

Mollusca Bivalvia : Archibenthal Nuculidae off New Caledonia

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ABSTRACT

Six species of Nuculidae have been identified from dredgings between 250 and 430 m off western New Caledonia : *Nucula nitidulaformis* Powell, 1971 ; *N. kanaka*, *N. oppressa*, and *N. libera*, spp. nov. ; *Nucula* sp. indet. ; and *Leionucula*

strangei (A. Adams, 1856). *Ennucula* Iredale, 1931, is considered a synonym of *Leionucula* Quenstedt, 1930. This nuculid fauna shows rather strong similarities to that of New Zealand.

RÉSUMÉ

Mollusca Bivalvia : Nuculidae bathyales de Nouvelle-Calédonie.

Six espèces de Nuculidae ont été identifiées dans des récoltes faites entre 250 et 430 m de profondeur à l'ouest de la Nouvelle-Calédonie : *Nucula nitidulaformis* Powell, 1971 ; *N. kanaka*, *N. oppressa* et *N. libera*, spp. nov. ; *Nucula* sp. indét. ; et *Leionucula strangei* (A. Adams, 1856). *N. nitidulaformis* et *L. strangei* ont été décrites de la Nouvelle-Zélande. *N. kanaka* montre des similitudes avec *N. nitidula* A. Adams, 1856, de la Nouvelle-Zélande et des Îles Chatham, et avec *N. beachportensis* Verco, 1907, de l'Australie. *N. oppressa* ressemble à *Linucula recens* Dell, 1956, de la Nouvelle-

Zélande et des Îles Chatham. Seule *N. libera* ne se rapproche pas d'une espèce de la Nouvelle-Zélande et, d'une manière générale, l'ensemble étudié a des rapports morphologiques assez étroits avec la faune de Nuculidae de la Nouvelle-Zélande. *Nucula strangei* a été classée dans le genre *Leionucula* Quenstedt, 1930, qui est caractérisé par l'absence d'une structure radiale intérieure des valves, qui par suite ont des bords lisses. *Ennucula* Iredale, 1931, est considérée comme un synonyme de *Leionucula*. Toutes les autres espèces rapportées possèdent cette structure et le bord ventral crénelé correspondant, et sont classées dans *Nucula* Lamarck, 1799. Dans *N. libera*, le bord ventral n'est crénelé qu'à partir d'une certaine taille.

INTRODUCTION

On account of my earlier work on a number of Australian Nuculidae (BERGMANS, 1978) Dr Philippe BOUCHET of the Muséum national d'Histoire naturelle in Paris invited me to study a collection of Nuculidae from dredgings from off the west coast of New Caledonia by the vessel "Vauban" in 1978 and 1979. As this material

offered an obvious opportunity to improve our knowledge and further shape ideas on the distribution patterns of archibenthal species or species aggregates in the Australian-Pacific region, and related taxonomic concepts, I accepted the offer with gratitude. This paper presents the results of this study.

MATERIAL AND METHODS

The material on which this report is based is listed under the species in the taxonomic section. Descriptions are in accordance with the terminology adopted in BERGMANS, 1978, and are explained in the Method paragraph of that paper. The present collection is housed in the Muséum

national d'Histoire naturelle in Paris (MNHN); small samples have been deposited in the Zoölogisch Museum of the University of Amsterdam (ZMA). The photographs in this paper have been made with a scanning electron microscope.

SYSTEMATIC ACCOUNT

Nucula nitidulaformis Powell, 1971

Figs 1-2

MATERIAL EXAMINED. — 1 complete shell, 4 odd valves, collected by Ph. BOUCHET, 23 May 1978, at "Vauban" Stn 2, 22°17' S, 167°14' E, New Caledonia, depth 425-430 m (1 shell, 3 valves : MNHN ; 1 valve : ZMA).

DESCRIPTION. — Valves small, relatively solid, moderately convex, trapezoid ovate in outline. Lunule only slightly depressed. Dorsal margin weakly curved, without median angulation. Posterior margin truncated, straight ; posterodorsal angle not very distinct, posteroventral angle rather distinct. Anterior margin somewhat truncated, slightly curved ; dorsal margin gradually passing into anterior margin, anteroventral angulation broadly rounded but quite distinct. Ventral margin rounded anteriorly and slightly less so posteriorly. Exterior of embryonic shell with probably bifid umbo (shells too worn to be conclusive) and microscopically pitted surface. Interdissonconch smooth except growth lines.

Remaining valve part with some pronounced growth lines and on the median part more or less affected by fine inner radial structure, which corresponds with crenulation of ventral margin. Hinge moderately strong, with up to 8 anterior and 5 posterior V-shaped secondary teeth (in the largest specimens of this sample). Tooth rows separated by a small chondrophore with a rounded or slightly angular ventral margin, only slightly projecting beyond hinge line, directed downward and very weakly forward. Dorsal margin somewhat thickened and flattened at both sides above chondrophore. No discernable trace of primary teeth. Adductor muscle scars distinct. Mantle line with shallow incurvation just anterior of the middle.

