht also occur in Rügen (and in Danish equivalent

strata) I have been able to recognize on fragments and on complete not wholly uncovered specimens.

The diverging striae seen on some specimens from Maastricht in the BINKHORST-collection, in the Berlin-Museum, are not an isolated fact : M. BLANCKENHORN, 1934 described an identical « ornamentation » on *S. nilsoni* from Upper Cretaceous strata in Lebanon (these are the generic characteristic diverging radial lines, which are unusually clear and became macroscopical).

Synonymy and differentiation :

The main problem concerning *S. nilsoni* (GOLDFUSS) is its differentiation towards *E. membranaceum* (NILSSON). The confusion between these 2 species was solved by D. WOLANSKY (for details see sub *E. membranaceum*).

I am not convinced that *Pecten nilsoni* var. *abbreviata* WOLANSKY is really conspecific with the species here discussed; the 3 specimens with the label *Pecten abbreviatus* VON HAGENOW which I saw in Greifswald have very small auricles and thus could probably rather belong to the genus *Lima* s. l. than to *Syncyclonema*. Unfortunately, I could not find in the Muséum national d'Histoire naturelle the specimens which D'ORBIGNY figured as *Pecten nilsoni* and which WOLANSKY considers to belong to the var. *abbreviata*. 7612 of the D'ORBIGNY collection is a very good specimen of *S. nilsoni*, but it came from Maastricht. *Syncyclonema nilsoni* can easily be differentiated from other *Syncyclonema*-species by its larger size, wider apical angle and curved apical margins.

Generic attribution :

Pecten nilsoni (GOLDFUSS) is much larger than *S. halli* but otherwise it shows the same characteristics (well developed byssal sinus, smooth discs) and thus its correct name is *Syncyclonema nilsoni* (GOLDFUSS, 1835).

Stratigraphical and geographical distribution

Cenomanian : G. F. R. :

Betzensteiner Kreidekalk, südl. Hüll (Mü.)
Fränkische Vesikulariskreide, Hubmersberg (Mü.) (both specimens are orig. L. LEHNER, 1937)

POLAND :

Bromberg (Geschiebe) (B., orig. DAMES)

Turonian : DENMARK :

Arnager (KO.)

G. D. R. :

Plauen, Dresden (DR.)
Strehlen (KO.)

G. F. R. :

Knollensand, nordwestlich Adlersberg (Mü. orig. DACQUÉ, 1939)

Senonian : BELGIUM - THE NETHERLANDS :

Battice (I. R. Sc. N. B.)
Kunrade (Ma.)
Lonzée (I. R. Sc. N. B.)
Visé (I. R. Sc. N. B.)
Voort-Zolder (I. R. Sc. N. B)

CZECHOSLOVAKIA :

Böhmisch Kamnitz (DR.)

DENMARK : Bornholm :

Bavnodde (KO.)
Blykobbe aa (KO.)

G. D. R. :

Gostritz, Dresden (DR.)
Salzberg, Quedlinburg (B., Halle)

G. F. R. :

Basdorf (B.)
Gross Bülten (GH.)

GREAT BRITAIN :

A. quadratus-zone, Hampshire (S. M. orig. H. WOODS)

SWEDEN :

Åhus (Lund)
Balsberg (KO.)
Köpinge (Lund, orig. NILSSON & HENNIG LO 77 t)
Lyckås (KO.)

Maastrichtian : BELGIUM - THE NETHERLANDS :

Maastricht (B., Ec. Min., I. R. Sc. N. B., KO., K. U. L., Musé. Coll D'ORBIGNY, R. U. G.)

BULGARIA :

Kartojaben (Univ. Sofia)
Kaulka (Univ. Sofia)
both near Pleven

DENMARK :

Aalborg (KO.)
Bögelund (KO.)
« Dania », Mariagerfjord (KO.)

Hillerslev (KO.)
Lindholm (KO.)
Møns Klint (KO.)
Nörholm (KO.)
Nørre Flödal (KO.)
Skelderig (KO.)
Skovbakken (KO.)
Stevns Klint (KO.)
Støre Taler (KO.)
Thy (KO.)

G. D. R. :

Rügen (B. coll. VON HAGENOW, GR. coll. VON HAGENOW & WOLANSKY, Halle)

G. F. R. :

Hemmoor (GH.)

GREAT BRITAIN :

Trimingham (S. M. orig. WOODS)

U. S. S. R. :

Ukraïne : Nagorzany (Ec. Min., N. M. W.)

