

The Pliocene Gastropoda (Mollusca) of Estepona, southern Spain. Part 27: Revision of the genera *Alvania* Risso, 1826 and *Manzonina* Brusina, 1870 (Rissoiidae, Caenogastropoda)

Bernard Landau^{1*}, Bruno Amati² & Mathias Harzhauser³

¹ Naturalis Biodiversity Center, P.O. Box 9517, 2300 RA Leiden, The Netherlands; Instituto Dom Luiz da Universidade de Lisboa, Campo Grande, 1749-016 Lisboa, Portugal; and International Health Centres, Av. Infante de Henrique 7, Areias São João, P-8200 Albufeira, Portugal; email: bernardmlandau@gmail.com

² Largo Giuseppe Veratti, 37/D, 00146 Rome, Italy; email: bruno_amati@yahoo.it

³ Natural History Museum Vienna, Burgring 7, 1010 Vienna, Austria; email: mathias.harzhauser@nhm-wien.ac.at

* Corresponding author

ZooBank registration – urn:lsid:zoobank.org:pub:39CB7A62-DA9E-42E1-9FB7-4981E85340D8

Received 22 November 2024, revised version accepted 11 February 2025

In this paper the genera *Alvania* Risso, 1826 and *Manzonina* Brusina, 1870 (Rissoiidae, Caenogastropoda) of the Upper Zanclean, Lower Pliocene of Estepona, southern Spain are reviewed. Twenty-eight species of *Alvania* are recorded, of which two are left in open nomenclature and nine are described as new: *Alvania acutissimispira* nov. sp., *Alvania bicingulina* nov. sp., *Alvania cimicoiberica* nov. sp., *Alvania hispanica* nov. sp., *Alvania iberopliocenica* nov. sp., *Alvania lachrymiformis* nov. sp., *Alvania lobilloensis* nov. sp., *Alvania vandervalki* nov. sp., *Alvania veleriniana* nov. sp. One species of the genus *Manzonina* is recorded.

This almost doubles the previously known number of 15 rissoiids from the Estepona deposits. Excluding species left in open nomenclature (2), this work highlights the highly endemic nature of the assemblages, with 11 (41%) found so far only in these assemblages. Fifteen (58%) are extinct.

KEY WORDS: southern Spain, Upper Pliocene, Gastropoda, *Alvania*, *Manzonina*, new species

Introduction

The genera *Alvania* Risso, 1826 and *Manzonina* Brusina, 1870 from the extremely rich uppermost Zanclean assemblages of Estepona, south-western Spain, were included in Landau *et al.* (2004), in which 15 species of *Alvania* were described and illustrated, two were described as new and two left in open nomenclature. One species of *Manzonina* was also included. A further 20 years of collecting and sieving with smaller mesh size have brought further species to light, and we take the opportunity to revise these genera herein.

Landau *et al.* (2004) was only the second monograph in the Estepona series, and the scanning pictures used an extremely old scanning electron microscope (SEM), even for that time. It led to some of the images being slightly distorted. We take the opportunity of re-illustrating all the material herein using the latest SEM available at the Naturalis Biodiversity Center (Leiden, The Netherlands) that provides far superior results.

Age of the deposits

Age of the Estepona assemblages has varied in the literature over time. Fresh samples from the various Estepona outcrops were collected by our team. Based on the calcareous nannofossils and planktonic foraminifera, a correlation of the Estepona assemblages with upper Zanclean biozones MNN14/NN15/CNPL3 (calcareous nannofossils) and MPL4a/upper PL2 to PL3 (planktonic foraminifera) was obtained, corresponding to an age of c. 4.0–3.8 Ma (Grunert, *et al.*, 2025; this volume, p. 17–23)

Material and methods

The material described herein was collected from several localities around Estepona by the senior author (BL) between 1997–2020 and by Henk Mulder between 2008–2023; to the latter we are extremely grateful for his tireless efforts and generosity in making his collection available to us. For a map of localities see Landau *et al.* (2003,

p. 4, text-fig. 1). The material is housed in the Natural History Museum Vienna (NHMW).

A comprehensive chresonymy and distribution is given for each species, in which only illustrated records are included. There are several important historical works on Mediterranean Neogene rissoids such as Sacco (1895) and L. Seguenza (1903) which offer descriptions without illustrations and/or drawings of the specimens. Rissoid taxonomy often relies on detail that could not be illustrated at the time. These historic references, although illustrated, are not included in the chresonymy as we cannot be certain which species is being referred to. For extant species a selection of references is given representing the species' geographical and/or ecological extension.

Protoconch measurements are taken using the same methods as in other parts of the Estepona series; that is, when counting protoconch whorls, the nucleus counts as the first half whorl following the model of Jablonski & Lutz (1980). We note that other methods, like that of Verduin (1984, fig. 1) do not count the nucleus, so that protoconch is always 0.5 whorls less than by the method used here. Method of counting protoconch whorls is often not stated in the material and methods of many papers and counting method should be taken into consideration when comparing whorl counts. Images by scanning electron microscopy (SEM) have been taken following the proposals of Gili & Martinell (1992). All images were taken with a Scanning electron microscope JEOL JSM-IT510, using high vacuum on coated specimens. Measurements of specimens illustrated here are given in the Description section, followed by the measurements given in Landau *et al.* (2004) to give an idea of size range. Note that lateral views of all species are given on Plate 31.

Protoconch measurements:

dp = diameter protoconch, **hp** = height protoconch, **dp/hp** = diameter/height protoconch, **dV1** = diameter first protoconch whorl, **dn** = diameter nucleus.

Abbreviations:

CO: Velerín conglomerates; **PA:** Rio del Padrón;
VC: Velerín carretera; **VS:** Velerín sands; **EL:** El Lobillo; see Landau *et al.* (2003, p. 4, text-fig. 1).
MNHN Muséum national d'Histoire naturelle, Paris (France)
MCZR Museo Civico di Zoologia, Roma (Italy)
NHMW Natural History Museum Vienna (Austria)
IRScNB collection Institut royal des Sciences naturelles de Belgique.

Systematic Palaeontology

Superorder Caenogastropoda Cox, 1960
 Superfamily Risssoidea Gray, 1847
 Family Rissoidae Gray, 1847
 Subfamily Rissoinae Gray, 1847
 Genus *Alvania* Risso, 1826

Type-species (by subsequent designation Nevill, 1885,

p. 105) – *Alvania europea* Risso, 1826 [= *Alvania cimex* (Linnaeus, 1758)], present-day, Mediterranean.

Note – Van Dingenen *et al.* (2016, p. 135) gave a synonymy for the genus. It is quite possible that some of these generic groups may be valid, but we await molecular data to confirm.

***Alvania acutissimispira* nov. sp.**

Plate 1, figs 1, 2; Plate 31, fig. 1

ZooBank registration – urn:lsid:zoobank.org:act:316FE706-7D68-4930-8D11-D42C4FB84D64

Type material – Holotype NHMW 2024/0206/0125, height 2.8 mm, width 1.3 mm; paratype 1 NHMW 2024/0206/0126, height 2.5 mm, width 1.3 mm.

Other material – Known from type series only.

Type locality – El Lobillo, Estepona, Spain.

Type stratum – Unnamed beds of uppermost Zanclean, Lower Pliocene.

Etymology – Name reflecting the unusually tall and pointed spire. *Alvania*, gender feminine.

Diagnosis – *Alvania* with small, slender shell, medium thickness, paucispiral protoconch bearing spiral cordlets, teleoconch with prosocline axial ribs and spiral cords, two spiral cords starting immediately after protoconch-teleoconch boundary, last whorl with 13 narrow axial ribs and seven spiral cords of equal thickness, slightly protruded tubercles developed at intersections, aperture with moderate varix and weak lirae.

Description – Shell small, of medium thickness, slender rissoid form, with rather acute elevated spire. Protoconch paucispiral, of 1.75 weakly convex whorls, with large nucleus, microsculpture of six low, weak spiral cordlets (slightly abraded), some tubercles near the suture (dp = 360 µm, hp = 325 µm, dp/hp = 1.10, dn = 110 µm, dV1 = 245 µm). Junction with teleoconch sharply delimited by scar and beginning of adult sculpture. Teleoconch of four convex whorls separated by moderately impressed linear suture. First whorls rather angular due to the presence of broad subsutural ramp; first whorl bearing 12 narrow, weakly prosocline axial ribs and two elevated spiral cords of equal strength; at protoconch/teleoconch junction greater space between the suture and the subsutural (adapical) cord. Third primary spiral appears mid subsutural ramp from third whorl so that subsequent whorls have coarsely cancellate sculpture with small, rounded tubercles developed at sculptural intersections. Surface microsculpture of marked spiral. Last whorl 54–56% of total height, convex, bearing 14 ribs and seven cords spirals, three above level of insertion of outer lip, four cords over base. Aperture ovate, relatively small, peristome complete, weakly lyrate within, outer lip weakly opisthocline, narrowly thickened with weakly crenulated edge.

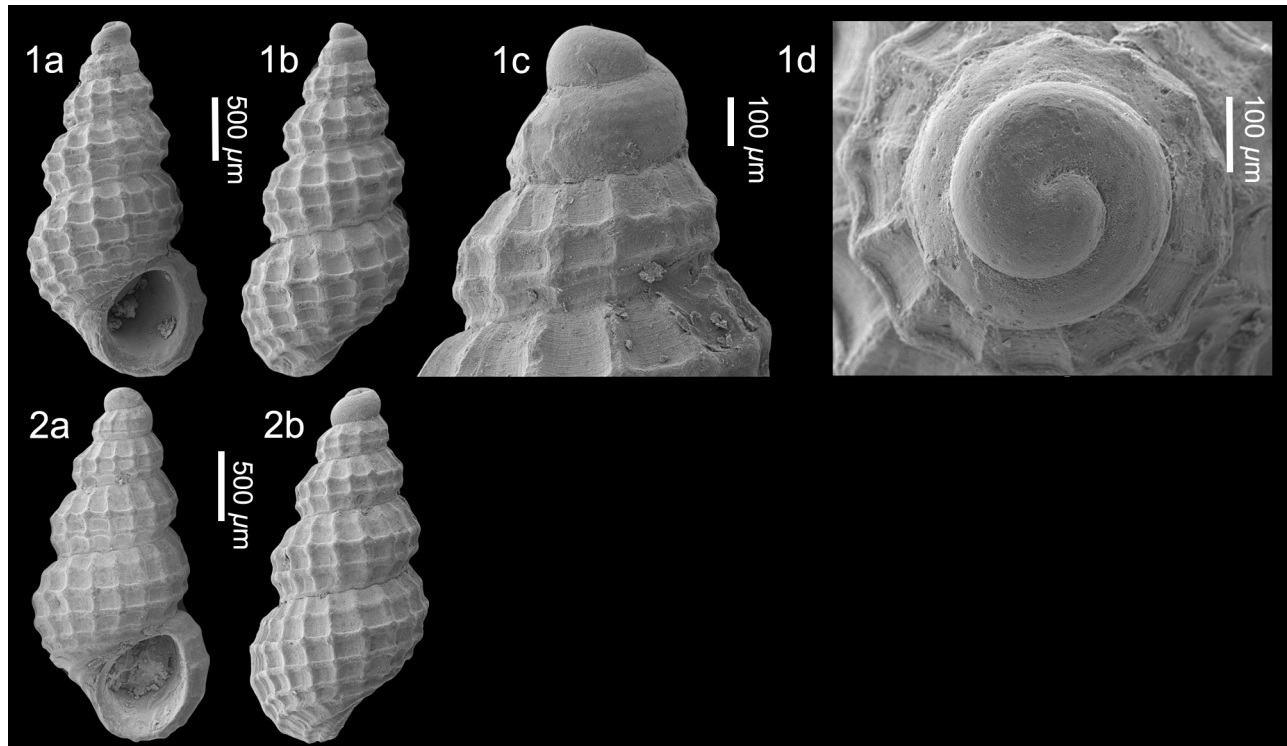


Plate 1. *Alvania acutissimispira* nov. sp.; 1. **Holotype** NHMW 2024/0206/0125, height 2.8 mm, width 1.3 mm, c, d, detail of protoconch; 2. **Paratype 1** NHMW 2024/0206/0126, height 2.5 mm, width 1.3 mm (SEM images). El Lobillo, Estepona, Upper Zanclean, Lower Pliocene.

Discussion – *Alvania iberopliocenica* nov. sp. differs from *Alvania acutissimispira* nov. sp. by its less acute profile of the early whorls, more convex whorls with the sculptural intersection (axial and spiral) more pronounced. The third primary spiral appears mid subsutural ramp already from the second whorl in *A. iberopliocenica* vs from the third in *A. acutissimispira*.

Alvania subareolata Monterosato, 1869, differs from *A. acutissimispira* in being thinner shelled, with a weaker labial varix, the outer lip is internally smooth vs weakly lirate, and the greater number of basal cords (5 vs 4) in the present species. The protoconch has similar microsculpture but with more convex whorls.

Alvania skylla Tisselli & Micali, 2023, differs from *A. acutissimispira*. in having a lower H/W ratio, with more angular whorls due to the presence of the subsutural ramp, and a third primary cord is absent or forms weakly on the last whorl.

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Alvania bicingulina* nov. sp.**

Plate 2, figs 1-4; Plate 31, fig. 2

ZooBank registration – urn:lsid:zoobank.org:act:F10953DF-CD1F-4F68-8A26-DFE3FC42565C

Type material – Holotype NHMW 2024/0206/0109,

height 2.3 mm, width 1.3 mm. **Velerín conglomerates.** Paratype 1 NHMW 2024/0206/0110, height 2.1 mm, width 1.2 mm; 3. Paratype 2 NHMW 2024/0206/0111, height 2.3 mm, width 1.4 mm; 4. Paratype 3 NHMW 2024/0206/0112, height 1.8 mm, width 1.2 mm. **El Lobillo.**

Other material – **EL:** NHMW 2024/0206/0113 (14).

Type locality – Velerín conglomerates, Velerín, Estepona, Spain.

Type stratum – Unnamed beds of uppermost Zanclean, Lower Pliocene.

Etymology – Name reflecting the two carinate spiral cords on each whorl. *Alvania*, gender feminine.

Diagnosis – Small, turreted-scalariform outline, rather fragile *Alvania* species, with protoconch of 1.75 convex whorls with microsculpture of ten fine, well-spaced spiral threads, with broad interspaces bearing minute granulations, teleoconch of 3.5 convex whorls with coarse cancel sculpture, 11 ribs which do not reach the base, crossed by 7 cords on penultimate whorl, outer lip with weak labial thickening.

Description – Shell very small, rather thin, rissoiform, with turreted-scalariform outline. Paucispiral protoconch of 1.75 convex whorls, with large nucleus; surface bear-

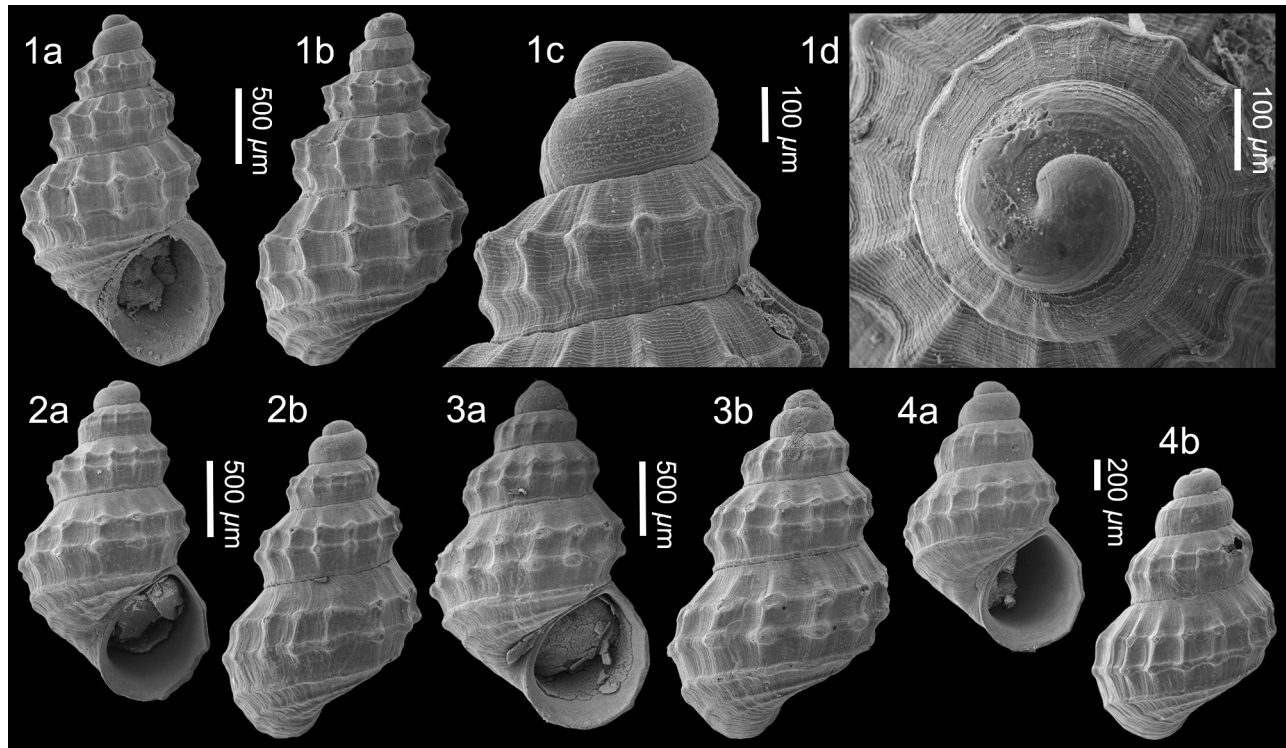


Plate 2. *Alvania bicingulina* nov. sp.; 1. **Holotype** NHMW 2024/0206/0109, height 2.3 mm, width 1.3 mm, c, d, detail of protoconch. Velerín conglomerates, Velerín. 2. **Paratype 1** NHMW 2024/0206/0110, height 2.1 mm, width 1.2 mm; 3. **Paratype 2** NHMW 2024/0206/0111, height 2.3 mm, width 1.4 mm; 4. **Paratype 3** NHMW 2024/0206/0112, height 1.8 mm, width 1.2 mm (SEM images). El Lobillo, Estepona, Upper Zanclean, Lower Pliocene.

ing ten fine, well-spaced spiral threads, with broad interspaces bearing minute granulations; three suprasutural (abapical) threads closer together ($dp = 320 \mu\text{m}$, $hp = 260 \mu\text{m}$, $dp/hp = 1.23$, $dn = 105 \mu\text{m}$, $dV1 = 205 \mu\text{m}$). Junction with the teleoconch clearly delimited by low, narrow varix. Teleoconch of 3.5 convex whorls with broad subsutural ramp, convex below, separated by incised suture. Sculpture of ten axial ribs on first whorl, eleven on penultimate whorl, slightly prosocline, not reaching base, crossed by two spiral cords of equal thickness to ribs forming coarse cancellate sculpture. Fine spiral microsculpture covers entire surface. Last whorl 62–66% of total height, with broad smooth subsutural ramp, faint spiral cord forming mid-ramp on last half whorl in fully grown specimens, two widely spaced cords between shoulder and aperture, five smoother and more appressed basal cords. Ovate aperture, outer lip slightly thickened by varix, slightly opisthocline to slightly prosocline, smooth within, slightly flared abapically.

Discussion – *Alvania clathrella* L. Seguenza, 1903 ex Monterosato ms. from the Sicilian Stage (Lower Pleistocene) to present-day (L. Seguenza, 1903 ex Monterosato ms., p. 52, pl. 11, fig 12) is very similar in having two cords on the suprasutural teleoconch whorls but differs from *Alvania bicingulina* nov. sp., in having fewer spiral cords on the last whorl 4 vs 5, in lacking marked spiral microsculpture on the teleoconch, and in its protoconch microsculpture that consists of sparse, randomly placed,

large, subtrigonal tubercles vs ten fine, well-spaced spiral threads, with broad interspaces bearing minute granulations in the present species.

