

**First record of the genus *Neosimnia* (Gastropoda: Ovulidae)
in the Eastern Indian Ocean, with the description of five
fossil species from the Miocene of West Java, Indonesia**

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ABSTRACT The genus *Neosimnia* P. Fisher, 1884, is reported for the first time from Indonesia in the form of several fossil species, recovered together from the Miocene deposits of Tasikmalaya, West Java. The species described closely resemble their current Atlantic counterparts, of which they exhibit all the modern characteristics. Nevertheless, they are undoubtedly new to science, as no living or fossil specimens of this genus are known from the Indian Ocean or the Western Pacific Region.

KEY WORDS Gastropoda, Ovulidae, *Neosimnia*, *N. brevicula*, *N. graniformis*, *N. multilineata*, *N. pseudolaewis*, *N. pulchra*, Miocene, Tasikmalaya, Java, Indonesia

INTRODUCTION

Ovulidae Schilder, 1968, are a fascinating group of shell-bearing gastropod mollusks, related to the well-known family *Cypraeidae* Rafinesque, 1815, from which they share a smooth, shiny shell. This characteristic, among other similarities, is due to the fact that the animal's mantle covers and camouflages the shell, but other features clearly distinguish them from cowries. *Ovulidae* are in fact ectoparasites of the corals on which they feed, and are therefore on average much smaller than cowries and are also more fragile, although a few species are exceptions. In addition, they lack columellar teeth and their spire is generally internalized at the posterior end. The *Ovulidae* family comprises more than 40 genera, corresponding to a much greater variety of shapes than the *Cypraeidae*.

To date, the number of fossil species of *Ovulidae* reported in the literature is much lower than that of *Cypraeidae*, probably because

only species with the strongest shells have reached us. This is particularly true of certain species of the genus *Neosimnia* P. Fisher, 1884 because of their thicker and more calloused shells. Species belonging to this genus therefore possess the mechanical characteristics needed to withstand the passage of geological periods, which is why they are well represented in the fossil record, especially in Europe. Indeed, numerous species have been described from the Eocene (*e.g.* *lhommei* Cossmann, 1907, *rostralina* Deshayes, 1865, *pacaudi* Dolin & Ledon, 2002) to the Pliocene (*e.g.* *pliomajor* Sacco, 1894, *passerinalis* Lamarck, 1810, *leathesi* Sowerby, 1825), through the Oligocene (*e.g.* *limondinae* Dolin & Lozouet 2004, *bosqueti* Nyst in von Koenen, 1890) and the Miocene (*e.g.* *subcarnea* d'Orbigny, 1852, *semen* DeFrance, 1825, *striatula* Millet, 1854, *miocaenica* Sacco, 1894, *fusulina* and *helenae* Dolin & Lozouet 2004). Moreover, other species in the same genus have been described from the southern USA, such as *subtruncata* and *texana* Johnson, 1899 (Eocene), *cookei*

MacNeil and Dockery, 1984 (Oligocene), *wisewoodae* Maury, 1917, *puella*, *terminatincta* and *crinata* Dolin, 1991 (Miocene), or from Colombia, such as *puana* Anderson, 1929 (Miocene). This list is given for illustrative purposes only, and in no way claims to be exhaustive.

However, so far, no member of the genus *Neosimnia* has been reported from outside its current distribution areas, which are nonetheless very wide. This genus is indeed known from the Mediterranean with the species *spelta* Linnaeus, 1758 and *illyrica* F.A. Schilder, 1925, from the Eastern Atlantic with *spelta* again, *senegalensis* F.A. Schilder, 1931 and *sculptura* Cate, 1973, and from the Western Atlantic with *bijuri* and *bartschi* Cate, 1973. The other species: *avena* G.B. Sowerby II, 1832, *arcuata* Reeve, 1865, *macleani* Cate, 1976, *loebbeckeana* Weinkauff, 1881, *barbarensis* Dall, 1892 and *hammesi* Bertsch & Bibbey, 1982, are found in the Eastern Pacific region, particularly along the coast from California south to Peru through central America. No mention of the genus *Neosimnia*, living or fossil, has ever been made in the Indian Ocean or in the Western Pacific region. Indeed, to the best of the authors' knowledge, fossil *Ovulidae* recorded in Indonesia, and in particular on the island of Java where the fossils described in this paper were found, belong exclusively to the following genera: *Volva* Röding, 1798, *Globovula* Cate, 1973, *Margovula* Iredale, 1935, *Prionovolva* Iredale, 1930 (Dharma 2005), *Pseudosimnia* F.A. Schilder, 1925 (Celzard & Dovesi, 2023) and *Phenacovolva* Iredale, 1930 (with a specimen of an undescribed species in the collection of the 1st author). There is no doubt, therefore, that the species introduced here are new to science and all, as shown below, are belonging to the genus *Neosimnia* P. Fisher, 1884.