Shells white or tinged with pale brown. Traces of transparent light brown periostracum preserved in two specimens.

Measurements : Table 1.

DISCUSSION. — *Nucula nitidulaformis* was described from specimens dredged at 366-475 m,

TABLE 1. — Measurements in mm and number of secondary teeth in *Nucula nitidulaformis* Powell, 1971 from "Vauban" Station 2, New Caledonia.

Specimen	Length	Height	Section (one valve)	Length embryonic shell	Number of secondary teeth anterior	posterior
MNHN (right)	1.84	(1.64) ⁺	0.60		8	4
ZMA (left)	1.84	1.60	0.56		8	5
MNHN (right) [']	1.76	1.48			7	3
MNHN (doublet)	1.56	1.28	0.44	c. 0.34		
MNHN (right)	(1.48) ["]	1.28	0.44	0.28	6	4

⁺ Ventral margin incomplete; ['] figured specimen; ["] posterior margin damaged.

east of Aldermen Islands, Bay of Plenty, New Zealand. The smallest specimen in the original lot, the holotype, measures 4.4 mm in length, the largest 7.8 mm. Larger specimens appear to be relatively high. Possible differences between New Zealand specimens and New Caledonian ones are the relatively low number of posterior secondary teeth in the latter and the rather perpendicular orientation of its chondrophore. POWELL (1971) counted 10 anterior and 8 posterior teeth (called posterior and anterior by him, respectively) in one of the Aldermen Islands specimens — without indicating valve length. He described the chondrophore as narrow, spoon-shaped, and anteriorly oblique. His photographs of the holotype specimen suggest that its chondrophore resembles that of the specimens from New Caledonia but unfortunately they are not distinct enough to be conclusive. In this connexion it may be of importance that POWELL did not assign *Nucula nitidulaformis* to the genus *Pronucula* Hedley, 1902 (considered a synonym of *Nucula* Lamarck, 1799, by the present author; see BERGMANS, 1978). Although there is a definite anteriorly directed vector in its orientation, the chondrophore in the New Caledonian specimens possesses the configuration thought to warrant recognition of *Pronucula* by POWELL. The present sample appears to be the first to be reported after the description of the species.

Nucula kanaka sp. nov.

