

# The identity of *Nucula perminima* Monterosato, 1875 and *Yoldia striolata* Brugnone, 1876 (Bivalvia: Protobranchia)

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## Abstract

Two enigmatic protobranchs, *Nucula perminima* Monterosato, 1875 and *Yoldia striolata* Brugnone, 1876, are revised basing on material from the Monterosato collection. *Nucula perminima*, described from off Sciacca, southwestern Sicily, is a paedomorphic nuculid of which *Nucula recondita* Gofas & Salas, 1996 is a junior synonym. *Yoldia striolata*, described as a Pleistocene fossil from Ficarazzi, Palermo, has a complex systematic history: its synonym list includes *Yoldia producta* Monterosato, 1880 and *Yoldiella sequenzae* Bonfitto & Sabelli, 1995. The new combination is *Yoldiella striolata* (Brugnone, 1876).

## Riassunto

È stata effettuata la revisione di due specie enigmatiche di protobranchi, *Nucula perminima* Monterosato, 1875 e *Yoldia striolata* Brugnone, 1876, sulla base di materiale presente nella collezione Monterosato. *Nucula perminima*, descritta dai fondi coralligeni al largo di Sciacca, è una specie pedomorfa e non uno stadio giovanile di nuculide come erroneamente ritenuto da Monterosato. *Nucula recondita* Gofas & Salas, 1996 ne è un sinonimo più giovane. È una specie criptica, capace di vivere anche in ambiente di grotta. *Yoldia striolata*, descritta per il Pleistocene di Ficarazzi presso Palermo, ha una storia sistematica complessa: la lista dei suoi sinonimi comprende *Yoldia producta* Monterosato, 1880 e *Yoldiella sequenzae* Bonfitto & Sabelli, 1995. La nuova combinazione applicata a questa specie è *Yoldiella striolata* (Brugnone, 1876). È una specie di acque profonde, presente in Mediterraneo e nel vicino Atlantico.

## Key words

Systematics, *Nucula*, *Yoldiella*, Monterosato, Brugnone, Mediterranean.

## Introduction

*Nucula perminima* Monterosato, 1875 and *Yoldia striolata* Brugnone, 1876 are two enigmatic protobranchs described in the early literature, the former from off Sciacca, southwestern Sicily, the latter as a Pleistocene fossil from Sicily. *Nucula perminima* remained totally forgotten in the malacological literature, but the recent description of a new species, possibly a synonym of *N. perminima*, led the identity of this species to be debated. The history of *Yoldia striolata* is a long sequence of synonymies and interpretations. In the present work, the identity of both species is discussed basing on material from the Monterosato collection (Museo Civico di Zoologia, Roma).