MATERIAL EXAMINED

Twenty-seven complete fossil shells of *Neosimnia*, one incomplete and one on matrix were examined, all from the same, south-eastern area of Tasikmalaya City, West Java, Indonesia, and found between 2 and 4 meters deep in the subsoil of Miocene sediments. For many of these fossils, cleaning, and in particular clearing the aperture, has proved extremely difficult, often impossible. This is due to the fact that the sediments are extremely hard in some cases, much harder than the thin shell which rests on it, and preventing it from falling apart. Removing these sediments therefore leads in many cases to the complete destruction of the shell, which we obviously wished to avoid, even if this has sometimes prevented us from directly observing certain important anatomical features, in particular the fossula and the funiculum. All holotypes are preserved in the Museo di Scienze Naturali dell'Università di Firenze (Firenze, Italia), whereas all paratypes are preserved in the Alain Celzard collection (Epinal, France).

ABBREVIATIONS

ACC Alain Celzard collection (Epinal, France)
IGF Firenze Natural History Museum
(Firenze, Italia)

TYPE LOCALITY AND STRATIGRAPHIC RANGE

All the specimens discussed here come from the same area, and were found together or separately several months apart. We can therefore consider that these different species all lived in the same place and were contemporary with each other.

The material presented was discovered west of Citalahab, towards Cibalong, southeast of Tasikmalaya, in the Southern Mountains Zone,

where there is a plateau with a surface of Miocene sedimentary rocks (Sampurno, 1976). This area is characterized by hills with forests and streams. The material was collected on ascending slopes between 400 and 700 m altitude on deeply fissured and collapsed hills characterized by exposed sandstones, where numerous fossil species were found. The fossils studied in this work belong to Middle Miocene sediments, in agreement with Soeria-Atmadja *et al.* (1994) and van Bemmelen (1949). In particular, the area near Citalahab is characterized by the Nyalindung Formation (Leloux and Wesselingh, 2009). The Nyalindung Formation is one of the largest accumulations of Neogene marine strata exposed on land in West Java, showing the stratigraphic successions that affected this part of Java during the Miocene to Pliocene period (Aswan *et al.* 2008). Based on the regional stratigraphy of the southern mountains of West Java, it can be assumed that the geological era corresponding to the material studied from the Nyalindung Formation is the late Middle Miocene, in particular the Serravallian (13.8 - 11.6 Ma) (Syarifin, 2011). At the research site, the sandy siltstone and calcareous sandstone substrate, in addition to providing the new species presented, also contains several shallow marine bivalves and mollusks such as: *Cardium* sp., *Chlamys* sp., *Fulvia* sp., *Tapes* sp., *Tellina* sp.; *Ancilla* sp., *Cypraea* sp., *Cymatium* sp., *Conus* sp., *Nassarius* sp., *Terebra* sp., *Turritella* sp., *Vasum* sp., *Vexillum* sp., and finally branching corals. This suggests deposition in a lower intertidal to upper subtidal tropical environment.

SYSTEMATICS

Class: Gastropoda Cuvier, 1795
 Subclass: Caenogastropoda Cox, 1960
 Order: Littorinimorpha Golikov & Starobogatov, 1975

Superfamily: Cypraeoidea Rafinesque, 1815
 Family: Ovulidae Fleming, 1822
 Subfamily: Simniinae F. A. Schilder, 1927
 Genus: *Neosimnia* P. Fisher, 1884

Neosimnia brevicula new species †
 Celzard and Dovesi, 2024
 (Plate 1)

Description. Shell medium sized to small, slightly rhomboidal, inflated, slightly calloused with an indistinct transverse angular dorsal ridge; aperture rather wide, widening anteriorly; funiculum prominent, cord-like; dorsum smooth and glazed, shiny, with longitudinal growth lines and with fine, barely visible striations near the tips; labrum thick and flattened, shouldered; ventrum slightly calloused, smooth; anterior terminal blunt; posterior terminal curled; inner adaxial carinal ridge limited to the fossular region, when visible.

Type Material. Holotype IGF 105212, length 15.97 mm, width 8.32 mm (Plate 1, A). *Neosimnia brevicula* paratypes (Plate 1): B= length 15.66 mm, width 7.65 mm; C= length 17.30 mm, width 8.16 mm; D= length 14.08 mm, width 6.96 mm. Plate 1 shows the holotype, and three paratypes.

Etymology. The name *brevicula* refers to the more rounded and squat outline than the other species described in this paper.

Neosimnia graniformis new species †
 Celzard and Dovesi, 2024
 (Plate 2)

Description. Shell small, slender ovate, solid; aperture wide, especially anteriorly; funiculum cord-like, produced; dorsum smooth and glossy, with terminal collars smooth or barely striated; labrum flattened, shouldered; ventrum smooth and glazed; anterior terminal blunt; posterior terminal produced, rounded and slightly oblique; fossula shallow; terminal ridge marked.

Type Material. Holotype IGF 105213, length 15.93 mm, width 7.21 mm (Plate 2, A). *Neosimnia graniformis* paratypes (Plate 2): B= length 12.76 mm, width 5.70 mm; C= length 13.55 mm, width 5.78 mm; D= length 14.08 mm, width 6.96 mm. Plate 2 shows the holotype, and three paratypes.

Etymology. The name *graniformis* comes from the fact that the shell is reminiscent of a grain of wheat, both in shape and color.