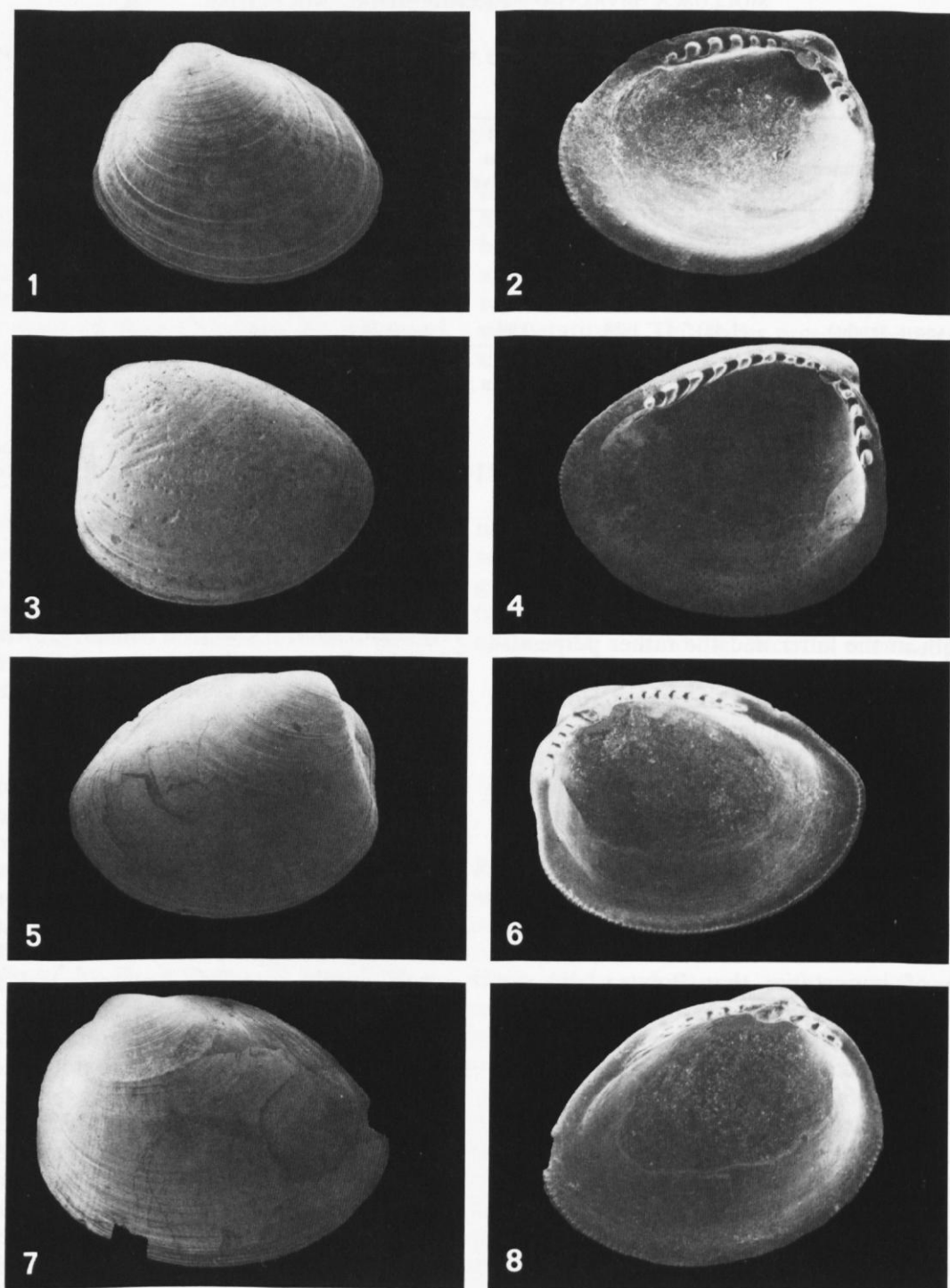
Figs 3-4

MATERIAL EXAMINED. — *Holotype*: 1 complete shell, collected by Ph. BOUCHET, 23 May 1978, at "Vauban" Stn 2, 22°17' S, 167°14' E, New Caledonia, depth 425-430 m (MNHN).

Paratypes: 2 left valves, data as for holotype specimen (MNHN; ZMA 3.88.001); 1 left valve, collected by Ph. BOUCHET, 23 May 1978, at "Vauban" Stn 3, 22°17' S, 167°12' E, New Caledonia, depth 390 m (MNHN).

DIAGNOSIS. — Shell small, triangular, relatively high, smooth except irregular growth lines. Chondrophore small but essentially oblique. Anterior tooth row continuing above chondrophore. Ventral margin crenulated.

DESCRIPTION. — Valves rather small, moderately solid, thickened in the median area, not much inflated, rounded triangular in outline. Lunule not depressed. Dorsal margin weakly curved, short, gradually passing into long and nearly straight anterior margin and strongly descending straight posterior margin. Ventral margin evenly rounded. Anteroventral angulation rounded, posteroventral angulation rather distinct. Umbo pointed. Delimitations of embryonic shell and interdissoconch not discernable in the present material. Sculpture consisting of growth lines and, on the median area, occasional radial lines corresponding with a radial inner structure. Ventral margin crenulated by this structure. Hinge without a trace of primary teeth and with rather narrow, V-shaped secondary teeth. Nine anterior and five posterior teeth in largest specimen. Anterior tooth row narrowing towards chondrophore, and continuing with only one or two very small teeth above it. Chondrophore small, oriented forwards, paralleling anterior tooth row; its ventral margin slightly inflated posteriorly and making a rounded angle with its anterior margin. Adductor muscle scars shallow but distinct. Mantle line simple. One



FIGS 1-8. — 1-2 : *Nucula nitidulaformis* Powell, length 1.76 mm, from 425-430 m at "Vauban" Stn 2 (22°17' S, 167°14' E), New Caledonia (MNHN). — 3-4 : *Nucula kanaka*, sp. nov., right valve of holotype specimen, length 2.84 mm, from 425-430 m at "Vauban" Stn 2 (22°17' S, 167°14' E), New Caledonia (MNHN). — 5-6 : *Nucula oppressa*, sp. nov., left valve, holotype specimen, length 2.84 mm, from 250-350 m at "Vauban" Stn 40 (22°30' S, 166°24' E), New Caledonia (MNHN). — 7-8 : *Nucula oppressa*, sp. nov., right valve, paratype specimen, length 2.06 mm, data as for holotype specimen (MNHN).

TABLE 2. — Measurements in mm and number of secondary teeth in *Nucula kanaka*, sp. nov., from "Vauban" Station 2 and 3, New Caledonia.

Specimen	Length	Height	Section (one valve)	Number of secondary teeth	
				anterior	posterior
Holotype (Stn 2)	2.84	2.48	0.68	right 9	4
				left 8	5
Paratype (Stn 2)	2.70	2.44	0.80	9	5
Paratype (Stn 2)	2.40	2.16	0.64	9	4
Paratype (Stn 2)	2.04	1.82	0.60	7	3
Paratype (Stn 3)	2.60	2.25	0.72	8	4

valve with a remnant of a dark brown periostracum.

Measurements : Table 2.

DISCUSSION. — Only the holotype has a well preserved hinge. In the paratypes it is difficult to see if the chondrophore is rounded and directed downwards or short and pointing forwards, and if the anterior teeth ascend above it. *Nucula kanaka* resembles the New Zealand species *Nucula nitidula* A. Adams, 1856 *sensu* POWELL (1979 : 356, Fig. 83-2), but differs in outline and details of the hinge. It is more produced dorsoposteriorly, its anterior tooth row is proportionally much narrower posteriorly, and its chondrophore is much shorter and directed more forwards. *Nucula beachportensis* Verco, 1907 (see BERGMANS, 1978, Fig. 15-19), from Australian waters, seems also morphologically related to *N. kanaka*. *N. kanaka* differs from it in being higher and more triangular, with a proportionally longer posterior margin, a smaller angle between its tooth rows, and a shorter chondrophore.