### *Nucula perminima* Monterosato, 1875

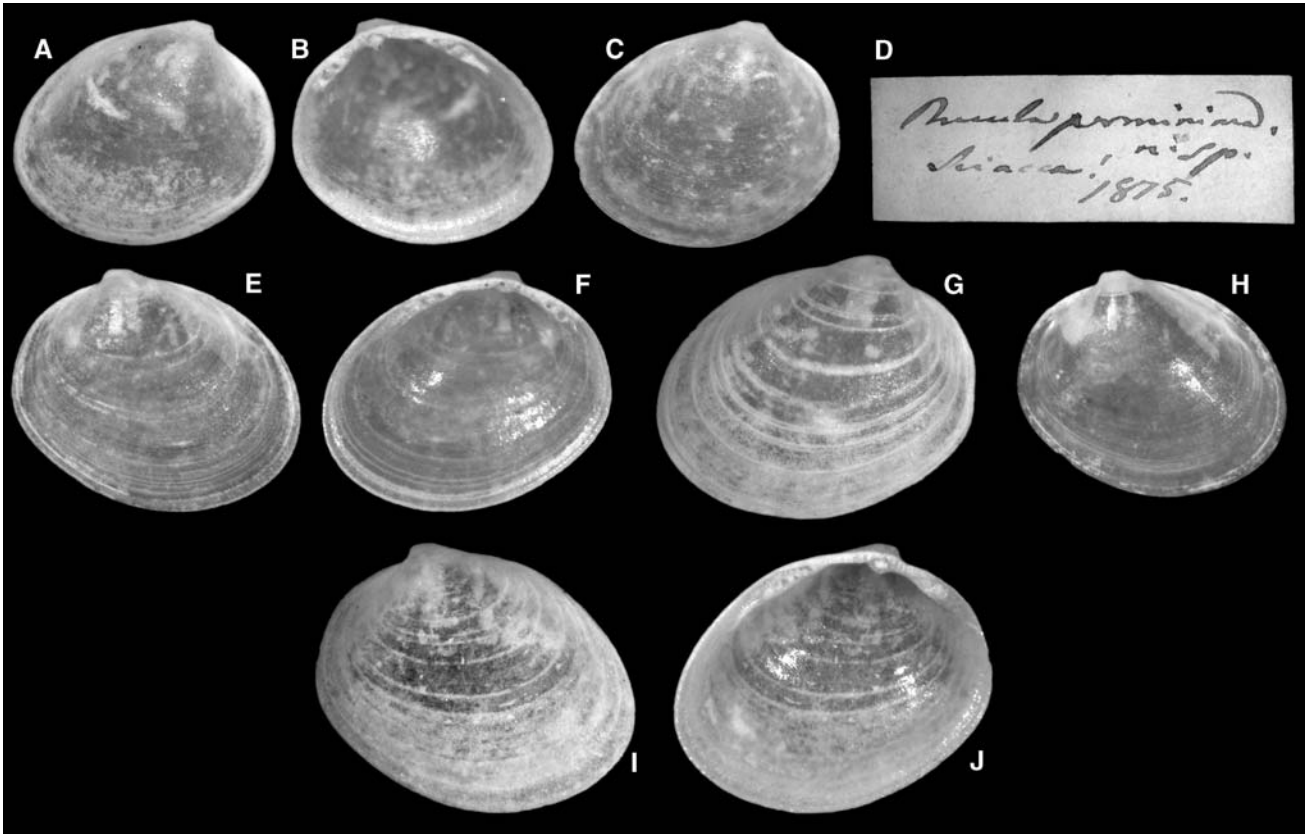
Monterosato (1875a) described *Nucula perminima* from the coralligenous bottoms off Sciacca, Sicily Channel. It was said to be very small ("La più piccola delle nostre *Nuculae* e forse anche di quante se ne conoscono viventi e fossili"), but apparently consisting of mature specimens. It was compared with young stages and growth series of other nuculids and found specifically distinct, even from *Nucula tenuis* (non *Nucula tenuis* Montagu, 1803, but *N. aegeensis* Forbes, 1844, now in *Ennucula* Iredale, 1931) which shares a smooth margin with *N. perminima*. A few years later, Monterosato (1878) listed some varieties of *Nucula nucleus* (L., 1758), including a var. *minima*

as a synonym of *N. perminima*. In the last note, Monterosato (1881) definitely regarded *N. perminima* as the juvenile stage of *N. aegeensis*.

The type material of *Nucula perminima* (MZR 14379, Fig. 1 D) consists of 12 valves and few complete shells (Fig. 1 A-C). This is a valid species, not a juvenile stage, clearly conspecific with the paedomorphic nuculid described from the Mediterranean as *Nucula recondita* by Gofas & Salas (1996: p. 430, figs. 14-22). The synonymy between *N. perminima* and *N. recondita* was first reported by Giannuzzi Savelli et al. (2001: p. 331, figs. 11-13) and Palazzi & Villari (2001: p. 24, figs. 91-96), but without the support of type material.

*Nucula perminima* actually is notably similar to the early stages of normal sized nuculid, as well documented by Gofas & Salas (1996) and this explains Monterosato's doubts about the taxonomic status. Up to the size of *N. perminima* (about 1 mm), all the juvenile nuculids have a smooth margin, but this species has well distinct, functional primary teeth whereas they are strongly reduced or totally lost in the other species (Gofas & Salas, 1996). The larval shell is flattish, with a central depression (Gofas & Salas, 1996).

This species exhibits a remarkable variability in the shell outline. The type material is less elongate and more convex ventrally than the specimens illustrated by Gofas & Salas (1996). Shell elongation and ventral convexity are also variable in the shells illustrated by Giannuzzi Savelli et al. (2001) and Palazzi & Villari (2001). The



**Fig. 1.** *Nucula perminima* Monterosato, 1875. **A-C.** Syntypes, Sicily Channel, off Sciacca (MZR 14379): **A, B.** 1.02 mm; **c.** 1.03 mm. **D.** Monterosato's label. **E-J.** Grotta dell'Accademia, Ustica Island, southern Tyrrhenian (author's collection): **E, F.** 1.13 mm; **G.** 1.24 mm; **H.** 1.05 mm; **I, J.** 1.23 mm.

