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1973

SYSTEMATIC REVISION
OF THE SUBFAMILY NEITHEINAE
(PECTINIDAE, BIVALVIA, MOLLUSCA)
OF THE
EUROPEAN CRETACEOUS

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by

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(WITH FIVE PLATES.)

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SYSTEMATIC REVISION
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A. — INTRODUCTION

The aim of the present research is to revise the European Cretaceous subfamily *Neitheinae* SOBETZKI (*Pectinidae*, *Bivalvia*, *Mollusca*) in the boreal and Tethyan palaeogeographical provinces.

The purpose is to redefine the species; an attempt is made to reassess their content by studying as many specimens as possible of each species. Hence the variability within the species may now be established. This is partly achieved by studying the species throughout their geographical and stratigraphical distribution, also outside Europe.

Along with the biological aspect of the revision, a nomenclatorial revision seems necessary in order to simplify the intricate taxonomy. As often as possible the types are located and lectotypes are chosen for many taxa. For the many species with a world-

wide distribution the original description is added, when this was originally printed in a publication which has become rare. For reasons of objectivity the original spelling has been respected.

The *Neitheinae* have many easily recognizable characteristics, which appear to be fairly stable in each individual species; doubts as to their specific position are less frequent than in other Cretaceous *Pectinidae*. The exact position of the subfamily in relation to the other Cretaceous *Pectinidae* is still unclear; the theories as to its origin are examined and for morphological reasons the theory of JAWORSKI has to be discarded. The stratigraphical terms used are those found in the «*Lexique Stratigraphique International*».

B. — CONSIDERATIONS ON THE GENUS *NEITHEA*

Family **PECTINIDAE** RAFINESQUE, 1815.

Subfamily **NEITHEINAE** SOBETSKI, 1960.

Genus **NEITHEA** DROUET, 1824.

I. — **Original diagnosis** as given by DROUET, p. 186.

« Coquille libre, inéquivale, équilatérale, auriculée; valve inférieure concave, terminée par un crochet recourbé en dedans; valve supérieure plane; charnière presque linéaire, multidentée, à dents sériales sur les auricules; deux dents cardinales oblongues, divergentes, aplaties sur les côtés et sillonnées transversalement; fossette du ligament intérieure, insérée sous le sommet. »

This diagnosis contains all the essential characteristics of the genus. It should, however, be enlarged because :

1. Not all the *Neithea*-species are equilateral; those which have asymmetrical valves can be included in the subgenus *Neithella*.

2. In some species both valves are convex: the left « concave » valve is incurved inside the right « convex » valve. Thus, both valves are on the same side of the plane which joins the beak of the right valve with its pallial margin. These species do not belong to a particular group: in some species flat, as well as concave, left valves are found.

II. — **Description of the genus** *Neithea* DROUET.

Inequivalve, equilateral or inequilateral shells; the auricles are well developed, equal or unequal, usually well separated from the shell proper. The valves are covered with a series of radial ribs which may be equal to very unequal.

The right valve is always convex, and, its beak is mostly recurved. The left valve is flattened or sometimes concave.

Characteristic of the genus are the hinge-teeth under the umbo. They are present on both valves, but are more strongly developed beneath the recurved beak of the right valve; along the cardinal line, the entire hinge is vertically striated. Underneath the beak there are two large, flat, striated teeth, directed outwardly. They are usually equal. On the

left valve there are two counter-teeth, usually very small. The vertical striae, along the cardinal line, are lower than on the right valve.

III. — **Choice of the type-species.**

A. — **List of species** as indicated by DROUET (pp. 186-188).

« 1. — **NEITHEE PECTINOIDE**

Neithea pectinoides N.

(Pl. 7, figs. 1 and 2.)

N. Testa trigona, sub-antiquata, interne valde concava; margine crenato, subpentagono; radiis 28 ad 31 confertis, aequalibus, glabris.

Coquille trigone, presque rustiquée, à valve inférieure très-concave; bord crénelé, presque pentagone; 28 à 31 rayons serrés, égaux et unis.

Pecten aequicostatus LAM. Hist. anim. s. vert. VI, p. 181, n° 13, des Esp. foss.

Habite. — Fossile des cotéaux de Gazonfier, de Sainte-Blaise et du Luard, communes de Sainte-Croix et d'Yvré-l'Evêque, près le Mans, département de la Sarthe; de Soucelles et de Soulaire, près Angers, département de Maine-et-Loire.

Largeur 20 à 54 millimètres.

2. — **N. COTES INEGALES**

Neithea versicostata N.

(Pl. 7, fig. 4.)

N. Testa trigona, margine crenato, pentagono; radiis numerosis, diversis, transverse substriatis, 6 remotis elevationibus.

Coquille trigone, à bord fortement crénelé et pentagone; rayons nombreux, striés transversalement, dont six plus gros et relevés.

Pecten versicostatus LAM. Hist. anim. s. vert. VI, p. 181 n° 14, des Esp. foss.

FAUJAS, Hist. nat. de la montagne de Saint-Pierre de Maestricht, p. 167, pl. 28, fig. 4.

A. BRONGNIART, Descript. géol. des environs de Paris, nouvelle édition, pl. IV, fig. 1, a, b.

Habite. — Fossile de Sainte-Croix, d'Yvré-l'Evêque, de la Chapelle-Saint-Remi, de Dissé-sous-Courcillon, de Crosnières, département de la Sarthe; de Soucelles et de Soulaire, département de Maine-et-Loire; de Vendôme, département de Loir-et-Cher.

Largeur 14 à 36 millimètres.

3. — **N. LISSE** *Neithea laevigata* N.

(Pl. 7, fig. 3.)

N. Testa trigona, laevi, longitudinaliter lineata; margine subintegro, rotundo.

Coquille trigone, lisse, marquée de lignes longitudinales peu apparentes; à bord entier et arrondi.

Habite. — Fossile de la butte de Clermont, près la Flèche, département de la Sarthe.

Largeur 15 à 28 millimètres.

4. — N. COSTANGULAIRE
Neithea costangularis N.

N. Testa trigona, arcuata; radiis sex maximis, longitudinaliter sulcatis; margine 6-angulato.

Coquille trigone, arquée, à six gros rayons sillonnés longitudinalement; bord à six angles.

Pecten costangularis LAM., Hist. anim. s. vert. VI, p. 182, n° 15 des Esp. foss. Encyclopédie, pl. CCXIV, fig. 10, a, b, c.

C'est avec très peu de doute que je rapporte au genre néithée le *Pecten costangularis* LAM., dont à la vérité je n'ai pu observer la charnière, mais qui se rapproche entièrement des trois premières espèces par sa conformation extérieure.

Habite. — Fossile de Saint-Maixent, près Montmirail, département de la Sarthe. »

B. — Choice of type-species.

STEWART (1930, p. 115) indicates the correct type-species of the genus *Neithea* DROUET: the first, valid designation of a type-species is indeed that by CHENU (1862, vol. 2, p. 186, figs. 941-944) who chose *Pecten aequicostatus* LAMARCK, 1819 as the type-species for *Neithea*.

The interpretation of F. K. NORTH (1951, p. 233) is invalid from the point of view of nomenclature; he designates *Pecten quinquecostatus* SOWERBY, 1814 as type-species. Herein he seconds the designations by HERRMANNSEN (1847-1849, vol. 2, p. 110), GRAY (1847, p. 200, n° 741), S. V. WOOD (1861, p. 36) which have date-priority over the designation by CHENU but are nevertheless invalid, because *Pecten quinquecostatus* SOWERBY was not included in DROUET's original species-list.

F. K. NORTH was well aware of this, but gave the following arguments for his interpretation: « ... STEWART suggested that these designations (1) were invalid on the ground that *N. quinquecostata* was not in DROUET's original list. But neither was *N. aequicostata*, except in synonymy. DROUET's first species was his own *N. pectinoides* (p. 186, pl. 7, fig. 12) and this is quite clearly LAMARCK's *Pecten aequicostatus* as has never been contested (1819, p. 181). But DROUET also included in his list *N. versicostata* (*Pecten versicostatus* LAMARCK, 1819, p. 181) and this is equally clearly the same as *N. quinquecostata* (J. SOWERBY, 1814, p. 122, pl. 56, figs. 4-8). Thus *N. quinquecostata* has exactly the same right as

has *N. aequicostata* to receive the subsequent designation as type and HERRMANNSEN's designation should be upheld ».

Despite these arguments it cannot be denied that DROUET expressly mentioned *Pecten aequicostatus*, even if only in synonymy, but not *Pecten quinquecostatus* (2).

Conclusion.

The type-species of the genus *Neithea* DROUET, 1824 is *Pecten aequicostatus* LAMARCK, 1819.

IV. — Discussion on the subgenera.

Because of the characteristics of the type-species chosen by CHENU, *Neithea* s. s. may be used for the species-group with equal or subequal ribs and equal auricles; these are the species with symmetrical shells.

Neitheops STEWART, 1930 (type-species *N. grandicosta* GABB, 1869) was created for those species which have equal auricles and teeth, but a rib-arrangement in which 6 rib are more pronounced than the others.

It is impossible to separate *Neitheops* from *Neithea* on the basis of this characteristic; indeed in one and the same species one can find specimens with unequal ribs and others with all their ribs perfectly equal [f.i. *Neithea regularis* (SCHLOTHEIM, 1813) from the Maastrichtian in Maastricht is found with equal and with unequal ribs; see also E. DARTEVELLE et S. FRENEIX, 1957, p. 72].

It is therefore impracticable to take the taxon *Neitheops* into consideration: the species classified by STEWART in *Neitheops* belong to *Neithea* s. s. [*N. grandicosta* GABB and *N. quinquecostata* » (*lapsus calami* for *N. quinquecostata*)]. *Neithea* s. s. is thus the appropriate subgenus for all the symmetrical species: i.e. those which are characterized by equal to slightly unequal auricles and equal teeth, by a symmetrical rib-arrangement, in which all ribs are equal, or of which 6 are more pronounced and have between them a symmetrical distribution of ribs and riblets.

The ribs on the left valve are always the negative impression of those on the right valve.

(1) The synonymy given by F. K. NORTH for *Pecten versicostatus* LAMARCK which considers LAMARCK's species identical with *Pecten quinquecostatus* seems doubtful — more details can be found below, sub *Neithea* (*Neithea*) *quinquecostata* (SOWERBY). DROUET's conception of *N. versicostata* is difficult to interpret from his quoted references:

LAMARCK 1814: is not *N. quinquecostata* (see below).

FAUJAS 1799, pl. 28, fig. 4: this is *N. sexcostata* (S. WOODWARD, 1833).

A. BRONGNIART 1822, pl. 4, fig. 1, a, b: this indeed is a *N. quinquecostata* (SOWERBY, 1814).

The figure given by DROUET himself (pl. 7, fig. 4) is insufficiently clear to permit any decision to be taken.

(2) By HERRMANNSEN, GRAY, S. V. WOOD designating *Pecten quinquecostatus* as type-species for *Neithea*.

The division of the genus *Neithea* as proposed by I. HAYAMI, 1965, must be revised, because he relies on the work of NORTH which, as stated above, is based upon an erroneous interpretation of the rules of zoological nomenclature:

— *Aequineithea* HAYAMI (1965, p. 292) is an objective synonym of *Neithea* s. s. as designed by CHENU: both taxa have *Pecten aequicostatus* LAMARCK as type-species.

— *Neithea* s. s. HAYAMI (1965, p. 292) [type-species *Neithea quinquecostata* (SOWERBY)] is a taxonomic synonym of *Neitheops* because both taxa have the same content.

— *Neithella* I. HAYAMI (1965, p. 291) [type-species *Janira wrightii* SHUMARD, 1860 (O.D.)] has been created for species with 4-6 asymmetrical ribs and very unequal auricles. The ribs of the left valve are the reflection, and not the negative impression, of those on the right valve. This subgenus must be maintained.

Conclusion

In the genus *Neithea* 2 moderately homogeneous groups can be distinguished:

Neithea (*Neithea*) STEWART, 1930: type-species *Pecten aequicostatus* LAMARCK, 1819;

Neithea (*Neithella*) HAYAMI, 1965: type-species *Janira wrightii* SHUMARD, 1860.

V. — Historical usage of the genus *Neithea*.

Rarely was a genus so clearly and unequivocally defined from its origin, and yet, it was only from around 1900 that DROUET's name came into regular usage.

The large isodont hinge-teeth are an excellent means of recognition but they were only rarely used with this aim. Perhaps this can be explained by the preservation-state of the fossils since the teeth can only be seen on specimens with a perfectly preserved beak. Such a state of preservation is exceedingly rare; even with such perfect fossils the clearing of the teeth is a long and arduous task.

Neithea was explicitly established for a clearly defined group of Cretaceous *Pectinidae*. Nevertheless many authors preferred to put *Neithea*-species into genera which were later found to be synonymous with *Pecten* s. s. MUELLER, 1776 and do not appear till Upper Tertiary or Quaternary [type-species of *Pecten* MUELLER, 1776 is *Ostrea maxima* L., 1758 (subsequent designation by SCHMIDT, 1818)].

Alternatively various authors used *Janira* SCHUMACHER, 1818 (*non* LEACH, 1814). The type-species *Janira intermedia* SCHUMACHER, 1818 is, according to DODGE, 1952 (p. 163), at least partly identical with *Pecten maximus* (L.) D'ORBIGNY used *Janira*, though

he explicitly states that in this genus a Cretaceous species-group must be distinguished from a recent group.

Vola KLEIN, 1753 has been mostly used after F. STOLICZKA, 1871. The type-species is *Pecten sinensis* SOWERBY because of identity (F. STOLICZKA, 1871, p. 420), but, as KLEIN is a pre-Linnean author, *Vola* is invalid [this is also true for *Vola* MOERCH, 1853 *non* KLEIN, *non* MULSANT (Colcopt.)].

The characteristics of *Neithea*-species however were recognised by various authors and, following DROUET, A. D'ORBIGNY, 1847 (pp. 623 and 624) gave an exhaustive discussion of them and on plate 444, fig. 9 a good figure of the hinge-teeth of a *N. aequicostata* (LAMARCK).

Already in 1861 W. GABB (p. 131) was writing: « The Cretaceous species referred by D'ORBIGNY and others to the genus *Janira*, are certainly generically different from the type *Pecten maximus*. They form a group to which DROUET gave the name *Neithea*... ».

GEINITZ, 1870 gives a good figure of a specimen with well-developed hinge-teeth: plate 45, fig. 14, a, b, *Neithea notabilis* (MUNSTER in GOLDFUSS).

PETHOE, 1906 (pp. 213 and 222) (a.o. after DROUET and CHENU) grants to *Neithea* the value of a genus-name^(*) for Cretaceous species and discusses the whole problem in detail. He gives several, unfortunately not very good, figures of teeth-bearing convex valves. It is important that he prepared specimens of four different species so as to uncover their teeth.

J. BOEHM, 1922 discusses the genus mainly from a phylogenetic viewpoint. Unfortunately he made an incorrect copy of DROUET's original diagnosis: in his article he mentions as: « ... valve inférieure convexe... » what DROUET called « ... valve inférieure concave... » and as « ... valve supérieure concave... » what DROUET called « ... valve supérieure plane... ».

J. V. L. RENNIE, 1930 describes the « teeth » of *Neithea* and their possible homology with those of *Spondylus* and *Plicatula*, principally by means of information gleaned from DALL, 1898.

B. WADE, 1926, plate 21, figs. 2 and 4 shows photographic figures of the inside of both valves of *Neithea regularis* (SCHLOTHEIM) which bear complete « teeth » and « counterteeth ». (WADE erroneously identified his specimens as *Pecten quinquecostatus* SOWERBY.)

VI. — Various classifications of the genus *Neithea*.

S. GILLET, 1924 classifies all *Neithea*-species according to the shape of their auricles. She takes neither the teeth nor the shell-shape into account. Her classification is undoubtedly partly correct,

(*) Already WOODS, 1903 was using *Pecten* (*Neithea*) instead of either *Janira* or *Vola* and this probably after FISCHER, 1887 (p. 946).

because auricles are an important characteristic which is usually easy to use. To make it completely valid it should however be used together with the shape of the shell.

I. HAYAMI, 1965 gives a very detailed classification of the genus *Neithea*. From the nomenclatorial point it is not very useful because, as stated above, he erroneously follows F.K. NORTH. As far as European species are concerned one gets the impression that he lacked material for comparison of those species and that he based his classification mainly on information gained from literature.

VII. — Origin of the genus *Neithea*.

The subfamily *Neitheinae* forms a well-delimited group of Cretaceous *Pectinidae*, occurring both in Lower and Upper-Cretaceous. After the Maastrichtian no more *Neithea*-species are found. They die out before the Danian.

In the course of pectinid-evolution, at different times, genera have evolved which show a noticeable general similarity to *Neithea* as far as external morphology (shape of the shell and rib-distribution) is concerned. None of those genera is similar enough to the *Neitheinae* to prove they are more closely related than at family-level.

Genera with a marked difference in convexity of the valves have evolved at different geological times :

— in Triassic times : *Indopecten* J. A. DOUGLAS, 1929 type-species *Pecten cignetti* KRUMBECK, 1913, which is characterized by a symmetrical rib-distribution consisting of 5 principal ribs on the convex valve. Species of this genus are known to occur in the Triassic of Timor and Narband (Iran);

— from Jurassic times several species have been described which have a very *Neithea*-like appearance.

From Europe and Africa :

Pseudovola depereti LISSAJOUS, 1923 type-species of the genus *Pseudovola* LISSAJOUS, 1923 from the Bathonian of Mâcon, France.

Pecten (Neithea?) ayarti G. DUBAR, 1948 from the Upper-Domerian of Morocco : the outside morphology represents an extraordinary similarity, as far as shape and rib-arrangement are concerned, with typical Cretaceous *Neithea*-species.

Pecten (Neithea?) rollieri COSSMANN, 1916 from the Charmouthien of Vendée (France) has, in the

same way as the South American species, an external *Neithea*-morphology, with about 10 equal ribs.

From South America :

From the South American Lias several *Weyla* J. BOEHM, 1922 -species are known. They have a perfect *Neithea*-morphology from the outside f.i. *Pecten alatus* VON BUCH, 1838 and *Pecten bodembenderi* BEHRENDSEN, 1891. Many authors have written about the possible connections of these remarkable *Pectinidae* which are usually found as closed, double-valved shells : E. PHILIPPI, 1900 (p. 111) : « ... dass die tertiären Janiren nicht von den cretaeisichen und diese wieder nicht von den liasischen abstammen, sondern dass alle drei in sich geschlossene Janiren-Gruppen sich unabhängig von einander aus dem Stamme des normalen *Aequipecten* entwickelt haben. Ich glaube, dass die Janiren eines der schönsten Beispiele für die Erscheinung bilden, die KOKEN « iterative Artbildung » genannt hat ». J. JAWORSKI, 1914 expresses a totally different view : concluding a systematic study based for the major part on South-American « Lias-Volen » (*Weyla*-species), he writes : « Unter den *Vola*-Formen der Kreide findet sich zunächst... der *Alata*-Stamm s. str. unzweifelhaft wieder... ».

These two opinions are quoted as examples of the different views held by different authors on the subject of the eventual connections of *Weyla* and *Neithea* and eventually of *Pecten* s. s.

To help to solve this problem Dr. N. J. MORRIS (British Museum, Natural History) offered to prepare a specimen of a South-American *Weyla*-species, very closely allied to *Pecten alatus* VON BUCH. The shell was completely silicified. For 4 days it was immersed in an acid bath, which dissolved the matrix without damaging the shell. When the shell was open, the valves came apart and the hinge was completely uncovered. The *Weyla*-species has a normal *Pectinidae*-hinge, such as found in any *Chlamys*-species or in *Pecten maximus* or *P. jacobaeus* : no trace of isodont teeth or vertical striae on the cardinal line, although the external morphology does not allow to distinguish a *Weyla*-specimen from a *Neithea*-species. Hence *Weyla* is not in the direct ancestry of *Neithea* and the problem of the origin of this last genus remains unsolved.

Tertiary *Pecten* s. s. species such as *Pecten (Pecten) josslingi* SMITH, 1847 show exactly the same morphology, consisting of a very convex and a flat valve, both covered with equal ribs. This makes the opinion of PHILIPPI on the origin of *Neithea* the most likely explanation but, at present, it cannot be proved.

C. — DESCRIPTION AND DISCUSSION OF SPECIES

1. — **Neithea (Neithea) aequicostata**
(J. B. LAMARCK, 1819).
(Pl. 1, figs. 1, a-c.)
- .1819 *Pecten aequicostatus* J. B. LAMARCK, p. 181, n°13.
- .1819 *Pecten phaseolus* J. B. LAMARCK, p. 181, n°12.
- .1824 *Neithea pectinoides* N. C. DROUET, pp. 186, 187, pl. 7, figs. 1, 2.
- .1824 *Neithea laevigata* N. C. DROUET, p. 188, pl. 7, fig. 5.
- 1825 *Pecten aequicostatus* M. DEFRANCE, p. 255.
Lamarck, (pro parte)
- .1833 *Pecten aequicostatus* A. GOLDFUSS, p. 54,
Lamarck. pl. 92, fig. 6.
- .1837 *Pecten tumidus* Duj. F. DUJARDIN, p. 214, pl. 16, figs. 13, 13a.
- .1839 *Pecten aequicostatus* H. B. GEINITZ, p. 22.
Lamarck.
- .1841 *Pecten aequicostatus* F. A. ROEMER, p. 54.
Lamarck.
- 1841 *Pecten longicollis* N. F. A. ROEMER, p. 54.
- .1846 *Pecten aequicostatus* A. E. REUSS, p. 32, pl. 40, figs. 2, a-B, 3, pl. 39, fig. 23.
Lamarck
- .1846 *Pecten aequicostatus* H. B. GEINITZ, p. 469.
Lam.
- v?1847 *Janira aequicostata* A. D'ORBIGNY, pp. 637,
(Lamarck) 638, pl. 445, figs. 1-4.
- v.1847 *Janira phaseola* A. D'ORBIGNY, pp. 635,
(d'Orbigny) 636, pl. 444, figs. 6-10.
- 1850 *Janira phaseola* d'Orb. A. D'ORBIGNY, p. 169,
n° 500.
- 1850 *Janira aequicostata* A. D'ORBIGNY, p. 170,
d'Orb. n° 501.
- (1850) *Pecten aequicostatus* H. B. GEINITZ, p. 186.
Lamarck
- (1854) *Pecten aequicostatus* J. MORRIS, p. 175.
Lam.
- 1863 *Pecten aequicostatus* A. KUNTH, p. 725.
Lam.
- 1863 *Janira phaseola* D. STUR, p. 56.
Lam. sp.
- (1866) *Pecten aequicostatus* C. GIEBEL, p. 48.
Lamarck.
- .1868 *Janira aequicostata* A. BRIART et F. L. COR-
d'Orb. NET, p. 49, pl. 4, figs. 25, 26.
- .1871 *Vola laevis* Drouet F. STOLICZKA, pp. 438,
439, pl. 31, figs. 7, 8.
- v.1872 *Vola phaseola* Lam. sp. H. B. GEINITZ, p. 199,
pl. 45, figs. 2-4.
- v.1872 *Vola aequicostata* H. B. GEINITZ, p. 200,
Lam. sp. pl. 45, figs. 5-7.
- v.1878 *Neithea aequicostata* E. BAYLE, pl. 122, fig. 4.
Lamarck sp.
- v.1882 *Janira aequicostata* P. DE LORIOI, p. 102,
Lamarck pl. 13, figs. 6-8.
- 1885 *Janira aequicostata* F. NOETLING, p. 21.
Lam. sp.
- ?1890 *Pecten phaseolus* A. PÉRON, p. 224.
Lamarck
- 1893 *Janira (Vola) aequi- costata* Lam. R. MICHAEL, p. 237.
- 1893 *Janira (Vola) phaseola* R. MICHAEL, p. 237.
Lam.
- ?1895 *Janira aequicostata* E. Tiessen, p. 472.
Lam. sp.
- (1897) *Janira laevis* P. CHOFFAT, p. 473.
- (1897) *Pecten (Janira) aequi- costatus* Lam. ? W. F. HUME, pp. 550,
551.
- v.1897 *Vola Ettalensis* U. SOEHLE, p. 39, pl. 4,
figs. 7, 7a.
- (1901) *Janira aequicostata* J. CORNET, B. 56, B. 58.
- (1901) *Janira phaseola* d'Orb. A. MICHALET, p. 583.
- v.1902 *Pecten (Neithea) aequi- costatus* Lamarck H. WOODS, pp. 208-210,
pl. 40, figs 8-9.
- (1904) *Vola aequicostata* J. J. JAHN, p. 300.
- (1905) *Janira (Vola) aequi- costata* Lam. sp. J. J. JAHN, p. 76.
- (1905) *Janira (Vola) phaseola* J. J. JAHN, p. 76.
Lam. sp.
- .1911 *Pecten aequicostatus* A. FRITSCH, p. 44, figs. 202, a, b.
Lamarck.
- ?1911 *Pecten decipiens* Reuss A. FRITSCH, p. 44, fig. 200.
- ?1913 *Vola (Janira) aequi- costata* Lk. sp. P. N. TSCHIRWINSKY,
p. 42.
- 1915 *Vola (Neithea) aequi- costata* Lam. E. FISCHER, p. 256.
- .1918 *Pecten aequicostatus* J. FAVRE, pl. 10, figs. 24, a, b, 25.
Lamarck
- (1924) *Neithea aequicostata* M. SCHLOSSER, p. 84.
Lam.
- (1926) *Neithea aequicostata* L. NOETH, p. 476.
Lam.
- (1928) *Neithea aequicostata* J. MACHAČEK, p. 444.
(Lam.)
- 1933 *Neithea aequicostata* W. HAENTZSCHEL, p. 131.
(Lam.)
- (1933) *Neithea aequicostata* R. FURON, p. 274.
Lmk.
- 1933 *Neithea phaseola* (Lam.) W. HAENTZSCHEL, pp. 131, 132, pl. 4, fig. 19.
- 1934 *Pecten (Neithea) aequi- costatus* Lam. V. ZAZVORKA et J. SOU-
KUP, p. 208.
- (1934) *Pecten (Vola) aequicos- tatus* Lam. M. BLANCKENHORN, p. 191.
- v.1937 *Pecten (Neithea) aequi- costatus* Lamarck R. MARLIÈRE, pp. 93,
94.
- ?1937 *Neithea aequicostata* L. LEHNER, pp. 192,
(Lamarck) 193.
- v.1939 *Neithea aequicostata* E. DACQUÉ, pp. 40-42,
Lam. pl. 2, fig. 6, pl. 5,
fig. 2.
- 1939 *Pecten (Neithea) aequi- costatus* Lamk. M. COLLIGNON, p. 68,
pl. 1, figs. 11-13.

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?(1942)	<i>Vola aequicostata</i> Lam.	C. I. LISSON, pp. 106, 108.
?1948	<i>Neithea aequicostata</i> (Lmk.)	G. TAVANI, p. 94.
?1948	<i>Neithea</i> sp. aff. <i>N. aequicostata</i> (Lmk.)	G. TAVANI, p. 94.
?1949	<i>Neithea</i> cf. <i>aequicostata</i> d'Orb.	M. COLLIGNON, p. 14.
v.(1953)	<i>Neithea aequicostata</i> Lam.	H. PRESCHER, p. 253.
v.(1953)	<i>Neithea phaseola</i> Lam.	H. PRESCHER, p. 253.
(1956)	<i>Neithea phaseola</i> (Lam.)	K. A. TROEGER, p. 90.
v. 1956	<i>Janira aequicostata</i> (Lamarck)	J. ROGER, n° 34, figs. 1-9.
. 1956	<i>Neithea aequicostata</i> (Lamarck)	J. ROGER, n° 34, figs. 24, a, b, 25.
v. 1956	<i>Janira phaseola</i> d'Orbigny	J. ROGER, n° 49, figs. 1-10.
(1966)	<i>Neithea aequicostata</i> (Lam.)	J. SVOBODA <i>et al.</i> , p. 493.
(1966)	<i>Neithea phaseola</i> (Lam.)	J. SVOBODA <i>et al.</i> , p. 493.
non 1850	<i>Pecten aequicostatus</i> (= <i>Neithea sexcostata</i> Woodward)	J. DE CARLO SOWERBY in F. DIXON, p. 356, pl. 28, figs. 17, 18.
non 1902	<i>Vola laevis</i> Drouet	P. CHOFFAT, pp. 151, 152, pl. III, figs. 11, 12.
non 1902	<i>Vola aequicostata</i>	P. CHOFFAT, p. 152, pl. III, fig. 10.
non 1912	<i>Vola aequicostata</i> Lamarck	O. SCHLAGINTWEIT, pp. 121, 122.
non 1912	<i>Pecten</i> (<i>Neithea</i>) <i>aequicostatus</i>	L. PERVINQUIÈRE, pp. 135, 136.
non 1916	<i>Neithea aequicostata</i> (Lamarck)	R. B. NEWTON, pp. 565, 566, pl. 1, figs. 2, 3.
non 1926	<i>Pecten</i> (<i>Neithea</i>) <i>aequicostata</i>	V. MOUTA et A. BORGÈS, p. 115.
non 1929	<i>Neithea aequicostata</i> (Lamarck)	J. V. L. RENNIE, pp. 16, 17.
non 1939	<i>Pecten</i> (<i>Neithea</i>) <i>Loevis</i> Drouet	M. COLLIGNON, pp. 68, 69, pl. 1, figs. 14, 15.
non 1957	<i>Neithea aequicostata</i> (Lamarck) [= <i>Neithea hispanica</i> (d'Orbigny)]	E. DARTEVELLE et S. FRENEIX, p. 73.
non 1911	<i>Vola phaseola</i> Lam. sp. [= <i>Neithea notabilis</i> (MÜNSTER in GOLDFUSS)]	A. FRITSCH, p. 45, fig. 206.

Location and designation of type-specimens. — The Muséum d'Histoire naturelle in Geneva possesses part of the LAMARCK collection. Among its specimens are the only known specimens from the original type-series of *Pecten aequicostatus* LAMARCK. These specimens are figured in the Catalogue of FAVRE, 1918. As the lectotype I propose the specimen figured on plate 10, figures 24, a, b, and which FAVRE labelled as « spécimen A ». The « spécimen B » is then the paralectotype. *Pecten phaseolus* LAMARCK: ROGER, 1956, n° 49 states that the original specimens of LAMARCK have been lost. No lectotype can thus be chosen. Since the taxon is sufficiently known from figures in DROUET and

D'ORBIGNY there seems to be no reason to designate a neotype.

Neithea pectinoides DROUET, *Neithea laevigata* DROUET: type-material unknown.

Pecten tumidus DUJARDIN: type-material unknown.

Pecten longicollis ROEMER: type-material in the ROEMER-Museum in Hildesheim (G.F.R.).

Vola Ettalensis SOEHLE: Bayerische Staatssammlung für Paläontologie und Historische Geologie 1898/62: I designated as the lectotype the original of plate 4, figure 7; two other specimens thus are paralectotypes.

Locus typicus. — Habite aux environs du Mans, département de la Sarthe (France).

Neithea phaseola (LAMARCK): Coulaines, près Le Mans (France).

Neithea pectinoides DROUET: Yvré-l'Évêque, près Le Mans (France).

Neithea laevigata DROUET: La Butte de Clermont, près La Flèche, département de la Sarthe (France) (O.D.).

Neithea tumida (DUJARDIN): Sonzay (France)

Neithea longicollis (ROEMER): Essen/Ruhr (G.F.R.).

Neithea ettalensis (SOEHLE): Lichtenstättgraben bei Ettal (Oberbayern) (G.F.R.) (O.D.).

Stratum typicum. — LAMARCK did not give stratigraphical data but since the type-locality which he mentioned, is at the same time the type-locality of the Cenomanian, it seems logical to consider that stage as the stratum typicum.

Neithea phaseola (LAMARCK): id.

Neithea pectinoides DROUET and *Neithea laevigata* DROUET: calcaire glauconique (Cenomanian).

Neithea tumida (DUJARDIN): grès verts (Cenomanian).

Neithea longicollis (ROEMER): Hilsconglomerat (here: Cenomanian).

Neithea ettalensis (SOEHLE): Lichtenstättgraben (Cenomanian).

Original description:

Pecten aequicostatus: P. testâ inaequalvi, trigonâ; valva superiore planâ; alterâ tumidâ, incurvato-arcuatâ; radii 28 ad 30 confertis, glabris, aequalibus.

Knorr. Petrif. 2 tab. B. II, n° 22, f. 3.

Habite aux environs du Mans, département de la Sarthe, et près d'Angers. Cabinet de M. Menard et le mien. Espèce remarquable, très voisine de la suivante (*), dont elle est distincte, et qui devient plus grande. Largeur, 50-52 millimètres.

(*) *Pecten versicostatus* LAMARCK.

Pecten phaseolus: P. testâ minimâ, oblongo-trigonâ; valvâ inferiore incurvato-arcuatâ; radiis exiguis, confertis, striaeformibus, aequalibus.

Knorr. Petrif. 2 tab. B III, fig. 2 ? (sic.)

Habite: Fossile de Coulaines, près Le Mans. Cabinet de M. Menard. Il a des stries plus fines, et s'élargit moins que le suivant (*).

On ne le trouve que très petit. Longueur, 14 mm.

Neithea pectinoides DROUET: see under the genus *Neithea* (p. 6).

Neithea laevigata DROUET: id.

Pecten longicollis ROEMER: viel länger als breit, klein mit 35-45 gleich starken Rippen, 1" lang.

Hilsconglomerat bei Essen.

Quader des Elbstollens.

Additional description :

Number of studied specimens : total : 345.

Austria	Albian	1
Belgium	Albian	47
	Cenomanian	39
Czechoslovakia	Cenomanian-Turonian	47
France :		
Southeast	Albian	10
Paris Basin	Cenomanian	67
G.D.R.	Cenomanian-Turonian	53
G.F.R. :		
Essen/Ruhr	Cenomanian	5
Regensburg	Cenomanian	10
Great Britain :		
England	Albian	33
	Cenomanian	18
Northern Ireland	Turonian	1
Jordan	Cenomanian	1
Morocco	Upper Cretaceous	1
Nigeria	Upper Cretaceous	1
Oman	Cretaceous	3
Poland : Silesia	Cenomanian	3

Measurements.

	U.P.D.	W	R	Number
Dép. Sarthe (France)	15.5-54.0	13.8-64.2	25-32	15
England	11.0-20.0	9.2-17.4	27-34	12
Hautrage (Hainaut, Belg.)	7.9-70.0	6.7-69.7	24-36	59 (33 convex)
Korycany (Czechoslovakia)	13.8-66.6	16.5-72.6	23-28	20 (8 convex)
Saxony (around Dresden)	13.4-64.6	14.4-76.2	23-33	31 (21 convex)

Apical angles measured on Korycany specimens :

convex valves : 82°-86°;
left valves : 100°-127°.

Description.

Diagnosis. — *Neithea*-species with 23-36 equal to subequal ribs, with very narrow intercostal intervals, equal smooth auricles, moderately convex to very convex right valve and flattened left valve.

(*) *Pecten aequicostatus* LAMARCK.

Beak : narrow and not very strongly recurved : it does not reach below the umbono-pallial plane.

Ribs : 23-36 equal, smooth ribs with very narrow intercostal intervals; sometimes there are a few areal riblets. The ribnumber varies because of variability and of preservation state.

Areas : smooth and curved inwardly.

Left valve : can be completely flattened to slightly concave.

Auricles : equal on both valves, smooth, right to acute-angled.

Teeth : two large teeth on the convex valve obliquely directed from the beak to the apical line; they form more or less the hypotenuse to the auricles.

Pallial margin : follows the ribs on the shell and has a jagged appearance in the specimens on which the outer shell layer is missing.

Discussion :

Synonymy. — *Pecten aequicostatus* LAMARCK = *Pecten phaseolus* LAMARCK.

The similarity is unmistakable : the general shape and the auricle shape are the same; they occur in the same localities and in the same stratigraphical horizons. The « differences » concern the rib-structure and are solely due to the preservation state : well-preserved specimens are recognized as *Neithea phaseola*; they have smooth shells with shallow grooves that delimit the ribs. If this outer layer is worn away then the shells appear under the condition which has been described as *Neithea aequicostata*; the shell is covered with equal ribs with not very deep intercostal intervals. How a *N. phaseola* becomes a *N. aequicostata* was illustrated, without however his recognizing it, by D'ORBIGNY, 1847 (pl. 444, figs. 7 and 10) : the uppermost shell-

layer is worn away and the, at first, linear intercostal grooves become deeper and broader and this process continues till the shell is worn away completely : the Steinkern is covered with ribs and intercostal intervals which have the same width.

N. pectinoides is assimilated by DROUET himself to *Pecten aequicostatus* LAMARCK. *N. laevigata* according to DROUET's figure and description is a perfect duplicate of *Pecten phaseolus* LAMARCK and thus of *N. aequicostata* (LAMARCK). *Pecten tumidus* DUJARDIN is as far as can be judged from the description and figure a well-preserved *Neithea aequicostata*.

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Pecten longicollis ROEMER: is a slightly distorted *N. aequicostata*.

D'ORBIGNY's interpretation has given rise to many problems; his *Janira phaseola* as seen on the figures and in the description is what LAMARCK describes as *Pecten aequicostatus*. This is the case for the specimens labelled 6464, 6464 A and 6464 B in his collection. 6464 C however is a *N. hispanica*. In his description and figures of *Janira aequicostata* a confusion seems to have arisen between *N. aequicostata* (LAMARCK) and *N. quinquecostata* (SOWERBY): the specimens labelled 6473, are such that the convex valve (figured by D'ORBIGNY on pl. 445, fig. 1 and by ROGER on figs. 5 and 6) very probably belongs to *N. quinquecostata*, whereas the flattened valve definitely belongs to *N. aequicostata*.

In the D'ORBIGNY collection the specimens labelled 6473 A from Villers (Calvados) and 6473 C from Schandau and Bannowitz (Saxony) are definitely *N. aequicostata*; 6473 B from Escragnoles (Var, *laps. cal.* is really Alpes Maritimes) is probably a *N. hispanica* (D'ORBIGNY). 6467 from Irs, near Castellane, is a typical *N. aequicostata*, but 6467 A from the same locality, which the manuscript D'ORBIGNY-label qualifies as *Janira aequistriata*, and which J. ROGER has figured on fiche no. 34, figures 8 and 9, is very probably a *N. coquandi* (PERON).

N. ettalensis has been poorly figured by SOEHLE; the specimens which I saw in Munich leave no doubt as to their identity as *N. aequicostata*.

It is possible that what I. HAYAMI, 1965 (pp. 309-310, pl. 43, fig. 6) describes as *N. (s.l.) aketoensis* sp. nov. from the Albian of Japan is in fact a *N. aequicostata*. The figured specimen, which is the only one that has been found so far, is incomplete and does not allow a definite conclusion to be drawn.

Variability. — This species is very variable in the number of ribs and in the size of the individual specimens.

Size: In the English Cenomanian all the specimens are of small size, whereas in the other areas where *N. aequicostata* is found, there is a large variability in the size of the individuals. In some Cenomanian localities such as Hautrage (Hainaut, Belgium), and around Regensburg and Dresden, the proportion of individuals reaching a large size is very high. This is remarkable, because, although such large specimens are found in the type-locality, they are rare.

Rib number: In this species it is impossible to differentiate between ribs and areal riblets (these are the ribs on the area-side of the first principal rib). Because of this the number of ribs, which is fairly constant in most *Neitheia*-species, as long as no riblets are taken into account, is highly variable in *N. aequicostata*. On Steinkernen the areal riblets are no longer visible and so the number of ribs is automatically lower

(since this preservation-state is the only one known from several localities those specimens cannot be eliminated).

Differentiation. — *Neitheia aequicostata* (LAMARCK) and *Neitheia hispanica* (D'ORBIGNY) are two very similar species. They can only be differentiated by their number of ribs; *N. hispanica* has only 19-22 ribs. Amongst all other *Neitheia*-species *N. aequicostata* can easily be recognized by its equal ribs, which make it impossible to differentiate principal from secondary ribs.

Generic attribution. — *Pecten aequicostatus* LAMARCK being the type-species of *Neitheia* DROUET belongs to the genus by definition and its correct name thus becomes *Neitheia (Neitheia) aequicostata* (LAMARCK).

Stratigraphical and geographical distribution:

Albian:

AUSTRIA:

Stiedelbachsgraben (Oberösterreich) (N.M.W.).

BELGIUM:

Bracquegnies (Meule de Bracquegnies) (I.R.Sc.N.B.).
Maisières (Hainaut) (I.R.Sc.N.B.).

FRANCE:

Cosne (Nièvre) (Mus. Gen., also originals of DE LORJOL: 1882).

GREAT BRITAIN:

Folkestone (Kent) (B.M.).
Haldon (Devon) (B.M., S.M.).
Sidmouth (Devon) (B.M.).

Cenomanian:

BELGIUM:

Hautrage (Hainaut) (I.R.Sc.N.B.).
Montignies-sur-Roc (Hainaut) (I.R.Sc.N.B., R.U.G.).
Tournai (Tourtia de Tournai) (I.R.Sc.N.B.).

CZECHOSLOVAKIA:

Bilin (Mus. Gen.).
Grossdorf (N.M.W.).
Hajek (Halle).
Hollubitz (N.M.W.).
Korycany (N.M.W., Halle, Mus. Gen.).
Pankraz (B., DR., Mus. Gen., N.M.W.).
Praha (B.).
Tetschen an der Elbe (Decin) (N.M.W.).
Trögelsberg (B.).
Tuchowitz (N.M.W.).
Turnov (N.M.W.).
Tyssa (Tissova) (N.M.W.).

FRANCE:

Briollay, Angers (Maine-et-Loire) (Mus. Gen.).
Etretat (Seine-Maritime) (B.M.).
Fécamp (Seine-Maritime) (Mus. Gen.).
La Butte près Le Mans (Sarthe) (Mus. Gen.).
La Palud-de-Moutiers (Basses-Alpes) (B.M.).
Le Havre (Seine-Maritime) (Ec. Min.).
Le Mans (Sarthe) (B.M., Ec. Min., Musé., Mus. Gen., Mus. Laus., N.M.W.).
Port-des-Barques, La Rochelle (Charente-Maritime) (B.).

- Rouen (Seine-Maritime) (B.M., DR.).
 Saint-Calais (Sarthe) (B., Mus. Gen.).
 Saint-Nazaire (Loire-Atlantique) (Ec. Min.).
 Vaches Noires, Dives (Calvados) (B., Mus. Gen.).
 Vimoutiers (Orne) (Mus. Laus.).
 Yvré-l'Évêque (Sarthe) (Ec. Min., also original of
 BAYLE, p. 122, fig. 4).
- G.D.R. : Saxony :
 Bannewitz (DR.).
 Dippoldiswalde (N.M.W.).
 Elbstollen (B.).
 Golderoda (DR.).
 Goldne Höhe (DR.).
 Klein Naundorf (DR.).
 Koschütz (Halle).
 Malter, Dippoldiswalde (DR., Halle, N.M.W.).
 Neuleuteritz, Gossebaude (DR.).
 Niederschöna (DR., N.M.W.).
 Oberhässlich, Dippoldiswalde (DR., also orig.
 GEINITZ, Elbthal I, pl. 45, figs. 2, 4, N.M.W.).
 Pirna (B.).
 Rippien (N.M.W.).
 Tharanderwald (B.).
 Welschhufe (B., B.M., Mus. Gen., Mus. Laus., DR.
 also orig. GEINITZ, Elbthal I, pl. 45, figs. 5,
 6, 7).
- G.F.R. :
 Bavaria :
 Lappersdorf, Regensburg (B.).
 Regensburg (N.M.W., Mus. Gen.).
 Westphalia :
 Essen/Ruhr (N.M.W.).
- GREAT BRITAIN :
 Branscombe (Devon) (S.M.).
 Charmouth (Dorset) (B.M.).
 Dunscombe (Devon) (S.M.).
 Hooken (Devon) (B.M.).
 Wilmington (Devon) (B.M.).
 Worbarrow (Dorset) (Geol. Sci.).
- POLAND : Silesia :
 Giesshübel, Lähn (B.).
 Humprichsberg, Lähn (B.).
 Plagwitz, Löwenberg (B.).
 Waltersdorf, Lähn (B.).
- Cenomanian-Turonian transition-zones :
 G.D.R. :
 Dohna (DR.).
 Elbstollen (DR.).
 Leiteritz (DR.).
- Turonian :
 G.D.R. : Plenus-zone :
 Goldne Höhe (DR.).
 GREAT BRITAIN : Northern Ireland :
 County Antrim (B.M.).
- 1912 *Vola aequicostata* O. SCHLAGINTWEIT, pp.
 Lamarck 121, 122.
 1912 *Pecten (Neithea) aequi-* L. PERVINQUIÈRE, pp.
costatus Lamarck 135, 136.
 v. 1916 *Neithea aequicostata* R. B. NEWTON, pp. 565,
 (Lamarck) 566, pl. 1, figs. 2, 3.
 ?1926 *Pecten (Neithea) aequi-* V. MOUTA et A. BORGES,
costata (Lmk.) p. 115.
 1929 *Neithea aequicostata* J. V. L. RENNIE, pp. 16,
 (Lamarck) 17.
 1939 *Pecten (Neithea) Loevis* M. COLLIGNON, pp. 68,
 Drouet 69, pl. 1, figs. 14, 15.
 ?1945 *Neithea salinasensis* J. V. L. RENNIE, pp. 30,
 sp. nov. 31, pl. 2, fig. 8.
 ?1945 *Neithea moutai* sp. nov. J. V. L. RENNIE, pp. 29,
 30, pl. 2, fig. 6, 7.
 (1945) *Pecten (Vola) hispanicus* J. R. BATALLER, p. 30.
 Orbigny
 1947 *Pecten (Vola) hispanicus* J. R. BATALLER, p. 235.
 d'Orbigny
 v. 1956 *Janira hispanica* J. ROGER, fiche n° 44.
 d'Orbigny
 1957 *Neithea moutai* Rennie E. DARTEVELLE et S.
 FREINEIX, p. 76.
 ?1957 *Neithea aequicostata* E. DARTEVELLE et S.
 (Lamarck) FREINEIX, p. 73.
 1959 *Neithea hispanica* J. R. BATALLER, p. 50.
 d'Orbigny sp.
 (1963) *Neithea aequicostata* G. HENRIQUES DA SILVA,
 (Lam.) p. 28.
 ?(1963) *Neithea aequicostata* A. F. SOARES, p. 9.
 (Lam.)
 ?1963 *Neithea hispanica* A. F. SOARES, p. 9.
 (d'Orbigny)

Location and designation of type-specimens. — In the Muséum national d'Histoire naturelle, D'ORBIGNY collection. J. ROGER chose a lectotype in 1956 : Coll. D'ORBIGNY, n° 6465.

Neithea moutai J. V. L. RENNIE : in the Geological Survey of Angola.

Neithea salinasensis J. V. L. RENNIE : id.

Locus typicus. — Llama Oscura près d'Oviedo (Spain).

Neithea moutai : Praia Grande (Angola).

Neithea salinasensis : Salinas (Angola).

Stratum typicum. — Cénomanién.

Neithea moutai : Senonian.

Neithea salinasensis : id.

Original description :

Espèce à vingt côtes larges, à peine séparées par un sillon. Espagne, Llama Oscura, près d'Oviedo.

Additional description :

Diagnosis. — *Neithea*-species covered by 18-21 equal ribs, separated by narrow intercostal intervals. Equal auricles which are, just as the areas, smooth. Left valve is flattened.

2. — *Neithea (Neithea) hispanica*
 (A. D'ORBIGNY, 1850).

- v. 1850 *Janira hispanica* d'Orb. A. D'ORBIGNY, p. 170,
 n° 507.
 v. 1869 *Neithia (sic) alpina* P. DUNCAN, p. 46.
 d'Orb.
 .1902 *Vola laevis* Drouet P. CHOFFAT, pp. 151,
 152, pl. III, figs. 11, 12.
 .1902 *Vola aequicostata* P. CHOFFAT, p. 152,
 Lamarck pl. III, fig. 10.

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This species is, except for the number of ribs, totally similar to *N. aequicostata*.

Discussion :

Because of the similarity of *N. hispanica* and *N. aequicostata* the former has, in literature, mostly been referred to the latter. Nevertheless *N. hispanica* is unquestionably a species in its own right : the lower number of ribs is a constant characteristic with a limited geographical and stratigraphical distribution : where *N. hispanica* occurs no *N. aequicostata* is found. *N. hispanica* has a typical Tethys-distribution which continues in the Central African Cretaceous.

Neithea moutai and *N. salinasensis*, both species of J. V. L. RENNIE, are based on very poorly preserved specimens. As far as can be judged they probably belong to *N. hispanica*, but since the figures are insufficiently clear and, because of the difference in stratigraphical horizon, it seems dangerous to draw a definite conclusion at this stage. Its equal ribs make it easy to differentiate *N. hispanica* from other *Neithea*-species. In a few species however, it can happen that the ribs are subequal, and if their number is the same, confusion might arise :

N. alpina (D'ORBIGNY) : those specimens which have 17-18 subequal ribs can still be differentiated from *N. hispanica* by the outwardly curved areas and by the broader beak.

N. regularis (SCHLOTHEIM) : specimens from the Upper Maastrichtian are often covered with 20-23 equal ribs; they can be differentiated from *N. hispanica* by the areas which are never smooth but covered by riblets.

N. gibbosa (PULTENEY) : some Cenomanian specimens are covered with 21-23 subequal ribs; they are differentiated from *N. hispanica* by their very unequal auricles and outwardly curved areas.

Generic attribution. — Considering the similarity to the type-species of the genus *Neithea* the attribution of *Janira hispanica* D'ORBIGNY to *Neithea* DROUET follows as a matter of course. The correct name thus becomes *Neithea (Neithea) hispanica* (D'ORBIGNY).

Stratigraphical and geographical distribution :

Albian : Vraconnian :

ANGOLA :

E. of Lobito, plateau 800 feet (B.M. L 25851, original to R. B. NEWTON, 1916).

Cenomanian :

ALGERIA :

Ain Beïra and Bardj Messaoud, Constantine (Musé.).

EGYPT : Sinai :

Wadi Qena (B.M.) and Wadi Nagh Badev (B.M., original to DUNCAN, 1869, LL 30995).

FRANCE :

Escragnolles (Alpes-Maritimes) (Musé., coll. D'ORBIGNY, 6465 A).

Grasse (Alpes-Maritimes) (N.M.W.).

SPAIN :

Oviedo (Musé., lectotype).

Tinto (B.).

3. — *Neithea (Neithea) alpina*

(A. D'ORBIGNY, 1847).