ETYMOLOGY. — The species name *kanaka* is derived from "Kanak", the original name of the people of New Caledonia.

Nucula oppressa sp. nov.

Figs 5-8

MATERIAL EXAMINED. — *Holotype* : 1 left valve, collected by A. WARÉN, 7 June 1979, at "Vauban" Stn 40, 22°30' S, 166°24' E, New Caledonia, depth 250-350 m (MNHN).

Paratypes : 54 valves, data as for holotype specimen (44 valves : MNHN ; 10 valves : ZMA 3.88.002).

DIAGNOSIS. — A small, ovate shell with a truncated posterior side ; essentially smooth ; with visible inner radial structure in the median area and finer, more traverse line structure in anterior and posterior areas ; typically nuculid teeth ; a short but very oblique chondrophore ; and all margins except the median part of the dorsal margin crenulated by the inner structure.

DESCRIPTION. — Valves rather small, thin to moderately solid, median area thickened in a number of the specimens — mostly in larger valves —, moderately inflated, ovate in outline except for almost perpendicular posterior side. Radial zone corresponding with straight posterior margin slightly depressed. Larger valves relatively higher. Dorsal margin curved, in some specimens with a slight angle beneath the umbo. Anterodorsal angulation poorly defined or absent. Posterodorsal angulation rounded but distinct. Anterior margin weakly curved, partly straight in some specimens. Posterior margin short and straight. Anteroventral junction weakly marked, rounded, posteroventral junction more distinct. Umbo pointed. Embryonic shell bifid, surface finely pitted. Interdissoconch smooth. Embryonic shell and interdissoconch without visible radial structure. Remaining part of valve essentially smooth, with fine growth lines and in some larger valves a few growth zones near the margin, mutually separated by grooves. Central part of valve with inner radial structure appearing as fine lines ; anterior and posterior parts with still finer and widely divergent line structure. In a number of specimens, most of which are quite worn, this finer structure is hardly or not discernable, especially on the posterior part. Ventral margin crenulated by the radial structure of the central part ; anterior and

posterior margins and adjoining parts of dorsal margin crenulated by the finer, divaricating structure. This latter crenulation is difficult to trace in the majority of the specimens but most probably distinct in fresh ones. Hinge without a trace of primary teeth. Dorsal margin slightly thickened at both sides above chondrophore. Chondrophore oblique, directed forwards, relatively short. Up to about 12 anterior and five posterior short, triangular, secondary teeth. Anterior tooth row with two or three small teeth above chondrophore. Adductor muscle scars and simple mantle line visible in good specimens. Periostracum not preserved.

Measurements : Table 3.

DISCUSSION. — Of the known nuculids, *Linucula recens* Dell, 1956, seems to be the morphologically nearest relative of *Nucula oppressa*. *N. oppressa* differs in being less equilateral, in having a relatively larger number of anterior teeth (11 in *recens* specimens up to 4.04 mm in length; DELL, 1956a), in the more oblique and more elongate form of the chondrophore, and in the form of the teeth near the chondrophore. In *oppressa*, these teeth do not deviate from the normal nuculid type. In *recens* "the two central teeth of each series are larger than their fellows and meet dorsally under the beaks to give the appearance of a bifid tooth, the two arms of which form the lateral limits of the chondrophore" (DELL, 1956a). (It has occurred to me that this configuration can only exist in one valve of each specimen, but its counterpart has not been described.) *Linucula* was described as a subgenus of *Nucula* by MARWICK (1931), to

accommodate small shells from the Tertiary of New Zealand with weak radial sculpture and finer radials on anterior and posterior parts. MARWICK did not describe the hinge, partly because it had not been preserved well enough in his specimens but his descriptions were very short anyway. DELL (1956a) included *Nucula gallinacea* Finlay, 1930, in *Linucula*, on account of a quite different type of aberrant sculpture on its anterior side; his figures of this species show a hinge typical of *Nucula*. DELL (1956a) reflected on the differences between that hinge and the hinge of *Linucula recens*, suggesting that *Linucula* — which he had raised to generic rank because of the divergent sculpture on its lunule, its well-defined geographical range, and its long Tertiary history — might consist of two groups. BERGMANS (1978) described *Nucula brongersmai* from New South Wales, Victoria and Tasmania in Australia, which also has a sculpture of radial lines and diverging lines on anterior and posterior parts, but smooth margins, and a round chondrophore separating the tooth rows. While agreeing that forms of aberrant structure and sculpture of anterior and posterior valve parts are worth considering in efforts to define natural groups within the Nuculidae, I do not think that *Linucula* is well defined, or that the species with such structure and sculpture are necessarily closely related. Further studies of such species should attempt to describe, and preferably illustrate, their hinge configurations in detail.