**Fig. 1.** *Nucula perminima* Monterosato, 1875. **A-C.** Sintipi, Canale di Sicilia, al largo di Sciacca (MZR 14379): **A, B.** 1,02 mm; **C.** 1,03 mm. **D.** Etichetta di Monterosato. **E-J.** Grotta dell'Accademia, Isola di Ustica, Mar Tirreno meridionale (collezione dell'autore): **E, F.** 1,13 mm; **G.** 1,24 mm; **H.** 1,05 mm; **I, J.** 1,23 mm.

shells from a shallow water cave (Di Geronimo et al., 1997) have a slightly more oblique outline (**Fig. 1 E-J**).

The life habits of *N. perminima* must be notably different from those of the normal sized nuculids, inhabiting soft bottoms as shallow burrowers. The original records of *N. perminima* and *N. recondita* are from hard substrates, the former from cavities and crevices in volcanic boulders colonized by *Corallum rubrum*, the latter from rocky bottoms with *Laminaria* and from *Posidonia* beds. Di Geronimo et al. (1997) reported this species from cave assemblages obtained from sediment samples. Also the record by Palazzi & Villari (2001) is from cave assemblages. *Nucula perminima* is evidently a cryptic species, as suggested by Di Geronimo et al. (1997: p. 24). Thanks to miniaturization, implying a lowering of energy requirement, it is able to cope with the oligotrophic conditions in the caves (Hayami & Kase, 1993). Similar considerations could be also applied to *Nucula bicornis*, another paedomorphic species from the Canary Islands, also described by Gofas & Salas (1996).

According to Hanken & Wake (1993), miniaturization may imply important phylogenetic perspectives. The suggestion by Gofas & Salas (1996) about the need for a new genus for these paedomorphic nuculids is herein strongly supported. Concerning this, other cases of miniaturized molluscs, such as the mytilid *Dacrydium* Torell, 1859 (Ockelmann, 1983; Salas & Gofas, 1997) and the nuculanid *Microgloma* Sanders & Allen, 1973 (Ockelmann & Warén, 1989), constitute systematic precedents.

#### *Yoldia striolata* Brugnone, 1876

Brugnone (1876: p. 9, fig. 9) described *Yoldia striolata* from Ficarazzi (Palermo), an Early Pleistocene (Sicilian) locality, frequently mentioned in the early literature on fossil molluscs (see Greco, 1986). The original illustration is poor, only showing the external surface of an ovate, moderately inequilateral bivalve with a weak commarginal sculpture and a relatively prominent umbo. No type material of *Y. striolata* was found in the Brugnone collection (Museo "G.G. Gemmellaro", University of Palermo) nor in the Monterosato collection.

The history of this species starts with Monterosato (1875b), who introduced *Leda (Yoldia) producta* as a *nomen nudum* for an extant species from off Palermo, quoting *Yoldia abyssicola* Torell, 1859 as a dubious synonym. It was then reported (Monterosato, 1877) from the Pleistocene of Ficarazzi, as a synonym of *Y. abyssicola* and *Y. striolata* and again as a synonym of *Y. abyssicola* in a checklist of living Mediterranean molluscs (Monterosato, 1878). Finally, Monterosato (1880) made available the name *Yoldia producta* by giving a reference to the published description of *Y. striolata* Brugnone, mentioning "type given by the author" and *Y. abyssicola* (non Torell) sensu Monterosato, 1878 as a misidentification of the same species. Therefore, *Yoldia producta* is an objective synonym of *Y. striolata*. It was said to be "different from *Y. lenticula*, Möll. (= *Y. abyssicola*, Torell), which is from Norway and all the Arctic region".

Seguenza (1877: p. 1180, pl. 5, fig. 28) reported *Yoldia abyssicola* Torell, 1859 from the Plio-Pleistocene of Southern Italy, with *Y. producta* and *Y. striolata* as synonyms. The illustration shows a bivalve somewhat similar to *Yoldiella philippiana* (Nyst, 1845), with a narrower posterior side and a commarginal striation. The same synonyms were listed for *Yoldia abyssicola* in a later work (Seguenza, 1879: p. 284).