Alvania fezata Landau, Ceulemans & Van Dingenen, 2018, from Atlantic Upper Miocene (Tortonian) of NW France, differs from *A. bicingulina* in larger size, axial sculpture reaching the base, broader last teleoconch whorl, and quite different protoconch sculpted by three robust non-equidistant keels (Landau *et al.*, 2018, p. 252, pl. 79, figs 1–2).

Alvania bicingulata (G. Seguenza, 1876), from the Pliocene of Messina, Sicily, differs from *A. bicingulina* in its larger shell size 3.35 mm (lectotype) vs 2.3 mm (holotype of the present species), with a more elongated outline, with a higher H/W ratio, greater number of axial ribs reaching the base, protoconch with different microsculpture of appressed trigonal granules (G. Seguenza, 1876, p. 63).

Alvania lucinae Oberling, 1970, from the present-day central and western Mediterranean is very similar in scalariform outline but differs from *A. bicingulina* in having a greater number of spiral cords on the penultimate whorl 8–9 of which 3–4 are placed above the aperture vs 7 of which 2 above the aperture. Its protoconch is sculptured by ca. ten parallel rows of rounded to broadly rounded microtubercles, and occasional spiral threads in the interspaces (Oberling, 1970, p. 3) vs ten fine, well-spaced spiral threads, with broad interspaces bearing minute granulations seen in *A. bicingulina*.

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Alvania cancellata* (Da Costa, 1778)**

Plate 3, fig. 1; Plate 31, fig. 3

- *1778 *Turbo cancellata* Da Costa, p. 104, pl. 8, figs 6, 9.
- 1830 *Rissoa crenulata* Michaud, p. 15, figs 1, 2.
- 1867 *Rissoa cancellata* var. *pauperula* Jeffreys, p. 9.
- 1891 *Alvania cancellina* Locard, p. 157.
- 1896 *Alvania laxa* Dautzenberg & Fischer, p. 456, pl. 19, figs 10-11.
- 1914 *Rissoia (Acinopsis) cancellata* Da Costa – Cerulli-Irelli, p. 204, pl. 16, figs 16-20.
- 1920 *Alvania (Acinopsis) cancellata* (Da Costa) – Harmer, p. 619, pl. 50, fig. 42.
- 1972 *Acinopsis venter* F. Nordsieck, p. 188, pl. R VII, fig. 3.
- 1974 *Acinopsis cancellata* (Da Costa, 1778) – Malatesta, p. 174, pl. 13, fig. 16.
- 1978 *Alvania cancellata* (da Costa, 1778) – Fretter & Graham, p. 177, figs 152-153.
- 1985 *Alvania cancellata* (da Costa, 1778) – Ponder, p. 139, figs A-C.
- 1987 *Alvania (Acinopsis) cancellata* (Da Costa 1779) – Cuerdo Barceló, p. 205, pl. 16, fig. 22.
- 1989 *Alvania cancellata* (da Costa, 1778) – Moolenbeek & Hoenselaar, p. 226, figs 24-26.
- 1991 *Alvania cancellata* (da Costa, 1778) – Poppe & Goto, p. 99, pl. 12, fig. 15.
- 1992 *Alvania (Alvania) cancellata* (Da Costa, 1778) – Cavallo & Repetto, p. 52, fig. 073.
- 1997 *Alvania (Alvania) cancellata* (Da Costa, 1778) – Giannuzzi-Savelli *et al.*, p. 102, figs 398, 408b.
- 2001 *Alvania (Alvania) cancellata* (Da Costa, 1778) – Silva, p. 142, pl. 5, figs 13-14.
- 2002 *Alvania cancellata* (da Costa, 1778) – Ávila *et al.*, p. 353, fig. 44.
- 2004 *Alvania cancellata* (da Costa, 1778) – Landau *et al.*, p. 36, pl. 5, fig. 4.
- 2005 *Alvania cancellata* (da Costa, 1778) – Rolán, p. 58, fig. 244.
- 2005 *Alvania cancellata* (da Costa, 1778) – Ávila, p. 268, 269, pl. 3, figs 1-12.
- 2006 *Alvania cancellata* (da Costa, 1778) – Chirli, p. 13, pl. 5, figs. 12-16, pl. 6, figs. 1-4.
- 2007 *Alvania cancellata* (da Costa, 1778) – Gofas, p. 790, figs 5A-B.
- 2009 *Alvania cancellata* (da Costa, 1778) – Martins *et al.*, p. 62, pl. 9, fig. 143-147.
- 2010 *Alvania cancellata* (da Costa, 1778) – Ávila *et al.*, p. 34, pl. 26, fig. 7-9.
- 2010 *Alvania cancellata* (da Costa, 1778) – Garilli & Parrinello, p. 169, fig. G.
- 2011 *Alvania cancellata* (da Costa, 1778) – Chirli & Linse, p. 76, pl. 20, fig. 3.
- 2011 *Alvania cancellata* (da Costa, 1778) – Tabanelli *et al.*, p. 10, figs 9, 10.
- 2011 *Alvania cancellata* (da Costa, 1778) – Scaperrotta

et al., p. 56, 5 unnumbered figs.

- 2011 *Alvania cancellata* (da Costa, 1778) – Gofas & J.D. Oliver *in* Gofas *et al.*, p. 178, 3 unnumbered figs.
- 2011 *Alvania cancellata* (da Costa, 1778) – Hernández *et al.*, p. 129, figs 38N-Q.
- 2013 *Alvania cancellata* (da Costa, 1778) – Raad *et al.*, p. 49, fig. 11.
- 2016 *Alvania cancellata* (da Costa, 1778) – Bitlis-Bakır & Öztürk, p. 448, pl. 2, fig. 12.
- 2017 *Alvania cancellata* (da Costa, 1778) – Bitlis-Bakır & Öztürk, p. 400, figs 2I-J.
- 2017 *Alvania cancellata* (da Costa, 1778) – Amati & Chiarelli, p. 845, fig. 14.
- 2018 *Alvania cancellata* (da Costa, 1778) – Brunetti & Cresti, p. 44, fig. 93.
- 2019 *Alvania cancellata* (da Costa, 1778) – Scaperrotta *et al.*, p. 142, pl. 3G.
- 2020 *Alvania cancellata* (da Costa, 1778) – Tabanelli *et al.*, p. 25, pl. 2, fig. 19.
- 2020 *Alvania cancellata* (da Costa, 1778) – Alf *et al.*, p. 112, pl. 94.
- 2021 *Alvania cancellata* (da Costa, 1778) – Chirli & Forli, p. 100, pl. 72, figs A1-18, pl. 73, figs A1-19, pl. 74, A1-4.
- 2023 *Alvania cancellata* (da Costa, 1778) – Sacchetti *et al.*, p. 46, pl. 2, fig. M₁-M₃.

Material and dimensions – Average height 4.2 mm. **EL:** NHMW 2024/0206/0003 (40). **CO:** NHMW 2024/0206/0001 (1), NHMW 2024/0206/0002 (50+). **PA:** NHMW 2024/0206/0004 (32). **VQ:** NHMW 2024/0206/0142 (19). **VC:** NHMW 2024/0206/0141 (1).

Description – see Landau *et al.* (2004, p. 36). Protoconch measurements: dp = 365 µm, hp = 365 µm, dp/hp = 1, dn = 85 µm, dV1 = 155 µm [dp = 347 µm, dn = 105 µm; Landau *et al.*, 2004, p. 35].

Discussion – *Alvania cancellata* (Da Costa, 1778) is the largest *Alvania* found in the Pliocene of Estepona. It is easily distinguished from its congeners in the deposits by the large size, robust shell and very coarse sculpture. Two present-day Mediterranean species have a similar strong cancellate sculpture, *Alvania hirta* (Monterosato, 1884) and *Alvania subcrenulata* (Bucquoy, Dautzenberg & Dollfus, 1884), but they are both smaller. The former only has two spiral cords placed above the aperture on the last whorl and the latter has four as opposed to three in *A. cancellata*. Both have paucispiral protoconch vs multispiral in *A. cancellata*.

Gofas (1999), in his review of the West African Rissoidae, suggested that although there were few extant species found both in the European and Macaronesian faunas and those of West Africa, there were certain planktrophic western European species with closely related counterparts in West Africa. The author interpreted this as the result of breakup of a former broader latitudinal range due to increasing north/south climatic contrast. In view of the fact that all four European members of

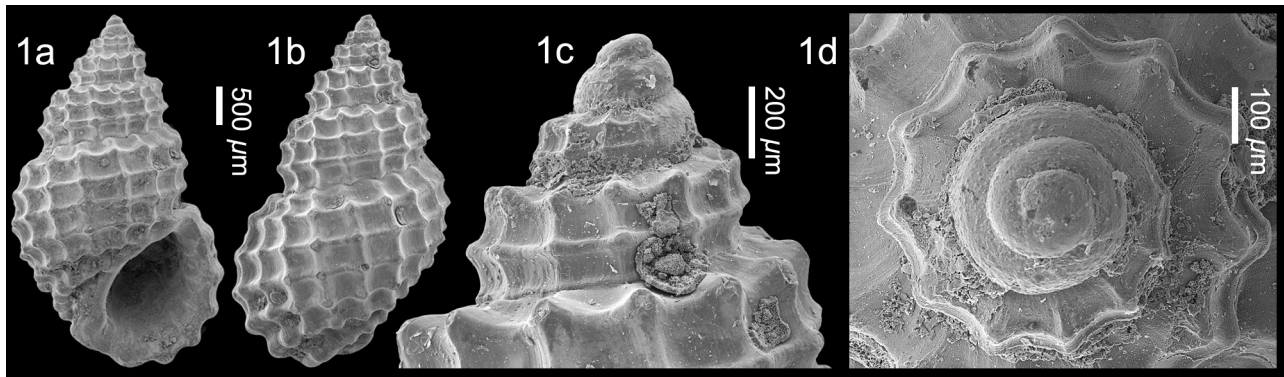


Plate 3. *Alvania cancellata* (da Costa, 1778); 1. NHMW 2024/0206/0001, height 4.6 mm, width 2.6 mm, c, d, detail of protoconch (SEM images). Velerín conglomerates, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

the species-pairs were present in the Pliocene Mediterranean, it seems likely that the West African species are direct descendants of them, rather than sharing a common ancestor. One of these species is *A. cancellata*. *Alvania marioi* Gofas, 1999 is very similar, with a coarse sculpture and nodes on the outer lip but is smaller (maximum height 3.15 mm vs average height 4.2 mm), slenderer, the abapical cord on the last whorl is narrow and beaded in *A. marioi* as opposed to massive and less clearly beaded. The protoconchs of the two species are similar.

Alvania venus (d'Orbigny, 1852) from the Early Miocene of the Atlantic Aquitaine basin of France has a similar shape, with a strong cancellate sculpture and the same number of spiral cords per whorl, but with the third early cord, already present from the second whorl and the absence of the nodule on the base of the columella. The sculpture on Protoconch I is also similar, consisting of fine spiral threads with micropustules in the interspaces, but Protoconch II is almost smooth, lacking the rows of pustules seen in *A. cancellata*, with only two faint threads above the suture in *A. venus* (see Lozouet *et al.* 2001, pl. 13, figs 5b-c).

In Estepona it is found exclusively in the shallow water assemblages, which agrees with its present-day habitat, intertidal to mid subtidal (Alf *et al.*, 2020, p. 112).

Distribution – Lower Pliocene: Atlantic, Santa Maria Island, Azores (Sacchetti *et al.*, 2023); western Mediterranean, Estepona Basin, S. Spain (Landau *et al.*, 2004); central Mediterranean, Italy (Chirli, 2006; Brunetti & Cresti, 2018; Tabanelli *et al.*, 2020). Upper Pliocene: central Mediterranean, Italy (Malatesta, 1974; Cavallo & Repetto, 1992; Tabanelli *et al.*, 2011). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1914; Malatesta, 1960; Garilli & Parrinello, 2010). Pleistocene (intermediate): western Mediterranean, Balearic Islands (Cuerda Barceló, 1987); eastern Mediterranean, Rhodes Island (Chirli & Linse, 2011). Upper Pleistocene: North Sea Basin, The Netherlands (Raad *et al.*, 2013); Atlantic, England (Harmer, 1920); Last Interglacial, MIS 5e, Santa Maria Island, Azores (Ávila *et al.*, 2010). Present-day: Atlantic, British Isles (Fretter & Graham, 1978), Azores (Moolenbeek & Hoenselaar, 1989), Madeira, south to

Selvagens, Canary Islands, Cabo Verde and NW Africa (Dautzenberg & Fischer, 1896; F. Nordsieck, 1972; Ávila, 2005, Gofas, 2007; Ávila *et al.*, 2012), São Tomé Island (Fernandes & Rolán, 1993), entire Mediterranean (Gianuzzi-Savelli *et al.*, 1997; Scaperrotta *et al.*, 2011, 2019; Gofas & J.D. Oliver *in* Gofas *et al.*, 2011; Bitlis-Bakır & Öztürk, 2016, 2017; Amati & Chiarelli, 2017), low tide line to 90 m depth (Poppe & Goto, 1991).

***Alvania cathyae* Landau, Marquet & Grigis, 2004**

Plate 4, fig. 1; Plate 31, fig. 4

- *2004 *Alvania cathyae* Landau, Marquet & Grigis, p. 37, pl. 6, fig. 1.
- 2021 *Alvania cathyae* Landau, Marquet & Grigis, 2004 – Chirli & Forli, p. 102, pl. 76, figs A1-4.

Material and dimensions – Average height, 2.9 mm. **EL:** NHMW 2024/0206/0005 (1). **CO:** NHMW 2024/0206/0006 (25). **VQ:** NHMW 2024/0206/0089 (5). **VC:** NHMW 2024/0206/0007 (1), NHMW 2024/0206/0008 (50+).

Description – see Landau *et al.* (2004, p. 37). Protoconch measurements: dp = 490 µm, hp = 395 µm, dp/hp = 1.24, dn = 130 µm, dV1 = 270 µm [dp = 482 µm, dn = 156 µm; Landau *et al.*, 2004, p. 43].

Discussion – *Alvania cathyae* Landau, Marquet & Grigis, 2004 is easily distinguished from its congeners in Estepona by the very flattened whorls, forming a regularly conical spire, the predominantly axial sculpture of narrow ribs that do not form nodules at the intersections with the spiral cords and, above all, the unusual protoconch microsculpture of broad flattened bands. We have not found any other European *Alvania* species with this type of sculpture.

Although we have found one specimen in the shallow water assemblage of El Lobillo and several in the Velerín conglomerates, this is predominantly a deeper water species found most abundant at Velerín carretera, together with other deeper water *Alvania* species, *Alvania cimicoides* (Forbes, 1844) and *Alvania diadema*

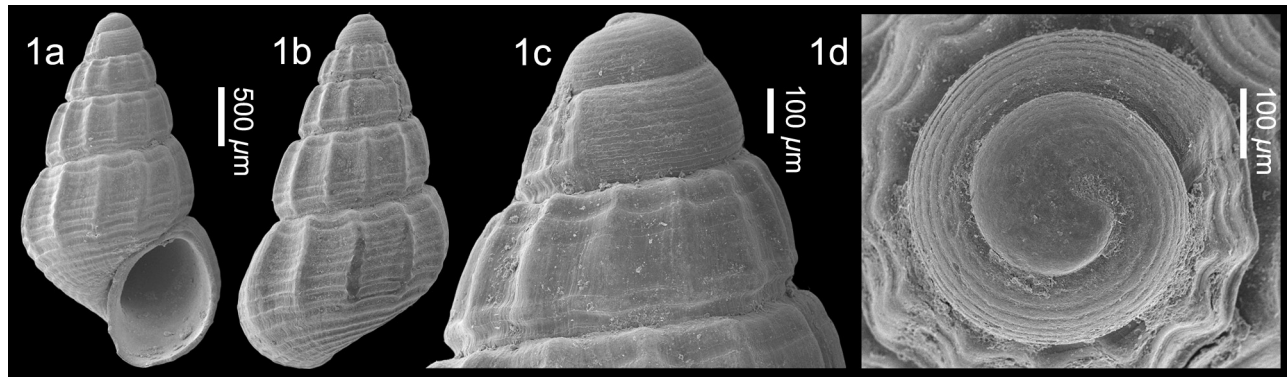


Plate 4. *Alvania cathyae* Landau, Marquet & Grigis, 2004; 1. NHMW 2024/0206/0007, height 3.0 mm, width 1.7 mm, c, d, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

(De Stefani, 1875) but is much less common than either of these.

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (Landau *et al.*, 2004).

Alvania cimex (Linnaeus, 1758)

Plate 5, fig. 1; Plate 31, fig. 5

- *1758 *Turbo cimex* Linnaeus, p. 761, No. 530.
- 1808 ?*Turbo calathiscus* Montagu, p. 132, pl. 30, fig. 5.
- 1826 ?*Alvania freminvillea* Risso, p. 141, pl. 9, fig. 118. [Arnaud, 1978, p. 117, pl. 8, fig. 57 (lectotype designated), treated as a synonym of *A. cimex* (before the specific separation of *A. mamillata* and *A. cimex*)].
- 1826 ?*Alvania europea* Risso, p. 142, pl. 9, fig. 116. [Arnaud, 1978: p. 116, pl. 8, fig. 54, fig. 57 (lectotype designated), treated as a synonym of *A. cimex* (before the specific separation of *A. mamillata* and *A. cimex*)].
- 1826 ?*Alvania pyramidata* Risso, p. 144. [Arnaud, 1978, p. 131, pl. 8, fig. 61 (lectotype designated), treated as a synonym of *A. cimex* (before the specific separation of *A. mamillata* and *A. cimex*)].
- 1836 ?*Rissoa granulata* Philippi, p. 153.
- 1886 *Alvania cimicina* Locard, p. 239 (unjustified emendation).
- 1891 *Alvania cimicina* Locard, p. 156, fig. 135 (unjustified emendation).
- 1920 *Alvania cimex* (Linné) – Harmer, p. 607, pl. 50, fig. 43.
- 1985 *Alvania cimex* (Linnaeus, 1758) – Ponder, p. 135, figs 86 a-e.
- 1986 *Alvania cimex* (Linnaeus, 1758) – Verduin, p. 28, fig. 2.
- 1990 *Alvania cimex* (Linnaeus, 1758) – Amati *et al.*, p. 48, fig. 4.
- 1991 *Alvania cimex* (Linnaeus, 1758) – Poppe & Goto, p. 99, pl. 12, figs 20-22.
- 1997 *Alvania (Alvania) cimex* (Linné, 1758) – Giannuzzi-Savelli *et al.*, p. 100, figs 386-387, 395a.

- 2010 *Alvania cimex* (Linnaeus, 1758) – Garilli & Parrinello, p. 169, fig. 3-H.
- 2011 *Alvania cimex* (Linnaeus, 1758) – Scaperrotta *et al.*, p. 57, 4 unnumbered figs and unnumbered pl.; 154 ‘4 unnumbered figs’.
- 2011 *Alvania cimex* (Linnaeus, 1758) – Gofas & J.D. Oliver in Gofas *et al.*, p. 178, 3 unnumbered figs.
- 2011 *Alvania cimex* (Linnaeus, 1758) – Chirli & Linse, p. 77, pl. 20, figs 4a-e.
- 2012 *Alvania cimex* (Linnaeus, 1758) – Antit & Azzouna, p. 121, figs d-e.
- 2014 *Alvania cimex* (Linnaeus, 1758) – Garilli & Parrinello, p. 385, figs 6A and 6B.
- 2015 *Alvania cimex* (Linnaeus, 1758) – J.D. Oliver *et al.*, p. 113, figs 5-7.
- 2016 *Alvania cimex* (Linnaeus, 1758) – Bitlis-Bakir & Öztürk, p. 448, pl.2, fig. 13.
- 2017 *Alvania cimex* (Linnaeus, 1758) – Bitlis-Bakir & Öztürk, p. 402, figs 4A, B.
- 2017 *Alvania cimex* (Linnaeus, 1758) – Amati *et al.*, p. 127, figs A, B.
- 2019 *Alvania cimex* (Linnaeus, 1758) – Scaperrotta *et al.*, p. 141, pl. 2A.
- 2020 *Alvania cimex* (Linnaeus, 1758) – Alf *et al.*, p. 112, pl. 95.
- 2021 *Alvania cimex* (Linnaeus, 1758) – Chirli & Forli, p. 103, pl. 76, figs B1-14, pl. 77, figs A1-20, pl. 78, figs A1-16 (some specimens depicted without the protoconch may not belong to *A. cimex*).
- non 2004 *Alvania cimex* (Linnaeus, 1758) – Landau *et al.*, p. 38, pl. 6, fig. 2.
- non 2006 *Alvania cimex* (Linné, 1758) – Chirli, p. 15, pl. 7, figs 1-7.
- non 2013 *Alvania cimex* (Linné, 1758) – Petracci & Bertamini, p. 3, figs 3, 4A, 4B.

