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Discovery of a new species of allied cowry (Gastropoda: Ovulidae) from the Miocene of Victoria, Southeastern Australia

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ABSTRACT A new species of *Ovulidae* J. Fleming, 1822 from the Middle Miocene of Victoria, Australia, is reported. The species is provisionally placed in the genus *Cuspivolva* Cate, 1973, which, if confirmed, will be the first record of this genus in the fossil record of this part of the world.

KEY WORDS Mollusca, Gastropoda, Ovulidae, *Cuspivolva hawkei*, Miocene, Victoria, Australia

INTRODUCTION

Australia is a large island continent which has produced a wide variety of shell-bearing gastropod mollusks in the family *Cypraeidae* Rafinesque, 1815. The fossil fauna from this region is relatively well documented, especially that from the Middle Miocene of Victoria, since the shells of this age have been deposited in a soft clay, which prevents them from being crushed and eroded (Lorenz, 2009). The majority of the species are endemic, and this is also true of the living species in this family as well as those in the fossil record. For example, species in the genera *Zoila* Jousseaume, 1884, *Umbilia* Jousseaume, 1884, as well as some extinct genera such as *Palliocypraea* Cossmann 1906, *Notoluponia* F.A. Schilder, 1935, and *Ponticypraea* Fehse, Lorenz, Hawke & Kovács, 2019 are all endemic, even if their generic placement within the *Cypraeidae* is questionable.

On the other hand, the family *Ovulidae* J. Fleming, 1822, commonly referred to as "allied cowries", is clearly less represented in terms of number of species or even collected specimens. A possible reason for this is that *Ovulidae* produce shells that are generally much smaller than those of Cypraeidae, which may explain why their fossils are more discreet and difficult to spot in the field, and are also considerably more fragile. It is therefore difficult to say whether these mollusks were actually rarer than their cowrie counterparts at the time. In any case, in the end, only a limited number of species have been described, and the specimens that have reached us from ancient times are often damaged.

The species described in this article is no exception. It is very small and as far as the author is aware, it is known from only two specimens, both slightly damaged. It has taken 15 years of active field research in Victoria, Southeastern Australia, to collect these two specimens. The fact that they differ from other known taxa and are virtually identical justifies their description today on a reliable basis. At first glance, their morphology strongly suggests the genus *Cuspivolva* Cate, 1973, which would then be the very first occurrence in the Australian fossil record, if not in the world fossil record. However, as will be mentioned in the discussion, certain anatomical criteria do not fully validate membership in this genus, which can therefore only be provisionally attributed to this new species. Whatever the case, there is no doubt that the species described here is new to science.

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MATERIAL EXAMINED

Two slightly damaged specimens, both from Victoria, Australia, were examined. One has damage to the anterior terminal, probably the thinnest and most fragile part of the shell, and the other has a series of cracks and a small section of the dorsum missing. The holotype has been deposited in the Melbourne Museum (Australia), whereas the paratype is preserved in the Alain Celzard collection (Epinal, France).

TYPE LOCALITY AND TYPE STRATUM

The specimens discussed herein come from two separate locations of slightly different stratigraphic levels, both Middle Miocene. The holotype was collected at Fossil Beach on the Mornington Peninsula, which is the type location for the Balcombian Stage. The latter is a major sub-division of the Tertiary in Australia. Fossil Beach consist of three main elements. The upper layer consists of Baxter sandstones, mixed with harder ironstones. Beneath this layer is a broad band of different-colored clays, underlain by bands of non-calcareous and calcareous clays (Balcombe clay), which contain abundant fossil gastropods.

The paratype was collected over a decade later and found near Princetown, Victoria, SE-Australia, which is the type location for the Gellibrand Marl. The coastal cliffs near Princetown are the best exposures of the Gellibrand Marl in the Otway basin and consist of thin beds of grey and blue fossiliferous clays. Access to the sections is difficult due to steep cliffs and large fallen boulders from the overlying dune limestone (Rosengren, 1987). For more information on the geology of the area, including the Tertiary stratigraphy of the Otway basin, readers may refer to Wopfner and Douglas (1971), Douglas and Ferguson (1976), or Morton (1995), among others.

The top of Figure 1 shows the paratype in situ at the time of discovery, and the bottom of the figure is a map of the two locations.