Neosimnia multilineata new species †
Celzard and Dovesi, 2024
(Plate 3)

Description. Shell rather small, spindle-shaped, humped centrally; aperture narrow, widening anteriorly; funiculum triangular, slightly raised; entire dorsum with incised, wavy striae; labrum calloused, uneven, thicker on posterior third in adult shells, paper-thin otherwise; ventrum bulbous, calloused, smooth and glossy in adult shells, striated like the dorsum in young shells; anterior terminal elongated, broad, spatulate and oblique; posterior terminal protruding; fossula shallow; inner adaxial carinal ridge not clearly visible in the material available.

Type Material. Holotype IGF 105214, length 12.29 mm, width 5.58 mm (Plate 3, A). *Neosimnia multilineata* paratypes (Plate 3): B= length 17.63 mm, width 8.02 mm; C= length 13.12 mm, width 6.10 mm. Plate 3 shows the holotype and two paratypes.

Etymology. The species presented is called *multilineata*, in reference to its unmistakable pattern of wavy spiral striations all over the dorsum.

Neosimnia pseudolaewis new species †
Celzard and Dovesi, 2024
(Plate 4)

Description. Shell medium sized, spindle-shaped, with pointed extremities, bulging

centrally; aperture moderately wide, much more anteriorly; funiculum transverse and raised; dorsum almost smooth, especially in its middle part, but with fine incised striae near the tips; labrum calloused, shouldered; ventrum slightly calloused, smooth and shiny; anterior terminal elongated, slightly spatulate; posterior terminal protruding; fossula shallow; terminal ridge distinct.

Type Material. Holotype IGF 105215, length 16.61 mm, width 8.02 mm (Plate 4, A). *Neosimnia pseudolaewis* paratypes (Plate 4): B= length 17.76 mm, width 8.67 mm; C= length 17.96 mm, width 8.76 mm; D= length 13.65 mm, width 6.57 mm. Plate 4 shows the holotype, and three paratypes.

Etymology. This species was called *pseudolaewis* because of its incompletely smooth surface, barely disturbed by thin lines of growth and fine striations on the tips with a slight tendency to spread over the dorsum.

Neosimnia pulchra new species †
Celzard and Dovesi, 2024
(Plate 5)

Description. Shell medium sized, spindle-shaped, rostrate, especially posteriorly; aperture rather narrow, but strongly widening anteriorly; funiculum slightly projecting; dorsum almost smooth, especially in its middle part, but with striations distinct on both terminal collars; labrum slightly flattened and shouldered; ventrum smooth and glazed, bulbous but not calloused; anterior terminal blunt; posterior terminal projecting and twisted; inner adaxial carinal ridge distinct, fossula shallow.

Type Material. Holotype IGF 105216, length 18.21 mm, width 7.86 mm (Plate 5, A). *Neosimnia pulchra* paratypes (Plate 5): B= length 16.15 mm, width 7.13 mm; C= length 18.69 mm, width 7.92 mm; D= length 19.25 mm, width 8.36 mm. Plate 5 shows the holotype, and three paratypes.

Etymology. The name *pulchra* refers to the elegantly slender, rostrate contour of the shell of this species.

DISCUSSION

The new species presented here can be readily assigned to the genus *Neosimnia* P. Fisher, 1884, as the characteristics of their shells follow particularly well the description found in Cate (1973), and which we repeat here *in extenso*: "Shells are of medium size, well formed, solid, broad centrally, attenuating immediately, evenly, to front and back, with a funicular spiral cord on rear base; they are usually dorsally striate". Moreover, the type species of this genus is *Bulla spelta* Linnaeus, 1758, now known as *Neosimnia spelta* Linnaeus, 1758, to which *Neosimnia graniformis* n. sp. is closely related.

It should be pointed out here that the present authors have chosen to follow Fehse's (2018) opinion that *Neosimnia* is a genus quite distinct from *Simnia*. These two genera have indeed previously been proposed as synonyms by Dolin and Ledon (2002) on the basis that *Simnia nicaeensis* Risso, 1826 would be a juvenile specimen of *Simnia spelta* Linnaeus, 1758, type species of *Neosimnia*, thus making "*Simnia* an objective synonym of *Neosimnia*". The authors refer the reader to Fehse (2018) for the reasons behind considering the genus *Neosimnia* fully valid when writing the present article.

It may be useful to emphasize that there are clearly other species yet to be described in this same genus *Neosimnia*, from the same area in Java, and from the same geological layer. Indeed, only some of the 29 fossils obtained by the present authors have been presented here, but some single specimens do not fit into any of the combinations of criteria summarized in Table 1, below. It will therefore be necessary to obtain more material to ensure that these are not

aberrant shells, so we decided not to present them here. Among them, a number of specimens were found apparently more or less compressed, maybe as a result of which they present a surprising diamond-shaped form. Their possibly deformed state makes it impossible to describe them with the same accuracy as we did before, but it is interesting to note that their shell is very thin, and these specimens cannot therefore be attributed to the very thick-shelled *graniformis* species, which is the one they most closely resemble. It must therefore be another species.