Material and dimensions – Average height 2.5 mm. **CO:** NHMW 2024/0206/0009 (1), NHMW 2024/0206/0010 (2) (locality of Padron given in Landau *et al.*, 2003, p. 38 is incorrect; *lapsus*).

Description – see Landau *et al.* (2004, p. 38). Protoconch

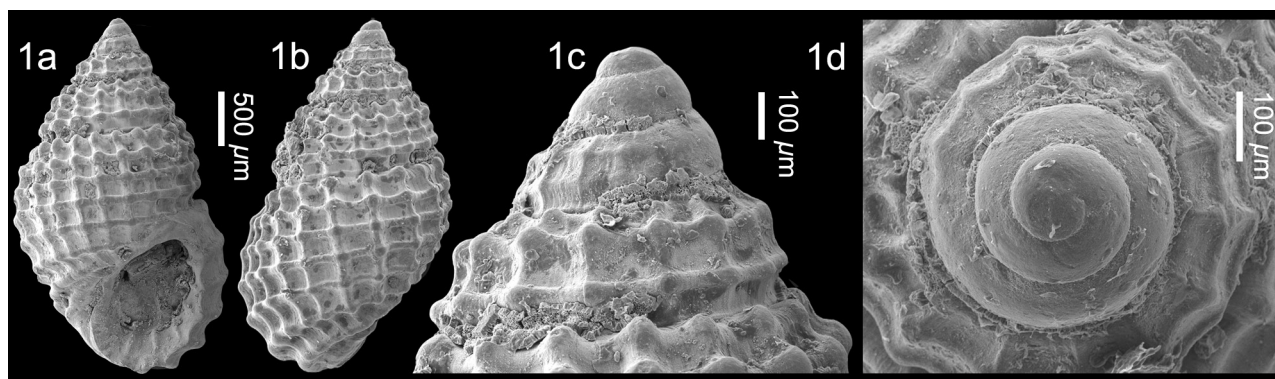


Plate 5. *Alvania cimex* (Linnaeus, 1758); 1. NHMW 2024/0206/0009, height 3.3 mm, width 2.0 mm, c, d, detail of protoconch (SEM images). Velerín conglomerates, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

measurements: $dp = 375 \mu m$, $hp = 300 \mu m$, $dp/hp = 1.25$, $dn = 100 \mu m$, $dV1 = 170 \mu m$ [$dp = 350 \mu m$; Landau *et al.*, 2004, p. 38].

Discussion – *Alvania* species belonging to the *Alvania cimex* (Linnaeus, 1758) group are difficult to identify without the protoconch (Amati *et al.*, 2017). In the specimen illustrated herein the protoconch surface is abraded.

Alvania cimex belongs to a small group of species with an almost indistinguishable teleoconch: *Alvania mamillata* Risso, 1826 and *Alvania aartseni* Verduin, 1986; a third species *Alvania cingulata* (Philippi, 1836) has recently been placed in synonymy with *A. mamillata* (Amati *et al.*, 2017). The diagnostic character that makes them easily separable is the protoconch type and sculpture. Therefore, the diagnosis of *A. cimex* is based almost exclusively on the different development (planktotrophic with multi-spiral protoconch in *A. cimex* vs non-planktotrophic with paucispiral protoconch in *A. mamillata* and *A. aartseni*). Several authors have raised doubts about there being two species and suggest this might be an example of polymorphism in larval development (poecilogony) (e.g., Gofas & J.D. Oliver, 2011; J.D. Oliver *et al.*, 2015; Romani *et al.*, 2018).

Alvania beani (Hanley in Thorpe, 1844) has a finer reticulate sculpture and the axial ribs do not extend onto the base. The protoconch microsculpture consists of irregular and discontinuous spiral threads. *Alvania hispidula* (Monterosato, 1884) has more convex whorls. Most similar is *Alvania geryonia* (Nardo, 1847), which also has flattish-sided whorls, but this species has four spiral cords even on the early teleoconch whorls and the adapical cord is more strongly developed. In *A. beani* the microsculpture on the protoconch also consists of spiral threads near the suture, similar to those seen in *A. cimex*, but they become weaker and disappear adapically.

Landau *et al.* (2004) recorded three specimens of *A. cimex* for the Pliocene of Estepona (Spain). The specimen depicted, however, differs from the shell morphology of *A. cimex*, having seven spiral cords on the last whorl, three of which are above the aperture vs about ten, four of which are always suprasutural. Small tubercles are developed at the sculptural intersections separated by wide

interspaces vs large nodules with narrow interspaces in *A. cimex*. Even the protoconch, although not perfectly preserved, shows differences in microsculpture. The photographs are slightly distorted, and we cannot say for certain what species they are.

Chirli (2006) depicted a specimen of *A. cimex*, but, in our opinion, it does not correspond to it. It differs in its slenderer shape with a narrower base. It has five spiral cords on the last whorl above the aperture vs four; the subsutural (adapical) cord is slightly more detached and more robust than subsequent cords [as e.g., in *Alvania agaja* De Stefani & Pantanelli, 1888, *Alvania mariae* (d'Orbigny, 1852) and *A. geryonia* (Nardo, 1847)] but not in *A. cimex*. Petracci & Bertamini (2013) recorded *A. cimex* from the Upper Miocene Messinian of Sogliano al Rubicone (Forlì-Cesena province, Italy). However, the specimen illustrated has a protoconch with rows of strong micro-pustules quite unlike that seen in present-day *A. cimex* as figured by Garrilli & Parrinello (2014, figs A₃, B₂, B₃; J.D. Oliver *et al.*, 2015: 114, figs 5, 6). Moreover, the Miocene shell is angular at the base, not seen in *A. cimex*, which has a regularly rounded last whorl. This record is excluded from the chresonymy.

Both Chirli (2006, p. 16) and Petracci & Bertamini (2013, p. 5) reported *A. cimex* in the Pliocene of England and France without giving references. We can find no reliable records for these occurrences, and they are excluded from the distribution.

Alvania cimex is extremely uncommon in the Estepona assemblages, and until now found only in the conglomerates. This agrees with its present-day habitat, intertidal to mid subtidal (Alf *et al.*, 2020, p. 112).

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (Landau *et al.*, 2004); central Mediterranean, Italy (Chirli, 2006). Lower Pleistocene: eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Upper Pleistocene: Atlantic, Selsey, England (Harmer, 1920); eastern Mediterranean, Greece (Garrilli & Parrinello, 2010, 2014). Pleistocene (indeterminate): Sicily, (Montepellegrino, Babbaurra, Ficarazzi (Monterosato-Brugnone collection, MCZR), Tunisia (Pallary, 1909; Amati *et al.*, 2017). Present-day: entire Mediterranean

(Verduin, 1986; Amati *et al.*, 1990; Giannuzzi-Savelli *et al.*, 1997; Scaperrotta *et al.*, 2011; Gofas *et al.*, 2011; Antit & Azzouna, 2012; J.D. Oliver *et al.*, 2015; Bitlis-Bakir & Öztürk, 2016, 2017; Amati *et al.*, 2017), shallow water (Poppe & Goto, 1991). In the Atlantic, confirmed occurrences of *Alvania cimicoides* are restricted to the Ibero-Moroccan gulf (Rueda *et al.*, 2000).

Alvania cimicoides (Forbes, 1844)

Plate 6, figs 1, 2; Plate 31, fig. 6

- *1844 *Rissoa cimicoides* Forbes, p. 189.
- 1844 *Rissoa sculpta* Philippi, p. 131, pl. 23, fig. 21.
- 1847 *Rissoa intermedia* Aradas, p. 75 (not Grateloup).
- 1867 *Rissoa cimicoides* var. *minima* Jeffreys, p. 15.
- 1878 *Alvania cimicoides* Forbes – O.G. Sars, p. 176, pl. 10, fig. 4.
- 1973 *Alvania cimicoides* (Forbes) – Di Geronimo & Pannetta, p. 76, pl. 1, fig. 3.
- 1974 *Turbona hispidula fuscoapicalis* F. Nordsieck, p. 11, fig. 6.
- 1978 *Alvania cimicoides* (Forbes, 1844) – Fretter & Graham, p. 175, figs 150-151.
- 1984 *Acinopsis? sculpta* (Philippi, 1844) Ferrero Mortara *et al.*, p. 217, pl. 39, fig. 2.
- 1984b *Alvania cimicoides* (Forbes, 1844) – Bogi *et al.*, p. 11, 1 unnumbered figure.
- 1993 *Alvania cimicoides* (Forbes, 1844) – Bouchet & Warén, p. 624, figs 1381-1385.
- 1996 *Alvania cimicoides* (Forbes, 1844) – Warén, p. 224, fig. 17G.
- 1997 *Alvania (Alvania) hispidula* (Monterosato, 1884) – Giannuzzi-Savelli *et al.*, p. 102, figs 401-403.
- 2000 *Alvania cimicoides* (Forbes, 1844) – Ardovini & Cossignani, p. 37, 1 unnumbered figure.
- 2004 *Alvania cimicoides* (Forbes, 1844) – Landau *et al.*, p. 38, pl. 7, fig. 1.
- 2005 *Alvania cimicoides* (Forbes, 1844) – Ávila, p. 281, figs 4-6.
- 2005 *Alvania cimicoides* (Forbes, 1844) – Rolán, p. 299, pl. 16, fig. 247.
- 2009 *Alvania cimicoides* (Forbes, 1844) – Martins *et al.*, p. 40, pl. 9, figs 152-154.
- 2011 *Alvania cimicoides* (Forbes, 1844) – Tabanelli *et al.*, p. 38, figs 7, 8.
- 2011 *Alvania cimicoides* (Forbes, 1844) – Gofas & Moreno in Gofas *et al.*, p. 188, 3 unnumbered figures.
- 2011 *Alvania cimicoides* (Forbes, 1844) – Hoffman *et al.*, p. 51, fig. 67.
- 2011 *Alvania cimicoides* (Forbes, 1844) – Chirli & Linse, p. 77, pl. 21, figs 1a-1e.
- 2012 *Alvania cimicoides* (Forbes, 1844) – Scaperrotta *et al.*, 2012, p. 43, 5 unnumbered figures.
- 2012 *Alvania cimicoides* (Forbes, 1844) – Brunetti & Vecchi, p. 114, pl. 6, figs a, b.
- 2016 *Alvania cimicoides* (Forbes, 1844) – Negri & Corbelli, p. 61, pl. 13, figs g-i.
- 2017 *Alvania cimicoides* (Forbes, 1844) – Bitlis-Bakir & Öztürk, p. 402, figs 4C, D.

- 2019 *Alvania cimicoides* (Forbes, 1844) – Scaperrotta *et al.*, p. 145, pl. 6N.
- 2020 *Alvania cimicoides* (Forbes, 1844) – Alf *et al.*, p. 112, pl. 95.
- 2021 *Alvania cimicoides* (Forbes, 1844) – Chirli & Forli, p. 104, pl. 78, figs B1-3, pl. 79, figs A1-19, pl. 80, figs A1-19, pl. 81, figs A1-3.
- 2022 *Alvania cimicoides* (Forbes, 1844) – Ardovini & Carone, p. 5, fig. 3Q.
- 2022 *Alvania cimicoides* (Forbes, 1844) – J.D. Oliver *et al.*, p. 8, figs 3a-g.
- 2024 *Alvania cimicoides* (Forbes, 1844) – Amati *et al.*, p. 31, fig. 9A.

Material and dimensions – Average height 3.9 mm. **CO:** NHMW 2024/0206/0076 (40). **VC:** NHMW 2024/0206/0011-0012 (2), NHMW 2024/0206/0013 (50+). **VQ:** NHMW 2024/0206/0084 (20). **PQ:** NHMW 2024/0206/0077 (1).

Description – see Landau *et al.* (2004, p. 38). Protoconch measurements: dp = 405-420 μ m, hp = 415-435 μ m, dp/hp = 0.95, dn = 60-70 μ m, dV1 = 130-145 μ m [dp = 330-360 μ m, dn = 70-90 μ m, dV1 = 135-150 μ m; Landau *et al.*, 2004, p. 38].

Discussion – *Alvania cimicoides* (Forbes, 1844) is similar to *Alvania beani* (Hanley in Thorpe, 1844), but the whorls are more convex, the v-shaped channel at the suture more marked and the reticulate ornament is coarser, with small tubercles formed at the sculptural intersections. Usually, *A. cimicoides* has a greater number of spiral cords on the last whorl (9-12 vs 9-10 in our specimens) and five spiral suprasutural cords, whereas our shells usually have four. The number of cords is similar to *Alvania hispidula* (Monterosato, 1884), which also has only four cords above the aperture on the last whorl, but that species has a very weakly sculptured protoconch (Bitlis & Öztürk, 2017, pl. 7, fig. 3C). The Estepona specimens show a strongly sculptured protoconch, with a pattern similar to that seen in *A. cimicoides*. The protoconch of the specimen figured by Landau *et al.* (2004, pl. 7, fig. 1d) has a protoconch about ¼ whorl smaller than that figured by Fretter & Graham (1978, fig. 151). The specimen figured herein is more typical for the species. *Alvania cimicoides* is considered mainly a deeper-water species found at depths of 100-4700 m (Bouchet & Warén, 1993, p. 626, Amati *et al.*, 2024, p. 22). In Estepona it is not found in the shallow water El Lobillo locality, but in all assemblages deposited at greater depths.

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (Landau *et al.*, 2004); central Mediterranean, Italy (Tabanelli *et al.*, 2011). Upper Pliocene: central Mediterranean, Italy (Sacco, 1895; Brunetti & Vecchi, 2012). Lower Pleistocene: central Mediterranean, Italy (Di Geronimo, 1979; Di Geronimo & La Perna, 1997); eastern Mediterranean, Rhodes Island (Chirli & Linse, 2011). Plio-Pleistocene: Strait of Sicily, Italy (Amati *et al.*, 2024). Present-day: Denmark Strait

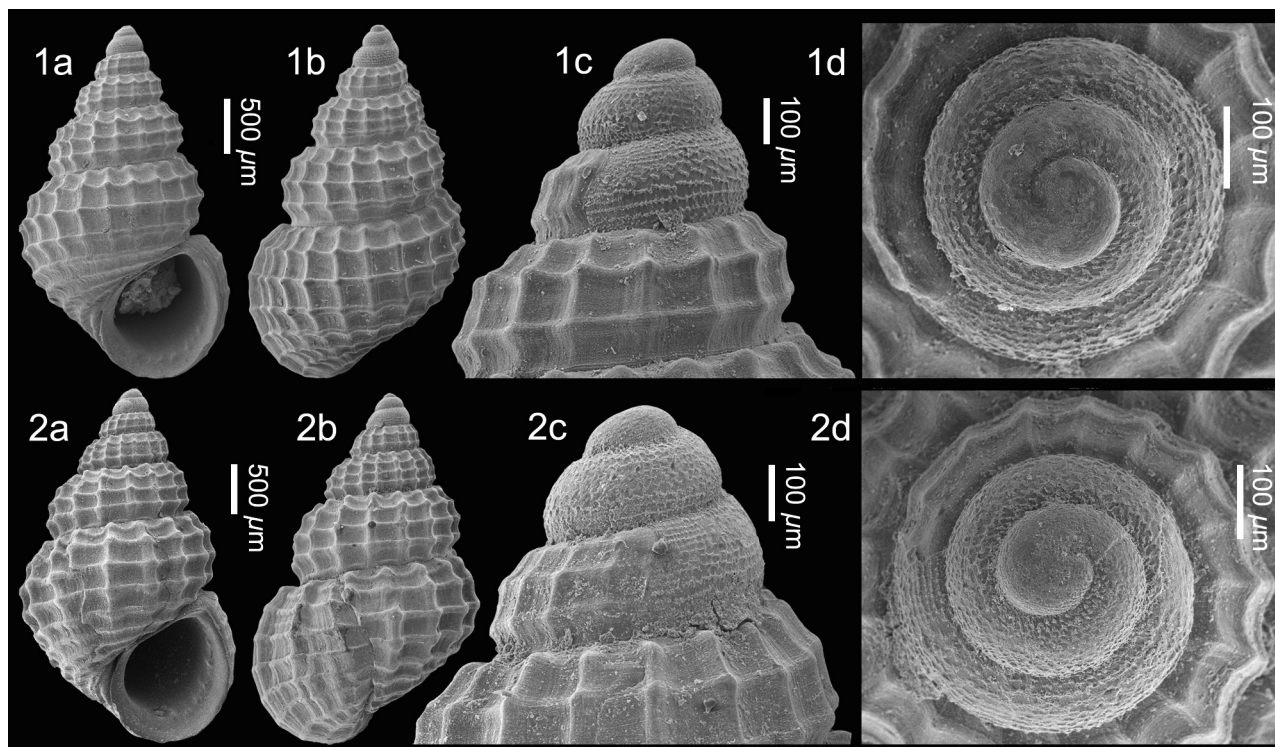


Plate 6. *Alvania cimicoides* (Forbes, 1844); 1. NHMW 2024/0206/0011, height 3.2 mm, width 1.9 mm, c, d, detail of protoconch; 2. NHMW 2024/0206/0012, height 3.6 mm, width 2.1 mm, c, d, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

between Iceland and Greenland, northern Iceland and off North cape, northern Norway, British Isles (Fretter & Graham, 1978; Bouchet & Warén, 1993; Hoffman *et al.*, 2011), Azores (Ávila, 2005; Martins *et al.*, 2009) to the Canaries, Atlantic coast of Spain (J.D. Oliver *et al.*, 2022), entire Mediterranean (Bogi *et al.*, 1984b; Gianuzzi-Savelli *et al.*, 1997; Ardevini & Cossignani, 2000; Gofas & Moreno in Gofas *et al.*, 2011; Scaperrotta *et al.*, 2012, 2019; Negri & Corselli, 2016; Bitlis-Bakir & Öztürk, 2017), Cape Verde Islands (Rolán, 2005), usually 100-1000 m depth (Bouchet & Warén, 1993).

***Alvania cimicoiberica* nov. sp.**

Plate 7, figs 1, 2; Plate 31, fig. 7

ZooBank registration – urn:lsid:zoobank.org:act:39C020A8-F8F3-46B4-B1FA-DA486D8DEED3

Type material – Holotype NHMW 2024/0206/0127, height 3.5 mm, width 2.0 mm; paratype 1 NHMW 2024/0206/0128, height 3.1 mm, width 1.8 mm; paratype 2 NHMW 2024/0206/0129, height 3.3 mm, width 1.9 mm; paratype 3 NHMW 2024/0206/0130, height 3.4 mm, width 1.9 mm; paratype 4 NHMW 2024/0206/0131, height 3.5 mm, width 1.9 mm.

Other material – **CO:** NHMW 2024/0206/0132 (34). **VQ:** NHMW 2024/0206/0137 (50+). **VC:** NHMW 2024/0206/0133 (50+).

Type locality – Velerín conglomerates, Velerín, Estepona, Spain.

Type stratum – Unnamed beds of uppermost Zanclean, Lower Pliocene.

Etymology – Compound name reflecting the close similarity to *Alvania cimicoides* and the Iberian Peninsula where it was found. *Alvania*, gender feminine.

Diagnosis – *Alvania* with small, gradate shell, medium thickness, acutely conical multispiral protoconch bearing fine, irregular spiral rows of somewhat cruciate micro-pustules, teleoconch of 3.25 whorls with well-developed subsutural ramp, with strongly cancellate sculpture, small, pointed tubercles at intersections, penultimate whorl 17-19 ribs and seven cords, three above level of insertion of outer lip, aperture with moderate varix and weak lirae.