Figure 1. Photo of paratype in situ at collection site, near Princetown, Gellibrand Marl Formation (top), and map of Australia's southeastern tip, the white stars with red borders indicating the two collection sites (bottom: Map data ©2024 Google).

Based on the regional stratigraphy of this part of the Otway basin, it can be asserted that the geological era corresponding to the material studied from the Gellibrand Marl Formation is Middle Miocene, in particular the Bairnsdalian (15 – 11.2 Ma). The latter rests on the

Balcombian (15.5 - 15 Ma), is overlain by the Mitchellian (11.2 – 5.3 Ma), and is roughly contemporaneous with the Serravallian Stage (13.6 - 11.6 Ma). In addition to the paratype of the new species described here, the clays on the site also contain bivalve mollusks (*Limopsis* sp., *Glycymeris* sp. *Macrodon* sp., *Dimya* sp., etc.), nautiloid cephalopods (*Aturia* sp.), gastropods (*Volutilithes* sp., *Friginatica* sp., *Umbilia* sp., etc.), scaphopods (*Dentalium* sp.), polyplacophorans (*Protochiton* sp.) as well as brachiopods and bones of extinct cetacean and penguin species.

SYSTEMATICS

Class	Gastropoda Cuvier, 1795
Subclass	Caenogastropoda Cox, 1960
Order	Littorinimorpha Golikov & Starobogatov, 1975
Superfamily	Cypraeoidea Rafinesque, 1815
Family	Ovulidae Fleming, 1822
Subfamily	Prionovolvinae Fehse, 2007
Genus	*Cuspivolva* Cate, 1973

Cuspivolva hawkei Celzard, new species †
(Plate 1; Plate 2)

Description. Shell very small, thin, oval-elongate roundly, wider in the posterior third; aperture wide, widening even slightly further anteriorly in the fossular region; funiculum nearly absent; entire dorsum with incised, wavy striae; labrum thickened, rounded, shouldered and entirely smooth; ventrum bulbous, striated like the dorsum; anterior terminal elongated, narrow and blunt; posterior end projecting, slightly pointed; fossula shallow; inner adaxial carinal ridge moderately developed.

Type Material. Holotype N° (still pending from the Museum) 7.80 mm (L), 4.30 mm (W), 3.50 mm (H) (Plate 1). *Cuspivolva hawkei* n. sp. paratype (Plate 2): 5.48 mm (L), 3.14 mm (W), 2.41 mm (H). Plate 1 shows the holotype and Plate 2 the paratype.

Etymology. The new species is named in honor of Angus Hawke, a passionate fossil collector and expert from Melbourne, SE-Australia, who discovered the holotype featured in this paper and provided his knowledge.

DISCUSSION

The new species presented here is tentatively assigned to the genus *Cuspivolva* Cate, 1973, mainly because of its resemblance to living species of the same genus, which are well represented in the Pacific Ocean. *Cuspivolva hawkei* n. sp. is probably related to *C. howlandae* Cate, 1974, known from the Philippines and Queensland, *C. ostheimerae* Cate, 1973, whose range extends from Japan to Australia, *C. singularis* Cate, 1973, from the central Indo-Pacific, and especially *C. bellica* Cate, 1973, found in China, Japan, the Philippines and even South Africa. What all these species have in common is their small size, their oval-pyriform to slightly rhomboid shape, and the distinct wavy striation of their shells, a consistent feature of all small species of the genus *Cuspivolva*, and which is how Lorenz and Fehse (2009) describe this genus. But even more characteristic is the pointed posterior end, which led Cate to give the genus its name, derived from the Latin word "cuspis" and meaning "pointed end" (Cate, 1973).

However, this assignment to the genus *Cuspivolva* Cate, 1973 is not entirely satisfactory either, as several anatomical features usually found in species of this genus are missing in *C. hawkei* n. sp. Firstly, the funiculum is nearly absent, whereas it is normally triangular and particularly prominent. Another peculiarity is that the outer labral margin is often denticulate posteriorly (Lorenz and Fehse, 2009), and it can even be noted that in the above-mentioned modern species to which *C. hawkei* n. sp. appears to be related, the entire labral margin is evenly denticulate. Finally, the width of the aperture in *C. hawkei* n. sp. is unusually wide for the genus, a feature only found so far in *Cuspivolva celzardi* Fehse, 2008, which was originally assigned to the genus *Primovula* Thiele, 1925 before revision in Lorenz and Fehse (2009).

