# *Babylonia spirata* (Linnaeus, 1758)

## a survey of the different variations and comments about the status of *Babylonia semipicta* (G.B. Sowerby II, 1866)

by Frank Nolf & Steve Hubrecht

# Pieter Bruegel the Elder

# The Tower of Babel

**Family: BABYLONIIDAE**
**Kuroda, Habe & Oyama, 1971**
**Subfamily: Babyloniinae**
**Kuroda, Habe & Oyama, 1971**
**Genus: *Babylonia* Schlüter, 1838**
**Typetaxon: *Babylonia spirata***
**(Linnaeus, 1758)**

The family ***Babyloniidae*** was originally described by Kuroda, Habe, and Oyama (1971) as a subfamily (Babyloniinae) within the BUCCINIDAE. It comprises two genera: ***Babylonia*** Schlüter, 1838, and ***Zemiropsis*** Thiele, 1929.

This study aims to investigate the variability of ***Babylonia spirata* (Linnaeus, 1758)**, with particular emphasis on the newly described species, ***Babylonia rubroaurantiaca* Cossignani, 2023,** and above all new insights about the real status of ***Babylonia semipicta* (G.B. Sowerby II, 1866)**.

This study constitutes an extended investigation into the morphological variations of ***Babylonia spirata***. A total of **436 shells** were selected from thousands of specimens acquired through various means, including purchases from fish markets, trawling by fishermen, and self-collecting. The majority of these specimens are currently housed in the private collection of Steve Hubrecht. It is important to note that this is not a statistical study, as many of the specimens were not collected in the wild but were instead sourced from fish markets or aquaculture facilities in Shanghai and Taiwan. Consequently, the precise origins remain uncertain and so potentially misleading.

Individuals in **Asian markets** display a marked preference for smaller animals with light-coloured shells. This choice significantly influences the supply and the ratio of classically patterned shells to those exhibiting aberrant colours and patterns. Nevertheless, aberrant forms are present only in limited quantities and remain rare. Furthermore, these variations are connected by a continuum of intermediate forms. In each sample of shells originating from the same locality, farm, or market, no two shells were found to be completely identical. Entire series of linked shells can be observed, demonstrating the gradation in morphological characteristics.

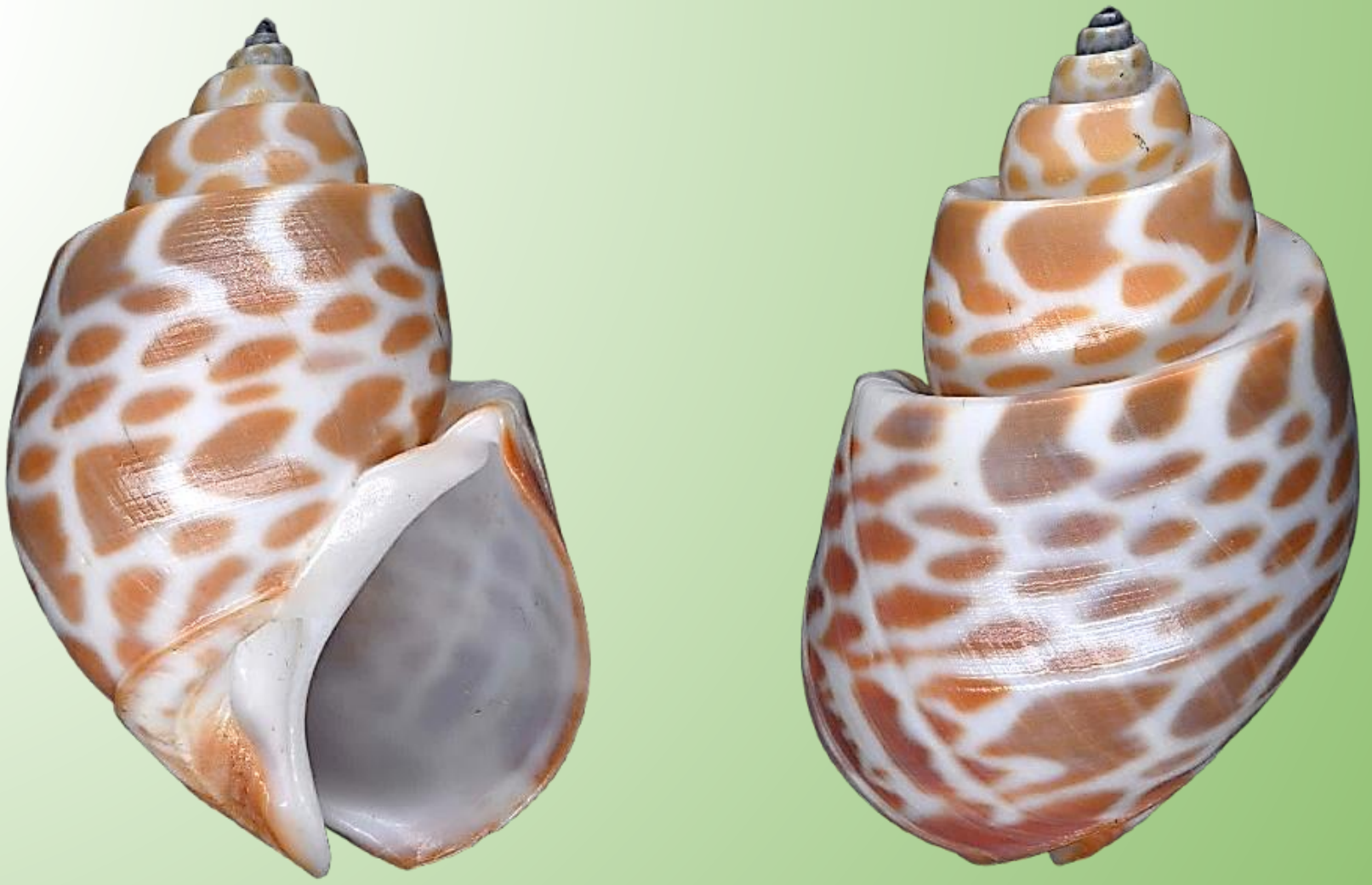
**Geographic distribution of *Babylonia spirata*:**

The western Indian Ocean, ranging from Saudi Arabia and Oman in the west, along the coasts of India, the Maldives, and Sri Lanka.

It is rarely collected in Thailand and Malaysia, but it is more commonly found in eastern Indonesia, particularly off Bali and Java. Occasionally trawled off Taiwan.

**Habitat:**

The species lives in sandy and muddy substrates, occuring in shallow waters at depths ranging from 10 to 100 m.



***Babylonia spirata* (L., 1758)**

Cuddalore, SE India. Trawled by fishermen. March 1999.
68.15 mm. Coll. FN02186.

***Babylonia spirata* (L., 1758)**

Cuddalore, SE India. Trawled by fishermen. March 1999.

74.32 mm. Coll. FN02186.