Syncyclonema gamsensis nom. nov.
(Pl. I, fig. 3.)

.	1854	— *Pecten exilis*	A. E. REUSS, p. 148, pl. 29, f. 10.
v .	1866	— *Pecten exilis* Reuss	K. A. ZITTEL, p. 109, pl. 17, f. 5a-c.
	(1871)	— *Pecten (Syncyclonema) exilis* Reuss	F. STOLICZKA, p. 428.
.	1895	— *Pecten (Pseudamusium) spathulatus* Roem.	F. VOGEL, p. 20, pl. 1, f. 14-16.
(non	1841	*Pecten spathulatus* F. A. Roemer, p. 50, pl. 8, f. 5.)	
non	1830	*Pecten exilis* E. E. Eichwald, p. 212.	

Derivatio nominis :

The area around the type-locality is known as « Gams ».

Location of types :

The REUSS-types were part of the Collection of Count Lobkowitz which was kept in the National Museum in Budapest. During a Hungarian Revolution the Museum was partly destroyed and the Count Lobko-

witz-collection has been lost since then (information received from Dr. H. KOLLMANN of the Naturhistorisches Museum in Vienna).

The REUSS-collection with many topotypes is in the Viennese Museum.

Stratum typicum

Mergeln des Aichkogels (Upper-Coniacian or Lower-Santonian : information given by Dr. H. KOLLMANN).

Locus typicus :

Aichkogel, Gams, Gosau (Austria)

Original description

« 8-10 mm hoch, fast kreisrund, wenig schief, gewölbt mit sehr dünner glatter, glänzender Schale. Sie ist mit äusserst feinen, nur den bewaffneten Auge erkennbaren Linien bedeckt, die nur den Ohren zunächst etwas stärker hervortreten. Die Ohren sind sehr klein, von der Schale abgesetzt, fast rechtwinklig. Scheint in den Mergeln des Achkogels gemein zu sein. »

Description of topotypes

4 specimens in the Naturhistorisches Museum in Vienna :

1864-XL-1191 : original to ZITTEL's pl. 17, f. 5a-c.
1864-XL-1192 : one left and one right valve.
1865-X-133 : one valve.

Measurements :

1864-XL-1192 is the only complete specimen :

	R	L
	—	—
U. P. D.	8 mm	7 mm
W.	8 mm	7 mm
A. A.	100°	93°
index $\frac{\text{U. P. D.}}{\text{W}}$	1.000	1.000

Description :

Diagnosis. — Small, very convex smooth *Syncyclonema* with small auricles.

right valve : smooth except for concentric growthlines.
anterior auricle : with deep byssal sinus but not elongated.
posterior auricle : very small and obtuse-angled.

left valve : sculpture as on right valve.
anterior auricle : rectangular.
posterior auricle : very small and hardly distinguishable from the shell.

Additional description

3 valves from Maastricht, Maastrichtian :

— 1 left and one inside of a right valve in the I. R. Sc. N. B.
— 1 left valve in the Natuurhistorisch Museum in Maatricht.

	L	R	L (Ma)
	—	—	
U. P. D.	10.8	10.8	10.9 mm
W.	9.9	9.9	11.7 mm
A. A.	97°	89°	108°
index $\frac{\text{U. P. D.}}{\text{W}}$	1.100	1.100	0.932

The specimens from Maastricht are very similar to those from Austria, but they are not quite so convex.

Discussion

This species seems to be very rare : I saw only 9 specimens.

Pecten spathulatus as described by F. VOGEL, 1895 is undoubtedly *Syncyclonema gamsensis* and not, as supposed by D. WOLANSKY, 1932, p. 19, *Pecten jugleri* VON HAGENOW : the Maastrichtian specimens lack the auricle ornamentation typical for *P. jugleri* (1).

Although *S. gamsensis* appears to be exceedingly rare it cannot belong to any other *Syncyclonema*-species : it is far too convex and has too small auricles to belong to *S. nilsoni* (GOLDFUSS); its apical margins are too short and the auricles too small to belong to *S. haggi* and *S. greppini* (PICTET & RENEVIER).