Description – Shell small, moderately robust, rissoi-form, with elevated somewhat gradate spire. Protoconch acutely conical, of 3.25-3.6 convex whorls, with small nucleus, bearing microsculpture on Protoconch I of rows of pustules forming slightly irregular threads with scattered pustules in the spiral interspaces, on Protoconch II spirals on adapical half of whorl disintegrate towards end of protoconch, on abapical half continue as continuous spirals; the pustules over entire Protoconch II irregularly cruciform (dp = 390-415 µm, hp = 360-460

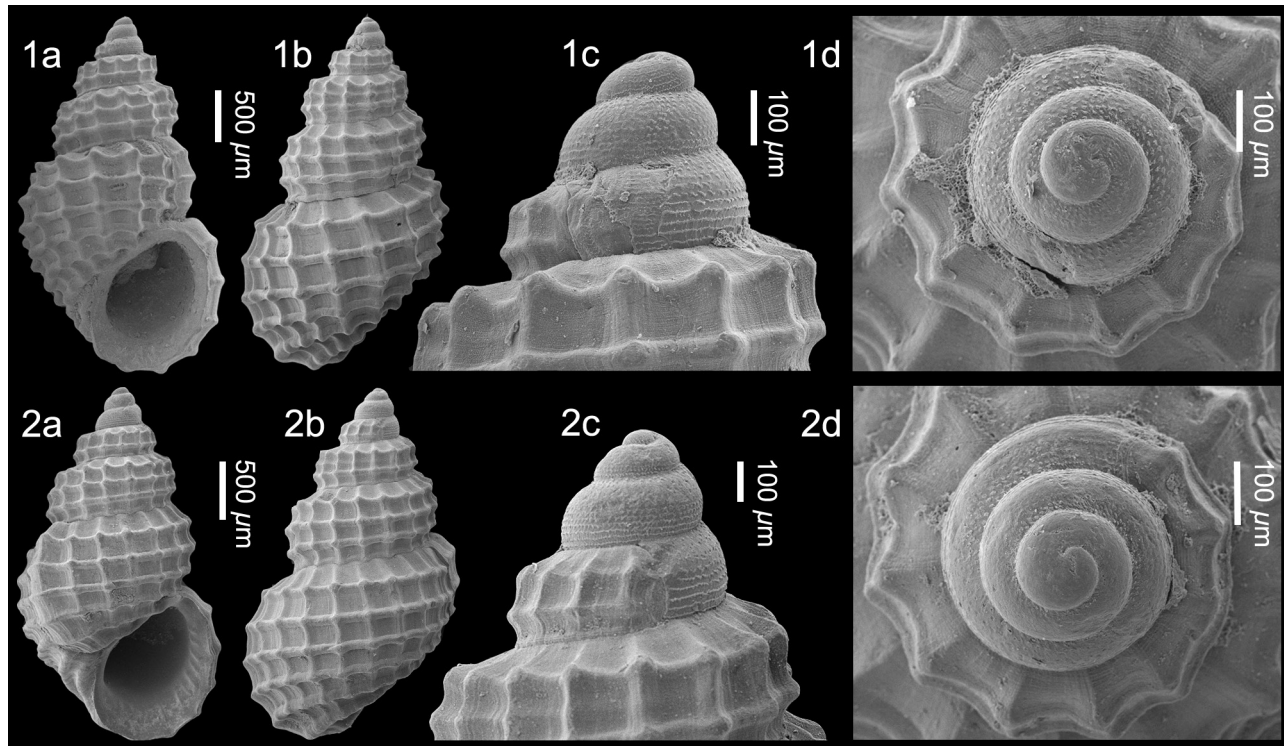


Plate 7. *Alvania cimicoiberica* nov. sp.; 1. **Holotype** NHMW 2024/0206/0127, height 3.5 mm, width 2.0 mm, c, d, detail of protoconch; 2. **Paratype 1** NHMW 2024/0206/0128, height 3.1 mm, width 1.8 mm, c, d, detail of protoconch (SEM images). Velerín conglomerates, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

μm , $\text{dp}/\text{hp} = 1.08$, $\text{dn} = 60\text{--}65 \mu\text{m}$, $\text{dV1} = 125\text{--}130 \mu\text{m}$). Junction with teleoconch sharply delimited by sinusigera. Teleoconch of 3.25 whorls separated by moderately impressed linear suture. First teleoconch whorl with broad, almost horizontal, subsutural platform, angled at shoulder, weakly convex below, bearing 12-13 narrow, elevated, prosocline ribs overrun by two cords, the adapical delimiting the shoulder, the abapical midway between shoulder cord and suture, forming small, pointed tubercles at intersections. On second half of second whorl third primary spiral intercalated between two earlier primaries, rapidly gaining strength and becoming equal to other primaries so that surface covered in regular, relatively coarse cancellate sculpture formed by elevated ribs and cords of roughly equal strength, with deep concave, square pits in the interspaces. On penultimate whorl fourth primary spiral just visible above suture. Abapically, subsutural ramp becomes steeper, shoulder less acute, and profile below shoulder more convex. Very fine spiral microsculpture consisting of rows of pustules covers entire teleoconch. Last whorl about 65% of total height, with shallow subsutural ramp, convex below, bearing 17-19 axial ribs that extend over base and seven spiral cords, three above level of insertion of outer lip, four over base; base imperforate. Almost all specimens bear a strong, slightly prosocline varix on the last whorl. Aperture ovate; outer lip slightly prosocline, thickened by varix with coarsely crenulate edge; bearing weak to moderate elongated denticles within that start at the peristome.

Discussion – *Alvania cimicoiberica* nov. sp. is at first glance closely similar to *Alvania cimicoidea* (Forbes, 1844), with which it co-occurs in the Estepona assemblages, and the protoconch microsculpture of the two is very similar. However, it reaches a smaller maximum size (3.5 vs 4.4 mm height), the protoconch in the Estepona material has a slightly greater number of whorls (3.25-3.6 vs 2.75-3.0) at a similar diameter ($\text{dp} = 390\text{--}415 \mu\text{m}$ vs $\text{dp} = 405\text{--}420 \mu\text{m}$), and it is more acutely dome shaped than in *A. cimicoidea*. The teleoconch whorls have a more strongly developed subsutural ramp in *A. cimicoiberica*, the whorls consequently are more gradate, the last whorl is squatter and more inflated in *A. cimicoidea*, a further spiral appears close to the suture on the subsutural ramp and the ribs weaken over the base, which is more flattened in *A. cimicoidea*. In almost all specimens of *A. cimicoiberica* there is a strong varix on the last whorl often placed just above the labial varix (Pl. 7, fig 1) or opposite (Pl. 7, fig. 2). Estepona specimens of *A. cimicoidea* do not have a varix; in one specimen figured herein (Pl. 6, fig. 2) there is repair twice on the last whorl probably as a result of damage from predation, but this is not a varix. The two species have similar microsculpture consisting of rows of pustules.

Alvania cancellata (da Costa, 1778), differs from *A. cimicoiberica* in having on average larger dimensions (height $> 4 \text{ mm}$) vs (height $< 4 \text{ mm}$), more oval and with a more robust shell. The varix of the external lip is stronger. Presence of a nodule at the base of the columella is clearly evident (Pl. 3, fig. 1a) vs absent. Subsutural ramp absent vs well developed in *A. cimicoiberica*. One or more ad-

ditional varix are occasionally present vs in the material examined from Estepona an additional varix is almost always present on the last whorl. Protoconch, with non-overlapping measurements: $dp = 365\ \mu\text{m}$, $hp = 365\ \mu\text{m}$, $dp/hp = 1$, $dn = 85\ \mu\text{m}$, $dV1 = 155\ \mu\text{m}$ [$dp = 347\ \mu\text{m}$, $dn = 105\ \mu\text{m}$; Landau *et al.*, 2004, p. 35] vs $dp = 390\text{--}415\ \mu\text{m}$, $hp = 360\text{--}460\ \mu\text{m}$, $dp/hp = 1.08$, $dn = 60\text{--}65\ \mu\text{m}$, $dV1 = 125\text{--}130\ \mu\text{m}$) in *A. cimicoiberica*.

Alvania miocrassicosta (Sacco, 1895) from the Miocene (Tortonian) of Montegibbio, Emilia-Romagna, Italy, differs from *A. cimicoiberica* in having three spiral cords that appear already from the first teleoconch whorl vs two in *A. cimicoiberica* and a different profile with a lower H/W ratio. The outer lip is internally smooth as opposed to lirate.

Alvania cerreti Gardella, Bertaccini, Bertamini, Bongiardino, Petracci & Tabanelli, 2021, from the Pliocene (Upper Zanclean) of Romagna, Italy, differs from *A. cimicoiberica* in having spinous tubercles developed at the sculptural, fewer axial ribs on the last whorl (10-11 orthocline vs 17-19 prosocline), and a proportionately smaller aperture.

Alvania marioi Gofas, 1999 present-day from the western coasts of Africa (Mauretania, Senegal, Ivory Coast, Angola), differs from *A. cimicoiberica* to have smaller dimensions (height 1.9-3.15 mm vs 3.1-3.5 mm), thicker varix, and wider spaced denticles inside the outer lip.

Alvania rykeli Hoenselaar & Goud, 1998, an extant species from Cape Verde Islands, differs from *A. cimicoiberica* in larger shell size (height 3.95-4.70 mm vs height 3.1-3.5 mm), sculptural elements (axial and spiral) are thinner, more tenuous and very nuanced at the base, tubercles developed at the sculptural intersections are smaller, fewer axial ribs (12-14 vs 17-19) and spiral cords (7-8 vs 6 in *A. cimicoiberica*), and *A. rykeli* a third primary cord that already appears from the first teleoconch whorl.

Alvania venus (d'Orbigny, 1852), from the Early Miocene of the Atlantic Aquitaine Basin of France, differs from *Alvania cimicoiberica* in having a lower protoconch with about one whorl less and more attenuated sculpture. Denticles are absent inside the outer lip vs always present in *A. cimicoiberica*, and it has eight spiral cords on last whorl, of which five are on base vs seven of which four are on base in *A. cimicoiberica*. *Alvania venus* is also

distinguished by having a third spiral cord that appears already from the first teleoconch whorl.

Alvania cimicoiberica is considered one of the deeper water species in the Estepona assemblages as it is common at all localities except the shallow water El Lobillo deposits, where it does not occur.

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

Alvania diadema (De Stefani, 1875)

Plate 8, fig. 1; Plate 31, fig. 8

- *1875 *Rissoa (Alvania) diadema* Doderlein, De Stefani, p. 69.
- 1895 *Alvania (Flemingia) zetlandica* var. *perrarinicincta* Sacco, p. 30, pl. 1, fig. 74.
- 1980 *Flemiella perrarinicincta* (Sacco, 1895) – Pavia, p. 211, pl. 2, figs 1, 2, 6, 7.
- 1981 *Profundialvania heraelaciniae* (Ruggieri, 1950) – Ruggieri, p. 205 (*pars*), fig. 1.
- 1984 *Flemingia zetlandica* var. *perrarinicincta* Sacco, 1895 – Ferrero Mortara *et al.*, p. 218, pl. 39, fig. 7.
- 1988 *Alvania (s.s.) diadema* (Doderlein m.s. in De Stefani, 1874 [*sic*]) – Tabanelli, p. 52, pl. 1, figs 1, 3, 4.
- 1992 *Alvania (Alvania) diadema* (De Stefani, 1874 [*sic*], Doderlein m.s.) – Cavallo & Repetto, p. 52, fig. 075.
- 2004 *Alvania diadema* (Doderlein in De Stefani, 1874 [*sic*]) – Landau *et al.*, p. 39, pl. 6, fig. 3.
- 2006 *Alvania diadema* (De Stefani, 1874 [*sic*], Doderlein m.s.) – Chirli, p. 19, pl. 8, figs 13-16, pl. 9, figs 1, 2.
- 2008 *Alvania diadema* (De Stefani) – Tabanelli, p. 26, 35, 56, 57, 59, 67, pl. 1, fig. 3.
- 2011 *Alvania diadema* (De Stefani, 1874 [*sic*] ex Doderlein ms.) – Tabanelli *et al.*, p. 39, fig. 17.
- 2021 *Alvania diadema* (De Stefani, 1875) – Chirli & Forli, p. 112, pl. 87, figs A1-16.

Material and dimensions – Average height 4.0 mm. CO: NHMW 2024/0206/0014 (4). VC: NHMW 2024/

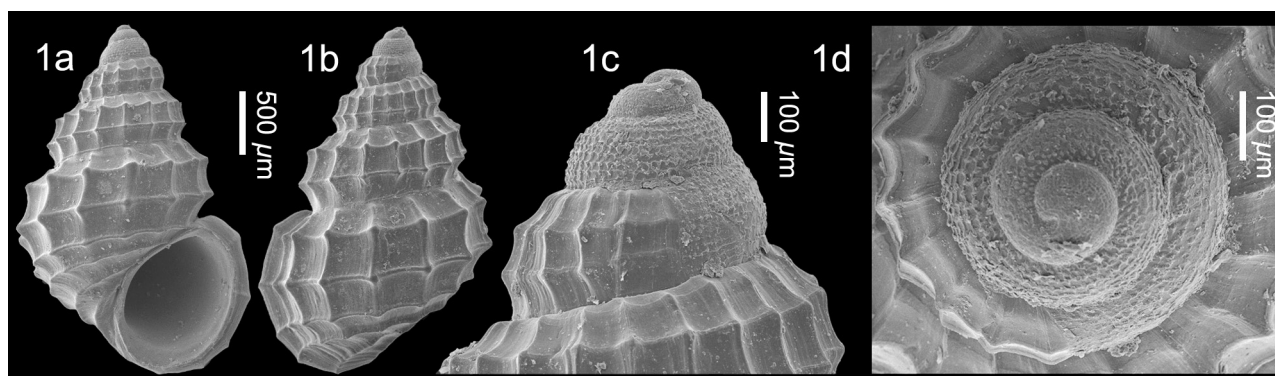


Plate 8. *Alvania diadema* (De Stefani, 1875); 1. NHMW 2024/0206/0015, height 2.8 mm, width 1.9 mm, c, d, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

0206/0015 (1), NHMW 2024/0206/0016 (50+). **VQ:** NHMW 2024/0206/0086 (5). **PQ:** NHMW 2024/0206/0017 (19).

Description – see Landau *et al.* (2004, p. 39). Protoconch measurements: $dp = 415 \mu m$, $hp = 455 \mu m$, $dp/hp = 0.91$, $dn = 83 \mu m$, $dV1 = 160 \mu m$ [$dp = 419 \mu m$, $dn = 100 \mu m$, $dV1 = 171 \mu m$; Landau *et al.*, 2004, p. 39].

Discussion – This species is easily distinguished from its congeners in *Estepona*, characterised by its elongated profile, open reticulate sculpture and spiny appearance. *Flemiella zetlandica* var. *perraricincta* (Sacco, 1895) is a junior synonym of *Alvania diadema* (De Stefani, 1875), 1888. According to Tabanelli (1988), *A. diadema* is widespread in the central Mediterranean from the Early to Late Pliocene. In the Early Pleistocene it is replaced by a closely related species *Alvania heraelaciniae* Ruggieri, 1950, which, according to Tabanelli (1988), is only present during the Early Pleistocene. The protoconchs of both species are identical, but *A. heraelaciniae* differs from the Pliocene species in having a more globose shell, with a shallower suture, the spiral cord above the suture is weaker, the aperture smaller, less oblique to the central axis and, the most constant difference, the labial varix is weak and flexuous. This species is found almost exclusively in the deeper water assemblages in *Estepona*.

Distribution – Upper Miocene: central Proto-Mediterranean, Italy (Sacco, 1895). Lower Pliocene: western Mediterranean, *Estepona* Basin, Spain (Landau *et al.*,

2004); central Mediterranean, Italy (Ruggieri, 1950; Pavia, 1980; Tabanelli, 1988; Chirli, 2006; Tabanelli *et al.*, 2011). Upper Pliocene: central Mediterranean (Sacco, 1895; Cavallo & Repetto, 1992; Tabanelli, 1988).

***Alvania granosa* Tabanelli, Bongiardino & Perugia, 2011**

Plate 9, fig. 2; Plate 31, fig. 9

*2011 *Alvania granosa* Tabanelli, Bongiardino & Perugia, p. 39, pl. 3, figs 15, 16.

2021 *Alvania granosa* Tabanelli, Bongiardino & Perugia, 2011 – Chirli & Forli, p. 127, pl. 101, figs A1-4.

Material and dimensions – Average height 2.8 mm. **VC:** NHMW 2024/0206/0057 (1), NHMW 2024/0206/0058 (1).

Description – Shell small, very solid, ovate, imperforate, with regularly conical spire. Protoconch paucispiral, 1.75 smooth whorls, with large nucleus ($dp = 350-395 \mu m$, $hp = 310-340 \mu m$, $dp/hp = 1.12-1.16$, $dn = 120-125 \mu m$, $dV1 = 220-240 \mu m$). Transition to teleoconch delimited by scar and beginning of adult sculpture. Teleoconch of 3.5 whorls separated by deeply impressed, narrowly canaliculate, linear suture. Spire whorls weakly convex, sculptured by 18-20 low orthocline later weakly prosocline ribs, slightly narrower than their interspaces, overrun by four low spiral cords, also slightly nar-

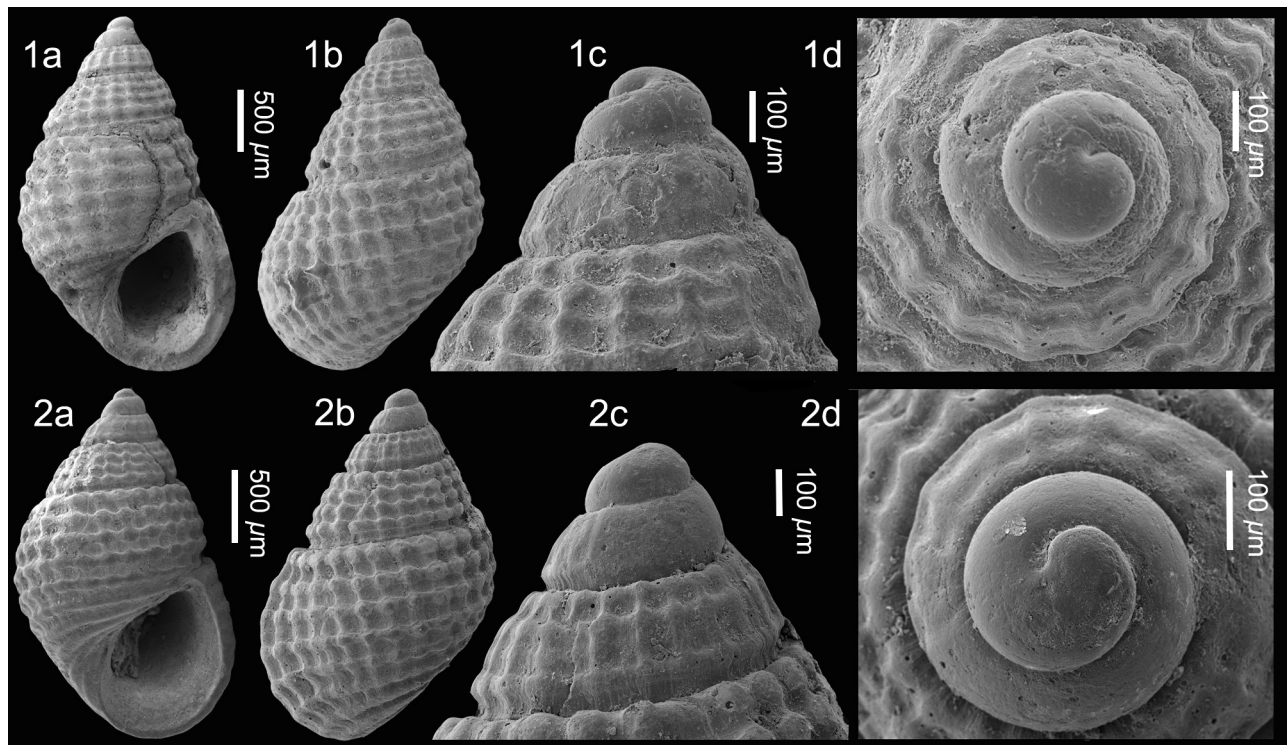


Plate 9. *Alvania granosa* Tabanelli, Bongiardino & Perugia, 2011; 1. NHMW 2024/0206/0057, height 2.9 mm, width 1.8 mm, c, d, detail of protoconch; 2. NHMW 2024/0206/0058, height 2.4 mm, width 1.5 mm, c, d, detail of protoconch (SEM images). Velerín carretera, Velerín, *Estepona*, Upper Zanclean, Lower Pliocene.

rower than their interspaces, increasing in strength towards suture, so that abapical cords forms periphery, fifth cord mostly obscured by suture; flattened ribs and cords forming relatively fine reticulated sculpture with squarish tubercles formed at intersections, cords slightly dominant. No microsculpture present. Last whorl 67-69% of total height, evenly convex bearing 20-22 prosocline ribs and four cords above level insertion of outer lip, six further cords over base. Aperture pyriform-ovate, peristome complete, sharply delimited from base. Outer lip greatly thickened by broad labial varix, slightly opisthocline, bearing about ten elongated denticles starting short distance behind peristome; anal sinus marked by shallow rounded groove on adapical edge of outer lip.