Jeffreys (1879: p. 54) reported *Leda striolata* Brugnone from some deep water stations in the Northeast Atlantic, with *Yoldia abyssicola sensu* Seguenza and *Yoldia producta* Monterosato as synonyms. It was compared with *Leda lenticula* Möller, 1842 as follows: "flatter, more sharply pointed or wedge-shaped at the anterior [sic] end, and concentrically striated; the striae are regular and sometimes numerous, but usually distant and covering the front only". Jeffreys added: "I had provisionally named this species *acutalis*".

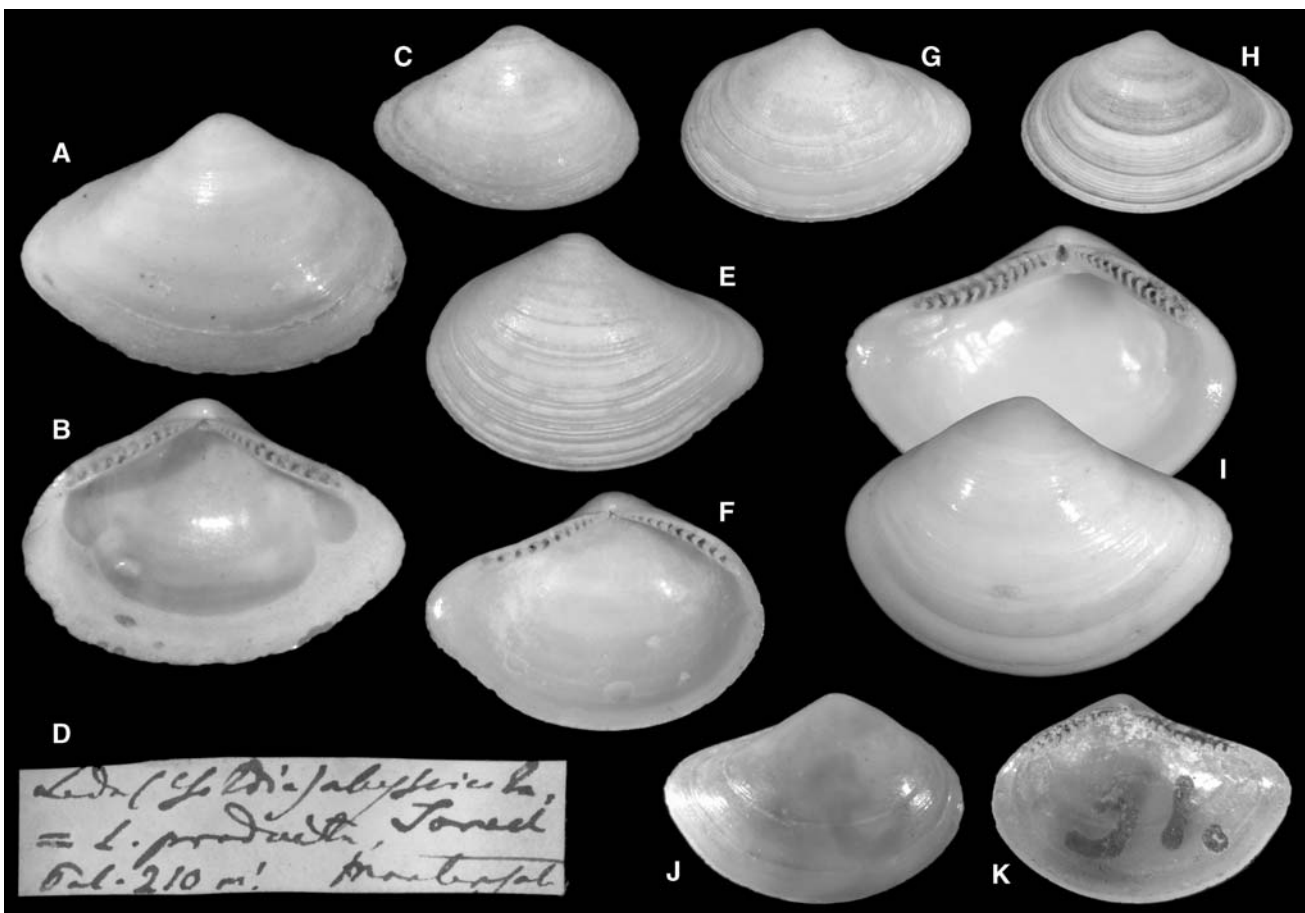
Warén (1989) gave an identity to *Yoldia striolata*, relying on material from the Jeffreys collection. For unknown reasons (mislabelling?), he found no difference between the material referred therein to *striolata* Brugnone and

to *pusio* Philippi, although these species were kept as distinct by Jeffreys (1879). Since *Leda pusio sensu* Jeffreys was mostly based on his var. *laticor*, misidentified as var. *salicensis* Seguenza, 1877 (Jeffreys, 1876, 1879), Warén (1989) proposed the synonymy *striolata* = *laticor* = *salicensis* and applied the combination *Neilonella striolata* (in family Neilonellidae Schileyko, 1989) to *Leda pusio* var. *laticor* Jeffreys, 1876.