ETYMOLOGY. — The specific name *oppressa*, derived from the Latin *opprimere* (to oppress, to hide) refers to the inner line structures, oppressed

TABLE 3. — Measurements in mm and number of secondary teeth in *Nucula oppressa*, sp. nov., from "Vauban" Station 40, New Caledonia.

Specimen	Length	Height	Section (one valve)	Number of secondary teeth anterior ++	posterior
Right valve	3.17	2.79	0.92	10	4
Left valve +	2.92	2.68	0.87	11	5
Right valve	2.75	2.38	0.75	10	4
Right valve	2.58	2.12	0.71	8	4
Right valve	1.88	1.58	0.50	6	3
Right valve	1.54	1.34	0.42	5	2

+ Holotype specimen (All others : paratype specimens).

++ Innermost anterior teeth often worn away.

in the sense that they do not affect the outer shell surface (except the margins) and hidden, or difficult to discern, in many specimens.

Nucula libera sp. nov.

Figs 9-12

MATERIAL EXAMINED. — *Holotype*: 1 complete shell, collected by A. WARÉN, 7 June 1979, at "Vauban" Stn 40, 22°30' S, 166°24' E, New Caledonia, depth 250-350 m (MNHN).

Paratypes: 13 complete shells and 246 valves, data as for holotype specimen (10 shells and 231 valves: MNHN; 3 shells and 15 valves: ZMA 3.88.003).

DIAGNOSIS. — A small, trapezoid ovate shell, with a relatively long posterior side, rather many posterior teeth, a partly concave posterior margin, a smooth outer surface, a weak ovate chondrophore separating the tooth rows, and in large specimens a crenulated ventral margin.

DESCRIPTION. — Valves small, moderately solid to solid, thickened in the central area in a number of larger specimens, only moderately inflated, trapezoid ovate in outline. Lunule slightly inflated, demarcated by a radial depression corresponding with a concavity in the posterior margin. Escutcheon not defined. Dorsal margin straight to slightly concave beneath the umbo and evenly, although not strongly, rounded at the sides; junction with anterior margin gradual or with a distinct angulation just above the anteriormost tooth, junction with posterior margin gradual. Anterior margin weakly rounded, ventrally straight in some specimens; anteroventral angulation rather distinct. Posterior margin more or less convex along the

tooth row and in most specimens distinctly concave beneath it; posteroventral junction distinct. Ventral margin rather broadly rounded, especially posteriorly. Umbo rather pointed. Embryonic shell extremely small, squarish ovate, with microscopically pitted surface. Interdissoconch smooth, polished, its margin distinct in part of the specimens. Remaining outer surface smooth, sometimes, in large specimens, with some slightly raised growth zones, especially near ventral margin. Radial structure weakly visible at a certain angle of light only. Hinge moderately strong, with up to six anterior and five posterior, moderately long, secondary teeth. Tooth rows separated by ovate chondrophore.

Chondrophore wider than high, not much projecting beyond hinge line, with a weakly rounded ventral edge. Resilifer roundish triangular. Dorsal margin thickened at both sides above chondrophore, in some specimens with traces of possible vertical striae on these thickened parts. In large specimens the inner ventral margin is weakly crenulated. Only in very few specimens a corresponding structure of radial lines is visible over a short distance near the crenulations. Adductor scars visible. Mantle line with shallow incurvation. Periostracum thin, transparent, tinged yellowish brown.

Measurements: Table 4.

REMARKS. — It is quite unusual that the crenulation of the ventral margin in an apparently radially structured *Nucula* shell is present only in large, probably adult specimens, and it is quite confusing when identifying smooth-margined specimens of this species. The variable outline, from rather squarish when the antero-dorsal angle is distinct and the posterior margin

TABLE 4. — Measurements in mm and number of secondary teeth in *Nucula libera* sp. nov., from "Vauban" Station 40, New Caledonia.

Specimen	Length	Height	Section (one valve)	Length embryonic shell	Length interdissoconch	Number of secondary teeth	
						anterior	posterior
Paratype, left valve	1.62	1.42	0.38	0.22		4	3
Paratype, right valve	1.84	1.62	0.54	0.22	0.70	7	4
Holotype, right valve	2.18	1.88	0.60	0.22		6	4
Holotype, left valve						6	5
Paratype, right valve	2.21	1.96	0.64	0.20	0.76	7	4

nearly straight, along the tooth row, to trapezoid ovate when that angulation is not well marked and the posterior margin distinctly curved, adds to the identification problem. A further difficulty is that fresh specimens are transparent and worn specimens opaque. Moreover, the valves are of rather variable thickness. It may be problematical to identify individual specimens, and it is fortunate that the type series is so large.

ETYMOLOGY. — This species is named *libera*, meaning free or unrestrained, in memory of Dr Dick HILLENUS, zoologist and writer, for whom freedom of thought and opinion were synonymous with life itself. Dr HILLENUS, a colleague at the Instituut voor Taxonomische Zoölogie of the Universiteit van Amsterdam, died unexpectedly on the 4th of May 1987, at the much too early age of 59.