- | | | |
|----------|--|---|
| 1842 | <i>Pecten versicostatus</i> Lam. | P. MATHÉRON, p. 185. |
| | Deshayes variété (c) nobis | |
| v. 1847 | <i>Janira alpina</i> | A. D'ORBIGNY, pp. 643, 644, pl. 446, figs. 4-8. |
| v. 1850 | <i>Janira Alpina</i> | A. D'ORBIGNY, p. 170, n° 506. |
| 1849 | <i>Pecten tricostatus</i> | E. BAYLE in FOURNEL, pp. 369, 370, pl. 18, fig. 30. |
| non 1859 | <i>Pecten tricostatus</i> | J. MÜLLER, p. 8, pl. 7, fig. 31. |
| . 1877 | <i>Janira Doumerci</i> | A. PÉRON, pp. 508, 509, pl. 7, fig. 3. |
| 1888 | <i>Janira Ficalhoi</i> Choffat | P. CHOFFAT, pp. 89, 90, pl. 5, figs. 8-10. |
| ? 1890 | <i>Pecten tricostatus</i> Bayle | A. PÉRON, pp. 229, 230. |
| . 1890 | <i>Pecten alpinus</i> d'Orbigny (sub <i>Janira</i>) | A. PÉRON, p. 223. |
| non 1847 | <i>Pecten alpinus</i> d'Orbigny | |
| (1900) | <i>Janira tricostata</i> Bayl. | M. BLANCKENHORN, p. 39. |
| 1904 | <i>Neithea tricostata</i> Bayle | H. DOUVILLÉ, p. 268, pl. 39, figs. 9, 10. |
| (1905) | <i>Neithea tricostata</i> Bayle | J. DE MORGAN, p. 180. |
| ? 1909 | <i>Janira daghestanica</i> nov. sp. | V. RENGARTEN, pp. 663, 664, 647, 650, 655, pl. 20, figs. 3, a, b. |
| 1912 | <i>Pecten (Neithea) alpinus</i> d'Orbigny | L. PERVINQUÈRE, p. 136. |
| non 1847 | <i>Pecten alpinus</i> d'Orbigny | |
| (1921) | <i>Neithea tricostata</i> Bayle | E. D. CURRIE, p. 537. |
| ? 1931 | <i>Vola alpina</i> d'Orb. | L. RIEDEL, p. 668. |
| 1934 | <i>Neithea alpina</i> d'Orbigny | A. A. OLSSON, pp. 31, 32. |
| . 1934 | <i>Pecten (Vola) alpinus</i> d'Orb. | M. BLANCKENHORN, p. 191. |
| non 1847 | <i>Pecten alpinus</i> d'Orbigny | |
| v. 1956 | <i>Neithea doumerci</i> (Peron) | J. ROGER, n° 36, figs. 1, 2, 3, 3 a, 3 b. |
| v. 1956 | <i>Neithea alpina</i> (d'Orbigny) | J. ROGER, n° 52. |
| 1957 | <i>Neithea ficalhoi</i> (Choffat) | E. DARTEVELLE et S. FRENEIX, p. 76. |
| . 1965 | <i>Neithea (Neithea) ficalhoi</i> (Choffat) | I. HAYAMI, pp. 302-305, pl. 42, figs. 5, 16. |
| . 1968 | <i>Neithea (Neithea) ficalhoi</i> (Choffat) | T. HANAI, I. OBATA, I. HAYAMI, p. 24, pl. 3, fig. 4. |
| non 1898 | <i>Vola alpina</i> d'Orb. | G. MUELLER, pp. 37, 38, pl. 4, fig. 7. |
| non 1931 | <i>Vola (Janira) alpina</i> d'Orb. | V. TZANKOV, tabl. III. |
| non 1940 | <i>Neithea alpina</i> | L. RIEDEL, p. 88. |

Location and designation of type-specimens. — In the Muséum d'Histoire natu-

relle in Paris, collection D'ORBIGNY. J. ROGER, 1956 chose a lectotype : n° 6466.

Pecten tricostatus BAYLE : I have not succeeded in finding where the specimen from the Fournel-collection, which BAYLE described, is located.

Janira doumerci PERON : type-material is in the Muséum national d'Histoire naturelle in Paris; among those J. ROGER, 1956 chose a lectotype.

Janira ficalhoi CHOFFAT : in the collections of the Angolan geological Survey; at present probably in Lisbon.

Locus typicus. — Escragnolles (Var) : this is the indication given by D'ORBIGNY and by J. ROGER; in the « Dictionnaire national des Communes de France, 1965, 18th Ed., Ed. ALBIN MICHEL » however one finds : Escragnolles (Alpes-Maritimes) (arr. Grasse, comm. Saint-Vaillier-de-Thiery).

Neithea tricostata (BAYLE) : à la grande halte, dans la marche vers El Outâia (route de Constantine à Biskra). Thus, probably in the neighbourhood of El Outaia, near Biskra in Algeria.

Neithea doumerci (PERON) : Rennes-les-Bains (Aude) (O.D.) (France).

Neithea ficalhoi (CHOFFAT) : Dombe Grande (O.D.) (Angola).

Stratum typicum. — Craie chloritée (Cenomanian).

Neithea tricostata (BAYLE) : accolé... *Hemipneustes africanus* : Upper Cretaceous.

Neithea doumerci (PERON) : calcaires à Echinides (Coniacian : fide J. ROGER, 1956, n° 36).

Neithea ficalhoi (CHOFFAT) : couches à *Pholadomya pleuromyaeformis* (Aptian ?) (fide Lexique).

Original description :

J. Testâ ovatâ, trigonâ, depressâ; valvâ superiore complanatâ; valvâ inferiore convexâ, incurvatâ, radiatim 6-costatâ; costis rotundatis, elevatis; interstitiis sulcis latis, bicostatis.

Dimensions. — Largeur, 53 millim. Par rapport à la largeur : longueur, $\frac{100}{100}$; épaisseur, $\frac{36}{100}$. Angle apical, sans les oreilles, 85°.

Coquille ovale, trigone, transverse, déprimée. Valve supérieure plane, striées concentriquement et costulée. Valve inférieure bombée, à sommet contourné, pourvue de six grosses côtes rayonnantes, saillantes, arrondies, entre lesquelles sont les sillons très-larges, peu creusés, où l'on remarque deux côtes égales, élevées, plus larges que les sillons qui les séparent. En dehors des grosses côtes externes il n'y a qu'une seule petite côte rayonnante.

Rapports et différences. — Rapprochée par son ensemble du *J. quinquecostata*, cette espèce s'en distingue par sa forme moins bombée, par ses côtes moins saillantes, et surtout par deux petites côtes égales entre chaque grande, au lieu de quatre. L'extérieur des côtes latérales n'a aussi qu'une côte au lieu de sept.

Localité. — Elle a été recueillie dans la craie chloritée à Escragnolles (sic) (Var), par MM. Mouton et Astier. J'en ai sous les yeux plusieurs exemplaires.

Pecten tricostatus BAYLE, 1849.

Pecten tricostatus NOB.

Janira Alpina D'ORB.

Ce fossile appartient à un groupe d'espèces du genre *Pecten*, dont la valve supérieure est concave, l'inférieure étant au contraire, plus ou moins convexe. M. D'Orbigny a formé avec ce groupe le genre *Janira*, que nous ne pouvons pas admettre, car il ne repose sur aucun caractère zoologique important, et d'ailleurs, les espèces qui le composent ne sont pas, comme le pense M. D'Orbigny, spéciales aux terrains crétacés, tertiaires, et à l'époque actuelle. Une espèce fort remarquable de ce groupe a été, en effet, découverte par M. Domeyko, dans les couches supérieures du lias des environs de *Coquimbo*, au Chili. Voici la description de cette espèce : coquille inéquivalve, équilatérale, pointue du côté du crochet, arrondie au bord opposé; la valve inférieure, très-convexe, et dont le crochet se recourbe fortement sur la ligne cardinale, est ornée de six grosses côtes, croissant en largeur de l'oreillette vers le milieu de la valve; les deux côtes médianes sont égales en ce point; ces côtes partent du crochet et vont, en divergeant, atteindre le bord arrondi de la coquille; leur surface est elle-même striée longitudinalement. On remarque, en outre, sur la surface de la coquille, depuis l'oreillette jusqu'à la première des grosses côtes, des stries profondes, longitudinales et rayonnantes; entre les grosses côtes, il y en a deux qui sont lisses, aplaties, et qui laissent entre elles des intervalles d'une longueur moitié moindre environ que la leur. La valve supérieure est légèrement concave; ses côtes et ses ornements correspondent à ceux de la valve inférieure. Les oreillettes sont sensiblement égales, larges et striées longitudinalement.

Le nom que nous avons assigné à cette coquille doit être pris dans le même sens que celui de *quinquecostatus* donné par Sowerby à une autre espèce du même genre. Il rappelle que les côtes sont alternativement plus grosses de trois en trois, ou bien que les deux petites côtes qui se trouvent entre deux grosses laissent entre elles trois sillons, représentant alors trois côtes d'égale largeur dans la contre-empreinte de la coquille.

En France ce *Pecten* a été trouvé dans le grès vert d'Escragnolles (Var), et M. Fournel l'a retrouvé, le 2 mars 1844, à la grande halte, dans la marche vers El-Outâia (route de Constantine à Biskra). Un des individus que nous avons examinés était accolé par sa valve supérieure sur la surface du test d'un *Hemipneustes africanus*.

Janira doumerci PERON, 1877.

Il existe à Rennes-les-Bains, dans les calcaires à Echinides, deux espèces de *Janira* très distinctes. La première, à deux petites côtes intermédiaires, ne me paraît pouvoir être rapportée à aucun type connu. Elle a la taille et la forme de la *J. Coquandi*, PERON, et les six échantillons que j'en connais atteignent de 35 à 40 mm. Elle a toujours deux côtes intermédiaires entre chacune des six grosses, et en cela elle se rapproche de la *J. Alpina*, d'Orb. Mais ces deux côtes intermédiaires sont loin d'être égales et régulières comme dans ce dernier type : l'une d'elles, la plus rapprochée du milieu de la coquille, est presque aussi forte que la grosse côte voisine, tandis que la seconde est toujours bien plus petite. En outre, en dehors des grosses côtes externes, il y a trois petites côtes rayonnantes bien marquées, tandis que dans la *J. Alpina* il n'y en a qu'une. Le test est orné de stries transversales très fines, et le plus souvent on voit au quart inférieur de la coquille un fort sillon d'accroissement. Je propose pour cette espèce le nom de *J. Doumerci*, en l'honneur d'un de nos

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collègues qui en a recueilli avec moi un bon exemplaire. Les figures 3-3b de la planche VII représentent la forme et le profil de cette nouvelle espèce.

Janira Ficalhoi CHOFFAT, 1888.

Coquille convexe, trigone, plus haute que large. Grande valve profonde, présentant extérieurement une convexité plus ou moins accentuée selon les individus, petite valve concave. Oreillettes ayant une faible longueur, mais passablement hautes. La grande valve est couverte de côtes rayonnantes, convexes, arrondies, régulières, portant des plis d'accroissement très fins, à peine visibles, sauf quelques-uns plus forts. Il y a 6 côtes principales, formant 6 angles sur le bord palléal; les intervalles qui les séparent contiennent deux côtes plus faibles, mais présentant les mêmes caractères. Les côtes principales présentent parfois à la base une légère division longitudinale, si faible que l'on peut à peine la considérer comme une côte accessoire; elle manque le plus souvent, et lorsqu'elle existe, se présente tantôt de chaque côté de la même côte, tantôt d'un côté seulement. Les espaces entre les côtes externes et les bords palléal et buccal ne sont ornés que par des plis d'accroissement aussi fins que ceux qui couvrent les côtes, ils présentent en outre une légère dépression longitudinale, mais pas de côtes.

La petite valve présente 6 sillons radiants, correspondant aux 6 côtes principales, et aboutissant par conséquent aux 6 angles du bord palléal. Entre deux sillons principaux s'en trouvent deux autres, correspondant aux côtes accessoires de la grande valve. Les intervalles entre deux sillons sont formés par des côtes arrondies, beaucoup plus étroites que celles de la grande valve, et beaucoup plus égales entre elles. Lorsqu'une des côtes principales de la grande valve présente un léger sillon longitudinal à sa base, le sillon de la petite valve est bordé par une côte double correspondant au dédoublement de la côte de la grande valve.

Rapports et différences. — Cette espèce est du même groupe que les *Janira atava* (ROEMER), *Morrissi* PICTET et REN., *quinquecostata* (SOW.), *quadricostata* (SOW.), *Faujasi* PICTET et CAMP., *tricostata* (BAYLE), et *Coquandi* PERON, espèces qui s'en distinguent par un plus grand nombre de côtes secondaires.

M. ROEMER a figuré et décrit une forme du Texas (1852, pl. 8, f. 4, p. 64), qu'il considère comme une variété de *Janira quadricostata*. Parmi les caractères de cette forme, il en est un qui se retrouve parfois dans notre espèce, c'est celle d'un sillon à la base des côtes principales, mais ce sillon qui n'est qu'exceptionnel dans notre espèce, est constant et en outre beaucoup plus accentué dans la forme du Texas; de plus, la description de la petite valve fait voir une assez grande différence.

Pecten Dresleri, DRESCHER (Z.D. GEOL. G. 1863, 15, p. 354, pl. 9, f. 17), ne présente que deux côtes intermédiaires, comme c'est le cas pour notre espèce, qui s'en distingue en ce que les espaces en dehors des côtes externes sont lisses, tandis qu'ils présentent des côtes radiantes chez *Pecten Dresleri*.

Janira alpina D'ORB., qui ne présente aussi que deux côtes intermédiaires, s'en distingue par le même caractère que l'espèce précédente et en outre par une plus grande taille et une plus grande largeur.

Gisement. — Dombe Grande. Couches à *Pholadomya pleuromyaeformis*, 13 exemplaires.

Additional description :

Number of studied specimens : 50 odd specimens from various, sometimes widely separated localities.

Measurements. — The preservation-state being mostly very insufficient, only a few of the studied specimens could be measured.

Usually the specimens are small to medium-sized *Neitheas* (the U.P.D. of the right valve is always less than 50 mm, and mostly smaller than 35 mm).

U.P.D. and W. are, on right valves, equal; on left valves, as can be expected, U.P.D. is shorter than W. Nevertheless, in this species, the difference between U.P.D. and W. is more striking on small than on large specimens.

As an example the measurements of a few double specimens from the Bagh Beds, Nerbuddha, India :

U.P.D. (right).	U.P.D. (left).	W (both v.)	AA (left).
—	—	—	—
18.15	16.05	15.40	97°
16.50	14.60	14.55	88°

Description.

Diagnosis. — Small to medium-sized *Neitheas*-species with two well-developed intercalary ribs between each two principal ribs; the areas are curved outwardly and smooth except for a few slight radial folds; auricles smooth.

The right valves are not very convex, particularly so on large specimens, and the left valves are flattened : I have not come across concave left valves.

The auricles are rather large and subequal.

On convex valves the areas are slightly curved outwardly and are covered by a variable number of riblets; these are, in fact, foldlike, not clearly differentiated structures, lying closely to the first principal rib; the other parts of the areas and auricles are smooth.

Rib arrangement : on right valves there are 16 ribs : 6 principal ribs with 2 intercalary ribs between each 2 principal ribs; intercostal intervals are always well-developed and flattened. The principal ribs can occasionally form a side rib on both sides : the section of such a rib shows a tripartite aspect, but the side ribs are never detached from the principal ribs.

On the flattened valves the differentiation between principal and intercalary « ribs » is not always evident : this is easily understood if one remembers that left valve « ribs » correspond to right valve intercostal intervals and those intervals on the right valve are far less dissimilar than the principal and intercalary ribs are themselves. Nearly all the specimens I studied have smooth ribs; this could however be accounted for the preservation state, and it could be, that concentric growth lines are present on extremely well preserved specimens as is illustrated on the photographs in I. HAYAMI, 1965.

Discussion :

Synonymy. — The confusion in the synonymy of the species has arisen, as is so often the case, from the incorrect description by its first author. A. D'ORBIGNY had only incomplete specimens in

his possession and when completing them in his figures he drew parts which do not correspond to what can be seen on the specimens.

To begin with, he points out in his description that the areas are covered with one riblet (« une seule petite côte »): this is true for the right (anterior) side of his convex valve, but on the left (posterior) side of the same valve there appear five folds that could be described as « petite côte ».

Where his figures are concerned I would like to state the following:

- figure 4: the auricles drawn here are not to be seen. In the figure the areas are curved inwardly, but in reality they curve outwardly; this results in the auricles, not being covered by the shell, seeming very much larger;
- figure 5: is incorrect in the rendering of the auricles; what remains of them, shows auricles which reach to 3/4 along the apical line from the beak;
- figure 6: is also inaccurate; the areas drawn here should be completely covered with ribs, whereas in fact on the specimen the first two drawn ribs, close to the auricle, do not appear at all and the area is smooth. Besides this, the first rib which is present, and which is the first principal rib, is far more prominent than the two following ribs;
- figure 7: the intercostal intervals are narrower when compared to the ribs than one might think when looking at this figure.

In 1849 E. BAYLE proposed a new name for *Janira alpina* D'ORBIGNY, because he did not accept *Janira* as a different genus from *Pecten*, and there was already a *Pecten alpinus*. E. BAYLE's description of an Algerian specimen corresponds to the lectotype of *N. alpina* (D'ORBIGNY): the BAYLE holotype being unknown^(*) one must go by the description and figure.

It should be taken into account, that BAYLE, like many of his contemporaries, used the term « length » with a meaning which is nowadays always given to « breadth » or « width » and so his « stries longitudinales » are really concentric striae.

A. PÉRON, 1877 (p. 503) gives a detailed discussion of D'ORBIGNY and BAYLE's « species ». He reaches the conclusion that *Pecten tricostatus* BAYLE is, according to his figure of it, practically a synonym of *N. striatocostata* (GOLDFUSS). His arguments are unconvincing; he has not seen BAYLE's original material: he states he had « de bons échantillons recueillis

(*) The collection of the « Ecole des Mines » contains one specimen which is labelled as *Pecten tricostatus* BAYLE. As locality it gives Djebel Aures. It belongs to *N. coquandi* (PERON). It could be that this specimen was considered by BAYLE as belonging to *P. tricostatus*, but since it does not correspond with the description, nor with the figure, it cannot be taken into account.

dans les mêmes couches où M. FOURNEL a trouvé le sien ». Obviously this is a poor argument because:

- BAYLE does not state precisely the strata from which his specimens came; he only mentions that one of them is attached to a *Hemipneustes africanus*;
- nothing prevents more than one species of the same genus being found in one and the same stratum; in Maastricht at least four occur in the same locality and stratum.

A. PÉRON, 1877 describes *Janira doumerci*. The differences which he indicates in comparison to *N. alpina* are, in my opinion, not conclusive. The dissimilarity between the intercalary ribs does not show on the lectotype. On fiche 36 of J. ROGER one can see that the « difference » does not reach above the normal variation one is to expect in « equal » ribs. This is also true for the broader and narrower ribs respectively in *N. alpina* and *N. doumerci*. Concerning the number of radial folds on the areas, see the discussion of the lectotype of *N. alpina*.

I have been unable to understand the argument by which J. ROGER keeps separate *N. doumerci* and *N. alpina*.

Janira ficalhoi as described by P. CHOFFAT, differs from *N. alpina* by having smooth areas and principal ribs which are more or less tripartite, but never lose their unity: the section is more angular than rounded. The first differential characteristic, according to HAYAMI's description, does not really exist; the areal riblets are present as lines or slight folds and their presence is directly correlated to the preservation state. The second differential characteristic could be an occasional particularity; some specimens from the Bagh Beds also exhibit it.

Thus I see no real reason to separate *N. ficalhoi* from *N. alpina*.

Janira daghestanica V. RENGARTEN, shows according to the author himself a strong resemblance to *N. alpina*, but has entirely smooth areas. No major difference seems to exist between both species; but since *N. daghestanica* is recorded from Neocomian strata in Daghestan (Caucasus), it is preferable to reserve judgment till the type-material can be studied.

Differentiation and affinities with other species. — *N. alpina* characterized by a rib arrangement consisting of six principal ribs with two intercalary ribs in each intercostal interval, and showing on well-preserved specimens concentric striae all over the ribs, holds a fairly isolated position in the *Neithea* (*Neithea*) group. Several authors, mainly German, have however published notices of occurrence and descriptions of supposed *N. alpina* from their Senonian, where in fact *N. striatocostata* (GOLD-

FUSS) was concerned. The differentiation between these species is not very difficult: in *N. striatocostata* the complete shell is covered with radial striae, the ribs are not clearly delimited amongst themselves, and there are four intercalary ribs, of which the nearest to the principal rib can have the appearance of side-ribs. In this case it could be that a poorly preserved specimen or a «Steinkern» gives the impression of having only two intercalary ribs. As long as a portion of the shell is left it is possible to see the radial striae and these are a good character for differentiating *N. striatocostata* from *N. alpina*. On Steinkernen it is very difficult to distinguish between the two species, especially if no auricles are present; if they are present then *N. striatocostata* has small auricles and inwardly curved areas, whereas *N. alpina* has relatively larger auricles and outwardly curved areas.

It is easy to differentiate *N. alpina* from other *Neithea*-species with clearly delimited ribs by considering the number of intercalary ribs: *N. gibbosa* (PULTENEY), *N. regularis* (SCHLOTHEIM), *N. coquandi* (PERON) have three intercalary ribs; the third species is known to occur with one of the intercalaries less developed (var. *atropha*): the third intercalary is then comparable with the non-detached side-rib resulting from the tripartition of a principal rib of *N. alpina*. Nevertheless both species can always be differentiated because in *N. coquandi* the auricles are relatively smaller, the areas are inwardly bent, the U.P.D. is much longer than the W. on the convex valve and the left valve is really concave.

N. quinquecostata and *N. syriaca* have 4 intercalary ribs.

The *Neithea*-species which are characterized by poorly delimited ribs, such as *N. notabilis* (MUNSTER in GOLDFUSS) and *N. atava* (ROEMER) can be differentiated from *N. alpina* on the shape of the ribs.

In the North American Cretaceous several species have been described, which judging from their descriptions and figures, appear to be similar to *N. alpina*: from the Albian-Cenomanian of Mexico and Texas *N. texana* (ROEMER, 1852), *N. subalpina* (E. BOESE, 1910), *N. irregularis* (E. BOESE, 1910). It seems very likely that when American and European material are compared the two first will be found to be synonymous with *N. alpina*.

It is sometimes difficult to differentiate between specimens of *N. alpina* and of *N. hispanica* (D'ORBIGNY), particularly if one only has flattened valves of *N. alpina* on which principal and intercalary ribs have the same development: the differences are then:

- the proportion of U.P.D./W.: *N. alpina* U.P.D. <W., *N. hispanica* U.P.D. \pm = W.;
- the number of ribs: 16 for *N. alpina*, 18-22 for *N. hispanica*.

Discussion of stratigraphical and geographical distribution. — This species is recorded over a very long period; the oldest specimens I studied date back to the Aptian-Albian and the youngest are from the Maastrichtian. Specimens are recorded from all the stages in this period, but they are always uncommon and only occur in the Tethyan and Central African Cretaceous.

Generic attribution. — *Janira alpina* D'ORBIGNY has the general characteristics of *N. aequicostata* (LAMARCK): equal auricles, convex right valve and flattened left valve, both covered with regularly distributed ribs, and the same general shape. However, as far as I could discern from the literature, no-one, so far, seems to have prepared the hinge-teeth which are the conclusive evidence. However there seems to be no reason to doubt that *Janira alpina* D'ORBIGNY belongs to the genus *Neithea* and thus it should correctly be named *Neithea (Neithea) alpina* (D'ORBIGNY, 1847).

Stratigraphical and geographical distribution:

Albian:

FRANCE:

Perte du Rhône (Ain) (S.M.).

JAPAN:

Lower Miyako group:

Hiraiga, Iwate prefecture (B.M.).

Cenomanian:

FRANCE:

Escragnolles (Alpes-Maritimes) (B., Mus. Gen. Musé a.o. orig. to D'ORBIGNY and J. ROGER, n° 52, coll. D'ORBIGNY: 6466).

ISRAËL:

Kurnub (B.M.).

U.S.S.R.:

Kursk (B.).

Turonian:

FRANCE:

Sougraigne (Aude) (B.).

Turonian-Senonian:

AUSTRIA: Untere Gosau:

Edelbachgraben (Mü.).

Senonian:

FRANCE:

Cognac (Charente) (B.).

Les Jambes, Périgueux (Dordogne) (Musé.).

Pérignac (Charente-Maritime) (B.).

Rennes-les-Bains (Aude) (Musé. Laus., Musé, a.o. originals to PÉRON and J. ROGER, n° 36).

Sainte-Hospice (Alpes-Maritimes) (B.M.).

Sougraigne (Aude) (B.M.).

Talmont (Charente-Maritime) (B.).

Senonian (Campanian):

JAMAICA:

Cambridge-Catadupa Railway Line (B.M., orig. C. T. TRECHMANN, 1927, pl. 1, fig. 8 determined as *N. quinquecostata*, L 74228).

Maastrichtian :		v. 1850	<i>Janira quadricostata</i>	A. d'ORBIGNY, p. 252, n° 879.
ALGERIA :		(1850)	<i>Pecten quadricostatus</i> Sow. (pro parte)	H. B. GEINITZ, p. 186.
Dordonien : Necmarins (B.M.).		?	<i>Pecten quadricostatus</i> Sow.	H. B. GEINITZ, p. 16, pl. 3, figs. 14, 15.
JAMAICA :		1850	<i>Janira quadricostata</i> d'Orb.	A. ALTH, p. 249.
Rudist Limestone : Logie Green Section (B.M.).		1852	<i>Pecten quadricostatus</i> Sow.	R. KNER, p. 317.
Above <i>Barrettia</i> -Limestone : St. Ann's Great River (B.M., orig. C. T. TRECHMANN, pl. 4, fig. 25, L 74225).		(1857)	<i>Janira quadricostata</i> d'Orb.	C. LORY, p. 47.
OMAN :		(1857)	<i>Pecten quadricostatus</i> d'Orb.	H. COQUAND, p. 90.
Jabal al Abyadh, Yangul (B.M., orig. G. M. LEES, p. 645, L 52794 and L 52795 determined as <i>Pecten (Neithea) quadricostatus</i>).		(1859)	<i>Pecten (Janira) quadri-</i> <i>costatus</i> Sow.	J. T. BINKHORST VAN DEN BINKHORST, p. 154.
Upper Cretaceous :		1863	<i>Pecten quadricostatus</i> Sow.	A. KUNTH, p. 725.
EGYPT :		(1866)	<i>Pecten quadricostatus</i> Sow.	C. GIEBEL, p. 48.
« aus der Ammonitenschicht, Local L : 10 km west von den Pyramiden von Gizeh (Grosse Pyrami- den) (B., coll. SCHWEINFURT).		.1869	<i>Janira quadricostata</i> Sow. sp.	E. FAVRE, p. 155.
INDIA :		v. 1870	<i>Janira Faujasi</i> Pictet et Camp.	F. J. PICTET et G. CAM- PICHE, p. 253.
Bagh Beds : Nerbudda (B.M., mentioned in P. M. DUNCAN, 1865, p. 354).		1870	<i>Pecten quadricostatus</i> Sow.	H. CREDNER, p. 232.
Cretaceous :		.1871	<i>Vola quinquecostata</i> Sowerby (pro parte)	F. STOLICZKA, pp. 437, 438, pl. 31, figs. 1-6, pl. 37, figs. 5-7, non figs. 4 and 8.
MOROCCO :		.1874	<i>Janira quadricostata</i> Sow. sp.	W. DAMES, p. 765.
4.1 miles E, 20 miles S of Hadjer el Ouagef (B.M.).		(1875)	<i>Janira quadricostata</i> d'Orb.	H. ARNAUD, pp. 32, 33, 36, 38.
U.S.A. :		(1875)	<i>Janira quadricostata</i> Sow. sp.	F. L. CORNET et A. BRIART, p. 117, 120.
Henderson, between Braunfels and Guadeloupe, Texas (Halle).		.1875	<i>Vola quadricostata</i> Sowerby	D. BRAUNS, pp. 388, 389.
		.1877	<i>Janira quadricostata</i> Sowerby	A. PÉRON, p. 502.
		.1885	<i>Vola quadricostata</i> Sow. sp.	J. BOEHM, p. 84.
		?1889	<i>Vola propinqua</i> n. sp.	E. HOLZAPFEL, p. 238, pl. 26, fig. 18.
		.1889	<i>Vola quadricostata</i> Sow. sp.	E. HOLZAPFEL, pp. 237, 238, pl. 26, fig. 20.
		v. 1889	<i>Vola quadricostata</i> Sowerby sp.	O. GRIEPENKERL, pp. 48, 49.
		.1890	<i>Pecten regularis</i> Schlotheim	A. PÉRON, pp. 230, 231.
		.1894	<i>Vola quadricostata</i> Sow. sp.	A. HENNIG, p. 520.
		non 1818	<i>Neithea aequicostata</i> (Lamarck)	
		?1895	<i>Janira quadricostata</i>	E. TIESSEN, p. 472.
		.1895	<i>Vola quadricostata</i> Sow.	F. VOGELS, pp. 25, 26.
		?1896	<i>Vola quadricostata</i> var. <i>sexcostata</i> nom. nov.	O. REIS, p. 7.
		v. 1896	<i>Vola quadricostata</i> Sow.	A. RUTOT, p. 30.
		.1897	<i>Vola quadricostata</i> Sowerby sp.	F. NOBTLING, pp. 42, 43, pl. 11, figs. 5, 6, 6b, 7, 7b.
		?1897	<i>Vola quadricostata</i> Sow. sp.	A. FRITSCH, p. 68.
		(1897)	<i>Janira quadricostata</i> d'Orbigny	M. MUNIER CHALMAS, p. 89.
		1897	<i>Vola quadricostata</i> (Sow.)	W. PETRACZEK, pp. 31, 32.
4. — <i>Neithea (Neithea) regularis</i> (E. F. VON SCHLOTHEIM, 1813). (Pl. 1, fig. 3, pl. 2, figs. 1 a-d.)				
.1799	—	FAUJAS DE SAINT FOND, p. 149, pl. 23, fig. 2.		
.1813	<i>Pectinites regularis</i>	E. F. VON SCHLOTHEIM, p. 112.		
.1820	<i>Pectinites regularis</i>	E. F. VON SCHLOTHEIM, p. 221.		
.1820	<i>Pectinites gryphaeatus</i>	E. F. VON SCHLOTHEIM, p. 224.		
.1833	<i>Pecten quadricostatus</i> (pro parte)	A. GOLDFUSS, pp. 54, 55, pl. 92, figs. 7, c-e, non figs. 7, a, b.		
non 1814	<i>Pecten quadricostatus</i> Sowerby = <i>Neithea gibbosa</i> (Pulteney)			
.1837	<i>Pecten Quinquecostatus</i>	A. d'ARCHIAC, p. 186.		
non 1814	<i>Pecten quinquecostatus</i> Sowerby			
?1839	<i>Pecten quadricostatus</i> Sow.	H. B. GEINITZ, p. 22.		
.1841	<i>Pecten quadricostatus</i> Sow.	F. A. ROEMER, p. 54.		
?1842	<i>Pecten versicostatus</i> Lam. Deshayes variété (b) <i>Pecten quadricostatus</i> Sow.	P. MATHÉRON, p. 185.		
1843	<i>Pecten quadricostatus</i> Sow.	H. B. GEINITZ, p. 16, pl. 16, figs. 14, 15.		
?1846	<i>Pecten quadricostatus</i> Sow.	H. B. GEINITZ, p. 469.		
?1846	<i>Pecten versicostatus</i> Lamarck (pro parte)	A. E. REUSS, pp. 31, 32.		
.1847	<i>Pecten quadricostatus</i> Sow.	J. MÜLLER, p. 33.		
.1847	<i>Pecten aequicostatus</i>	J. MÜLLER, p. 33.		
non 1818	<i>Pecten aequicostatus</i> Lamarck			
v. 1847	<i>Janira quadricostata</i>	A. d'ORBIGNY, pp. 644- 646, pl. 447, figs. 1-7.		
v. 1850	<i>Janira Geinitzii</i> d'Orb.	A. d'ORBIGNY, p. 197, n° 167.		

OF THE SUBFAMILY NEITHEINAE, ETC.

- ?1897 *Vola quadricostata* O. REIS, p. 75.
 (1898) *Janira quadricostata* L. M. VIDAL, pp. 861, 862, 897.
 .1898 *Vola quadricostata* Gein.
 .1898 *Vola quadricostata* G. MUELLER, pp. 35, 37,
 Sow. sp. pl. 4, figs. 9, 10.
 (1899) *Janira quadricostata* A. DE RIAZ, p. 425.
 d'Orb.
 (1899) *Janira quadri-costatus* A. W. ROWE, p. 364.
 Sby.
 ?1900 *Janira quadricostata* G. VON ARTHABER, p.
 d'Orbigny 306.
 1901 *Vola quadricostata* F. STURM, p. 90.
 (1901) *Vola quadricostata* M. VON PALFY, p. 120.
 Sow. sp.
 ?1902 *Vola regularis* P. CHOFFAT, pp. 149,
 Schlotheim 150.
 (1903) *Neithea quadricostata* H. DOUVILLE, p. 94.
 (1903) *Vola quadricostata* Sow. F. NOETLING, p. 518.
 (1903) *Janira regularis* L. PERVINQUIÈRE, p. 151.
 Schlotheim
 1903 *Pecten regularis* F. FOURTEAU, pp. 318,
 Schlotheim 319.
 ?(1904) *Janira quadricostata* M. SCHLOSSER, p. 655.
 Sow.
 .1905 *Pecten quadricostatus* T. WEGNER, pp. 170,
 Sow. 171.
 (1905) *Janira (Vola) quadri-* J. J. JAHN, p. 76.
costata Sow.
 .1906 *Neithea Faujasi* J. PETHOE, pp. 222, 223,
 (Pictet et Campiche) pl. 15, figs. 6, 7.
 ?1906 *Neithea quadricostata* J. PETHOE, p. 223, pl. 13,
 (d'Orbigny) Drouet fig. 11.
 v.1909 *Neithea quadricostata* R. B. NEWTON, p. 55,
 J. Sowerby pl. 2, figs. 18-21.
 1911 *Vola quadricostata* Sow. K. VOGEL VAN FALCKEN-
 STEIN, p. 557.
 .1912 *Pecten (Neithea) regu-* L. PERVINQUIÈRE, pp.
laris Schlotheim 138, 139.
 (1918) *Janira quadricostata* A. HURE, p. 118.
 d'Orb.
 (1919) *Neithea Faujasi* Pict. F. KOCH, p. 239.
 (1919) *Neithea quadricostata* F. KOCH, p. 239.
 Sow.
 1922 *Neithea grypheata* J. BOEHM, p. 141.
 Schlotheim
 .1922 *Pecten quadricostatus* W. KOEPLITZ, pp. 34,
 Sow. 35.
 (1924) *Neithea Faujasi* Pict. u. L. LEHNER, p. 180.
 Camp.
 (1924) *Neithea quadricostata* R. ABRARD, pp. 643, 644,
 d'Orb. 645, 646.
 .1926 *Pecten quinquecostatus* B. WADE, pp. 64, 65,
 Sowerby pl. 21, figs. 1, 5.
 non 1814 *Pecten quinquecostatus* Sowerby
 (1928) *Neithea quadricostata* G. ASTRE, p. 271.
 d'Orbigny
 ?1930 *Neithea quadricostata* R. HÄGG, pp. 43, 44.
 (1930) *Neithea quadricostata* F. CHARLES et J. FLAN-
 DRIN, p. 435.
 Sow.
 (1931) *Janira quadricostata* A. BENOIT, p. 79.
 (1931) *Vola (Janira) quadri-* A. STEPHANOFF, p. 19.
costata Sowerby
 (1931) *Vola (Janira) quadri-* V. TZANKOV, Tabl. III.
costata Sow.
 1931 *Pecten (Neithea)* E. BASSE, p. 46.
quinquecostatus
 non 1814 *Pecten quinquecostatus* Sowerby
- ?1931 *Neithea gryphaeata* L. NOETH, pp. 336, 337,
 Schloth. pl. 18, figs. 18-20.
 1931 *Vola quadricostata* Sow. L. RIEDEL, p. 668.
 1931 *Neithea grypheata* W. HAENTZSCHEL, p.
 (Schloth.) 497.
 1932 *Pecten (Neithea) regu-* E. BASSE, p. 22.
laris Schlotheim
 (1933) *Janira quadricostata* A. BENIOT, pp. 14, 24,
 25, 26.
 .1934 *Neithea grypheata* H. ANDERT, pp. 167-173,
 Schlotheim sp. pl. 9, figs. 13, 16,
 textfig. 18.
 (1934) *Janira quadricostata* P. GOCEV, p. 36.
 Sow.
 (1934) *Vola quadricostata* Sow. St. T. JELEV, p. 119.
 (1935) *Neithea* cfr. *Faujasi* Pict. M. MARCHETTI, p. 27.
 et Camp.
 (1935) *Janira quadricostata* H. KATSCHTHALER, p.
 Sow. 175.
 1937 *Neithea gryphaeata* E. BEYENBURG, pp. 305,
 (v. Schloth.) 306.
 1937 *Neithea gryphaeata* (v. E. BEYENBURG, p. 306.
 Schloth.) var. *subae-*
quicostata G. Müller
 v.1939 *Neithea gryphaeata* E. DACQUE, p. 123,
 Schloth. pl. 12, fig. 10.
 v.1939 *Neithea gryphaeata* E. DACQUE, p. 200,
 Schloth. pl. 16, figs. 2, 3, 29.
 (1939) *Pecten (Neithea) quadri-* E. BASSE, p. 41.
costata Sow.
 .1940 *Pecten (Neithea) Sanfi-* C. MAXIA, pp. 5, 7,
lippii pl. 1, figs. 5, 8.
 (1940) *Neithea gryphaeata* (v. L. RIEDEL, p. 88.
 Schloth.)
 .1942 *Neithea regularis* Schil. A. M. TORRIANI, pp. 88,
 (sic) 89, pl. 6, figs. 1 a, b.
 .1942 *Neithea grypheata* Schl. W. J. M. VAN DER WEIJ-
 DEN, pp. 32, 34, pl. 1,
 figs. 4 a, h, pl. 2, fig. 4.
 .1943 *Neithea grypheata* W. J. M. VAN DER WEIJ-
 (Schlotheim) DEN, pp. 88, 89, pl. 8,
 figs. 8-11.
 (1949) *Neithea regularis* A. CHAVAN, p. 495.
 v.1949 *Neithea gryphaeata* L. R. COX, p. 9.
 (1953) *Neithea quadricostata* H. PRESCHER, p. 253.
 Sow.
 (1954) *Neithea (Janira) cfr.* R. GIVULESCU, p. 208.
quadricostata Sow.
 (1954) *Neithea gryphaeata* R. HAGG, p. 41.
 (von Schlotheim)
 (1956) *Pecten (Neithea) quadri-* P. SENESSE, p. 166.
costata Sow.
 (1960) *Janira quadricostata* M. SERONIE-VIVIEN, p.
 d'Orb. 101.
 ?1961 *Neithea (Neitheops) quin-* C. ROSSI-RONCHETTI et
quecostata (Sowerby) C. ALBANESI, pp. 271,
 272, pl. 20, fig. 6.
 (1961) *Janira quadricostata* M. SERONIE-VIVIEN, p.
 d'Orb. 105.
 1962 *Neithea quadricostata* I. PREDA, p. 71.
 Sow.
 ?1962 *Nithea (sic) quadricos-* V. TEMKOVA, p. 110.
tata (sic) (Sowerby)
 (1964)^a *Pecten (Neithea) gry-* H. ARNOLD, pp. 95, 98,
phaeatus Schloth. *qua-* 100, 102, 104.
dricostatus
 (1964)^a *Pecten (Neithea) gry-* H. ARNOLD, pp. 97, 98.
phaeatus Schloth.

- (1964)a *Pecten* (*Neithea*) *gryphaeatus* Schloth. sub-*aequicostatus* G. Müll. H. ARNOLD, p. 100.
 (1964)a *Pecten* (*Neithea*) *quadricostatus* Sow. H. ARNOLD, p. 101.
 (1964)b *Neithea quadricostata* Sow. H. ARNOLD, p. 207.
 (1964)c *Neithea gryphaeata* (Schloth.) H. ARNOLD, p. 317.
 (1964)c *Neithea quadricostata* Sow. H. ARNOLD, p. 317.

Location and designation of type specimens. — Original designation by SCHLOTHEIM: FAUJAS DE SAINT FOND, plate XXIII, figure 2: the holotype is the original to FAUJAS' figure. In principle FAUJAS' original material is in the Muséum national d'Histoire naturelle in Paris, but since no original FAUJAS labels are extant, the holotype has to be considered as lost. However the figure in FAUJAS leaves no doubt as to the nature of the species and, it is so common in Maastricht, that there is no need to chose a lectotype for *Neithea regularis* (SCHLOTHEIM).

Pectinites gryphaeatus VON SCHLOTHEIM: In principle the type of this species is in the Museum of the VON HUMBOLDT University in Berlin; however the sole specimen of this species that I could find in the SCHLOTHEIM-collection is labelled 23.7.Q.K.965 and mentions *Pectinites regularis* from Aachen. Thus it must be admitted that the holotype of *P. gryphaeatus* is lost.

Janira geinitzii D'ORBIGNY, 1850: Muséum national d'Histoire naturelle in Paris, collection D'ORBIGNY 6903 [not 6903 A which belongs to *Neithea striatocostata* (GOLDFUSS)].

Janira faujasi PICTET et CAMPICHE is by definition synonym with *N. regularis*, as the type is the very same one which SCHLOTHEIM designated for *N. regularis*.

Vola propinqua: HOLZAPFEL collection was kept in the Geologische Landesanstalt in Berlin and this was largely destroyed during the second world war.

Pecten (*Neithea*) *sanfilippoi* MAXIA: Coll. SANFILIPPO, Istituto geologico della Università di Roma.

Locus typicus. — Petersberg (Maastricht, Holland).

Neithea gryphaeata: Aachen (G.F.R.).

Neithea geinitzii: Kreslingswalde (l.c. for Kieslingswalde, Silesia, Poland).

Neithea propinqua: Vaals (Holland).

Neithea sanfilippoi: Sofeggin, Tripolitania (Lybia).

Stratum typicum. — The type-locality is the Montagne-Saint-Pierre; the stratum-typicum is thus Maastrichtian by definition.

Pectinites gryphaeatus: neuer Sandstein der Gegend von Aachen: Campanian.

Janira geinitzii: Turonien [in fact the stratigraphic age of Kieslingswalde is Lower Senonian (Emscher)].

Vola propinqua: Grünsand (Campanian).

Pecten (*Neithea*) *sanfilippoi*: Maastrichtiano.

Original description:

Pectinites regularis FAUJ. Petersberg, T. 23, fig. 2. SCHLOTHEIM 1813.

SCHLOTHEIM 1820.

Grösstentheils untere Hälften auf der Gebirgsart des Petersberges aufliegend, und sehr vollständig erhalten, mit versteinerten Schaale, und auf neuem Sandstein mit gleichfalls sehr gut erhaltener versteinerten Schaale von Aachen. Die untern Hälften haben viel Aehnlichkeit von jungen Exemplaren der *Ostrea maxima* und *sulcata* LINN.

Conf. FAUJ. ST. FOND. Petersberg, T. 23, f. 2.

An beyden Orten kommen sie ziemlich häufig vor, aber sonderbar ist es, dass man fast immer nur die untern, und höchst selten auch die oberen Hälften findet.

Pectinites gryphaeatus VON SCHLOTHEIM.

Aus dem neuern Sandstein der Gegend von Aachen, vollständig mit grössentheils erhaltener und versteinerten Schaale, und den Muschelohren.

Dieser merkwürdiger Pectinit, der von den bekannten Originalen der gegenwärtigen Schöpfung gänzlich abweicht, ist bisher fast durchgängig zu den Chamiten gerechnet worden, weil man ihn wahrscheinlich nur sehr selten mit erhaltener Schaale, und mit seinen Ohren auffindet. Er ist ausserordentlich hoch gewölbt, und mit einen nach Art der Gryphiten sehr stark umgebogenem Schnabel versehen, der sehr spitzig zuläuft. Die Ohren sind nicht sehr gross, und gleichförmig zu beyden Seiten, der vordere Rand unterwärts gebogen. Die Längenrippen ziemlich schmal, abgerundet und so geordnet, dass immer drey etwas schmälere, zwischen einer breitem Rippe befindlich sind. Ausserdem ist die Schaale mit ausserordentlich feinen, kaum merkbaren Querstreifen versehen.

Janira Geinitzii D'ORBIGNY: *Pecten quadricostatus*, GEINITZ (non SOWERBY).

Cette espèce diffère du *Quadricostatus* par ses trois côtes inégales, au lieu d'être égales. Silésie, Kreslingswalde (sic); France, Martignes.

Janira Faujasi PICTET et CAMPICHE.

(*J. quadricostata*, D'ORBIGNY, Pal. fr. non Sow.), espèce bien distincte de la *quadricostata* par ses sept ou huit côtes qui occupent les régions externes, comme chez la *quinquecostata*. La valve supérieure a été très bien figurée par FAUJAS DE ST-FOND, pl. XXIII, fig. 2, et par GOLDFUSS, pl. 92, fig. 7. Elle est très répandue en France et en Allemagne, depuis la craie de Villedieu jusqu'à la craie de Maastricht (Départements de la Charente, de la Charente-Inférieure, d'Indre-et-Loire, de l'Isère, de l'Yonne, de la Savoie, etc.). Craie de Silésie, de Bohème, de Hanovre, de Westphalie, de Saxe, d'Aix-la-Chappelle, etc.

Additional description:

Number of specimens: only those specimens are mentioned which are from localities where they are numerous enough to make measurement worthwhile:

OF THE SUBFAMILY NEITHEINAE, ETC.

- from the Sint Pietersberg (Maastricht): convex valves; 70; flattened valves: 323.
- Harz-area (G.F.R.): Gross Büten 12 specimens; Hoheneggelsen: 20.

— ribs: completely smooth and clearly differentiated from the intercostal intervals; the relative width of the intervals and the ribs do not seem to have a stable relation: they can be narrower, equally broad or wider than the ribs.

Measurements.	U.P.D.	W	AA	Ribs	Areal riblets
St. Piet. conv. v.	14.7-73.5	10.5-69.5	65°- 88°	19-24	L: 1-8, R: 1-6
St. Piet. flat v.	12.2-71.0	12.8-69.7	102°-122°	19-23	L: 4-8, R: 3-7
Gr. Bü.	42.0-58.0	40.5-47.5	—	—	—
Hohenegg.	24.0-47.0	22.0-50.0	—	—	—

Distribution of principal and intercalary ribs on Sint Pietersberg specimens:

- convex valves: 19(1), 20(3), 21 (42), 22(5), 23(1), 24(1).
- flattened valves: 19(22), 20(223), 21(38), 22(2), 23(1).

Distribution of areal riblets on convex valves:

- L area: 1(3), 2(3), 3(1), 4(9), 5(23), 6(12), 8(1).
- R area: 1(1), 2(7), 3(16), 4(14), 5(10), 6(2).

Description.

Diagnosis. — Medium-sized to large *Neitheia*-species with 6 principal ribs and, between 2 of those, 3 equal intercalary ribs; all ribs can be equally developed. The inwardly bent areas and the subequal auricles are covered with numerous radial filae. The left valve is always flattened.

Right valve: very convex but the beak is never bent beyond the pallial plane (connects the pallial margin of the convex valve with the umbo of the left valve), the umbo is rather broad and thus the whole valve has a plump appearance.

— rib arrangement: 6 principal ribs, between each two of those 3 intercalary ribs; the latter are equal but the former can be much more developed than the latter, or have the same development, in which case all the ribs appear equal. This equality between all ribs is found more often on large valves than on small ones, and is more frequent in Maastrichtian than in older strata.

— areas: bent inwardly and covered with areal-riblets (filae) which may vary in number, but which are always present. They are no more than minute filae, radiating from the umbo, projecting just above the shell-surface.

— auricles: subequal on both valves and triangular, right to acute-angled. The hinge-line is straight. The auricles are covered with filae, similar to the areal-riblets; their number is variable but they are relatively fewer on the lower part (as compared to the upper part) of the auricles. Areas and auricles are not sharply delimited from each other. On the right auricle there is a slight byssal (?) sinus. The beak projects above the hinge-line.

Left valve: flattened, and never concave.

— rib arrangement: because the ribs of both valves fit into each other at the pallial margin, the ribs of the right valve correspond to the intercostal intervals on the left valve. The difference between principal and intercalary ribs can hardly be noticed on these valves and on the majority of the specimens from Maastricht it is impossible to see it at all.

— pallial margin: if the ribs are equal it is rounded, but if there is a slight difference between principal and intercalary ribs, it is hexagonal.

— areas: much narrower than on the convex valves and covered with areal-riblets.

— auricles: subequal; the left auricle shows the same sinus as on the right auricle of the convex valve. As on the right valve the auricles are covered with numerous, irregularly distributed filae.

The valve is rather broad: the width is nearly always greater than the U.P.D.; the apical angle is very wide.

Discussion:

Variability. — Although the number of ribs varies only slightly, there still is a great variability among them, but it originates in their differential development; if the principal ribs are more strongly developed than the intercalaries, the shell will have a hexagonal shape, whereas, if all the ribs have an equal or almost equal development, the shell has a rounded shape. The rib shape thus decides of the left valve-shape and its pallial margin at all times; indeed strongly differentiated ribs on the convex valve result in a hexagonal margin for the left valve, on which it will be possible to differentiate between narrower and broader grooves, corresponding to the ribs of the right valve. A right valve with equal or subequal ribs will correspond to a left valve with equal grooves and with a well rounded pallial margin. The other shell-characteristics are not noticeably variable.

It is not possible to prove whether the equality of ribs is achieved through an evolutionary progress; Maastrichtian specimens from Maastricht mostly bear equal ribs; this could be a localized phenomenon if one considers that Maastrichtian and Upper Senonian specimens from the Charente do not show this equa-

lity, but Lower Senonian specimens from the Harz have it very strongly (these last specimens were described by G. MUELLER as var. *subaequicostata* i.e. as-good-as-equal-ribs). In other localities equally ribbed specimens have been found and this explains why J. MUELLER mentions a *N. aequicostata* from Vaals and A. HENNIG from the Swedish Campanian.

Synonymy. — GOLDFUSS and D'ORBIGNY are at the origin of a confusion about the content of the species *Pecten quadricostatus* SOWERBY [= *Neithea gibbosa* (PULTENEY)]. This species is characterized by almost the same rib arrangement as *N. regularis*, but it has unequal auricles and completely smooth, outwardly bent areas. Stratigraphically the species are separated because *N. gibbosa* died out in Middle Cenomanian times, and *N. regularis* is not found before the uppermost Cenomanian.

GOLDFUSS did not distinguish between the species; D'ORBIGNY described a *J. quadricostata* which is undoubtedly a *N. regularis*. In his mind some confusion must have remained; in his collection he identified a specimen from Salazac (Gard) which is evidently a *N. gibbosa* as a *J. quadricostata*.

Most authors did not notice that there is a disparity between the Upper Cretaceous species *J. quadricostata* D'ORBIGNY and the Middle Cretaceous species *Pecten quadricostatus* SOWERBY. Because of this all synonymy lists have to be very carefully verified.

That such a mistake occurred is understandable because, on some specimens of *N. regularis* the distinctive characteristics are not so easily recognized: *J. geinitzi* D'ORBIGNY has an uncommonly large auricle, and thus doubt may arise. As far as the areas are concerned it is still clearly a *N. regularis*, with unusually large auricles due to its youth.