Discussion – These specimens probably represent *Alvania granosa* Tabanelli, Bongiardino & Perugia, 2011, described from the Piacenzian Upper Pliocene of Rio Merli. Unfortunately, the surface of the protoconch is abraded and does not show the fine irregular spiral threads seen in Tabanelli *et al.* (2011, pl. 3, fig. 15b), but both the protoconch and teleoconch profile and teleoconch sculpture are similar.

Alvania granosa is separated from the present-day *A. mamillata* Risso, 1826 by its protoconch microsculpture, which although very similar in sculpture typology, appears coarser and more confused (cf. Tabanelli *et al.*, 2011 and J.D. Oliver *et al.*, 2015). As the surface sculpture is abraded in both specimens from Estepona, we cannot say with certainty which of the two species it is. However, the Estepona specimens are small, similar in size to the Italian Pliocene specimens (2.1-2.6 mm; *fide* Tabanelli *et al.*, 2011), but with a thickened outer lip suggesting they are fully adult. Tabanelli *et al.* (2011) noted that whilst *A. mamillata* was variable in size (1.9-5.5 mm; *fide* Verduin, 1986; reaching 6.6 mm, personal data), the smaller specimens of *A. mamillata* did not have a thickened outer lip, suggesting they were not fully grown. *Alvania mamillata* has not been found in the fossil state so far.

Therefore, in view of its small but fully adult size, we provisionally use the name *A. granosa* until a specimen is found with its protoconch sculpture intact to confirm this position.

Several Miocene species have been described that may or may not be senior synonyms. *Acinus pseudocimex* L. Seguenza, 1903 (1903, p. 46, pl. 11, fig. 5) from the Upper Miocene Tortonian of Rometta (Messina, Italy) may be this species, but without SEM images it is impossible to decide. *Acinus cimex* var. *tauroparva* Sacco, 1895 from the Lower Miocene Colli Torinesi of Italy is also clearly related (see Ferrero Mortara *et al.*, 1984, pl. 38, fig. 9), although it seems to have fewer spiral cords on the penultimate whorl.

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Upper Pliocene: central Mediterranean, Italy (Tabanelli *et al.*, 2011).

Alvania hispanica nov. sp.

Plate 10, figs 1, 2; Plate 31, fig. 10

ZooBank registration – urn:lsid:zoobank.org:act:CC4FAE89-D440-4F72-8BFD-62ABC61D7C13

Type material – Holotype NHMW 2024/0206/0139, height 2.2 mm, width 1.1 mm; paratype 1 NHMW 2019/0167/0007, height 2.2 mm, width 1.1 mm. **Velerín conglomerates**. paratype 2 NHMW 2024/0206/0140, height 2.1 mm, width 1.0 mm. **Velerín carretera**.

Other material – Known from type series only.

Type locality – Velerín conglomerates, Velerín, Estepona, Spain.

Type stratum – Unnamed beds of uppermost Zanclean, Lower Pliocene.

Etymology – From the Latin name for Spain ‘*Hispania*’. *Alvania*, gender feminine.

Diagnosis – *Alvania* with small (height <3 mm), slender and rather robust shell, paucispiral protoconch, teleoconch with prosocline axial ribs and spiral cords, two spiral cordlets starting immediately at protoconch-teleoconch boundary, last whorl with about 20 thin axial ribs and ten spiral cordlets of equal thickness, small protruding tubercles developed at intersections, fine spiral microsculpture, aperture with varix.

Description – Shell very small, slender rissoiform, with elevated spire. Protoconch paucispiral, of 1.65-1.75 convex whorls, with large, elevated nucleus; surface microsculpture of crowded pustules (dp = 340-400 µm, hp = 240-290 µm, dp/hp = 1.17-1.67, dn = 115-135 µm, dV1 = 245-255 µm). Junction with teleoconch sharply delimited by elevated scar. Teleoconch of four convex whorls with periphery placed just below mid-whorl, separated by deeply impressed linear suture. Sculpture of two spiral cords at teleoconch junction overrunning 15 narrow axial ribs on first whorl. First half of second teleoconch third cord appears over subsutural ramp, rapidly increasing in strength. On second half second whorl further cord appears below and above suture. Penultimate whorl with about 20 prosocline axial ribs and six spiral cords, forming slightly horizontally elongate reticulate sculpture, with small, rounded tubercles developed at intersections. Teleoconch microsculpture of fine spiral threads alternated by thicker others in spiral interspaces. Last whorl 55-57% of total height, evenly convex, bearing ten spiral cords; six above level of insertion of outer lip, four further cords over base; axials weaken rapidly over base. Aperture small, ovate (filled with matrix), outer lip thickened, slightly opisthocline.

Discussion – There has been enormous confusion surrounding *Alvania subareolata* Monterosato, 1869. Chirli & Forli (2021, pl. 140) illustrated a number of specimens

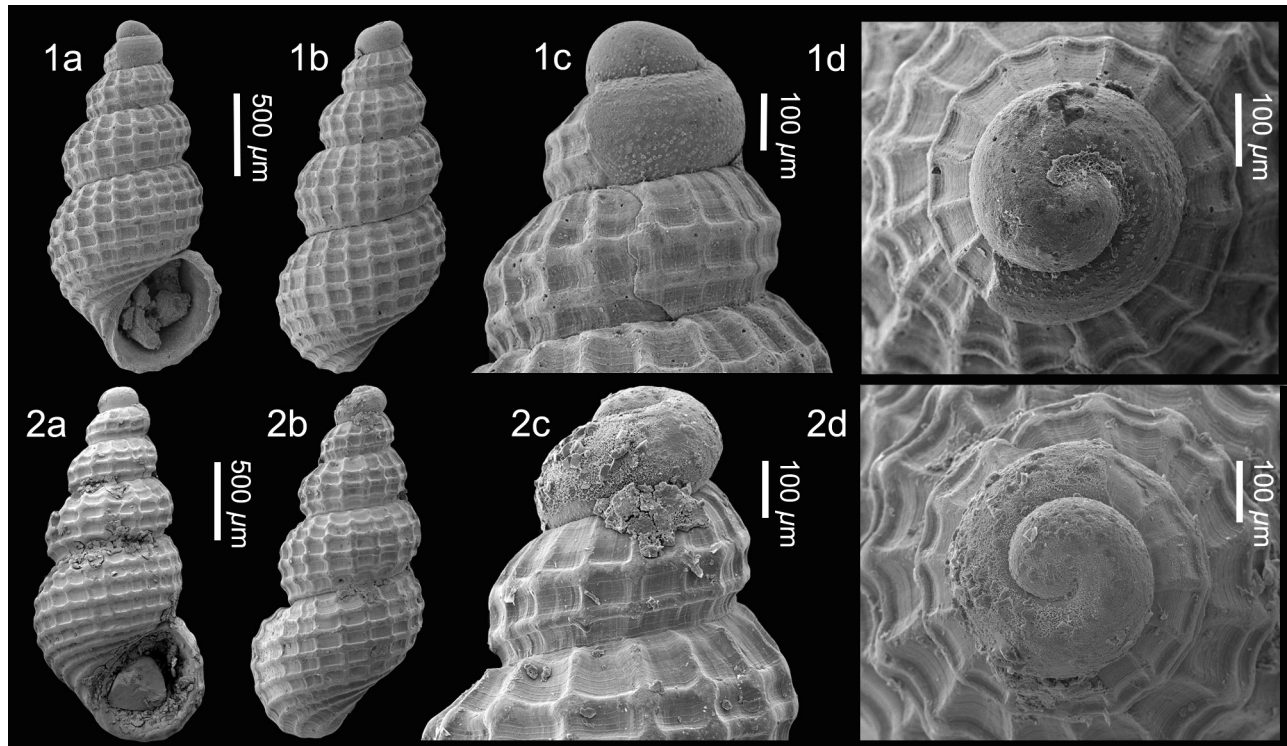


Plate 10. *Alvania hispanica* nov. sp.; 1. **Holotype** NHMW 2024/0206/0139, height 2.2 mm, width 1.1 mm, c, d, detail of protoconch; 2. **Paratype 1** NHMW 2019/0167/0007, height 2.2 mm, width 1.1 mm, c, d, detail of protoconch (SEM images). Velerín conglomerates, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

that represent a collection of other author's figures for this species. Of these, only one represents *A. subareolata* (pl. 140, fig. 15), which is a reproduction of a syntype from the Monterosato collection MCZR (from Appoloni *et al.*, 2018, figs 16L, M). We (B. A.) have examined hundreds of syntypes from the Monterosato collection, and there is little variability. Tisselli & Micali (2023) highlighted that under the name *A. subareolata* there were two different species, *A. subareolata*, and a new species, *Alvania skylla* Tisselli & Micali, 2023.

Alvania hispanica nov. sp. is closely similar to *A. subareolata* but differs in having a more robust shell and coarser sculpture. Some differences are also noted in the teleoconch microsculpture: slender spiral threads, alternating with thicker ones as opposed to closer-set and finer threads of equal size in *A. subareolata*.

Alvania iberopliocenica nov. sp. differs from *A. hispanica* in having coarser sculpture with fewer ribs and cords (respectively: 7-13 vs 10-20). More pronounced tubercles are developed at the intersections in *A. iberopliocenica*.

Alvania acutissimispira nov. sp. differs from *A. hispanica* in having more acute early whorls, the last whorl has a wider base, and fewer ribs and cords (respectively (7-14 vs 10-20).

Alvania hispanica is very uncommon in the Estepona assemblages and so far found only in the Velerín conglomerates.

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

Alvania iberopliocenica nov. sp.

Plate 11, figs 1-2; Plate 31, fig. 11

ZooBank registration – urn:lsid:zoobank.org:act:42AB0CA1-EFE1-4313-BE5F-D3A3451D194B

Type material – Holotype NHMW 2024/0206/0118, height 2.8 mm, width 1.0 mm; paratype 1 NHMW 2024/0206/0119, height 2.6 mm, width 1.1 mm; paratype 2 NHMW 2024/0206/0120, height 2.7 mm, width 1.1 mm.

Other material – Known from type series only.

Type locality – Velerín quarry, Velerín, Estepona, Spain.

Type stratum – Unnamed beds of uppermost Zanclean, Lower Pliocene.

Etymology – Name compound from Iberian Peninsula and the Pliocene epoch in which it occurred. *Alvania*, gender feminine.

Diagnosis – *Alvania* with small (height <3 mm), slender shell, medium thickness, tall paucispiral protoconch, teleoconch with prosocline axial ribs and spiral cords, two spiral cords starting immediately after the protoconch-teleoconch boundary, last whorl with 12 thin axial ribs and seven spiral cords of equal thickness; small protruding tubercles developed at intersections, aperture relatively small, with moderately thick

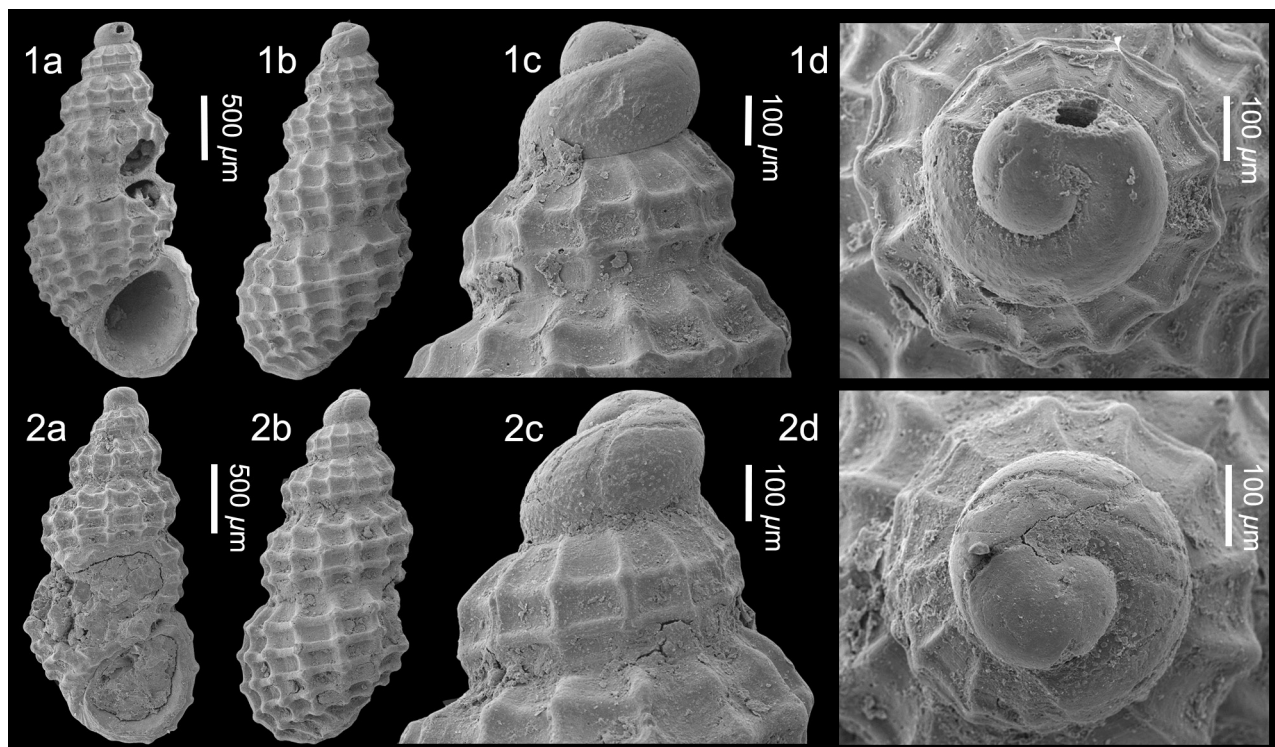


Plate 11. *Alvania iberopliocenica* nov. sp.; 1. **Holotype** NHMW 2024/0206/0118, height 2.8 mm, width 1.0 mm, c, d, detail of protoconch; 2. **Paratype 1** NHMW 2024/0206/0119, height 2.6 mm, width 1.3 mm, c, d, detail of protoconch (SEM images). Velerín quarry, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

labial varix, outer lip weakly opisthocline, internally lirate.

Description – Shell small, of medium thickness, slender rissoiform, with elevated spire. Protoconch paucispiral, of 1.6–1.75 tall, convex whorls with large nucleus, initially 5–6 low, weak spiral cordlets that on the last half whorl disintegrate into series of spiral tubercles more or less arranged in a disorderly manner ($dp = 390 \mu m$, $hp = 285 \mu m$, $dp/hp = 1.36$, $dn = 165 \mu m$, $dV1 = 310 \mu m$). Junction with teleoconch sharply delimited by scar and beginning of adult sculpture. Teleoconch of four convex whorls. First whorl bearing 12 weakly prosocline narrow axial ribs and two elevated spiral cords of equal strength to ribs; at protoconch/teleoconch junction greater space between suture and subsutural cord than between cords. Third primary spiral appears mid subsutural ramp on second whorl. Subsequent whorls coarsely cancellate with small, pointed tubercles developed at intersections. Sutures narrowly impressed, linear. Weak spiral microsculpture.

Last whorl 54–55% of total height, convex, with 12 slightly prosocline ribs and seven spiral cords; three spirals above level of the insertion of the outer lip, plus four cords over base. Ovate aperture, peristome complete, weakly lirate within, outer lip opisthocline, narrowly thickened with crenulated edge.

Discussion – *Alvania iberopliocenica* nov. sp. is very similar to *Alvania subareolata* Monterosato, 1869, in its

elongated shell profile and protoconch microsculpture. However, *A. subareolata* differs in having axial ribs on the teleoconch that do not reach the base, the sculpture (axial and spiral) is decidedly thinner and less protruding, the third subsutural cord appears on the last whorl vs already on the second, in the greater number of spiral cords on the base 5 vs 4, stronger spiral microsculpture, and the interior of the external lip smooth vs weakly lyrate.

Alvania skylla Tisselli & Micali, 2023 differs from *A. iberopliocenica* in having a less elongated shell profile, the first subsutural spiral cord is absent or more rarely appears on the last whorl vs present already on the second whorl, having fewer axial ribs that barely reach the base, spiral microsculpture that is much more marked, and the interior of the outer lip is smooth vs weakly lirate.

See under *Alvania acutissimispira* nov. sp. for further comparison.

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Alvania lachrymiformis* nov. sp.**

Plate 12, figs 1–2; Plate 31, fig. 12

ZooBank registration – urn:lsid:zoobank.org:act:A2EB6CB4-6443-45C2-9EEC-11FD5B7BF715

Type material – Holotype NHMW 2024/0206/0063, height 2.6 mm, width 1.5 mm; paratype 1 NHMW 2024/

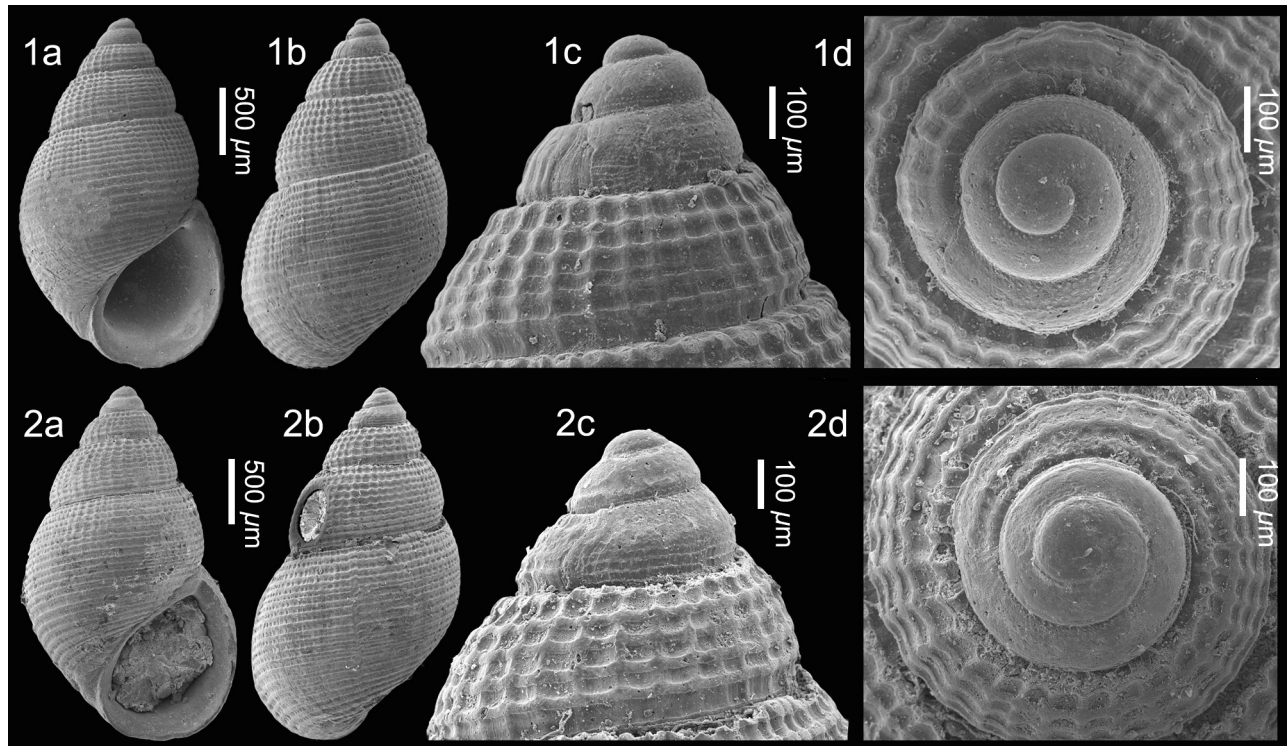


Plate 12. *Alvania lachrymiformis* nov. sp.; 1. **Holotype** NHMW 2024/0206/0063, height 2.6 mm, width 1.5 mm, c, d, detail of protoconch; 2. **Paratype 1** NHMW 2024/0206/0063, height 2.7 mm, width 1.6 mm, c, d, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

0206/0064, height 2.7 mm, width 1.6 mm; paratype 2 NHMW 2024/0206/0065, height 2.6 mm, width 1.4 mm; paratype 3 NHMW 2024/0206/0066, height 2.7 mm, width 1.7 mm.