***Babylonia spirata* (L., 1758)**

Cuddalore, SE India. Trawled by fishermen. March 1999.
78.79 mm. Coll. FN02186.

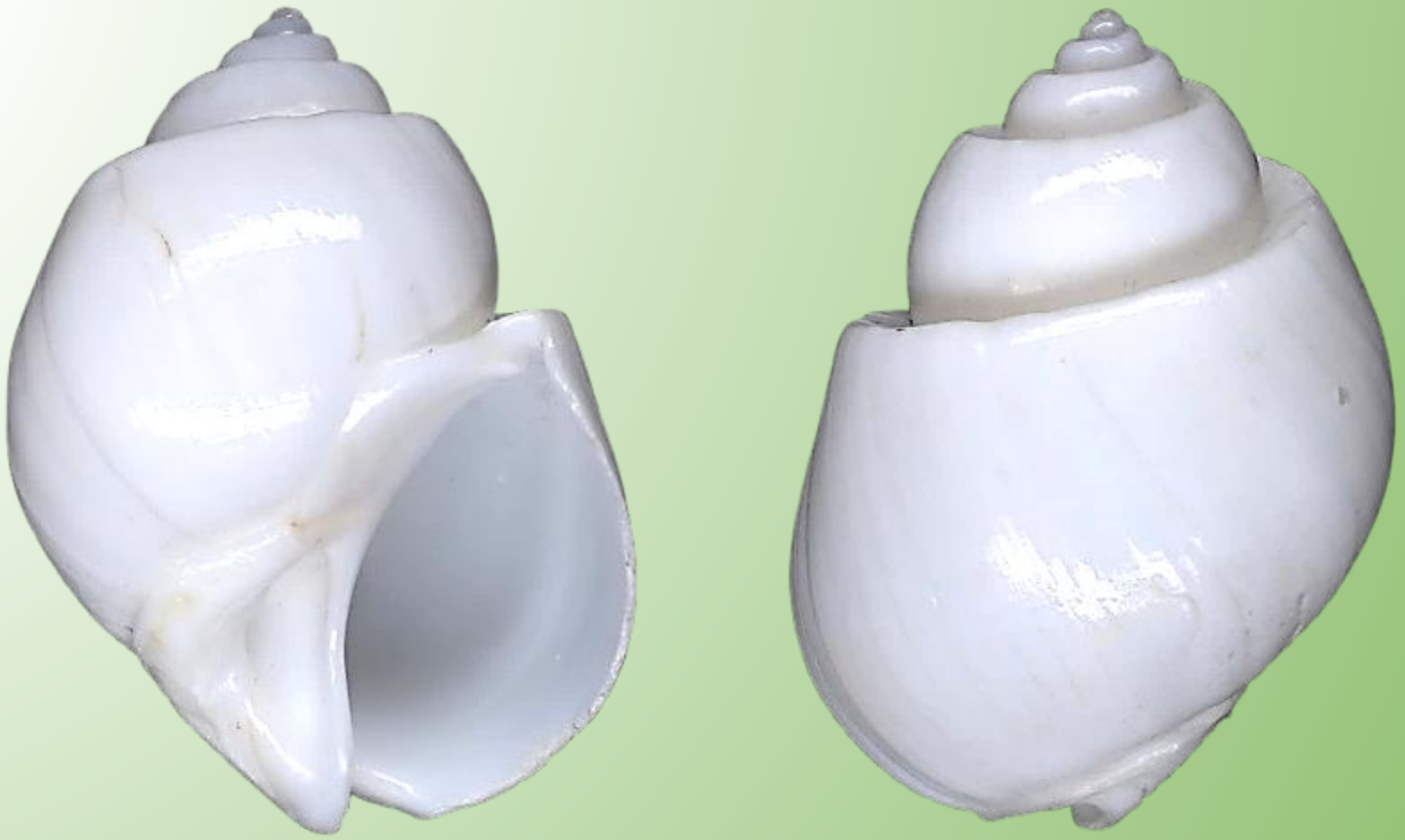
***Babylonia spirata* (L., 1758)**

Rameswaram, SE India. Dredged by fishermen. October 2003.
67.14 mm. Coll. FN02186c.

***Babylonia spirata* (L., 1758)**

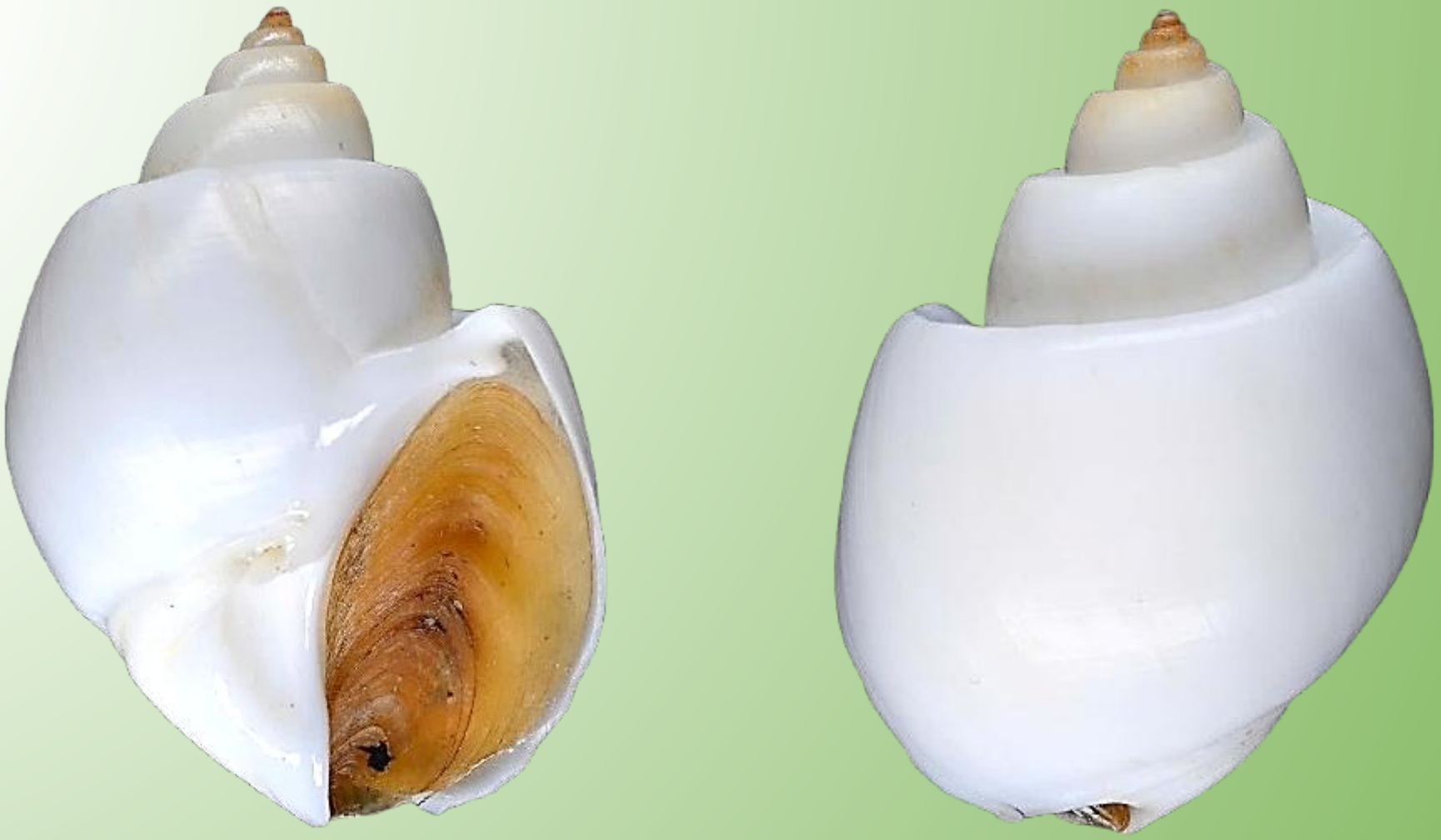
Rameswaram, SE India. Dredged by fishermen. October 2003.
69.92 mm. Coll. FN02186c.