PICTET et CAMPICHE understood that the erroneous interpretations were originated in D'ORBIGNY's mistake, and to solve the problem, and, evidently unaware of SCHLOTHEIM's work, they established a new species, with the figure from FAUJAS as holotype. The species *Janira faujasi* PICTET et CAMPICHE is thus an objective, subsequent synonym of *N. regularis*.

In connection with this, F. STOLICZKA lost his normally remarkable sagacity: as he states correctly, it happens that intercostal intervals of *N. regularis* bear 4 intercalaries instead of the customary 3; this however does not make such a specimen a transitional form between *N. regularis* and *N. quinquecostata* (SOWERBY). If such a transition did ever exist then, at some moment in time, a series of specimens should have existed amongst which the transitional specimens would be very numerous and the individuals with 3 and 4 intercalaries very rare. Such a situation is unknown and individuals with a mixed number of intercalaries occur rarely in most localities: their

extreme rarity is shown by the number of intercalaries mentioned above for Maastricht-specimens.

Neithea propinqua (HOLZAPFEL) is a slightly aberrant form; the specimens have relatively large auricles and are smaller [cf. *N. geinitzii* (D'ORBIGNY)]. It is likely they are young individuals; indeed in the I.R.Sc.N.B. there is a complete series of *N. regularis* from Aachen; the smaller specimens tally with HOLZAPFEL's description and figure of *N. propinqua*. It is thus obvious that HOLZAPFEL described ordinary *N. regularis*, but very small specimens.

J. BOEHM's, 1922 nomenclatorial interpretation is incorrect: he chose the name *gryphaeata* whereas *regularis* has date priority.

Apparently, according to the description and figures, there are no reasons for considering *N. sanfilippoi* (MAXIA) different from *N. regularis*.

Differentiation. — *N. gibbosa* (PULTENEY) is differentiated from *N. regularis* by its unequal auricles, outwardly bent areas; both auricles and areas are smooth.

N. coquandi (PERON) is differentiated by its concave left valve, by its almost smooth areas, by a more narrow very incurved beak.

N. alpina (D'ORBIGNY) differs by the number of ribs: 2 intercalaries in each interval instead of 3.

N. quinquecostata (SOWERBY) has 4 intercalaries, a narrower umbo, and is frequently covered by numerous concentric growth lines, its areas and auricles are completely covered with filae.

N. sexcostata (WOODWARD) and *N. striatocostata* (GOLDFUSS) have less clearly delimited, but more numerous intercalaries.

Generic attribution. — The similarity of some specimens of *Pectinites regularis* SCHLOTHEIM, 1813 with the type-species of *Neithea* s.s. is such that no doubt can exist as to its attribution to this genus. The correct name thus becomes *Neithea* (*Neithea*) *regularis* (SCHLOTHEIM, 1813).

Stratigraphical and geographical distribution:

Cenomanian:

BELGIUM:

Montignies-sur-Roc (I.R.Sc.N.B., R.U.G.).
Tournai (I.R.Sc.N.B., Musé., Mus. Gen.).

G.D.R.:

Elbsandsteingebirge (DR., Mus. Laus.).

Turonian:

CZECHOSLOVAKIA:

Kreibitz (B., DR.).

FRANCE:

Charente-Dordogne:
Cognac (Charente) (B., B.M.).

OF THE SUBFAMILY NEITHEINAE, ETC.

- Ribérac (Dordogne) (B.).
 Royan (Charente-Maritime) (B.).
- S.E. France :
 South shore of étang de Caraité, Martigues (Bouches-du-Rhône) (B.M.).
- G.D.R. : Saxony :
 Hirschmühle, Schöna an der Elbe (DR.).
 Israel's Steinbruch, Mehlen (DR.).
 Königstein (DR., N.M.W.).
 Nikolsdorf (DR.).
 Polenzthal: Hohnstein, Mühlbergstrasse and Wartenburgstrasse (DR., Belegstücke for PRESCHER).
 Posta (DR.).
 Postelwitz (DR., also orig. GEINITZ, Elbthal II, pl. 10, fig. 15).
 Prietzschgrund, Schandau (DR.).
 Prossen, Schandau (DR.).
- GREAT BRITAIN :
 Northern Ireland : County Antrim (B.M.).
- Senonian :
- ASSAM :
 Garo Hills (photographs in B.M.).
- BULGARIA :
 Beloslav, Varna district (Univ. Sofia).
 Kipra, Varna district (Univ. Sofia).
 Novosel, Shumen district (Univ. Sofia).
 Pozevo, Shumen district (Univ. Sofia).
 Shumen (Univ. Sofia).
 Sredkia, Kolarovgrad district (Univ. Sofia).
 Srednia, Shumen district (Univ. Sofia).
- FRANCE :
 Normandy :
 Fécamp (Seine-Maritime) (Musé., Coll. d'ORBIGNY, 7617 M).
 Néhou (Manche) (B., Musé. Coll. d'ORBIGNY, 7617 Q et 7618 Q).
 Valognes (Manche) (B., Mus. Gen., N.M.W.).
- Seine-Loire :
 Couture (Loir-et-Cher) (Musé.).
 Meudon (Seine-et-Oise) (Mus. Gen.).
 Saint-Gervais, Blois (Loir-et-Cher) (Musé. Coll. d'ORBIGNY, 7617 K).
 Saint-Paterne (Indre-et-Loire) (Musé., Coll. DE VIBRAYE, orig. J. ROGER, 37).
 Tours (Indre-et-Loire) (B.M., Mus. Gen., Mus. Laus., Musé. Coll. d'ORBIGNY, 7617, orig. J. ROGER, 37, fig. 3, 4 a-c).
 Vendôme (Loir-et-Cher) (Musé. Coll. d'ORBIGNY, 7617 I).
 Villavard (Loir-et-Cher) (Musé. Coll. d'ORBIGNY, 7617 F).
 Villedieu (Loir-et-Cher) (B., B.M., Ec. Min., Mus. Gen., Mus. Laus., Univ. Neuch., Musé. Coll. d'ORBIGNY, 7617 F).
- S.E. France :
 Les Jeannots, Dieulefit (Drôme) (Mus. Gen.).
 Sougraigne (Aude) (B., Halle).
- S.W. France :
 Bergerac (Dordogne) (Mus. Laus., N.M.W.).
 Cognac (Charente) (Musé. Coll. d'ORBIGNY, 7617 B).
 Croix-des-Cigales, Bordeaux (Gironde) (B.).
 Meschers (Charente-Maritime) (Ec. Min.).
 Mirambeau (Charente-Maritime) (Mus. Coll. d'ORBIGNY, 7617 E, orig. J. ROGER, 37).
 Mouthiers (Charente) (Musé. Coll. d'ORBIGNY, 7617 G).
 Ribérac (Dordogne) (B., Ec. Min.).
- Royan (Charente-Maritime) (Ec. Min., Mus. Gen., Mus. Laus., Musé. Coll. d'ORBIGNY, 7617 D, orig. J. ROGER, 37).
 Saintes (Charente-Maritime) (Musé. Coll. d'ORBIGNY, 7617 A).
 Saint-Aulais, Barbézieux (Charente) (B.M.).
 Saint-Florent-Lavernelle (N.M.W.).
 Talmont (Charente-Maritime) (B., GH., Mus. Laus.).
 Touvent (Charente-Maritime) (B.M.).
- G.D.R. :
 Blankenberg, Blankenbergschichten (Halle).
 Halberstadt (GR.).
 Quedlinburg, Salzbergmergel (B., B.M., DR., GR., Halle).
- G.F.R. :
 Bavaria :
 Martersberg, Passau (DR.).
- Hannover-Harz :
 Adenstedt (B., GH.).
 Gehrden (B., GH., Halle, N.M.W.).
 Gross Bünten (GH.).
 Hoheneggelsen (GH.).
 Ilsede (GH.).
 Lüneburg (B.M.).
- Westphalia :
 Coesfeld (B.).
 Haltern (B., DR., Halle, N.M.W.).
- INDIA :
 Trichinopoly, Ariyalur Group, N.W. of Ariyalur Village (B.M.).
- POLAND : Silesia :
 Kieslingswalde (B., DR., GEINITZ, orig. 1843, pl. 3, figs. 14, 15, Musé. orig. d'ORBIGNY, 1850: *Janira geinitzi*, 6903).
 Waltersdorf, Lähn (B.).
 Warthau (B.).
- SPAIN :
 Maësta, Estella, S. San Sebastian (B.).
- U.S.S.R. : Ukraine :
 Lwow (B.).
- Senonian (Campanian) :
- BELGIUM :
 Boirs (DR., I.R.Sc.N.B.).
- G.F.R. :
 Aachen (B. also orig. SCHLOTHEIM for *Pectinites regularis* 23.7.Q.K.965, I.R.Sc.N.B.).
 Lusberg, Aachen (B., DR., Halle, Mus. Gen.).
- HOLLAND :
 Cottessen (Ma.).
 Kunrade (Ma.).
 Tertstraeten (Ma.).
 Vaals (B.M., I.R.Sc.N.B.).
 Valkenburg (B., DR., also orig. GEINITZ, Elbthal II, pl. 10, fig. 16, Ma., R.U.G.).
- SWEDEN :
 Rödmölla, Tösterup (B.).
- Maastrichtian :
- BELGIUM :
 Ciplly (Ec. Min., I.R.Sc.N.B.).
 Folx-les-Caves (B.M., I.R.Sc.N.B.).
 Kanne (I.R.Sc.N.B., Ma.).
- BULGARIA :
 Komarevo (Univ. Sofia, I.R.Sc.N.B.).
 Pleven (B.M., I.R.Sc.N.B., Univ. Sofia).
 Rialovo, Pleven district (Univ. Sofia).
 Shumen (Univ. Sofia).
 Tchernevo, Varna district (Univ. Sofia).

- FRANCE : Craie à Baculites :
 Fresville (Manche) (B.M.).
 Orglandes (Manche) (B.M., Ec. Min.).
- G.D.R. :
 Rügen (B.M., GR.).
- HOLLAND :
 Bemelen (Ma.).
 Geulhem (Ma.).
 Sint-Pietersberg (B. Coll. BINKHORST, B.M., DR.,
 G.H., I.R.Sc.N.B., K.U.L., Ma., Mus. Gen., Mus.
 Laus., Musé. Coll. d'ORBIGNY, 7617, J. ROGER,
 37, fig. 5, R.U.G., Univ. Neuch.).
- Upper Cretaceous :
- INDIA :
 Pondicherry (B.M. described by E. FORBES, 1845 as
Pecten quinquecostatus).
 Verdachellum (B.M.).
- LEBANON :
 Schweifat, Mount Lebanon (B.M.).
- S.A.R. : Zululand :
 Manuan Creek (B.M. also orig. R. B. NEWTON,
 1909, pl. 2, figs. 18-21, L 22045).
 Umsinene Zone Baken 624, Umsinene River (B.).
- SYRIA :
 Fjzum im Karmel (B., NOETLING leg.).
5. — *Neithea (Neithea) coquandi* (PERON, 1877).
 (Pl. 3, figs. 1, a-c.)
- .1862 *Janira tricostata* H. Coq. H. COQUAND, pp. 219,
 220, pl. 13, figs. 3, 4.
- v.1866 *Janira quadricostata* K. A. ZITTEL, pp. 115,
 Sow. sp. 116, pl. 18, figs. 4 b-h,
 non fig. 4 a [= *N. alpina* (d'ORBIGNY)].
- v.1869 *Neithia* (sic) *tricostata* P. M. DUNCAN, p. 46.
 Bayle sp.
- .1877 *Janira coquandi* Peron A. PÉRON, pp. 501-509,
 pl. 7, figs. 2, 2 a.
- ?1888 *Janira Welwitschi* P. CHOFFAT, pp. 90, 91,
 Choffat pl. 5, fig. 11.
- 1890 *Pecten Coquandi* Peron A. PÉRON, pp. 224-226.
 (sub *Janira*)
- 1890 *Pecten Coquandi* Peron A. PÉRON, pp. 226, 227.
 var. *atrophica*
- 1890 *Vola quadricostata* Sow. M. BLANCKENHORN, p.
 sp. non! Goldf., Bronn, 77.
 Orbigny, Zittel, Gei-
 nitz, Schlüter, Cred-
 ner, etc.
- ?1892 *Neithea quadricostatus* K. FUTTERER, p. 80,
 (Sowerby) pl. 3, fig. 6.
- ?1897 *Vola quadricostata* Sow. U. SOEHLE, p. 39.
 sp.
- 1897 *Vola cenomanensis* sp. n. U. SOEHLE, p. 39, pl. 4,
 figs. 6, 6 a-c.
- 1901 *Vola quadricostata* Sow. H. IMKELLER, p. 31, pl. 1,
 sp. figs. 8, 9.
- 1903 *Vola quadricostata* Sow. E. DACQUÉ, p. 361.
 sp.
- (1903) *Janira Coquandi* Peron L. PERVINQUIÈRE, pp. 66,
 67, 69, 76, 77, 79, 81.
- (1904) *Neithea tricostata* H. DOUVILLÉ, p. 224.
- .1912 *Pecten (Neithea) Shawi* L. PERVINQUIÈRE, pp.
 Pervinquièrè 136-138, pl. 9, figs.
 1, a, b, 2, 3, a, b, 4-6.
- (1915) *Neithea Shawi* C. F. PARONA, pp. 21, 22.
- v?1916 *Neithea angoliensis* R. B. NEWTON, p. 566,
 nov. sp. pl. 1, fig. 4.
- v.1916 *Neithea tricostata* R. B. NEWTON, p. 567,
 Coquand pl. 1, fig. 5-7.
- 1922 *Pecten (Neithea) quinque-* J. COTTREAU, p. 34, pl. 1,
costatus Sow. figs. 9, 9a.
- non 1814 *Pecten quinquecostatus* Sowerby
- 1924 *Vola cenomanensis* Söhle M. SCHLOSSER p. 84.
- (1924) *Neithea quadricostata* M. SCHLOSSER, p. 86.
 Sow.
- non 1814 *Pecten quadricostatus* Sowerby
- v?1927 *Neithea propinqua* (Hzfl.) J. BOEHM, pp. 202, 203
- non 1889 *Neithea propinqua* (Holzapfel)
 = *N. regularis* (Schlotheim, 1813)
- (1928) *Pecten (Neithea) Shawi* L. PICARD, p. 80.
 Perv.
- .1929 *Neithea tricostata* J. V. L. RENNIE, pp. 17-
 (Coquand) 19, pl. 1, figs. 10-12.
- 1932 *Pecten (Neithea) quinque-* E. BASSE, p. 22.
costatus Sow.
- non 1814 *Pecten quinquecostatus* Sowerby
- .1934 *Pecten (Vola) Shawi* M. BLANCKENHORN, p.
 Perv. 191, pl. 9, figs. 24,
 a, b, pl. 10, fig. 75.
- (1935) *Neithea Shawi* Perv. M. MARCHETTI, pp. 26,
 28.
- v?1937 *Neithea regularis* L. LEHNER, pp. 101, 102,
 Schlotheim pl. 26, fig. 1.
- 1942 *Pecten (Neithea) shawi* F. HEYBROEK, p. 454.
 Pervinquièrè
- (1955) *Pecten* aff. *shawi* (sic) I. A. M. FARAG, p. 156.
 Per.
- ?1957 *Neithea shawi* Pervin- E. DARTEVELLE et S.
 quièrè FRENEIX, pp. 74, 75,
 pl. 9, figs. 8-11.
- v.1957 *Neithea tricostata* R. A. REYMENT, p. 50,
 (Coquand) pl. 7, figs. 15, a, b.
- ?1958 *Neithea* cf. *shawi* A. FERREIRA-SOARES, p.
 Pervinquièrè 14.
- ?1959 *Neithea* cf. *shawi* A. F. SOARES, pp. 141,
 Pervinquièrè 142.
- (1963) *Neithea shawi* A. FERREIRA-SOARES, p.
 (Pervinquièrè) 8.

Location and designation of type-specimens. — In the COQUAND collection; location unknown.

Janira welwitschi CHOFFAT: Geological Service of Angola, in Lisbon, Portugal.

Vola cenomanensis SOEHLE: lost during world war II; before that the collections of the former Bavarian Geological Survey were kept in the Bayerische Staatssammlung für Paläontologie und Historische Geologie in Munich.

Pecten (Neithea) shawi PERVINQUIÈRE: the PERVINQUIÈRE Collection is in the Sorbonne in Paris.

Neithea angoliensis NEWTON: British Museum (Nat. Hist.) London L 25853.

Locus typicus. — Tenoukla (Algeria).

Neithea welwitschi: Dombé Grande (Angola) (O.D.).

OF THE SUBFAMILY NEITHEINAE, ETC.

Neithea cenomanensis: Lichtenstättgraben (Bavaria, G.F.R.) (O.D.).

Neithea shawi: Bireno (Tunisia).

Neithea angoliensis: 20-80 metres above the Catumbela Dam (Angola) (O.D.).

Stratum typicum. — Assises rhotomagiennes (Cenomanian).

Neithea welwitschi: ? cénomanien.

Neithea cenomanensis: Cenoman.

Neithea shawi: Cénomanien à faciès néritique.

Neithea angoliensis: creamy coloured limestone with ironstone nodules (Albian-Cenomanian?).

Original description:

Long.: 67 mm; larg.: 60 mm.

Coquille très convexe, trigone considérée dans son ensemble, polygonale à sa base, un peu plus large que haute; valve inférieure fortement bombée et recourbée à son sommet, pourvue de six côtes élevées, arrondies, saillantes, celle du milieu un peu plus large et un peu plus élevée que les deux autres.

Cette espèce rappelle au premier coup d'œil la *J. quadricostata* d'Orb.; mais elle s'en distingue nettement par sa forme plus élancée et surtout par l'inégalité des trois côtes intermédiaires. Elle a été recueillie par moi à Ténoukka, à Batna, à Kenchela et dans l'Auress, dans les assises rhotomagiennes.

M. Julien vient de la découvrir aussi au vallon de San Peiré, commune de Salazac, près de Pont-Saint-Esprit (Gard) associée au *Pecten asper* et *Scaphites aequalis*.

Le *Pecten tricostatus* Bayle, Rich. min. de l'Algérie, pl. 18, fig. 30, est santonien et n'est autre chose que la *J. quadricostata* de d'Orbigny.

Janira Welwitschi CHOFFAT, 1888.

Quoique cette espèce ne me soit connue que par une valve inférieure, je n'hésite pas à l'établir, car elle est complètement différente de toutes les espèces venues à ma connaissance. Cette valve présente extérieurement une convexité assez fortement accentuée, et est couverte par environ 21 larges côtes, arrondies, séparées par un sillon étroit et profond. Onze de ces côtes sont alternativement plus élevées que les six autres. Les méplats entre les deux côtes externes et les oreillettes sont en outre couverts par 2 à 3 côtes faibles.

Pecten Texanus RÖMER (Texas, p. 65, pl. 8, fig. 3) ressemble un peu à notre espèce par la largeur de ses côtes, mais elles sont aplaties au lieu d'être arrondies et l'intervalle entre deux côtes fortes est couvert par deux côtes plus faibles, au lieu de ne l'être que par une seule, comme c'est le cas dans notre espèce. Le grand exemplaire de *Janira aequicostata* figuré par M. Bayle dans ses « Fossiles principaux » pl. 122, a quelque ressemblance éloignée avec notre espèce: il en diffère en ce que ses côtes sont toutes de force égale.

Gisement. — Dombe Grande. Niveau inconnu, probablement cenomanien.

Additional description:

Number of studied specimens: 110.

Algeria ..	...	Cenomanian-Upper Senonian ...	...	33
Angola ..	...	? Albian-Cenomanian ...	...	8
Austria .	...	Turonian-Senonian ...	...	21
Egypt ...	...	Cenomanian-Senonian ...	...	5

France ..	...	Cenomanian-Senonian ...	...	6
Iraq ...	...	? Albian-Cenomanian ...	...	7
Israel ...	...	Cenomanian .	...	18
Lebanon ...	...	? Cenomanian ...	...	6
Nigeria .	...	? Cenomanian ...	...	3
Somalia ...	...	Senonian ...	...	1
Turkey .	...	Senonian ...	...	1
Yugoslavia ...	...	Maastrichtian ...	...	1

Measurements.

Cenomanian from Tenoukka (Algeria): double specimens:

H	W	Ribs	AA	Side
—	—	—	—	—
—	44.2	21	—	R
42.5	43.2	21	97°	L
—	37.1	21	—	R
34.6	37.1	21	102°	L

Cenomanian from Djebel Auress (Algeria):

H	W	Ribs	AA	Side
—	—	—	—	—
41.5	37.9	21	87°	L

Cenomanian from Tebessa (Algeria):

H	W	Ribs	AA	Side
—	—	—	—	—
38.8	37.3	21	97°	L

Description.

Diagnosis. — Medium-sized to large *Neithea*-species, with very convex right valves and flattened to concave left valves. Six prominent principal ribs, between each two of those 3 unequal intercalary ribs. Areas inwardly bent. Auricles and areas smooth.

Right valve: beak is strongly incurved and narrow, thus giving the whole shell a slender appearance; U.P.D. > W.

Left valve: flattened to concave; U.P.D. ≤ W.

Rib arrangement: 6 prominent principal ribs; in principle 3 intercalaries between each 2 principal ribs; the intercalaries are unequally developed and frequently not much more developed than filae. Nearly always the middle intercalary (the furthest away from the principal ribs) is more strongly developed than the side-intercalaries (those lying close to the principal ribs). Generally the ribs have a smooth appearance.

Areas: strongly inwardly bent on the right valve; no ornamentation is present; sometimes however some folds, only vaguely delimited, can have the appearance of riblets. On some areas one of these folds is present, and very rarely there can be three. But even in the latter case the major part of the area is perfectly smooth.

Auricles: very small, equal and smooth.

Discussion :

Variability. — The proportions do not vary much; the most striking variable characteristic is in the relative rib development; intercalary ribs can :

- be equal between much more developed principal ribs;
- be unequal and have the middle intercalary more strongly developed than the side-intercalaries;
- same situation as above but the middle-intercalaries are as strongly developed as the principal ribs : the shell looks as if there were 11 principal ribs with one intercalary in each interval;
- one intercalary rib between each pair of principal ribs did not develop, or hardly (var. *atropa* PÉRON);
- both side-intercalaries between each pair of principal ribs did not develop much (var. *biatropa* PERVINQUIÈRE);
- var. *biatropa* with very strongly developed middle intercalaries with the aspects of principal ribs : shell with 11 equal ribs : can be compared with *N. angoliensis* NEWTON and *N. decemcostata* (D'ORBIGNY);
- all ribs — principals as well as intercalaries — reach the same development : confusion with *N. hispanica* can arise, as far as the rib-arrangement is concerned.

Synonymy. — The nomenclatorial confusion started from the very beginning of this species' description : H. COQUAND, 1862 gave it the name *Janira tricostata* without taking *Pecten tricostatus* BAYLE, 1848, also a *Neithea*, into consideration : thus COQUAND's name is a secondary homonym.

PÉRON corrected the nomenclature and changed it into *Janira coquandi* (PÉRON, 1877).

PERVINQUIÈRE interpreted the nomenclature of this species wrongly on two points :

- the description by SHAW has no taxonomical value since SHAW is a pre-Linnean author; and, anyway, the description is such that it is impossible to know by it, which species SHAW meant to describe;
- the argument according to which *N. coquandi* cannot be used because there is a previous *Pecten coquandianus* D'ORBIGNY, is void : *coquandianus* and *coquandi* are not homonymous as « specific » names.

K. A. ZITTEL evidently knew the study by COQUAND, 1862. By wrongly naming his specimens of *N. coquandi*, *Janira quadricostata*, he has been the cause of much confusion : his figures and descriptions [except fig. 4 a = *N. alpina* (D'ORBIGNY)] correspond fully with *N. coquandi* and not with *N. regularis* (SCHLOTHEIM) = *N. quadricostata* (D'ORBIGNY, non

SOWERBY). On his figured specimens it is impossible to see the « concentrischen Linien » mentioned by him and the area riblets drawn on plate 18, figure 4 d : as stated in his text the areas are smooth except for a few filae. By not noticing the difference which exists between his specimens and *N. regularis*, he has overlooked one of the most striking faunal differences between Senonian North-European and Tethyan faunas.

In *Janira welwitschi*, P. CHOFFAT described a typical example of an individual with middle intercalaries as strongly developed as the principal ribs.

Vola cenomanensis U. SOEHLE, 1897 is based on very small Bavarian Cenomanian specimens; their size makes it extremely difficult to count the ribs. In the Bayerische Staatssammlung in Munich there are several specimens from the type-locality, Lichtenstättgraben near Ettal; if it were necessary, a lectotype could be chosen amongst them. Since the specimens are extremely small, poorly developed ribs are very easily overlooked. This explains why, for some individuals, the ribnumber is indicated as being as low as 17.

Neithea angoliensis R. B. NEWTON is a very small and poorly preserved specimen; the ribs which can be seen make it probable that it is a *N. coquandi* in which the middle intercalary ribs have attained the same development as in the principal ribs.

Differentiation. — *N. (N.) coquandi* (PÉRON) differs from other *Neithea*-species with 3 intercalary ribs in the following points :

- the intercalary ribs are mostly unequal and the middle intercalary is the most strongly developed;
 - the areas are smooth, or at most, carry a few (max. 3) poorly differentiated folds, close to the first principal-rib; the areas are strongly inwardly bent;
 - the auricles are equal, very small and smooth;
 - the beak is narrow and very strongly incurved;
 - the left valve is usually not flattened but concave.
- N. coquandi* differs thus from *N. gibbosa* (PULTENEY) in having :
- small equal auricles;
 - inwardly bent areas;
 - a deeply incurved beak;
 - a much more slender shell-shape;
 - more unequal intercalary ribs (this characteristic should be used very cautiously since in *N. gibbosa* the middle intercalary ribs may be more prominent than the side intercalary ribs).

N. coquandi differs from *N. alpina* (D'ORBIGNY) in having 3 intercalary ribs; those individuals which are described by the names var. *atropa* and *biatropa* and, which have the intercalaries reduced to very thin ribs, can still be differentiated because those

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thin ribs are in the intercostal intervals and not, on the sides of the principal ribs.

From all other *Neithea*-species with 2, 4 or more intercalary ribs the differentiation is easily made on the number of intercalaries.

N. coquandi differs from *N. hispanica* (D'ORBIGNY) in having:

- irregular ribs;
- a more incurved beak.

The rib number is almost the same.

N. aequicostata (LAMARCK) cannot be confused with *N. coquandi* because the former has a much higher number of ribs.

Neithea (Neithea) amanoi I. HAYAMI, 1965 (pp. 299-301, pl. 41, figs. 8-10, pl. 42, figs. 1-4) from the Lower Miyakoan (Aptian) from Japan offers, according to the author himself, a great similarity with *N. shawi* (PERVINQUIÈRE) = *N. coquandi* (PÉRON), but: « the anterior auricle is larger and the umbo may be more salient and narrower than that of *N. shawi* ». The material is very poorly preserved as can be seen from the figures of the holotype and paratypes; without better material we will never know what *N. amanoi* stands for. The individuals figured on plate 42, figure 4 has definitely in comparison with *N. coquandi* a larger auricle and the figured left valves appear more flattened. I do not see a difference in the A.A. On the other hand, the Japanese specimens are smaller than the average of known *N. coquandi*; this might eventually explain the discrepancies in the auricle-shape and convexity. In the present circumstances one must limit oneself to noticing a great morphological similarity, which might point to a close relation.

Generic attribution. — I do not know of any specimen of *J. coquandi* which shows the typical *Neithea*-hinge teeth, but considering its similarity with *N. regularis* (SCHLOTHEIM) which does have them, it seems logical to assume that both species belong to the same genus. The correct name for *Janira coquandi* PÉRON, 1862 thus becomes *Neithea (Neithea) coquandi* (PÉRON, 1862).

Stratigraphical and geographical distribution:

Albian-Cenomanian:

ANGOLA:

- Catumbela Dam, prov. Benguella (B.M. orig. *Neithea angoliensis* R. B. NEWTON, L 25853).
- Lobito (B.M. orig. R. B. NEWTON, L 25850, L 25852, L 25865).
- Lucira, Lobito (B.M.).

Cenomanian:

ALGERIA:

- Aïn Beïra, Constantine (Musé.).
- Bardj Messaoud, Constantine (Musé.).
- Batna (B., B.M., GR., K.U.L., Mus. Gen., Mus. Laus.).

- Djebel Auress (Ec. Min., K.U.L.).
- Draa el Oust (Musé.).
- Les Tamarins, Constantine (Musé.).
- Tebessa (Ec. Min.).
- Ténoukla (B., B.M., K.U.L., N.M.W.).

EGYPT:

- Wadi Nagh Badev (B.M. orig. P. DUNCAN, 1869, LL 30994).

FRANCE:

- Saint-Paulet-des-Caissons, Pont-Saint-Esprit (Gard) (B.M.).

IRAQ:

- Kurdistan: Ser Amadia (B.M.).

ISRAEL:

- Kurnub (B.M.).

LEBANON:

- Mount Carmel (B.M.).

SYRIA:

- Slennfé (B.MM.).

Turonian:

FRANCE:

- Sougraigne (Aude) (B.).

Turonian-Lower Senonian:

AUSTRIA:

- Breitenau, Kiefersfelden (Mü.).
- Gosau (B., DR., Halle).
- Gosau, Edelbachgraben (Mü.).
- Gosau, Finstergraben (DR., Mü.).
- Gosau, Grabenbach (B., Mü.).
- Gosau, Pass - Gschütt (N.M.W. original ZITTEL 1864: 1824, pl. 18, figs. 4 b-g).
- Hellabrunn, Salzburg (Mü.).

Senonian (Santonian):

FRANCE:

- Sougraigne, S.E. of Rennes-les-Bains (Aude) (B.M., Musé. Coll. D'ORBIGNY, 7618 Q).

ALGERIA:

- Djelfa, Alger (Musé.).
- Kef Matrak (B.).
- Les Tamarins, Alger (B.).
- Necmarins (B.M.).

IRAQ:

- Bekhme Gorge (B.M.).

SOMALIA:

- S. of Ban Kufo waterhole (B.M.).

TURKEY:

- Kandili, E. of Karghali, Bithynia (B.M.).

Upper Cretaceous:

FRANCE:

- Clansayes (B.).

YUGOSLAVIA:

- Bistranska gora (Univ. Zagreb).

6. — *Neithea (Neithea) quinquecostata*

(J. SOWERBY, 1814).

(Pl. 2, figs. 2 a-c.)

- | | | |
|---------|------------------------------------|--|
| v. 1814 | <i>Pecten quinquecostata</i> | J. SOWERBY, pp. 122, 123, pl. 56, figs. 4-8. |
| . 1822 | <i>Pecten quinquecostatus</i> | A. BRONGNIART, pp. 251, 320, 332, 600, pl. 4, figs. 1 a-c. |
| 1825 | Peignes côtes inégales (pro parte) | M. DEFRANCE, pp. 254, 255. |

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.1827	<i>Pecten quinquecostatus</i> Sow.	S. NILSSON, pp. 19, 20, pl. 9, fig. 8, pl. 10, fig. 7.	1882	<i>Janira quinquecostata</i> Sow. sp.	J. KIESOW, p. 240.
.1833	<i>Pecten quinquecostatus</i> Sow.	A. GOLDFUSS, p. 55, pl. 93, figs. 1 a-c.	1882	<i>Vola quinquecostata</i> Sow.	H. SCHROEDER, p. 271.
?1837	<i>Pecten versicostatus</i> Lam.	F. DUJARDIN, p. 227.	v.1883	<i>Pecten (Neithea) atava</i> (Roemer) d'Orbigny	W. KEEPING, p. 107, pl. 4, fig. 6.
(1839)	<i>Pecten quinquecostatus</i>	A. D'ARCHIAC, pp. 269, 271, 276.	.1883	<i>Vola quinquecostata</i> (Stol.)	A. FRITSCH, p. 116, figs. 90, a, b.
1839	<i>Pecten quinquecostatus</i> Sow.	H. B. GEINITZ, p. 22.	(1889)	<i>Vola quinquecostata</i> (Sow.)	A. FRITSCH, p. 85.
(1840)	<i>Pecten quinquecostatus</i> Sow.	J. CORNUEL, p. 258.	?1889	<i>Vola cf. quinquecostata</i> Sow.	E. HOLZAPPEL, pp. 237, 238.
(1841)	<i>Pecten quinquecostatus</i> Sow.	A. LEYMERIE, p. 323.	?1890	<i>Pecten quinquecostatus</i> Sowerby	A. PÉRON, pp. 227, 228.
1841	<i>Pecten quinquecostatus</i> Sow. var.	F. A. ROEMER, p. 54.	(1893)	<i>Janira (Vola) quinque-</i> <i>costata</i> Sow.	R. MICHAEL, p. 237.
?1841	<i>Pecten quinquecostatus</i> Sow. var.	F. A. ROEMER, p. 54.	?1895	<i>Janira quinquecostata</i> Sow. sp.	E. TIESSEN, p. 471.
?1842	<i>Pecten versicostatus</i> Lam. Deshayes variété (a) <i>Pecten quinquecostatus</i> Sow.	P. MATHÉRON, p. 185.	1896	<i>Vola quinquecostata</i> Goldf.	A. RUTOT, p. 30.
(1843)	<i>Pecten Quinquecostatus</i> Sow.	A. LEYMERIE, p. 27.	(1897)	<i>Vola quinquecostata</i> Low. sp. (sic)	O. REIS, p. 7.
(1845)	<i>Pecten quinque-costatus</i> Sow.	E. FORBES, p. 249.	(1897)	<i>Neithea quinquecostata</i> Sowerby	W. B. CLARK, R. H. BAGG et G. B. SHAT- TUCK, pp. 330, 335.
?1846	<i>Pecten versicostatus</i> Lamarck (pro parte)	A. E. REUSS, pp. 31, 32.	1897	<i>Vola quinquecostata</i> Sow.	R. LEONHARD, p. 46.
v.1847	<i>Janira quinquecostata</i> d'Orbigny	A. D'ORBIGNY, pp. 632- 635, pl. 444, figs. 1-5.	(1897)	<i>Pecten (Janira) quinque-</i> <i>costatus</i>	W. F. HUME, pp. 548, 549, 551, 552, 553, 559, 564, 569.
1847	<i>Pecten quinquecostatus</i> Sow.	J. MUELLER, p. 33.	(1897)	<i>Vola quinquecostata</i> Sow.	U. SOEHLE, p. 40.
(1850)	<i>Pecten quinquecostatus</i> Sow.	H. B. GEINITZ, p. 186.	(1897)	<i>Vola (Janira) quinque-</i> <i>costata</i> Sow.	G. RADKEWITSCH, p. 100.
1850	<i>Pecten quinquecostatus</i> C.	J. DE CARLO SOWERBY in F. DIXON, p. 356, pl. 28, figs. 1-3.	.1897	<i>Vola quinquecostata</i> Sow.	A. HENNIG, p. 52.
?1853	<i>Janira quinquecostata</i> d'Orbigny	F. J. PICTET et W. ROUX, pp. 506-508, pl. 45, figs. 3 a-c.	(1898)	<i>Neithea cf. quinque-</i> <i>costata</i>	H. DOUVILLÉ, p. 386.
(1854)	<i>Janira quinquecostata</i> d'Orb.	G. COTTEAU, p. 117.	1898	<i>Vola quinquecostata</i> Sow. sp.	G. MUELLER, p. 35.
(1854)	<i>Pecten quinquecostatus</i> Sow.	J. MORRIS, p. 177.	(1899)	<i>Vola quinquecostata</i> Sow. sp.	G. BODE, p. 155.
(1857)	<i>Pecten quinquecostatus</i> Sow.	H. COQUAND, pp. 62, 70.	(1899)	<i>Janira quinque-costata</i> Sby.	A. W. ROWE, p. 364.
1863	<i>Janira quinquecostata</i> Sow. sp.	D. STUR, p. 56.	(1900)	<i>Janira quinquecostata</i> Sby.	G. E. DIBLEY, p. 494.
(1863)	<i>Janira quinquecostata</i> Sow. sp.	H. WOLF, p. 283.	(1900)	<i>Vola quinquecostata</i>	M. BLANCKENHORN, p. 29.
1863	<i>Pecten quinquecostatus</i> Sow.	A. KUNTH, p. 725.	1901	<i>Vola quinquecostata</i> Sow. sp.	H. IMKELLER, p. 32.
(1866)	<i>Pecten quinquecostatus</i> Sow.	C. GIEBEL, p. 48.	(1901)	<i>Vola quinquecostata</i>	H. FORIR, p. M 14.
1870	<i>Janira quinquecostata</i> Sow. sp.	C. SCHLUETER, pp. 937, 951.	(1901)	<i>Janira quinquecostata</i>	J. CORNET, p. B 56.
1871	<i>Vola quinquecostata</i> Sowerby (pro parte)	F. STOLICZKA, pp. 437, 438, pl. 31, figs. 1-6, pl. 37, figs. 4-9.	(1902)	<i>Vola quinquecostata</i>	A. WOLLEMANN, p. 59.
1871	<i>Pecten quinquecostatus</i> Sow.	C. L. GRIESBACH, p. 68.	?1902	<i>Vola quinquecostata</i> J. Sowerby	P. CHOFFAT, p. 149.
.1871	<i>Janira quinquecostata</i> (Sow.) d'Orbigny	F. J. PICTET et G. CAM- PICHE, pp. 246-249.	(1903)	<i>Janira quinquecostata</i> Sow.	G. W. LAMPLUGH et J. F. WALKER, p. 263.
1877	<i>Vola quinquecostata</i> (Stol.)	A. FRITSCH, p. 137.	(1903)	<i>Neithea quinquecostata</i> Sby.	A. W. ROWE, p. 50.
(1877)	<i>Janira quinquecostata</i> d'Orb.	DE COSSIGNY, p. 323.	(1905)	<i>Pecten (Neithea) quin-</i> <i>quecostatus</i> Sow.	H. J. O. WHITE et L. TEACHER, p. 468.
v.1878	<i>Neithea quinquecostata</i> Sowerby sp.	E. BAYLE, pl. 122, figs. 2, 3.	(1905)	<i>Janira (Vola) quinque-</i> <i>costata</i> Sow. sp.	J. J. JAHN, p. 76.
			?1906	<i>Vola quinquecostata</i> Sow. sp.	A. WOLLEMANN, p. 269.
			.1906	<i>Pecten (Neithea) quin-</i> <i>quecostatus</i> , Sowerby	H. WOODS, p. 298, pl. 35, fig. 14.
			(1908)	<i>Pecten quinque-costatus</i> Sby.	A. W. ROWE, p. 339.
			(1908)	<i>Pecten (Neithea) quinque-</i> <i>costatus</i> Sow.	G. W. YOUNG, p. 454.

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- v.1910 *Neithea quinquecostata* R. B. NEWTON, pp. 58,
J. Sowerby 59, pl. 3, figs. 1, 2.
- 1911 *Vola quinquecostata* K. VOGEL VON FALCKEN-
Sow. STEIN, p. 557.
- (1911) *Neithea quinquecostata* B. BUJALSKI, p. 440.
Sow.
- 1911 *Pecten (Neithea) quin-* H. WOODS, p. 277.
quecostatus Sowerby
- (1913) *Vola quinquecostata* Sow. E. SPENGLER, p. 237.
- ?1913 *Vola (Janira) quinque-* P. N. TSCHIRWINSKY, p.
costata Sow. 42.
- 1914 *Janira (sic) quinque-* D. JIMENEZ DE CISNE-
costata Sow. ROS, p. 231.
- (1916) *Vola quinquecostata* Sow. C. WIMAN, p. 81.
- (1918) *Neithea quinquecostata* G. E. DIBLEY, p. 93.
(Sowerby)
- ?1918 *Pecten (Neithea) quinque-* J. WOLDRICH, pp. 284-
costatus Sowerby 285, pl. 4, fig. 12.
- 1920 *Neithea quinquecostata* F. ROMAN et P. MAZE-
Sowerby RAN, p. 88, pl. 9, fig.
12.
- (1923) *Pecten (Neithea) quin-* J. CORNET, p. 140.
quecostatus Sow.
- (1924) *Neithea quinquecostata* H. D. HEWITT, p. 241.
(Sowerby)
- (1924) *Neithea quinquecostata* C. T. A. GASTER, p. 110.
(J. Sow.)
- (1924) *Neithea quinquecostata* M. SCHLOSSER, p. 87.
Sow.
- v.1924 *Neithea quinquecostata* R. B. NEWTON, p. 148.
(J. Sowerby)
- (1924) *Neithea quinquecostata* J. CORNET, p. B 182.
- (1926) *Neithea quinquecostata* L. NOETH, p. 476.
Sow.
- (1928) *Neithea quinquecostata* J. MACHAČEK, p. 444,
(Sow.) 449.
- .1929 *Neithea quinquecostata* L. BARRABE, p. 165,
Sowerby pl. 9, fig. 18, 18 a.
- (1929) *Neithea quinquecostata* C. P. NICOLESKO, p. 172.
- ?1929 *Neithea quinquecostata* J. V. L. RENNIE, p. 17,
(J. Sowerby) pl. 1, fig. 13.
- .1930 *Neithea quinquecostata* J. V. L. RENNIE, pp.
(Sowerby) 179-182, pl. 18, figs.
1-5.
- (1930) *Neithea quinquecostata* H. BESAIRE, p. 616.
Sow.
- (1931) *Neithea quinquecostata* B. KOKOSZYNSKA, p. 668.
Sow.
- ?1931 *Neithea quinquecostata* L. NOETH, p. 336.
Sow.
- 1931 *Vola quinquecostata* Sow. L. RIEDEL, p. 668.
- (1931) *Vola quinquecostata* W. F. KRIJNEN, p. 181.
- v.(1931) *Vola (Janira) quinque-* V. TZANKOV, Tabl. III.
costata Sow.
- 1932 *Vola quinquecostata* D. WOLANSKY, p. 19.
Sowerby
- (1932) *Vola quinquecostata* Sow. A. JESS, p. 86.
- (1933) *Janira quinquecostata* A. BENOIT, pp. 10, 19.
- 1933 *Neithea quinquecostata* W. HAENTZSCHEL, p.
(Sow.) 132.
- (1934) *Vola quinquecostata* St. T. JELEV, p. 123.
Sow.
- 1934 *Pecten (Neithea) quin-* M. COLLIGNON, pp. 18,
quecostatus Sow. 19, pl. 3, figs. 1, 1 a.
- (1934) *Neithea cf. quinque-* A. HEIM, O. SEITZ,
costata (Sow.) S. FUSSENEGGER, p.198
- (1934) *Pecten (Neithea) quinque-* V. ZAZVORKA et J. SOU-
costatus Sow. KUP, p. 208.
- v.1937 *Neithea regularis* L. LEHNER, pp. 101,
Schlotheim (pro parte) 102, pl. 26, figs. 2, 3.
(non fig. 1).
- (1937) *Neithea quinquecostata* S. Z. ROZYCKI, p. 31.
Sow.
- 1938 *Pecten quinquecostatus* J. G. CARLSSON, p. 9.
Sowerby
- (1939) *Neithea cf. quinque-* J. HOUDARD, p. 629.
costata (Sow.)
- ?1939 *Neithea quinquecostata* E. DACQUÉ, pp. 43, 44,
Sow. pl. 1, figs. 14, 15.
- 1940 *Neithea quinquecostata* G. TAVANI, p. 50.
Sow.
- ?1940 *Pecten (Neithea) quinque-* C. MAXIA, pp. 3, 4.
costatus Sow.
- .1940 *Pecten (Neithea)* C. MAXIA, pp. 7-9, pl. 1,
Checchiai fig. 9.
- (1942) *Vola 5-costata* Sow. C. I. LISSON, pp. 84, 85,
88, 89, 90, 91, 94.
- .1943 *Neithea gryphaeata* W. J. M. VAN DER WEIJ-
(Schlotheim) DEN, pp. 89, 90, pl. 8,
var. *quinquecostata* figs. 12, 13.
(Sowerby)
- 1948 *Neithea quinquecostata* G. TAVANI, pp. 92, 93.
(Sow.)
- 1949 *Neithea quinquecostata* E. NALDINI, p. 88.
(Sow.)
- 1949 *Neithea quinquecostata* M. COLLIGNON, p. 14.
Sow.
- 1950 *Neithea quinquecostata* M. COLLIGNON, p. 31.
Sow.
- (1953) *Pecten (Neithea) quinque-* J. DVORAK, pp. 530, 531,
costatus Sow. 533.
- (1953) *Pecten (Neithea) quinque-* J. DVORAK, p. 29.
costatus Sow.
- (1954) *Neithea quinquecostata* R. HÄGG, p. 42.
(Sowerby)
- (1954) *Neithea (Janira)* R. GIVULESCU, p. 208.
quinquecostata Sow.
- (1954) *Neithea quinquecostata* A. F. DE LAPPARENT, p.
193.
- (1956) *Neithea quinquecostata* K. A. TROEGER, p. 90.
Sow.
- (1957) *Janira (Neithea)* L. CAYEUX, p. 12.
5-costata d'Orb. (sic)
- 1957 *Neithea quinquecostata* E. DARTEVELLE et S.
(Sow.) FRENEIX, p. 74.
- (1958) *Janira Quinquecostata* L. CAYEUX, p. 13.
d'Orb.
- ?1959 *Neithea quinquecostata* Y. YABE, p. 289.
(Sow.)
- (1960) *Neithea quinquecostata* M. S. ERISTAVI, p. 85.
(sic) Sow.
- (1962) *Neithea quinquecostata* R. E. H. REID, p. 75.
(J. Sowerby)
- (1963) *Neithea quinquecostata* A. F. SOARES, p. 9.
(Sowerby)
- (1964)a *Pecten (Neithea) gry-* H. ARNOLD, p. 104.
phaeatus Schloth.
quinquecostatus Sow.
- (1964)b *Neithea quinquecostata* H. ARNOLD, p. 207.
Sow.
- (1964)c *Neithea quinquecostata* H. ARNOLD, p. 317.
(Sow.)
- 1964 *Neithea quinquecostata* R. GIERS, p. 234.
(Sow.)
- ?1965 *Neithea quinquecostata* S. CIESLINSKI, p. 31,
(Sowerby) pl. 4, figs. 2, a, b.

1965	<i>Neithea (Neithea) nipponica</i> sp. nov.	I. HAYAMI, pp. 296-297, pl. 40, figs. 1-6, pl. 52, figs. 1, 2.
(1966)	<i>Neithaea (sic) quinquecostata</i> Lam. (sic)	S. L. BENKÖ, p. 73.
1968	<i>Neithea (Neithea) nipponica</i> Hayami	T. HANAI, I. OBATA, I. HAYAMI, p. 24, pl. 3, fig. 5.
non 1837	<i>Pecten Quinquecostatus</i>	A. D'ARCHIAC, p. 186.
non 1850	<i>Pecten quinquecostatus</i>	R. KNER, p. 29.
non 1871	<i>Vola quinquecostata</i> (p.p.)	F. STOLICZKA, pp. 437, 438.
non 1903	<i>Pecten quinquecostatus</i>	G. G. SHATTUCK, p. 16, pl. 5, figs. 2-4.
non 1926	<i>Pecten quinquecostatus</i>	B. WADE, p. 64, pl. 21, figs. 1-5.
non 1931	<i>Pecten (Neithea) quinquecostatus</i>	E. BASSE, p. 46.
non 1942	<i>Neithea quinquecostata</i>	G. TAVANI, pp. 8, 9, pl. 1, figs. 2, 3.
non 1961	<i>Neithea (Neitheops) quinquecostata</i>	C. ROSSI-RONCHETTI et C. ALBANESI, p. 271, pl. 20, figs. 5, 6.
= 1813	<i>Neithea regularis</i> (Schlotheim)	
non 1927	<i>Neithea quinquecostata</i> J. Sow.	C.T. TRECHMANN, p. 34, pl. 1, fig. 8.
= 1847	<i>Neithea cf. alpina</i> (d'Orbigny)	
non 1967	<i>Neithea (Neitheops) quinquecostatus</i> (Sowerby)	A. POLŠAK, p. 31, pl. 2, fig. 4, p. 158.
= ?1877	<i>Neithea coquandi</i> (Peron)	

Location and designation of type specimens. — In the SOWERBY collection, kept in the British Museum, the originals of SOWERBY's figures are present. With Dr. N. J. MORRIS a lectotype was chosen: 43324.

Pecten (Neithea) checchiae MAXIA: Coll. SANFILIPPO, Istituto Geologico del Università di Roma.

Neithea (Neithea) nipponica HAYAMI: holotype in the Department of Geology, Kyushu University, n° G. K. H. 6263.

Locus typicus. — Chute (England).

Neithea checchiae: Soffegin, Tripolitania (Lybia).

Neithea (Neithea) nipponica: Hn 6201, northeast of Raga, Tanchata village, Shimohei County, Iwate Prefecture, Japan.

Stratum typicum. — Greensand (Lower-Cenomanian).

Neithea checchiae: Maestrichtiano.

Neithea (Neithea) nipponica: Aketo formation, Albion.

Original description:

Spec. char. Subtriangular, rather oblique, front semicircular, toothed; convex valves gibbous, ribbed, principal costae six, with four lesser ones between each: surface finely transversely striated. Upper valve flat-toothed.

The obliquity of this shell is slight, the length not much greater than the width; the lines of growth frequently being

deep and crossed by the ribs give the shell a fringed or furbellowed aspect: the flat valve has diverging striae and notches corresponding in number with the costae upon the hollow valve. The whole surface is covered with minute transverse striae, which in the chalk specimens are often nearly obliterated. Figs. 4 and 5 are from the Sussex Chalk near Lewes, by favour of G. A. Mantell, Esq. they very much accord with those of the green sand from Wiltshire, figured below, but appear to be longer, and to have the transverse striae of growth very remarkable. The shell represented at fig. 5 is a curiosity, showing the inner side of the flat valve, which is slightly convex within. I gathered the small shell, fig. 6, at Chute Farm, it is a young deep undervalue, with the transverse striae of growth neatly arching between the larger six costae. Figs. 7 and 8 show the upper and under valves of different specimens, they are from the green sand at Chute, and are chiefly siliceous; for the use of one I am indebted to Thomas Meade, Esq. Such are said to be found at Devizes and Blackdown, with the upper valve. It is possible that these are different species from those in the Chalk, the costae are less prominent, and the striae more distinct; at present, however, I can consider them only as varieties.

Tabl. 56, fig. 3 represents a specimen in ferruginous sandstone from Chute, which may possibly prove to be a distinct species. Its length exceeds its breadth by one-fifth, and on the sides of the larger costae are two lesser ones, which are partly blended with them; the surface is nearly smooth. I have only seen this specimen.

Additional description:

Number of studied specimens: 670.