Therefore, if not *Cuspivolva* Cate, 1973, to which genus should this new species be attributed to, as it bears no resemblance to any other fossil allied cowries from Australia? Indeed, to the best of the author's knowledge, the latter are limited to the genera *Cypraedia* Swainson, 1840, *Diminovula* Iredale, 1930, *Pellasimnia* Iredale, 1931, *Eschatocypraea* F.A. Schilder, 1966, *Ponticypraea* Fehse et al., 2019, *Sphaerocypraea* A. Schilder, 1927 and *Willungia* Powell, 1938, whether "true" Ovulidae, Eocypraeidae or Pediculariidae (the boundaries between these families of the superfamily *Cypraeoidea* Rafinesque, 1815 being somewhat porous, depending on the authors and databases). Moreover, all these genera known from Australia are in no way connected with *C. hawkei* n. sp.

Lorenz and Fehse (2009) report that the small species in the genera *Cuspivolva* Cate, 1973, *Primovul*a Thiele, 1925 and *Dentiovula* Habe, 1961 are closely related, and that DNA analysis would be necessary to definitively confirm their status. Indeed, the overall impression of the holotype of *C. hawkei* n. sp. is reminiscent of *Primovula beckeri* G.B. Sowerby, III, 1900, from South Africa, Tanzania and Mozambique, with which it shares an obvious air of family. Nevertheless, what characterizes the genus *Primovula*, according to Lorenz and Fehse (2009), in addition to a narrow aperture, a crenulated funiculum, and a crenulated labral lip, especially adapically, is an acutely angled posterior terminal. The posterior terminal of *C. hawkei* n. sp. does not correspond to that of *Primovula* or *Dentiovula*, nor is there consistency in the absence of funiculum or crenulation of the labrum.

Despite its *Primovula*-like aspect, this species therefore seems to have even less in common with the genus *Primovula* than with the genus *Cuspivolva*. The new species described here also bears some resemblance to a minute *Pseudosimnia shikamai* Cate, 1973 or *Pseudosimnia diaphana* Liltved, 1987 in their general appearance, both species are also entirely covered with incised striae. However, attribution to the genus *Pseudosimnia* F.A. Schilder, 1925, if correct, still does not solve the problem of the lack of funiculum and denticulation of the labrum.

This raises the question of whether the two specimens considered here are juveniles of this new species. It is indeed well known that, in subadult shells, the funiculum is very underdeveloped and the labral teeth are coarser, more widely spaced and less pronounced than in mature shells. In fact, this was the basis on which Lorenz and Fehse (2009) placed *Pseudosimnia aurora* Omi, 2003 in synonymy with *Pseudosimnia pyrulina* A. Adams, 1854. The subadults of many *Ovulidae* species also tend to be lightly striated compared to adults whose species have a smooth dorsum (and usually only retain remnants of striae near the terminal collars), or are more deeply striated than adults whose species are naturally striated at maturity.

However, on close examination of *C. hawkei* n. sp., the thick, well-formed labrum margin does not argue in favor of juvenile specimens, in which the labrum would have been very thin. As for the absence of funiculum and labral teeth, this was also observed in *Pseudosimnia javanensis* Celzard & Dovesi, 2023, another Miocene species but from Java, Indonesia. Nevertheless, there was no doubt that the latter species belonged to the genus *Pseudosimnia* F.A. Schilder, 1925, despite the lack of these diagnostic anatomical characters that are absolutely typical of present-day species. The question arises as to whether some *Ovulidae* species from the Miocene might not display neotenic characters: indistinct funiculum, and perfectly formed but totally smooth, toothless labrum.

Given that attempts to assign them to other genera such as *Sandalia* Cate, 1973 or *Carpiscula* Cate, 1973, whose outline is vaguely reminiscent of the present new species, are even less convincing when looked at in detail, it is preferable to stick to the genus *Cuspivolva* for the time being. Hopefully, other specimens in better condition will eventually be discovered, enabling their description to be further refined and their classification to be more securely placed in a known genus, if not in a new one that remains to be defined and named, something the author has preferred to refrain from doing.