**Albinistic forms:** The shell colour varies widely, ranging from dark reddish-brown to pale orange or purple-pink. Specimens exhibiting a total or partial albinistic character, often with an olive-coloured periostracum, are not uncommon. In contrast, the periostracum of adult shells is typically rusty-brown, relatively thick, felty in texture, and predominantly deciduous.



***Babylonia spirata* (L., 1758)**

Cuddalore, SE India. Trawled by fishermen at a depth of 20 m. March 2003.
35.60 mm. Coll. FN02186b.



***Babylonia spirata* (L., 1758)**

Tongchuan Fish Market, Shanghai, China. 8 April 2016.

24.02 mm. Coll. Steve Hubrecht.

***Babylonia spirata* (L., 1758)**

Cuddalore, SE India. Trawled by fishermen at a depth of 20 m. March 2003.
51.61 mm. Coll. FN02186b.

***Babylonia spirata* (L., 1758)**

Cuddalore, SE India. Trawled by fishermen at a depth of 20 m. March 2003.
64.87 mm. Coll. FN02186b.

# Teratological forms of *Babylonia spirata*

***Babylonia spirata* (L., 1758)**

Cuddalore, SE India. Trawled by fishermen. January 1999.

**Teratological form**.

31.06 mm. Coll. FN02186a.

***Babylonia spirata* (L., 1758)**

Cuddalore, SE India. Trawled by fishermen. January 1999.

**Teratological form**.

35.07 mm. Coll. FN02186a.

***Babylonia spirata* (L., 1758)**

Cuddalore, SE India. Trawled by fishermen. January 1999.

**Teratological form**.

39.85 mm. Coll. FN02186a.

***Babylonia spirata* (L., 1758)**

Cuddalore, SE India. Trawled by fishermen. January 1999.

**Teratological form**.

40.42 mm. Coll. FN02186a.

***Babylonia spirata* (L., 1758)**

Cuddalore, SE India. Trawled by fishermen. January 1999.

**Teratological form**.

41.30 mm. Coll. FN02186a.

***Babylonia spirata* (L., 1758)**

Cuddalore, SE India. Trawled by fishermen. January 1999.

**Teratological form**.

41.60 mm. Coll. FN02186a.

***Babylonia spirata* (L., 1758)**

Cuddalore, SE India. Trawled by fishermen. January 1999.

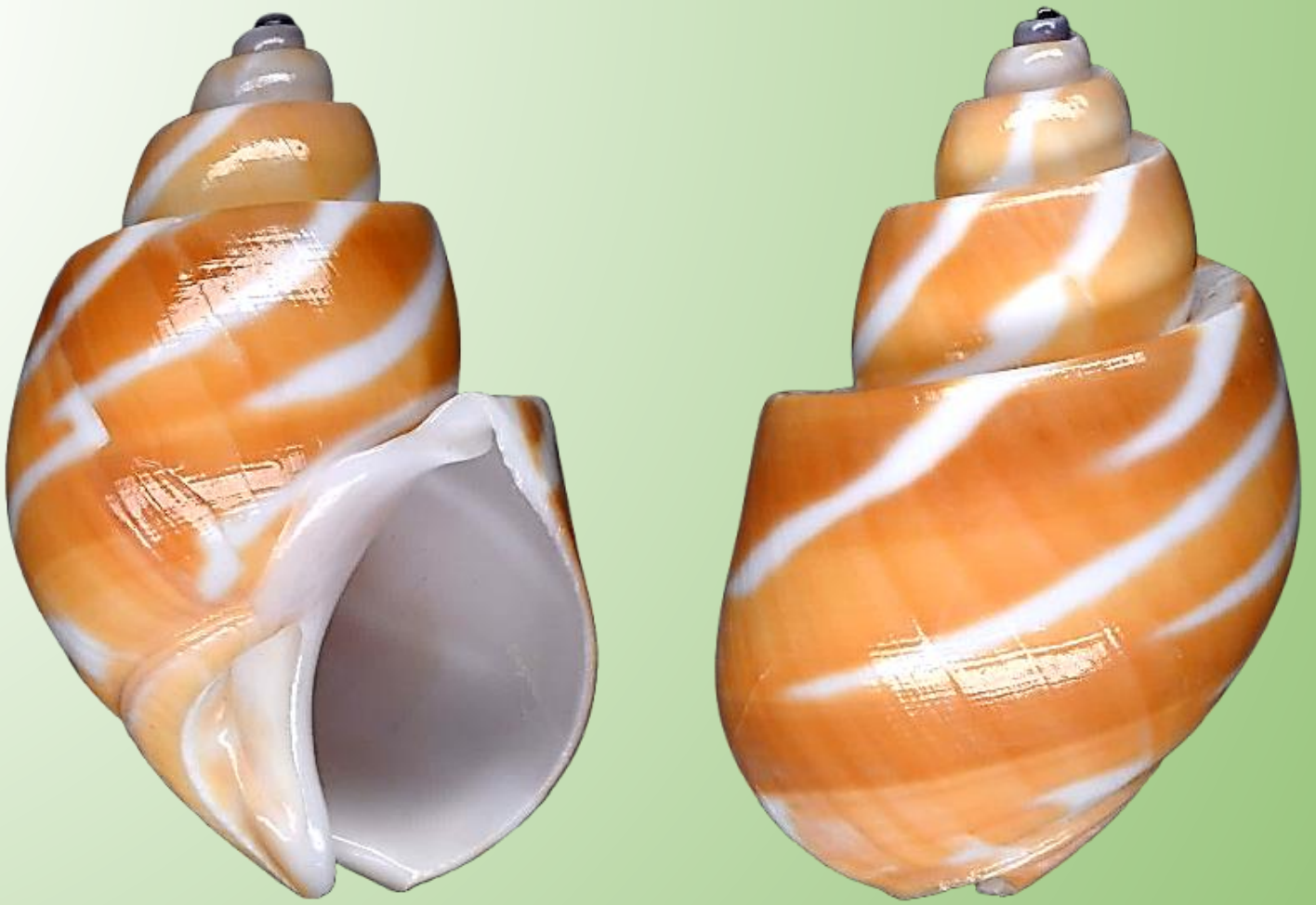
**Teratological form**.