Algeria ..	Albian ..	1
Belgium ..	Cenomanian: Tourtia de Tournai ..	40
	Campanian: Hainaut ..	20
	Maastrichtian ..	55
Bulgaria ..	Senonian ..	3
Czechoslovakia ..	Cenomanian-Turonian ..	16
	Senonian ..	1
France ..	Albian ..	20
	Cenomanian:	
	Le Mans-Normandie ..	56
	Aube ..	1
	Senonian:	
	Paris-bassin ..	28
	Charente ..	5
	Southern Fr. ..	6
	Maastrichtian: Cotentin ..	2
G.D.R. .	Cenomanian-Turonian: Saxony ..	21
	Maastrichtian: Rügen ..	15
G.F.R. ..	Cenomanian:	
	Essen/Ruhr ..	13
	Regensburg ..	7
	Senonian:	
	Westphalia-Hannover ..	7
	Harz ..	42
	Campanian: Aachen ..	5
	Maastrichtian ..	1
Great Britain ..	Barremian ..	3
	Aptian ..	23
	Albian ..	82
	Cenomanian ..	50
	Cenomanian-Turonian ..	3
	Turonian ..	9
	Chalk ..	9
	Upper Chalk ..	9
	Senonian ..	32

OF THE SUBFAMILY NEITHEINAE, ETC.

Holland	Maastrichtian ..	...	...	...	...	...	...	30
India	Upper Cretaceous	...	...	...	...	...	...	5
Jordan	Turonian ..	...	...	...	...	...	...	2
Poland	Cenomanian-Senonian :	Silesia	...	...	...	...	...	4
Sweden	Campanian	...	...	...	...	...	...	7
Switzerland ..	Albian	...	...	...	...	...	...	34
Syria	Cretaceous	...	...	...	...	...	...	2
U.S.S.R.	Cretaceous	...	...	...	...	...	...	1

Measurements.

a) SOWERBY specimens :

	U.P.D.	W	AA	R	Side	Areal riblets
Pl. 56, fig. 6	—	—	—	—	—	—
Pl. 56, fig. 7	—	16.5	—	26	R	L 10, R 6
	28.3	30.5	—	29	R	L 8, R 6
Pl. 56, fig. 4	—	29.9	107°	28	L	—
Pl. 56, fig. 5	—	29.1	—	26	R	—
	—	31.3	—	26	L	—

b) Gross Bülden (Harz) : 42 specimens all right valves :

U.P.D. : 11.0-62.5, av. 45.4
 W. : 11.0-57.0, av. 44.2

Description.

Diagnosis. — Medium-sized to large *Neitheia*-species with 6 prominent principal ribs; between a pair of those there can be 3-6 intercalary ribs, but the usual number is 4; equal auricles covered, as the areas are, with numerous areal-riblets (filae).

The umbo is incurved, but not very deeply so, the ribs and riblets cover the total shell-surface and auricles; U.P.D. is mostly a little longer than the W.; the right valve A.A. is narrower than 90°.

The right valve is shallowly convex, ribs and intervals are evenly distributed on the shell surface. The left is flattened, never concave, $W. \pm = U.P.D.$, sometimes longer.

Rib arrangement: 6 principal ribs with between them usually 4 intercalaries: thus the number of ribs is 26 ($5 \times 4 + 6$). However, there are quite a number of shells on which in one or in several of the principal rib-intervals there is a different number of intercalaries; sometimes there are 3, sometimes 5, exceptionally even 6.

If the number of intercalaries is higher than 4 then it is found in the outer principal intervals, if it is lower than 4 then it is in the middle principal intervals.

The difference between principal and intercalary ribs is usually obvious. The intercalaries are equal but it can happen that the middle ones are more developed than the outer ones, and this then occurs in all principal intervals.

Areas: all areas are covered with a varying number of radial riblets, which cover the areal surface and the auricles.

The whole shell is covered by concentric growth-lines. Their number varies, but they are always conti-

nued on the areas, and there, they are more obvious than on the shell proper. On both valves they create a slight sinking on the ribs and close to the pallial margin this sometimes gives a step-like structure on them.

The ribs never show a radial striation; they are almost broader than the intercostal intervals.

Discussion :

Variability. — In this species the variability is most obvious in the number of intercalary ribs.

The characteristics of the species can however still be recognized even if there are more intercalaries: the proportion U.P.D./W. does not change because if there are 5 intercalaries instead of 4, each of them is a little narrower.

Synonymy. — It is generally accepted, particularly by D'ORBIGNY and by H. WOODS that *Pecten versicostatus* LAMARCK, 1819 (p. 181) is a synonym of *N. quinquecostata* (SOWERBY). The definition by LAMARCK (?) applies to all *Neitheia*-species with prominent principal ribs.

The figure in the Encyclopédie méthodique, which concords fully with the figures given by FAVRE, 1918 (Conchifères monomyaires fossiles II, figs. 26, a, b, c), of the LAMARCK type kept in Geneva, and which I studied, is not a *N. quinquecostata*. It is a *N. coquandi* (PÉRON) [not a *N. quadricostata* (SOWERBY) = *N. gibbosa* (PULTENEY) as suggested by FAVRE, because

(?) Original description of *P. versicostatus* LAMARCK.

P. testâ inaequalvi, trigonâ; valvâ superiore planâ; alternâ tumidâ incurvato-arcuatâ; radiis numerosis confertis, quorum aliquot remotis aliis elevatoribus.

Encyclop. pl. 214, f. 10, a, b, c.

List. Conch. t. 451, f. 9 et 10.

Habite ... Fossile de Coulaines, près du Mans, et des environs de Souigné-sous-Ballon. Cabinet de M. Menard et le mien. Mus. n°. Ses quatre ou cinq côtes plus saillantes que les autres font aisément reconnaître cette espèce; mais elle offre diverses variétés de taille, et en nombre de leurs côtes ou rayons.

the auricles are subequal and small] because of its general shape and rib arrangement.

Also after seeing the specimen I consider it very unlikely that it should have come from Le Mans: in general aspect and colour it definitely looks like North African specimens.

There is no reason from this specimen to assimilate *Pecten versicostatus* LAMARCK with *N. quinquecostata*. If the collection of the Muséum national d'Histoire naturelle in Paris could reveal some more original LAMARCK specimens then perhaps it could be understood how D'ORBIGNY came to this strange assimilation.

F. STOLICZKA, 1871 ascertained that the species cannot be separated for purely stratigraphical reasons as D'ORBIGNY tried to prove. However he went too far in his assimilation of species. Even though it is true that many individuals of *N. gibbosa* (PULTENEY) (mentioned by STOLICZKA sub *N. quadricostata*) have 4 intercalary ribs in the most anterior and posterior intervals, there remain other differences between *N. gibbosa* and *N. quinquecostata*. With F. STOLICZKA's way of thinking only one *Neithea*-species would have occurred in the Upper-Cretaceous.

The individuals figured by F. STOLICZKA seem to belong to different species, as far as can be decided on figures alone:

plate 31, figures 1, 1a, 1b from Moraviatoor belongs probably to *N. quinquecostata* (SOWERBY);

plate 31, figures 2 and 3 from the same locality are extremely difficult to determine: the areas appear to be smooth and thus it may be *N. syriaca* (CONRAD) or *N. coquandi* (PERON) but no decision can be reached because it is impossible to count the intercalary ribs;

plate 31, figures 4 and 6 from Odium belong probably to *N. regularis* (SCHLOTHEIM), but the state of preservation is not very good;

plate 31, figure 5 from Ariyalur could be a *N. quinquecostata*, but then a very young individual, or otherwise it could be a *N. sexcostata* (WOODWARD) though for this the auricles are slightly over size;

plate 37, figure 4 from Ariyalur belongs very probably to *N. quinquecostata*;

plate 37, figures 5, 7 and 9 from Comaropolliam could be either *N. regularis* (SCHLOTHEIM) or *N. coquandi* (PERON);

plate 37, figure 6 from Odium has the general shape of *N. syriaca* (CONRAD) but on figure 6a areal riblets are shown;

plate 37, figure 8 from the vicinity of Andoor probably belongs to *N. gibbosa* (PULTENEY).

E. BAYLE, 1878 figured an almost perfect individual of *N. quinquecostata* from the Cenomanian in Rouen.

L. LEHNER, 1937 considers, in the same way as F. STOLICZKA, that the species with 3 and 4 intercalary

ribs are not different species at all. He gives them the name *N. regularis* (SCHLOTHEIM). In LEHNER's case the confusion is understandable; the material which he studied is very poorly preserved; areas and auricles which are the good differential characteristics between the different species here considered, are rarely recognizable and most specimens are nothing but Steinkernen.

C. MAXIA based *N. checchiae* on an incomplete, crushed right valve; the figure does not show any characteristic which allows a separation from *N. quinquecostata*. The arguments pronounced by C. MAXIA to support this separation appear to me unconvincing. I cannot distinguish *N. (N.) nipponica* HAYAMI, 1965 from *N. quinquecostata* on the basis of the description and figures. According to HAYAMI (p. 297) the differences are the following:

- « — umbo of the right valve is slightly narrower;
- umbonal area of the left valve is less concave;
- shell convexity is distinctly weaker in *N. nipponica* (sic) than in *N. quinquecostata*. »

The umbo of the right valve is by definition subject to variation; if it appears somewhat narrower on *N. nipponica* this could, however, also be explained by the fact that the Japanese specimens are rather smaller and, on *Pectinidae*, the umbo is wider on larger (older) valves than on smaller (younger) ones.

Umbonal area of the left valve: *N. quinquecostata* is characterized by a completely flattened left valve, so it seems pointless to talk of « less concave » since it is never concave.

Shell convexity: plate 40, figure 1 represents the holotype of *N. nipponica*; it has to be admitted that this specimen is not very convex; the figures of the other specimens (pl. 40, figs. 5 and 6, pl. 52, figs. 1 and 2) are normally convex individuals; the weaker convexity of the holotype could be explained by its much larger size: larger (older) specimens usually grow less convex than smaller (younger) ones.

Differentiation. — *N. quinquecostata* is characterized by principal intervals with 4 intercalary ribs, by areas and auricles which are covered with equal radial striae (filae), by a moderately convex right valve and a flattened left valve; the auricles are small and do not jut out far beyond the umbo.

N. regularis (SCHLOTHEIM) differs by the number of intercalary ribs; when those are irregularly distributed, and a doubt exists, one may investigate the areas: in *N. regularis* they are only partly covered by areal lines and the auricles are smooth. One could never describe the areal ornamentation of *N. regularis* as riblets: it is not salient enough.

N. striatocostata (GOLDFUSS) differs by the less regular intercalaries: those specimens which have 4 intercalaries, are such that the 2 intercalaries nearest to the principal ribs lie on the sides of those princi-

pals, instead of lying in the principal intercostal interval. Also the ribs of *N. striatocostata* are always radially striated and this never occurs in *N. quinquecostata*.

N. sexcostata (WOODWARD) is generally much smaller, more convex and the number of ribs is variable, but usually superior to 4 intercalaries; all ribs are radially striated; the principal ribs are more salient and the intercostal intervals are deeper and narrower than in *N. quinquecostata*.

N. atava (ROEMER) has the general shape of *N. quinquecostata*, but its auricles are bigger, its right valve is more concave in individuals of the same size, its principal ribs are more salient, its intercalaries are more developed than riblets. I mention this species here, because very worn individuals of Steinkernen of *N. quinquecostata* could sometimes cause confusion.

N. syriaca (CONRAD) differs only slightly from *N. quinquecostata*: the rib-arrangement is the same but the relative strength of the ribs is different: the principal ribs are more prominent and the intercalary ribs less so, and also, unequal amongst themselves; the areas and auricles are smooth; this is a constant characteristic probably of specific nature.

The other *Neithea*-species differ so much, both in auricle shape and in number of ribs, that any confusion appears highly unlikely.

Generic attribution. — *Pecten quinquecostatus* SOWERBY, 1814 has an undeniable similarity with *Neithea* (*Neithea*) *aequicostata* (LAMARCK) both in shape of auricles and in « teeth »; also the number of ribs is the same but their distribution is different. I think this is enough for considering that the correct name for *Pecten quinquecostatus* (SOWERBY) is *Neithea* (*Neithea*) *quinquecostata* (SOWERBY, 1814).

Stratigraphical and geographical distribution:

Barremian:

GREAT BRITAIN:

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

Aptian:

GREAT BRITAIN:

Lower Aptian:

Upware (Cambs.) (S.M., also original of W. KEEPING, pl. 4, fig. 6, mentioned in H. WOODS, p. 199, B 19429, and W. KEEPING mentioned in WOODS, p. 204, B 19430-19433).

Upper Aptian:

Faringdon Bed, Faringdon (Berks) (S.M., also mentioned by H. WOODS, p. 227, B 17841-17844).

Lower Greensand:

Atherfield (Isle of Wight) (B.M.).
Chale (Isle of Wight) (B.M.).
Dorking (Surrey) (B.M.).

Folkestone (Kent) (B.M.).
Longleat (J. de C. SOWERBY Coll. B.M.).
Maidstone (Kent) (B.M.).
Sandown (Isle of Wight) (B.M.).
Shanklin (Isle of Wight) (B.M.).

Upper Aptian-Lower Albian:

GREAT BRITAIN: ferruginous sands:
Shanklin (Isle of Wight) (B.M.).

Albian:

ALGERIA:

Bou Thaleb (B.).

GREAT BRITAIN:

Leymeriella tardefurcata-zone:

Billington crossing, Leighton Buzzard (Beds) (B.M., S.M.).

Grovebury, Leighton Buzzard (Beds) (B.M.).

Shenley Hill (Shenley Limestone) (Beds) (B.M., S.M.).

Gault: basal nodule bed:

Folkestone (Kent) (S.M.).

West Dereham (Norfolk) (B.M.).

Upper Albian: Blackdown Beds:

Blackdown (B.M., Mus. Gen., S.M.).

Haldon (B.M., S.M.).

Stoliczkaia dispar-zone:

Worbarrow (Dorset) (B.M.).

Cenomanian:

BELGIUM:

Tourtia de Tournai:

Montignies-sur-Roc (N.M.W., I.R.Sc.N.B.).

Tournai (B., DR.).

Tournai, Cherq (carr. DELWART) (I.R.Sc.N.B.).

Tournai, Cherq (carr. CORNET) (I.R.Sc.N.B.).

Tournai (with a manuscript label by NYST: *Pecten nerviensis* I.R.Sc.N.B.).

Upper Cenomanian:

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

CZECHOSLOVAKIA:

Billin (N.M.W.).

Korycany (Halle, N.M.W.).

Kreibitz (B., N.M.W.).

Schneeberg, Praha (DR.).

Tyssa (DR.).

FRANCE:

N.W.:

Auberville (Calvados) (B.M.).

Briollay, Angers (Maine-et-Loire) (Mus. Gen.).

Challay, Montoire (Loir-et-Cher) (Mus. Gen.).

Fécamp (Seine-Maritime) (Ec. Min., Mus. Gen.).

Hennequeville (Calvados) (Mus. Gen.).

Le Havre (Seine-Maritime) (Mus. Gen., Univ. Neuch.).

Le Havre, Cap de la Hève (B.M., DR.).

Lillebonne, Rouen (Seine-Maritime) (Ec. Min., GR.).

Nogent-le-Rotrou (Eure-et-Loire) (Mus. Gen.).

Orbiquet (Calvados) (Mus. Gen.).

Rouen (Seine-Maritime) (B., Ec. Min. orig. BAYLE pl. 122, figs. 2, 3 Mus. Gen., N.M.W.).

Vaches Noires, Dives (Calvados) (B., Mus. Laus.).

Valognes (Manche) (B.).

Vimoutiers (Orne) (Mus. Laus.).

S.E.:

Escragnolles (Alpes-Maritimes) (B.).

Marolles (Aube) (Halle).

Neuvy-sur-Loire (Nièvre) (Mus. Gen.).

Ville-de-Caussaux, Grasse (Alpes-Maritimes) (B.).

- G.F.R. :
 Bavaria :
 Regensburg (N.M.W.).
 Westphalia :
 Essen/Ruhr (B., DR., N.M.W.).
- GREAT BRITAIN :
 England : Upper Greensand :
 Chute (B.M. SOWERBY orig. pl. 56, figs. 6, 7
 n° 43324).
 Devizes (B.M.).
 Niton (Isle of Wight) (S.M.).
 Sand Rock Spring (B.M.).
 Seaton (Devon) (B.M.).
 Shaftesbury (B.M.).
 Sidmouth (Devon) (B.M.).
 Ventnor (Isle of Wight) (B.M., S.M.).
 Warminster (B.M., orig. pl. 57, fig. 6 in British
 Mesozoic Fossils, 1964 n° 88926, Geol. Sci.
 orig. H. Woods, pl. 39, fig. 16, n° 8419, Mus.
 Laus., S.M.).
 Wilmington (B.M.).
 Lower Chalk :
 Branscombe (Devon) (S.M.).
 Dunscombe (Devon) (S.M. orig. H. Woods pl. 40,
 fig. 1, B 6365).
 White Cliff (S.M.).
Holaster subglobosus-zone :
 Punfield (Dorset) (B.M.).
 Northern Ireland :
 Yellow sandstone, Collin Glen (Antrim) (B.M.).
 Foreshore, N. of Larne (Antrim) (B.M.).
- POLAND : Silesia :
 Friedland (Mus. Gen.).
 Humpriess, Lähn (B.).
 Langenoorwerk, Löwenberg (B.).
- Cenomanian-Turonian :
 BELGIUM : Tourtia de Mons : Assise de Saint-Aybert :
 Anderlues (Puits du Viesnoy) (I.R.Sc.N.B.).
 FRANCE : Tourtia de Mons : Assise de Saint-Aybert :
 Boussort, Maubeuge (I.R.Sc.N.B.).
- Turonian :
 BELGIUM :
 Craie de Maisières, Maisières (Hainaut) (Univ.
 Neuch.).
 G.D.R. : Saxony :
 Hochwald (DR.).
 Hohnstein, Wartenbergstrasse and Mühlbergstrasse
 (DR. orig. PRESCHER).
 Nikolsdorf (Sächs. Schweiz) (DR.).
 N.W. Fuss des Kl. Zschirnsteines am O. Ausgang v.
 Kl. Giesshübel (DR.).
 Postelwitz, Bad Schandau (B., DR.).
 Stadt Wehlen (DR.).
 Strehlen (B., DR., N.M.W.).
 Zeichen (DR.).
 Zschertnitz (DR.).
- G.F.R. : Bavaria :
 Regensburg (DR.).
- GREAT BRITAIN :
 England :
 Blue Bel Hill, Burham (Kent) (B.M.).
Holaster planus-zone :
 Culver (Isle of Wight) (B.M.).
 Guildford Bypass (Surrey) (B.M.).
 Upper Warlingham (B.M.).
- Northern Ireland :
 Chloritic sandstone, County Antrim (B.M.).
- JORDAN :
 Hebron (B.M.).
- Senonian :
 CZECHOSLOVAKIA :
 Bilin (Mus. Gen.).
 FRANCE :
 Meudon (Seine-et-Oise) (B., Musé., Mus. Gen., Mus.
 Laus., N.M.W., Univ. Neuch.).
 Villedieu (Loir-et-Cher) (Mus. Gen.).
- G.F.R. :
 Hannover-Harz :
 Adenstedt (Halle).
 Gehrden (B., N.M.W.).
 Gross Bülden (B.M., GH.).
 Gross-Ilse (B., B.M.).
 Hoheneggelsen (GH.).
 Lengede (GH.).
 Northern Germany :
 Hemmoor (GH.).
 Westphalia :
 Haldem (B.M.).
- GREAT BRITAIN :
 England : Chalk (this is not necessarily Senonian s.l.
 but can also be Turonian) :
 Arundel (Houghton Pit) (B.M.).
 Brighton Sussex (B.M.).
 Lewes (Sussex) (B.M. orig. SOWERBY 1814, pl. 56,
 figs. 4, 5, SOWERBY Coll., ex. G. A. MANTELL
 Coll., L 79781-79782, S.M.).
 Norwich (in flint) (B.M.).
 Upper Chalk :
 Croydon (B.M.).
 Gravesend (B.M., Geol. Sci. orig. H. Woods, pl. 39,
 fig. 17, n° 8362, S.M.).
 Norwich B.M., S.M.).
 Sussex (no further specification) (B.M. orig.
 H. Woods, pl. 40, figs. 3, 5, F. DIXON Coll.,
 L 15741, L 15742).
- Micraster cortestudinarium*-zone :
 Borstal Fort, Rochester (Kent) (S.M.).
 Borstal Manor Quarry, Rochester (Kent) (B.M.).
 Chatham (B.M.).
 Dyke Railway Station (Sussex) (B.M.).
 Luton, Chatham (B.M.).
 Offham Hill, Lewes (Sussex) (B.M.).
 Purley, S. of Croydon (Surrey) (B.M.).
 Seaford Head (Sussex) (B.M.).
- Micraster coranguinum*-zone :
 Gillingham (Kent) (B.M.).
 Gravesend (B.M.).
 Northfleet (Kent) (B.M.).
 Thanet Coast (Kent) (B.M.).
- Uintacrinus*-band, *Marsupites*-zone :
 Margate (Kent) (B.M.).
 Saint Ann Without, Lewes (Sussex) (B.M.).
- Offaster pilula*-zone :
 Soberton (Hants.) (S.M.).
 Sutton Scotney Station (Hants.) (S.M.).
- Goniotethis quadratus*-zone :
 Hursley (Hants.) (S.M.).
 Rottingdean (Sussex) (B.M.).
 West Harnham, Salisbury (Wilts) (B.M. orig.
 H. Woods, pl. 40, fig. 2, L 64224).

OF THE SUBFAMILY NEITHEINAE, ETC.

- Belemnitella mucronata*-zone :
 Mousehold, Norwich (B.M.).
 Trimmingham (Norfolk) (B.M.).
 « derived in Eocene gravels » :
 Haldon Hills (B.M.).
 Northern Ireland :
 Whitehead, 12 miles N.E. of Belfast (B.M.).
- INDIA :
 Bridge at 14 3/4 miles from Perambular on Ariyalur
 Road, Trichinopoly (B.M.).
- POLAND :
 Kieslingswalde (DR., GR.).
- SYRIA :
 Bloudane (B.M.).
- Senonian (Campanian) :
 G.F.R. :
 Around Aachen (B.).
 HOLLAND :
 Vaals (Halle, I.R.Sc.N.B., Ma.).
 SWEDEN :
 Ifö (B.M., GR.).
 Ignaberga (B., B.M., GR., Musé.).
- Maastrichtian :
 BELGIUM-HOLLAND :
 Sint-Pietersberg, Maastricht (I.R.Sc.N.B., Ma.).
 BULGARIA :
 Lukovit (Univ. Sofia).
 Pleven (Univ. Sofia).
- Upper Cretaceous :
 INDIA :
 Verdachellum [from Geol. Soc. coll. orig. E. FORBES,
 Trans. Geol. Soc. (2), 7, p. 153, Geol. Soc. Reg.
 n° 10664, kept in B.M.].
 S.A.R. :
 Manuan Creek, Zululand (B.M., L 22046 orig.
 R. B. NEWTON, 1909, pl. 3, figs. 1,2).
 U.S.S.R. :
 On the Volga, Turbino (GR.).
- Cretaceous :
 U.S.A. :
 Texas (no further specification) (Halle).
7. — *Neithea (Neithea) syriaca* (CONRAD, 1852).
 (Pl. 5, fig. 3, a, b.)
- 1847 *Pecten quinquecostatus* J. MORRIS, p. 295.
 var.
- .1852 *Janira Syriaca* CONRAD, p. 230, pl. 1,
 fig. 6.
- v.1853 *Janira quinquecostata* F. J. PICTET et W. ROUX,
 (pro parte) p. 506, pl. 45, figs. 3,
 a, b (non 3 c).
- v.1858 *Janira Morrisi* Pictet et F. J. PICTET et E. RENE-
 Renevier vier, pp. 128-130, pl.
 19, figs. 2 a-d.
- v.1871 *Janira Morrisi* Pictet et F. J. PICTET et G. CAM-
 Renevier piche, pp. 244-246.
- ?1883 *Pecten (Neithea) Morrisii* W. KEEPING, pp. 106,
 Pictet et Renevier 107.
- ?1890 *Vola quinquecostata* Sow. M. BLANCKENHORN, pp.
 non ! Lam. (sic) 77, 78.
- (1900) *Janira Morrisi* Pict. et E. FICHEUR, p. 566.
 Ren.
- .1902 *Vola Morrisi* Pictet et P. CHOFFAT, pp. 147,
 Renevier 148, pl. 3, figs. 5, 6.
- v.1903 *Pecten (Neithea) Morrisi* H. WOODS, pp. 201, 202,
 (Pictet et Renevier) pl. 39, figs. 11 a-c,
 12 a, b, 13.
- .1912 *Pecten (Neithea) Morrisi* L. PERVINQUIÈRE, p. 135,
 Pictet et Renevier pl. 9, figs. 7, a, b.
- (1921) *Pecten (Neithea) Morrisi* S. GILLET, pp. 22, 23.
 P. et Ren.
- v.(1922) *Pecten (Neithea) Morrisi* G. W. BUTLER, p. 315.
 (Pict. et Ren.)
- 1923 *Pecten (Neithea) Morrisi* V. K. PETROVIC, p. 63.
 Pict. et Ren.
- (1927) *Neithea Morrisi* Pictet P. FALLOT et J. R. BA-
 Renevier Ren. sp. TALLER, pp. 259, 275.
- (1927) *Janira Morrisi* Pictet et A. JAYET, pp. 167, 168.
 Renevier
- ?1932 *Janira morrisi* Pict. et E. ACKERMANN, pp. 21,
 Ren. var. *héberti* Dép. 22.
- ?1934 *Pecten (Neithea) morrisi* T. NAGAO, pp. 206-209,
 (Pictet and Renevier) pl. 26, figs. 2-6.
- 1934 *Pecten (Vola) quinquecos-* M. BLANCKENHORN, p.
tatus Sow. (non Lam.) 191
 var. *syriaca* Conr.
- 1940 *Neithea Morrisi* Pictet G. TAVANI, p. 47.
 et Renevier
- .1942 *Pecten (Neithea) quin-* F. HEYBROEK, p. 455.
quecostatus Sow. (non
 Lam.) var. *syriaca*
 Conrad
- (1942) *Vola 5-costata* Sow. var. C. I. LISSON, pp. 82, 85,
Morrisi Pict. et Ren. 91, 94.
- ?1942 *Neithea* cfr. *Morrisi* G. TAVANI, p. 9.
 (Pictet et Renevier)
- (1945) *Neithea Morrisi* Pictet et J. R. BATALLER, p. 30.
 Renevier var. *major*
 Vidal-Molina
- 1947 *Pecten (Neithea) morrisi* E. F. RICHARDS, pp. 56,
 (Pictet and Renevier) 57, pl. 7, figs. 2, 3.
- 1947 *Neithea Morrisi* Pict. et J. R. BATALLER, p. 154.
 Ren. var. *major* Vidal-
 Molina
- .1947 *Neithea (Neitheops)* E. VOKES, pp. 166, 167,
syriaca (Conrad) pl. 4, figs. 1-7.
- 1948 *Neithea Morrisi* (Pictet G. TAVANI, pp. 93, 94,
 et Renevier) pl. 1, figs. 10, 11.
- (1951) *Neithea morrisi* Pict. et J. GLAÇON et D. MON-
 Ren. gin, p. 426.
- (1955) *Pecten syriacus* Conr. I. A. M. FARAG, p. 151.
- (1955) *Neithea morrisi* P. et R. I. A. M. FARAG, p. 154.
- .1955 *Neithea Coxi* I. G. E. D. MAHMOUD,
 pp. 105, 106, pl. 6,
 figs. 2-5.
- 1957 *Pecten (Neithea) cfr.* M. AMANO, pp. 88, 89,
morrisi (Pictet and
 Renevier) pl. 1, figs. 17, 18, 20-
 25, 27-29.
- (1958) *Neithea Morrisi* Pict. J. R. BATALLER, p. 49.
- (1961) *Neithea syriaca* (Conrad) R. CASEY, p. 618.

Location and designation of type-specimens. — From VOKES, 1947 :

« type-specimen : lost.
 neosyntypes : AMNH 25996 : 1 and 2.
 hypotype : 25996/1 from Ruweissat Na'mân
 (Lebanon). »

Janira morrisi PICTET et RENEVIER: in the Muséum d'Histoire naturelle in Geneva.

Neithea coxi MAHMOUD: Geology Department, Alexandria, Egypt.

Locus typicus. — Abeih (VOKES: « Olive locality »: this is were the syntypes are from).

Neithea morrisi (PICTET et RENEVIER): Perte du Rhône (Ain) (France).

Neithea coxi MAHMOUD: Moghara (Sinai) (Egypt).

Stratum typicum. — (Albian? or Aptian?).

Neithea morrisi (PICTET et RENEVIER): Aptien.

Neithea coxi MAHMOUD: Albien inférieur et moyen.

Original description:

Subtriangular, elevated; superior valve slightly concave, with rather narrow, unequal ribs and concentrically wrinkled, about twenty-six in number; inferior valve ventricose, with six large ribs, rounded and finely wrinkled; intervals with generally four rounded unequal ribs.

Abeih'

Janira morrisi PICTET et RENEVIER.

Dimensions.

Largeur	27 mm
Par rapport à la largeur: longueur	0,80
Par rapport à la largeur: épaisseur	0,45
Angle apical	60°

Coquille triangulaire, composée d'une valve inférieure convexe, à sommet fortement recourbé, et d'une valve supérieure un peu concave. Oreilles petites, médiocrement inégales et peu contournées. La grande valve est ornée de six grosses côtes arrondies, séparées par des intervalles assez profonds. Dans celui des deux grosses côtes médianes on remarque tantôt quatre, tantôt cinq côtes rayonnantes plus petites, dont les latérales sont les plus faibles; dans les autres intervalles leur nombre est en général de quatre, mais il se réduit quelquefois à trois, surtout dans les intervalles externes. Toutes ces côtes longitudinales sont coupées par des stries d'accroissement fines, régulières et parallèles au bord. En dehors des deux côtes extérieures, la coquille est presque toujours lisse et marquée seulement de stries d'accroissement obliques; quelquefois cependant on y remarque aussi un léger pli costiforme peu apparent. Les oreilles sont lisses et marquées seulement de stries d'accroissement. La petite valve est ornée de six côtes rayonnantes, canaliculées, dans les intervalles desquelles on remarque trois, rarement quatre, côtes rayonnantes plus petites. La face interne de cette dernière valve, que l'on trouve plus fréquemment que l'externe, est convexe, a une apparence plus lisse, et reproduit en les affaiblissant les ornements de l'autre face. Quelques côtes se subdivisant en stries secondaires, multiplient ainsi leur nombre, mais seulement en apparence.

Rapports et différences. — Notre janira se distingue principalement de la *J. quinquecostata*, par le caractère qu'indique M. Morris, savoir, les area lisses qu'elle présente en dehors des côtes externes, tandis que ces mêmes régions sont ornées, dans l'espèce cénomaniennne, de côtes

aussi apparentes que celles du reste de la coquille. On peut ajouter que les oreilles de la véritable *J. quinquecostata* sont plus grandes, plus inégales, ornées de stries rayonnantes faisant suite aux côtes des area externes, et que les intervalles intercostaux sont moins excavés dans notre espèce.

Histoire. — Malgré ces différences, cette janira a été généralement confondue avec la *J. quinquecostata*. M. d'Orbigny a le premier reconnu que cette assimilation était erronée; il a montré que les janira néocomiennes, qui avaient été décrites sous ce nom par MM. Roemer, Leymerie, Matheron et Forbes doivent en être spécifiquement séparées. En acceptant complètement cette manière de voir nous ne sommes pas aussi certains que M. d'Orbigny que toutes ces coquilles appartiennent bien à une seule et même espèce, et nous sommes en désaccord avec lui sur le nom qu'il lui donne. Cet auteur en effet assimile cette espèce au *P. atavus*, Roemer (Ool. Geb., suppl., p. 29, pl. 18, fig. 21), dont la description se rapporte évidemment au contraire à celle dont M. d'Orbigny a fait sa *J. neocomiensis*, et qui est si clairement caractérisée par ses intervalles plats, ornés de stries rayonnantes au lieu de côtes, et de stries d'accroissement très accusées et fortement infléchies du côté du crochet. Il est d'autant plus évident que M. Roemer a bien envisagé cette espèce comme nous venons de le dire, qu'il cite d'ailleurs deux janira dans le hilsconglomerat: le *P. atavus* et le *P. quinquecostatus*, var.; cette dernière espèce est évidemment celle qui nous occupe ici, ainsi que le prouve incontestablement le texte même de la description.

En 1847, M. Morris s'aperçut également que l'espèce du lower greensand n'était probablement pas le véritable *P. quinquecostatus*, mais il la conserva avec doute sous ce nom, comme une variété particulière. Dans la *Description des mollusques des grés verts*, deux espèces ont de même été réunies sous le nom de *J. quinquecostata*. Nos nouvelles études nous ont montré que ce nom ne doit être attribué qu'aux échantillons du gault; ceux du terrain aptien, signalés alors comme ayant les area externes lisses, appartiennent à notre nouvelle espèce. Cette janira n'ayant encore reçu, comme nous venons de le montrer, aucun nom qu'elle puisse conserver, nous la dédions au géologue anglais qui a signalé son véritable caractère distinctif.

Nous avons dit plus haut que M. d'Orbigny avait donné le nom de *J. atava* aux janira du lower greensand et du terrain néocomien qui appartiennent à ce type, et nous avons montré que ce nom ne peut en aucune manière leur être conservé. Comme nous l'avons déjà dit, il nous reste quelques doutes sur la convenance de les réunir toutes en une seule espèce. Il ne serait pas impossible qu'il y eût dans les terrains crétacés inférieurs au gault, deux janira appartenant au type de la *J. quinquecostata*. L'une d'elles, figurée dans la Paléontologie française, caractérisée par des sillons plus profonds et par des côtes plus inégales, atteignant souvent une grande taille, appartiendrait au terrain néocomien proprement dit. L'autre (*J. Morrisi*) rappelant mieux le facies et la taille de la *J. quinquecostata*, caractériserait le lower greensand d'Angleterre et le terrain aptien de nos environs. Nous devons en terminant faire remarquer que quelle que soit la solution de cette question, elle n'influera en rien sur le nom spécifique que doivent porter nos échantillons. S'il n'y a qu'une seule espèce, le nom de *J. Morrisi* devra être substitué à celui de *J. atava* d'Orb. (non Roemer); s'il y en a deux, l'espèce du néocomien proprement dit devra recevoir un nouveau nom.

Localités. — La *J. Morrisi* est très abondante à la Perte du Rhône dans la marne jaune (h). Elle est plus rare dans la couche à orbitolites (g) et dans les grés durs (d). Musée de Genève et collection Renevier. M. Campiche l'a également trouvée dans la marne jaune de Sainte-Croix, où elle paraît rare.

Additional description :

Numbers of studied specimens : total : 222.

Angola	Albian	1
France	Barremian : Salève	2
	Aptian-Albian : Perte du Rhône ...	67
	Aptian-Albian : Marseille ...	2
	Albian? : Meule de Bernissart ...	1
Great Britain ...	Aptian (Lower Greensand) ...	69
	Albian ...	10
Israel ...	Albian ...	3
Jordan	Albian ...	4
Lebanon ...	Aptian-Albian	5
Madagascar ..	Albian ...	1
Somalia ...	Cretaceous ...	1
S.A.R.	Albian : Zululand ...	1
Switzerland ..	Aptian ...	27
	Albian ...	28

Measurements. — Complete specimens are very rare and so few specimens have been measured.

Ex. :

Zululand specimen : U.P.D. 48; W. 43.

Bernissart-Meule specimen : U.P.D. 48.2; W. 41.1.

British and Swiss specimens are usually smaller : U.P.D. does not reach 35.

Description.

Diagnosis. — Small to medium-sized *Neithea*-species with 4 intercalary ribs and smooth areas and auricles.

In shell shape, auricle shape and ribdistribution *N. syriaca* is very similar to *N. quinquecostata*. The differences in those characteristics are only noticeable on large series of specimens; the principal ribs are more prominent and sharper, the intercalary ribs slightly less salient and somewhat irregular. The only good differential characteristic lies in the smoothness of the areas and auricles. They never have radial riblets but they sometimes have a not clearly delimited fold, on the area of the right valve, very close to the first principal rib. This fold could be considered as a « rib ».

Discussion :

Variability. — The number of counted ribs varies in this species: the 4 intercalary ribs are often unequal in development: the 2 middle intercalaries being much more salient than the 2 which lie closer to the principal ribs; in certain shells some of those lesser developed intercalaries are not more than striae lying on the bottom of the principal interval. In this case the rib number, not taking the striae into account, is less than what is normally expected.

Synonymy. — As PICTET et RENEVIER stated, many *N. quinquecostata* of older authors belong effectively to *N. syriaca*; this does however not go as far as these two authors tried to show. *N. syriaca*

(CONRAD) as described and figured by H. VOKES is certainly synonymous with *N. morrissi* (PICTET et RENEVIER): the presence or absence of an areal fold is not a specific characteristic: in the same locality specimens with and without fold are found.

N. coxi MAHMOUD differs from *N. syriaca*, according to the author, in the following points :

« Ces échantillons sont bien voisins de l'espèce *N. morrissi* PICTET et RENEVIER. Seulement, la partie du test comprise entre les côtes principales externes et le bord de la coquille, au lieu d'être lisse et dépourvue de toute sorte de côtes rayonnantes, comme chez *N. morrissi*, et au lieu d'être complètement costulée (avec plusieurs costules intercalaires), comme chez *N. quinquecostata* Sow., montre au contraire une seule costule large [pl. VI, fig. 46 (sic, l.c. for 4 b)] mais moins bien individualisée que celles situées entre les côtes principales. »

This differential character is not a properly differential character as can be read in the description of PICTET et RENEVIER who already mentioned « un léger pli costiforme peu apparent ».

Janira matheroniana P. DE LORIOU, 1866 (p. 83, pl. E, fig. 9) from the Urgonien (Barremian) of Grand-Salève, au-dessus d'Essert (Haute Savoie, France) is known from a very poorly preserved specimen in the Muséum d'Histoire naturelle in Geneva: it has smooth areas and very salient principal ribs and four unequal intercalaries, of which the two middle ones are the more developed. It is thus undoubtedly closely related to *N. syriaca* but whether both species are synonymous cannot be decided on such incomplete material.

Differentiation. — Towards *N. (N.) quinquecostata* see in this species.

Towards the other *Neithea*-species on the same grounds as *N. quinquecostata*.

Generic attribution. — The similarity with *N. (N.) quinquecostata* (SOWERBY) is such that for the same reasons as those given for this species, one may assert that the correct name of *Janira syriaca* CONRAD, 1852 must be *Neithea (Neithea) syriaca* (CONRAD, 1852).

Stratigraphical and geographical distribution :

Barremian :

FRANCE :

Essert, Mont Salève (Haute Savoie) (Mus. Gen.).

Aptian :

FRANCE :

Perte du Rhône (Ain) (B., DR., Mus. Gen.; Mus. Laus. orig. PICTET et RENEVIER, pl. 19, figs. 2, 2b, 2d, Coll. RENEVIER, n° 21307, N.M.W., S.M., Univ. Neuch.).

Le Rôve, Martigues (Bouches-du-Rhône) (B.).
Septèmes (Bouches-du-Rhône) (Mus. Gen.).

GREAT BRITAIN:

Lower Aptian:

Perna-bed:

Atherfield (Isle of Wight) (Mus. Laus., S.M. also orig. H. Woods, pl. 39, fig. 13, B 12669).

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

Perna-bed: Atherfield Clay:

East Shalford (Surrey) (S.M.).

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

Sevenoaks (Kent) (B.M.).

Woodhatch, Reigate (Surrey) (S.M.).

Middle-Upper Aptian:

Crackers:

Atherfield (Isle of Wight) (S.M.).

Ferruginous Sands:

Shanklin (Isle of Wight) (Mus. Gen., S.M.).

Hythe Beds:

Lympne (Kent) (Geol. Sci. orig. H. Woods, pl. 39, figs. 111, 12, n° 8364, 8446).

Lower Greensand:

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

Folkestone (Kent) (B.M.).

Maidstone (Kent) (B.M.).

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

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

Sevenoaks (Kent) (B.M.).

Aptian (without specification):

Littleton (B.M.).

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

LEBANON: Aptian ?:

Nahr Beirut (B.M.).

SWITZERLAND:

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

Perriblanc d'Argentine (Vaud) (Mus. Laus.).

Albian:

ANGOLA:

Lucira, Lobito (B.M.).

FRANCE:

Northern France:

Meule de Bernissart: Onnaing-lez-Valenciennes (Nord) (I.R.Sc.N.B.).

Southern France:

Cosne (Nièvre) (Mus. Gen.).

Perte du Rhône (Ain) (Mus. Laus.).

GREAT BRITAIN:

regularis-zone:

Billington level Crossing, Pratt's Pit, Leighton Buzzard (Beds) (B.M.).

mammillatus-zone:

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

Chamberlain Barn Pit, Leighton Buzzard (Beds) (B.M.).

benettianus-zone:

Osmington (South Dorset) (B.M.).

Without stratigraphical specification:

Folkestone (Kent) (B.M.).

JORDAN:

800-1000 ft. O.D. S. side Wadi Farah (B.M.).

LEBANON:

Nahr Beirut (B.M.).

MADAGASCAR:

Ambarimanga, Sitampiky, N.W. Madagascar (B.M.).

S.A.R. (Albian ?):

Umsinene, Zululand (GH.).

SWITZERLAND:

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

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

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

Mont Saxonet (Vaud) (Mus. Gen.).

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

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

Albian-Cenomanian:

ISRAEL:

Kurnub (B.M.).

Cretaceous:

JORDAN:

Nablus (B.M.).

LEBANON:

Abeih (B.M.).

SOMALIA:

Sheik Gure, Middle Webi Shebeli (B.M.).

SYRIA:

Marrachk, Elharf (B.M.).

Ruisseh, Naaman (B.M.).

8. — *Neithea (Neithea) atava* (F. A. ROEMER, 1839).

(Pl. 1, figs. 2a, 2b.)

- | | | |
|--------|--|--|
| .1839 | <i>Pecten atavus</i> Nob. | F. A. ROEMER, pp. 29, 30, pl. 18, fig. 21. |
| 1841 | <i>Pecten atavus</i> N. | F. A. ROEMER, p. 54. |
| v.1847 | <i>Janira atava</i> d'Orbigny | A. D'ORBIGNY, pp. 627-629, pl. 442, figs. 1-3, 5. |
| v.1847 | <i>Janira neocomiensis</i> d'Orbigny | A. D'ORBIGNY, pp. 629-631, pl. 442, figs. 4, 6-9. |
| 1849 | <i>Janira atava</i> d'Orb. | A. STROMBECK, p. 464. |
| v.1850 | <i>Janira atava</i> d'Orb. | A. D'ORBIGNY, p. 83, n° 395. |
| v.1850 | <i>Janira Neocomiensis</i> d'Orb. | A. D'ORBIGNY, p. 83, n° 396. |
| (1850) | <i>Pecten atavus</i> Römer | H. B. GEINITZ, p. 186. |
| 1852 | <i>Pecten atavus</i> | BUVIGNIER, p. 474. |
| (1855) | <i>Janira Neocomiensis</i> d'Orb. | G. COTTEAU, p. 117. |
| (1855) | <i>Janira atava</i> d'Orb. | G. COTTEAU, p. 117. |
| .1871 | <i>Janira atava</i> (Roemer) d'Orbigny | F. J. PICTET et G. CAMPICHE, pp. 237-240, pl. 180, figs. 1 a-c, 2-9. |
| .1871 | <i>Janira neocomiensis</i> d'Orbigny | F. J. PICTET et G. CAMPICHE, pp. 240-242. |
| 1895 | <i>Janira atava</i> (A. Römer) d'Orb. | G. MAAS, p. 269. |
| .1896 | <i>Janira atava</i> A. Römer | A. WOLLEMANN, p. 841. |
| (1897) | <i>Neithea (Vola) aff. atava</i> Roem. | V. POPOVICI-HATZEG, p. 550. |
| 1899 | <i>Vola (Janira) atava</i> | D. ANTHULA, p. 71. |
| (1899) | <i>Neithea atava</i> F. A. Roem. | G. BOEHM, p. 338. |
| .1900 | <i>Janira atava</i> A. Roemer | A. WOLLEMANN, pp. 30-32. |
| (1900) | <i>Janira cf. atava</i> d'Orb. | E. FICHEUR, pp. 567, 569. |

OF THE SUBFAMILY NEITHEINAE, ETC.

- (1901) *Janira* aff. *atava* Roem. ZLATARSKI, p. 286.
 (1903) *Janira atava* L. PERVINQUIÈRE, p. 40.
 (1903) *Janira* aff. *atava* L. PERVINQUIÈRE, p. 55.
 (1905) *Janira atava* d'Orb. A. PÉRON, p. 364.
 v. 1905 *Vola Neumanni* nov. sp. E. DACQUÉ, pp. 12, 13, pl. 3, figs. 1, a, b.
 . 1907 *Pecten (Neithea) atavus* Roemer M. COSSMANN, p. 37, pl. 5, fig. 19.
 . 1910 *Vola lindiensis* n. sp. E. KRENKEL, p. 205, pl. 21, fig. 4.
 1912 *Pecten (Neithea) atavus* A. Roemer L. PERVINQUIÈRE, p. 135.
 . 1914 *Vola lindiensis* Krenkel E. LANGE, pp. 212, 213, pl. 16, figs. 10-12, pl. 17, figs. 1-3.
 ?1914 *Pecten (Neithea) atavus* Roemer M. MORAND, pp. 226, 227.
 . 1916 *Pecten (Neithea) atavus* Roemer M. COSSMANN, pp. 41, 42, pl. 3, figs. 18, 19.
 ?1916 *Neithea Morrisi* Pictet et Renevier H. DOUVILLE, p. 171, pl. 20, figs. 17, 18.
 . 1916 *Pecten (Neithea) atavus* Roemer M. COSSMANN, p. 398, pl. 13, figs. 6-8.
 (1918) *Neithea atava* d'Orb. S. GILLET, p. 118.
 (1919) *Pecten (Neithea) atavus* Roem. I. TOMITCH, p. 118.
 1921 *Pecten (Neithea) atava* (sic) Roemer S. GILLET, pp. 92-94.
 1923 *Pecten (Neithea) atavus* Roemer V. K. PETKOVIC, p. 63.
 (1927) *Neithea atava* d'Orb. sp. P. FALLOT et J. R. BATALLER, pp. 262, 275.
 (1933) *Janira atava* Römer A. HEIM, E. BAUMBERGER, S. FUSSENEGGER, pp. 175, 204.
 (1933) *Janira atava* A. BENOIT, p. 9.
 v. (1934) *Pecten atava* (sic) Roemer ST. T. JELEV, p. 118.
 . 1948 *Neithea Atava* Roemer sp. R. P. CHARLES, pp. 5, 6.
 . 1948 *Neithea Atava* Roemer sp. var. *neocomiensis* d'Orbigny pro sp. R. P. CHARLES, p. 6.
 1952 *Neithea atava* (Römer) MATSUMOTO et KANMERA, p. 45.
 1953 *Neithea atava* Roemer *saxatilis* nov. subsp. D. MONGIN et P. TROUVÉ, pp. 235, 236, pl. 3, fig. 6.
 . 1954 *Neithea atava* (Roemer) L. R. COX, p. 627, pl. 64, fig. 4.
 v. 1954 *Neithea atava* (Roemer) L. R. COX, p. 627, pl. 64, fig. 1.
 (1958) *Neithea atava* Roemer J. R. BATALLER, p. 49.
 (1960) *Neithea atava* Roem. M. S. ERISTAVI, pp. 51, 54, 55, 61, 73.
 1961 *Pecten (Neithea) lindiensis* (Krenkel) W. G. AITKEN, p. 93.
 . 1965 *Neithea (Neithea) kanmerai* sp. nov. I. HAYAMI, pp. 305, 306, pl. 43, figs. 1-5, pl. 52, fig. 3.
 non 1854 *Pecten atavus* Roem. J. MORRIS, p. 175.
 non 1883 *Pecten (Neithea) atava* W. KEEPING, p. 107, pl. 4, fig. 6.
 non 1903 *Pecten (Neithea) atavus* H. WOODS, pp. 200, 201, pl. 39, figs. 6-10.
 non 1965 *Neithea (Neithella) sp.* cf. N. (N.) *atava* I. HAYAMI, pp. 307-309, pl. 44, figs. 1-4, pl. 52, fig. 4.

Location and designation of type-specimens. — In the Roemer-Museum in Hildesheim (G.F.R.).

Janira neocomiensis D'ORBIGNY: Coll. D'ORBIGNY in Muséum national d'Histoire naturelle in Paris; J. ROGER chose a lectotype: 5136 B.

Vola neumanni DACQUE: in the Bayerische Staatssammlung für Paläontologie und historische Geologie in Munich (G.F.R.).

Vola lindiensis KRENKEL: probably in the Staatliches Museum für Naturkunde in Stuttgart, Ludwigsburg (G.F.R.).

Neithea (Neithea) kanmerai HAYAMI: University of Kyushu, Department of Geology (GK. H 6132).

Locus typicus. — Schöppenstedt (G.F.R.).

Neithea neocomiensis: Hauterive near Neuchâtel, Switzerland.

Neithea neumanni: « Abstieg zum Wabi am Abunas », Ethiopia (O.D.).

Neithea lindiensis: Niongala, Tanzania (O.D.).

Neithea kanmerai: loc. Km. 3085c, south of Kohara, Tôyô village, Yatsushiro County, Kumamoto Prefecture, Japan.

Stratum typicum. — Im Hilse (Neocomian).

Neithea neocomiensis: néocomien inférieur (Hauterivian?).

Neithea neumanni: Neocom.

Neithea lindiensis: Neokom.

Neithea kanmerai: Hinagu Formation (Upper Neocomian).

Original description:

P. (Jacobaeus) testa ovato-acuta concentricè subtilissime lineata inferne sexangulari, valva sinistra plana margine incrassata interne dense subsulcato, dextra convexo-gibba costis senis elatis rotundatis, interstitiis planis latis quadrisulcatis.

Es gehört diese Art zur Familie der Jacobäen, und ist die früheste, bislang bekannte Form derselben. Das Gehäuse ist spitz eiförmig, unten sechskantig. Die linke Schale ist platt, hat innen eine sehr verdickten Rand, zahlreichen Längsstreifen und aussen vier stärkere Rippen; die rechte Schale ist sehr stark gewölbt und trägt sechs dicke, runde Längsrippen. Die breiten Zwischenräume sind platt, zeigen 3 bis 4 schwache Längsfurchen und sehr feinen, regelmässigen, aufwärts gebogene, dicht stehende Anwachslinien.

Wird selbst doppelt so gross, als das abgebildete Exemplar, und findet sich im Hilse bei Schandelahe und Schöppenstedt nicht selten.

Neithea neocomiensis (D'ORBIGNY).

I. testâ trigonâ, transversâ, concentricè striatâ; valvâ superiore concavo-planâ, radiatim costatâ; costis (6) latis, excavatis; interstitiis sulcis latis, excavatis (medio), obscure 3-striatis; valvâ inferiore convexâ, incurvatâ, radiatim 6-cos-

tatâ; costis incrassatis, rotundatis, convexis; interstitiis sulcis latis, excavatis, complanatis; auriculis inaequalibus, elongatis, transversim striatis.