Leionucula strangei (A. Adams, 1856)

Figs 13-14

Nucula strangei A. Adams, 1856 : 52.
Ennucula strangei - DELL, 1956a : 11, pl. 1, fig. 1.

MATERIAL EXAMINED. — 31 valves, collected by A. WARÉN, 7 June 1979, at "Vauban" Stn 40, 22°30' S, 166°24' E, New Caledonia, depth 250-350 m (26 valves : MNHN ; 5 valves : ZMA) ; 1 valve, collected by A. WARÉN, 7 June 1979, at "Vauban" Stn 33, 22°33' S, 166°25' E, New Caledonia, depth 290-350 m (MNHN).

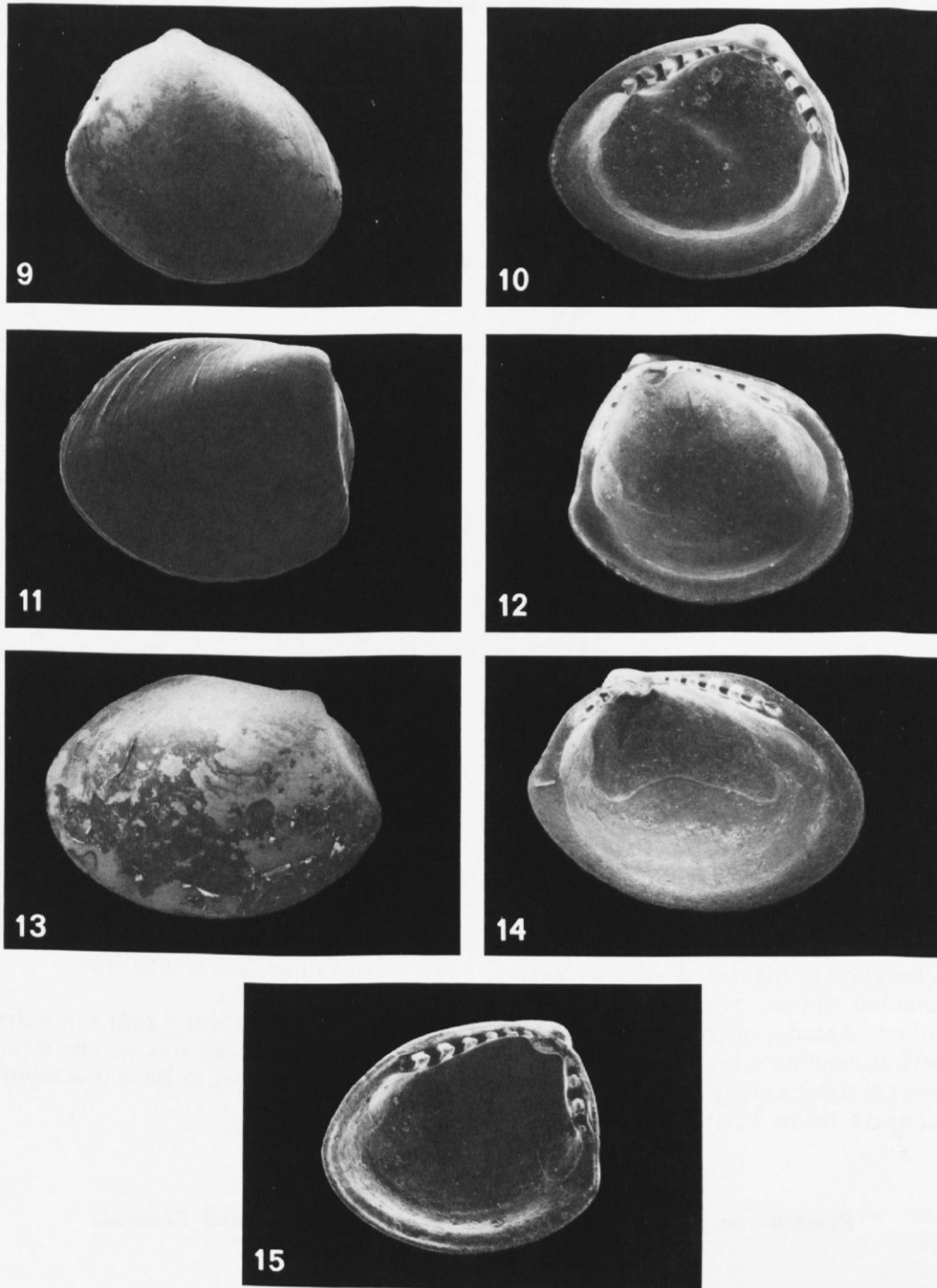
DESCRIPTION. — New Caledonian valves up to about 7 mm long, generally rather thin but thickened in the area enclosed by adductor muscle scars and mantle line, moderately inflated, broadly trapezoid in outline. Lunule and escutcheon slightly depressed, lunule bordered by a weak ridge. Older valves relatively more convex. Dorsal margin evenly curved, junctions with anterior and posterior margins gradual. Anterior margin very slightly convex in small specimens and straight or with a weak concavity above the junction with the ventral margin in large specimens. Posterior margin slightly concave below tooth row. Ventral margin broadly rounded, posteriorly somewhat flattened, gradually passing into anterior margin but with rather distinct posteroventral angle. Umbo rather pointed. Margins of embryonic shell and inter-

dissoconch indistinct in these rather worn specimens. Embryonic shell microscopically pitted externally. Rest of valve with fine growth lines, which in large specimens may become quite pronounced near the valve margin, where a few growth zones may develop into concentric riblets. No trace of an inner radial structure or a corresponding sculpture.