In the collections of the Palaeontologiska Institutionen of the University of Lund, sub n° LO1238 t & LO 1239 t are the originals of *Pecten concentricepunctatus* REUSS as described and figured by HENNIG, 1897, pp. 40-41, pl. 3, f. 3-5 from Köpinge. Whether those specimens are really the originals to these figures is difficult to decide : according to HENNIG his specimens attain a U. P. D. of 30 mm, and these 2 specimens are only 11 mm high. Also the punctate diverging striae which HENNIG draws on f. 5 are not present : there are diverging striae, but no punctation. Several Swedish authors report occurrences of *Pecten concentricepunctatus* (2), but these references seem to apply to very finely ornamented *Camptonectes virgatus* (NILSSON, 1827). I saw only one other

(1) *Pecten jugleri* VON HAGENOW is in fact, as I saw when studying WOLANSKY's specimens in Greifswald, an unusual preservation state of the very common Upper Cretaceous *Camponectes virgatus* (NILSSON), in which only the auricles and the areas retained the *Camponectes* ornementation.

(2) J. C. MOBERG, 1884, p. 16; id. 1886, p. 375; G. DE GEER, 1887, p. 15; B. LUNDGREN, 1889, p. 64; A. HENNIG, 1894, p. 519; R. HÄGG, 1935, p. 34; id. 1947, p. 69.

specimen (1) referred to in literature, and thus would rather not venture an opinion as to their general specific position; but, as far as the 2 specimens in the Lund Palaeontological Collections are concerned, they certainly belong to *S. gamsensis* having the short apical margins, the rather convex valves (particularly so on the left valve), the relatively short auricles with well-developed byssal sinus on the right valve typical for that species.

Generic attribution :

The unequal auricles with byssal sinus and the macroscopically smooth shell prove that *Syncyclonema gamsensis*, nom. nov. for *Pecten exilis* REUSS non EICHWALD, really belongs in the genus *Syncyclonema* MEEK.

Stratigraphical and geographical distribution

Senonian : AUSTRIA :

Aichkogel, Gams, Gosau (N. M. W.) (Upper Coniacian-Lower Santonian)

SWEDEN :

Köpinge (Lund)

Maastrichtian : THE NETHERLANDS :

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

Syncyclonema cretacea (NYST, 1843)

.	1827	— *Pecten corneus*	S. NILSSON, p. 23, pl. 9, f. 16 sup., pl. 10, f. 11.
non	1818	*Pecten corneus* Sowerby, pl. 204.	
non	1842	*Pecten corneus* G.B. Sowerby, p. 71 (fide Sherborn).	
non	1843	*Pecten corneus* Melleville, p. 86 (fide Sherborn).	
	1843	— *Pecten cretaceus* Nobis	P. NYST, p. 299.
?	1870	— *Pecten cretaceus* Nyst	C. SCHLUETER, p. 951.
?	1882	— *Pecten cretaceus* Nyst	H. SCHROEDER, p. 268.
.	1897	— *Pecten cretaceus* Nyst	A. HENNIG, pp. 43-45, pl. 3, f. 12, 13 & 20.
v .	1921	— *Pecten (Syncyclonema) cretaceus* Nyst	J. P. J. RAVN, pp. 22-23.
.	1923	— *Pecten (Syncyclonema) cretaceus* Nyst	A. JESSEN & H. ØDUM, pp. 34-35.
.	1938	— *Pecten cretaceus* Nyst	J. G. CARLSSON, p. 9.
	1947	— *Pecten (Syncyclonema) cretaceus* Nyst	R. HÄGG. pp. 67-68.

(1) R. HÄGG, 1954, p. 39, pl. 5, f. 56 : is a *S. nilsoni* (GOLDFUSS) but a poorly preserved specimen.

Holotype :

Palaeontologiska Institutionen, Lund University, Sweden : L. O. 75 t & L. O. 76 t; at present both specimens appear to be lost; no other complete specimens are available.

Locus typicus :

Köpinge (O. D.)

Stratum typicum :

In calce arenosa et carbonifera (Campanian).

Original description

« P. testa orbiculari convexiuscula, lineis impressis concentricis regularibus; interstitiis convexiusculis striatis; radiis nullis; auriculis inaequalibus; callo intus utrinque ad latera cardinis. Diam. circa 50 mm.

Descript. — Inter majores species nostrae formationis cretacea testa orbicularis parum convexa, utraque valva aequalis, concentrice & regulariter striata. Tota scil, superficies ornatur lineis concentricis impressis, quarum duae in unoquoque millimetri spatio; interstitia convexa & tenuissime striata; radiorum nulla vestigia observantur. Auriculae inaequales; ante has in pagina testae interna callus utrinque crassus jacet, qui antice magisque divergit & sensim evanescit. In hac parte valva crassima est.