Dimensions. — Largeur, 28 millim. Par rapport à la largeur : longueur, 82/100 ; épaisseur, 52/100. Angle apical, sans les oreillettes, 62°.

Coquille convexe, trigone, étroite, transverse, couverte, partout, de stries concentriques assez prononcées. Valve supérieure un peu concave, ornée de six côtes rayonnantes larges, presque aussi larges que les sillons qui les séparent, dont les quatre du milieu sont très creusées en gouttières. Entre ces côtes les sillons sont excavés, sans côtes rayonnantes, mais avec des indices de stries rayonnantes. Valve inférieure bombée, à sommet contourné, orné de six grosses côtes saillantes, larges et arrondies, entre lesquelles sont des sillons fortement excavés sans côtes rayonnantes distinctes. Les oreilles, très-longues, sont inégales et striées en travers.

Rapports et différences. — Cette espèce, qui, sans doute, a été confondue avec la précédente (*), s'en distingue facilement par sa taille toujours plus petite, par sa forme plus étroite, par ses six côtes rayonnantes infiniment plus grosses, par leur intervalle plus uniformément creusé, sans côtes rayonnantes bien distinctes, mais seulement strié en travers. Les jeunes du *J. atava* se distinguent toujours de cette espèce par les côtes rayonnantes dans l'intervalle des six angles.

Localité. — Elle est propre à l'étage néocomien inférieur et se trouve généralement avec le *J. atava*. Elle a été recueillie à Hauterive, près de Neuchâtel (Suisse), par M. Dubois et par moi; à Saint-Dizier et à Bettancourt-la-Ferrée (Haute-Marne) par M. Tombeck et par moi; à Russey et à Maison-dessous-les-Ecorces, à Cerneux (Doubs), par M. Carteron; aux environs de Saint-Sauveur (Yonne), par M. Robineau-Desvoidy; à Vandœuvre (Aube), par M. d'Archiac et par moi.

Additional description :

Number of studied specimens : total : 352.

Algerian	Neocomian	1
Alpine (Swiss and French) ...	Neocomian	239
Bulgarian	Neocomian	4
Ethiopian	Neocomian	1
French (non Alpine)	Neocomian	88
German	Neocomian	8
Hungarian	Neocomian	1
Tanzanian	Neocomian	9
Trinidadian	Neocomian	1

Measurements. — Several specimens of this species are known to have reached very large sizes : e.g. B.M. L 51819 from Niongala, Tendaguru district, Tanzania : left valve : U.P.D. 127.7; W. 133.8; A.A. 107°; hinge-line : 65.4; from the same locality L 51859 has a size closer to that of other *Neithea*-species : W. = 24.0.

Also at other localities very large specimens are found, but the range of U.P.D. and W. start at 15 and can reach 150, though rarely.

Description.

Diagnosis. — *Neithea*-species with strongly recurved beak and very convex right valve, particularly on small (young) specimens; flattened left valve; rela-

tively small auricles; 6 salient principal ribs with deep intercostal intervals.

Auricles : mostly small and subequal; they reach 1/3 of the apical line on large individuals; the outer margin is usually rounded; surface smooth.

Areas : smooth apart from concentric striae and one riblet close to the first principal rib.

Right valve : with 6 principal, heavy almost equal ribs; depending on their growth-stage, they can be either very salient and have the same width as the intervals [in young (=small) valves] or otherwise be narrower than the intervals and less salient [in older (=larger) valves]. On well preserved specimens the ribs and the intercostal intervals, but not the areas, are covered with radial striation. In the intervals, planes which can reach a slight prominence can be delimited. Some authors consider those as « ribs ». They certainly might be the origin of the ribs in later *Neithea*-species. The number of those delimited « ribs » varies : the following distribution has been found :

- P 1 : 2 : P 2 : 5 : P 3 : 5 : P 4 : 5 : P 5 : 2 : P 6.
- P 1 : 2 : P 2 : 2 : P 3 : 5 : P 4 : 2 : P 5 : 2 : P 6.
- P 1 : 5 : P 2 : 5 : P 3 : 5 : P 4 : 5 : P 5 : 5 : P 6.

In some intervals but not regularly, 3 « ribs » are found. The principal ribs can also bear more or less delimited planes which can, if slightly prominent, divide the principal ribs into sideribs.

The whole valve is covered with thin, concentric striae which continue on the areas and auricles.

In poorly preserved specimens one gets the impression that principal ribs, intercostal intervals, areas and auricles are smooth.

Left valve : the ribs structure of the left valve is the counterpart of the one described for the right valve : it consists of 5 radial projections which correspond to the intercostal interval of the right valve and consequently are much wider on large valves than on smaller ones. The principal ribs of the right valves correspond to the intercostal intervals of the left valve.

In well preserved specimens these valves are covered with the same type of striation as described for right valves.

Discussion :

Variability. — As in many *Pectinidae*-species the proportion U.P.D./W., the A.A. and the convexity of this species are different in young and older specimens. In the latter the value U.P.D./W. decreases progressively, the A.A. becomes wider, and the convexity becomes less marked. On very large specimens the rib and intercostal interval-sculpture is far less regular than on smaller valves.

The differences between young and old specimens is specially noticeable in this species because the material covers a very wide size-range.

(*) *Neithea atava* (ROEMER).

Synonymy. — *Janira neocomiensis* D'ORBIGNY is not different from *N. atava* (ROEMER); the arguments used by D'ORBIGNY to differentiate both « species » are easily explained by the difference in size and state of preservation. The fact quoted by him : « ... se trouve généralement avec le *J. atava* » is also an indication that it is one and the same species. *Janira neocomiensis* are young individuals of *N. atava*.

Vola neumanni DACQUÉ, from the Lower Cretaceous of Ethiopia, is, as DACQUÉ himself already supposed, a very large specimen of *N. atava*. Similar specimens are found in the Alpine Neocomian. The relative flatness and irregular rib distribution are due to the size of the specimen.

Vola lindiensis KRENKEL from the Tendaguru-Schichten as figured by KRENKEL is not a convincing *Neithea atava*. In the British Museum (Nat. Hist.) a series of specimens is kept from the same locality which undoubtedly belong to the same species. Dr. N. J. MORRIS attracted my attention to the fact that those specimens do not specifically differ from *N. atava*. The largest specimens are very much larger than the sizes mentioned by ROEMER and D'ORBIGNY but as no other differences can be found there appears to be no reason to keep them separated from *N. atava*.

Neithea (Neithea) kanmerai HAYAMI : by following H. WOODS interpretation of *N. atava*, HAYAMI found himself compelled to create a new species for specimens which are obviously large *N. atava*; he has been misled by D'ORBIGNY's description of *N. atava* : the figure is supposed to be in « grandeur naturelle », where in fact its scale is 3/2; this explains the relatively narrow beak on the figure and on this HAYAMI bases the differentiation. HAYAMI's differences in ribs structure are due to the fact that he only possesses « Steinkernen ».

Differentiation. — Compared with other *Neithea*-species *Neithea atava* has always been well isolated. Only H. WOODS misinterpreted the species, which is certainly very rare for him. As *N. atava* he described large specimens of *N. notabilis* (MUENSTER in GOLDFUSS). When well preserved both species are easily differentiated because *N. atava* is a *Neithea* s. s. and has equal or subequal auricles whereas *N. notabilis* is a *Neithella* and has very unequal auricles.

Very worn individuals of *N. syriaca* (CONRAD) or *N. quinquecostata* (SOWERBY) could be taken for *N. atava* because of the general shape; this only seldom happens because there is a stratigraphical discrepancy.

From all other *Neithea*-species *N. atava* can be differentiated by the absence of proper intercalary ribs. From *Neithella*-species it differs in having subequal auricles.

Generic attribution. — *Pecten atavus* ROEMER exhibits the hinge structure with teeth typical for the genus *Neithea*. The equal auricles and the symmetrical shell-shape justify the conviction that the correct name is *Neithea (Neithea) atava* (ROEMER, 1839).

Stratigraphical and geographical distribution :

Berriasian :

SWITZERLAND :

Crases de la Veveyse, Châtel-Saint-Denis (Fribourg) (Mus. Laus.).

Valanginian :

FRANCE :

Censeau (Jura) (Mus. Gen.).

Salève (Haute-Savoie) (Mus. Gen.).

Vallon-des-Verrières (Doubs) (Univ. Neuch.).

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

Hauterivian :

BULGARIA :

Skala, district Tolbouchinsk (Univ. Sofia).

FRANCE :

Auxerre (Yonne) (Univ. Neuch.).

Bord du Suran (Ain) (Mus. Gen.).

Censeau (Jura) (Mus. Gen.).

Craz (Ain) (Mus. Laus.).

La Croisette, Salève (Haute-Savoie) (Mus. Gen.).

Grande Varappe, Salève (Haute-Savoie) (Mus. Gen. orig. DE LORIOI, 1861, pl. 14, fig. 3).

Grange Marin, Salève (Haute-Savoie) (Mus. Gen. orig. DE LORIOI, 1861, pl. 14, fig. 1).

Leymiat (Ain) (Mus. Gen.).

Marolles (Aube) (Mus. Gen.).

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

Pontarlier (Doubs) (Mus. Laus.).

Salève (Haute-Savoie) (Mus. Gen.).

Les Verrières françaises (Doubs) (Univ. Neuch.).

Villers-le-Lac (Doubs) (Mus. Laus.).

G.F.R. :

Bavaria : Pechthäusl, Berchtesgaden, Anschnitt IV der Deutsche Alpenstrasse (Mü.).

SWITZERLAND :

Auberson (Vaud) (Mus. Laus.).

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

Routes des Combes au Crêterset, Côte aux fées (Vaud) (Mus. Laus.).

Hauterive (Neuchâtel) (Mus. Gen., Mus. Laus.).

Mormont (Vaud) (Mus. Laus.).

Neuchâtel (Neuchâtel) (Univ. Neuch.).

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

Tylonne près Brethonnières (Vaud) (Mus. Laus.).

Vallée de Nozon (Vaud) (Mus. Laus.).

Vallorbes (Vaud) (Mus. Laus.).

Vaulion (Vaud) (Mus. Laus.).

Le Voisinage près du Locle (Neuchâtel) (Mus. Gen.).

Barremian :

BULGARIA :

Kalougerovo (Univ. Sofia).

FRANCE :

Château d'Annecy (Haute-Savoie) (Mus. Gen.).

Châtillon-de-Michaille (Ain) (Mus. Gen. orig. PICTET et CAMPICHE, pl. 180, Mus. Laus.).

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

Morteau (Doubs) (Univ. Neuch.).
 Orgon (Bouches-du-Rhône) (Mus. Laus.).
 Petit Salève (Haute-Savoie) (Mus. Gen.).
 Régny (Haute-Savoie) (Mus. Gen. orig. PICTET et
 CAMPICHE, pl. 180).
 Thoiry (Ain) (Mus. Laus.).

SWITZERLAND :

Auberson (Vaud) (Mus. Laus.).
 Bôle (Vaud) (Univ. Neuch.).
 Cressier (Neuchâtel) (Univ. Neuch.).
 Gondoux, Mormont (Vaud) (Mus. Laus.).
 Mormont (Vaud) (Mus. Laus., Univ. Neuch.).
 Neuchâtel (Neuchâtel) (Univ. Neuch.).
 Roc-sur-Cournaux (Neuchâtel) (Univ. Neuch.).
 La Rusille (Vaud) (Mus. Gen., Mus. Laus., Univ.
 Neuch.).

Neocomian :

ALGERIA :

Arnovel, Constantine (Musé.).

ETHIOPIA :

On the Wabi near Abunass (40-41 E.L., 7-8 N.L.)
 (Mü. orig. DACQUE, 1905 *Vola neumanni*).

FRANCE :

Allègre (Gard) (Mus. Gen.).
 Auxerre (Yonne) (B., Ec. Min., Musé. Coll.
 d'ORBIGNY, 5135 B, Mus. Gen., Mus. Laus.).
 Bernouil (Yonne) (Mus. Gen., Mus. Laus.).
 Bettancourt-la-Ferrée (Haute-Marne) (Musé. Coll.
 d'ORBIGNY, 5135 D).
 Censeau (Jura) (Mus. Gen., Musé. Coll. d'ORBIGNY,
 5135 A).
 Combe-du-Lac (Doubs) (Mus. Gen.).
 Flogny (Yonne) (Mus. Gen.).
 Fortenay (Yonne) (Mus. Laus.).
 Germigney (Haute-Saône) (Mus. Laus.).
 Gy-l'Evêque (Yonne) (B., Mus. Gen.).
 Jonches (Yonne) (Mus. Gen.).
 Lattes (Alpes-Maritimes) (B.).
 Marolles (Aube) (B., Ec. Min., Musé. Coll.
 d'ORBIGNY, 5135 C et D, Mus. Gen., Mus.
 Laus.).
 Morteau (Doubs) (Mus. Gen.).
 Orgon (Bouches-du-Rhône) (B.).
 Plagny (Yonne) (Musé.).
 Rimet (Isère) (Mus. Gen.).
 Saint-Sauveur (Yonne) (Ec. Min.).
 La Varape, Salève (Haute-Savoie) (Mus. Laus.).
 Vaucluse (Doubs) (N.M.W.).
 Ventoux (Musé. Coll. d'ORBIGNY, 5135).
 Villeversure (Ain) (Mus. Laus.).
 Villers-le-Lac (Doubs) (B.).

G.D.R. :

Galgenberg, Quedlinburg (B.).

G.F.R. :

Achim, Börsum, Hannover (Mus. Laus.).
 Berklingen (B.).
 Gross Vahlberg (B.).
 Schöppenstedt (B., Mus. Gen.).

SWITZERLAND :

Cressier (Neuchâtel) (Mus. Gen., Univ. Neuch.).
 Hauterive (Neuchâtel) (B., Mus. Gen.).
 Landeron (Neuchâtel) (Mus. Gen.).
 Neuchâtel (Neuchâtel) (B., Univ. Neuch.).
 La Rusille (Vaud) (Mus. Gen.).
 Sainte Croix (Vaud) (DR., Ec. Min., Mus. Gen.).
 Sentis (Appenzell) (B.M., Halle).

TANZANIA :

Trigonia schwarzi-bed :

Mikadi, hills to the N.E. of and overlooking Miambo,
 Tendaguru (B.M.).
 Mikadi (B.M.).
 Western locality, Niongala, Tendaguru (B.M.).

Aptian :

TANZANIA :

Eastern locality, N. of Membuku River, Niongala,
 Tendaguru (B.M.).

Albian ? :

HUNGARY :

Pitulat, Steiersdorf, Banat (N.M.W.).

Lower Cretaceous :

TRINIDAD :

Pointe-à-Pierre (B.M. orig. L. R. Cox, 1954, pl. 64,
 fig. 1, L. 83487).

9. — *Neithea (Neithea) sexcostata*

(S. WOODWARD, 1833).

(Pl. 5, figs. 2a, 2b.).

- | | | |
|--------|---|---|
| .1833 | <i>Pecten sexcostatus</i> | S. WOODWARD, p. 48,
pl. 5, f. 29. |
| 1833 | <i>Pecten striatocostatus</i>
(pro parte) | A. GOLDFUSS, p. 55, pl.
93, figs. 2, c, d, e
(non 2, a, b, f, g). |
| v.1847 | <i>Janira Dutemplei</i>
d'Orbigny | A. D'ORBIGNY, pp. 646,
647, pl. 447, figs. 8-11. |
| v.1850 | <i>Janira Dutemplei</i> d'Orb. | A. D'ORBIGNY, p. 253,
n° 880. |
| v.1850 | <i>Janira carantonensis</i>
d'Orb. | A. D'ORBIGNY, p. 170,
n° 509, |
| (1854) | <i>Pecten sexcostatus</i>
Woodw. | J. MORRIS, p. 177. |
| .1869 | <i>Janira striato-costata</i> | E. FAVRE, pp. 156-158,
pl. 13, fig. 12, 13. |
| .1887 | <i>Vola (Janira) Dutemplei</i>
d'Orb. | A. PÉRON, pp. 164-166. |
| .1889 | <i>Vola striato-costata</i>
Gldf. | E. HOLZAPFEL, p. 239,
pl. 26, fig. 19. |
| 1890 | <i>Pecten Dutemplei</i>
d'Orbigny (sub <i>Janira</i>)
non <i>Pecten Dutemplei</i>
d'Orbigny | A. PÉRON, pp. 232, 233. |
| 1895 | <i>Vola striato-costata</i>
Goldf. | F. VOGEL, pp. 26, 27. |
| .1896 | <i>Vola striato-costata</i> ?
Goldf. | A. RUTOT, pp. 13, 31. |
| .1896 | <i>Vola Dutemplei</i> ? d'Orb. | A. RUTOT, pp. 14, 31. |
| (1896) | <i>Vola Dutemplei</i> d'Orb. | O. REIS, p. 7. |
| 1898 | <i>Vola striato-costata</i>
Goldf. sp. | G. MUELLER, p. 37,
pl. 4, fig. 8. |
| (1899) | <i>Janira dutemplei</i> d'Orb. | A. W. ROWE, p. 364. |
| (1901) | <i>Janira Dutemplei</i> d'Orb. | A. MICHALET, pp. 582,
586. |
| (1901) | <i>Vola striato-costata</i>
Goldf. sp. | A. WOLLEMANN, p. 18. |
| .1902 | <i>Vola striato-costata</i>
Goldfuss sp. | A. WOLLEMANN, pp. 63,
64. |
| ?1902 | <i>Vola</i> cfr. <i>Dutemplei</i>
d'Orbigny | P. CHOFFAT, p. 149, pl. 3,
figs. 8, 9. |
| v.1903 | <i>Pecten (Neithea) sex-</i>
<i>costatus</i> , Woodward | H. WOODS, pp. 214-217,
pl. 40, figs. 10-15,
pl. 41, figs. 1-10. |
| (1909) | <i>Pecten (Neithea)</i> cf.
<i>sexcostatus</i> Woodward | B. RYDZEWSKI, p. 193. |

OF THE SUBFAMILY NEITHEINAE, ETC.

1909 *Neithea* cf. *striato-costata* Gldf. sp. W. ROGALA, p. 744.
 .1909 *Neithea striatocostata* Gldf. W. ROGALA, p. 746, fig. 1.
 .1925 *Vola sexcostata* Woodw. J. P. J. RAVN, p. 31, pl. 1, fig. 7.
 v.1930 *Vola (Janira) Dutemplei* d'Orbigny V. TZANKOV, p. 43.
 v.(1931) *Vola (Janira) Dutemplei* d'Orb. V. TZANKOV, tabl. III.
 (1931) *Neithea sexcostata* Woodw. B. KOKOSZYNSKA, p. 668.
 .1932 *Vola striato-costata* Goldfuss D. WOLANSKY, p. 19.
 v.1937 *Neithea notabilis* (Münster, 1833) L. LEHNER, pp. 103, 104, pl. 23, fig. 14, pl. 26, fig. 4.
 1942 *Neithea sexcostata* Woodward V. STCHEPINSKY, pp. 56, 57, pl. 4, fig. 6.
 1948 *Neithea sexcostata* (Woodward) G. TAVANI, p. 93.
 (1950) *Neithea sexcavata* (sic) (Woodw.) L. N. LEONTIEV, p. 294.
 v.1956 *Neithea martiniana* d'Orbigny - in coll. J. ROGER, n° 42, figs. 1-4.
 v.1956 *Neithea dutemplei* (d'Orbigny) J. ROGER, n° 43, figs. 1-5, 8-11.
 v.1956 *Neithea carantonensis* (d'Orbigny) J. ROGER, n° 48, figs. 1-4.
 (1964) b *Neithea sexcostata* Woodw. H. ARNOLD, p. 207.
 (1964) c *Neithea sexcostata* (Woodw.) H. ARNOLD, p. 317.

Original description :

S. WOODWARD did not give a description :

Pecten sexcostatus, Tab. 5, fig. 29; Harford Bridge, c, Bishop's Bridge, r.

In footnote : « The Norfolk specimens are identical with those of the green sand of Wiltshire ».

Pl. 5, fig. 29 are poor figures but they represent a left and right valve in a recognizable way.

Neithea dutemplei.

J. testâ ovato-oblongâ, trigonâ, transversâ; valva inferiore maximè convexâ, inflatâ, incurvatâ, radiatim 6-angulatâ, angulis elevatis, carinatis, tricostulatis; interstitiis sulcis excavatis, bi- vel tricostulatis.

Dimensions. — Largeur, 15 mm. Par rapport à la largeur : longueur 70/100; épaisseur, 50/100. Angle apical, sans les oreilles, 50°.

Coquille très convexe, ovale; oblongue, trigone, transverse. Valve inférieure bombée, à sommet fortement recourbé, pourvue de six angles rayonnans très saillans, carénés, formés d'une grosse côte divisée en trois petites côtes longitudinales. Entre les angles saillans se trouvent des sillons fortement excavés où se remarquent deux ou trois côtes étroites, séparées par de profonds sillons.

Rapports et différences. — Voisine du *J. quinquecostata* et confondue avec elle, cette espèce s'en distingue par le manque de stries concentriques, par ses angles bien plus saillans, par ses sillons plus excavés et tout autrement ornés. Ce sont bien deux espèces différentes.

Localité. — M. Dutemple l'a rencontrée dans la craie blanche ou étage sénonien de Chavot (Marne).

Neithea carantonensis.

Jolie espèce avec 7 côtes intermédiaires très inégales entre chaque grosse côte, et striées en travers. Charas (Charente-Inférieure).

Additional description :

Number of studied specimens : 943.

Austria	Santonian	1
Belgium	Cenomanian	5
	Cenomanian-Turonian	16
	Turonian-Coniacian	13
	Upper Senonian	55
Belgium-Holland ...	Maastrichtian	452
Bulgaria	Maastrichtian	5
Czechoslovakia ...	Cenomanian-Turonian	3
France	Cenomanian	4
	Senonian :	
	Charente	12
	Provence	32
G.D.R.	Cenomanian : Saxony	15
	Senonian	7
	Maastrichtian : Rügen	82
G.F.R.	Senonian	20
	Maastrichtian	6
Great Britain	Cenomanian	54
	Senonian	148
Iran	Upper Cretaceous	1
Poland	Senonian : Silesia	1
S.A.R.	Upper Cretaceous	3
Sweden	Senonian	2
U.S.S.R.	Maastrichtian	6

Location and designation of type-specimens. — WOODS, 1903, page 217: lost.

Janira dutemplei D'ORBIGNY : in the Muséum national d'Histoire naturelle, Paris; lectotype : Coll. D'ORBIGNY, 7616, chosen by J. ROGER, 1956.

Janira carantonensis D'ORBIGNY : in the same Muséum; lectotype : Coll. D'ORBIGNY, 6474, chosen by J. ROGER, 1956.

Neithea martiniana D'ORBIGNY in J. ROGER : in the same Muséum; holotype : Coll. D'ORBIGNY, 7615, designated by J. ROGER, 1956.

Locus typicus. — Harford Bridge (Norwich) (England).

Neithea dutemplei : Chavot (Marne) (France).

Neithea carantonensis : Charas (Charente-Maritime) (France).

Neithea martiniana : Martigues (Bouches-du-Rhône) (France).

Stratum typicum. — Upper Chalk (Upper Senonian).

Neithea dutemplei : Sénonien (craie blanche).

Neithea carantonensis : Cénomaniens.

Neithea martiniana : Sénonien.

Measurements. — Very small *Neithea*-species: U.P.D. and W. inferior to 30 mm.

On right valves U.P.D. > W.

On left valves U.P.D. \geq W.

Description.

Diagnosis. — Small *Neithea*-species with very convex right valve and flattened left valve. Both valves bear 6 very salient principal ribs with deep intercostal intervals, which are, in the same way as the inwardly bent areas and the equal auricles, covered with thin, very numerous, not very salient riblets which are crossed by slightly salient concentric growthlines.

To Woods', 1903, pages 215 and 216, description nothing essential can be added. The differences which he noted between his forma α and forma β are probably little more than local variations: in Maastricht most specimens have the forma α , which Woods thought to be limited to the Cenomanian.

Discussion:

Variability. — The variability existing in this species is illustrated by Woods' recognition of 2 formae. He saw those forms as stratigraphical varieties corresponding to different horizons and representing an evolutionary sequence; as mentioned above it is more probably a question of local varieties due to environmental factors.

Synonymy. — *Pecten sexcostatus* WOODWARD, although established without description is completely defined by its figures and localization. The booklet by WOODWARD was apparently not well-known on the European continent because continental authors did not use WOODWARD's name before it was propagated by H. Woods.

Pecten striatocostatus GOLDFUSS, plate 93, figures 2 c-e (non fig. 2, a, b, f, g) also belongs here: the confusion with *N. striatocostata* (GOLDFUSS) (see below under that species) resulted in many authors describing *N. sexcostata* sub *N. striatocostata*.

GOLDFUSS' figures are not quite satisfactory: 2, c, d show auricles which are oversized and 2 e is rather fanciful regarding the ornamentation.

Janira dutemplei D'ORBIGNY is undoubtedly a *N. sexcostata*; D'ORBIGNY's figures do not correspond to reality; he drew a forma β and his specimens belong to forma α , as can be seen on fiche 43 by ROGER.

Janira carantonensis D'ORBIGNY falls into synonymy of *N. sexcostata*; contrarily to what D'ORBIGNY and J. ROGER wrote (une valve droite... qui correspond parfaitement à la diagnose de D'ORBIGNY...) the specimens from the D'ORBIGNY collections have 4 to 5 intercalary ribs (this can be seen on fig. 1 of

ROGER). They correspond with forma β , but their principal ribs are not so very salient. I can see no specific difference between figure 1 of ROGER and figure 6 a, plate 41 in Woods.

Neithea martiniana (manuscript D'ORBIGNY in J. ROGER) is established with very poorly preserved specimens; I do not hesitate to consider them synonyms with *N. sexcostata* because, also from Martinique, there are several very well preserved *N. sexcostata* specimens in the collections of the Kat. Univ. Leuven.

Neithea (Neithea) matsumotoi sp. nov. I. HAYAMI, 1965 (pp. 297-299, pl. 41, figs. 1-7) does not seem to be different from *N. sexcostata*, despite what I. HAYAMI says; as far as can be judged from description and figures only, no difference can be found; but *N. matsumotoi* is stratigraphically earlier than *N. sexcostata* and, because of that, it seems preferable not to draw conclusions without having seen the material.

In the Prodrôme D'ORBIGNY described a *Janira albensis* from various Lower Cretaceous localities. The lectotype figured by J. ROGER on fiche 40 is very fragmentary. The part which is left shows a nice rib-section which could belong to *N. sexcostata*. The very incomplete state of the sole specimen makes it impossible to draw a conclusion.

Differentiation. — *Neithea sexcostata* (WOODWARD) is very small in comparison to other Upper-Cretaceous *Neithea*-species and so little confusion took place. If it occurs it is usually for obvious reasons with young individuals of other species.

From all species with well delimited intercalary ribs such as *N. alpina* (D'ORBIGNY), *N. regularis* (SCHLOTHEIM), *N. coquandi* (PERON), *N. quinquecostata* (SOWERBY), *N. aequicostata* (LAMARCK), *N. hispanica* (D'ORBIGNY), *N. syriaca* (CONRAD), *N. sexcostata* is differentiated by the very salient principal ribs and the not well delimited, irregular and radially striated ribs. *N. atava* (ROEMER) does not have real intercalary ribs.

Other *Neithea*-species have unequal auricles: this is so in *N. gibbosa* (PULTENEY), *N. fleuriausiana* (D'ORBIGNY), *N. deshayana* (MATHERON), *N. dutruegei* (COQUAND), *N. dilatata* (D'ORBIGNY), *N. notabilis* (MUNSTER in GOLDFUSS).

N. sexangularis (D'ORBIGNY) is relatively much wider (W. > U.P.D.) and the principal ribs are even more salient.

N. striatocostata (GOLDFUSS) is the only species with which confusion may easily arise. In both species the ribs are radially striated which gives the ornamentation a similar aspect; however in *N. sexcostata* the principal ribs are always much more salient and

sharper, the number of intercalaries is higher and the areas are more inwardly bent. In small specimens it is preferable to differentiate both species by their numbers of intercalaries and on account of the U.P.D./W. index: in *N. sexcostata* it is always >1 ; in *N. striatocostata* it is ≤ 1 .

Generic attribution. — The general shape and the ornamentation of *Pecten sexcostatus* WOODWARD, 1833 correspond so fully with the generic characteristics of *Neithea* that even without knowing the hinge teeth we may assume that the correct name is *Neithea (Neithea) sexcostata* (WOODWARD, 1833).

Stratigraphical and geographical distribution:

Cenomanian:

BELGIUM:

Tourtia de Tournai, Tournai (I.R.Sc.N.B.).

CZECHOSLOVAKIA:

Chribska (Kreibitz) (B.).

FRANCE:

Le Havre (B.M.).

Le Mans (N.M.W.).

G.D.R.:

Prinzenhöhe, Dresden (DR. orig. GEINITZ, Elbthal I, pl. 45, fig. 10).

GREAT BRITAIN:

Upper Greensand:

Lulworth Cove (Dorset) (B.M.).

Warminster (Wilts) (B.M., N.M.W., S.M.).

Schloenbachia varians-zone:

Aburton (Sussex) (B.M.).

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

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

Dover (Kent) (S.M. orig. H. WOODS, pl. 41, fig. 6a-c, B 6395, p. 41, figs. 7, 8, B 211, B 212).

Mere, Middle of Dead Maid Pit (Wilts) (B.M.).

Merstham (Surrey) (B.M.).

Saint Catherine's Point (Isle of Wight) (B.M.).

Swindon, Chiselden Camp, tranches below hospital (Wilts) (B.M.).

Ventnor (Isle of Wight) (S.M.).

A. rhotomagensis-zone:

Folkestone (Kent) (B.M.).

Holaster subglobosus-zone:

Burwell (Cams.) (S.M.).

Cherryhinton (S.M.).

Dover (B.M.).

Folkestone (B.M.).

Cenomanian-without specification:

Bingham (Dorset) (B.M.).

Cenomanian-Turonian transition:

FRANCE: Tourtia de Mons, Assise de Saint-Aybert:

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

Boussières-sur-Sambre (Nord) (I.R.Sc.N.B.).

G.D.R.:

Elbstollen, Dresden (DR.).

Turonian:

G.D.R.:

Plenus-zone:

Goldne Höhe, Dresden (DR.).

Mittelturon:

Kohlberg, Pirna (DR.).

Kopitz, Pirna (DR.).

Polenzthal, Hohnstein (DR. orig. PRESCHER).

Strehlen (DR. orig. GEINITZ, Elbthal II, pl. 10, figs. 17, 18).

Turonian-Senonian transition:

AUSTRIA:

Gosauthal (N.M.W.).

BELGIUM: Craie de Maisières:

Maisières (B.M.).

Senonian:

CZECHOSLOVAKIA: Iserschichten:

Lindenau (DR.).

Böhmisch Zwickau (DR.).

FRANCE:

Paris Basin:

Chavot (Marne) (Musé. d'ORBIGNY coll., 7616, N.M.W.).

Meudon (Seine-et-Oise) (Mus. Laus.).

S.E. France:

Ausseing (Haute-Garonne) (B.M.).

Bugarach, Rennes-les-Bains (Aude) (B.M.).

Etang-de-Berre, Martigues (Bouches-du-Rhône) (B., K.U.L.).

Le Beausset (Var) (Musé.).

Le Castellet (Var) (B.M.).

Martigues (Bouches-du-Rhône) (B., B.M., K.U.L., Musé., Mus. Gen.).

S.W. France:

Charas (Charente-Maritime) (Musé.).

G.D.R.:

Langenberg, Westerhausen (B.).

Salzberg, Quedlinburg (B., DR.).

G.F.R.:

Coesfeld (B.).

Haldem (B., Halle, Mus. Gen., N.M.W.).

Lauingen, Königslutter (B. orig. GRIEPENKERL, 1889).

Lüneburg (B. orig. STROMBECK, 1863, p. 155).

GREAT BRITAIN:

Micraster cortestudinarium-zone:

Dover (Kent) (B.M.).

The Cleft, Beer Head (Devon) (B.M.).

Micraster coranguinum-zone:

Falmer Church (Sussex) (B.M.).

Gravesend (Kent) (B.M.).

Michelclever (Hants) (B.M., S.M.).

Odiham (Hants) (B.M.).

Thanet Coast (B.M.).

Uintacrinus-band:

Littleton (Hants) (S.M.).

Margate (Kent) (B.M.).

Odiham (Hants) (B.M.).

Thanet Coast (B.M.).

Marsupites testudinarium-band:

Brighton (Sussex) (B.M.).

Offaster pilula-zone, hagenowia-horizon:

North Lancing (Sussex) (B.M.).

Offaster pilula-zone, pilula-subzone:

Weston (Hants) (S.M.).

Goniotenthis quadratus-zone:

Angmering (Sussex) (B.M.).

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

Charmandean Lang (Sussex) (B.M.).

Coddenham Church (Suffolk) (B.M.).

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

East Harnham, Salisbury (Wilts) (B.M., orig. H. Woods : pl. 40, fig. 10 : L 64216; pl. 40, fig. 11 : L 64217; pl. 40, fig. 12 : L 64218; pl. 40, fig. 13 : L 64220; pl. 40, fig. 14 : L 64219; pl. 40, fig. 15 : L 64223; pl. 41, fig. 1 : L 64221; pl. 41, fig. 2 : L 64222).

Portsdown Hills (Hants) (B.M.).
Shawford (Hants) (S.M.).
West Harnham, Salisbury (Wilts) (B.M.).
White Nothe (Dorset) (B.M.).

Belemnitella mucronata-zone : low in *B. mucronata*-zone :
Whitecliff Bay (Isle of Wight) (B.M.).

B. mucronata-zone : middle *B. mucronata*-zone :
Catton, Norwich (B.M.).
Hartford Bridges, Norwich (B.M., S.M., orig. H. Woods, pl. 41, fig. 3, B 1120).

B. mucronata-zone :
Alderbury, Salisbury (Wilts) (B.M.).
Norwich (Cunnell's Pit and Dereham Road) (B.M.).
Scratchell's Bay (Isle of Wight) (B.M.).
Studland (Dorset) (B.M.).

POLAND : Silesia :
Sprottau (not *in situ* : Geschieben) (B.).

Senonian (Campanian) :
IRAN :
Tang Kora (B.M.).
SWEDEN :
Ignaberga (GR.).

Senonian s.l. :
GREAT BRITAIN :
Chalk :
Braishfield (Hants) (S.M.).
Sompting (Sussex) (B.M.).
Upper Chalk :
Brighton (Sussex) (S.M.).
Compton, Winchester (Hants) (S.M.).
Guildford (Surrey) (S.M.).
Lewisham (Kent) (S.M.).
Margate (Kent) (B.M.).
Narborough (Norfolk) (B.M., S.M.).
Norwich (Norfolk) (B.M., S.M.).
Salisbury (Wilts) (B.M.).
Silkstead (S.M.).
Trimingham (B.M.).
Wanborough (Surrey) (B.M.).
West Horsley (Surrey) (B.M.).

Maastrichtian :
BELGIUM-HOLLAND :
Ciply (B., DR., Ec. Min., I.R.Sc.N.B., Musé.).
Kanne (I.R.Sc.N.B., Ma., N.M.W.).
Kunrade (DR.).
Maastricht (B., DR., I.R.Sc.N.B.).
Sint-Pietersberg, Maastricht (B., Ma., I.R.Sc.N.B.).

BULGARIA :
Shumen (Univ. Sofia).
Somovit (Univ. Sofia).

G.D.R. : Lower Maastrichtian :
Rügen (B., DR., GR., Halle, N.M.W.).

G.F.R. :
Boimstorf (GH.).
Lägerdorf (GH.).

GREAT BRITAIN : *Liostrea lunata*-zone :
Trimingham (Norfolk) (B.M.).

U.S.S.R. :
Nagorzany, Lwow (Ukraine) (B., Ec. Min., N.M.W.).

Upper Cretaceous :

GREAT BRITAIN :

Wool (Dorset) (B.M.).

Senonian derived in Eocene gravels :

Haldon Hills (B.M.).

Chalk flint in drift :

Peterhead (Aberdeenshire) (B.M.).

MOZAMBIQUE :

Mazamba River, Sheringoma (B.M. mentioned in R. B. NEWTON, 1916, p. 148).

S.A.R. :

Umtanvuna Series, Umzanbana River, Port Natal (B.M.).

10. — *Neithea* (*Neithea*) *striatocostata*

(A. GOLDFUSS, 1833).

(Pl. 3, fig. 2 a-d.)

- | | | |
|---------|---|---|
| v.1833 | <i>Pecten striatocostatus</i> | A. GOLDFUSS, p. 55,
pl. 93, figs. 2, a, b, g,
f (non figs. 2, c, d, e). |
| ?1837 | <i>Pecten Striatocostatus</i>
Goldf. var. <i>gibba</i> , <i>complanata</i> , <i>maxima</i> | A. D'ARCHIAC, p. 186. |
| 1839 | <i>Pecten striatocostatus</i>
Goldf. | H. B. GEINITZ, p. 22. |
| (1840) | <i>Pecten striatocostatus</i>
Goldf. | J. CORNUEL, p. 258. |
| .1841 | <i>Pecten striato-costatus</i>
Goldf. | F. A. ROEMER, p. 55. |
| (1843) | <i>Pecten Striatocostatus</i>
Goldf. | A. LEYMERIE, p. 27. |
| ?1846 | <i>Pecten striato-costatus</i>
Goldf. | A. E. REUSS, p. 32. |
| ?1847 | <i>Pecten striato-costatus</i>
Goldfuss | J. MUELLER, p. 33. |
| v.1847 | <i>Janira Truellei</i>
d'Orbigny | A. D'ORBIGNY, pp. 647,
648, pl. 448, figs. 1-4. |
| v.1847 | <i>Janira striato-costata</i>
d'Orbigny | A. D'ORBIGNY, pp. 650,
651, pl. 449, figs. 5-9. |
| ?(1850) | <i>Pecten striato-costatus</i>
Goldf. | H. B. GEINITZ, p. 188. |
| .1850 | <i>Janira striato-costata</i>
d'Orb. (pro parte, non
stratum) | A. D'ORBIGNY, p. 170,
n° 508. |
| v.1850 | <i>Janira substriato-costata</i> | A. D'ORBIGNY, p. 253,
n° 884. |
| v.1850 | <i>Janira Truellei</i> | A. D'ORBIGNY, p. 253,
n° 881. |
| (1859) | <i>Pecten (Janira) striato-costatus</i>
Goldf. | J. T. BINKHORST VAN
DEN BINKHORST, pp.
134, 154. |
| v?1863 | <i>Janira striatocostata</i>
Goldf. | A. VON STROMBECK, p.
155. |
| (1866) | <i>Pecten striatocostatus</i>
Gf. | C. GIEBEL, p. 48. |
| (1875) | <i>Janira substriatocostata</i>
d'Orb. | H. ARNAUD, pp. 21, 26,
32, 33, 36, 43, 45, 52. |
| (1888) | <i>Vola striatocostata</i>
d'Orb. | F. E. GEINITZ, p. 743. |
| .1892 | <i>Vola substriato-costata</i>
d'Orb. | F. VOGEL, p. 63. |
| .1895 | <i>Vola substriato-costata</i>
d'Orb. | F. VOGEL, p. 27. |
| (1896) | <i>Vola striatocostata</i>
Goldf. sp. | O. REIS, p. 7. |
| (1897) | <i>Vola striatocostata</i>
Goldf. sp. | O. REIS, p. 75. |

OF THE SUBFAMILY NEITHEINAE, ETC.

?1898	<i>Vola alpina</i> d'Orb.	G. MUELLER, pp. 37, 38, pl. 4, fig. 7.
(1899)	<i>Janira striato-costata</i> d'Orb.	N. KRISCHTAFOVITSCH, pp. 9, 10.
(1901)	<i>Vola</i> aff. <i>striato-</i> <i>costata</i> d'Orb.	M. VON PALFY, p. 120.
?1904	<i>Neithea striatocostata</i> Goldfuss	H. DOUVILLÉ, p. 267, pl. 39, figs. 5-8.
(1905)	<i>Neithea striatocostata</i> Goldfuss	J. DE MORGAN, p. 180.
.1906	<i>Neithea Böckhi</i> Pethö nov. sp.	J. PETHÖ, pp. 224-227, pl. 13, fig. 10, pl. 15, figs. 8, 9, 12.
.1906	<i>Neithea</i> aff. <i>striatocostata</i> d'Orb.	J. PETHÖ, pp. 228-230, pl. 16, figs. 2, 2A.
(1911)	<i>Neithea striato-costata</i> Goldf.	W. ROGALA, p. 493.
1915	<i>Janira</i> (sic) <i>striatocostata</i> Goldf.	E. FISCHER, p. 261.
.1918	<i>Pecten</i> (<i>Neithea</i>) <i>Woodsi</i> n. sp.	J. WOLDRICH, p. 285, pl. 4, fig. 13.
(1919)	<i>Neithea striatocostata</i> Goldf.	F. KOCH, p. 239.
1923	<i>Vola</i> (<i>Neithea</i>) <i>striato-</i> <i>costata</i> Goldf.	A. JESSEN et H. ØDUM, p. 38.
(1926)	<i>Vola</i> (<i>Neithea</i>) <i>striato-</i> <i>costata</i> Goldf.	H. ØDUM, p. 181.
v.1927	<i>Neithea Philippsoni</i> n. sp.	J. BOEHM, pp. 203, 204, pl. 13, fig. 7 a.
v.1930	<i>Vola</i> (<i>Janira</i>) <i>striato-</i> <i>costata</i> Goldfuss	V. TZANKOV, pp. 42, 43.
v.1931	<i>Vola</i> (<i>Janira</i>) <i>alpina</i>	V. TZANKOV, tabl. III.
v.1931	<i>Vola</i> (<i>Janira</i>) <i>striato-</i> <i>costata</i> Goldf.	V. TZANKOV, tabl. III.
v.1934	<i>Vola striatocostata</i> Goldf.	ST. T. JELEV, pp. 119, 123.
1940	<i>Neithea alpina</i>	L. RIEDEL, p. 88.
(1945)	<i>Vola striato-costata</i> Goldf.	A. JESSEN, p. 13.
(1964) b	<i>Neithea</i> cf. <i>striatocostata</i> Glf.	H. ARNOLD, p. 207.
non 1842	<i>Pecten striato-costatus</i> Goldf.	P. MATHÉRON, p. 185.
	Indicated as coming from the Neocomian of Allauch : it could be a <i>N. atava</i> (ROEMER).	
non 1833	<i>Pecten striato-costatus</i> <i>nobis</i>	A. GOLDFUSS, p. 55, pl. 93, figs. 2, c, d, e.
= 1833	<i>Neithea sexcostata</i> (Woodward)	
non 1854	<i>Pecten striato-costatus</i> Goldf.	J. MORRIS, p. 177.
non 1869	<i>Janira striatocostata</i>	E. FAVRE.
non 1889	<i>Vola striatocostata</i>	E. HOLZAPPEL.
non 1895	<i>Vola striato-costata</i>	F. VOGEL.
non 1896	<i>Vola striatocostata?</i> Goldf.	A. RUTOT, p. 31.
non 1902	<i>Vola striato-costata</i> Goldfuss sp.	A. WOLLEMAN, p. 63.
non 1909	<i>Neithea</i> cf. <i>striato-</i> <i>costata</i> Gldf. sp.	W. ROGALA, p. 744.
non —	<i>Neithea striatocostata</i> Gldf.	W. ROGALA, p. 746, fig. 1.
non 1932	<i>Vola striato-costata</i> Goldfuss	D. WOLANSKY, p. 19.

Janira truellei D'ORBIGNY : in the Muséum national d'Histoire naturelle in Paris (France); coll. D'ORBIGNY, 7619.

Janira substriato-costata D'ORBIGNY : id.; lectotype chosen by J. ROGER : coll. D'ORBIGNY, 7618 F.

Neithea böckhi PETHÖE : in the Hungarian geological service in Budapest.

Pecten (*Neithea*) *woodsii* WOLDRICH : probably in the National Museum in Prague, Czechoslovakia.

Neithea philippsoni J. BOEHM : British Museum (Natural History) in London : L 49458.

Locus typicus. — Maastricht (Sint Pietersberg) (Holland).

Neithea truellei : Saintes (Charente-Maritime) (France) (O.D.).

Neithea substriatocostata : Cognac (France) (designated by J. ROGER).

Neithea böckhi : Cerevic (Fruška Gora) (Yugoslavia).

Neithea woodsii : Neratovice (Czechoslovakia).

Neithea philippsoni : Kandili (östlich von Karagahli) (Turkey).

Stratum typicum. — Im Kreidetuff zu Maastricht (Upper Maastrichtian).

Neithea truellei : Sénonien (Santonian ?).

Neithea substriatocostata : Sénonien (Coniacian ?). grauer Tonmergel (Upper-Senonian).

Neithea böckhi : glimmeriger schwarzer und dunkelgrauer Tonmergel (Upper-Senonian).

Neithea woodsii : Cenoman.

Neithea philippsoni : Senon.

Original description :

Pecten testa ovato-trigona inferne sexangulata concentrice lineata, valva dextra plana, plicis sex lineatis; sinistra convexo gibba, costis senis elatis costulatis, binis minoribus lineisque interstitialibus interpositis; auriculis subaequalibus costulatis.

Faujas pl. 24, f. 4.

E creta tofiana montis St. Petri et chloritea Westphaliae M.B., M.M.

Auch diese Art hat ganz die äussere Form der beiden vorigen (*), unterscheidet sich jedoch sehr deutlich durch die Beschaffenheit ihrer Rippen. Die 6 hochgewölbten Rippen der linker Schale sind durch Furchen in 3-5 kleinere abgetheilt, welche Abtheilung bei den ältern Schalen sehr verwischt, bei den jüngern aber deutlich ausgedrückt ist. Mit zunehmender Alter erheben sich diese Rippen immer mehr und mehr, und erscheinen durch Abnutzung ganz glatt und abgerundet. Je zwischen zweien derselben liegen zwei kleinere, welche öfters durch einige Linien abgetheilt sind, und zwischen ihnen findet

(* *Pecten quadricostatus* [= *Neithea regularis* (SCHLOTHEIM) et *Neithea gibbosa* (PULTENEY)] et *Pecten quinquecostatus*.

Location and designation of type-specimens. — In the Bayerische Staatssammlung für Paläontologie und Historische Geologie in München, G.F.R.

sich eine schmale Linie. In den auf diese Weise sehr verengten Zwischenfurchen bemerkt man concentrische Querlinien, welche aber bei alten Schalen selten erhalten sind. Die rechte, flach-concave Schale hat 6 Falten, deren Ecken am Rande vortreten. Auf ihrer innern Fläche zeigt sie dieselben Furchen wie die vorige Art ⁽¹⁰⁾; auf der äussern aber ist sie mit gedrängten, abwechselnd breitem und schmälern Linien bedeckt, welche gewöhnlich durch mehrere dicke Wachstumsabsätze unterbrochen. Findet sich im Kreidetuff zu Maastricht und in der chloritischen Kreide, bei Coesfeld, Dülmen und Lemförde in Westphalen.

Janira substriatocostata D'ORBIGNY, 1850 = *Janira striatocostata* D'ORBIGNY, 1847.

J. testâ ovato-trigonâ, transversâ; valvâ inferiore convexâ, incurvatâ, radiatim 6-costata; costis obtusis, longitudinaliter striatis; interstitiis sulcis subcomplanatis, longitudinaliter, 4-costulatis; costulis inaequalibus, sulcis angustatis; auriculis inaequalibus, radiatim costulatis.

Dimensions. — Largeur, 50 mm. Par rapport à la largeur : longueur, 87/100; épaisseur, 40/100. Angle apical, sans les oreilles, 66°.

Coquille ovale, trigone, transverse, très-renflée. Valve inférieure très bombée, fortement recourbée au sommet, pourvue de six fortes côtes saillantes, entre lesquelles sont des parties peu excavées, où l'on remarque au milieu deux côtes incertaines, deux autres côtes plus incertaines encore de chaque côté. Celles-ci, de même que les grosses côtes, sont striées en long. Les oreilles inégales sont triangulaires, costulées en rayons.

Rapports et différences. — Voisine, par ses côtes striées en long, du *J. Truellei*, cette espèce s'en distingue à tous les âges par ses côtes plus prononcées et en nombre différent.

Localité. — Elle est spéciale aux couches supérieures de l'étage sénonien du bassin pyrénéen. Elle a été recueillie par moi aux environs de Cognac (Charente) et à Royan (Charente-Inférieure).

Janira Truellei D'ORBIGNY.

J. testâ ovatâ, trigonâ, concentricè striatâ; valvâ superiore complanatâ; valvâ inferiore convexâ, incurvatâ, radiatim 6-angulatâ, angulis obtusis, unicastis; interstitiis sulcis latis, excavatusculis, longitudinaliter 5-costatis; costis longitudinaliter striatis.

Dimensions. — Longueur, 62 mm. Par rapport à la longueur : largeur, 98/100; épaisseur, 41/100. Angle apical, sans les oreilles, 80°.

Coquille ovale, trigone, transverse, renflée, striée concentriquement. Valve supérieure plane; valve inférieure très bombée, recourbée au sommet, pourvue de six angles saillants en rayons, marqués d'une légère côte non distincte, entre lesquelles sont des parties légèrement excavées, sur lesquelles sont cinq côtes longitudinales, peu élevées, fortement striées en long, séparées par des sillons peu profonds. La partie externe de la dernière côte est simplement pourvue de stries rayonnantes. Dans le jeune âge, les cinq côtes intermédiaires sont seulement divisées en deux.

Rapports et différences. — Cette espèce, par ses côtes et par ses stries, est voisine du *J. striato-costata* (*Pecten striato-costata* Goldf.) mais elle s'en distingue par tous ses détails d'ornemens.

Localité. — Elle est propre à l'étage sénonien des environs de Saintes (Charente-Inférieure), où je l'ai recueillie.

⁽¹⁰⁾ *Pecten quinquecostatus*.

Additional description :

Number of studied specimens : 231.

Belgium-Holland ...	Maastrichtian ..	...	...	...	46
Bulgaria ...	Senonian s. l. ..	...	...	...	43
Czechoslovakia ...	Turonian ..	...	...	...	1
France ...	Senonian : Paris Basin ...	...	...	...	9
	Senonian : Charente ...	...	...	...	65
	Senonian : S.E. France ..	...	...	...	8
	Maastrichtian : Cotentin ...	...	...	...	14
G.D.R. ...	Maastrichtian : Rügen ...	...	...	...	8
G.F.R. ...	Cenomanian ...	...	...	...	1
	Senonian ..	...	...	...	22
	Maastrichtian ..	...	...	...	6
Great Britain ..	Maastrichtian ..	...	...	...	2
Hadramaut ...	Upper Cretaceous ...	...	...	...	1
Jordan ...	Upper Cretaceous ...	...	...	...	2
Sweden ...	Senonian ..	...	...	...	3
Turkey ...	Senonian ..	...	...	...	1

Measurements. — Maastricht :

Maastrichtian : topotypes :

U.P.D. varies from 15.3 to 55.5;

W. varies from 15.4 to 57.2.

Senonian-Hoheneggelsen :

U.P.D. varies from 14.5 to 47;

W. varies from 17 to 42.

Senonian-La Valette (Charente) :

on measurable specimens :

U.P.D. varies from 52.8 to 61.9;

W. varies from 44.2 to 71.2.

Description.