Generally speaking, the new species described in this paper are surprisingly reminiscent of living species of the genus *Neosimnia* occurring in the Atlantic Ocean, a considerable distance from where the present fossils were collected. Table 1 summarizes the main identification keys for the five new species reported here. In short, the species can be distinguished from one another as follows:

- *N. multilineata* n. sp. and *N. pseudolaevis* n. sp. are unambiguously reminiscent of the very rare *N. bijuri* Cate, 1976, whose range extends from Florida to northern Brazil. The main distinguishing feature between the two, apart from minor differences in funiculum, labrum and general outline, probably subject to small intraspecific variations, is that, as emphasized by the name given to them, *N. multilineata* n. sp. is almost entirely covered by a very dense network of very thin and tight transverse spiral cords of equal width along the entire length of the shell, whereas *N. pseudolaevis* n. sp. is almost entirely smooth, revealing fine longitudinal growth lines that are therefore orthogonal to the very thin incised striae visible on *N. multilineata* n. sp.
- *N. brevicula* n. sp. is distinguished from the other species by its squat outline, somewhat reminiscent of the former genus

Pseudocyphoma Cate, 1973, synonymized by Lorenz & Fehse (2009) with *Cyphoma* Röding, 1798, and which corresponded to species with a sub-angled dorsal ridge and a less calloused shell than typical *Cyphomas*. Its curled posterior end, recalling to some extent that of the genus *Simnialena* Cate, 1973, also separates it from the other species. Finally, when viewed from the ventral side, the left abapical outline is almost rectilinear closest to the terminal anterior, whereas it is clearly concave in the more rostrate *N. multilineata* n. sp., *N. pseudolaewis* n. sp. and *N. pulchra* n. sp.

- *N. pulchra* n. sp. is the largest, most slender species, with the thinnest shell, and undoubtedly the most elegant with its well-developed, slightly curved ends, at least on the posterior side, if not on both sides. Smooth like *N. pseudolaewis* n. sp., tips excluded, it is more elongated, lighter, and shows no trace of transverse dorsal keel.
- *N. graniformis* n. sp. is the smallest of all, with a solid, thick, oval-shaped shell. As mentioned above, it is reminiscent of the living *N. spelta* Linnaeus, 1758, but which is more calloused and swollen. *N. graniformis* n. sp. is therefore even more similar to the closely related *N. illyrica*, F.A. Schilder, 1925, its shell being more slender, less calloused and its aperture wide, but not as wide as in *N. spelta*. *N. graniformis* n. sp. is also reminiscent of *N. semen* Defrance, 1825 from the Miocene of France, with which it shares many anatomical features. In fact, *N. semen* and *N. graniformis* n. sp. would probably be very difficult to separate from each other if they could be found together in the same deposit, a hypothesis that is absolutely impossible given the distance separating them.

SPECIES	<i>N. brevicula</i>	<i>N. graniformis</i>	<i>N. multilineata</i>	<i>N. pseudolaewis</i>	<i>N. pulchra</i>
SIZE	medium	small - medium	medium	medium	medium
SHELL	thick, solid	thick, solid	rather fragile	thick, solid	lightweight
OUTLINE	slightly rhomboidal	slender ovate	spindle-shaped	spindle-shaped	broadly fusiform, slender
DORSUM	smooth with stronger growth lines	smooth, shiny	striated	smooth with thin growth lines	smooth with thin growth lines
VENTRUM	slightly calloused	not calloused but glazed	slightly calloused and glazed if adult	slightly calloused	not calloused
TERMINAL ENDS	posterior curling, anterior blunt	posterior rounded, anterior blunt	of nearly equal lengths	posterior pointed, anterior blunt	projecting, twisted
FUNICULUM	slightly projecting	protruding	poorly produced	projecting	projecting
TERMINAL RIDGE	well-produced	well-produced	distinct	well-produced	well-produced
APERTURE	wide, even more anteriorly	wide	rather narrow, widening anteriorly	moderately wide	narrow, strongly widening
LABRUM	flattened, shouldered	flattened, shouldered	slightly calloused, not or poorly shouldered	calloused, shouldered	slightly flattened, not or poorly shouldered

Table 1. Identification keys for the five new fossil species of *Neosimnia* from the Miocene of Java.

In conclusion, we report for the first time the genus *Neosimnia* in the western Indian Ocean, on the border with the eastern Pacific, in the form of several fossil species found in Miocene sediments south of Tasikmalaya, a locality in West Java. Clearly, there is still much to be discovered in these same sediments, as the authors are aware of other *Neosimnia* specimens, so far unique and for which they have therefore decided not to describe them. More specimens will therefore be needed to complete the description of the species in this genus, which was clearly abundant at the time, to the point of giving a diversity of forms reminiscent of present-day species from the Mediterranean and the near Atlantic, and even of small *Cyphoma* now living from the Caribbean to northern Brazil.