Interdum haec species reperitur colore subfusco vel corneo. Varietas pallidior quoque obvenit. Testa, quamvis crassa, fragillima ets; quare rare integra occurrit.

Locus. — In calce arenosa & carbonifera ex regione Köpingensis, satis raro. »

Additional description

Number of studied specimens : 12

Danish Senonian	4 specimens
Swedish Campanian	8 specimens

In literature this species has been cited from quite a few localities, but both in the Mineralogisk Museum, Copenhagen and in the Palaeontologiska Institutionen in Lund the species is very poorly represented by fragmentary specimens. The complete specimens figured by NILSSON and HENNIG are lost.

Measurements :

As NILSSON and HENNIG stated this is a large species : 55 mm high by 53 mm wide with A. A. 118° (HENNIG, 1897, p. 43); the only specimen which I could measure (from Øretorp, Scania, in Mineralogisk Museum) U. P. D. 53.2, W. 52.9.

Description :

Diagnosis. — Large orbicular *Syncyclonema*-species with thick shell; both valves are covered with regular numerous concentric ridges which continue on the auricles.

For further details see in HENNIG, 1897; he saw more specimens than I did.

Discussion

Synonymy :

As far as I know SCHLUETER's record of *Syncyclonema cretacea* from Westphalia has not been confirmed by later authors.

The species has a restricted distribution both in time and in area : Bornholm and Scania, from the Santonian to the Campanian.

Stratigraphical and geographical distribution

Santonian : DENMARK : Bornholm :

Bavnodde (KO.)
Forchhammers Odde (KO.)
Vest for Bavnodde (KO.)

Campanian : SWEDEN : Scania :

Balsberg (KO.)
Ignaberga (Lund)
Kjuge (Lund)
Köpinge (Lund)
Oppmanna (Lund)
Øretorp (KO.)

Syncyclonema hagenowi nov. sp.

(Pl. III, fig. 1 a-c.)

Derivatio nominis :

In honour of F. VON HAGENOW who described the Maastrichtian fauna of the Island Rügen (German Democratic Republic).

Nomenclature :

The name *Pecten hagenowi* has been found on manuscript labels by NYST & DE KONINCK in the collections of the I. R. Sc. N. B.

Holotype and Paratypes :

I. R. Sc. N. B., type-collection 9853 : holotype; 9854 & 9855 : paratypes.

Stratum typicum :

Upper Maastrichtian (Craie tuffacée).

Locus typicus :

Saint-Symphorien, Hainaut, Belgium.

Description of holotype and topotypes

Number of studied specimens : 99 from the type-area.

Measurements :

umbo-palleal diameter : from 31 mm to 71 mm; av. 51.5 mm (n= 87)
width : from 32 mm to 68 mm av. 48.0; (n = 87)
A. A. : from 90° to 119°; av. 100°; (n = 87)

index $\frac{\text{U. P. D.}}{\text{W}}$ from 0.9038 to 1. 2400; av. 1.0721.

Description :

Diagnosis. — Medium to large *Syncyclonema*-species with pronounced concentric ornamentation on both valves, with straight apical and hinge margins.

macrosculpture : both valves are covered with well developed concentric ridges; on poorly preserved valves these are not clearly visible. Their number varies between 15 and 27. Near the pallial margin they are closer to one another than in the umbonal area.

right valve : anterior auricle has an equilateral triangular shape and a deep byssal sinus which reaches about half the lenght of the auricle.

posterior auricle : almost right angled and half the size of the anterior auricle.

The concentric ridges are continued on the anterior auricle as lines and lie closer to each other than on the disc.

left-valve : both auricles are right-angled but the anterior is about twice the size of the posterior.

Hinge margin and apical margins are straight; the latter reach about half the lenght of the U. P. D.

Discussion

Among the European *Syncyclonema*-species this is the only one with a concentric macroscopical ornamentation on both valves.

On many specimens the radial diverging *Camptonectes*-vermiculations are macroscopically visible (pl. III, f. 3 b).

S. hagenowi can be differentiated — from *S. halli* (GABB) by its larger size, smaller auricles, more pronounced concentric ornamentation on both valves, and by its more orbicular shape.

— from *S. nilsoni* (GOLDFUSS) by its higher shape, generally smaller size, longer and straight apical margins, almost straight hinge-margin, and concentric macrosculpture.

— from *S. haggi* nom. nov. by its larger size, smaller auricles, shorter apical margins, concentric ornamentation. The auricles have a different surface distribution in both species : *S. hagenowi* : $\frac{P}{A} = \frac{1}{2}$; *S. haggi* : $\frac{P}{A} = \frac{1}{3}$.