Diagnosis. — Medium-sized to large *Neitha*-species with well developed, salient, broad principal ribs, and a varying number of intercalary ribs, relatively large auricles which, as the areas, are covered with riblets. The ribs and intervals show a pronounced radial striation. The beak is not very incurved; the left valve is flattened and the right valve not very convex.

Rib-arrangement: all right valves have 6 broad principal ribs which create digitations on the pallial margins : 4 are very prominent and 2 on the sides are less pronounced. In the deepest part of the principal intervals two radial structures are always present; sometimes they are nothing more than flat ribbons which are separated from one another, and, from the principal ribs, by not much more than striae-like grooves. In the latter case the principal ribs are less prominent than in the former and the digitations less developed. Between both extremes all transitional stages can be found. Principal and intercalary ribs are covered by radial striae : those can be of a variable depth; the ribs thus seem to be divided into riblets. The principal ribs in particular are often divided into 3 parts; 2 riblets lie

either on the rib-sides or very close to the principal ribs in the intervals. This is more frequent on those specimens which have 2 well developed intercalary ribs.

The complete shell is covered by numerous growth-lines; near the pallial margin they form «steplike» structures.

Left valves are different when young and old. Apart from their size, which is a very relative characteristic, the difference lies in the absence and presence of «steplike» prominences which are not found on small (young) valves.

The young valves have principal ribs which are not very salient and not very obviously differentiated. The intercalary ribs are not differentiated and cannot be distinguished from the principal intervals. The only very apparent fact is the very strong radial striation. On some valves the principal ribs can hardly be delimited from the intervals.

On larger valves, the area close to the umbo bears the same ornamentation as on young valves. Further on the valve the principal ribs become very salient and the consecutive «step-like» projections are disposed in such a way that they give the valve a slight convexity, which attains its maximum at the first big step-like projection.

At the pallial margin the intervals clearly show intercalaries which are the counterpart of those on the right valve: there is usually one intercalary rib delimited by two groove-like lines or proper grooves, according to whether the right valve has 2 ribbons, or two proper ribs in the intervals.

Auricles: subequal, right valve anterior and left valve posterior auricles are characterized by a slight hollowing at the shell margin; relatively large auricles; their outer edges meet the hinge line perpendicularly and reach the apical line at 2/5 of its total length.

The areas, very inwardly bent, and the auricles are covered with a very close striation which sometimes become riblets.

The umbo is quite narrow on the right valve (95°) and wider on the left valves (95°-120°).

Discussion:

Variability. — The variability of this species is very wide as regards the rib structure and this is probably the origin of the confused synonymy (see below); when very worn the whole shell appears to be covered by thin radial ribs.

Synonymy. — GOLDFUSS, plate 93, figures 2 a-g: *Pecten striatocostatus*.

In fact figure 2, a, b, f, g belong to *Neithea striatocostata*, but 2, c, d, e belong to *Neithea sexcostata* (WOODWARD, 1833).

A. D'ORBIGNY, 1847 chose and decided that «pl. 93, figures 2, a, b (exclus. fig. c, d)» belonged to *Janira striatocostata*. This is the first choice and thus for nomenclatorial purposes the valid one. GOLDFUSS types have intercalary ribbons rather than ribs.

A. D'ORBIGNY, 1850 retracted his previous opinion: he places 508 «*Janira striatocostata* D'ORB., 1847⁽¹⁾. *Pecten* id., GOLD. 2, p. 55, pl. 93, fig. 2, Westphalie, Koesfeld, Lemford (sic)» in the 20^e étage (the Cenomanian). The explanation probably lies in the fact that he associated «chloritische Kreide» with «craie chloritée» and thus it would be Cenomanian, whereas it belongs to Campanian strata. To remain consistent with himself he had to give another name to the Senonian species. This is the reason for the name *Janira substriatocostata* D'ORBIGNY.

For nomenclature the first choice, from the Paléontologie française, remains the valid one and consequently the name from the Prodrôme (*Janira substriatocostata*) is invalid, being an objective synonym (both species have the same type).

D'ORBIGNY's specimens, kept in the Muséum national in Paris, and taking into account the very wide variability mentioned above for the rib structure, do not allow us to doubt that indeed they belong to the species *N. striatocostata* (GOLDFUSS).

The lectotype 7618 F, figured by J. ROGER N.S. 50, figures 1, a, b is a very worn specimen of the form with two well developed intercalary ribs.

7618 from Royan has been determined by ROGER (N.S. 50, 1955) as *Neithea böckhi* (PETHOE); as far as I can make out, it is just another specimen with 2 very developed prominent intercalary ribs, and there seems to be no reason to ascribe it to another species than *N. striatocostata*.

Also from the D'ORBIGNY collection:

7618 A from Tours (Senonian) mentioned, but without number on the fiche of J. ROGER.

7618 B from Saint-Même (Senonian).

7618 C from Moutiers (Senonian) (is mentioned by J. ROGER as *N. substriatocostata*; another specimen from the same locality however is determined by ROGER as *N. böckhi*; I do not see any specific difference between both).

7618 D from Saint-Secondin (Loir-et-Cher) (Senonian).

7618 H from Maastricht (Maastrichtian) (3 specimens have this number; both by D'ORBIGNY and by J. ROGER they have been determined as belonging to *N. substriatocostata*; two indeed belong to *N. striatocostata*; the third specimen is a *N. sexcostata* (WOODWARD).

⁽¹⁾ D'ORBIGNY, 1847 in de Prodrôme is the date of the Prodrôme-manuscript and not the date of the Paléontologie Française, to which D'ORBIGNY gives the date 1845 or 1846 (again the date of the manuscript).

7618 I is ascribed to *N. striatocostata* by J. ROGER; the figures from GOLDFUSS to which ROGER refers show clearly that he is the last author to mistake *N. striatocostata* for *N. sexcostata*; as is very obvious on figures 9, *a* and *b* of fiche 50 the specimens from Le Beausset (Var) belong to *N. sexcostata* (WOODWARD).

The other specimens from the Paris-collection, figured by ROGER, show by themselves that they are conspecific:

- figures 3 *a*, 3 *b* is a specimen of the form with almost ribbon-like intercalaries and very salient digitations of the pallial margin, which correspond to the end of the principal ribs.
- figures 4 *a*, 4 *b* represent the extreme form with (relatively) very strongly developed intercalary ribs, and divided principal ribs; the specimen is incomplete and because of that seems narrower.

D'ORBIGNY's opposite opinions have confused later authors and thus the first choice amongst GOLDFUSS' figures has rarely been respected. Several authors made a new choice and nearly always in such a way that their *N. striatocostata* became synonymous with *N. sexcostata*.

Janira truellei D'ORBIGNY, 1847 is represented in the D'ORBIGNY collection by only one specimen. It is very poorly preserved as is shown on fiche 45, figure 5 by ROGER; it can still be ascertained that the principal ribs were radially divided and that 2 intercalary ribs were present.

As far as the preservation state permits a conclusion, it is probable that figure 5 is a specimen intermediary between figure 3 *a* and figure 4 *a* (both on fiche 50) whilst figure 6 is a very worn replica of figure 3 *b* (on fiche 50).

I do not understand how J. ROGER can ascribe figure 7 with any certainty to *N. truellei*: it is a very worn and incomplete specimen.

The specimens which ROGER mentions from Cibly partly belong to *N. striatocostata* but also some belong to *N. sexcostata* (WOODWARD).

Janira striatocostata from the Lüneburg Senonian described by A. VON STROMBECK is a very corroded specimen which does not really allow a certain identification.

Vola alpina as described and figured by G. MUELLER, from the Harz-Senonian also belongs here: this is shown by the many specimens which are kept in the Geologisches Staatsinstitut in Hamburg and which come from one locality; the misunderstanding probably arose from the fact that *N. striatocostata* has 2 intercalary ribs in the same way as *N. alpina* (D'ORBIGNY). The Harz-specimens do not have the outwardly bent and smooth areas which are also typical for *N. alpina*.

Neithea böckhi PETHOE from the Peterwardeiner Schichten in the Fruska Gora is simply another exem-

ple of the variation-series figured by GOLDFUSS. PETHOE found *N. böckhi* and *N. aff. striatocostata* together and this shows that he had both forms of the variation series.

Neithea woodsii (J. WOLDRICH) from the Koryzaner Schichten of Neratovice is an objective synonym of *N. striatocostata* as here described: J. WOLDRICH did not know of D'ORBIGNY's choice and so he misinterpreted the name.

The holotype of *Neithea philippsoni* J. BOEHM is a very poorly preserved specimen; J. BOEHM himself already pointed out that it is very similar to *N. striatocostata*. Moreover he does not point out any difference between both « species ». As far as can be seen there is none.

Differentiation. — The only species which really shows a great similarity to *N. striatocostata* is *Neithea sexangularis* (D'ORBIGNY). The general shape is almost the same but *N. sexangularis* has more prominent digitations and is relatively broader. The distribution of the radial striation is also different: in *N. sexangularis* the close and very numerous striae delimit thin ribbons which cannot be counted and appear to be very irregularly placed.

The confusion between *N. striatocostata* and *N. alpina* which exists in German literature is the consequence of not giving sufficient importance to the radial striation on the whole shell and particularly on the areas and to the direction in which these areas are bent.

More confusion is found in specimens which are very worn; those with only worn ribbons in their intervals might suggest *N. atava* (ROEMER). Even in the strongly corroded state a difference exists because on *N. atava* the areas are smooth and the auricles are smooth, equal and smaller.

When the principal ribs are divided into 3, and the intercalary ribs are well developed, one could mistake *N. striatocostata* for *N. quinquecostata* (SOWERBY). As ROGER mentions on fiche 50 this has happened on plate 13, figure 10, and plate 15, figure 12 in PETHOE, 1906. It could indeed be as ROGER states, but I would like to remark that PETHOE's figures are not very good and that he explicitly states in the text that all ribs are radially striated.

N. sexcostata (WOODWARD) differs from *N. striatocostata* by smaller auricles, relatively greater U.P.D., and much smaller average size.

The other *Neithea*-species can easily be differentiated by the number of intercalary ribs and the absence of radial striation on their ribs.

Generic attribution. — *Pecten striatocostatus* GOLDFUSS, 1833, as here described, has the most important characteristics of the genus and subgenus *Neithea*: almost equal auricles, symmetrically distributed ribs. The left-valve ribs are the negative

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impression of the right valve ribs; this is particularly obvious for the intercalary ribs, but less so for the principal ribs; they are generally prominent on both valves but the rib-parts which are concave on the left valve are convex on the right and v.v.

Pecten striatocostatus GOLDFUSS does not have all the characteristics of the genus *Neithea*, but it has most of them so that it probably belongs to that genus and its correct name is *N. (Neithea) striatocostata* (GOLDFUSS, 1833).

Stratigraphical and geographical distribution :

Senonian :

BULGARIA :

- Chisjata (Univ. Sofia).
- Dopno novo, Tshirpan (Univ. Sofia).
- Itchovia (Univ. Sofia).
- Lozevo (Univ. Sofia).
- Novosel (Univ. Sofia).
- Sredkia, Kolarovgrad (Univ. Sofia).
- Suvorovo, Varna (Univ. Sofia).

FRANCE :

- Paris Basin :
- Pont (Cher) (Mus. Laus.).
- Tours (Indre-et-Loire) (Mus. Laus.).
- Villedieu (Loir-et-Cher) (B., B.M., Ec. Min., K.U.L., Mus. Gen.).

Cotentin :

- Fresville (Manche) (Mus. Gen.).
- Valognes (Manche) (B.).

S.E. France :

- Le Castellet (Var) (Mus. Gen.).
- Saint-Jean, Nice (Alpes-Maritimes) (B.M.).

S.W. France :

- Cognac (Charente) (B.).
- Croix-des-Cigales, Bordeaux (Gironde) (B.).
- Gensac (Haute-Garonne) (Ec. Min., Mus. Gen.).
- La Barade (Ec. Min.).
- La Ribochère (GH.).
- Lavalette (Charente-Maritime) (Ec. Min.).
- Les Paquiers, Bergerac (Dordogne) (Mus. Laus.).
- Meschers, Royan (Charente-Maritime) (B.M., Mus. Laus.).
- Neuvic (Dordogne) (B.M.).
- Pérignac (Charente-Maritime) (Mus., Gen., N.M.W.).
- Royan (Charente-Maritime) (B.M., Ec. Min.).
- Saintes (Charente-Maritime) (Univ. Neuch.).
- Talmont (Charente-Maritime) (Mus. Laus.).

G.D.R. :

- Harz : Klosterholz, Ilsenburg (B.).

G.F.R. :

- Harz : Gross Bülden (GH., Halle).
- Hoheneggelsen (GH.).
- Lüneburg, Zeltberg (B. orig. VON STROMBECK, GH.).
- Osterfeld, Essen/Ruhr (DR.).

Senonian (Campanian) :

BULGARIA :

- Pleven (Univ. Sofia).

CZECHOSLOVAKIA :

- Deberno (N.M.W.).

HOLLAND :

- Valkenburg (B., Ma., I.R.Sc.N.B.).

JORDAN :

- Wadi el Kelt, 3 mles W. of Jericho (B.M.).

SWEDEN :

- Ignaberga (B.).

TURKEY :

- Kandili, E. of Karhagli, Bithynia (B.M., orig. J. BOEHM : *N. philippsoni*, L 49458).

Maastrichtian :

BELGIUM-HOLLAND :

- Geulhem (Ma.).
- Maastricht (B., B.M., Ec. Min., GH., I.R.Sc.N.B., Musé., Mus. Gen., Mus. Laus., R.U.G.).
- Sint-Pietersberg (GH., I.R.Sc.N.B., Ma.).

BULGARIA :

- Nedalsko, Jambolsko (Univ. Sofia).
- Pleven (Univ. Sofia).
- Shumen (Univ. Sofia).
- Somovit (Univ. Sofia).

FRANCE :

- Cotentin :
- Fresville (Manche) (B.M.).
- Orglandes (Manche) (B.M., Ec. Min.).

G.D.R. :

- Rügen (B., DR., GR.).

G.F.R. :

- Hemmoor (GH.).

GREAT BRITAIN :

- Trimingham (Norfolk) (Geol. Sci. orig. H. WOODS, pl. 41, figs. 9, 10 : 9042, 9043).

Upper Cretaceous :

HADRAMAUT (S. ARABIA) :

- Wadi Ghiadhat, Hadjar Province (B.M.).

11. — *Neithea (Neithea) sexangularis*
(A. D'ORBIGNY, 1847).

(Pl. 3, fig. 3.)

- | | | |
|---------|------------------------------|---|
| v. 1847 | <i>Janira sexangularis</i> | A. D'ORBIGNY, pp. 648, 649, pl. 448, figs. 5-8. |
| v. 1850 | <i>Janira sexangularis</i> | A. D'ORBIGNY, p. 253, n° 882. |
| (1857) | <i>Pecten sexangularis</i> | H. COQUAND, p. 86. |
| | d'Orb. | |
| (1875) | <i>Janira sexangularis</i> | H. ARNAUD, pp. 36, 38, 43, 44. 45. |
| | d'Orb. | |
| ?(1896) | <i>Vola sexangularis</i> | O. REIS, p. 7. |
| ?(1897) | <i>Vola sexangularis</i> | O. REIS, p. 75. |
| ?1897 | <i>Vola quinqueangularis</i> | F. NOETLING, p. 42, pl. 10, figs. 3, 3 a, 4, 4 a. |
| | spec. nov. | |
| (1900) | <i>Vola sexangularis</i> | M. BLANCKENHORN, p. 32. |
| ?(1903) | <i>Vola quinqueangularis</i> | F. NOETLING, p. 518. |
| | Noet. | |
| (1924) | <i>Neithea sexangularis</i> | R. ABRARD, pp. 643, 645, 646. |
| | d'Orb. | |
| v. 1956 | <i>Neithea sexangularis</i> | J. ROGER, n° 46, figs. 1-8. |
| | d'Orbigny | |

Location and designation of type-specimens. — In the Muséum d'Histoire naturelle, in Paris: coll. D'ORBIGNY, 7620, chosen by J. ROGER, 1956.

Vola quinqueangularis NOETLING: in the Geological Survey coll. of India.

Locus typicus. — Pons (chosen by ROGER) (Charente-Maritime) France.

Neithea quinqueangularis: Dès valley, Mari Hills, Baluchistan (West-Pakistan).

Stratum typicum. — Etage sénonien ou craie supérieure du bassin pyrénéen (Senonian-according to several authors: Upper Senonian (=Campanian)).

Neithea quinqueangularis: Dès valley, Upper Cretaceous, Maëstrichtian.

Original description:

J. testâ trigonâ, concentricè subtilissimè striatâ; valvâ inferiorè convexâ, incurvatâ, radiatim 6-angulatâ; angulis subacutis, bicostatis; interstiis sulcis latis, excavatis, longitudinaliter striato-costulatis; auriculis inaequalibus, acutis, radiatim costulatis.

Dimensions. — Largeur, 77 mm. Par rapport à la largeur: longueur 82/100; épaisseur, 37/100; longueur de la facette des oreilles, 38/100. Angle apical, sans les oreilles, 92°.

Coquille trigone, flabelliforme, plus longue que large, marquée, en travers, de très-légères stries d'accroissement. Valve inférieure très-bombée, fortement recourbée au sommet, pourvue de six angles très-saillans, anguleux, formés de deux petites côtes entre lesquelles sont des parties très-évidées, creuses, ornées d'un grand nombre de petites côtes ou de stries longitudinales peu prononcées. La partie externe des angles externes est striée en long. Oreilles inégales, anguleuses, ornées de petites côtes rayonnantes.

Rapports et différences. — Cette espèce est voisine de forme du *J. Truellei*, mais elle s'en distingue spécifiquement par ses angles plus saillans, pourvus de deux au lieu d'une côte, par un grand nombre de petites côtes ou de stries intermédiaires au lieu de cinq côtes, enfin par un aspect tout différent.

Localité. — Elle est propre à l'étage sénonien ou craie supérieure du bassin pyrénéen. Elle a été recueillie à Pons, à Coze, à Mirambeau (Charente inférieure), par M. d'Archiac et par moi.

Additional description:

Numbers of studied specimens: 22 from the Senonian of the Charente (France).

Measurements. — Examples:

Talmont (Charente) (Mus. Laus.): left valve:
U.P.D. 43.5; W. 50.8; A.A. 103°.

La Roquette (Charente) (Kat. Univ. Leuven):
left valve:
U.P.D. 37.7; W. 45.8; A.A. 104°.

Description.

Diagnosis. — Medium-sized *Neithea*-species with 6 very prominent principal ribs which result in a strongly digitated pallial margin. On the intervals and on the principal ribs there are numerous, not very salient and very narrow, riblets.

Right valve: broad and not very convex; auricles are probably equal, but I am not certain of it because I have not seen any specimen with wholly undamaged auricles.

Left valve: flattened, if one can say so when the principal ribs are so salient; in shape it is more angular than the right valve; for this valve also I never saw complete auricles, but what I saw makes it probable that they are very small.

Rib arrangement: rather plain, consisting of 6 principal ribs which have the same width as the intervals, and both are covered with riblets, which vary in number and width; this could be due to the preservation state.

On some specimens the general aspect is smooth: the riblets have then only reached a striac development, and do not project above the shell-surface.

Discussion:

Variability. — Having seen relatively few specimens of this species the only variability I could notice is that in ornamentation and rib shape: the ribs are not always as salient nor the pallial margin as digitated as D'ORBIGNY's figures lead one to assume. The number of riblets varies greatly, but they are always evenly distributed on the principal ribs and in the intervals and this makes it difficult to decide where the principal rib ends and the interval begins.

Synonymy. — The description and figures in D'ORBIGNY are almost correct, but on figure 5 he exaggerated the angularity: the difference in length in the middle and outer ribs is more pronounced than on his drawing and because of this, the pallial margin is less angular. On the photographs of the type-specimens given by J. ROGER this is clearly visible.

The type-specimens of O. REIS in Munich are lost; from the same localities from which he mentioned *N. sexangularis* new material has been collected: in those new specimens from the Hachauer Schichten nothing is ascribable to *N. sexangularis*; some specimens of *N. sexcostata* (WOODWARD) are present so it could be, but it cannot be proved, that REIS' material really belonged to *N. sexcostata*.

N. quinqueangularis (NOETLING) has, on the specimens figured by the author, only 5 principal ribs: I have the impression that the figured specimens are imperfect and that complete they probably had an extra rib. Here, only the original material, could allow a decisive conclusion to be reached. If NOETLING's species were proven identical with *N. sexangularis* (D'ORBIGNY), it would be an important stratigraphical and paleogeographical point: until now D'ORBIGNY's species is only known to occur in strata of Campanian-Maastrichtian age of S.W. France. The species from Baluchistan comes from strata attributed to different formations, but which are all supposedly of Senonian-Maastrichtian age. The other *Pectinidae* mentioned by NOETLING do not give a precise stratigraphical indication: *Vola quadricostata* [= *N. Nei-*

thea) *regularis* (SCHLOTHEIM)] occurs from the Upper-Cenomanian to the Upper-Maastrichtian and *Pecten dujardini* ROEMER [= *Lyropecten (Aequipecten) ternatus* (MUNSTER in GOLDFUSS, 1833)] has a similar stratigraphical distribution. It is typical that both species are also found in the Charente.

The exact systematic position of *N. sexangularis* is difficult to assess: the special shape makes its relation to other species indistinct.

Some specimens as f.i. fig. 4 of J. ROGER, n° 46, however, are comparable to worn individuals of *N. striatocostata* (MUNSTER in GOLDFUSS). In this particular specimen the only real distinctive characteristic is the large number of riblets. Other individuals with the ornamentation described and figured by D'ORBIGNY make any confusion impossible. They are the extreme variation in this species. It seems likely that *N. sexangularis* is closely related to and perhaps evolved from *N. striatocostata*.

Differentiation. — *Neithea sexangularis* is differentiated from:

- *N. striatocostata* (MUNSTER in GOLDFUSS) by a more digitated pallial margin and by far more numerous riblets and probably by having smaller auricles;
- *N. sexcostata* (WOODHARD) by a much broader shell (U.P.D.<W.), by a wider A.A., relatively smaller auricles and by more digitated pallial margin;
- *N. quinquecostata* (SOWERBY) by the more salient principal ribs and the more numerous, but less developed riblets;
- *N. atava* (ROEMER) by narrower, less prominent principal ribs and more regularly distributed riblets;
- *N. notabilis* (MUNSTER in GOLDFUSS) by the symmetrical shell and by the small, equal auricles;
- *N. gibbosa* (PULTENEY), *N. coquandi* (PERON), *N. regularis* (SCHLOTHEIM), *N. alpina* (D'ORBIGNY), *N. dilatata* (D'ORBIGNY), *N. dutrugei* (COQUAND) by the absence of intercalary ribs.

Generic attribution. — Considering the probable relationship of *Janira sexangularis* D'ORBIGNY, 1847 with *Neithea (Neithea) striatocostata* (MUNSTER in GOLDFUSS) one may conclude that its correct name is *Neithea (Neithea) sexangularis* (D'ORBIGNY, 1847).

Stratigraphical and geographical distribution:

Senonian:

FRANCE:

S.W. France:

Gensac (Haute-Garonne) (GH.).

- Meschers (Charente-Maritime) (B.M.).
- Pons (Charente) (Musé. Lectotype coll. d'ORBIGNY, 7620).
- Ribérac (Dordogne) (B.).
- Royan (Charente-Maritime) (B., Ec. Min., Musé.).
- Saintes (Charente-Maritime) (Musé., K.U.L.).
- Saint-Léger (Charente-Maritime) (Musé.).
- Talmont (Charente-Maritime) (B., GH., K.U.L., Mus. Gen., Mus. Laus.).

12. — *Neithea (Neithea ?) gibbosa*

(R. PULTENEY, 1813).

(Pl. 2, fig. 3.)

- .1813 *Pecten gibbosus* R. PULTENEY, p. 107, fig. 2, pl. of Melbury Fossils.
- 1813 *Pecten planatus* R. PULTENEY, p. 107, fig. 3, pl. of Melbury Fossils.
- v.1814 *Pecten quadricostata* J. SOWERBY, p. 121, pl. 56, fig. 1, 2.
- .1833 *Pecten quadricostatus* (pro parte) A. GOLDFUSS, pp. 54, 55, pl. 92, figs. 7, a, b.
- ?1846 *Pecten versicostatus* Lamarck (pro parte) A. E. REUSS, pp. 31, 32.
- (1850) *Pecten quadricostatus* Sow. (pro parte) H. B. GEINITZ, p. 186.
- v.1853 *Janira Faucignyana* Pictet et Roux F. J. PICTET et W. ROUX, pp. 505, 506, pl. 45, figs. 2, a, b.
- (1854) *Pecten quadricostatus* Sow. J. MORRIS, p. 177.
- .1868 *Janira quadricostata* Sow. sp. A. BRIART et F. L. CORNET, p. 48, pl. 4, figs. 21, 22.
- v.1871 *Janira quadricostata* Sowerby F. J. PICTET et G. CAMPICHE, pp. 249-251.
- v.1882 *Janira quadricostata* Sowerby P. DE LORIOU, p. 103, pl. 13, fig. 4.
- (1897) *Pecten (Janira) quadricostatus* Lam. W F. HUME, pp. 549, 558.
- ?1897 *Vola quadricostata* Sow. sp. U. SOEHLE, p. 39.
- (1901) *Janira quadricostata* G. DE STEFANO, pp. 57, 59.
- ?1901 *Vola quadricostata* Sow. sp. H. IMKELLER, p. 31, pl. 1, figs. 8, 9.
- v.1903 *Pecten (Neithea) quadricostatus* Sowerby H. WOODS, pp. 210-214, pl. 40, figs. 6, 7, textfig. 3-5.
- ?(1903) *Janira cf. quadricostata* Sowerby L. PERVINQUIÈRE, p. 59.
- (1904) *Neithea quadricostata* H. DOUVILLÉ, p. 214.
- v.1916 *Neithea quadricostata* (Sow.) R. B. NEWTON, p. 568, pl. 1, fig. 8.
- 1926 *Pecten (Neithea) quadricostata* (Sow.) V. MOUTA et A. BORGÈS, p. 55.
- ?(1926) *Neithea quadricostata* L. NOETH, p. 476.
- (1930) *Neithea quadricostata* (Sow.) H. BESAIRIE, p. 617.
- ?1930 *Neithea quadricostata* (J. Sowerby) J. V. L. RENNIE, p. 241, pl. 30, figs. 10-12.
- (1931) *Janira quadricostata* Sow. M. BREISTROFFER, p. 1203.
- 1932 *Neithea quadricostata* Sow. (non d'Orb.) J. FLANDRIN, p. 162.
- v.1939 *Neithea quadricostata* Sow. E. DACQUÉ, pp. 42, 43, pl. 2, figs. 7 et 10.

v. 1939	<i>Pecten (Neithea) quadricostatus</i> Sowerby	R. MARLIÈRE, pp. 91-93.
?1940	<i>Neithea quadricostata</i> Sow.	G. TAVANI, p. 48, pl. 1, fig. 1, 2.
. 1940	<i>Neithea gibbosa</i> (Pulteney)	L. R. COX, p. 124, pl. 7, figs. 2, 3.
?1957	<i>Pecten (Neithea) aff. quadricostatus</i> Sowerby	M. AMANO, pp. 89, 90, pl. 2, fig. 1.
1957	<i>Neithea gibbosa</i> (Pulteney)	E. DARTEVELLE et S. FRENEIX, pp. 73, 74.
(1960)	<i>Neithea quadricostata</i> Sow. non d'Orb.	J. AUBOUIN et al. et M. LYS et al., p. 457.
1962	<i>Neithea gibbosa</i> (Pulteney)	Brit. Mes. Foss. p. 156, pl. 56, figs. 3, 4.

Location and designation of type-specimens. — Lost (L. R. COX, 1940, p. 124).

Pecten quadricostata SOWERBY: in the British Museum (Nat. Hist.), London: 43323.

Janira faucignyana PICTET et ROUX: in the Muséum d'Histoire naturelle in Geneva.

Locus typicus. — Melbury (Dorset) (England).

Neithea quadricostata: Haldown (Haldon) near Exeter (England) (O.D.).

Neithea faucignyana: Le Saxonet (Haute-Savoie) (France).

Stratum typicum. — Not mentioned (according to L. R. COX: Upper Greensand = Upper Albian-Lower Cenomanian).

Neithea quadricostata: Greensand (Albian-Cenomanian).

Neithea faucignyana: grés verts (Albian).

Original description:

Pecten (gibbosus) testa inaequali, aequilatera, auriculata, fornice gibba, costis (21) rotundatis laevibus, quartis fornicis radiis, reliquis crassioribus.

Pecten quadricostata SOWERBY.

Spec. Char. Triangular, nearly even, front semicircular, margin notched. Convex valve ribbed, larger costa six, three smaller between each. Posterior auricle large.

The length is somewhat greater than the width; surface is nearly smooth. There are regularly three small costa between each of the larger, making five sets of four ribs each: near the sides the costae are less regular and smaller.

... from Haldown near Exeter, out of the green sand...

... from the green sand at Chute Farm, in the parish of Horningham, near Longleat, Wilts.

... from near Stourhead...

Janira faucignyana PICTET et ROUX.

J. testâ convexâ, trigonâ; valvâ inferiore convexissimâ, incurvatâ, concentricè striatâ, radiatim 6-costatâ; costis elevatis, rotundatis; intermediis sulcis latis, parum excavatis, 3-costatis, costis inaequalibus; auriculis magnis, laevigatis.

Dimensions:

Largeur	74,00 mm
Par rapport à la largeur: longueur	0,100 mm
Par rapport à la largeur: épaisseur (mesure approximative)	0,35 mm
Angle apical	85°

Coquille trigone, aussi longue que large; nous n'en connaissons pas la valve supérieure. Valve inférieure très bombée, à sommet très contourné, ornée partout de stries fines, concentriques, et pourvue de six côtes rayonnantes principales, arrondies et saillantes; les intervalles compris entre ces grosses côtes sont larges, peu excavés, presque plans et ornés chacun de trois côtes arrondies, saillantes, de moitié moins fortes que les précédentes, plus larges que les sillons qui les séparent; la côte médiane est plus grosse dans chaque intervalle que les deux latérales. Oreillettes lisses, triangulaires et enroulées.

Le moule porte l'empreinte en relief des côtes de la coquille. Les six côtes principales sont marquées sur toute la longueur de même que la côte médiane de chaque intervalle; les côtes latérales ne sont bien visibles qu'à leur terminaison vers le bord palléal. Le bord cardinal de la facette des oreillettes est strié en travers.

Rapports et différences. — Cette espèce est très voisine par ses ornements de la *J. quadricostata* D'ORB., du terrain sénonien, mais elle a un angle apical plus ouvert et des oreillettes plus grandes.

Localités. — Cette belle espèce a été trouvée au Saxonet; elle n'y est pas commune; elle a été découverte aussi à la Perte du Rhône. Collections du Musée Académique et de M. Roux.

Additional description:

Number of studied specimens: 246.

Angola	Albian-Cenomanian	2
Belgium	Albian	38
Czechoslovakia	Cenomanian	4
France	Albian	22
	Cenomanian	3
G.F.R.	Cenomanian	1
Great Britain	Aptian-Albian	10
	Albian-Cenomanian	156
India	Middle Cretaceous	3
Israel	Cenomanian	1
Poland	Cenomanian	1
Switzerland	Albian	5

Description.

Diagnosis. — Medium-sized to large *Neithea*-species with large, unequal auricles, 6 well-developed principal ribs and intervals with 3 intercalaries; areas almost smooth and outwardly bent.

For large specimens not much can be added to the description given by H. WOODS, 1903. Among the material collected from the Meule de Bracquenies (Hainaut, Belgium) there are about 30 valves which are all smaller than the smallest specimen mentioned by H. WOODS. They are mostly imperfect convex valves with the following characteristics:

— auricles are proportionally larger than in older (larger) shells, and almost equal (in older valves they are unequal: the posterior auricle is larger than the anterior);

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Measurements.

	H	W	AA	Side	Ribs
Warminster	59.3	65.4	—	L	21
	38.5	42.1	—	L	20
	—	40.5-80.6	—	R (8)	21-23
	—	66.06	—	—	21,2
Blackdown	—	—	—	R (12)	21-24 av. 22
Ventnor (Isle of Wight)	—	52.8	—	R	21
	—	81.8	—	R	23
	—	89.6	—	R	21
	67.3	72.8	136°	L	21
	75.2	78.8	118°	L	20
	77.8	87.5	—	L	22
Korycany (Czechoslovakia)	±59	55.5	—	R	23
	52.2	56.6	106°	L	21
	41.3	45.5	104°	L	21

Bracquagnies : mostly very small specimens : H < 30; ribs : 21 to 23, av. 21.6 (11 valves).

— the concentric striation, which is visible on the whole shell, is very obvious on the auricles and is there, perpendicular to the ribs, particularly on the anterior auricles.

It goes as far as the upper margin of the auricles (hinge-line); on the posterior auricle a homologous striation is transversed by a few radial, slightly salient riblets, situated on the limit of the posterior area of the valve and the auricle.

Discussion :

Variability. — In principle the number of intercalary ribs is 3; however, it happens that some principal intervals bear 4, instead of 3, intercalaries, and this mostly, in the outer intervals. More rarely an extra intercalary rib is present in one of the median intervals; this explains specimens with a total of 24 ribs. These specimens seem to be exceptional and I have seen them only from Blackdown (England).

The number of riblets on the areas varies and it is very difficult to define it; those riblets are very easily worn off and in many cases the areas are not wholly disengaged from the matrix. On those specimens where they could be counted, the same number was present on anterior and posterior areas: between 2 and 6.

The differences which are to be seen in auricle-shape depend largely on the size of the individuals, thus probably on the growth stage. On smaller (younger) shells, the auricles are relatively larger in comparison to the shell than on larger (older) shells.

Synonymy. — *Pecten gibbosus* PULTENEY was published in a paper which had been completely lost for Palaeontology. The name which has been used for 150 years was *Pecten quadricostatus*

SOWERBY, which is a few years younger than PULTENEY's name. L. R. COX, 1940 took PULTENEY's paper and the name *Pecten gibbosus* out of oblivion.

The advantage of using PULTENEY's name is that the difference between *Neithea quadricostata* (SOWERBY) [= *N. gibbosa* (PULTENEY)] and *N. quadricostata* (D'ORBIGNY) [= *N. regularis* (SCHLOTHEIM)] becomes clearly established.

Indeed, since GOLDFUSS, there has been a very profound confusion between *N. quadricostata* (SOWERBY) from the Aptian-Cenomanian and the species with 3 intercalary ribs, from the Upper Cretaceous [*N. regularis* (SCHLOTHEIM)]. GOLDFUSS gave the name *Pecten quadricostatus* to both. D'ORBIGNY made things even more confused by describing as *Janira quadricostata* a very obvious *N. regularis* (for more details see above sub *N. regularis*). BRIART et CORNET, 1868, PICTET et CAMPICHE, 1871 corrected this mistake and WOODS description and figures definitely put an end to it.

Differentiation. — The very early confusion between *N. gibbosa* and *N. regularis* is easy to understand, if one remembers that it is very rare to find well preserved fossils and that the differential characteristics between the 2 species are only clearly visible on very well preserved specimens: both areas and auricles must be visible.

On less well preserved specimens a difference can still be noted by the less convex right valve of *N. gibbosa*, by its wider umbo, its flatter intervals, but these characteristics are difficult to interpret without a large series of comparative material.

The other *Neithea*-species may be differentiated from *N. gibbosa* by :

— the areas, beak and auricles for *N. coquandi* (PÉRON);

- the number of intercalary ribs for *N. alpina* (D'ORBIGNY);
- the areas and shape of the shell and equal ribs for *N. hispanica* (D'ORBIGNY);
- the wide beak and the number of ribs for *N. striatocostata* (GOLDFUSS) and *N. sexcostata* (WOODWARD);
- the unequal ribs for *N. fleuriausiana* (D'ORBIGNY), though in this case the shape is similar.

Neithea royeriana (D'ORBIGNY, 1850) from the Aptian of Vassy: « Espèce voisine par le nombre de ses côtes du *J. quadricostata*, mais avec plus d'inégalité dans leur largeur et dans leur disposition ». This description could point to a *N. gibbosa*. The type-specimen according to D'ORBIGNY's register should have the n° 5678 A. This specimen I could not find during my stay at the Muséum. I did find 5678, but this individual is from Pont Varin (Haute-Marne) and thus cannot be used as a type, because it was not mentioned in the original description. Besides it has such a narrow beak that it cannot be confused with *N. gibbosa*.

N. attockensis L. R. Cox, 1935 (pp. 20 and 21, pl. 2, figs. 17-20) from the Albian of Attock district, India shows a strong similarity to *N. gibbosa*; the specimens of the former species are however much smaller and seem to be more convex than those of the latter, and unfortunately the preservation state is poor, so that no definite conclusion can be reached without the original material.

Generic attribution. — *Pecten gibbosus* PULTENEY, 1813 has the general shape of *N. regularis* (SCHLOTHEIM), excepting the auricles. Thus it seems logical to allot it to the genus *Neithea*. The unequality of the auricles in large specimens makes it impossible to be sure whether it belongs to the subgenus *Neithea* as well. Therefore the correct name of *Pecten gibbosus* PULTENEY, 1813 at present seems to be *Neithea* (*Neithea*?) *gibbosa* (PULTENEY, 1813).

Stratigraphical and geographical distribution:

Albian:

BELGIUM: Meule de Bracquegnies:

- Bracquegnies (DR., I.R.Sc.N.B.).
- Thieu (I.R.Sc.N.B.).

FRANCE:

- Bains-de-Rennes (Aude) (Mus. Laus.).
- Clansayes-Saint-Paul (Drôme) (B.).
- Cosne (Nièvre) (Mus. Gen. orig. DE LORIOU, pl. 13, fig. 4).
- Mont Saxonet (Haute-Savoie) (Mus. Gen. orig. PICTET et ROUX, *Janira faucignyana*).
- Perte du Rhône (Ain) (Mus. Gen., Mus. Laus., Univ. Neuch.).
- Thivencelles (Fosse-Saint-Pierre) (Nord) (I.R.Sc.N.B.).

GREAT BRITAIN:

dispar-subzone:

- Donhead St. Andrews, Shaftesbury (B.M.).

- Punfield (Dorset) (B.M.).
- Rock Cottages, Eversholt (Dorset) (B.M.).
- White Nothe (Dorset) (B.M.).

varicosum-auritus-subzone:

- Blackdown (B.M., Mus. Gen., S.M.).
- Black Ven, Charmouth (Dorset) (B.M.).
- Charmouth (Dorset) (B.M.).
- Charton (Devon) (B.M.).
- Haldon (B.M.).
- Little Haldon (S.M.).
- Melbury Abbass (Dorset) (B.M.).
- Ponchydown (S.M.).
- Sidmouth (Devon) (B.M.).
- Whitecliff, Seaton (Devon) (B.M.).

SWITZERLAND:

- Col de la Cheville (Mus. Gen., Mus. Laus.).
- Surchamp (Mus. Laus.).

Albian-Cenomanian:

GREAT BRITAIN: Upper Greensand:

- Armswell (Dorset) (Oxf.).
- Atherfield (Isle of Wight) (Mus. Gen., S.M.).
- Ballard Down, Swanage (Mus. Laus., S.M.).
- Batcombe (Dorset) (Oxf.).
- Chardstock, Axminster (Devon) (B.M.).
- Cheddington (Dorset) (Oxf.).
- Corfe Castle (Dorset) (B.M.).
- Devizes (B.M., Oxf.).
- Eggerdon Hill (Dorset) (S.M.).
- High Stony (Dorset) (B.M.).
- Lulworth Cove (Dorset) (S.M.).
- Lyme Regis (Dorset) (Mus. Gen., Oxf., S.M.).
- Maiden Bradley (Oxf.).
- Maiden Newton (S.M.).
- Monks Bay (Isle of Wight) (B.M.).
- Moxull (Isle of Wight) (B.M.).
- Punfield (Dorset) (B.M.).
- Seales Green, Shourton (Oxf.).
- Shaftesbury (Dorset) (B.M.).
- Stonebarrow Cliff, Charmouth (Dorset) (B.M.).
- Sutton Veny (Oxf., S.M. orig. Woods pl. 40, fig. 6, B 46964).
- Swanage (Mus. Laus.).
- Undercliff (Isle of Wight) (Univ. Neuch.).
- Ventnor (Isle of Wight) (B.M., Mus. Gen., S.M.).
- Warminster (B.M., S.M. orig. H. Woods, p. 213, text figs. 3 and 4, pl. 40, fig. 7, B 46963).
- Weymouth (B.M.).
- White Nothe (Dorset) (B.M.).
- Worbarrow (Dorset) (B.M., Mus. Laus.).

Cenomanian:

ANGOLA:

- Catumbela, Prov. Benguela (B.M., orig. R. B. NEWTON, 1916, pl. 1, fig. 8).

BELGIUM: Tourtia de Tournai:

- Montignies-sur-Roc (Ec. Min., I.R.Sc.N.B., R.U.G.).
- Tournai (DR., I.R.Sc.N.B., N.M.W., R.U.G.).
- Meule de Bernissart:
- Harchies (I.R.Sc.N.B.).

CZECHOSLOVAKIA:

- Korycany (N.M.W.).

FRANCE:

- Assigny (Seine-Maritime) (Ec. Min.).
- Châteauneuf (Charente) (Mus. Gen.).
- Valbonne (Gard) (Mus. Gen.).

G.F.R.:

- Bavaria: Regensburg (DR.).

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GREAT BRITAIN :

England :

- Chardstock (B.M.).
- Haven Cliff (Devon) (B.M.).
- Humble Point, Rousdon, Seaton (Devon) (B.M.).
- W. of Pinhay Bay, S.E. Devon (B.M.).

Northern Ireland : County Antrim :

- Cave Hill (B.M.).
- Collin Glen (B.M.).
- Woodburn (B.M.).

INDIA :

- Bagh Beds : Nerbuddha (B.M.).

ISRAEL :

- Kurnub (B.M.).

POLAND : Silesia :

- Schmottsuffer, Lähn (B. mentioned in KUNTH, 1862 and in DRESCHER, 1863).

Sowerby Collection :

Aptian :

GREAT BRITAIN :

Lower Greensand :

- Longleat (B.M. 43324).

Greensand :

- Chute (B.M. 43323, Mineral Conchology of Great Britain, pl. 56, fig. 2).
- Halldown (B.M. 43323, id., pl. 56, fig. 1).
- Stourhead (B.M. Mineral Conchology, pl. 183, 43323).

13. — *Neithea* (*Neithea* ?) *dutrugei*

(H. COQUAND, 1862).

(Pl. 4, fig. 3, pl. 5, figs. 4, a, b.)

- .1862 *Janira Dutrugei* H. Coq. H. COQUAND, p. 219, pl. 13, figs. 1, 2.
- 1885 *Janira aequicostata* P. CHOFFAT, pp. 62-67.
non Neithea aequicostata (Lamarck)
- 1890 *Vola Dutrugei* Coq. M. BLANCKENHORN, pp. 78, 79, pl. 4, figs. 8, 9.
- 1900 *Janira Dutrugei* (sic) P. CHOFFAT, pp. 155, 162.
- (1901) *Janira Dutrugei* G. DE STEFANO, p. 58.
- (1901) *Janira Dutrugei* A. MICHALET, p. 582.
Coquand
- .1902 *Vola Dutrugei* (sic) Co- P. CHOFFAT, pp. 150,
quand var. *Beirensis* 151, pl. II, figs. 1, 2.
Choffat
- 1903 *Pecten Dutrugei* R. FOURTEAU, pp. 317,
Coquand 318.
- 1917 *Janira duplicicosta* F. FRECH, pp. 270, 271,
Roemer pl. 14, figs. 1 a-c.
- ?1934 *Pecten (Vola) Dutrugei* M. BLANCKENHORN, p.
Coq. 194, pl. 9, fig. 25.
- .1934 *Pecten (Vola) zakar- M. BLANCKENHORN, p.
jensis* n. sp. 194, pl. 9, figs. 26,
a, b.
- (1935) *Pecten Dutrugei* Coq. E. DAGUIN, p. 293.
- (1935) *Neithea* cfr. *Dutrugi* M. MARCHETTI, p. 26.
Coq.
- .1942 *Neithea Dutrugei* (Coq.) G. TAVANI, pp. 9, 10,
pl. 7, fig. 4.
- ?1948 *Neithea* sp. aff. G. TAVANI, p. 95.
N. Dutrugei Coq.
- (1955) *Pecten* cf. *dutrugi* Coq. I. A. M. FARAG, p. 156.

Location and designation of type-specimens. — I have been unable to trace the COQUAND Collection.

Pecten (Vola) zakarjensis BLANCKENHORN: in the Hebrew University in Jerusalem (Israel).

Locus typicus. — Ténoukla (Algeria).

Neithea zakarjensis: Zakarja near Bethlehem (Israel) (O.D.).

Stratum typicum. — Rhotomagien (Cenomanian).

Neithea zakarjensis: Cenomanian.

Original description :

Long. : 70 mm; larg. : 65 mm.

Coquille très-convexe, ovale, trigone presque aussi large que haute. Valve supérieure très-excavée, ornée de côtes rayonnantes, nombreuses, séparées par des sillons peu creusés, dont six plus profonds que les autres. Valve inférieure fortement bombée et recourbée à son sommet, pourvue de deux systèmes de côtes fasciculées; le premier, plus saillant, formé de trois côtes assez épaisses; le deuxième d'une grosse côte, mais moins élevée que dans les premières, engagée entre deux sillons profonds dans lequel se développe quelquefois une petite côte. Région anale et buccale portant des côtes rayonnantes plus fines au nombre de dix à douze.

Cette espèce qui rappelle les *J. quinquecostata* et *quadricostata* s'en sépare facilement par la disposition de ses grosses côtes qui sont constamment au nombre de trois. Je l'ai recueillie dans l'étage rhotomagien de Ténoukla, de Batna et de Chélich (Aouess).

Additional description :

Number of studied specimens: 35 specimens from various localities.

Measurements.

On the measurable specimens :

Loc.	U.P.D.	W	Hingeline	Side
—	—	—	—	—
Batna	29.5	28.1	22.9	L I
Ténoukla	31.6	31.6	—	L I
Ténoukla	—	31.6	—	R
Ténoukla	—	24.3	—	R
Djebel ben	—	66.25	—	R
Younès	60.1	66.25	—	L

Description.

Diagnosis. — Medium-sized *Neithea*-species with very convex right valve, concave left valve, unequal auricles; six principal ribs, which can be tripartite; in each interval 5 intercalary ribs of which the middle one is more developed; auricles and outwardly bent areas are covered with riblets.

General shape: as in *N. gibbosa* (PULTENEY) but the left valve is concave instead of flattened.

Auricles: on the convex valve, the left auricle is very elongated and forms an acute angle with the

hinge line; when complete the lower margin reaches the middle of the side-margin of the shell. The right auricle has the same shape, but it is smaller, narrower and the lower margin is hollowed; it ends on the area and not on the shell itself.

On the concave valve the auricles have the same shape, but here the right auricle is the larger and the left one the smaller.

Rib distribution: basis-pattern consists of 6 principal ribs with 5 intercalaries in each interval, among which the median one reaches the same development as the principal ribs. Sometimes the principal ribs are split into 3 ribs; this happens irregularly and occasions the wide variability in rib number.

Areas: covered with a variable number of riblets which also cover the auricles; areas are bent outwardly and are not sharply delimited from the auricles.

Discussion:

The specimen figured by COQUAND was not very fortunately chosen because, its ribpattern is of an unusual type with tripartite principal ribs and 3 intercalary ribs of which the side ones are filae-like. Besides, the auricles of COQUAND's specimen are obviously incomplete and the additions incorrect. The rib pattern given above, with more regular distribution, is more common than the one figured by COQUAND. There are nevertheless cases where the rib-division goes further than mentioned above: *Neithea dutruegi* var. *beirensis* (CHOFFAT) in which both the principal and the median intercalary ribs are split into three and so the rib number is greatly increased.

Also on CHOFFAT's specimens the areal riblets are very developed and reach a stage comparable to an intercalary rib: this explains the very high rib number (80) given by CHOFFAT.

On Steinkernen the thinnest intercalary ribs and the riblets on areas and auricles are invisible; thus steinkernen appear to bear only 11 equally developed ribs. In the British Museum (Nat. Hist.) sub LL 21536-21542 there is a whole series which agrees with this description. By accepting this interpretation of the above mentioned specimens it is possible to put *N. duplicicosta* (F. RECH, 1917) and probably also *N. blanckenhorni* (BROILI) into synonymy with *N. dutruegi*.

N. zakarjensis (BLANCKENHORN) according to its description and figure is a typical *N. dutruegi* of the most common form.

This species has a slightly particular position amongst the other *Neithea*-species because of its exceptionally high number of ribs in the most extreme cases. Because of this high rib number it is difficult to recognize the regular rib distribution which characterizes *Neithea*-species.

Generic attribution. — As for *Neithea* (*Neithea* ?) *gibbosa* (PULTENEY).

Stratigraphical and geographical distribution:

Albian-Cenomanian:

IRAQ:

Nahr Umr, Basrah (B.M.).

Cenomanian:

ALGERIA:

Batna (B., B.M., Ec. Min., Halle, K.U.L., Mus. Laus.).

Ser Baïra, Aïn Oulmen (B.).

Tenoukla (B., B.M., K.U.L.).

JORDAN:

Ain Hamar, 5 mls E of Es Salt (B.M.).

Ain Hommar (B.M.).

Ain Umna (B.M.).

Es Salt (B.M.).

Wadi Mojeb, E of Dead Sea (B.M.).

ISRAËL:

Rekhme (B.M.).

Rumman (B.M.).

Wadhi Melihar (B.M.).

TUNISIA:

Djebel Ben Younès, Gafsa (B.M.).

Senonian:

SYRIA:

Labter-Nagnagiye area (Palmyrides) (B.M.).

Upper Cretaceous:

EGYPT:

Sinai: Kloster St. Paul (B.).

« am Fusse der Kalkberge im Osten von Gebel Dara, mittellägyptische Wüste » (B.).

IRAQ:

Achyr Dagh, Luristan (B.M.).

NIGERIA:

East of Mount Burgi, Awe (B.M.).

Orofu, Muri province (B.M.).

PORTUGAL:

Alcantara, Lisbon (B.).

14. — *Neithea* (*Neithea* ?) *dilatata*

(A. D'ORBIGNY, 1847).

v. 1847	<i>Janira dilatata</i>	A. D'ORBIGNY, pp. 638,
	d'Orbigny	639, pl. 445, figs. 5-8.
v. 1850	<i>Janira dilatata</i> d'Orb.	A. D'ORBIGNY, p. 170,
		n° 502.
v. 1956	<i>Neithea dilatata</i>	J. ROGER, n° 53.
	d'Orbigny)	

Location and designation of type-specimens. — Lectotype chosen by J. ROGER, 1956: D'ORBIGNY Collection n° 6468 in the Muséum national d'Histoire naturelle in Paris.