43.57 mm. Coll. FN02186a.

# *Babylonia spirata* var. *alborubra* Spalowsky, 1795

The arrangement of blotches is highly variable, ranging from orange or reddish zigzag markings to discrete blotches on a white background, similar to specimens of the nominal species. Transitional variations can be documented, leading to the conclusion that this is merely a **form of *Babylonia spirata***.

Type locality: **India**.
Also collected in **Chinese** and **Taiwanese** waters.



***Babylonia spirata* var*. alborubra* (Spalowsky, 1795)**
Cuddalore, SE India. Trawled by fishermen. March 2003.
48.17 mm. Coll. FN13007.

***Babylonia spirata* var*. alborubra* (Spalowsky, 1795)**
Cuddalore, SE India.
62.78 mm. Coll. Steve Hubrecht.

***Babylonia spirata* var*. alborubra* (Spalowsky, 1795)**

Sanzhi District, northern New Taipei, Taiwan. Trawled by fishermen. March 2003. 46.97 mm. Coll. Steve Hubrecht.

***Babylonia spirata* var*. alborubra* (Spalowsky, 1795)**

Sanzhi District, northern New Taipei, Taiwan. Trawled by fishermen. March 2003. 48.33 mm. Coll. Steve Hubrecht.

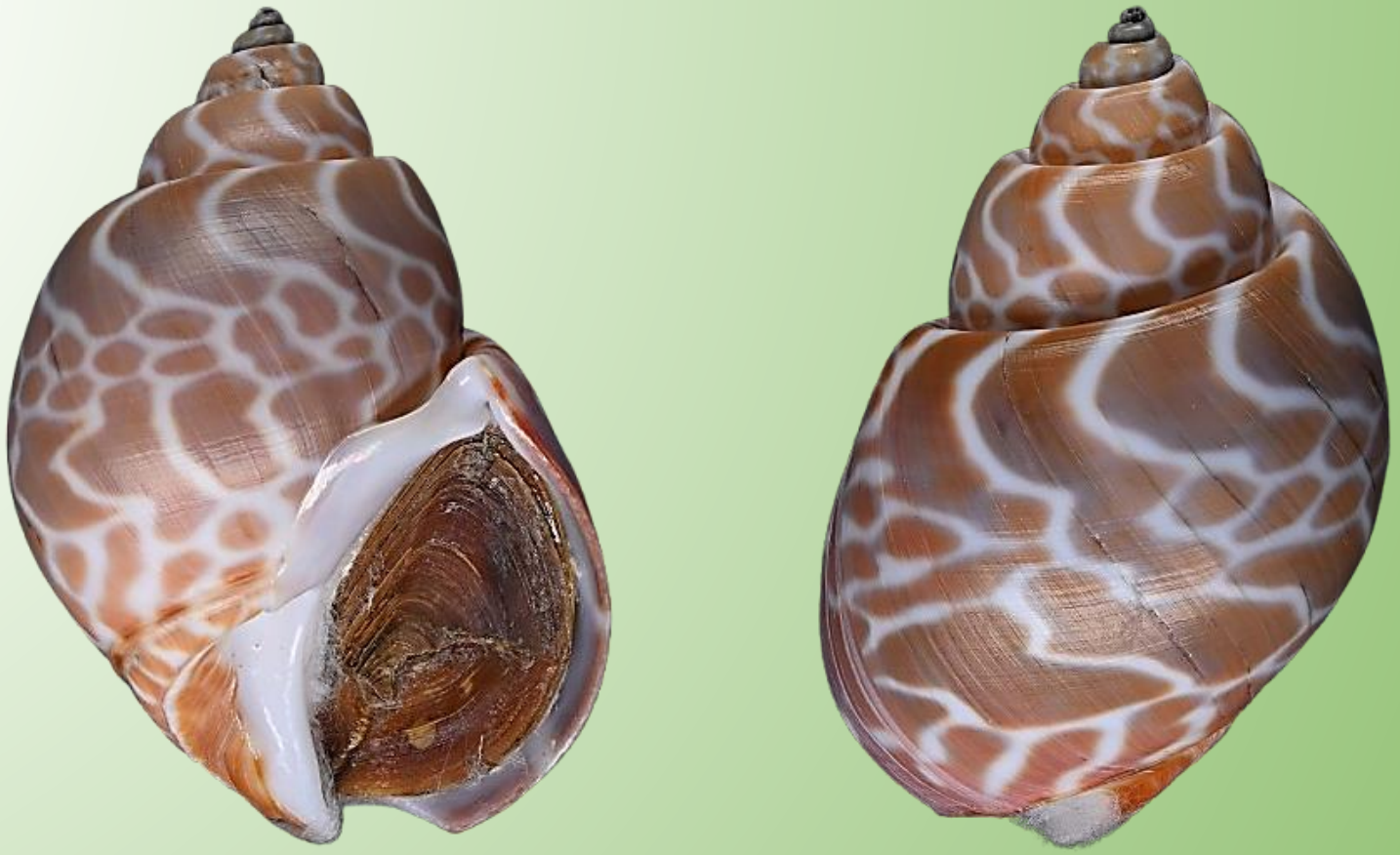
***Babylonia spirata* var*. alborubra* (Spalowsky, 1795)**
Tongchuan Fish Market, Shanghai, China. 17 April 2005.
47.31 mm. Coll. Steve Hubrecht.

***Babylonia spirata* var*. alborubra* (Spalowsky, 1795)**
Tongchuan Fish Market, Shanghai, China. 17 April 2005.
46.80 mm. Coll. Steve Hubrecht.

## ***Babylonia spirata balinensis* Cossignani, 2009**

Specimens from Bali typically exhibit a pattern of large, irregular dots separated by narrow white lines, referred to as ***Babylonia spirata balinensis* Cossignani, 2009**.

However, intermediate forms between this variation and the standard patterned specimens are commonly observed in most populations, necessitating the recognition of the '*balinensis'* variation as a **junior synonym**.



***Babylonia spirata balinensis* Cossignani, 2009**
**[= junior synonym of *B. spirata* var. *alborubra* (Spalowsky, 1795)]**
Senang, Bali, Indonesia.
Trawled by local people at a depth of 30-40 m. June 2013.
57.71 mm. Coll. Steve Hubrecht.