— from *S. gamsensis* nom. nov. by its larger size, less convex shape, and concentric macrosculpture.

— from *S. haldonensis* by its smaller auricles.

Generic attribution :

The unequal auricles, well developed byssal sinus and concentric macrosculpture explain the attribution to *Syncyclonema*.

Stratigraphical and geographical distribution

Maastrichtian : BELGIUM :

Cuesmes, Saint-Symphorien and Spiennes : « Craie phosphatée »
Ciply, Ciply-Malogne : « Poudingue de la Malogne A »
Ciply, Mesvin-Bélian, Saint-Symphorien : « Craie Tuffeau de Saint-Symphorien »
(all specimens in I. R. Sc. N. B.)

Syncyclonema ? semiplicata (ALTH, 1850)

(Pl. III, fig. 2 a-c.)

.	1850	— *Pecten semiplicatus* m.	A. ALTH, p. 247, pl. 12, f. 32.
	1863	— *Pecten semiplicatus* Alth	S. PLACHETKO, p. 20, pl. 1, f. 20.
v .	1869	— *Pecten semiplicatus* Alth	E. FAVRE, pp. 150-151, pl. 13, f. 7.
	(1899)	— *Pecten semiplicatus* Alth	N. KRISCHTAFOVITSCH, p. 9.

Holotype :

Lost; the few originals of ALTH that are still extant are in the Naturhistorisches Museum in Vienna. They came there in 1862 with the

collection of a monk from Prague. This can mean either that ALTH never possessed a personal collection, or else that he sold his fossils shortly after publishing his paper.

Stratum typicum :

Kreidemergel (Upper Maastrichtian).

Locus typicus :

Lemberg (Lwow, Ukraine, U. S. S. R.).

Original description

« P. testa tenuissima, suborbiculari, compressa, radiatim plicata, plicis paucis, latis, planis et ante marginem saepe desinentibus, rostro rectangulo marginibus ejus aequalibus rectis, ad medietatem testae decurrentibus, auriculis inaequalibus.

Dim. : Länge 12, Breite 14 Mill.

Schale fast kreisrund, sehr dünn und blättrig, sehr flach, radial gefaltet. Die wenigen (6-10) Falten sind wenig sichtbar, sie sind breit und sehr flach, sie werden gegen den Rand schwächer und hören manchmal vor demselben auf. Die Schlosskanten sind gerade, reichen bis fast zur Mitte der Breite der Muschel, wo sie einen deutlichen Winkel bilden. Der Schlosskantenwinkel ist ein rechter, oder selbst noch kleiner. Die Ohren sind ungleich, das grosse abgerundet, und an der Basis etwas ausgeschnitten, das kleinere ist fast rechtwinklich.

Selten im Kreidemergel von Lemberg.

Additional description

Numbers of studied specimens : 14 specimens

Maastrichtian from the stratotype	11 specimens
Maastrichtian from Lwow	3 specimens

Measurements :

On specimens from Maastricht :

U. P. D. : between 10.5 mm and 25.8 mm; av. 19.3 mm (n = 9)

W. : between 10.4 mm and 22.2 mm; av. 17.8 mm (n = 9)

A. A. : between 93° and 107°; av. 100° (n = 9)

index $\frac{\text{U. P. D.}}{\text{W}}$ between 1.000 and 1.133 : av. 1.0473

number of plicae : between 12 and 17.

Description :

Diagnosis. — Slightly prosocline, smooth *Syncyclonema*-species with wide, radial vaguely delimited folds.

The auricles are large and unequal. The posterior auricles along the apical margin attain a height which equals ⅓ of the U. P. D.

The apical margins are straight at the posterior side and recurved at the anterior disc side and reach in this latter case a height which equals ½ U. P. D. The hinge margin is straight and long.

The folds are only very slightly prominent above the disc surface.

Right valve : the pallial margin and the side margin meet in a point which is nearer the hinge margin on the anterior than on the posterior disc side; anterior auricle : large, winglike, with deep byssal sinus, smooth; posterior auricle : has the same surface as the anterior auricle, obtuse angled, triangular with a very long side along the apical margin.

Left valve : the pallial margin and the side margin meet in the same way as on the right valve : anterior auricle : large, acute-angled and smooth; posterior auricle : as on the right valve.