Locus typicus. — Le Mans (Sarthe) (France).

Stratum typicum. — Craie chloritée (Cenomanian).

Original description:

J. testâ rotundatâ, depressâ, latâ; valvâ inferiori convexiusculâ, radiatim 6-costatâ; costis magnis, rotundatis, elevatis;

interstitiis sulcis latis, complanatis, medio 5-costulato, costulis inaequalibus, interstitiis sulcis angustatis, transversim striatis; auriculis magnis inaequalibus, radiatim costatis.

Dimensions. — Longueur, 23 millim. Par rapport à la longueur : largeur, 100/100; épaisseur, 35/100; longueur de la facette des oreillettes, 100/100. Angle apical, sans les oreillettes, 78°.

Coquille peu convexe, large, arrondie. Valve inférieure bombée, ornée de six grosses côtes rayonnantes, saillantes, arrondies, entre lesquelles sont de très-larges sillons peu creusés, plats, pourvus chacun de cinq côtes longitudinales inégales, dont les trois médianes sont les plus larges, séparées par des sillons étroits, fortement striés en travers. En dehors des côtes externes sont cinq ou six petites côtes. Les oreilles, énormes, sont inégales, couvertes de côtes rayonnantes; l'oreille buccale est très allongée, pointue.

Rapports et différences. — Cette espèce se rapproche du *Janira quinquecostata* par ses six côtes saillantes, mais elle s'en distingue par une forme infiniment plus large, moins bombée, par ses oreilles plus grandes et par ses sillons ornés de cinq au lieu de quatre côtes intermédiaires.

Localité. — Je l'ai recueillie dans les couches inférieures de l'étage turonien ou de la craie chloritée du Mans (Sarthe), dans la même couche que le *Gryphaea colomba*. Elle y est rare.

Additional description :

Number of studied specimens: 17, only convex valves.

Measurements.

4 specimens from Le Mans (Musé. Gen.) :

U.P.D.	W.	A.A.
—	—	—
19.3	18.7	60°
17.7	16.9	61°
10.6	9.2	60°
8.2	7.0	58°

1 specimen from Val-au-Clair, Fécamp (Musé. Gen., coll. PICTET) :

U.P.D.	W.	A.A.
—	—	—
—	14.6	65°

Description.

Diagnosis. — Small *Neithea* species, with not very convex right valve, with 6 principal ribs and intervals with 5 intercalaries; auricles very large and unequal; areas with 4-7 riblets; their outer part and the auricles are covered with a radial striation.

To D'ORBIGNY's original and J. ROGER subsequent description very little can be added: except that the valves can be normally convex, almost as convex as *N. sexcostata*, on some individuals, and that on other individuals, the right valves of the same size are just not quite flattened.

Discussion. — This seems to be a species with a very restricted geographical distribution and even in that area it is rare. It does show a great similarity with *N. dutruei* (COQUAND); the general

shape, the shape of the auricles and areas are the same and the number of ribs is the same. The differences are that in *N. dilatata* the average size is much smaller and that, as far as could be checked, the ribs do not divide. These are minor differences. On one specimen from the Ecole des Mines growth lines cover the whole shell; these I did never notice on *N. dutruei*. At present I do not consider both species synonymous because of their geographical distribution, but they are undoubtedly very closely related.

Generic attribution. — As for *Neithea* (*Neithea*?) *gibbosa* (PULTENEY).

Stratigraphical and geographical distribution :

Cenomanian :

FRANCE :

- Le Mans (B.M., DR., Ec. Min., Musé., Mus. Gen., N.M.W.).
- Val-au-Clair, Fécamp (Mus. Gen.).

15. — *Neithea* (*Neithea*?) *fleuriausiana*
(A. D'ORBIGNY, 1847).

(Pl. 4, fig. 1.)

v. 1847	<i>Janira Fleuriausiana</i>	A. D'ORBIGNY, pp. 631, 632, pl. 443, figs. 1, 2.
	d'Orbigny	
v. 1850	<i>Janira Fleuriausiana</i>	A. D'ORBIGNY, p. 169, n° 498.
	d'Orb.	
v. 1850	<i>Pecten (Janira) inconstans</i> n. s.	D. SHARPE, p. 188, pl. 19, figs. 3, a, b.
(1857)	<i>Pecten Fleuriausianus</i>	H. COQUAND, p. 69.
	d'Orb.	
1885	<i>Janira quinquecostata</i>	P. CHOFFAT, pp. 52, 57.
	Sow.	
?1892	<i>Neithea acuticostata</i>	K. FUTTERER, p. 80, pl. 3, fig. 7.
	n. sp.	
1900	<i>Janira Fleuriausiana</i>	P. CHOFFAT, p. 183.
	d'Orb.	
1900	<i>Janira Stefanoi</i> (sic)	P. CHOFFAT, p. 183.
	sp. nov.	
1900	<i>Janira Lapparenti</i>	P. CHOFFAT, p. 183.
	sp. nov.	
.1902	<i>Vola Fleuriausiana</i>	P. CHOFFAT, p. 153, pl. 3, fig. 4.
	d'Orbigny	
.1902	<i>Vola Lapparenti</i> Choffat	P. CHOFFAT, pp. 153, 154, pl. 3, figs. 1-3.
.1902	<i>Vola inconstans</i> Sharpe	P. CHOFFAT, p. 156, pl. 2, figs. 4-6.
?1902	<i>Vola Stefanoi</i> Choffat	P. CHOFFAT, p. 155, pl. 2, figs. 3, a, b.
1903	<i>Vola Lapparenti</i> Choff.	R. J. SCHUBERT, pp. 266-268.
(1915)	<i>Neithea Fleuriausiana</i>	C. F. PARONA, p. 28.
	(d'Orb.)	
(1915)	<i>Neithea Lapparenti</i>	C. F. PARONA, p. 28.
	(Choff.)	
1956	<i>Neithea fleuriausiana</i>	J. ROGER, n° 41, figs. 1-5.
	(d'Orbigny)	
(1960)	<i>Neithea fleuriausiana</i>	J. AUBOUIN <i>et al.</i> <i>et</i> M. LYS <i>et al.</i> , p. 457.
	d'Orb.	
v?1967	<i>Neithea cf. lapparenti</i>	M. PLENIČAR <i>in</i> S. BUSER, p. 150.
	(Choff.)	

- v?1967 *Neithea inconstans* A. POLŠAK, p. 31, p. 158.
(Sharpe)
v.1967 *Neithea lapparenti* A. POLŠAK, p. 32, pl. 2,
(Choffat) fig. 2, p. 158.
v.1967 *Neithea acuticostata* A. POLŠAK, pp. 30, 31,
Futterer pl. 2, fig. 3, p. 158.

Location and designation of type-specimens. — Lectotype chosen by J. ROGER in the D'ORBIGNY collection, Muséum national d'Histoire naturelle in Paris: n° 6463 from Ile d'Aix (Charente-Maritime).

Pecten inconstans SHARPE: British Museum (Nat. Hist.) London (L 92317).

Neithea acuticostata FUTTERER: according to the author in the Kgl. Museum für Naturkunde, Berlin; to-day this is the Paläontologisches Museum der Humboldt Universität. However during my stay in Berlin I have been unable to trace the type.

Janira stefanoi CHOFFAT: in the geological Survey in Lisbon, Portugal.

Janira lapparenti CHOFFAT: idem.

Locus typicus. — Ile d'Aix (Charente-Maritime), France (designated by J. ROGER, 1956).

Neithea inconstans: Lisbon (Portugal).

N. acuticostata: Calonniche, Lago di S. Croce (near Belluno in the Venetian Alps) (Italy).

N. stefanoi: Bellas (Portugal).

N. lapparenti: Tentugal (Portugal).

Stratum typicum. — Craie chloritée, avec les *Caprina bipartita* et les *Radiolites foliacea* (Cenomanian).

Neithea inconstans: Hippuritic Limestone.

N. acuticostata: Rudistenkalk (Turonian).

N. stefanoi: Bellasien (Cenomanian).

N. lapparenti: Cénomaniens supérieur à *Neolobolites vibrayanus*.

Original description:

I. testâ ovată, depressâ, valvâ superiore convexo-planâ, radiatim sex-angulato-costatâ; costis inaequalibus, multicostulatis; interstitiis sulcis latis, excavatis (medio), decem costulatis; valvâ inferiore concavâ, radiatim 6-angulatâ, angulis convexis, 4-costulatis; interstitiis sulcis latis, excavatis, medio decem, inaequaliter costulatis; auriculis magnis, inaequalibus, radiatim inaequaliter costulatis.

Dimensions. — Longueur, 150 mm. Par rapport à la longueur: largeur, 79/100; épaisseur, 33/100; longueur de la facette des oreillettes, 58/100. Angle apical, sans les oreillettes, 104°.

Coquille ovale, plus longue que large, déprimée dans son ensemble. Valve supérieure légèrement convexe, ornée de six saillies rayonnantes, inégales, marquées de côtes longitudinales inégales, entre lesquelles sont autant de larges sillons légèrement excavés. Valve inférieure assez convexe, bombée, pourvue de six côtes rayonnantes, formées, chacune, de quatre petites côtes très inégales. Entre chaque côte sont de très larges sillons excavés, pourvus d'une grande nombre de côtes rayonnantes, inégales. Le sillon du milieu en offre une dizaine

très-inégales, parmi lesquelles on en distingue une médiane double. Elles sont séparées par d'étroits sillons. Les oreilles sont grandes, inégales, couvertes d'un grand nombre de côtes rayonnantes, très-inégales entre elles.

Rapports et différences. — Cette espèce, voisine, par ses nombreuses côtes, du *J. striatocostatus*, s'en distingue par sa forme plus longue que large, tout à fait différente, par ses côtes autrement disposées, par sa valve supérieure un peu convexe, et enfin par tous ses détails d'ornement et de forme.

Localité. — Elle forme un horizon particulier à la partie la plus inférieure de l'étage turonien ou de la craie chloritée, avec les *Caprina bipartita* et les *Radiolites foliacea*. Elle a été recueillie par moi à l'Ile d'Aix, à l'Ile Madame (Charente Inférieure), à Saint-Trojan, près de Cognac, et aux environs d'Angoulême (Charente).

Additional description:

Number of studied specimens: 26.

Cenomanian of S.W. France: 13.

Hippuritic Limestone of Portugal: 8.

Hippuritic Limestone of Yugoslavia: 5.

Measurements.

4 double specimens from the Coll. K.U.L.

U.P.D.	W	Hingeline	AA	Loc.
33.7	34.1	41.2	94°	Ile Madame (Char. Mar.)
54.6	61.0	—	—	Angoulême (Char.)
69.4	81.8	—	104°	Ile Madame (Char. Mar.)
100.9	110.6	71.5	88°	Ile Madame (Char. Mar.)

Description.

Diagnosis. — Remarkable *Neithea*-species with almost straight beak, very large auricles especially on small (young) valves, an irregular distribution of intercalary ribs. Typical for Rudist bioherms and thus often very distorted and flattened specimens.

The beak, being almost straight, makes the right valve far less convex than in other *Neithea*-species. This results in the left valve being concave, flattened or even slightly convex. It could be that this variation depends on the substratum on which the organism lived.

The rib distribution is very variable though the basis pattern is the same as in the other *Neithea*-species: 6 principal ribs which are strongly developed and salient above the shell surface. Between these principal ribs, and, on their sides, the number of intercalaries varies greatly because the numerous intercalaries do occasionally split. The number of intercalaries is not even stable in the intervals of one shell, e.g. the numbers of intercalary ribs counted at the pallial margin on the specimens of which measurements are given above (anterior-posterior):

4 / 6 / 9 / 5 / 4
6 / 10 / 9 / 7 / 4
6 / 9 / 9 / 7 / 4
5 / 5 / 7 / 10 / 4

(on the last specimen the rib number at the anterior side is abnormally low, because it is slightly distorted).

The intercalaries are more numerous in the middle of the shell than on the sides; this may be related to the intervals being wider in the middle too.

The intercalaries vary not only in number, but also in development; some intercalaries almost reach the development of principal ribs.

The *auriculae* are large and very unequal: on the right valve the anterior auricle has a hollowed lower margin; the posterior auricle is larger, it ends beyond half the apical line. Its hinge line is as long as half the width of the shell, and, in some cases it is even longer. On the left valve, the auricles are the reflected image of the right valve auricles: the anterior one here is the larger and the posterior one is the smaller, but it is not hollowed. The side-margin of the auricles is rectangular to the hinge-line, on small specimens, because the angle is acute; on larger specimens the auricles are rectangular and the side-margin is parallel with the U.P.D. of the shell.

The *areas* and auricles are covered with close-set riblets which reach the same development as the intercalaries. Around the umbo these riblets are diverging; on the areas they are almost parallel with the last principal ribs; each next riblet is slightly displaced so that the last riblet on the auricle is parallel to the hingeline.

Discussion:

Variability. — As stated in the additional description the shape of the principal and intercalary ribs is extremely variable: at one end of the variation series one finds specimens with 6 very salient principal ribs with a great number of intercalary ribs (which are difficult to count) much less developed than the principal ribs, at the other end there are fewer intercalary ribs which are almost as strongly developed as the principal ribs; thus in very extreme cases one sees specimens with almost equal ribs.

The size is very variable too; the measurements given above are on the low side; in Rudist bioherms individuals can reach very large sizes.

Synonymy. — *Neithea fleuriausiana* (D'ORBIGNY) had been very well described, but, badly figured: the additions added for completing a poorly preserved specimen are not quite correct; on the drawing of the right valve the anterior auricle is larger than the posterior one, whereas in fact it is the other way round. The ornamentation is far less regular than drawn by D'ORBIGNY.

N. inconstans (SHARPE) and *N. acuticostata* FUTTERER are both forms with 19 almost equal ribs, thus the extreme case mentioned in the variability. Here

the areas and auricles are exactly as represented on the typical form by D'ORBIGNY.

N. lapparenti (CHOFFAT) differs from *N. fleuriausiana*, according to CHOFFAT, by having much sharper ribs. From Ile Madame I have seen a specimen which has very sharp ribs too; but this is due partly to the preservation state and partly to the variability of the rib shape.

N. stefanoi (CHOFFAT) is slightly more convex than the other forms and might, according to figure 3 b in CHOFFAT, even have an incurved beak; the auricles are otherwise proportioned. Without seeing the material I cannot decide whether the differences fall within the variation.

Habitat. — The species is typical for Middle Cretaceous rudist-reefs. As all other « reef » organisms they are strongly adapted to their physical environment and this explains their somewhat irregular shapes and the great variability in their proportions. Limited to the Tethys « reefs ».

Differentiation. — This species is exceptional among the *Neithea*-species. It differs from most other *Neithea*-species by its irregularity and by its not very pronounced convexity of right valves. It has a morphological similarity with *N. deshayana* (MATHERON) which could result from similar environment; they both lived in rudist reefs. Their auricles have similar forms, but the ribs structure cannot be compared because for *N. deshayana* this is practically unknown. It seems not impossible that both species might be closely related. Large specimens of *N. atava* (ROEMER) are sometimes slightly similar to *N. fleuriausiana* but they are never as flat and irregular as *N. fleuriausiana* and their auricles are much smaller.

Generic attribution. — J. ROGER expresses some doubts as to the generic position of *Janira fleuriausiana*. His doubts can be easily understood, because, indeed, the beak is not incurved and the right valve is not very convex. A specimen from Ile Madame (Charente-Maritime) kept in the Coll. K.U.L. shows clearly on its posterior auricle the sawlike striation at the hinge which according to DROUET's definition of the genus is the second generic characteristic. The auricles being unequal one cannot decide whether *Janira fleuriausiana* belongs to the subgenus *Neithea* as well. The correct name in the present state of knowledge thus becomes *Neithea* (*Neithea*?) *fleuriausiana* (D'ORBIGNY, 1847).

Stratigraphical and geographical distribution:

Cenomanian:

FRANCE: S.W. France:

Angoulême (Charente) (Ec. Min., K.U.L., Musé. Coll. D'ORBIGNY, 6463 A, N.M.W.).

- Châteauneuf (Charente) (Ec. Min.).
 Ile d'Aix (Charente-Maritime) (Musé. lectotype Coll. d'ORBIGNY, 6463 B).
 Ile Madame (Charente-Maritime) (K.U.L.).
 Port-des-Barques (Charente-Maritime) (Musé. coll. d'ORBIGNY, 6463 C, Mus. Gen.).
 Rochefort-sur-Mer (Charente-Maritime) (Ec. Min.).

Cenomanian-Turonian: Hippuritic Limestone:

PORTUGAL:

- Alcantara, Lisbon (Ec. Min.).
 Lisbon (B.M. type SHARPE: *Neithea inconstans*, L 92317, N.M.W.).

YUGOSLAVIA:

- Fontanela (Istria) (Univ. Zagreb).
 Jaksice, Pacin (Istria) (Univ. Zagreb).
 Karoce (Istria) (Univ. Zagreb).
 Pula (Istria) (B. coll. L. VON BUCH).
 Vrhovlje (Geol. Zav. Ljubljana).

16. — *Neithea* (*Neithea*?) *deshayana*

(P. MATHERON, 1842).

(Pl. 5, figs. 1a and 1b.)

- | | | |
|---------|--|--|
| .1842 | <i>Pecten deshayana</i> Math. | P. MATHÉRON, pp. 184, 185, pl. 29, fig. 12. |
| v.1847 | <i>Janira Deshayesiana</i> d'Orbigny | A. d'ORBIGNY, pp. 626, 627, pl. 441, figs. 1-3. |
| v.1850 | <i>Janira Deshayesiana</i> d'Orbigny | A. d'ORBIGNY, p. 107, n° 733. |
| v?1871 | <i>Janira euryotis</i> Pictet et Campiche | F. J. PICTET et G. CAMPICHE, pp. 243, 244, pl. 181, figs. 4-7. |
| 1907 | <i>Pecten</i> (<i>Neithea</i>) <i>Deshayesianus</i> Matheron em. | M. COSSMANN, pp. 36, 37, pl. 5, figs. 11, 12. |
| 1916 a | <i>Pecten</i> (<i>Neithea</i>) <i>planivalvis</i> n. sp. | M. COSSMANN, p. 399, pl. 13, figs. 9-11, pl. 14, fig. 9. |
| 1916 b | <i>Pecten</i> (<i>Neithea</i>) <i>Deshayesianus</i> Math. | M. COSSMANN, p. 398, pl. 13, figs. 6-8. |
| .1916 c | <i>Pecten</i> (<i>Neithea</i>) <i>Deshayesianus</i> Matheron | M. COSSMANN, p. 42, pl. 4, figs. 15-17. |

Location and designation of type specimens. — In the Muséum d'Histoire naturelle in Marseille (France).

Janira euryotis PICTET et CAMPICHE: Muséum d'Histoire naturelle in Geneva (Switzerland).

Pecten (*Neithea*) *planivalvis* COSSMANN: Sorbonne, Paris.

Locus typicus. — Orgon (designated by COSSMANN, 1907) (Bouches-du-Rhône, France).

Neithea euryotis: Châtillon-de-Michaille (Ain, France).

N. planivalvis: Orgon (Bouches-du-Rhône, France).

Stratum typicum. — 31c: Néocomien (according to the description Urganien = Barremian).

Neithea euryotis: urgonien supérieur (Barremian).

N. planivalvis: urgonien (Barremian).

Original description:

P. testâ ovato-orbiculari, transversâ, supernè rotundatâ valvâ superiore concavâ radiatâ decem plicatâ, propè aurículas angulatâ, radiis numerosissimis sulcis conformibus transversim substriatis; valvâ inferiore convexâ, incurvato-arcuatâ, subobliquâ, nitidâ, concentricè substriatâ; plicis valvæ superioris, radiatis, obscuris, obtusis; auriculis inaequalibus magnis, in valvâ supernâ minutissimè sulcato-striatis; margine cardinali recto, longissimo.

L'intérieur de la valve supérieure présente dix ou douze grandes côtes qui sont accusées au dehors par un égal nombre de côtes plus obtuses. Les oreillettes antérieures sont fort grandes.

Longueur 100 millim.; largeur 100 millim.; hauteur, au-dessus du plan de l'ouverture de la valve inférieure, 40 millim.

Portl. 31 c. les Martigues, Orgon, St-Chamas, etc.

Janira euryotis Pictet et Campiche.

Dimensions:

Longueur: 25 mm.

Par rapport à la longueur, largeur 0,90 à 0,95.

Par rapport à la longueur, épaisseur 0,30.

Par rapport à la longueur, longueur du bord cardinal 0,90. Angle apical: 92°.

Description. — Coquille un peu plus longue que large, légèrement anguleuse au milieu de la région buccale et de la région palléale. Oreillettes très-considérables, la buccale étant visiblement échancrée, mais pas très-profondément. Grande valve médiocrement bombée, à crochet peu infléchi. Petite valve plate, l'oreillette en étant séparée par une carène.

Nous n'avons aucun échantillon dont le test soit conservé dans son entier; mais ce que nous possédons suffit pour démontrer que toute la coquille est couverte de côtes rayonnantes fines, un peu inégales, mais n'offrant point la disposition des espèces précédentes, les plus grosses dépassant peu les autres en dimension, et étant à peu près en même nombre. Ces côtes sont légèrement granuleuses. Elles sont bien marquées sur les oreillettes et sur la valve plate. Sur la valve bombée, elles sont coupées par des lignes concentriques en gradins, qui les rendent irrégulières; elles paraissent d'ailleurs s'y conserver moins bien que sur l'autre valve.

Le moule est lisse, ainsi que les couches internes de la coquille. On verra dans la fig. 7 la face interne d'une petite valve qui est lisse partout où sa couche superficielle est conservée, et qui laisse voir les côtes rayonnantes là où elle est enlevée. C'est le contraire de la face externe, où les côtes dépendent de la couche superficielle.

Rapports et différences. — Cette janira appartient au même type que la *Deshayesiana*, et lui ressemble beaucoup par sa forme générale, par la grandeur de ses oreillettes et par sa grande valve presque lisse. Mais la comparaison de bons échantillons d'Orgon avec les nôtres nous a prouvé que ces espèces sont cependant clairement distinctes. La *J. Deshayesiana* est plus ronde; sa grande valve est marquée de deux dépressions costiformes le long du bord anal, qui manquent toujours à la nôtre; sa petite valve est concave au lieu d'être plane, et d'une ornementation toute différente, bien décrite, mais mal figurée par d'Orbigny, qui paraît n'avoir connu que l'impression interne de cette valve sur le moule. Le test est orné de sept ou huit grosses côtes, séparées chacune par une plus petite, avec des stries intermédiaires, ce qui ne ressemble point à la *J. euryotis*.

Gisement. — Nous ne connaissons cette espèce que de l'étage urgonien supérieur de Châtillon-de-Michaille. Nous en avons sous les yeux une quinzaine d'échantillons de l'une ou de l'autre valve. Coll. Pictet.

OF THE SUBFAMILY NEITHEINAE, ETC.

Additional description :

Numbers of studied specimens : 70.

France	Urgonien (Barremian-Lower Aptian)	67
Austria	Barremian	3

Measurements.

5 specimens from Martigues (Bouches-du-Rhône) (Musée Coll. D'ORBIGNY 5511) :

U.P.D.	W.	Side	A.A.
—	—	—	—
55.0	58.8	R	—
—	92.2	R	—
—	60.8	R	—
—	54.4	R	—
—	63.3	R	—

8 specimens from Orgon (Bouches-du-Rhône) (I.R.Sc.N.B.) :

U.P.D.	W.	Side	A.A.	
—	—	—	—	
97.2	92.8	R	—	
—	84.8	L	—	
—	95.0	R	98°	
59.7	65.3	R	—	
91.8	106.3	R	98°	
—	80.0	R	93°	} double valved specimen
66.2	76.3	L	111°	
44.8	45.2	R	98°	} idem
—	±46	L	133°	
82.3	—	L	108°	} idem
91.8	—	R	93°	

12 specimens from Châtillon-de-Michaille (Ain) (Mus. Gen. Coll. PICTET : type-series for *Neithea euryotis*).

U.P.D.	W.	Side	A.A.
—	—	—	—
18.3	18.4	R	91°
26.7	30.5	L	97°
—	—	L	91°
9.2	8.8	L	87°
12.8	—	L	84°
8.5	9.1	L	88°
9.5	9.3	R	87°
7.1	6.1	L	85°
—	—	L	88°
—	—	R	86°
—	—	R	80°
20.7	20.2	R	87°

Description.

Diagnosis. — This very remarkable *Neithea*-species is, because of its usual preservation state, even more extraordinary; in its usual preservation state the right valve appears to be completely smooth, apart from numerous concentric and radial striae. On the best preserved left valves one can count 11 ribs which are sometimes almost equal but, on other specimens, a more developed rib is followed by a less developed one, etc. Between the ribs there is a great number of radial striae. The auricles are very large but more so, at the posterior shell side.

In the I.R.Sc.N.B. there is one specimen with a right valve covered by ribs; this proves that originally, both valves were covered by 11 almost equal ribs, which were covered by a great number of radial striae.

Right valves are not very convex, and the beak is only very slightly incurved, if incurved at all; the usual aspect is smooth with radial and concentric striae.

The auricles are large, especially the posterior one; the anterior one is smaller and has a shallow but definite byssal sinus. The posterior auricle is as long on the hinge line as half the width of the shell. The anterior is a little shorter on the hinge-line.

Left valves are sometimes flattened and sometimes slightly concave; they are covered with usually 11 ribs and radial and concentric striae. The anterior auricle is very large and covered with radial striae, and on very well preserved specimens, with radial riblets. The posterior auricles are much smaller, without byssal sinus but with radial lines.

Discussion :

Variability. — The preservation state is very important in this species because the ornamentation varies according to it. The shell is originally very thick and, depending on the number of layers that are worn off, one finds all transitions between shells covered by equal single ribs to completely smooth shells, which are however not Steinkernen. The flattened or concave left valves are usually less worn than the right valves.

The size varies too and so do the proportions : U.P.D. ≥ W. on small right valves but U.P.D. < W. on larger valves.

Synonymy. — MATHÉRON and COSSMANN's names have been given to different preservation states. How far *Janira euryotis* PICTET et CAMPICHE is a synonym of *N. deshayana* is difficult to decide. All PICTET specimens are very much smaller; the general shape is similar but the shell appears to be thinner and far less convex. Where the first could be ascribed to the size of the specimens the second is difficult to explain, because in most *Neithea*-species the convexity decreases when the size increases.

Those differences could be due to slightly different ecological factors; but because of the presence of slight differences it seems preferable to question the synonymy of *N. euryotis*.

Differentiation and affinities. — The very special shape of this species has made its differentiation easy; its most frequent preservation state with an almost smooth convex valve puts it apart among the other *Neithea*-species.

As long as the right valve is not well known the definition of relationships remains very difficult to solve; the auricles of the right valve point towards a possible relationship with *Neithea* (*Neithea*?) *gibbosa* (PULTENEY).

From other *Neithea*-species *Neithea deshayana* differs by its smooth convex valve and its very large auricles.

Palaeoecology. — All specimens come from Urgonien (Barremian-Lower Aptian) rudist bioherms.

Generic attribution. — M. COSSMANN, 1916a, plate 4, figure 15 solves the problem: it is the figure of a right valve with well developed hinge-teeth. The subgenus is more difficult to define; as in *Neithea gibbosa* (PULTENEY) the auricles are very unequal, but in *Neithea* s. s. they are equal. The other characteristics such as a symmetrical shell are according to *Neithea* s. s. It seems thus logical that the correct name of *Pecten deshayanus* MATHERON, 1842 is *Neithea* (*Neithea*?) *deshayana* (MATHERON, 1842).

Stratigraphical and geographical distribution:

Barremian (Urgonien):

FRANCE: S.E. France:

- Châtillon-de-Michaille (Ain) (Mus. Gen.: *N. euryotis*).
- Martigues (Bouches-du-Rhône) (B., Musé., Mus. Gen.).
- Orgon (Bouches-du-Rhône) (B., B.M., Ec. Min., I.R.Sc.N.B., K.U.L., Mü., Musé., Mus. Gen., Mus. Laus.).
- Perte-du-Rhône (Ain) (Mus. Laus.).
- Saint-Pierre, Martigues (Bouches-du-Rhône) (B.M.).
- Sassenage (Isère) (B., Mus. Gen.).

AUSTRIA: Vorarlberg:

- Schrattenkalk: Bezauf (Mü.).

17. — *Neithea* (*Neithella*) *notabilis*

(G. VON MUENSTER in GOLDFUSS, 1833).

(Pl. 4, fig. 2.)

.1833	<i>Pecten notabilis</i> Münster	A. GOLDFUSS, p. 56, pl. 93, figs. 3 a-c.
?1839	<i>Pecten digitalis</i> v. Römer	H. B. GEINITZ, p. 21.
1839	<i>Pecten notabilis</i> Mün.	H. B. GEINITZ, p. 22.
.1841	<i>Pecten digitalis</i> N.	F. A. ROEMER, p. 55, pl. 8, fig. 7.
.1841	<i>Pecten notabilis</i> v. Münster	F. A. ROEMER, p. 55.
v.1847	<i>Janira longicauda</i> d'Orbigny	A. D'ORBIGNY, pp. 639, 640, pl. 445, figs. 9-14.
v.1847	<i>Janira cometa</i> d'Orbigny	A. D'ORBIGNY, pp. 640, 641, pl. 445, figs. 15-19.
v.1847	<i>Janira digitalis</i> d'Orbigny	A. D'ORBIGNY, pp. 642, 643, pl. 446, figs. 1-3.

(1850)	<i>Pecten notabilis</i> Mün. Goldf.	H. B. GEINITZ, p. 188.
(1850)	<i>Pecten digitalis</i> Römer	H. B. GEINITZ, p. 188.
(1850)	<i>Pecten cometa</i> (d'Orb.)	H. B. GEINITZ, p. 188.
v.1850	<i>Janira cometa</i> d'Orb.	A. D'ORBIGNY, p. 170, n° 504.
v.1850	<i>Janira digitalis</i> d'Orb.	A. D'ORBIGNY, p. 170, n° 505.
v.1850	<i>Janira longicauda</i> d'Orb.	A. D'ORBIGNY, p. 170, n° 503.
1850	<i>Janira notabilis</i> d'Orb.	A. D'ORBIGNY, p. 170, n° 508.
(1866)	<i>Pecten notabilis</i> Mstr.	C. GIEBEL, p. 48.
.1868	<i>Janira cometa</i> d'Orb.	A. BRIART et F. L. CORNET, p. 50, pl. 4, figs. 23, 24.
v.1870	<i>Vola notabilis</i> Mün. sp.	H. B. GEINITZ, p. 202, pl. 45, figs. 10-12.
v.1870	<i>Vola longicauda</i> d'Orb.	H. B. GEINITZ, pp. 202, 203, pl. 45, figs. 16, 17.
v.1870	<i>Vola digitalis</i> A. Römer sp.	H. B. GEINITZ, p. 203, pl. 45, figs. 13-15.
.1877	<i>Vola</i> (<i>Janira</i>) <i>longicauda</i> d'Orb.	A. FRITSCH, p. 137, textfig. 131.
(1877)	<i>Janira cometa</i> d'Orb.	DE COSSIGNY, p. 323.
?1890	<i>Pecten</i> aff. <i>cometa</i> d'Orbigny	A. PÉRON, p. 228.
1893	<i>Janira</i> (<i>Vola</i>) <i>longicauda</i> d'Orb.	R. MICHAEL, p. 236.
v.1895	<i>Janira Johannis Boehmi</i> n. sp.	E. TIESSEN, p. 473, pl. 17, fig. 5.
(1901)	<i>Janira cometa</i> d'Orbigny	A. MICHALET, p. 577.
?1902	<i>Vola</i> sp. aff. <i>longicauda</i> d'Orbigny	P. CHOFFAT, p. 152.
v.1903	<i>Pecten</i> (<i>Neithea</i>) <i>cometa</i> (d'Orbigny)	H. WOODS, pp. 200, 201, pl. 39, figs. 6-10.
v.1903	<i>Pecten</i> (<i>Neithea</i>) <i>atavus</i> Römer	H. WOODS, pp. 197-199, pl. 39, figs. 1-5 (non synonymy).
non 1839	<i>Neithea atava</i> (F. A. Römer)	
.1911	<i>Vola phaseola</i>	A. FRITSCH, p. 45, fig. 206.
(1924)	<i>Neithea longicauda</i> d'Orb.	M. SCHLOSSER, p. 87.
1926	<i>Neithea longicauda</i> d'Orb.	L. NOETH, p. 476.
1933	<i>Neithea notabilis</i> (Münst.)	W. HAENTZSCHEL, pp. 132, 133, pl. 4, figs. 17, 18.
?1933	<i>Neithea digitalis</i> (Roem)	W. HAENTZSCHEL, p. 133.
(1934)	<i>Pecten</i> (<i>Neithea</i>) <i>notabilis</i> Münst.	V. ZAZVORKA et J. SOKUP.
?1937	<i>Neithea</i> cf. <i>digitalis</i> (Roemer)	L. LEHNER, p. 194.
(1937)	<i>Neithea notabilis</i> Münst.	S. ROCZYCKI, p. 31.
(1937)	<i>Neithea Johannis</i> (sic) <i>Boehmi</i> Tss.	S. Z. ROCZYCKI, p. 31.
v.1939	<i>Pecten</i> (<i>Neithea</i>) <i>cometus</i> d'Orbigny	R. MARLIÈRE, pp. 94, 95, pl. 6, fig. 1.
v.1939	<i>Neithea notabilis</i> Münst.	E. DACQUÉ, pp. 44, 45, pl. 1, fig. 12.
.1939	<i>Neithea notabilis</i> Münst.	E. DACQUÉ, pp. 44, 45, pl. 1, fig. 16.
.1939	<i>Neithea cometa</i> d'Orb.	E. DACQUÉ, p. 80, pl. 16, fig. 31.
v.1939	<i>Neithea notabilis</i> Münst.	E. DACQUÉ, pp. 97, 98, pl. 6, figs. 21, 22, pl. 7, fig. 4.

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. 1939	<i>Neithea cometa</i> d'Orbigny	E. DACQUÉ, p. 98.
1939	<i>Pecten (Neithea) Hourcqi</i> nov. sp.	M. COLLIGNON, p. 69, pl. 1, figs. 16, 17.
v. 1953	<i>Neithea notabilis</i> Münst.	H. PRESCHER, p. 253.
(1956)	<i>Neithea notabilis</i> Mün.	K. A. TROEGER, pp. 54, 90.
1965	<i>Neithea (Neithella)</i> sp. cf. <i>N. (N.) atava</i> (Römer)	I. HAYAMI, pp. 307-309, pl. 44, figs. 1-4, pl. 52, fig. 4.

Location and designation of type-specimens. — GOLDFUSS states that his type-specimen, from the Essener Grünsand, is in the Munich Museum; in the Bayerische Staatssammlung there are sub n° 1872 XI 64 two valves stated on their labels as being GOLDFUSS types. These seem to be very doubtful types: GOLDFUSS mentions explicitly that he only knew the left valve; on the specimens in Munich the stated locality and age is *Mittel Pläner, Reinhausener Galgenberg* and *Unterturon Knollensand, Regensburg*. The Bayerische Staatssammlung does not contain any other specimen of *N. notabilis* from Essen. It should be accepted that the GOLDFUSS holotype is lost (see DACQUÉ, 1939, p. 45).

Pecten digitalis ROEMER: in the Roemer Museum, Hildesheim.

Janira longicauda D'ORBIGNY: in the Muséum national d'Histoire naturelle, Paris: D'ORBIGNY collection n° 6469 (lectotype chosen by J. ROGER, 1956).

Janira cometa D'ORBIGNY: in the Muséum national d'Histoire naturelle, Paris: D'ORBIGNY collection n° 6470 (lectotype chosen by J. ROGER, 1956).

Janira johannisboehmi TIESSEN: in the Paläontologisches Museum of the von Humboldt Universität in Berlin.

Pecten (Neithea) hourcqi COLLIGNON: in the Ecole Nationale supérieure des Mines, Paris; I did not find them during my visit there.

Locus typicus. — Essen an der Ruhr (G.F.R.) (O.D.).

Neithea digitalis: Tharand (near Dresden) (G.D.R.) (O.D.).

N. longicauda: environs du Mans (Sarthe) (France) (O.D.).

N. cometa: Le Havre (France) (designated by J. ROGER, 1956).

N. johannisboehmi: Langenberg, Westerhausen (G.D.R.) (O.D.).

N. hourcqi: Anabatsifaka, Menabe (Madagascar) (O.D.).

Stratum typicum. — Grünsände (Cenomanian).

Neithea digitalis: Quader (Cenomanian).

N. longicauda: craie chloritée (Cenomanian).

N. cometa: couches inférieures de l'étage turonien (to-day considered as Cenomanian).

N. johannisboehmi: Untere Tourtia (Lower Cenomanian).

N. hourcqi: Cénomanien.

Original description:

Pecten testa ovato-oblonga inferne sexangulata, valva sinistra convexo-gibba concentricè lineata, costis senis elatis interstitiisque concavis radiatim lineatis, auriculis magnis acutis.

Ex arena viridi Westphaliae.

Dieser Pectinit sieht noch mit den verhergehenden⁽¹⁾ in nächster Verwandtschaft. Wir kennen nur die linke Schale desselben, welche ebenfalls hoch gewölbt ist, einen überbogenen Wirbel, 6 hohe Rippen und einen sechseckigen unteren Rand hat. Die Rippen sowohl als die tiefen Zwischenfurchen sind mit gleichförmigen, ausstrahlenden Linien dicht besetzt, über welche feine concentrische gedrängt und wellenförmig hinweglaufen. Die Ohren sind, wie es scheint, lang und zugespitzt.

Findet sich im Grünsande bei Essen an der Ruhr.

Pecten digitalis ROEMER, 1841.

Gewölbt, so breit wie lang, mit fünf starken, ungleichen, hoch gewölblich, schnell am Breite zunehmenden Falten, welche durch schmale, tiefe, concave Furchen getrennt werden; vorderes Ohr der linken Schale unten auch ausgeschnitten und gross. Quader bei Tharand.

Janira longicauda D'ORBIGNY, 1847.

J. testâ trigonâ, transversâ, convexâ, concentricè costulatâ; valvâ superiore complanatâ, radiatim 5-costatâ; costis latis, elevatis, rotundatis, transversim striatis; interstitiis sulcis excavatis, longitudinaliter 6-costulatis; costulis crenulatis; valvâ inferiore convexâ, incurvatâ, 5-costatâ; costis tricostatis, transversim striatis; auriculis inaequalibus, radiatim costatis; auriculâ buccali maximè elongatâ, rostratâ.

Dimensions. — Largeur, 8 millim.

Coquille très convexe, trigone, transverse. Valve supérieure aplatie, ornée de cinq grosses côtes rayonnantes, larges, convexes, couvertes de petites côtes transversales; entre ces grosses côtes sont six sillons d'égale largeur, très-excavés, dans lesquels sont des lignes rayonnantes de petits tubercules. Valve inférieure très-bombée, recourbée au sommet, pourvue de cinq grosses côtes rayonnantes, formées chacune de trois côtes fortement costulées en travers. Oreilles très-inégales: l'oreille anale très-courte, très-petite; l'oreille buccale très-grande, prolongée en un long rostre.

Rapports et différences. — Cette espèce se distingue facilement de toutes les autres par ses cinq côtes au lieu de six. C'est une des plus élégantes.

Localité. — Je l'ai recueillie dans les couches inférieures de l'étage turonien ou de la craie chloritée, dans les grès des environs du Mans (Sarthe), où elle est assez rare.

Janira cometa D'ORBIGNY, 1847.

J. testâ trigonâ, transversâ, convexâ; valvâ superiore complanatâ, radiatim 5-costatâ; costis rotundatis, transversim striatis; interstitiis sulcis excavatis, longitudinaliter subsulcatis; valvâ inferiore convexâ, incurvatâ, radiatim 5-costatâ; costis angulatis, angustatis, transversim striatis; interstitiis sulcis latis, excavatis, longitudinaliter minutè costatis; auriculis inaequalibus, buccali maximè elongatâ, rostratâ.

⁽¹⁾ *Pecten striatocostatus* [= *Neithea striatocostata* (GOLDFUSS) + *Neithea sexcostata* (WOODWARD)].

Dimensions. — Largeur, 10 millim.

Coquille trigone, étroite, transvers. Valve supérieure aplatie, ornée de cinq grosses côtes rayonnantes, saillantes, striées en travers, entre lesquelles sont de très-larges sillons peu profonds, où l'on remarque, sur les stries transverses, les indices de stries rayonnantes, très-peu prononcées. Valve inférieure très convexe, arquée au sommet, pourvue de cinq angles saillans, étroits, striés en travers sur leur convexité, entre lesquels sont quatre dépressions profondes, où l'on remarque de nombreuses petites côtes crénelées. Les oreilles sont très-inégales; l'oreille anale très-courte; l'autre très-longue, prolongée en pointe.

Rapports et différences. — Cette espèce se rapproche, par ses cinq côtes et par sa forme, du *J. longicauda*, mais elle s'en distingue facilement par ses côtes plus étroites, anguleuses, et tout différemment ornées. Assez voisine du *P. notabilis* Goldf. (dont je fais le *Janira notabilis*), elle en diffère par cinq grosses côtes au lieu de six.

Localité. — Elle est propre aux couches inférieures de l'étage turonien du bassin parisien. Elle a été recueillie dans la craie chloritée de Villers (Calvados), par M. d'Archiac et par moi; au Havre (Seine-Maritime), par moi. Elle y est rare.

Additional description :

Number of studied specimens: 179.

Belgium	Albian and Cenomanian	15
Czechoslovakia ...	Cenomanian and Lower Turonian ...	25
France	Cenomanian	21
G.D.R. (Saxony) .	Cenomanian and Lower Turonian ...	36
G.F.R. :		
Bavaria : Cenomanian ...	... .. .	4
Westphalia : Cenomanian ...	... .. .	6
Great Britain ...	Lower and Middle Cretaceous ...	62

Measurements.

Korycany (Cenomanian) :

U.P.D.	W.	A.A.	Side	Ribs
—	—	—	—	—
18.2-33.3	16.3-23.2	74°-86°	L	5-6
22.5-37.6	19.2-30.3	64°-68°	R	5-6

Warminster (Upper Greensand) :

U.P.D.	W.	A.A.	Side	Ribs
—	—	—	—	—
—	6.7-17.8	—	R	4-6

Description.

Diagnosis. — Small *Neithella*-species with 4-6 very prominent angular ribs, which result in a very angular pallial margin (4-6 angular), very unequal auricles and an asymmetrical shape (most obvious in 5 ribbed specimens).

The ribs and the deep intervals between them are covered with radial striae which sometimes get more developed and then reach the filae-stage.

The complete shell, when well preserved, is covered by concentric growth lines; where they are very prominent they form ridges.

The right valve is very convex and narrow: U.P.D. always superior to W. The anterior auricle

very long: its length equals half the shell width. It is triangular but with a rounded angle at the anterior shell-side. The posterior auricle is very small and obtuse: it does not project from below the beak.

The left valve is flattened, but the ribs are angular and give the valve a convex appearance. The posterior auricle is very elongated and has the same shape, in reflection, as the anterior auricle on the right valve. The anterior auricle is very small and obtuse-angled.

The rib number is in fact always six, but very often the ribs near to the side margins are less developed and they do not affect the angularity of the pallial margin. In a few, exceptional cases these smaller ribs are really absent.

Discussion :

Variability. — The most obvious variable characteristic lies with the ribs; not only does their number vary, but also their shape, and this depends on the shell size (=age) and preservation state. In small valves the ribs are very angular with a narrow top, in larger valves the ribs are rounded and their top is broad. Worn specimens of either type have broad rib tops.

Synonymy. — According to ROEMER the difference between his *Pecten digitalis* and *N. notabilis* (MUNSTER in GOLDFUSS) is, that in the former species, the rib tops are rounded instead of angular. As stated above this is not a differential characteristic, particularly not if one remembers that Saxonian Middle Cretaceous Pectinids are, in a very large proportion Steinkernen. The many *Neithella* specimens which I studied from these Cretaceous strata all obviously belonged to the same species.

N. longicauda (D'ORBIGNY) is supposed to differ by having broader ribs and in D'ORBIGNY's figure the valve has very broad ribs indeed. Whether this is a specific, differentiating characteristic, as J. ROGER thinks, I strongly doubt. GEINITZ (1870, pl. 45, figs. 10-17 a) figures a complete series of specimens, which show all transitions between specimens with very narrow ribs and broad intervals, and specimens with very broad ribs and narrow intervals. All those specimens come from the same area and have the same stratigraphical age. The specimens with very narrow ribs are cores and give a false impression of the species.

The proportion U.P.D./W. is according to ROGER different in *N. longicauda* from what it is in *N. notabilis*; the state of the lectotype of *N. longicauda* is such that sufficiently precise measurements cannot possibly be taken and so no comparison is possible.

D'ORBIGNY differentiated his *Janira cometa* from *N. notabilis* because of different rib numbers. J. ROGER proved this to be a changing character. The fact that J. ROGER finds, among the type-series

OF THE SUBFAMILY NEITHEINAE, ETC.

of *J. cometa* D'ORBIGNY specimens belonging to *N. cometa*, *N. longicauda* and *N. digitalis* certainly proves that recognizing the different « species » is such a difficult job that all divisions are arbitrary and that the logical solution is to consider them all synonyms of *N. notabilis*.

Janira johannisboehmi TIESSEN is kept in the VON HUMBOLDT University in Berlin; as supposed by WOODS it is really a synonym of *N. notabilis*.

Pecten (Neithea) hourcqi M. COLLIGNON is, as far as can be judged without seeing the types, identical with *N. notabilis*. For a definite decision the type-material should however be studied.

Differentiation. — *Neithea notabilis* is a typical *Neithella*-species and in the Middle Cretaceous in Europe, it seems to be the only species belonging to this subgenus. A related species comes from Neocomian strata, *Neithea valangiensis* (PICTET et CAMPICHE). This last species differs from *N. notabilis* by having well developed filae on all its ribs and a narrower beak.

From the Upper Senonian of the Fruška Gora (Yugoslavia) J. PETHOE, 1906 (pp. 227-228, pl. 15, figs. 10 and 11) mentions *Neithea almusana* which appears to be very similar to *N. notabilis*, but has a more incurved umbo. J. PETHOE had only 2 specimens.

From the other *Neithea*-species *Neithea notabilis* differs by:

- its very unequal auricles;
- its asymmetrical shape;
- the absence of secondary and tertiary ribs.

H. WOODS, who probably never had the opportunity of studying true *Neithea atava* (ROEMER), since it does not occur in Great Britain, described the larger specimens of *N. cometa* (= *N. notabilis*) as belonging to *N. atava*. Strangely enough his synonymy is quite correct. This mistake is probably due to the fact that in WOODS' time the importance of auricle-shape was not yet known.

I. HAYAMI, 1965 follows WOODS' opinion and so his *N. (Neithella) atava* belongs in fact to *N. (Neithella) notabilis*.

Generic attribution. — *Pecten notabilis* MUENSTER in GOLDFUSS, 1833 is a *Neithea*-species because of its general shape and because it has *Neithea*-hinge teeth (see a.o. GEINITZ, 1870, pl. 45, figs. 14, a, b).

Pecten notabilis MUENSTER in GOLDFUSS belongs to the subgenus *Neithella* by its shape. The correct name thus becomes *Neithea (Neithella) notabilis* (MUENSTER in GOLDFUSS).

Stratigraphical and geographical distribution:

Neocomian ?:

FRANCE:

Vaucluse (Doubs) (B.M.).

Aptian:

GREAT BRITAIN:

Upware Sands:

Upware (B.M., Univ. Neuch.).

Faringdon Sponge Gravel:

Faringdon (B.M., S.M. orig. H. WOODS, p. 199, *Pecten (Neithea) atavus*, B 17835-6).

Aptian-Albian:

GREAT BRITAIN: Lower Greensand:

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

Upware (Cambs.) [B.M., S.M. orig. KEEPING 1883,

Pecten (Neithea) ornithopus, B 19418-19426,

and B 19415-19417, KEEPING 1883, pl. 4,

figs. 5, a, b, H. WOODS, 1903, pl. 39, figs. 2,

3 a, b, 4 a-c].

Albian:

BELGIUM: Meule de Bracquegnies:

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

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

GREAT BRITAIN:

Haldon (B.M.).

Ponchdown, Blackdown (S.M.).

mammillatus-nodules:

Chamberlain Barn Pit, Leighton Buzzard (Beds) (S.M.).

dispar-zone:

Punfield (Dorset) (B.M.).

Cenomanian:

BELGIUM: Tourtia de Tournai:

Tournai (I.R.Sc.N.B., N.M.W.).

CZECHOSLOVAKIA:

Korycany (Mus. Gen., N.M.W.).

Tyssa (B., DR., N.M.W.).

FRANCE:

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

Le Havre (Seine-Maritime) (Musé. orig. D'ORBIGNY,

pl. 445, figs. 15-19 and J. ROGER n° 56, fig. A

coll. D'ORBIGNY, 6470, Mus. Laus.).

Le Mans (B.M., Ec. Min., Musé. orig. D'ORBIGNY,

pl. 446, figs. 1-3, J. ROGER n° 54, figs. A-B,

coll. D'ORBIGNY, 6471, coll. D'ORBIGNY, 6469,

6469 A, orig. J. ROGER, n° 55, figs. A-D, Mus.

Gen.).

Rouen (Mus. Gen.).

Vaches Noires (Calvados) (B.).

Southern France:

Irs, Castellane (Musé. orig. D'ORBIGNY, coll. 6470 A,

J. ROGER, n° 56).

Mauran-Ausseing (Haute-Garonne) (B.M.).

Vaucluse (Doubs) (N.M.W.).

G.D.R.:

Saxony:

Dohna-Brandmühle (DR.).

Dohna-Kahlebusch (DR.).

Dohna-Schneidemühle (DR.).

Elbstollen (DR.).

Forsthaus-Plauen (DR.).

Koschütz (DR.).

Leiteritz (DR.).

Malter, Dippoldiswalde (DR.).
 Naundorf, Freiberg (B.).
 Neuleuteritz, Gossebaude (DR.).
 Oberhässlich, Dippoldishöhe (DR., N.M.W.).
 Pennrich (DR.).
 Plauen, Dresden (N.M.W.).
 Tharander Wald (B.).

Harz :

Langenberg, Westerhausen (B. orig. TIESSEN, pl. 19, fig. 1).

G.F.R. :

Essen/Ruhr (DR.).
 Regensburg (N.M.W.).

GREAT BRITAIN :

Beer Head, Seaton (Devon) (B.M.).
 Dunscombe (Devon) (S.M.).
 Durdle Door (Dorset) (B.M.).
 Hooken Beach (S. Devon) (B.M.).
 Punfield (Dorset) (B.M.).
 Rocken End, Saint Catherine Point (Isle of Wight) (B.M.).
 Ventnor (Isle of Wight) (Mus. Gen., S.M.).
 Warminster (B.M., orig. H. Woods, pl. 39, fig. 8, 8871, pl. 39, fig. 6, 38267, Geol. Sci. orig. H. Woods, pl. 39, fig. 9, 8278, pl. 39, fig. 10, 8445, S.M. orig. H. Woods, pl. 39, fig. 7, B 46977).
 Whitecliff (Devon) (B.M.).
 Wilmington (Devon) (B.M.).
 Worbarrow (Dorset) (B.M.).