Other material – Average height 2.6 mm. **CO:** NHMW 2024/0206/0074 (5). **VQ:** NHMW 2024/0206/0090 (10). **VC:** NHMW 2024/0206/0067 (15).

Type locality – Velerín carretera, Estepona, Spain.

Type stratum – Unnamed beds of uppermost Zanclean, Lower Pliocene.

Etymology – Name from Latin '*lachrymiformis*, -e' (adjective) reflecting the teardrop profile. *Alvania*, gender feminine.

Diagnosis – Small, solid, teardrop-shaped *Alvania* species with protoconch of 2.7 convex whorls with fine spiral microsculpture, teleoconch of three convex whorls, suture weakly impressed, with extremely fine cancellate sculpture, about 40 ribs crossed by 10-11 cords on penultimate whorl, outer lip thickened.

Description – Shell small, solid, teardrop-shaped, with regularly conical spire. Protoconch multispiral, 2.7 whorls with small nucleus (dp = 385-395 µm, hp = 305-320 µm, dp/hp = 1.23-1.26, dn = 70-80 µm, dV1 = 150-155 µm). Transition to teleoconch delimited by sinusigera

and beginning of adult sculpture. Teleoconch of three weakly convex whorls separated by shallowly impressed, narrowly canaliculate, linear suture. Sculpture very fine; first whorl with about 30 ribs, two spiral cords at protoconch/teleoconch boundary, rapidly becoming four cords on second half of first whorl, abapically further fine cords intercalated, penultimate whorl with about 40 very fine ribs crossed by 10-11 narrow flattened cords, roughly equal in width to their interspaces, forming extremely fine reticulated pattern with cords slightly predominant. No teleoconch microsculpture present. Last whorl 70-72% of total height, evenly convex bearing about 60 prosocline ribs and 11-12 cords at and above level insertion of outer lip, about 16 further cords over base. Aperture pyriform-ovate, peristome complete, sharply delimited from base. Outer lip slightly prosocline, smooth and thickened within; shallow V-shaped groove on adapical tip of outer lip.

Discussion – *Alvania lachrymiformis* nov. sp. is found only in the deeper water assemblage of Velerín carretera. It probably belongs to a group of deeper water species with planktotrophic development and dense cancellate sculpture including the Mediterranean Lower Pleistocene to present day *Alvania geryonia* (Nardo, 1847) that differs in having coarser sculpture often with small tubercles developed at sculptural intersections and *Alvania fredianii* Della Bella & Scarponi, 2000 from the Pliocene of Italy that differs in having a somewhat telescopic profile with a slightly gradate spire and the last

whorl is broader, roundly angled at the base, amongst others, most of which have coarser sculpture [e.g., *Alvania mariae* (d'Orbigny, 1852)].

It is also similar to *Alvania magistra* Chirli, 2006 in having extremely finely cancellate sculpture, but differs in being smaller, having a less inflated last whorl, a smaller aperture, a less marked anal sinus which in *A. magistra* forms a distinct U-shaped groove at the adapical end of the outer lip (see Chirli, 2006, pl. 11, fig. 14, pl. 12, fig. 7). Moreover, the protoconch in that species is not covered in fine spirals; it has a honeycomb microsculpture over Protoconch I and two spirals near the suture in Protoconch II (see Chirli, 2006, pl. 12, figs 1-3). Some finely sculptured forms of *Alvania amoena* Tabanelli, Bongiardino & Perugia, 2011, described from the Upper Pliocene of Italy (e.g., Tabanelli *et al.*, 2011, pl. 2, fig. 13), have a similar teleoconch, but differ immediately in their paucispiral protoconch.

As the name suggests, it is also closely similar in shape to *Alvania lachrymula* Landau, Ceulemans & Van Dingenen, 2018 from the Upper Miocene Tortonian of the Ligerian Basin, NW France, but that species has a protoconch of only two whorls, coarser sculpture, and a deeper V-shaped suture. From the same Ligerian Basin *Alvania renauleauensis* Landau, Ceulemans & Van Dingenen, 2018 has similarly fine spiral sculpture, but is a less solid species and differs in its whorl profile and the angle of insertion of the outer lip. The slightly older Langhian Middle Miocene *Alvania lactanea* Glibert, 1949 from the Loire Basin, NW France, is superficially similar in having fine sculpture, but is umbilicate.

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (this paper)

Alvania lactea (Michaud, 1830)

Plate 13, fig. 1; Plate 31, fig. 13

- *1830 *Rissoa lactea* Michaud, p. 7, figs 11, 12.
- 1895 *Alvania* (*Massotia*) *lactea* var. *semiacostata* Sacco, p. 28, pl. 1, fig. 69.
- 1895 *Alvania* (*Massotia*) *lactea* var. *fusulatovaricosa* Sacco, p. 28, pl. 1, fig. 70.

- 1889 *Massotia Dajerleini* Monterosato, p. 33 (misspelled *dojerleini*, corrected to *Dajerleini* p. 120).
- 1920 *Alvania* (*Massotia*) *lactea* (Michaud) – Harmer, p. 621, pl. 50, fig. 41.
- 1921 *Alvania* (*Massotia*) *lactea* (Michaud) – Cossmann, p. 21, pl. 1, figs 47-48.
- 1978 *Alvania lactea* (Michaud, 1830) – Fretter & Graham, p. 186, fig. 160.
- 1987 *Alvania* (*Massotia*) *lactea* (Michaud 1832 [sic]) – Cuerdo Barceló, p. 204, pl. 16, fig. 21.
- 1991 *Alvania lactea* (Michaud, 1830) – Poppe & Goto, p. 100, pl. 12, fig. 27.
- 1996 *Alvania lactea* Michaud, 1830 – Warén, p. 225, fig. 17C.
- 1997 *Alvania* (*Alvania*) *lactea* (Michaud, 1832 [sic]) – Giannuzzi-Savelli *et al.*, p. 116, figs 494-498.
- 2004 *Alvania lactea* (Michaud, 1832 [sic]) – Landau *et al.*, p. 40, pl. 7, fig. 2.
- 2006 *Alvania lactea* Michaud, 1832 [sic] – Chirli, p. 23, pl. 10, figs 9-16.
- 2009 *Alvania lactea* (Michaud, 1832 [sic]) – Scaperrotta *et al.*, p. 36, 5 unnumbered figures.
- 2008 *Alvania lactea* (Michaud, 1830) – Garilli, p. 29, figs 44-49, 53-61.
- 2013 *Alvania lactea* (Michaud, 1830) – Raad *et al.*, p. 46, fig. 1.
- 2017 *Alvania lactea* (Michaud, 1832 [sic]) – Bitlis-Bakir & Öztürk, p. 404, figs 5A, B.
- 2018 *Massotia dajerleini* Monterosato, 1889 – Appoloni *et al.*, p. 104, figs 14A, B.
- 2019 *Alvania lactea* (Michaud, 1830) – Scaperrotta *et al.*, p. 142, pl. 3I.
- 2020 *Alvania lactea* (Michaud, 1830) – Alf *et al.*, p. 114, pl. 96.
- 2021 *Alvania lactea* (Michaud, 1836 [sic]) – Chirli & Forli, p. 137, pl. 106, figs C1-9; p. 353, pl. 107, figs A1-19; p. 354, pl. 108, figs A1-4 (some specimens depicted that are not well identifiable may belong to other species).

Material and dimensions – Average height 4.2 mm. **EL:** NHMW 2024/0206/0018 (17). **CO:** NHMW 2024/0206/0019 (1), NHMW 2024/0206/0020 (31). **VQ:** NHMW 2024/0206/0083 (1). **PQ:** NHMW 2024/0206/0079 (1).

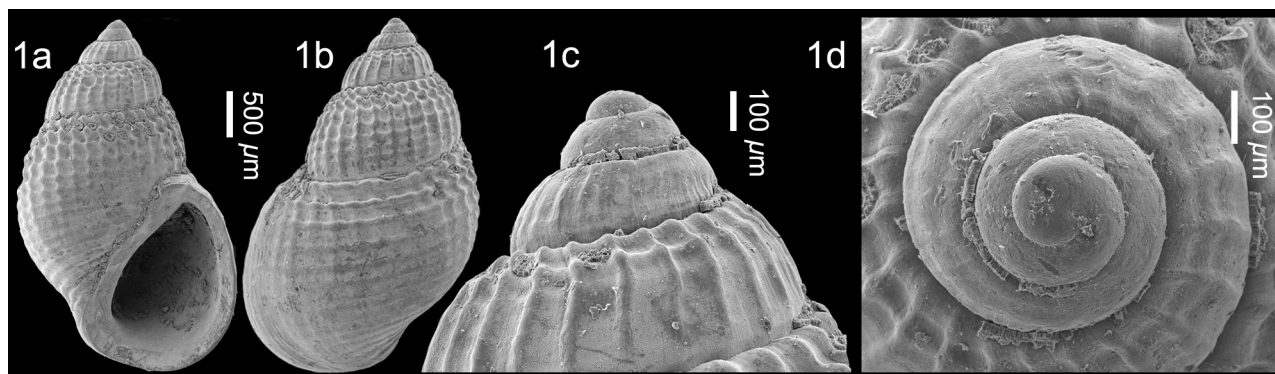


Plate 13. *Alvania lactea* (Michaud, 1830); 1. NHMW 2024/0206/0019, height 3.9 mm, width 2.4 mm, c, d, detail of protoconch (SEM images). Velerín conglomerates, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

Description – see Landau *et al.* (2004, p. 40). Protoconch measurements: $dp = 555 \mu\text{m}$, $hp = 350 \mu\text{m}$, $dp/hp = 1.59$, $dn = 105 \mu\text{m}$, $dV1 = 190 \mu\text{m}$.

Discussion – The ovate shape, large last whorl and aperture make this species very characteristic and difficult to confuse with its congeners. It is a highly variable species, for full discussion see Garilli (2008, p. 35). In Estepona it is found only in the shallow water assemblages, which fits with its present-day shallow water habitat (Alf *et al.*, 202, p. 114).

Alvania miolactea Landau, Ceulemans & Van Dingenen, 2018, from the Upper Miocene Tortonian Ligerian Basin of NW France, is similar to *Alvania lactea* (Michaud, 1830) but differs in having a larger protoconch with different microsculpture and stronger axial teleoconch sculpture.

Italian Lower Pliocene specimens illustrated as *A. lactea* by Chirli (2006, pl. 10, figs 9-16) and those from the Upper Miocene and Lower Pliocene figured by Garilli (2008, p. 32, figs 44, 47, 48) may reflect a wide range of intraspecific variability of *A. lactea* or might represent a distinct species (early whorls more acute, thicker labial varix, more numerous and denser sculpture). The protoconchs are similar but indistinguishable from those of many congeners. We provisionally place them in the chresonymy.

Distribution – Upper Miocene: central Proto-Mediterranean, Italy (Garilli, 2008). Lower Pliocene: western Mediterranean, Estepona Basin, Spain (Landau *et al.*, 2004); central Mediterranean, Italy (Chirli, 2006; Garilli, 2008). Upper Pliocene: central Mediterranean, Italy (Sacco, 1895; Garilli, 2008). Lower Pleistocene: central Mediterranean, Italy (Garilli, 2008). Upper Pleistocene: North Sea Basin, British Isles (Harmer, 1918), The Netherlands (Raad *et al.*, 2013); Atlantic, post-glacial, Iceland (Warén, 1996), subfossil, Sweden (Hubendick & Warén, 1969); western Mediterranean, Balearic Islands (Cuerda Barceló, 1987); central Mediterranean, Sicily (Garilli, 2008). Present-day: Atlantic, British Isles, Channel Islands, southwards to Morocco (Fretter & Graham, 1978), entire Mediterranean and Black Seas (Giannuzzi-Savelli *et al.*, 1997; Bitlis & Öztürk, 2017; Scaperrotta *et al.*, 2019). Sublittoral and at extreme low tide under stones (Poppe & Goto, 1991).

***Alvania* sp. '*A. lineata* complex' sensu Amati *et al.*, 2019**

Plate 14, fig. 1; Plate 31, fig. 14

Material and dimensions – Height 3.4 mm. CO: NHMW 2024/0206/0021 (1).

Description – Shell small, solid, rissoiform, imperforate, with relatively high spire. Protoconch multispiral of 2.25 convex whorls, surface abraded ($dp = 305 \mu\text{m}$, $hp = 255 \mu\text{m}$, $dp/hp = 1.20$, $dn \sim 115 \mu\text{m}$, $dV1 \sim 175 \mu\text{m}$). Transition to teleoconch delimited by beginning of adult sculpture. Teleoconch of 4.5 convex whorls separated by deeply impressed suture, narrowly canaliculate. First whorl with 14 narrow orthocline ribs, overrun by two narrow, elevated spiral cords (III and V) starting immediately after protoconch/teleoconch boundary; cord I subsutural starting on second whorl (I, III, V) gradually, on third whorl cord II and IV are interposed (I, II, III, IV, V). Very fine threads overrun cords, not present in spiral interspaces. Last whorl 59% of total height, strongly convex, weakly angled at base, bearing 14 weakly prosocline ribs, 11 spiral cords, five above level insertion of outer lip, six further cords over base; ribs weaken rapidly over base. Aperture small, ovate, per-

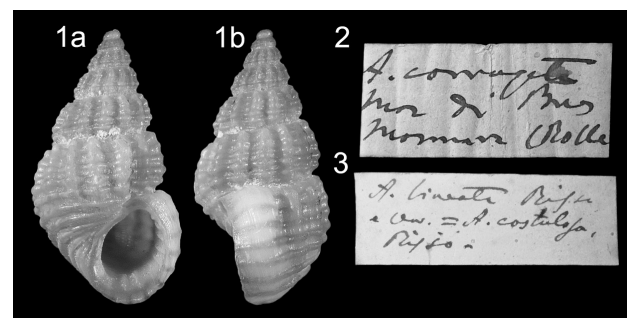


Plate 15. *Alvania* sp. '*Alvania lineata* complex', as *Alvania corrugata* Brusina, 1866 (synonym of *A. lineata*, *fide* Brusina, 1866, p. 26), Sea of Marmara (Turkey); 1. Shell Monterosa coll. MCZR-M-22152, height 4.65 mm. 2. Original label; 3. A second original label, probably earlier, reports *A. lineata* var. = *A. costulosa* Risso, now synonymous with *A. discors* (Allan, 1818) (see lectotype MNHN IM-2000-36710).

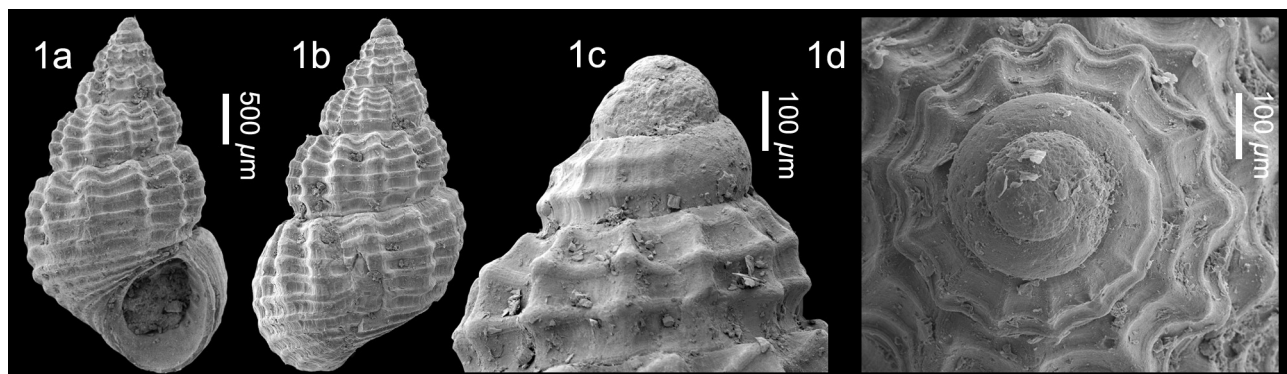


Plate 14. *Alvania* sp. '*Alvania lineata* complex'; 1. NHMW 2024/0206/0021, height 3.4 mm, width 2.0 mm, c, d, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

istome complete, sharply delimited from base. Outer lip strongly thickened by broad labial varix, prosocline, bearing about eight elongated denticles starting short distance behind peristome; anal sinus rounded, weakly developed.

Discussion – This specimen is not identifiable as any extant or extinct species. Represented by a single specimen from the Velerín conglomerates assemblage, we leave it in open nomenclature.

We believe that, for some characteristics of the shell morphology, this species can be included in the complex called ‘*Alvania lineata* complex’ of Amati *et al.* (2019). Some present-day specimens from the Marmara Sea (Pl. 15, fig. 1) are very similar because they share a multispiral protoconch, a similar shell profile, mode of development of the additional spiral cords, and in the number of spiral cords (5) on the last whorl above the aperture. This last feature is rather uncommon in species of the complex (e.g., *Alvania rominae* Amati, Trono & Oliverio, 2020).

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Alvania lobilloensis* nov. sp.**

Plate 16, figs 1, 2; Plate 31, fig. 15

ZooBank registration – urn:lsid:zoobank.org:act:9E614CE0-2778-4E75-8274-E3F6AFC2B922

Type material – Holotype NHMW 2024/0206/0121, height

1.8 mm, width 1.2 mm; paratype 1 NHMW 2024/0206/1022, height 1.5 mm, width 0.9 mm (subadult); paratype 2 NHMW 2024/0206/0123, height 2.4 mm, width 1.4 mm.

Other material – **EL:** NHMW 2024/0206/0124 (50+), **VQ:** NHMW 2024/0206/0096 (8).

Type locality – El Lobillo, Estepona, Spain.

Type stratum – Unnamed beds of uppermost Zanclean, Lower Pliocene.

Etymology – Name after the type locality of El Lobillo in Estepona. *Alvania*, gender feminine.

Diagnosis – *Alvania* species of small size, globose, medium thickness, multispiral protoconch of 2.8 whorls with faint spiral microsculpture, teleoconch of up to three convex whorls, relatively fine cancellate teleoconch sculpture with very variable number of ribs, last whorl with eight cords, four above level insertion of outer lip, four over base, aperture large, labial varix moderately thickened, weakly lirate within.