Anterior hinge plate narrowing towards chondrophore and continuing above it. Posterior hinge plate rather wide, its inner margin undulated by the teeth. Chondrophore concave, rather long, projecting beyond hinge plate, oriented toward anteroventral junction of valve margin ; in young specimens (Fig. 14) the chondrophore hardly diverges from the anterior tooth row but after this stage its orientation changes and it becomes divergent. Up to 15 anterior and seven posterior secondary teeth, rather flat and broad, with weakly V-shaped basal sections. Adductor muscle scars distinct. Pallial line distinct, with a wide curve upward in the middle (Fig. 14). Shells white or tinged with very pale brown, polished inside. Periostracum not preserved. Inner ventral margin smooth.

Measurements : Table 5.

DISCUSSION. — DELL (1956b) figured an adult shallow-water specimen from Wellington Harbour, measuring 12.3 mm in length, and remarked that deep-water specimens do not attain a very large size. The present specimens are small, with a number of them about 7 mm in length, suggesting that this may be the adult size in the population concerned. Compared to DELL's figure, they are more trapezoid in outline, with a somewhat more truncated anterior margin and a slightly less produced posterior side, and only in large specimens a chondrophore resembling that in DELL's specimen. Of the Australian smooth-margined Nuculidae, *Nucula loringii* A. Adams & Angas, 1864 seems related. This species was synonymized with *Nucula cumingii* Hinds, 1843 by HEDLEY (1913), who figured the type specimen, but considered different from that species by IREDALE (1939), who figured a specimen from Low Isles, Queensland. To judge from those illustrations, *loringii* has a more produced posterior side, a larger angle between the tooth rows, much weaker teeth, and a narrower and longer chondrophore. Nevertheless, type material of *loringii* and *strangei* should be compared to



FIGS 9-15. — 9-10 : *Nucula libera*, sp. nov., right valve of paratype specimen, length 2.13 mm, from 250-350 m at "Vauban" Stn 40 (22°30' S, 166°24' E), New Caledonia (MNHN). — 11-12 : *Nucula libera*, sp. nov., left valve of paratype specimen, length 1.71 mm, data as for valve of figs 9-10. — 13-14 : *Leionucula strangei* (A. Adams), left valve, length 3.25 mm, from 250-350 m at "Vauban" Stn 40 (22°30' S, 166°24' E), New Caledonia (MNHN). — 15 : *Nucula* sp. indet., length 2.06 mm, from 425-430 m at "Vauban" Stn 2 (22°17' S, 167°14' E), New Caledonia (MNHN).

TABLE 5. — Measurements in mm and number of secondary teeth in *Leionucula strangei* (A. Adams, 1856) from "Vauban" Station 40, New Caledonia.

Specimen	Length	Height	Section (one valve)	Number of secondary teeth anterior	posterior
Right valve	7.17	5.50	1.83	14	7
Left valve	7.08	5.50	1.83	14	6
Left valve	6.10	4.71	1.25	12	5
Figured left valve	3.25	2.37	0.67	7	3

assess the possible relationship between the two forms. Unfortunately, HEDLEY (1913) offered no discussion on this point.

Nucula sp. indet.

Fig. 15

MATERIAL EXAMINED. — 1 right valve, collected by Ph. BOUCHET, 23 May 1978, at "Vauban" Stn 2, 22°17' S, 167°14' E, New Caledonia, depth 425-430 m (MNHN).

DESCRIPTION. — Valve small, very inequilateral, relatively solid, moderately convex, rounded triangular in outline. Median part of valve thickened. Lunule somewhat depressed, bordered by an indistinct radial ridge. Dorsal margin consisting of an anterior part which is curved at the ends and straight in the middle, and a very short, rather straight posterior part; the two parts start beneath the umbo at slightly different levels (the posterior part more ventrally), causing a slight concavity in the dorsal margin. Antero-dorsal junction obtuse, posterodorsal junction more distinct. Anterior margin weakly convex. Anteroventral junction a broad curve. Posterior margin weakly convex along tooth row and very weakly concave below it. Posteroventral angu-

lation distinct. Ventral margin rounded. Surface of embryonic shell microscopically pitted. Outer surface of valve, including interdissoconch, smooth except very fine growth lines. Hinge rather strong, with seven anterior and four (fourth minute) posterior, short, secondary teeth. Anterior tooth row distinctly more narrow towards chondrophore and continuing above it. Chondrophore short, not extending far beyond ventral hinge line, distinctly forward directed, with its anterior margin bordering anterior tooth row but separated from posterior tooth row by small interspace. Dorsal margin peculiarly thickened along both tooth rows, with indistinct groove over the length of these, as if to receive two ridges dorsal to the tooth rows in the left valve. No trace of primary teeth. Adductor muscle scars visible. Mantle line with shallow incurvation in the middle. Valve white. Traces of a dark brown periostracum.