Cenomanian-Turonian transition :

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

G.D.R. : Saxony :

Altfranken, Dresden (B.).
 Elbestinitz (N.M.W.).
 Elbstollen (B.).
 Kauscha, Dresden (DR. orig. GEINITZ Elbthal I, pl. 45, figs. 11 or 12).

18. — *Neithea (Neithella) valangiensis*

(F. J. PICTET et G. CAMPICHE, 1870).

- | | | |
|---------|---|--|
| v. 1870 | <i>Janira valangiensis</i>
Pictet et Campiche | F. J. PICTET et G. CAMPICHE, pp. 242, 243, pl. 181, figs. 1-3. |
| 1898 | <i>Janira valangiensis</i> | E. BAUMBERGER et H. MOULIN, p. 171. |
| (1918) | <i>Pecten (Neithea) Valanginiensis</i> Pict. et C. | W. KILIAN, p. 339. |
| (1919) | <i>Pecten (Neithea) Valanginiensis</i> Pict. et Camp. | I. TOMITCH, pp. 118, 120. |
| 1921 | <i>Pecten (Neithea) Valanginiensis</i> P. et Camp. | S. GILLET, p. 92. |
| (1949) | <i>Neithea</i> (l. c.) (<i>Janira valanginiensis</i> (Pict. et Camp.)) | B. KOKOSZYNSKA, p. 16. |

Location and designation of type-specimens. — The type-series, as mentioned by PICTET et CAMPICHE, is partly in the Muséum d'Histoire naturelle in Geneva, and partly in the Musée géologique in Lausanne.

Auberson, Sainte-Croix, Coll. CAMPICHE : orig. plate 181, figures 1 and 2 (Mus. Laus.).

Sainte-Croix, Coll. PICTET : (Mus. Gen.).

Ville-de-Pont (Doubs), Coll. PICTET : orig. plate 181, figure 3 (Mus. Gen.).

Ballaigues (Vaud), Coll. PICTET : (Mus. Gen.).

Vigneules (Lac de Biemme), Coll. PICTET : (Mus. Gen.) (= Vingel).

Villers-le-Lac (Doubs), Coll. PICTET : (Mus. Gen.).

Gaicht (Bienne), Coll. PICTET : (Mus. Gen.).

Boucherans, Coll. PICTET : (Mus. Gen.).

Mièges, Coll. PICTET : (Mus. Gen.).

Cinquétral (Jura), Coll. PICTET : (Mus. Gen.).

For lectotype I chose the specimen 17628 coll. CAMPICHE in the Musée géologique Lausanne which is the original of plate 181, figure 1.

Locus typicus. — Sainte-Croix (Vaud) (Switzerland).

Stratum typicum. — Valangien (Valanginian).

Original description :

Dimensions :

Longueur	28 mill.
Par rapport à la longueur, largeur	1,15
Par rapport à la longueur, épaisseur	0,63
Angle apical	60°

Description. — Coquille trigone, un peu plus large que longue, composée de deux valves inégales, mais bombées toutes les deux en dehors. L'inférieure est semblable à celle des espèces précédentes⁽¹⁾, la supérieure forme une saillie très-marquée dans son milieu. Tous nos exemplaires présentent une obliquité marquée.

La valve profonde est ornée de six côtes rayonnantes, arrondies, séparées par des intervalles larges et peu creusés. Sur toute la coquille, on voit des stries d'accroissement fines et régulières. Les intervalles présentent des côtes rayonnantes arrondies, dont la médiane est ordinairement la plus forte. Ces côtes sont moins subordonnées aux principales que dans l'*atava*. La valve inférieure présente aussi six côtes principales, dont une est presque toujours sensiblement plus forte que les autres, et donne à la coquille une apparence très-oblique. Les intervalles sont peu profonds; ils sont ornés de nombreuses côtes rayonnantes subordonnées.

La valve supérieure rencontre l'autre de diverses manières. Tantôt (fig. 2) elles font toutes deux un angle presque égal avec le plan horizontal. Tantôt (fig. 3) la petite valve, renflée dans son centre seulement, s'aplatit au contact de l'autre. Tantôt (fig. 1), au contraire, c'est le bord qui présente le renflement principal.

Rapports et différences. — Cette espèce est très voisine de la *J. atava*, ayant, comme elle, six grosses côtes rayonnantes, et dans chaque intervalle celle du milieu un peu prédominante. Elle en diffère par ses intervalles moins creusés, et par ses grosses côtes plus rondes et moins domi-

⁽¹⁾ *Neithea atava* (ROEMER) *Neithea neocomiensis* (D'ORBIGNY) (= *Neithea atava* juv.).

nantes. Mais son principal caractère consiste dans la forme de la valve supérieure, qui au lieu d'être concave, est toujours relevée dans son centre.

Gisement à Sainte-Croix. — L'étage valangien, soit le calcaire roux, soit les marnes à bryozoaires. Elle ne paraît pas abondante. Coll. Campiche, coll. Pictet.

Autres gisements observés. — L'étage valangien inférieur de la Ville-de-Pont, recueilli par M. Jaccard. Le même étage à Ballaigues (Vaud) et à Vigneules (Lac de Biemme). La limonite valangienne à Villers-le-Lac, à Gaicht, à Boucherans et à Mièges. L'étage néocomien inférieur de Cinquétral (Jura).

Il est probable qu'il faudra ajouter une partie des gisements valangiens, dans lesquels on cite la *J. atava*.

Additional description :

Number of studied specimens : 126.

Berriasian	Switzerland	1
Valanginian	Alpine	77
Hauterivian	Alpine	24
Aptian	Alpine	24

Measurements.

	U.P.D.	W.	A.A.	S.
Mièges (Coll. PICTET) (Mus. Gen.)	23.9	18.3	48°	R
Id.	21.4	—	50°	R
Sainte Croix (Coll. PICTET) (Mus. Gen.)	23.1	20.8	57°	R
Id.	13.25	12.4	54°	R
Id.	19.4	16.8	51°	R
Id.	—	—	50°	R
Id.	14.6	—	47°	R
Id.	—	13.8	72°	L
Villers-le-Lac (Coll. PICTET)	29.3	—	58°	R
Cinquétral (Coll. PICTET) (Mus. Gen.)	—	14.8	50°	R
Id.	17.8	14.8	76°	L
Id.	14.4	12.6	54°	R
Id.	22.8	—	53°	R

Description.

Diagnosis. — Small to medium-sized *Neithella*-species with 5-6 angular ribs, which form deep incisions on the pallial margin, very unequal auricles and an asymmetrical shape. The intercostal intervals bear well-developed intercalary ribs.

The shell is completely covered with not very prominent growthlines.

The umbo is very narrow, particularly so on the right valve.

The ornamentation consists in 6 (sometimes 5) well developed primary ribs. In the intervals, nearest to the areas, there are 3 or 5 intercalary ribs, in medial intervals there are always 5 intercalary ribs. Often, the medial intercalary rib is more developed than the others in the same interval; sometimes all intercalary ribs are equal in development. Intercalary ribs are always present and even on very worn valves the medial ones are still visible.

The right valve is very convex; the left valve is flattened or slightly convex; the reason for the occasional convexity lies in the characteristics of the sub-

genus *Neithella* : the right-valve ribs and the left-valve ribs are very angular; at the pallial margin they grow towards each other and give the left valve a convex aspect. The « convexity » is increased by the particular growth-process of those ribs on the left valve : when the shell is small, the ribs on the left valve do not rise much above the shell-surface, but, at a certain stage, they become very salient and this definitely gives the shell a convex aspect.

The auricles are rarely preserved; when they are, the anterior ones are very large and wing-like and the posterior ones small and obtuse angled.

Discussion :

Variability. — The primary ribs are constant in number and shape; the differences of shape that do occur are largely due to preservation state. For the intercalary ribs the preservation state is very important since it is the reason of most « variations » in them. When they are all almost equal the shell reminds one of *Neithea sexcostata* (WOODWARD), but the auricles are different.

Synonymy. — This species has not been recorded from areas outside the prealpine and alpine regions of France and Switzerland. Except by PICTET et CAMPICHE it has rarely been mentioned at all. This can be explained by its usual preservation state; without auricles it is impossible to differentiate specimens of *N. valangiensis* from young valves of *N. atava* (ROEMER) which are then usually called *N. neocomiensis*. It could be, as suggested by PICTET et CAMPICHE that several records of *N. atava* are, in fact, *N. valangiensis*.

Also the rare records of *N. valangiensis* could be due to the great importance PICTET et CAMPICHE assigned to the « biconvexity » of the species : this is in fact an exceptional state largely due to an unusual development of the ribs and not to a convex shape of the left valve itself. This « convexity » of left valves is not limited to *N. valangiensis* but appears in other species with very salient principal ribs such as *N. atava* (ROEMER) and *N. striatocostata* (GOLDFUSS).

Differentiation. — *N. valangiensis* differs from *N. notabilis* (MUENSTER in GOLDFUSS) by having a narrower umbo, a shorter anterior auricle, less angular principal ribs and well developed intercalary ribs.

Well preserved specimens are differentiated from other *Neithea* (*Neithea*)-species by the auricle-shape and the relative obliquity; specimens in poor preservation state, without auricles, are extremely difficult to differentiate.

N. atava specimens without auricles, differ from *N. valangiensis* specimens, in the same state, in the latter having a narrower umbo and more and better

developed intercalary ribs, and a generally oblique shape. The differential characteristics can only be used if one has a large series of specimens and they are not good enough for differentiating small incomplete *N. atava* from *N. valangiensis*.

With other *Neithea*-species confusion is unlikely, except perhaps with poorly preserved specimens of *N. (Neithea) sexcostata* (WOODWARD); but even in this species the intercalary ribs are less obviously differentiated, the concentric ornamentation is much more prominent and the areas are covered with numerous close riblets, whereas *N. valangiensis* has completely smooth areas.

Generic attribution. — *Janira valangiensis* PICTET et CAMPICHE has the same general shape as *N. notabilis* (MUENSTER in GOLDFUSS). It seems very likely that the former species also has a *Neithea*-hinge, even if so far it has not been proved. The unequal auricles and the obliquity of the shell characterize the species as belonging to the subgenus *Neithella*. The correct name of *Janira valangiensis* PICTET et CAMPICHE, 1870 thus becomes *Neithea (Neithella) valangiensis* (PICTET et CAMPICHE, 1870).

Stratigraphical and geographical distribution:

Valanginian:

FRANCE:

- Cinquétral (Jura) (Mus. Gen.).
- Mièges (Jura) (Mus. Gen.).
- Ville-de-Pont (Doubs) (Mus. Gen.).
- Villers-le-Lac (Doubs) (Mus. Gen.).

SWITZERLAND:

- Arzier (Vaud) (Mus. Gen., Mus. Laus.).
- Ballaigues (Vaud) (Mus. Gen.).
- Boucherans (Vaud) (Mus. Gen.).
- Chamblon (Vaud) (Mus. Gen.).
- Colas, Sainte-Croix (Vaud) (Mus. Laus.).
- Comte (Vaud) (Mus. Gen.).
- Gaicht, Biel (Bern) (Mus. Gen.).
- La Rusille (Vaud) (Mus. Gen.).
- Le Dat, Semsales (Fribourg) (Mus. Gen., Mus. Laus.).
- Sainte-Croix (Vaud) (Mus. Gen.).
- Vingel, Biel (Bern) (Mus. Gen.).

Hauterivian:

FRANCE:

- Auxerre (Yonne) (Mus. Laus.).
- Bettancourt (Haute-Marne) (Mus. Gen., Mus. Laus.).
- Grange-Marin, Salève (Haute-Savoie) (Mus. Gen.).
- Salève, Varappe (Haute-Savoie) (Mus. Gen., Mus. Laus.).

SWITZERLAND:

- Auberson, Sainte-Croix (Vaud) (Mus. Laus.).
- Hauterive (Neuchâtel) (Mus. Laus.).
- Landeron (Neuchâtel) (Mus. Laus.).

Aptian:

FRANCE:

- Perte-du-Rhône (Ain) (Mus. Gen.).

19. — Addenda to the genus *Neithea*.

1. Species mentioned in literature and studied but of uncertain position.

a) *Neithea? decemcostata* (D'ORBIGNY, 1847) (pp. 649, pl. 449, figs. 1-4).

In the D'ORBIGNY collection (7621), Muséum national d'Histoire naturelle, Paris, this species is represented by one specimen from the Senonian of Cognac. It is a steinkern with 10 equal ribs; the auricles are invisible.

It seems doubtful that this species really belongs to *Neithea* because of its ribnumber: all *Neithea*-species have 6 principal ribs + a multiple of 5 for the intercalary ribs. On steinkernen only the most developed intercalary ribs remain visible and on certain species such as *N. coquandi* (PERON), *N. dutruei* (COQUAND) and *N. valangiensis* (PICTET et CAMPICHE) specimens with 11 ribs are known, but never with 10 ribs; besides on the valve which D'ORBIGNY described as *Janira decemcostata* the umbo is not incurved, and this is a character found in all *Neithea*-species living in other than reef-habitats.

b) *Neithea linearis* J. BOEHM, 1927 (p. 203, pl. 13, fig. 12).

The type is in the British Museum (Natural History), L 49457 and comes from the Senonian of Kandhili in Bithynia (Turkey). It is very poorly preserved. It could be related to *N. aequicostata* (LAMARCK) but the state of the specimens does not make a definite identification possible.

c) *Neithea (Neithea) zitteli* (G. A. PIRONA, 1884).

.1884	<i>Janira Zitteli</i> Pr. n. sp.	G. A. PIRONA, pp. 166, 167, pl. 3, figs. 1-15.
v.1892	<i>Neithea Zitteli</i> (Pirona)	K. FUTTERER, p. 79.
(1897)	<i>Neithea Zitteli</i> Pirona	G. BOEHM, p. 171.
1899	<i>Janira Zitteli</i> Pirona	P. OPPENHEIM, pp. 45, 46.
(1899)	<i>Neithea Zitteli</i> Pirona	K. A. REDLICH, p. 150.
1901	<i>Neithea Zitteli</i> Pirona	K. A. REDLICH, pp. 76-81.
?1926	<i>Neithea Zitteli</i> (Pir.)	C. F. PARONA, p. 52, pl. 5, fig. 3.
v.1960	<i>Neithea zitteli</i> Pirona	M. PLENÍČAR, p. 29.
v.1967	<i>Neithea zitteli</i> (Pirona)	A. POLŠAK, pp. 31, 32.

Holotype. — Probably in the Geological Museum of the University of Pavia, Italy.

Locus typicus. — Col de Schiosi, Venetian Alps (Italy).

Stratum typicum. — Terreno cretacea con Rudiste (Turonian?).

Original description :

Larghezza della valva inferiore : adulti 48 a 65 mill.; giovani 32 a 36 mill.

Lunghezza in rapporto alla larghezza : 0.83-0.84.

Lunghezza della valva super. in rapporto alla sua larg. : 1.10-1.14.

Angolo apicale : 65°.

Testa trigona, crassa latior quam longa. Valva inferior valde convexa, costis sex validioribus radiantibus ornata, cum interpositis aliis duobus, vel tribus, minoribus; superficies interna laevis. Umbo incurvatus, crassus. Auriculae non expansae, semilunares, buccalis paullo major.

Valva superior convexo-plana, latior quam longa, costis sex majoribus cum aliis duobus vel tribus minoribus interpositis, necnon lineis concentricis armata. Superficies interna, laevis; margo subundulatus. Impressio pallealis semicircularis brevior quam in valva superiore. Umbo planus, laevis. Auriculae subplanae, buccalis trigona, major.

Conchiglia trigona, allungata, molto grossa. Valva inferiore più larga che lunga, molto grossa e molto convessa; umbone molto spesso e incurvato. La superficie esterna è ornata da sei coste maggiori, raggianti, nell'intervallo delle quali vi hanno due e più raramente tre coste secondarie, minori, tondeggianti. In alcuni esemplari la differenza tra le coste maggiori e le intermedie è così poco sensibile, che la conchiglia si direbbe equicostata, cioè dipende in parte dalla divisione, tanto delle maggiori quanto delle minori, per solchi che prendono origine verso la metà della larghezza della valva, in parte dalla corrosione. La superficie interna è liscia, senza traccia di coste o di solchi anche nell'individui giovani. L'impressione muscolare, di forma ovale, è portata da un cuscinetto rilevato principalmente verso l'interno e verso il lato branchiale. Impressioni palleali leggermente sprofondate. Margine libero appena ondulato e in corrispondenza delle coste maggiori, di poco sporgente dalla linea generale.

Orecchiette semilunari, grosse, la buccale un poco maggiore della anale. Fossetta ligamentare quadrilunga, profonda.

Valva superiore più lunga che larga, grossa, alquanto convessa verso il terzo superiore, più o meno depressa verso il margine, ornata da sei coste grosse, tondeggianti e verso il margine bi-tripartite per uno o due solchi poco profondi, che incominciano a circa due terzi dall'apice dell'umbone, ch'è piano e liscio. Due coste secondarie stanno interposte tra l'una e l'altra delle sei maggiori, e tramezzo a quelle talvolta una, talvolta due costicine assai più piccole. Linee d'accrescimento, parallele al margine e molto sensibili, danno alla superficie della valva l'aspetto tessellato. Margine subundulato e pochissimo sporgente fuori della linea generale in corrispondenza delle sei coste maggiori. Superficie interna liscia, con brevi intaccature presso il margine libero. Impressioni palleali semicirculari, ben marcata, meno estesa di quella della valva inferiore. Impressioni muscolari subcirculari, alquanto scabra e incavata. Orecchietta buccale alquanto maggiore della anale, di forma triangolare, internamente liscia, ed all'esterno leggermente striata; la sinistra alquanto obliqua. Modello liscio.

Oss. e Diff. — La *Janira Zitteli* ha qualche analogia colla *J. atava* Roem., sp. e colla *J. quadricostata* Sow. Sfortunatamente la maggior parte degli esemplari più completi della valva inferiore ha subito una specie di decorticazione, la quale rende la superficie esterna quasi liscia, sebbene vi si scorgano manifeste altrettante viti di color bruno quante erano le coste sì principale che secondarie (22-24). Dalla *J. atava* differisce essenzialmente, perchè la conchiglia è molto più grossa, a superficie interna affatto liscia e senza solchi in corrispondenza delle sei coste maggiori. Dalla *J. quadricostata* differisce per la forma, numero e disposizione delle coste secondarie, per l'angolo apicale più aperto, e si dall'una come dall'altra per la convessità e la forma generale della valva superiore.

Nun è rara, avendo potuto esaminare della valva inferiore 10 esemplari, e della valva superiore 4.

Additional description :

Number of studied specimens : 40 specimens from the hippuritic limestone in the Venetian Alps and in Istria.

Measurements.

U.P.D. varies from 30 mm to 75 mm.

W varies from 28 mm to 73 mm.

AA was measured on 1 large specimen : 94°.

Rib number is difficult to count because many of the ribs are divided.

Diagnosis. — Medium to large-sized *Neithea*-species with 6 principal ribs and in each principal interval 3 intercalary ribs.

The umbo is very incurved, the areas are inwardly bent. The principal ribs are often tripartite.

Discussion. — This species is very similar to *Neithea regularis* (SCHLOTHEIM); the only differential characteristic that can easily be used lies in the tripartition found in several of the principal ribs; also the left valve shows a tendency to be convex.

It is difficult to judge whether these characteristics are of specific or of subspecific nature; indeed the species occurs in a limited geographical, stratigraphical and palaeoecological distribution: the hippuritic limestone of Istria and the neighbouring Venetian Alps, in Upper-Cenomanian and Turonian.

Unfortunately the material is usually very poor so that precise information on the rib- and areal-ornamentation and on the shape of the auricles is not available. It seems preferable in the present state of our knowledge to keep the species separate, as no sufficient basis is present to form an opinion as to its probable relation among the *Neithea*-species with 3 intercalary ribs.

Generic attribution. — No hinge-teeth are known, but considering the general similarity of *Janira zitteli* with *Neithea aequicostata* (LAMARCK), type-species of *Neithea* (DROUET) there seems no reason to doubt that both species are congeneric. The correct name of *Janira zitteli* thus becomes *Neithea* (*Neithea*?) *zitteli* (PIRONA).

Stratigraphical and geographical distribution :

Cenomanian-Turonian : hippuritic Limestone :

ITALY :

Calloniche, Lago di S. Croce (Venezia) (B., orig. FUTTERER).

YUGOSLAVIA :

Glavice (Istria) (Univ. Zagreb).
Oportalj (around) (Univ. Zagreb).
Pinguente (Istria) (B.M.).
Vrhovlje (Geol. Zav. Ljubljana).

2. Species described in recent literature.

Neithea (*Neithella*?) *rotundata* S. FRENEIX et R. LEFEVRE, 1968 (pp. 773 and 774, p. 28, figs. 3-5). The original material appears to be poorly preserved. There seems to be a similarity with *N. fleuriausiana* (D'ORBIGNY), but without seeing the type-material nothing more can be said at present.

3. Species mentioned, but insufficiently described for identification.

Pecten (*Neithea*) *blanci* N. SHALEM, 1937, page 38, plate 1, figures 45, a-c.

Neithea trevisani G. TAVANI, 1948, pages 95 and 96, plate 2, figures 4, 5, 8.

Neithea paulii Landerer J. R. BATALLER, 1947, pages 154 and 155, textfigure.

4. Correction: *Neithea kaufmanni* MAYER-EYMAR in GILLET, 1921, page 118.

S. GILLET mentions this species from « Valanginien du Lac de Thoune ». In the monograph of MAYER-EYMAR, 1887 there is a *Pecten kaufmanni* (p. 19, pl. 2, fig. 1) from the Bartonian of Ralligstösche on the Thuner See. Apparently it is an error by S. GILLET.

The same is true for I. HAYAMI, 1965 who mentions *Neithea kaufmanni* MAYER-EYMAR, 1893 from the Somaliland Neocomian. In MAYER-EYMAR's publication on Somaliland no *Pectinidae*-species is described nor mentioned.

20. — Explanation of the symbols and terms used in the descriptions.

a) List of the applied morphological terms.

apical angle: angle between the two apical lines = umbonal angle.

apical line: delimitation between the disc and the auricle = umbonal fold.

auricles, auriculae: on both valves there are anterior and posterior auricles; the anterior auricle of the right valve may have an obsolete byssal sinus.

beak: umbo.

disc: whole valve, except the auricles.

hinge-line: exterior margin of the auricles, going through or lying just above the umbo and thus covering the hinge (= hinge margin).

index $\frac{H}{W}$: index of umbo-pallial diameter (height) to width (length).

left valve: dorsal valve; in *Neitheinae* also called concave or flat valve.

lines and striae: concentric, radial or oblique very narrow structures which are only very slightly elevated above the shell-surface.

outer-margin: the auricle margin which connects the end of the hinge line with the disc and ends where the apical line and side margin meet.

pallial margin: ventral (lowest) margin of the disc; mostly semicircular.

rib: every moderately broad elevation of the shell surface continuous from umbo to margin.

riblet: narrow, almost linear, elevation of surface of shell.

right valve: ventral valve; in *Neitheinae* also called convex valve.

side margin: the disc margin between the end of the apical line and the pallial margin.

umbo: beak; the section point between the apical lines; the oldest part of the shell.

umbo-pallial diameter: the distance between the umbo and the middle of the pallial margin.

umbonal or apical region: the part of the shell close to the umbo.

width: the maximum distance perpendicular to the umbo-pallial diameter (= length).

b) List of abbreviations used in the descriptions.

av.: average.

U.P.D.: umbo-pallial diameter.

W.: width.

c) List of prefixes used to indicate the various collections.

B.: Paläontologisches Museum der von Humboldt Universität, Berlin.

B.M.: British Museum (Natural History), Palaeontology Department, London.

DR.: Staatliches Museum für Geologie und Mineralogie, Dresden.

Ec.Min.: Chaire de Paléontologie, Ecole nationale des Mines, Paris.

Geol.Bund.: Geologische Bundesanstalt, Vienna.

Geol.Sci.: Geological Sciences Institute, London.

Geol.Zav.Ljubljana: Geološki Zavod, Ljubljana.

GH.: Geologisches Staatsinstitut, Hamburg.

GR.: Sektion Geologische Wissenschaften der Ernst-Moritz-Arndt Universität, Greifswald.

Halle: Geiseltal Museum der Martin-Luther Universität, Halle-Wittenberg.

I.R.Sc.N.B.: Institut Royal Sciences naturelles de Belgique, Brussels.

K.U.L.: Laboratorium voor Paleontologie, Katholieke Universiteit Leuven, Louvain.

Ma.: Natuurhistorisch Museum, Maastricht.

OF THE SUBFAMILY NEITHEINAE, ETC.

Mü. : Institut für Paläontologie und Historische Geologie, Bayerische Staatssammlung, München (Munich).

Musé. : Muséum national d'Histoire naturelle, Paris.

Mus.Gen. : Muséum d'Histoire naturelle, Geneva.

Mus.Laus. : Musée géologique, Lausanne.

N.M.W. : Naturhistorisch Museum, Vienna.

R.U.G. : Laboratorium voor Palcontologie, Rijksuniversiteit Gent (Ghent).

S.M. : Sedgwick Museum, Cambridge.

Univ.Neuch. : Laboratoire de Géologie, Neuchâtel.

Univ.Sofia : University Kliment Ochriski, Palaeontology Chair, Sofia.

Univ.Zagreb. : Palaeontology Chair, University of Zagreb.

d) Explanation of the symbols used in the synonymy lists.

1870 : though there is no reason to doubt the identity of reference with the species under discussion, there is no definite proof of both being identical.

? 1870 : the specific attribution of the author seems doubtful.

. 1870 : the specific attribution of this author is undoubtedly correct.

v. 1870 : I saw the original and the specific attribution is correct.

v? 1870 : I saw the original and am not convinced by the specific attribution.

(1870) : the species is mentioned in a list, without a description; it is impossible to check the attribution.

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F. — GEOGRAPHICAL INDEX

1. ABBREVIATIONS

Alg.	=	Algeria.	Leb.	=	Lebanon.
Ang.	=	Angola.	Lyb.	=	Lybia.
Ass.	=	Assam.	Mad.	=	Madagascar.
Aus.	=	Austria.	Mor.	=	Morocco.
Bel.	=	Belgium.	Moz.	=	Mozambique.
Bul.	=	Bulgaria.	Nig.	=	Nigeria.
C.H.	=	Zwitzerland.	Oma.	=	Oman.
Cze.	=	Czechoslovakia.	Pak.	=	Pakistan.
Egy.	=	Egypt.	Pol.	=	Poland.
Eth.	=	Ethiopia.	Por.	=	Portugal.
Fra.	=	France.	S.A.R.	=	South African Rep.
G.B.	=	Great Britain.	Som.	=	Somaliland.
G.D.R.	=	German Dem. Rep.	Spa.	=	Spain.
G.F.R.	=	German Fed. Rep.	Swe.	=	Sweden.
Had.	=	Hadhramaut.	Syr.	=	Syria.
Hol.	=	Holland.	Tan.	=	Tanzania.
Hun.	=	Hungary.	Tri.	=	Trinidad.
Ind.	=	India.	Tun.	=	Tunisia.
Ira.	=	Iraq.	Tur.	=	Turkey.
Isr.	=	Israel.	U.S.A.	=	U.S.A.
Ita.	=	Italy.	U.S.S.R.	=	U.S.S.R.
Jam.	=	Jamaica.	Yu.	=	Yougoslavia.
Jap.	=	Japan.			
Jor.	=	Jordan.			

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H. — SUMMARY

This paper contains a systematic revision of all Cretaceous European, boreal and Tethyan *Neitheinae*. For each species it gives an exhaustive synonymy, the location of the type, the locus typicus and stratum typicum (these have been all or partly chosen for *Neitheia aequicostata*, *N. coquandi*, *N. quinquecostata*, *N. atava*, *N. sexcostata*, *N. striatocostata*, *N. dutruei*, *N. valangiensis*), the original description (if the publication has become rare), a description and discussion,

and the geographical and stratigraphical distribution based on studied material.

By comparing a large number of specimens of each species the variability within the species is established. This makes it possible to simplify the often entangled nomenclature.

The stratigraphical and palaeogeographical implications will be discussed in a further paper on Cretaceous *Pectinidae*.

I. — RÉSUMÉ

Le but de cette étude a été de faire la révision systématique de toutes les espèces de Neithéinés du Crétacé européen du domaine boréal et de la Téthys. Pour chaque espèce nous avons mentionné la synonymie critique et exhaustive, l'endroit où se trouve le type, la localité-type et son niveau stratigraphique (ceux-ci ont été désignés pour *Neitheia aequicostata*, *N. coquandi*, *N. quinquecostata*, *N. atava*, *N. sexcostata*, *N. striatocostata*, *N. dutruei*, *N. valangiensis*), la description originale (quand celle-ci avait été publiée

dans une œuvre devenue rare), une description avec discussion, et la distribution stratigraphique et géographique entièrement basée sur des matériaux étudiés.

La comparaison de nombreux spécimens pour chaque espèce a permis d'établir la variabilité dans l'espèce, et ainsi, la nomenclature, souvent très embrouillée, a pu être beaucoup simplifiée.

Les implications stratigraphiques et paléogéographiques seront discutées dans une étude complémentaire des Pectinidés crétaciques.

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PLATES

EXPLANATION OF PLATE I.

FIG. 1. — *Neithea (Neithea) aequicostata* (LAMARCK).

Le Mans (France); Cenomanian.
Coll. Ecole nationale des Mines, Paris.

- a) Hinge of right valve, $\times 5$.
- b) Interior of right valve, $\times 5$.
- c) Exterior of right valve, $\times 5$.

FIG. 2. — *Neithea (Neithea) atava* (ROEMER).

Auxerre, Yonne (France); Neocomian.
Coll. Ecole nationale des Mines, Paris.

- a) Hinge of right valve, $\times 3$.
- b) Exterior of right valve, $\times 1$.

FIG. 3. — *Neithea (Neithea) regularis* (SCHLOTHEIM).

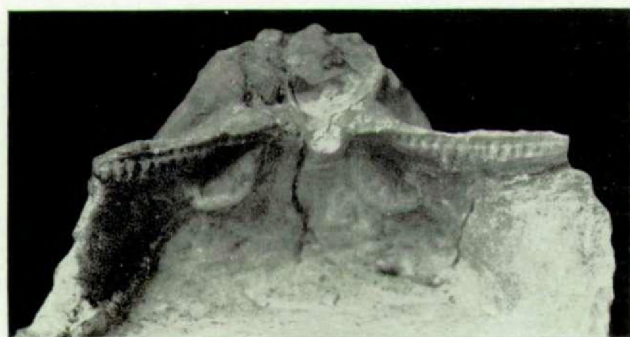
Exterior of left valve, $\times 1$.
Sint Pietersberg, Maastricht (Netherlands); Upper Maastrichtian.
Coll. I.R.Sc.N.B. — Fig. spec. 9803.



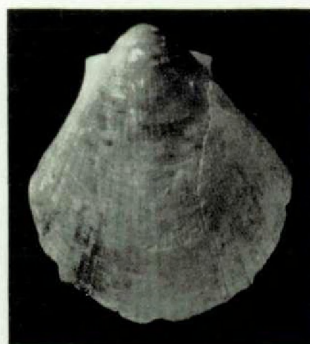
1 a



1 b



2 a



1 c



2 b



3

A. V. DHONDT. — Systematic revision of the subfamily *Neitheinae*
(*Pectinidae*, *Bivalvia*, *Mollusca*) of the European Cretaceous.

EXPLANATION OF PLATE II.

FIG. 1. — *Neithea (Neithea) regularis* (SCHLOTHEIM).

Sint Pietersberg, Maastricht (Netherlands); Maastrichtian.

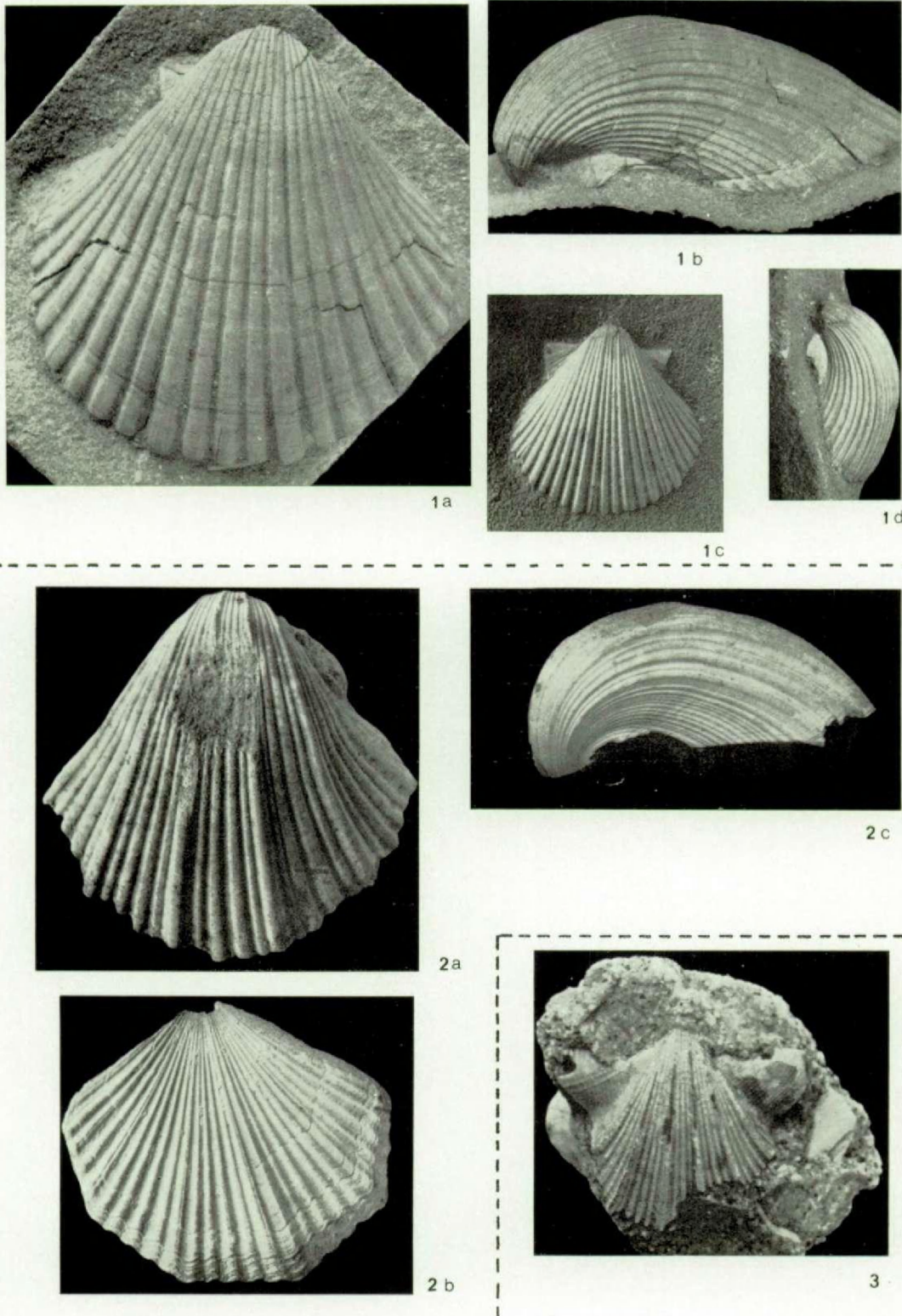
- a) Exterior of right valve, $\times 1$.
Coll. I.R.Sc.N.B. — Fig. spec. 9799.
- b) Lateral view of right valve, $\times 1$.
Coll. I.R.Sc.N.B. — Fig. spec. 9799.
- c) Exterior of right valve, $\times 1$.
Coll. I.R.Sc.N.B. — Fig. spec. 9810.
- d) Lateral view of right valve, $\times 1$.
Coll. I.R.Sc.N.B. — Fig. spec. 9810.

FIG. 2. — *Neithea (Neithea) quinquecostata* (SOWERBY).

- a) Exterior of right valve, $\times 1$.
Rouen; Cenomanian.
Coll. I.R.Sc.N.B. — Fig. spec. 9802.
- b) Exterior of left valve, $\times 1$.
Folx-les-Caves (Belgium); Maastrichtian.
Coll. I.R.Sc.N.B. — Fig. spec. 9804.
- c) Lateral view of right valve, $\times 1$.
Rouen (France); Cenomanian.
Coll. I.R.Sc.N.B. — Fig. spec. 9802.

FIG. 3. — *Neithea (Neithea ?) gibbosa* (PULTENEY).

Exterior of right valve, $\times 5$.
Bracquegnies, Meule de Bracquegnies (Belgium); Albian.
Coll. I.R.Sc.N.B. — Fig. spec. 9814.



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EXPLANATION OF PLATE III.

FIG. 1. — *Neithea (Neithea) coquandi* (PERON).

Djebel Lasseigne, Aures (Algeria); Cenomanian.
Coll. I.R.Sc.N.B. — Fig. spec. 9807.

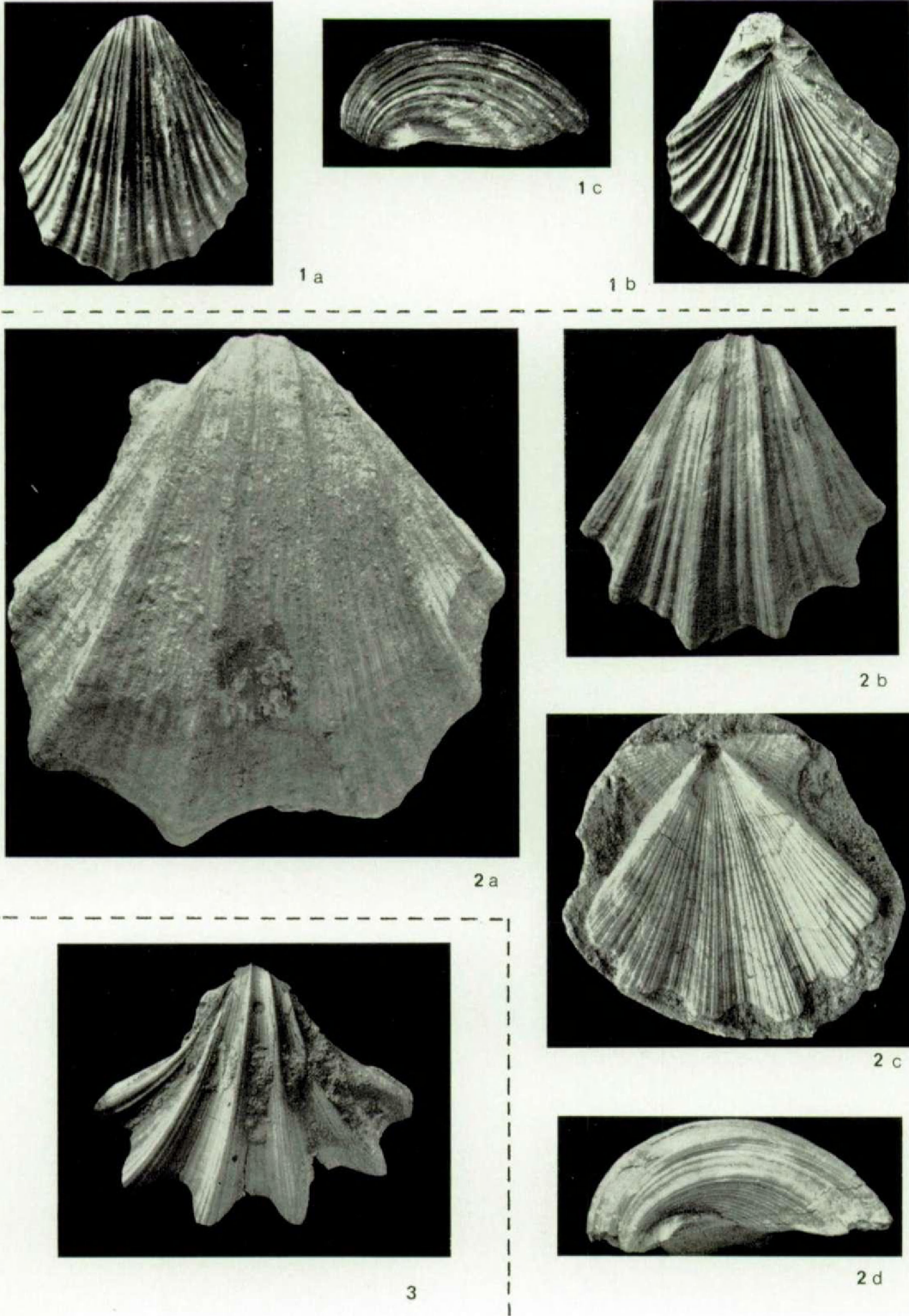
- a) Exterior of right valve, $\times 1$.
- b) Exterior of left valve, $\times 1$.
- c) Lateral view of right valve, $\times 1$.

FIG. 2. — *Neithea (Neithea) striatocostata* (GOLDFUSS).

- a) Exterior of worn right valve, $\times 1$.
Livernon (France); Campanian.
Coll. I.R.Sc.N.B. — Fig. spec. 9798.
- b) Exterior of right valve, $\times 1$.
Meschers (France); Campanian.
Coll. I.R.Sc.N.B. — Fig. spec. 9805.
- c) Exterior of left valve, $\times 1.5$.
Maastricht (Netherlands); Maastrichtian.
Coll. I.R.Sc.N.B. — Fig. spec. 9811.
- d) Lateral view of right valve, $\times 1$.
Meschers (France); Campanian.
Coll. I.R.Sc.N.B. — Fig. spec. 9805.

FIG. 3. — *Neithea (Neithea) sexangularis* (D'ORBIGNY).

Exterior of right valve, $\times 1$.
Cailhau (France); Campanian.
Coll. I.R.Sc.N.B. — Fig. spec. 9809.



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EXPLANATION OF PLATE IV.

FIG. 1. — *Neithea (Neithea) fleuriausiana* (D'ORBIGNY).

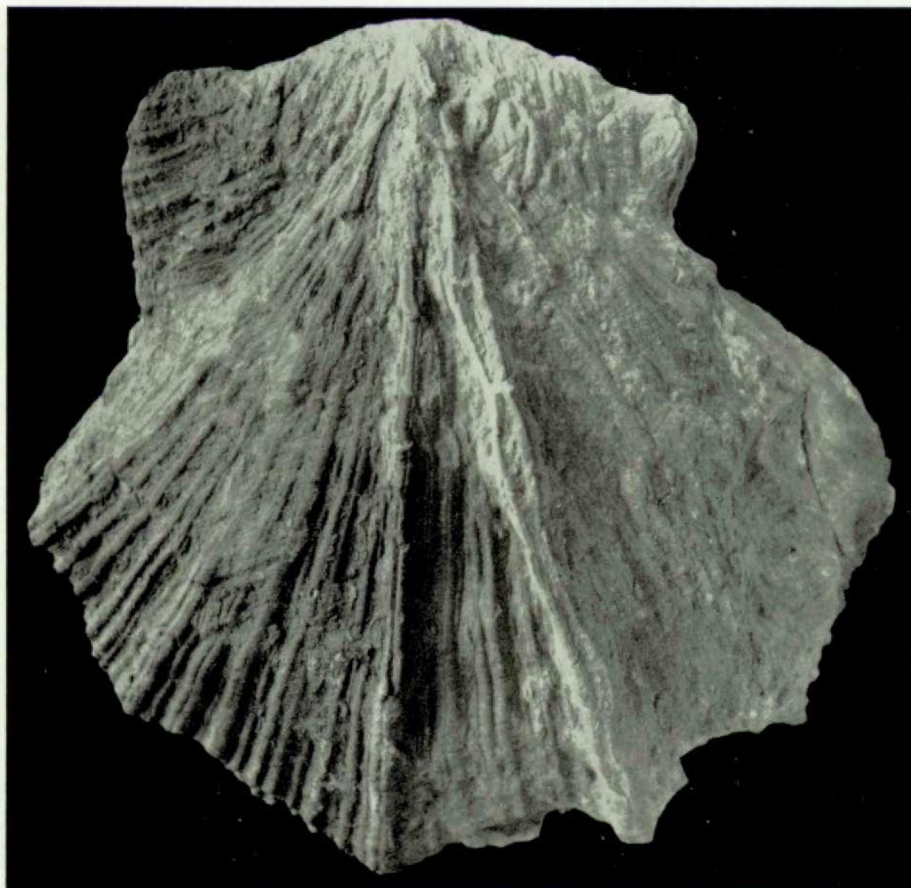
Exterior of right valve, $\times 1$.
Ile Madame (France); Cenomanian.
Coll. I.R.Sc.N.B. — Fig. spec. 9801.

FIG. 2. — *Neithea (Neithella) notabilis* (MUNSTER *in* GOLDFUSS).

Exterior of right valve, $\times 5$.
Vimoutiers (France); Cenomanian.
Coll. I.R.Sc.N.B. — Fig. spec. 9815.

FIG. 3. — *Neithea (Neithea?) dutrugei* (COQUAND).

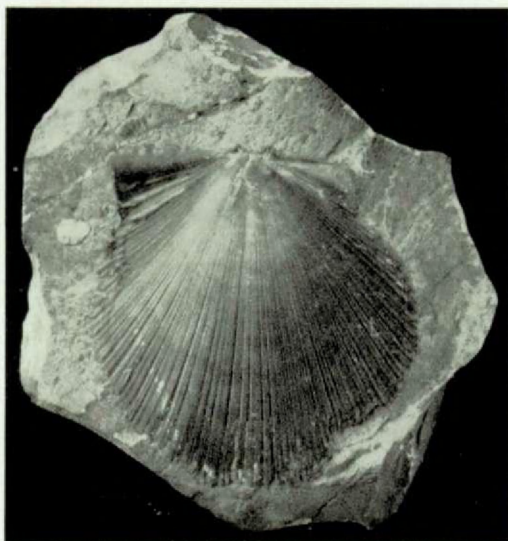
Interior of left valve, $\times 1.5$.
Batna (Algeria); Cenomanian.
Coll. I.R.Sc.N.B. — Fig. spec. 9813.



1



2



3

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EXPLANATION OF PLATE V.

FIG. 1. — *Neithea* (*Neithea*?) *deshayana* (MATHÉRON).

Orgon (France); Barremian.
Coll. I.R.Sc.N.B. — Fig. spec. 9800.
a) Exterior of right valve, $\times 1$.
b) Exterior of left valve, $\times 1$.

FIG. 2. — *Neithea* (*Neithea*) *sexcostata* (WOODWARD).

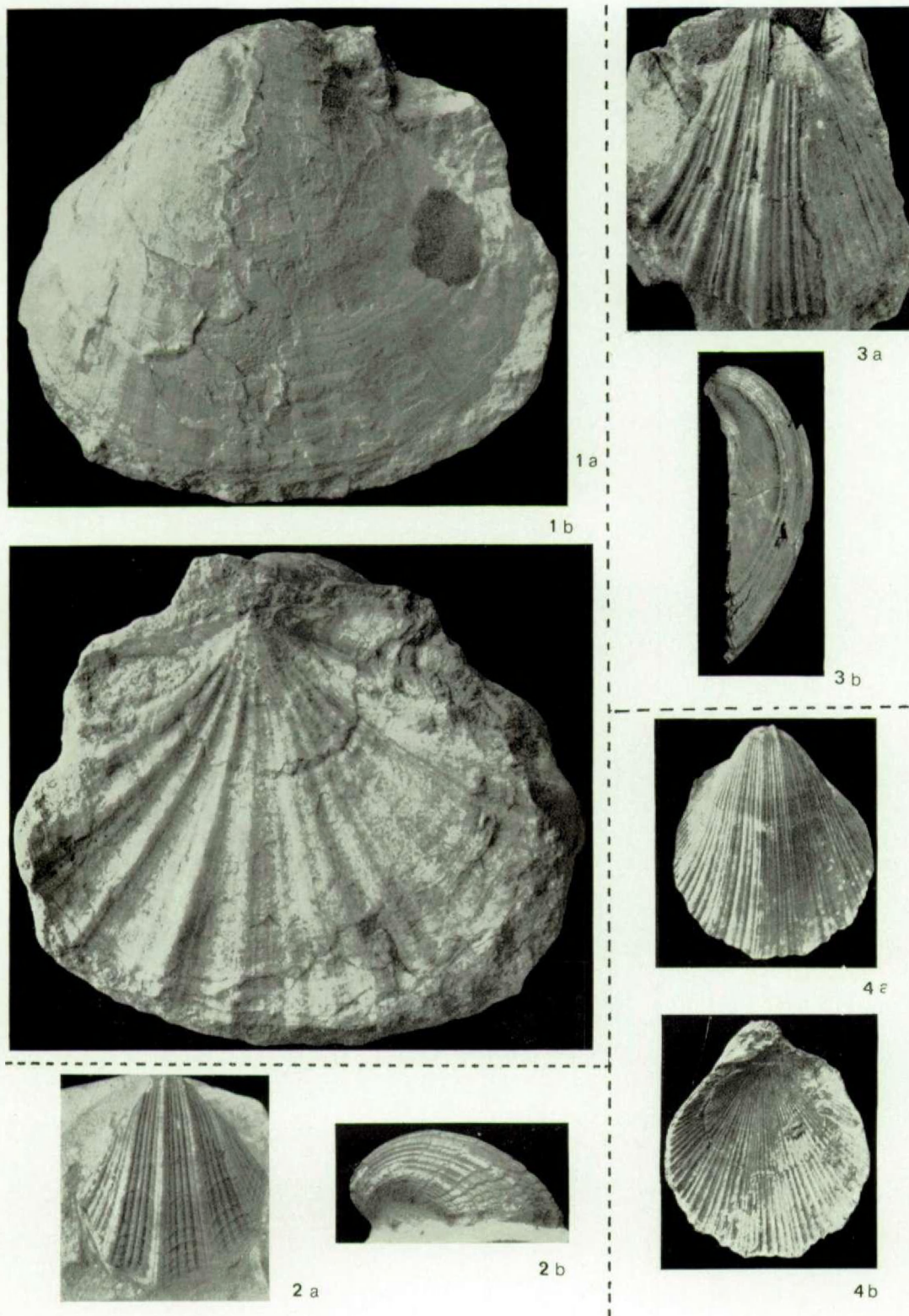
Cuesmes (Belgium); Campanian.
Coll. I.R.Sc.N.B. — Fig. spec. 9812.
a) Exterior of right valve, $\times 1.5$.
b) Lateral view of right valve, $\times 1.5$.

FIG. 3. — *Neithea* (*Neithea*) *syriaca* (CONRAD).

Onnaing-lez-Valenciennes (France); Meule de Bernissart; Albian.
Coll. I.R.Sc.N.B. — Fig. spec. 9806.
a) Exterior of right valve, $\times 1$.
b) Lateral view of right valve, $\times 1$.

FIG. 4. — *Neithea* (*Neithea*?) *dutrugei* (COQUAND).

Tenoukla (Algeria); Cenomanian.
Coll. I.R.Sc.N.B. — Fig. spec. 9808.
a) Exterior of right valve, $\times 1$.
b) Exterior of left valve, $\times 1$.



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