Description – Shell very small, medium thickness, globose rissoiform, with conical spire. Protoconch multispiral, 2.8 whorls with small nucleus, faint microsculpture of minute pustules roughly arranged in spiral rows, more evident towards abapical suture (dp = 385 μ m, hp = 315 μ m, dp/hp = 1.22, dn = 55 μ m, dV1 = 125 μ m). Transition to teleoconch delimited by sinusigera and beginning of adult

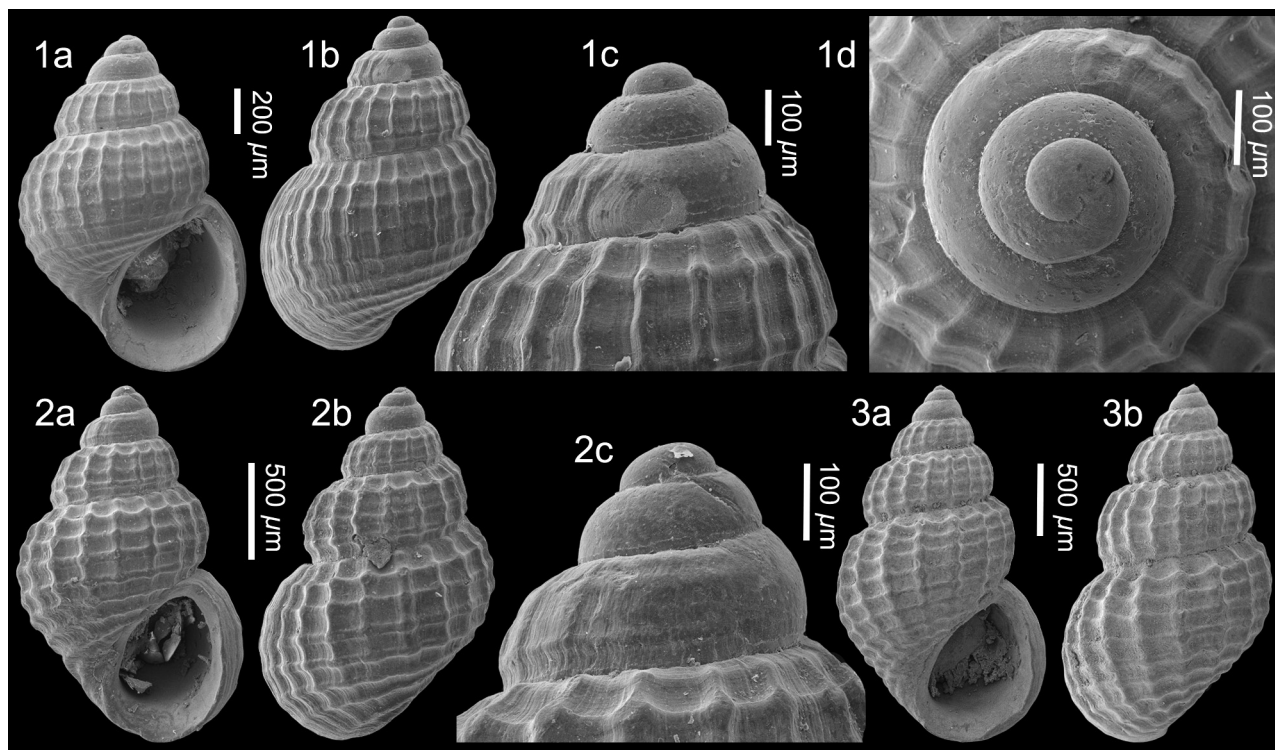


Plate 16. *Alvania lobilloensis* nov. sp.; 1. **Paratype 1** NHMW 2024/0206/1022, height 1.5 mm, width 0.9 mm (subadult), c, d, detail of protoconch; 2. **Holotype** NHMW 2024/0206/0121, height 1.8 mm, width 1.2 mm, c, detail of protoconch; 3. **Paratype 2** NHMW 2024/0206/0123, height 2.4 mm, width 1.4 mm (SEM images). El Lobillo, Estepona, Upper Zanclean, Lower Pliocene.

sculpture. Teleoconch of up to three convex whorls separated by moderately impressed linear suture. Sculpture very variable; first whorl with about 22 ribs, two spiral cords at protoconch/teleoconch boundary. On second half of first whorl one further cord intercalated mid-subsutural ramp and between cords, rapidly increasing in strength to four subequal cords on second whorl. Fine spiral microsculpture present. Last whorl 64-68% of total height, inflated, evenly convex bearing about 20 weakly prosocline ribs and eight cords: four above level insertion of outer lip, four further cords over base. Aperture pyriform-ovate, relatively large, peristome complete, sharply delimited from base. Outer lip flexuous, orthocline or slightly opisthocline, thickened by labial varix, smooth within, somewhat expanded abapically; adapically poorly delimited shallow V-shaped groove.

Discussion – *Alvania lobilloensis* nov. sp. is found most commonly in the El Lobillo outcrop in the Estepona assemblages where it is very common. It is also extremely variable not only in size. Although never larger than 2.4 mm in height, considerably smaller specimens show adult thickening of the outer lip. Spire height, globosity of the last whorl, and above all the number of axial ribs, are all variable.

Alvania lanciae (Calcare, 1845), from the present-day Mediterranean Sea, differs from *A. lobilloensis* in developing tubercles at the sculptural intersections that are slightly elongated along the spiral cords, strengthening toward the base as opposed to small and rounded, the aperture bears 5-7 weak elongated denticles within vs smooth, and the suprasutural cord is more robust and elevated than the others (Amati, 2012) vs all of the same thickness and equidistant in *A. lobilloensis*.

Alvania amphitrite Thivaoui, Harzhauser & Koskeridou, 2019 from Early Miocene of Greece, resembles *A. lobilloensis* in its ovoid outline with low H/W ratio and in having the first spiral cord (adapical) that has a slightly larger and less developed space than the other cords, but differs in its thinner labial varix and the base being convex vs slightly concave in *A. lobilloensis* nov. sp. The protoconch is devoid of sculpture in *A. amphitrite* vs microsculpture of minute pustules roughly arranged in spiral rows, more evident towards abapical suture.

Alvania calliope Chirli & Linse, 2011 from the Lower Pleistocene of Rhodes Island, differs from *A. lobilloensis* in having less convex spiral whorls, more robust axial and spiral sculpture and narrower aperture. The protoconch also has a different microsculpture (Chirli & Linse, 2011, p. 56, pl. 20, fig. 2).

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

Alvania magistra Chirli, 2006

Plate 17, figs 1, 2; Plate 31, fig. 16

1999 *Alvania textilis* (Philippi, 1844) – Forli *et al.*, p. 113, pl. 2, fig. 13, 14 [non Philippi, 1844].

2004 *Alvania* sp. 1 – Landau *et al.*, p. 46, pl. 10, fig. 3.

*2006 *Alvania magistra* Chirli, p. 25, pl. 11, figs 13-16, pl. 12, figs 1-5.

2006 *Alvania magistra magistrisplicata* Chirli, p. 26, pl. 12, figs 6-8.

2021 *Similvania magistra* (Chirli, 2006) – Chirli & Forli, p. 194, pl. 157, figs B1-5, pl. 158, A1-6.

Material and dimensions – Average height 4.8 mm. **EL:** NHMW 2024/0206/0022 (50+). **CO:** NHMW 2024/0206/0023 (1), NHMW 2024/0206/0024 (10). **VC:** NHMW 2024/0206/0025 (1).

Description – see Landau *et al.* (2004, p. 46). Protoconch measurements: dp = 380 μ m, hp = 280 μ m, dp/hp = 1.36, dn = 105 μ m, dV1 = 200 μ m [dp = 361 μ m, dn = 84 μ m, dV1 = 160 μ m; Landau *et al.*, 2004, p. 39].

Discussion – This species is characterised by its relatively large size and globose whorls, predominantly spiral sculpture composed of very fine, close-set spiral cords and very weak axial sculpture restricted to the adapical portion of the whorls. Moreover, it has a very characteristic anal canal forming a deep notch on the apical portion of the outer lip. This is likely to be *Alvania magistra* Chirli, 2006, described from the Lower Pliocene of Italy. Unfortunately, the protoconch in the Estepona specimens is slightly abraded and does not show the very fine reticulated pattern on Protoconch I and two fine spiral threads just above the suture on Protoconch II illustrated by Chirli (2006, pl. 11, fig. 16, pl. 12, figs 1-3). Nevertheless, the number of protoconch whorls is the same 2.25 (not 2.5 as stated in Landau *et al.*, 2004, p. 46; *lapsus*), and the teleoconch shape and sculpture lies within the range of the Italian specimens. The only species it can be compared to is *Alvania lactea* (Michaud, 1830), but apart from being slenderer, having a deeper suture, and having finer sculpture than that species, *A. lactea* lacks the deep anal notch on the apical portion of the outer lip.

Along with the nominate species, Chirli (2006) described the subspecies *magistrisplicata* said to differ in being more globose, having fewer by stronger axial folds on the last two whorls, more numerous spiral cords, and a more expanded aperture. According to Chirli, both forms coexist in the 'Poggio alla Fame' deposits of Tuscany, Italy. Apart from the unlikely possibility of a species and subspecies coexisting, we report that the *magistrisplicata* form also occurs in the El Lobillo deposits. These tend to be gerontic specimens with expanded apertures and thickened labial varix that accentuate the unusual character of the deep anal sinus in this species. We therefore formally synonymise the subspecies with the type.

It is interesting to point out the specimen (Pl. 17, fig. 2), with an unusual greater height/width ratio: 1.83 compared to that of the most common form equal to 1.61 (Pl. 17, fig. 1), 1.63-1.75, calculated from the figures (Chirli, 2006), which certainly broadens the infraspecific variability.

According to Chirli (2006, p. 26), the specimen from the Italian Lower Pliocene illustrated by Forli *et al.* (1999, p. 113, pl. 2, fig. 12, 13) as *Alvania textilis* (Philippi, 1844) is not that species but *A. magistra*. *Alvania textilis* (Philip-

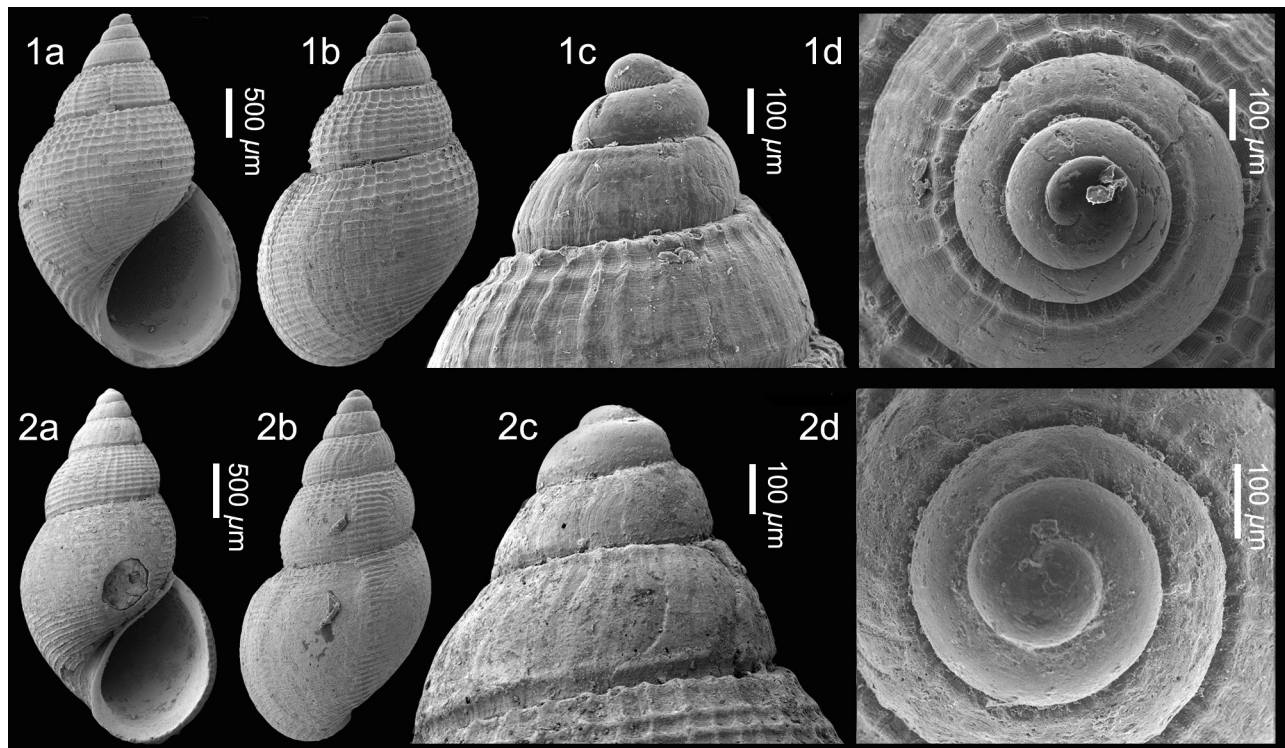


Plate 17. *Alvania magistra* Chirli, 2006; 1. NHMW 2024/0206/0023, height 3.7 mm, width 2.3 mm, c, d, detail of protoconch. Velerín conglomerates. 2. NHMW 2024/0206/0025, height 3.3 mm, width 1.8 mm, c, d, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

pi, 1844) was synonymised with *Alvania beanii* (Hanley in Thorpe, 1844) by Sabelli *et al.* (1990, 1992). Forli *et al.* (1999, p. 113) questioned this synonymy, but illustrated *A. magistra*.

In Estepona this is predominantly a shallow water species, most abundant in the shallow water El Lobillo deposits and becoming progressively more uncommon in the Velerín conglomerates and carretera deposits. We also record it from the Atlantic Upper Pliocene Mondego Basin of Central-West Portugal herein.

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (Landau *et al.*, 2004); central Mediterranean, Italy (Forli *et al.*, 1999; Chirli, 2006). Upper Pliocene: Atlantic, Mondego Basin, Portugal (NHMW coll.).

***Alvania punctura* (Montagu, 1803)**

Plate 18, fig. 1; Plate 31, fig. 17

- *1803 *Turbo punctura* Montagu, p. 320, pl. 12, fig. 5.
- 1843 *Rissoa puncturata* MacGillivray, p. 327 (unjustified emendation).
- 1852 *Turritella Dorvilleana* Leach in Gray, p. 161.
- 1867 *Rissoa punctura* var. *diversa* Jeffreys, p. 18.
- 1878 *Alvania punctura* Mont. – O.G. Sars, p. 177, pl. 10, figs 6a, 6b.
- 1886 *Alvania puncturata* Montagu [*sic*] – Locard, p. 247 (unjustified emendation).

- 1914 *Rissoia (Alvania) punctura* Mtg. – Cerulli-Irelli, p. 203, pl. 16, figs. 10–15.
- 1920 *Alvania punctura* (Montagu) – Harmer, p. 615, pl. 51, fig. 32.
- 1978 *Alvania punctura* (Montagu, 1803) – Fretter & Graham, p. 184, fig. 158.
- 1982 *Alvania punctura* (Montagu, 1803) – Gofas & Warén, p. 11, pl. 1, figs 1–3.
- 1982 *Alvania (Alvaniella) punctura* (Montagu, 1803) – Van Aartsen, p. 5, 6, figs 1 (six specimens) and one unnumbered figure.
- 1984a *Alvania (Arsenia) punctura* (Montagu, 1803) – Bogi *et al.*, p. 19, 1 unnumbered figure.
- 1985 *Alvania (Alvania) punctura* (Montagu) – Ponder, p. 144, pl. 95 A–E.
- 1996 *Alvania punctura* (Montagu, 1803) – Warén, p. 225, fig. 17E–F.
- 1997 *Alvania (Alvania) punctura* (Montagu, 1803) – Giannuzzi-Savelli *et al.*, p. 106, figs. 433–436.
- 2001 *Alvania (Alvania) punctura* (Montagu, 1803) – Silva, p. 145, pl. 5, figs. 19–20.
- 2004 *Alvania punctura* (Montagu, 1803) – Landau *et al.*, p. 42, pl. 8, fig. 1.
- 2007 *Alvania punctura* (Montagu, 1803) – Gofas, p. 790, fig. 5F (only protoconch figure).
- 2010 *Alvania punctura* (Montagu, 1803) – Scaperrotta *et al.*, p. 55, 5 unnumbered figures.
- 2011 *Alvania punctura* (Montagu, 1803) – Tabanelli *et al.*, p. 43, fig. 19.
- 2011 *Alvania punctura* (Montagu, 1803) – Gofas &

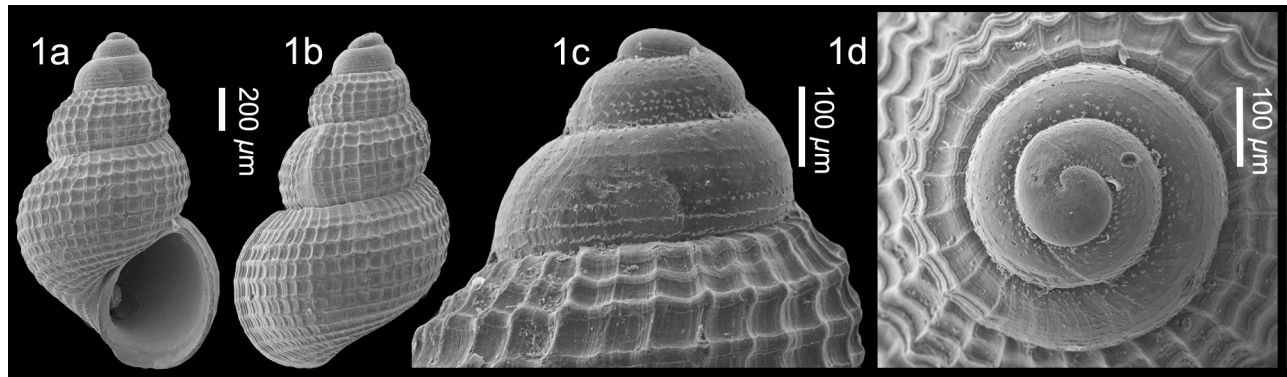


Plate 18. *Alvania punctura* (Montagu, 1803); 1. NHMW 2024/0206/0027, height 1.6 mm, width 1.0 mm, c, d, detail of protoconch (SEM images). Velerín conglomerates, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

- J.D. Oliver in Gofas *et al.*, p. 185, 3 unnumbered figs.
- 2011 *Alvania punctura* (Montagu, 1803) – Tabanelli *et al.*, p. 62, pl. 3, fig. 19.
- 2011 *Alvania punctura* (Montagu, 1803) – Chirli & Linse, p. 82, pl. 23, figs 4a-e.
- 2012 *Alvania punctura* (Montagu, 1803) – Brunetti & Vecchi, p. 113, pl. 5, figs a, b.
- 2013 *Alvania punctura* (Montagu, 1803) – Nekhaev, p. 2, figs 2, 3.
- 2013 *Alvania punctura* (Montagu, 1803) – Raad *et al.*, p. 48, fig. 6.
- 2014 *Alvania punctura* (Montagu, 1803) – Garilli & Parrinello, p. 381, 396, figs 7C-E.
- 2017 *Turbo punctura* Montagu, 1803 [*Alvania punctura* (Montagu, 1803)] – P.G. Oliver *et al.*, p. 397, figs 60-60.3 (3 figures of the same syntype).
- 2017 *Alvania punctura* (Montagu, 1803) – Bitlis-Bakir & Öztürk, p. 404, figs 5G, H.
- 2018 *Alvania punctura* (Montagu, 1803) – Chimienti *et al.*, p. 198, fig. 11.
- 2019 *Alvania punctura* (Montagu, 1803) – Scaperrotta *et al.*, p. 144, pl. 5C.
- 2020 *Alvania punctura* (Montagu, 1803) – Alf *et al.*, p. 116, pl. 96.
- 2021 *Alvania punctura* (Montagu, 1803) – Chirli & Forli, p. 162, pl. 128, figs B1-14, pl. 129, figs A1-19, pl. 130, figs A1-17 (some specimens depicted may not belong to this species).
- 2022 *Alvania punctura* (Montagu, 1803) – J.D. Oliver, p. 12, figs 5a-d.
- 2024 *Alvania punctura* (Montagu, 1803) – Amati *et al.*, p. 31, fig. 9F.

Material and dimensions – Average height 1.5 mm. **EL:** NHMW 2024/0206/0026 (50+). **CO:** NHMW 2024/0206/0027 (1), NHMW 2024/0206/0028 (10). **VQ:** NHMW 2024/0206/0080 (2). **VC:** NHMW 2024/0206/0071 (2).

Description – see Landau *et al.* (2004, p. 42). Protoconch measurements: dp = 380-390 µm, hp = 310-360 µm, dp/hp = 1.06-1.25, dn = 40-60 µm, dV1 = 115-120 µm [dp =

350 µm, dn = 45 µm, dV1 = 120 µm; Landau *et al.*, 2004, p. 42].

Discussion – *Alvania punctura* (Montagu, 1803) is easily distinguished from its congeners in Estepona by the small size, regularly rounded whorls and very fine evenly reticulate sculpture. Although the protoconch is somewhat eroded, the sculpture is identical to that described and figured for the modern specimens (see Fretter & Graham 1978, p. 185, fig. 159; Giannuzzi-Savelli *et al.*, 1997, fig. 436). The size of the protoconch in our specimen is, however, significantly larger than that described by Fretter & Graham (1978) (total larval shell diameter of 350 µm vs 200-250 µm; diameter first whorl 120 µm vs 85-95 µm).