Discussion

S. semiplicata is an interesting species because it has lived only a very short period : in Maastricht it is only found in the uppermost strata of the upper Maastrichtian. In Lwow the strata are of similar age (*B. americana*-zone) as in Maastricht, but whether they really contain *S? semiplicata* only in the uppermost strata is very difficult to ascertain on the data available to me.

The figures in ALTH, PLACHETKO (fig. 20 in PLACHETKO is probably only a copy of the fig. in ALTH) and FAVRE are poor. These figures gave a wrong idea as to the exact nature of the height and width of the folds : these are not delimited as if they were ribs (as could be thought from the figures) and they do reach the pallial margin. They are not well differentiated which makes it very difficult to draw them in a satisfactory way. Only with oblique light can they be seen clearly.

The FAVRE specimens kept in the Naturhistorisches Museum in Vienna prove that the specimens from Lwow and from Maastricht belong to the same species; apart from the general shape and the auricle shape the number of folds is also the same. The folds and the slightly prosocline shape allow an easy differentiation of *S? semiplicata* and the other *Syncyclonema*-species.

Generic attribution :

It is difficult to decide whether *Pecten semiplicatus* ALTH really belongs to *Syncyclonema* : it has a smooth shell surface, unequal auricles, a deep byssal sinus but on no other *Syncyclonema* species has a radial fold-system been described and because of this it seems preferable to name the species *Syncyclonema ? semiplicata* (ALTH).

Stratigraphical and geographical distribution

Upper-Maastrichtian : BELGIUM - THE NETHERLANDS :

Sint Pietersberg (I. R. Sc. N. B.)
E. N. C. I. quarry (Ma.)

U. S. S. R. :

Ukraïne : Lwow (N. M. W., orig. FAVRE : 1862-V-281, 1862-V-282).

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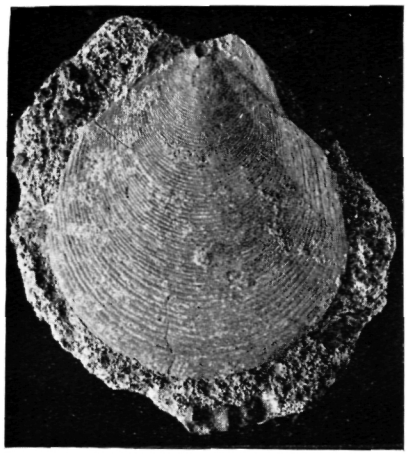
E. SPECIFIC INDEX

F. GEOGRAPHICAL INDEX

Abbreviations :

G. B. : Great Britain
G. D. R. : German Democratic Republic
G. F. R. : German Federal Republic
S. A. U. : South African Union



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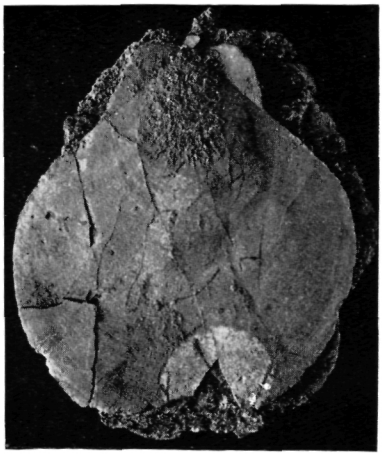

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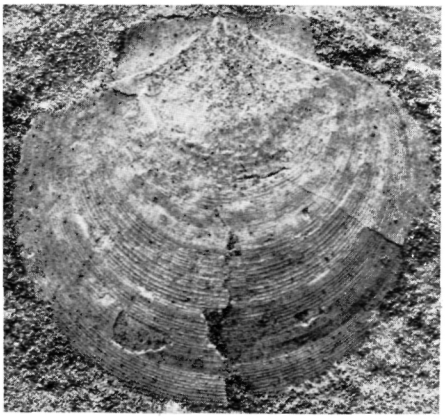

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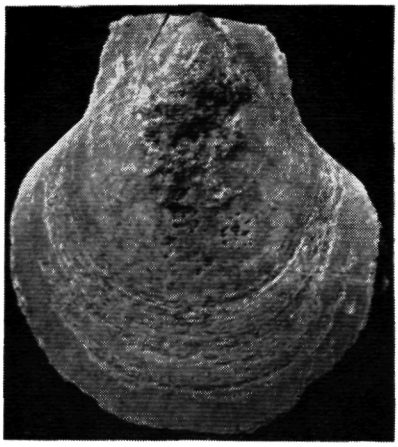