Allen & Sanders (1996), basing on the illustration of *Yoldia abyssicola* by Seguenza (1877), concluded that *producta* and *striolata* were the same species, without mentioning that they are objective synonyms, and different from *Leda pusio* var. *laticor* to which they applied the combination *Neilonella salicensis*.

More recently, Jeffreys' var. *laticor* was moved to the genus *Pseudoneilonella* Laghi, 1986 (Neilonellidae) as *P. laticor* (Jeffreys, 1876) by La Perna (2007). In the same work, *Pseudoneilonella pusio* (Philippi, 1844) and *P. salicensis* (Seguenza, 1877) from the Mediterranean Plio-Pleistocene, were kept as distinct species.

Warén's (1989) interpretation of *Yoldia striolata* as *Leda pusio* var. *laticor* Jeffreys was questioned by Di Geronimo



**Fig. 2. A-C, E-H.** *Yoldiella striolata* (Brugnone, 1876). **A, B.** Syntype of *Yoldia producta* Monterosato, 1880, Palermo, 210 m, 4.68 mm (MZR 14425). **C.** Marseille, 3.20 mm (MZR 14425). **D.** Monterosato's label [*Leda (Yoldia) abyssicola* Torell = *L. producta* Monterosato Pal. 210 m!]. **E-G.** Archi (southern Calabria), Early-Middle Pleistocene: **E, F.** 4.06 mm (author's collection); **G.** 3.51 mm (author's collection). **H.** Southern Tyrrhenian, Eocumm95 st. 14, 38°20'08" N, 14°10'47" E, 1139 m, 3.20 mm (author's collection). **I-K.** *Yoldiella philippiana* (Nyst, 1845): **I.** Villafranca Tirrena (Messina), Early Pleistocene, 5.20 mm (author's collection). **J, K.** Syntype of *Nucula tenuis* Philippi, 1844, 3.60 mm (Humboldt Museum, Berlin; photo A. Warén).

**Fig. 2. A-C, E-H.** *Yoldiella striolata* (Brugnone, 1876). **A, B.** Sintipo di *Yoldia producta* Monterosato, 1880, Palermo, 210 m, 4,68 mm (MZR 14425). **C.** Marsiglia, 3,20 mm (MZR 14425). **D.** Etichetta di Monterosato [*Leda (Yoldia) abyssicola* Torell = *L. producta* Monterosato Pal. 210 m!]. **E-G.** Archi (Calabria meridionale), Pleistocene inferiore-medio: **E, F.** 4,06 mm (collezione dell'autore); **G.** 3,51 mm (collezione dell'autore). **H.** Mar Tirreno meridionale, Eocumm95 st. 14, 38°20'08" N, 14°10'47" E, 1139 m, 3,20 mm (collezione dell'autore). **I-K.** *Yoldiella philippiana* (Nyst, 1845): **I.** Villafranca Tirrena (Messina), Pleistocene inferiore, 5,20 mm (collezione dell'autore). **J, K.** Sintipo di *Nucula tenuis* Philippi, 1844, 3,60 mm (Museo Humboldt, Berlino; foto A. Warén).

a	
<i>Testa minuta, ovata, subaequilatera</i> Shell small, ovate, subaequilateral	+
<i>transversim tenuiter striata</i> transversally finely striated	+
<i>striae in medio testae remotiores,</i> <i>in umbonibus obsolete</i> striae more distant in the middle of shell, lost on umbo	+
<i>lateribus rotundatis; postico subattenuato,</i> <i>vix altero productiore</i> both sides rounded; posteriorly narrower and slightly more elongate	+
<i>margine integro</i> margin smooth	+
b	
<i>Differt a Yoldia tenui (Nucula) Phil., cujus formam</i> <i>quadammodo simulat,</i> It differs from <i>Yoldia tenuis</i> , to which it is somewhat similar in shape,	
<i>testa majore</i> by a larger	
<i>ventricosiore</i> more convex shell	+
<i>umbonibus tumidioribus et magis incurvis</i> umbo more inflated and curved	+
<i>angulo apicali acutiore</i> umbonal angle sharper	+
<i>latere postico retuso</i> posterior side obtuse	+
<i>externa superficiei argute striata</i> outer surface distinctly striated	+

**Tab. 1.** Original description of *Yoldia striolata* Brugnone, 1876. Crosses indicate full correspondence with the characters of *Yoldiella seguenzae* Bonfitto & Sabelli, 1995 (a) and with the differences between *Y. seguenzae* and *Y. philippiana* (b).