***Babylonia spirata var. chrysostoma***
**(G.B. Sowerby II, 1866)**

***Eburna chrysostoma* Sowerby, 1866** was published as a form of ***Eburna canaliculata*** Schumacher, 1817, a **synonym** of *Babylonia spirata* (Linnaeus, 1758).

Specimens of *B. chrysostoma* from “Ceylon” (Sri Lanka) were described as having a “*bright orange*” aperture with and “*smaller spots, more mottled and blended. The subsutural channel is invariably narrower*”.

More extensive information was provided by **Tryon (1881)**: “*shoulder sharp-edged, deeply channeled; umbilicus narrow, perforated or closed; epidermis frequently adhering, dark brown; coloring a well-defined series of blotches superiorly, below which are numerous, rather large transverse or oblique oval spots; some of the latter frequently become confluent into an inferior revolving series of irregular or cuneiform markings*”.

**Geographic distribution:** India and Sri Lanka.

The descriptions and figures provided by Sowerby (1859, 1866) and Tryon (1881) make it evident that no morphological differences can be discerned between this form and the nominal species. The only variation lies in the colour of the aperture and its edges, which ranges from salmon and orange-red to vermillion.

**Geographic distribution:** India and Sri Lanka.

***Babylonia spirata* var*. chrysostoma* (G.B. Sowerby II, 1866)**
Pondicherry, SE India. Dredged by local fishermen. October 2003.
46.40 mm. Coll. FN08653.

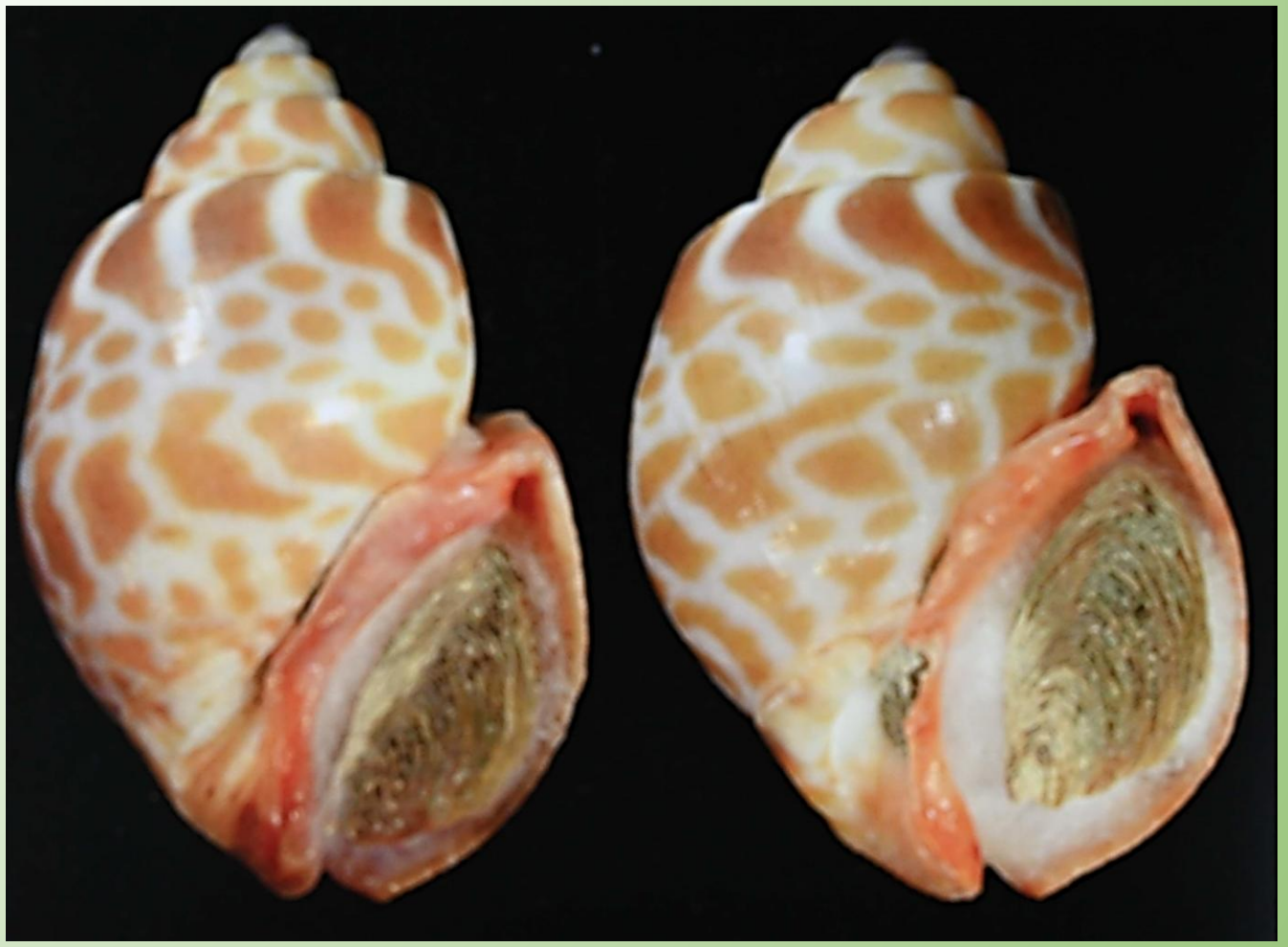
***Babylonia spirata* var*. chrysostoma* (G.B. Sowerby II, 1866)**
Kilakarai, Tamil Nadu, SE India. Dredged by local fishermen. 1977.
53.76 mm. Coll. Steve Hubrecht.

**Cossignani (2023)** described ***Babylonia rubroaurantiaca*** as a new species rather than as a form, attributing to it the same morphological characteristics as *B. spirata* var. *chrysostoma*. However, no significant differences were identified in the publication, despite reference to Fraussen & Stratmann (2013). Consequently, this new species is merely a *junior synonym* of ***B. spirata* var. *chrysostoma* (Sowerby, 1866)**, and therefore of ***Babylonia spirata***.

**Geographic distribution:** India.

***Babylonia rubroaurantiaca* Cossignani, 2023**
100 km off Colachel (Kolachal), Kanyakumari District, India.
In trawl nets of local fishermen at a depth of 40-50 m. December 2022.
57.76 mm. Holotype. *Malacologia*, 119: 23-25.

***Babylonia rubroaurantiaca* Cossignani, 2023**
100 km off Colachel (Kolachal), Kanyakumari District, India.
In trawl nets of local fishermen at a depth of 40-50 m. December 2022.
48.75 mm. Paratype 1. *Malacologia*, 119: 23-25.



***Babylonia rubroaurantiaca* Cossignani, 2023**

100 km off Colachel (Kolachal), Kanyakumari District, India.