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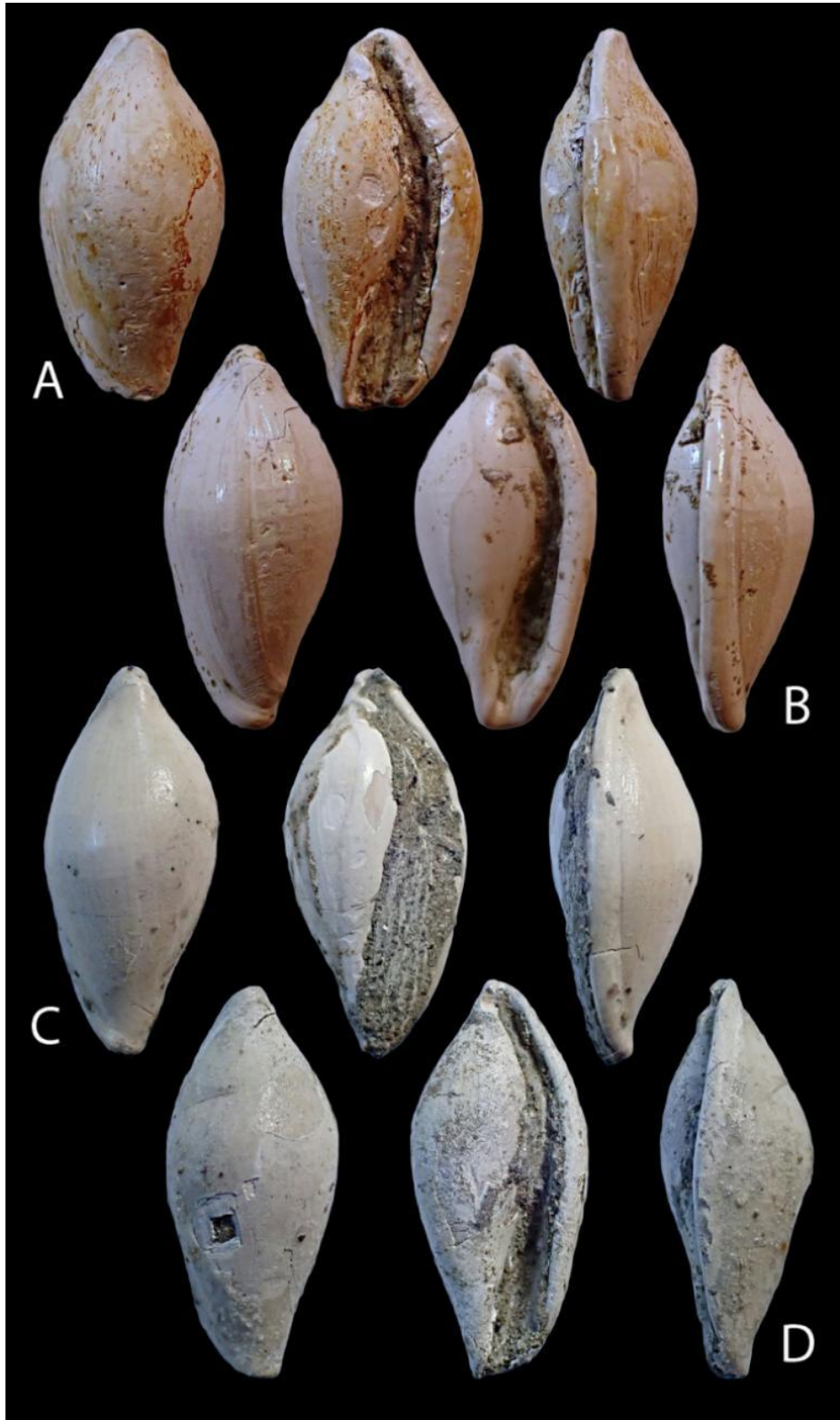


Plate 1. *Neosimnia brevicula* n. sp. Holotype **A**= length / width: 15.97 / 8.32 mm; Paratypes and corresponding lengths / widths: **B**= 15.66 / 7.65 mm; **C**= 17.30 / 8.16 mm; **D**= 14.08 / 6.96 mm. All paratypes are in the ACC collection.