Measurements : Length 2.06, height 1.84, section 0.63 mm ; length of embryonic shell 0.23 and of interdissoconch 0.56 mm.

REMARKS. — As there is only one valve of this apparently undescribed species, and its condition is not perfect, I prefer to leave it without specific name.

Remarks on the genera *Leionucula* Quenstedt, 1930, and *Ennucula* Iredale, 1931

IREDALE's proposal to place smooth-margined *Nucula* species in a separate genus, *Ennucula* Iredale, 1931, has been followed by a number of authors for Australian and New Zealand species. In his diagnosis of *Ennucula*, IREDALE (1931) compared it with the type species of *Nucula*

Lamarck, 1799, i. e. *Nucula nucleus* (Linnaeus, 1758), only. His diagnosis was very short : " a notably oblique chondrophore, above which the teeth become much smaller, and the angle of opposition of the two rows of teeth is scarcely marked ; further, the edge of the European shell

is strongly denticulate, whereas ours is practically smooth."

As the obliqueness of the chondrophore is variable in both *Nucula* and in the species assigned to *Ennucula*, and the innermost anterior teeth, above the chondrophore, are smaller than their more anterior fellows in all Nuculidae with teeth above the chondrophore, the essential character of *Ennucula* seems to be its smooth margin. QUENSTEDT (1930) had proposed the genus *Leionucula* for smooth-margined Nuculidae. Although that author had not intended a systematic revision of the Family Nuculidae, his extensive study of morphological changes in its representatives through geological times resulted in conclusions about some natural sections, among which *Leionucula*. The diagnosis of this section, readily accepted as genus by THIELE (1934) and later authors, is "Bandgrubenzahn öfter, Verbindungsstück der Schlossplatte selten fehlend. Schalenrand glatt und daher die Grenzfläche von Schaloberschicht und Perlmutter eben. Gault bis jetzt." (QUENSTEDT, 1930 : 112). ("Tooth-like projection on hinge plate part in

between resilifer and posterior tooth row often, hinge plate part in question rarely lacking. Valve margin smooth and thus interface of outer and nacreous shell layers smooth. From Gault to Recent.") Diagnostic for all species is the absence of radial inner shell structure and the corresponding smooth margin.

As IREDALE offered no additional characters which would separate *Ennucula* from *Leionucula* — apart from its supposedly different distribution in both time and space (IREDALE, 1939) — I consider *Ennucula* Iredale, 1931, a synonym of *Leionucula* Quenstedt, 1930. I have retained that genus for *Nucula strangei* A. Adams for the simple reason that there is no evidence that the shells of that species are radially structured, although it is not altogether impossible that they are (compare TAYLOR, KENNEDY & HALL, 1969). All other species described in this paper, except the as yet unnamed single valve, have crenulated ventral margins. *Nucula libera* is exceptional in that this crenulation develops only after a certain growth stage, but its inner radial structure is visible from the usual (prodissoconch) stage on.

Affinities of the New Caledonian archibenthal Nuculidae

The Nuculidae treated in this paper represent the first to be reported from New Caledonia. Two species, *Nucula nitidulaformis* and *Leionucula strangei*, have been described from New Zealand. The latter has been reported from Australia by SUTER (1913) but this has never been confirmed. In the present report it is suggested that *strangei* should be compared to the Australian *Nucula loringii* to assess if and how closely the two are related.

Nucula kanaka may be related to *N. nitidula* from New Zealand and Chatham Islands (POWELL, 1979) and to *N. beachportensis* from southeastern, southern and northwestern Australia (BERGMANS, 1978). *N. oppressa* seems to be related to *Linucula recens* from New Zealand and Chatham Islands (DELL, 1956b). *N. libera* is not obviously related to any of the known New Zealand species; it may belong to the same

lineage as the Australian *Nucula saltator* Iredale, 1939, from Queensland and possibly also from western Australia (BERGMANS, 1978) but that species is nevertheless quite distinct in a number of characters (compare Figs 27-29 in BERGMANS, 1978). The single valve listed provisionally as *Nucula* species cannot be associated with any of the known species.

It is possible that the New Caledonian archibenthal nuculid fauna, if examined further, will indeed be found to be more strongly related to that of New Zealand *sensu lato* than to others. At the same time the New Caledonian assemblage may partly consist of endemic species or species which do occur, or have their nearest relatives, off the Great Barrier Reef, eastern Papua or Rennell Island, for instance. From those areas no archibenthal Nuculidae seem to have been described yet.

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