In trawl nets of local fishermen at a depth of 40-50 m. December 2022.

paratype 2: 54.80 mm (left) & paratype 3: 56.60 mm (right). *Malacologia*, 119: 23-25.

# ***Babylonia spirata var. semipicta***
# **(G.B. Sowerby II, 1866)**

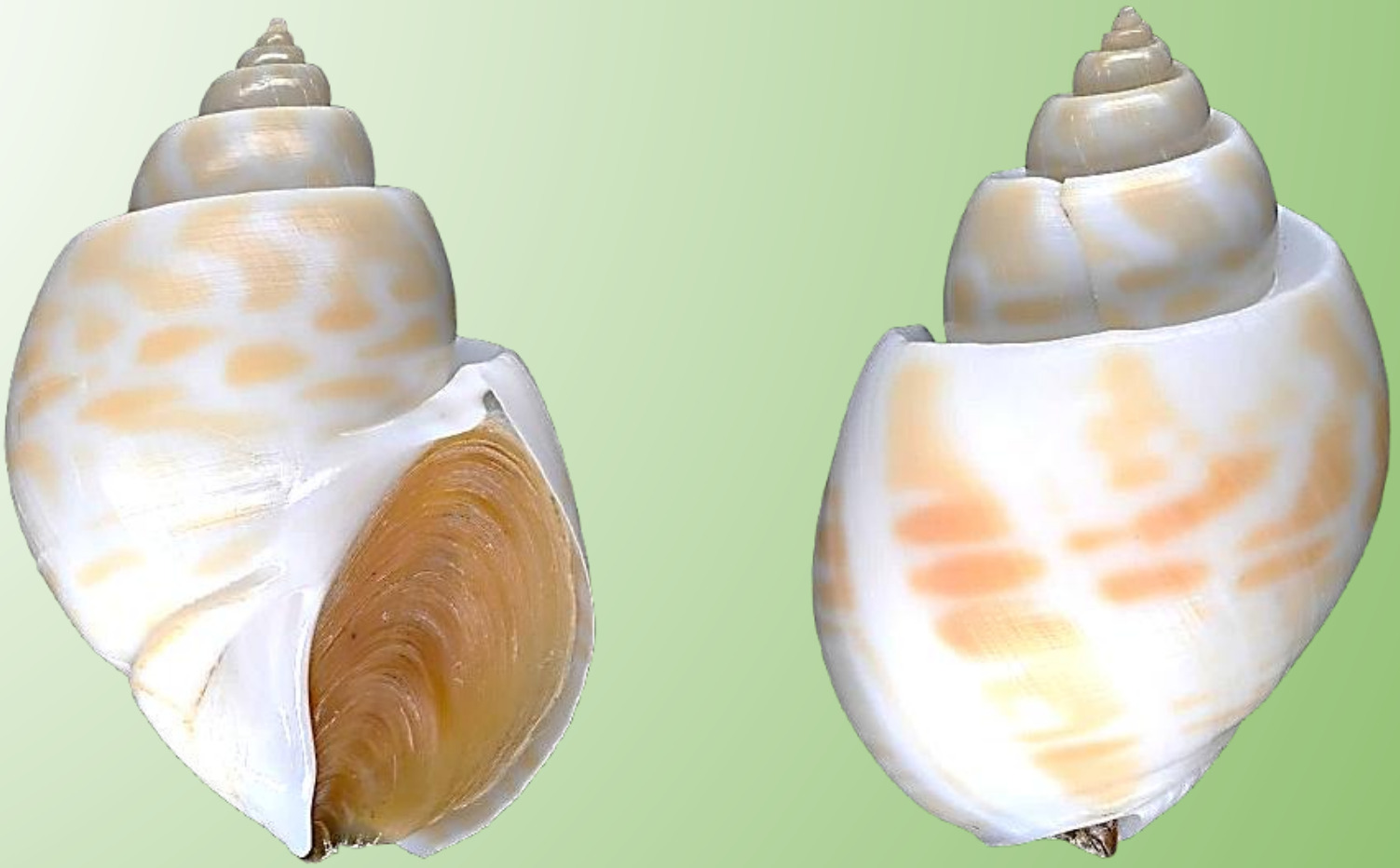
**Description:** *Eburna semipicta* was originally cited by G.B. Sowerby II, 1866 without pagination, but illustrated on pl. 291, figs 12-13 from “Ceylon” (Sri Lanka): “*more rounded than Eburna canaliculata* (syn. of Babylonia spirata), *with rounded spots arranged in a broad band in the centre of the whorls, about four spots deep, and in a lower band two spots deep; the canaliferous varix and the umbilicus are narrow*”.

***Babylonia spirata* var*. semipicta* (G.B. Sowerby II, 1866)**
Kilakarai, Tamil Nadu, SE India. Trawled by fishermen.
58.67 mm. Coll. FN10054.

***Babylonia spirata* var*. semipicta* (G.B. Sowerby II, 1866)**

Off Cuddalore, SE India. Trawled by fishermen at a depth of 20-30 m. January 1996. 49.14 mm. Coll. Steve Hubrecht.