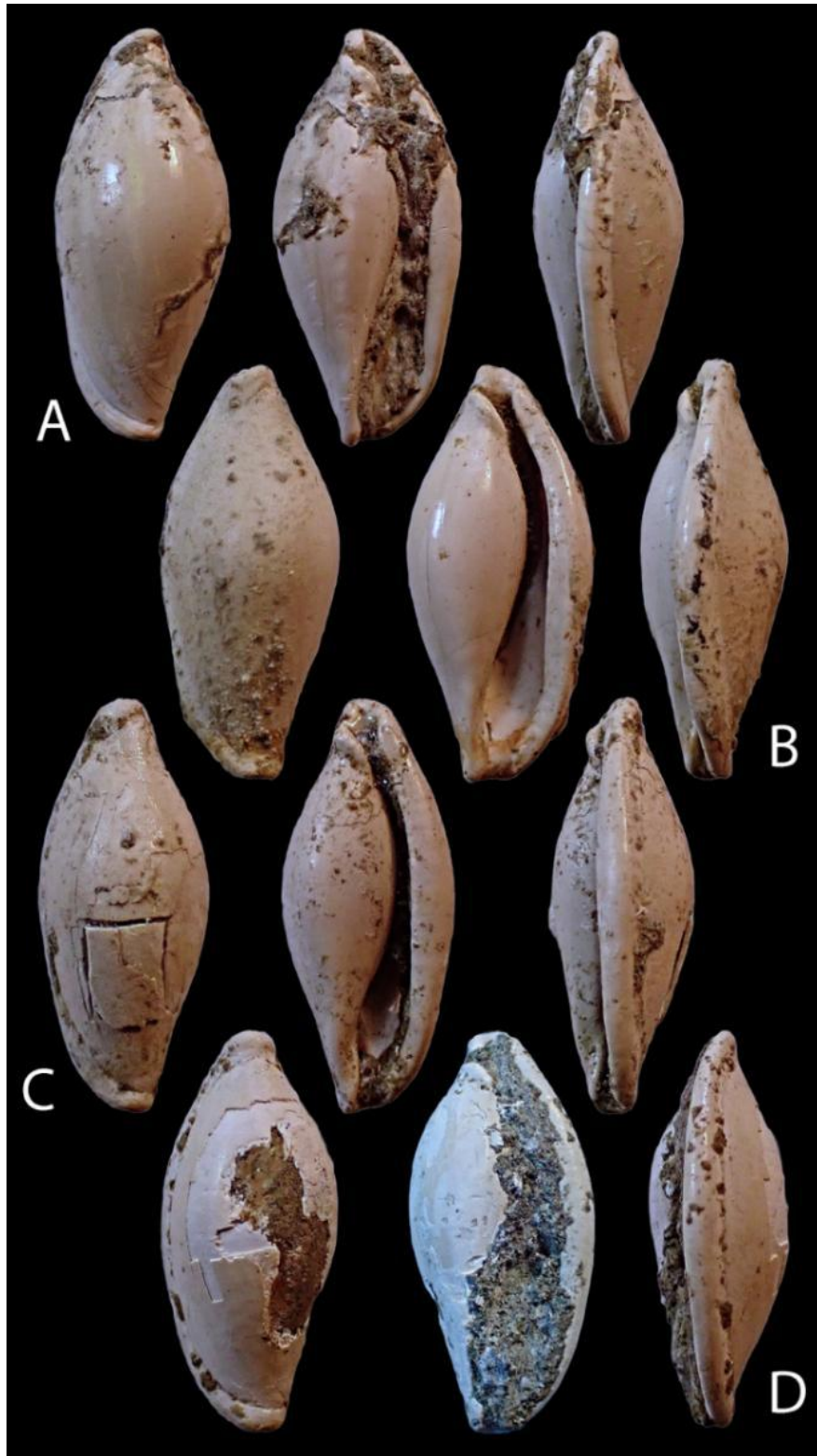


Plate 2. *Neosimnia graniformis* n. sp. Holotype **A**= length / width: 15.93 / 7.21 mm; Paratypes and corresponding lengths / widths: **B**= 12.76 / 5.70 mm; **C**= 13.55 / 5.78 mm; **D**= 14.08 / 6.96 mm. All paratypes are in the ACC collection.