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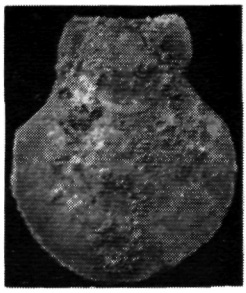

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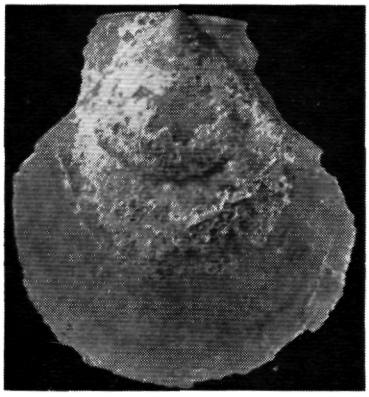

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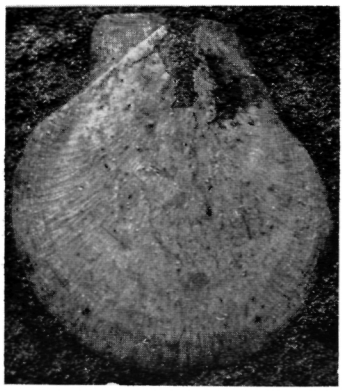

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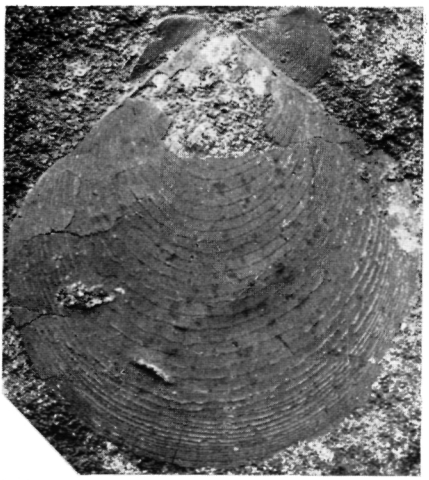

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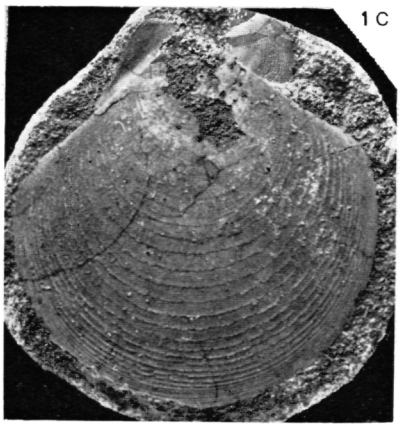

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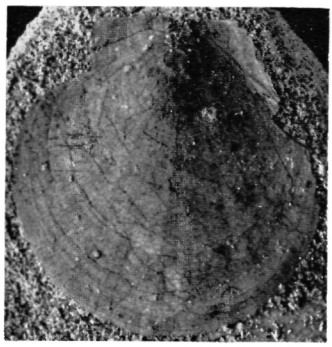

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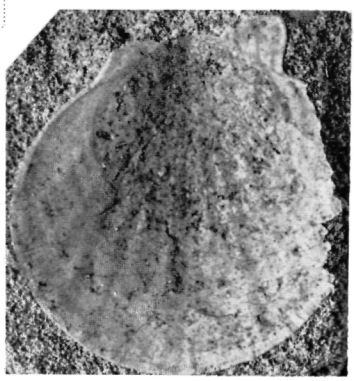

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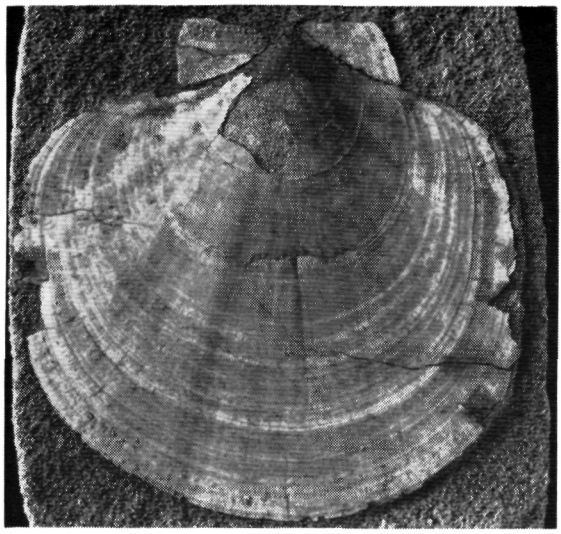