**Special specimen with filled umbilicus.**

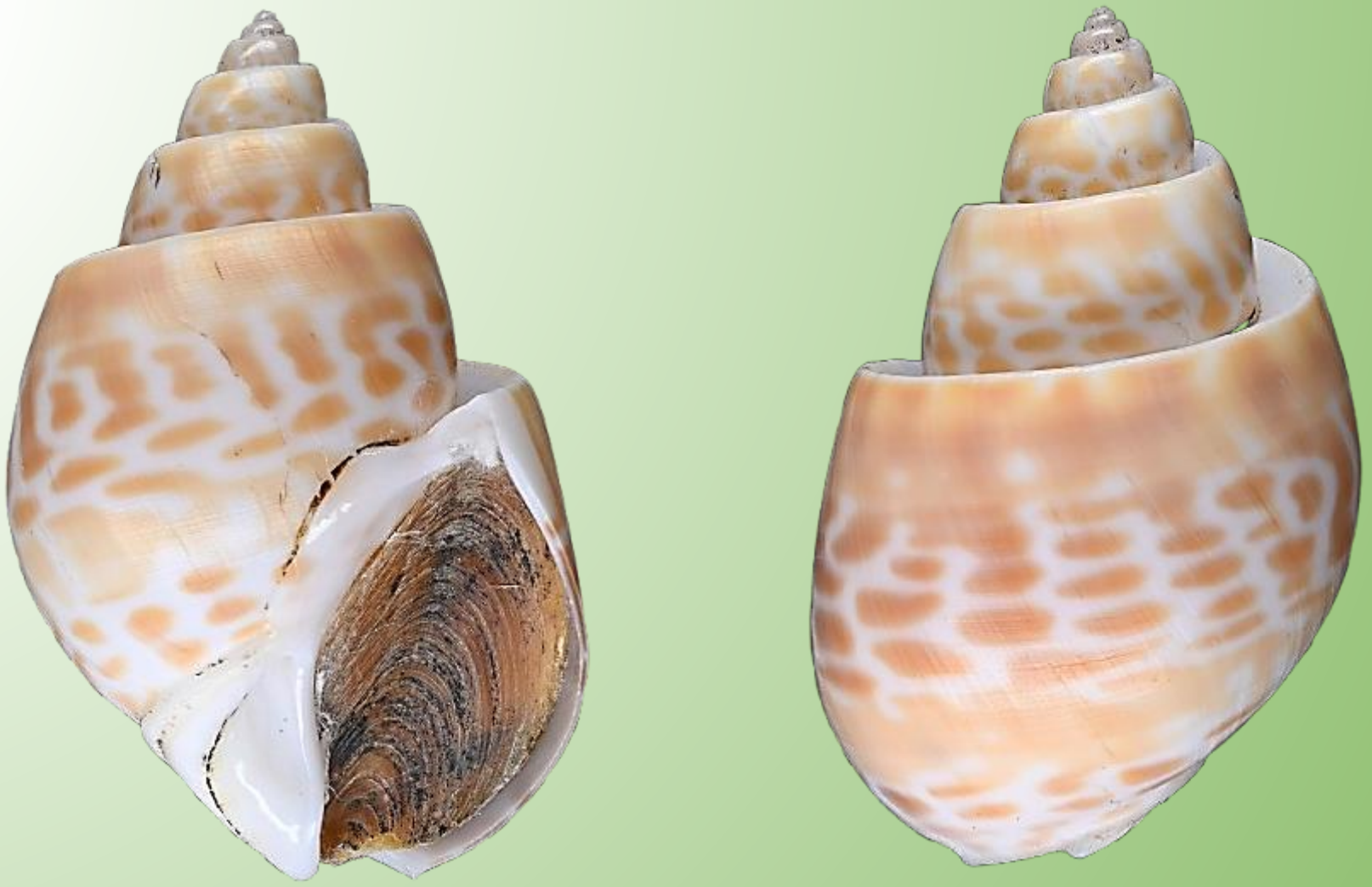


***Babylonia spirata* var*. semipicta* (G.B. Sowerby II, 1866)**
Polomeyi Beach, Langkawi, Malaysia. In sand at low tide.
41.36 mm. Coll. Steve Hubrecht.

***Babylonia spirata* var*. semipicta* (G.B. Sowerby II, 1866)**
Indonesia, Java Sea. Trawled by fishermen.
48.40 mm. Coll. FN10054a.

***Babylonia spirata* var*. semipicta* (G.B. Sowerby II, 1866)**

Off Western Java, Indonesia. Trawled by fishermen at a depth of 60-100 m.
54.45 mm. Coll. Steve Hubrecht.



***Babylonia spirata* var*. semipicta* (G.B. Sowerby II, 1866)**

Off Western Java, Indonesia. Trawled by fishermen at a depth of 60-100 m.
56.25 mm. Coll. Steve Hubrecht.

***Babylonia spirata* var*. semipicta* (G.B. Sowerby II, 1866)**
Tongchuan Fish Market, Shanghai, China. 13 May 2006.
49.76 mm. Coll. Steve Hubrecht.

***Babylonia spirata* var*. semipicta* (G.B. Sowerby II, 1866)**
Tongchuan Fish Market, Shanghai, China. 13 May 2006.
58.75 mm. Coll. Steve Hubrecht.

***Babylonia spirata* var*. semipicta* (G.B. Sowerby II, 1866)**
Tongchuan Fish Market, Shanghai, China. 4 February 2006.
55.89 mm. Coll. Steve Hubrecht.

***Babylonia spirata* var*. semipicta* (G.B. Sowerby II, 1866)**
Tongchuan Fish Market, Shanghai, China. 4 February 2006.
57.94 mm. Coll. Steve Hubrecht.

***Babylonia hongkongensis* Lai & Gou, 2010**
**[= junior synonym of *B. spirata* var*. semipicta* (G.B. Sowerby II, 1866)]**
North Taiwan. Trawled by fishermen at a depth of 30-50 m.
46.07 mm. Coll. Steve Hubrecht.

***Babylonia hongkongensis* Lai & Gou, 2010**
**[= junior synonym of *B. spirata* var*. semipicta* (G.B. Sowerby II, 1866)]**
North Taiwan. Trawled by fishermen at a depth of 30-50 m. January 2011.
50.20 mm. Coll. Steve Hubrecht.

Tryon (1881) depicted a specimen from an unknown locality and highlighted the two-banded arrangement of the spots, as well as the absence of the superior row of blotches.

Patterson Edward et al. (2022) discuss only two species: *B. spirata* and *B. zeylanica* (Bruguière, 1789).
There is no mention or illustration of *B. semipicta* (G.B. Sowerby II, 1866) in their extensive work.

**Fraussen & Stratmann (2013)** regarded ***B. semipicta*** as a **variant** of ***B. spirata***, characterised by two bands: one along the mid-whorl and the second at the base, formed by small dots or specks that are closely situated. The subsutural zone is pure white. Occasionally, the lower spiral band is absent, leaving a white base. Some shells may exhibit the typical *semipicta* pattern on the upper whorls, with the body whorl remaining pure white.

***Babylonia angusta*** van Regteren Altena & Gittenberger, 1981, is considered a **subjective junior synonym** of ***B. semipicta*** (Yen et al., 2024). The holotype was not illustrated in the original description, but Fraussen & Stratmann (2013) illustrated the holotype as well as two paratypes in Figs 39, a-d. It is characterised by a narrow subsutural channel, with the type locality listed as "*China*". However, no native *B. angusta*-like species have been found in either Taiwan or China, and it has not been recorded in any publication since the description by Fraussen & Stratmann (2013).

**Geographic distribution:** Shells displaying the described pattern of *Babylonia semipicta* have been discovered together with normal-patterned specimens of *B. spirata* and completely albinistic ones in the area off **Tuticorin (India)**. These samples became part of the collections of Fraussen, Stratmann, Nolf and Hubrecht.
However, most of the *semipicta* shells are found in **the Java Sea (Indonesia),** where they live together with ***B. spirata balinensis*** Cossignani, 2009.

The *semipicta* form is also collected from Langkawi (Malaysia), China and even trawled off North Taiwan (***B. hongkongensis* Lai & Gou, 2010**).

Since April 2009, numerous '*semipicta*'-patterned specimens have also been found in fish markets in Taiwan and China (Fraussen & Stratmann, 2013), although all were sourced from the Java Sea, due to both legal and illegal international trade in East Asia since the 1950s.

**Discussion:** A thorough study of *Babylonia spirata* and other related species is challenging, particularly due to their commercialisation and cultivation in sea farms. The origin of the samples is often uncertain, and the results from DNA sequencing can only be considered plausible if specimens are sourced from the wild. Unfortunately, forms such as '*semipicta*', '*chrysostoma*', and '*alborubra*' are rarely encountered.