In conclusion, a new species of *Ovulidae* from the Middle Miocene of southeastern Australia has been described and named *Cuspivolva hawkei* n. sp. Several uncertainties remain as to the exact assignment of this new species to this genus, but if it is confirmed, then this is the first occurrence of *Cuspivolva* in the (Australian) fossil record. If it is another related genus, it will also be a novelty, as to the author's knowledge, there are no further records of closely related genera from this age and region. If it is none of these, then it is a new genus, but whose description should be conditional on the examination of many more specimens, and preferably belonging to more than a single species.

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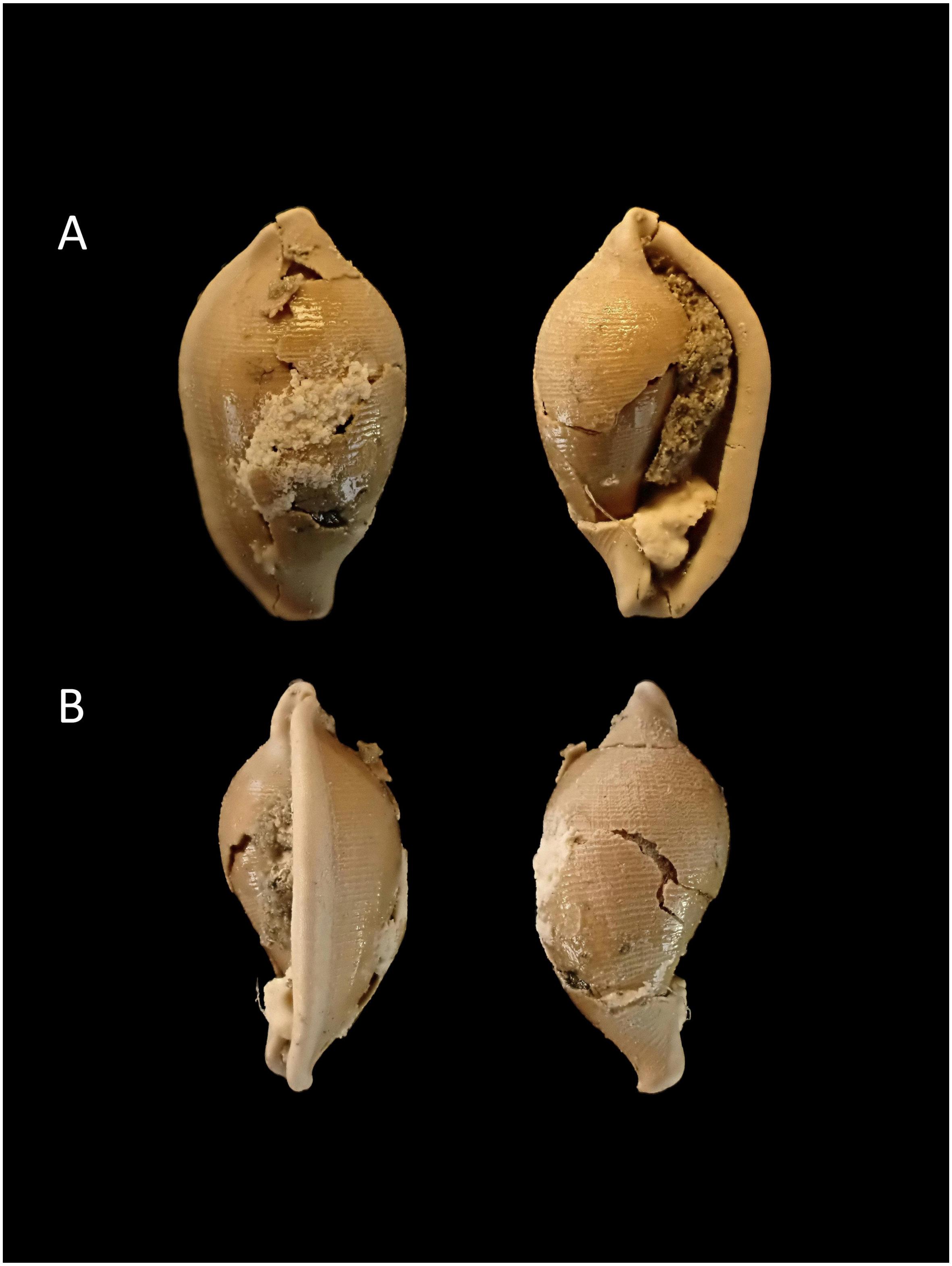

Plate 1. Holotype of *Cuspivolva hawkei n. sp*. (holotype number still pending from the Museum). Length 7.80 mm, width 3.50 mm.