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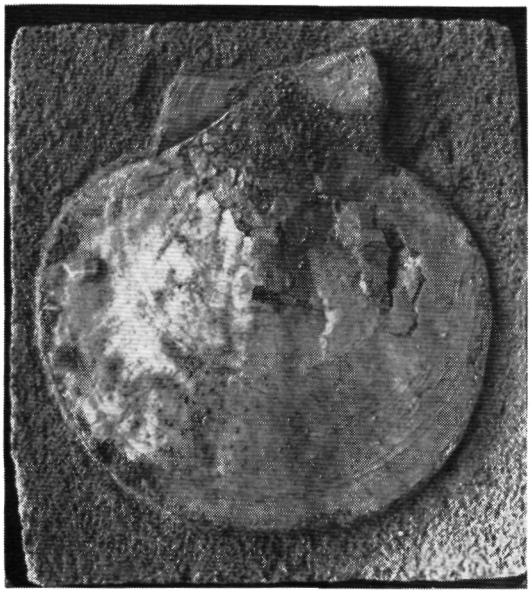

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A. DHONDT. — Systematic Revision of *Entolium, Propeamussium (Amusiidae)* and *Syncyclonema (Pectinidae, Bivalvia, Mollusca)* of the European boreal Cretaceous.

G. EXPLANATION OF PLATES

All the figured specimens belong to the Collections of the Institut royal des Sciences naturelles de Belgique; T. C. M. I. : type collection of Mesozoic Invertebrates.

PLATE I

Fig. 1. — *Entolium orbiculare* (SOWERBY).
a : Tournai, Hainaut (Belgium); Cenomanian (Tourtia de Tournai); T. C. M. I. 9847; left valve (× 1.5).
b : Charbonnages d'Harchies, Hainaut (Belgium); Albian (Meule de Bernissart); T. C. M. I. 9846; right valve (× 1.5).

Fig. 2. — *Entolium membranaceum* (NILSSON).
a : Sint Pietersberg, Maastricht (The Netherlands); Upper Maastrichtian (Craie tuffacée); T. C. M. I. 9831; (× 1.5).
b : Sint Pietersberg, Maastricht (The Netherlands) : Upper Maastrichtian (Craie tuffacée); T. C. M. I. 9843 (× 1.5).

Fig. 3. — *Syncyclonema gamsensis* nom. nov.
Sint Pietersberg, Tranchée Canal Albert, Limburg (Belgium); Upper Maastrichtian (Craie tuffacée, couche à *Pyrgopolon*); T. C. M. I. 9874; left valve (× 3).

PLATE II

Syncyclonema haggi nom. nov.

Fig. 1 a-c. — Vaals, Limburg (The Netherlands); Campanian (Sables de Vaals);
a : T. C. M. I. 9884; left valve (× 6).
b : T. C. M. I. 9886; right valve (×6).
c : T. C. M. I. 9885; left valve (× 6).

Fig. 1 d-f. — Petit Lanaye (Limburg), Tranchée Canal Albert (Belgium); Upper Maastrichtian (Craie tuffacée).
d : T. C. M. I. 9888; right valve (× 6).
e : T. C. M. I. 9889; left valve (× 6).
f : T. C. M. I. 9890; left valve (× 6).

PLATE III

Fig. 1. — *Syncyclonema hagenowi* nov. sp.
Saint-Symphorien, Hainaut (Belgium); Upper Maastrichtian (Craie phosphatée, Tuffeau de Saint-Symphorien).
a : holotype : T. C. M. I. 9853; right valve (× 2).
b : paratype : T. C. M. I. 9854; left valve (× 2).
c : paratype : T. C. M. I. 9855; right valve (× 2).

Fig. 2. — *Sycyclonema ? semiplicata* (ALTH).
a : Vechmaal, Grottes d'Henisdaal, Limburg (Belgium), Upper Maastrichtian; T. C. M. I. 9850; inside of right valve (× 1.5).
b-c : Maastricht, Sint Pietersberg, Limburg (The Netherlands), Upper Maastrichtian (Craie tuffacée).
b : T. C. M. I. 9861; inside of left valve (× 2).
c : T. C. M. I. 9860; left valve (× 2).

PLATE IV

Fig. 1. — *Syncyclonema nilsoni* (GOLDFUSS).
Maastricht, Sint Pietersberg, Limburg (The Netherlands); Upper Maastrichtian (Craie tuffacée).
a : T. C. M. I. 9829; left valve (× 1.5).
b : T. C. M. I. 9830; right valve (× 1.5).

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