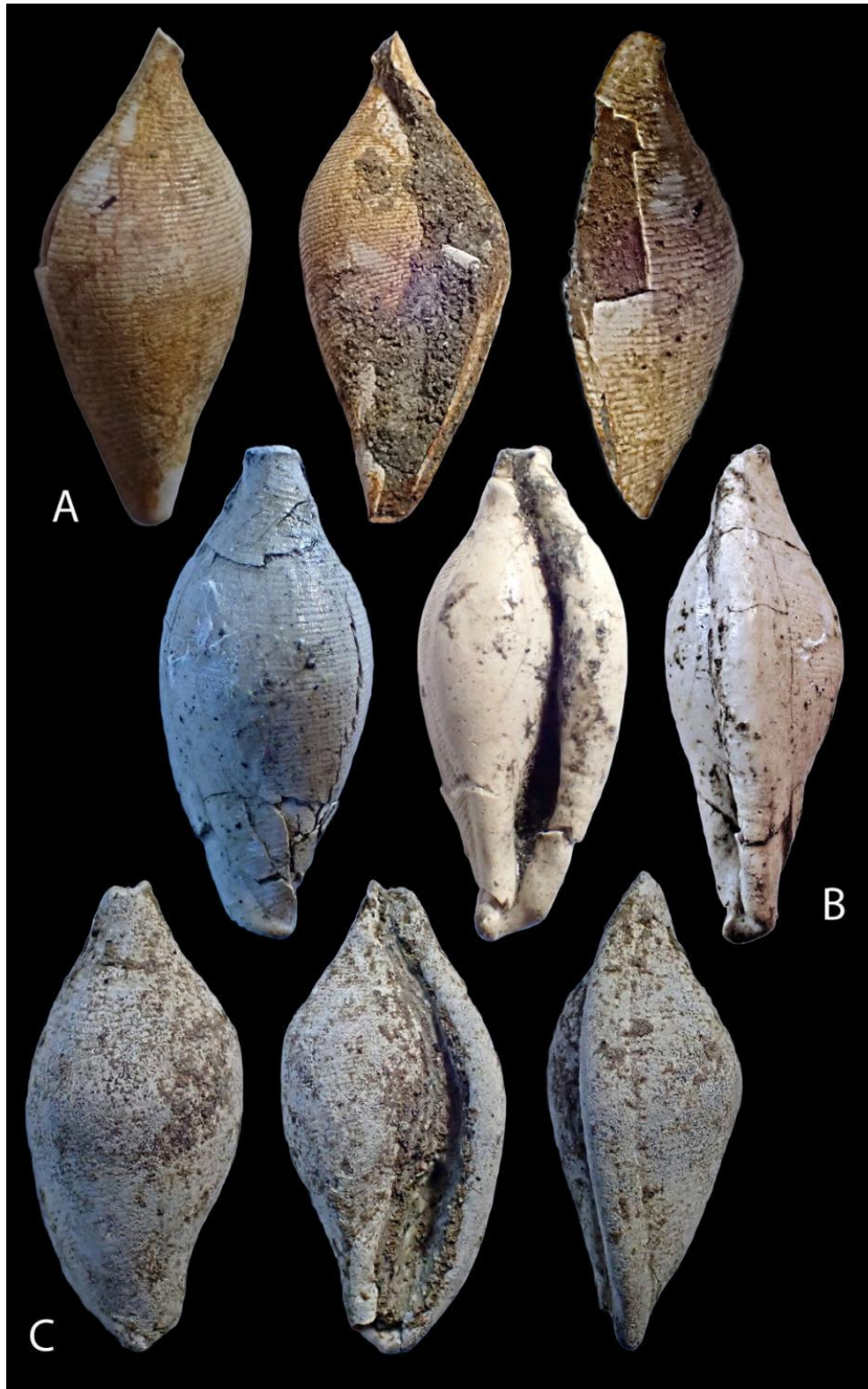


Plate 3. *Neosimnia multilineata* n. sp. Holotype **A**= length / width: 12.29 / 5.58 mm, juvenile specimen; Paratypes and corresponding lengths / widths: **B**= 17.63 / 8.02 mm; **C**= 13.12 / 6.10 mm, very eroded, probably slightly subadult specimen. All paratypes are in the ACC collection.