**Tab. 1.** Descrizione originale di *Yoldia striolata* Brugnone, 1876. Le crocette indicano piena corrispondenza con i caratteri di *Yoldiella seguenzae* Bonfitto & Sabelli, 1995 (a) e con le differenze fra *Y. seguenzae* and *Y. philippiana* (b).

& La Perna (1997) and La Perna (2003), but without proposing an alternative interpretation. Brugnone described his species using the word *striata* and compared it with *Nucula tenuis* Philippi, 1844, i.e. *Yoldiella philippiana* (Nyst, 1845) (see Warén, 1989 for the nomenclatural history of *Nucula tenuis* Philippi, 1844). *Yoldia striolata* must be then a protobranch with a sculpture of commarginal striae, different from the coarser sculpture of *Pseudoneilonella latior* and similar, in the gross shell morphology, to *Yoldiella philippiana*. On the other hand, Torell's *Yoldia abyssicola* is a junior synonym of *Yoldiella lenticula* (Möller, 1842), an Arctic species somewhat similar to *Y. philippiana* (Warén, 1989: p. 239, figs. 8c, d; 10e, f).

The proper understanding of Brugnone's species should be based on the concept which Monterosato (1880) had

of this species: he had the possibility to compare his Recent material of *producta* side by side with the fossil type of *striolata*, given by Brugnone (see above), and realized that they were the same species. The material of *Yoldia producta* (MCZ 14425, Fig. 2 D) consists of two valves and a few fragments from off Palermo (Fig. 2 A, B) and of a single, smaller valve from Marseille (Fig. 2 C). This material is conspecific with *Yoldiella seguenzae* Bonfitto & Sabelli, 1995, described from the Tyrrhenian Sea (Bonfitto & Sabelli, 1995). *Yoldiella striolata* (Brugnone, 1876) is then the new combination for *Yoldia striolata*.

There is a close match between the description of *Yoldia striolata* and the characters of *Yoldiella seguenzae* (Tab. 1 A). Also the differences remarked by Brugnone (1876) between *Yoldia striolata* and *Yoldia tenuis* (Philippi) correspond to the differences between *Yoldiella seguenzae* and *Y. philippiana* (Tab. 1 B). The only apparent discrepancy lays in size: *Y. striolata* was said to be larger than *Y. philippiana*, but the two species attain a similar maximum shell size, about 5 mm in length, according to the morphometric data by Bonfitto & Sabelli (1995). Brugnone's specimen was described as being 6 mm long, 4.5 mm high and 3 mm wide: it was then particularly large, but the length to height ratio is 1.33, close to 1.38 calculated for the largest valves (5.0 mm in length) of *Y. seguenzae* from the data of Bonfitto & Sabelli (1995).

The sculpture of *Yoldiella striolata* is somewhat variable, from a pattern of well defined commarginal striae, mainly near the ventral margin, to almost consisting of only growth lines, as seen in the present illustrations (Fig. 2 A-C, E-H) and in other illustrated material (Bonfitto & Sabelli, 1996: fig. 5, 6; Di Geronimo & La Perna, 1997: pl. 7, figs. 5, 6; Giannuzzi Savelli et al., 2001: figs. 58, 59). The same illustrations also cover the variability range in shell shape of this species. For comparison, material of *Yoldiella philippiana* is here illustrated (Figs. 2 I-K), including a syntype of *Nucula tenuis* Philippi, 1844.

*Yoldiella striolata* is a deep water species, also occurring in the adjacent Atlantic, with a depth range of 500-2000 m (Bonfitto & Sabelli, 1995; Salas, 1996; La Perna, 2003). The Ficarazzi stratigraphic sequence includes shallow water calcarenites and fine grained deposits of outer shelf-upper slope deposition (Buccheri, 1983, 1984). Some bathyal species were reported from this locality by Monterosato (1872).

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