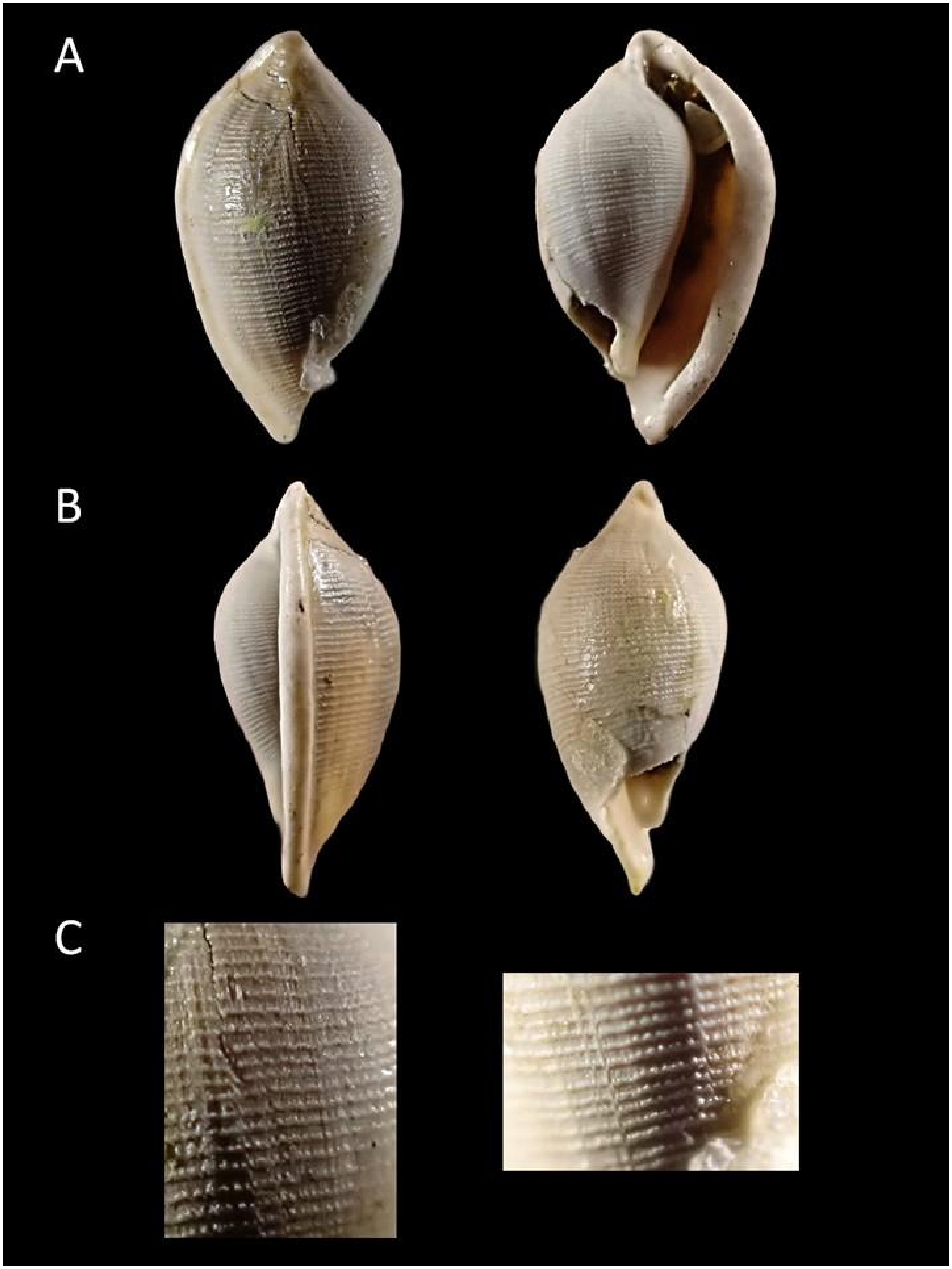

Plate 2. Paratype of *Cuspivolva hawkei n. sp*. (Alain Celzard collection). Length 5.48 mm, width 3.14 mm. **A**, Dorsal and ventral views; **B**, Side views; **C**, Zoom on the dorsum, showing that the wavy pattern of the incised striae is due to nodules located periodically on one edge and then on the other of the main striae direction.