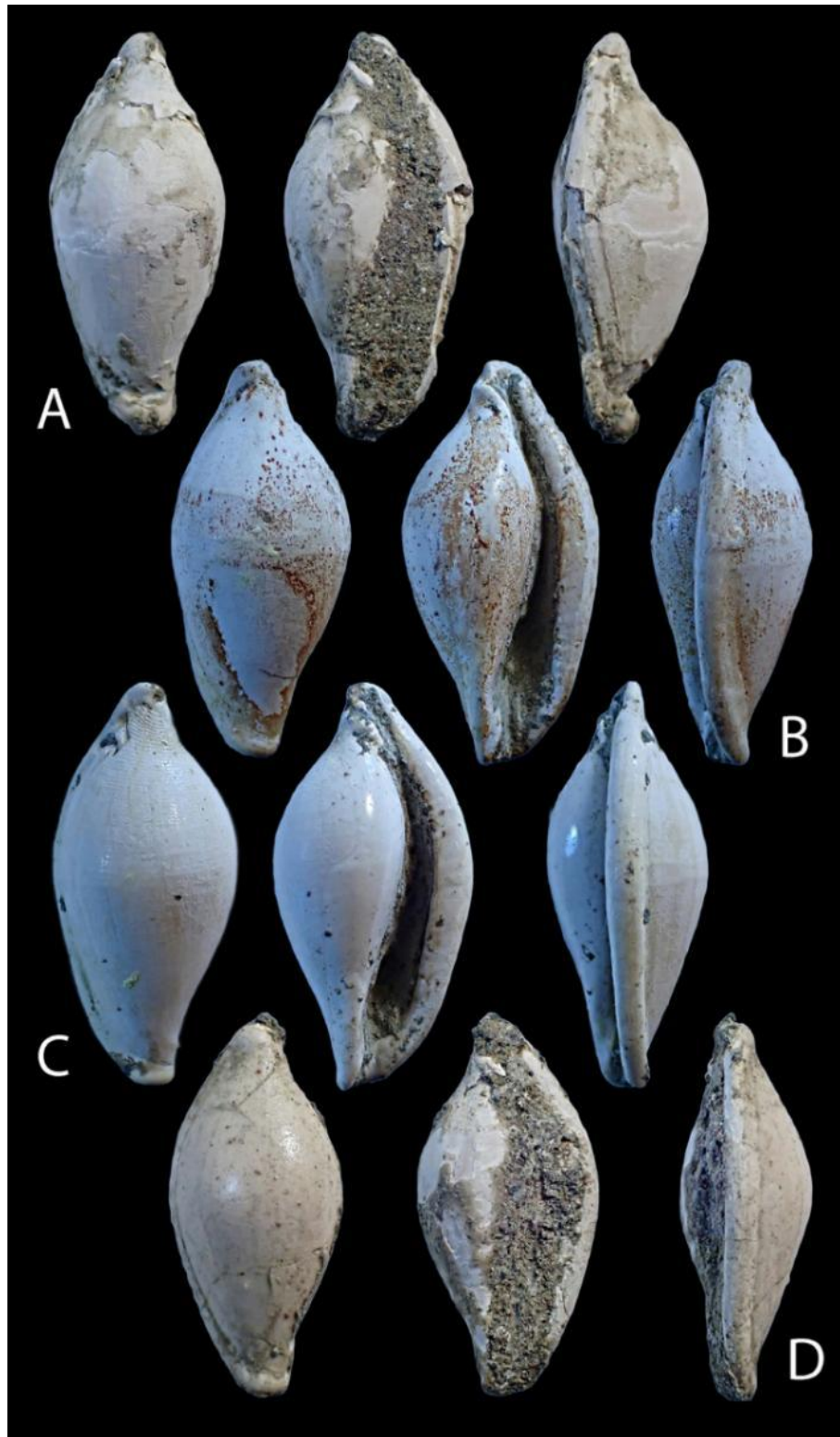


Plate 4. *Neosimnia pseudolaavis* n. sp. Holotype **A**= length / width: 16.61 / 8.02 mm; Paratypes and corresponding lengths / widths: **B**= 17.76 / 8.67 mm; **C**= 17.96 / 8.76 mm; **D**= 13.65 / 6.57 mm. All paratypes are in the ACC collection.

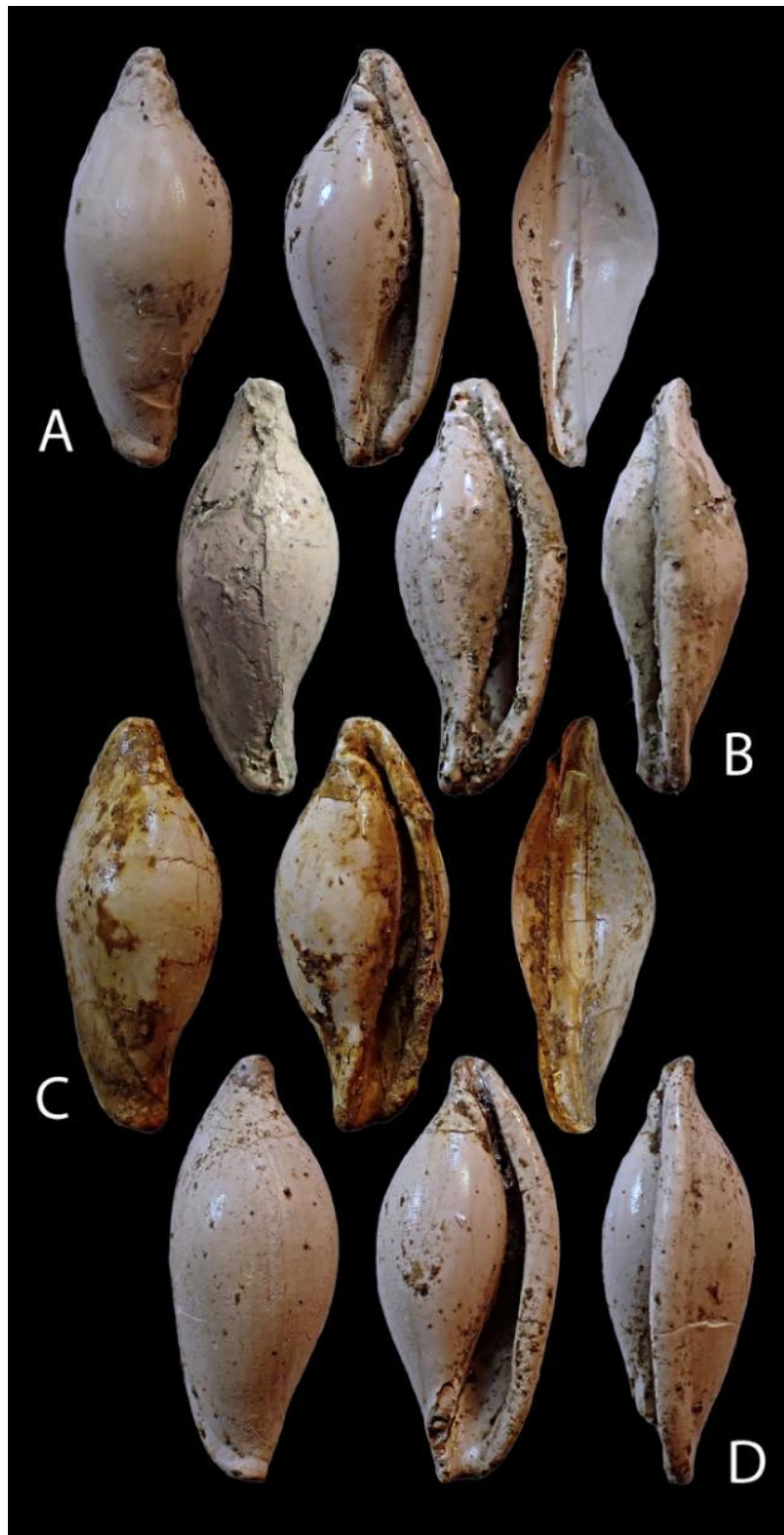


Plate 5. *Neosimnia pulchra* n. sp. Holotype **A**= length / width: 18.21 / 7.86 mm; Paratypes and corresponding lengths / widths: **B**= 16.15 / 7.13 mm; **C**= 18.69 / 7.92 mm; **D**= 19.25 / 8.36 mm. All paratypes are in the ACC collection.