Yen et al. (2024) propose that *Babylonia spirata* var. *semipicta*, *B. spirata* var. *balinensis* Cossignani, 2009, and the enigmatic species from '*China*', *B. angusta* Altena & Gittenberger, 1981, constitute a **monophyletic group** with a more extensive distribution within Indonesia. This hypothesis implies that these taxa may all represent a **single species**.

Given that *B. semipicta* is the oldest available name within this group of three, it is recommended that ***B. semipicta* be accorded priority**, with *B. balinensis* and *B. angusta* consequently treated as junior synonyms. Nevertheless, the findings derived from sequencing three mitochondrial genes are not entirely definitive and are characterised as being '*poorly supported*' (Yen et al., 2024).

**Yen et al. (2024)** assert that ***B. semipicta*** should no longer be regarded merely a morphological variant of *B. spirata,* but rather as a **distinct species**, supported by **multi-locus phylogenetic analyses**.

The researchers employed several operational taxonomic units (OTUs) to delineate the species boundaries. The analysis yielded three OTUs, which formed two separate groups: one corresponding to *B. spirata*, and the other encompassing *B. angusta*, *B. spirata* var. *balinensis* and *B. spirata semipicta*.

However, a fourth OTU, generated using multi-rate Poisson Tree Process (mPTP), indicated that *B. spirata* and *B. semipicta* should be grouped together. Yen et al. (2024) caution that the mPTP approach is prone to excessive grouping (over-lumping), rendering its reliability questionable.

The geographical delimitation between *B. spirata* (from the western Indian Ocean to India) and *B. semipicta* (Java Sea, Indonesia) presents an additional issue.

How can we explain the occurrence of *B. semipicta* in Indian waters, specifically the specimens illustrated and described by Fraussen & Stratmann (2013) and the specimens in collections Nolf and Hubrecht from eastern India?

There are **several possibilities** regarding the **exact recognition** of one or two different species:

- ***B. semipicta* coexists with *B. spirata* in India**. In this case, efforts should be made to search for live specimens of both species in India in order to obtain molecular data from the same mitochondrial genes studied by Yen et al. (2024). They also refer to a **'*clear separation in their distribution*'**, which contrasts with their statement that the pattern of the *semipicta* form **'*can be found both in Indonesia and India*'**.

- It is possible that **Indian fishermen trawl in Indonesian waters** and bring *B. semipicta* specimens to Indian fish markets or to wholesale dealers of commercial shells.

- Another possibility is that the **same pattern** of blotches occurs in **both species**.

- It is crucial to highlight that there are minimal morphological differences in the general outline and umbilicus between the two species. Contrary to the assertion by Yen et al. (2024) that *B. semipicta* exhibits ‘a **more** rounded shell shape‘, most specimens of *B. semipicta* are, in fact, **less** globose. Overall, both *B. spirata* and *B. semipicta* display a broadly similar shell outline.

- The only argument for **distinguishing the species** comes from the **phylogenetic analysis** conducted by **Yen et al. (2024)**. However, their results are **not entirely** convincing.

At the heart of this dilemma likes the question is: what should be considered the true *Babylonia semipicta* form? It is likely the Chinese researchers selected specimens that closely Sowerby's original illustration. However, numerous intermediate forms exist between *B. spirata* and *B. semipicta,* as demonstrated in this presentation.

Additionally, comparisons are warranted with the variation observed within ***Babylonia borneensis*** **(G.B. Sowerby II, 1864)**, as figured herein. **The series of illustrations also includes several '*semipicta*' forms.**

***Babylonia borneensis* (G.B. Sowerby II, 1864)**
North Taiwan. Trawled by fishermen. August 2009.
61.31 mm. CFN12791.

***Babylonia borneensis* (G.B. Sowerby II, 1864)**

Trawled off Sumatra, Indonesia. Ah Yat Seafood Market, Singapore.

5 January 2007.

36.87 mm. Coll. Steve Hubrecht.

***Babylonia borneensis* (G.B. Sowerby II, 1864)**

Trawled off Sumatra, Indonesia. Ah Yat Seafood Market, Singapore.

5 January 2007.

44.04 mm. Coll. Steve Hubrecht.

***Babylonia borneensis* (G.B. Sowerby II, 1864)**

Trawled off Sumatra, Indonesia. Ah Yat Seafood Market, Singapore.

5 January 2007.

45.96 mm. Coll. Steve Hubrecht.

***Babylonia borneensis* (G.B. Sowerby II, 1864)**

Trawled off Sumatra, Indonesia. Ah Yat Seafood Market, Singapore.

5 January 2007.

53.73 mm. Coll. Steve Hubrecht.

***Babylonia borneensis* (G.B. Sowerby II, 1864)**

Trawled off Sumatra, Indonesia. Ah Yat Seafood Market, Singapore.

5 January 2007.

55.68 mm. Coll. Steve Hubrecht.

***Babylonia borneensis* (G.B. Sowerby II, 1864)**

Trawled off Sumatra, Indonesia. Ah Yat Seafood Market, Singapore.

5 January 2007.

58.65 mm. Coll. Steve Hubrecht.

Survey of results from our investigation:

- Tongchuan Fish Market, Shanghai, China (2005-2008): among 12 lots comprising 376 shells:
    * 331 *Babylonia spirata* (classic form),
    * 30 *alborubra/balinensis,*
    * 3 *hongkongensis,* and
    * 12 *semipicta.*
- South India/Sri Lanka:
    * 47 *spirata*,
    * 1 *semipicta*,
    * 4 *chrysostoma,* and
    * *2 alborubra.*

- Indonesia:

No classic *spirata* were acquired from fish markets; however,

    * 2 *semipicta* were recorded.

- Malaysia:
    * 1 *spirata*,
    * 1 *semipicta*, and
    * 2 *alborubra* (all collected in the wild).
- Taiwan:
    * 2 *alborubra* and 2 *semipicta* were sourced from restaurants, while hundreds of classic *spirata* were observed on fish markets.

# Conclusion

Finally, we hypothesise the existence of **a single polymorphic species, *Babylonia spirata***, distributed across the same geographical range, extending from India, Sri Lanka, and Thailand to Indonesia and the Java Sea.

Morphologically, **numerous intermediate forms** are observed, ranging from the characteristic blotched pattern of ***B. spirata*** to the distinct organisation of two bands on the last whorl in the ***semipicta*** form: one along the mid-whorl and the other at its base. **Comparable intermediate forms** are also present within ***B. borneensis.***

Within this framework, ***Babylonia semipicta*** is treated as a **junior synonym** of ***B. spirata, as well as Babylonia chrysostoma* (G.B. Sowerby II, 1866), *Babylonia alborubra* (Spalowsky, 1795), *Babylonia rubroaurantiaca* Cossignani, 2023 and *Babylonia spirata balinensis* Cossignani, 2009.**