Several Recent Mediterranean species such as *Alvania subsoluta* (Aradas, 1847), *A. parvula* (Jeffreys, 1884) and *Alvania hallgassi* Amati & Oliverio 1985 have a similar shape and teleoconch sculpture, but all three have a smaller protoconch consisting of only 1½-2 whorls. In Estepona it is found exclusively in the shallower water assemblages which agrees with its present-day habitat intertidal to mid subtidal (Alf *et al.*, 2020, p. 116) depths from 15 to 150 m (Amati *et al.*, 2024).

Distribution – Lower Pliocene: North Sea Basin, Coralline Crag, England (S.V. Wood, 1848; Harmer, 1920); western Mediterranean, Estepona Basin, Spain (Landau *et al.*, 2004); central Mediterranean, Italy (Tabanelli *et al.*, 2011). Upper Pliocene: North Sea Basin, Red Crag, England (Harmer, 1920); Atlantic, Mondego Basin, Portugal (NHMW coll.); central Mediterranean, Italy (Tabanelli *et al.*, 2011; Brunetti & Vecchi, 2012). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1914; Garilli & Parrinello, 2014); eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Upper Pleistocene: North Sea Basin, The Netherlands (Raad *et al.*, 2013), Denmark (Petersen, 2004); Atlantic, England, Ireland (Harmer, 1920). Plio-Pleistocene: Strait of Sicily, Italy (Amati *et al.*, 2024). Present-day: Atlantic, Barents Sea (Nekhaev, 2013), northern Norway, southwards to Morocco (Fretter & Graham, 1978; Gofas & Warén, 1982; Gofas, 2007; J.D. Oliver, 2022), entire Mediterranean (Gofas & Warén,

1982; van Aartsen, 1982; Bogi *et al.*, 1984a; Giannuzzi-Savelli *et al.*, 1997; Scaperrotta *et al.*, 2010, 2019; Bitlis & Öztürk, 2017; Gofas & J.D. Oliver in Gofas *et al.*, 2011; Garilli & Parrinello, 2014).

***Alvania* sp. '*A. scabra* complex' sensu Amati *et al.*, 2020a**

Plate 19, fig. 1

Material and dimensions – Height 3.1 mm. **VQ:** NHMW 2024/0206/0136 (1). **VC:** NHMW 2024/0206/0068 (1).

Description – Shell small, of medium thickness, slender weakly pagodiform, with elevated spire. Protoconch tall, paucispiral, of 1.8 convex whorls, with small, flattened nucleus; surface abraded (no microsculpture preserved) ($dp = 390\ \mu\text{m}$, $hp = 420\ \mu\text{m}$, $dp/hp = 0.93$, $dn = 100\ \mu\text{m}$, $dV1 = 210\ \mu\text{m}$). Junction with teleoconch sharply delimited by scar. Teleoconch of 3.75 angular whorls. First whorl bearing 17 narrow axial ribs and two spiral cords at protoconch/teleoconch junction, adapical strongest delimiting broad, flattened subsutural ramp, abapical placed mid-way between shoulder cord and suture; small, pointed tubercles developed at sculptural intersections. On second whorl, third spiral appears just above suture, so that subsequent whorls have very coarsely cancellate sculpture. Suture narrowly impressed, linear. Surface bearing microsculpture of fine crowded threads over entire surface.

Last whorl 58% of total height, with wide, steep, flattened subsutural ramp, angled at shoulder, bearing two spirals above level of insertion of outer lip, plus two further cords over base. Aperture ovate, peristome complete, smooth within, outer lip narrowly thickened.

Discussion – Unfortunately, this species is represented by very few specimens and the protoconch microsculpture is not preserved. It belongs to the *Alvania scabra* complex (sensu Amati *et al.*, 2020a). It is most similar to the extant *Alvania pizzinii* Amati, Smriglio & Oliverio, 2020a recently described from the Central Tyrrhenian Sea, but differs in its slender profile, in having three instead of four cords on the penultimate whorl, in hav-

ing only three instead of five cords over the base, and *A. pizzinii* lacks the fine spiral microsculpture seen in the Estepona species (see Amati *et al.*, 2020a, fig. 17F vs Pl. 19, fig. 1c; *hoc opus*). It is also similar to the Italian Pliocene *Alvania maurizioi* Chirli, 2006, in its slender somewhat pagodiform outline with a wide subsutural ramp without spiral sculpture. However, *A. maurizioi* again has a greater number of spiral cords on the last whorl (8), of which three above the aperture vs five in the Estepona species of which two are above the aperture.

Moreover, in the Estepona species the outer lip is smooth, whereas in *A. maurizioi* it is denticulate or lirate. Lastly, the Estepona species differs from both *A. pizzinii* and *A. maurizioi* in that in these two species the two cords at the protoconch/teleoconch junction are of equal strength, whereas in the Estepona species the adapical cord delimiting the subsutural ramp is far stronger.

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Alvania seanlandaui* Landau, Marquet & Grigis, 2004**

Plate 20, fig. 1; Plate 31, fig. 18

*2004 *Alvania seanlandaui* Landau, Marquet & Grigis, p. 43, pl. 8, fig. 3.

Material and dimensions – Holotype; IRScNB IST No. 6590, height, 2.44 mm, width 1.36 mm. **CO:** NHMW 2024/0206/0075 (6). **VQ:** NHMW 2024/0206/0087 (4). **VC:** NHMW 2024/0206/0072 (1), NHMW 2024/0206/0073 (2).

Description – see Landau *et al.* (2004, p. 43). Protoconch measurements: $dp = 380\ \mu\text{m}$, $hp = 355\ \mu\text{m}$, $dp/hp = 1.07$, $dn = 140\ \mu\text{m}$, $dV1 = 290\ \mu\text{m}$ [$dp = 367\ \mu\text{m}$, $dn = 149\ \mu\text{m}$, $dV1 = 285\ \mu\text{m}$; Landau *et al.*, 2004, p. 43].

Discussion – The specimen illustrated herein is in better condition than the holotype. The protoconch is paucispiral, just over 1.5 whorls, with a sculpture (described below) similar to that of *Alvania tomentosa* (Pallary, 1920)

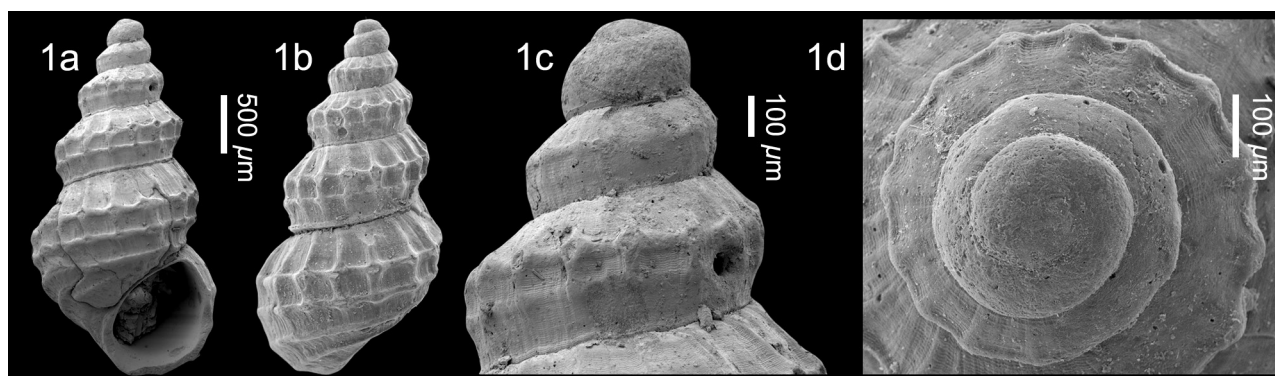


Plate 19. *Alvania* sp. '*A. scabra* complex' sensu Amati *et al.*, 2020a; 1. NHMW 2024/0206/0068, height 3.1 mm, width 1.6 mm, c, d, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

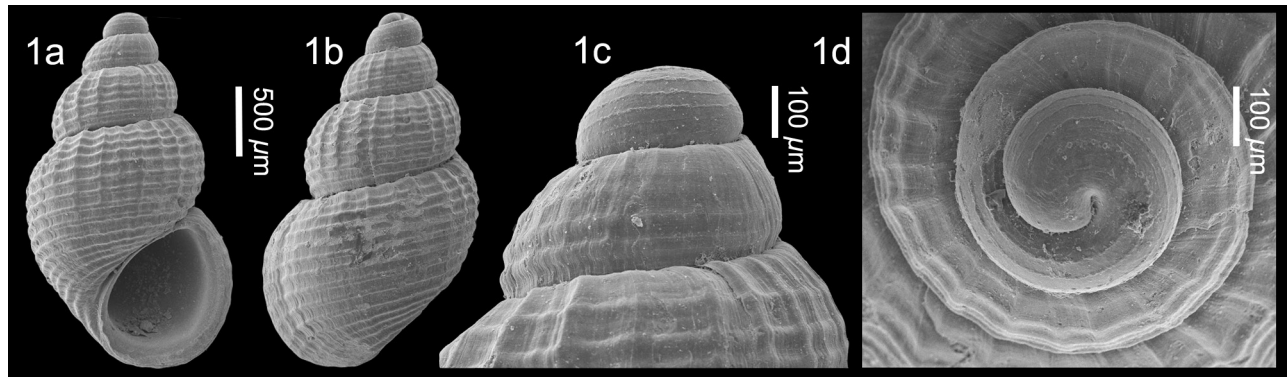


Plate 20. *Alvania seanlandaui* Landau, Marquet & Grigis, 2004; 1. NHMW 2024/0206/0072, height 2.6 mm, width 1.5 mm, c, d, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

(c.f., Pl. 25, figs 1-2; *hoc opus*), however the teleoconch is quite different between these two species. The teleoconch sculpture of close-set cords and ribs of roughly equal strength forming a dense reticulate pattern is similar to that seen in several European species, i.e., *Alvania geryonia* (Nardo, 1847), *A. beani* (Hanley in Thorpe, 1844), *A. cimicoides* (Forbes, 1844) and some varieties of *A. testae* (Aradas & Maggiore, 1844) (see Bouchet & Warén, 1993, figs 1404-1405), however, the protoconch is quite different from any of these.

Alvania seanlandaui Landau, Marquet & Grigis, 2004, has a teleoconch very similar to that of *Alvania parvula* (Jeffreys, 1884), both in outline and in the types of sculpture (axial and spiral). It differs essentially for the protoconch with larger diameters, both of the nucleus: 140-149 µm vs 115 µm and of the 1st whorl: 285-290 µm vs 235 µm; it also has a greater height: 355 µm vs 300 µm. Sculpted by pustules more or less welded together forming 6-7 well-spaced spiral cordlets vs 9-10 thin cordlets fragmented by tubercles. The shell size is slightly larger 2.4-2.6 mm high vs 1.7-2.2 mm. It is rather uncommon in the Estepona assemblages.

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (Landau *et al.*, 2004).

Alvania subareolata Monterosato, 1869

Plate 21, fig. 1

- *1869 *Alvania subareolata* Monterosato, p. 9, pl. 1, fig. 3.
- 1920 *Rissoa (Alcidia) ignorata* Monterosato in Pallary, p. 51, figs 25, 26.
- 1980 *Alvania subareolata* Monterosato, 1869 – Melone & Sabelli, p. 364, fig. 6.
- 1984 *Alvania subareolata* Monterosato, 1869 – Van Aartsen *et al.*, p. 24, 112, fig. 101.
- 1991 *Alvania trinacriae* Oberling, 1970 – Moolenbeek *et al.*, p. 115, fig. 7; p. 119, fig. 18.
- 1997 *Alvania (Alvania) subareolata* (Monterosato, 1869) [*sic*] – Giannuzzi Savelli *et al.*, p. 112, 113, figs 472, 473.

- 2011 *Alvania subareolata* Monterosato, 1869 – Gofas & Oliver, p. 187, right figure.
- 2018 *Alvania subareolata* Monterosato, 1869 – Appoloni *et al.*, p. 47, 106, figs 16L, M.
- 2023 *Alvania subareolata* Monterosato, 1869 – Tisselli & Micali, p. 159, figs 1D-F.
- non 1997 *Alvania subareolata* Monterosato, 1869 – Giannuzzi-Savelli *et al.*, p. 112, 113, fig. 474 only [= *Alvania skylla* Tisselli & Micali, 2023].
- non 1999 *Alvania subareolata* Monterosato, 1869 – Gofas, p. 90, figs 48-49 [= *Alvania skylla* Tisselli & Micali, 2023].
- non 2010 *Alvania subareolata* Monterosato, 1869 – Scaperrotta *et al.*, p. 57, figures unnumbered [= *Alvania skylla* Tisselli & Micali, 2023].
- non 2011 *Alvania subareolata* Monterosato, 1869 – Gofas & Oliver, p. 187, left figure [= *Alvania skylla* Tisselli & Micali, 2023].

Material and dimensions – Height 3.1 mm. **VC:** NHMW 2024/0206/0069 (1).

Description – Shell small, of medium thickness, slender rissoiform, with elevated spire. Protoconch paucispiral, just over 1.5 convex whorls, with large, elevated nucleus; bearing sculpture of granules roughly arranged in about six rows of broad, flattened cords, tending to be irregularly scattered near the protoconch-teleoconch junction (dp = 410 µm, hp = 335 µm, dp/hp = 1.22, dn = 160 µm, dV1 = 315 µm). Junction with teleoconch sharply delimited by scar and beginning of adult sculpture. Teleoconch of 3.75 convex whorls. First whorl bearing 14 weakly opisthocline narrow axial ribs and two elevated spiral cords of equal strength at protoconch/teleoconch junction. Third primary spiral appears mid subsutural ramp on third whorl so that subsequent whorls have very coarsely cancellate sculpture; tiny, pointed tubercles developed at sculptural intersections. Suture narrowly impressed, linear. Surface bearing microsculpture of fine crowded threads over entire surface. Last whorl 58% of total height, strongly convex, slightly depressed at base, bearing 16 ribs and three spirals above level of the insertion of the outer lip, plus

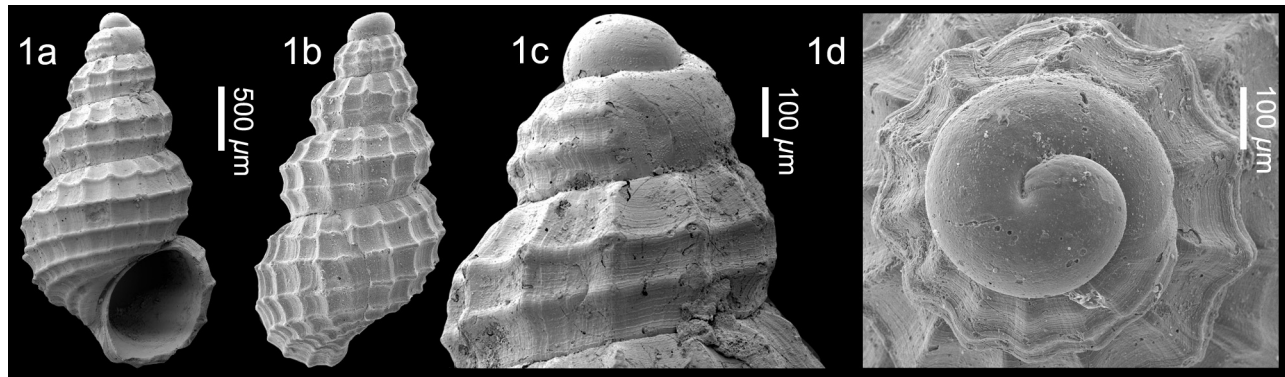


Plate 21. *Alvania subareolata* Monterosato, 1869; 1. NHMW 2024/0206/0069, height 2.8 mm, width 1.5 mm, c, d, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

four cords over base. Aperture ovate, peristome complete, smooth within, outer lip narrowly thickened.

Discussion – This species is represented by a single specimen, but it is almost perfectly preserved. The specimen represents an intermediate form between typical *Alvania subareolata* Monterosato, 1969 and *Alvania skylla* Tisselli & Micali, 2023, which was already recognised by Tisselli & Micali (2023) as a western Mediterranean form of *Alvania subareolata*. Tisselli & Micali (2023, p. 162) tabulated the main differences between the two forms and their new species. In summary, the western Mediterranean forms are larger (2.08–2.7 vs 1.85–2.38 mm height), with a slightly larger aperture (63–67% vs 52–64% of last whorl height), the outer lip varix is more strongly developed, and the protoconch lower (257–314 µm vs 329–357 µm). The Estepona specimens agrees with the western Mediterranean form in being large (2.8 mm height), with a relatively large aperture. *Alvania skylla* differs in being smaller shelled (1.55–2.08 mm height), with more angular teleoconch whorls with pointed tubercles developed at sculptural intersections.

Similar also to species of the *Alvania scabra* complex (*sensu* Amati *et al.*, 2020a) and is indeed more like *A. scabra* (Philippi, 1844) but differs in its protoconch microsculpture of a dozen parallel rows of rounded to broadly triangular microtubercles, sometimes fused, and occasional spiral threads in the interspaces (see Amati *et al.*, 2020a, figs 15B, 15B1). The spiral teleoconch microsculpture is also seen in *A. scabra* (see Amati *et al.*, 2020a, figs 15B, 15C).

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: central Mediterranean (Monterosato, 1869; Appolloni *et al.*, 2018).

***Alvania testae* (Aradas & Maggiore, 1844)**

Plate 22, fig. 1; Plate 31, fig. 19

- 1836 *Rissoa reticulata* Philippi, p. 156, pl. 10, fig. 14
(*non Rissoa reticulata* G. B. Sowerby I, 1833).

- *1844 *Rissoa testae* Aradas & Maggiore, p. 207.
1850 *Rissoa abyssicola* Forbes in Forbes & Hanley, p. 86.
1870 *Rissoa abyssicola* var. *coniformis* Jeffreys, p. 77.
1878 *Alvania abyssicola* Forb., Jeff. – O.G. Sars, p. 176, pl. 10, figs 5a–5c.
1980 *Rissoa abyssicola* var. *conformis* Jeffreys, 1870 – Warén, p. 22 pl. 4 figs 2, 3 (lectotype).
1984 *Flemingia scalaris* var. *taurinusensis* Sacco, 1895 – Ferrero Mortara *et al.*, p. 218, pl. 40, fig. 1.
1985 *Alvania (Alvania) testae* (Aradas and Maggiore) – Ponder, p. 137, figs 88A, B.
1991 *Alvania testae* (Aradas & Maggiore, 1843) – Poppe & Goto, p. 102, pl. 12, fig. 18.
1992 *Alvania (Alvania) testae* (Aradas & Maggiore, 1844) – Cavallo & Repetto, p. 52, fig. 078.
1993 *Alvania testae* (Aradas & Maggiore, 1844) – Bouchet & Warén, p. 628, figs 1386–1387, 1400–1405.
1993 *Alvania testae* (Aradas & Maggiore, 1844) – Oliverio *et al.*, 1993, p. 255, pl. 1, figs 1–3.
1994 *Alvania (Alvania) testae* (Aradas & Maggiore, 1844) – Bernasconi & Robba, p. 96, 97, pl. 2, figs 3, 4, pl. 3, fig. 1.
1996 *Alvania testae* (Aradas & Maggiore, 1844) – Warén, p. 222, fig. 18E.
1997 *Alvania testae* (Aradas & Maggiore, 1843 [*sic*]) – Giribet & Peñas, p. 63, pl. 3, fig. 7.
1997 *Alvania (Alvania) testae* (Aradas & Maggiore, 1844) – Giannuzzi-Savelli *et al.*, p. 104, figs 413–416.
2004 *Alvania testae* (Aradas & Maggiore, 1844) – Öztürk *et al.*, p. 69, fig. 5.
2004 *Alvania testae* (Aradas & Maggiore, 1844) – Landau *et al.*, p. 43, pl. 9, fig. 1.
2006 *Alvania testae* (Aradas & Maggiore, 1844) – Chirli, p. 35, pl. 17, figs 9–16.
2011 *Alvania testae* (Aradas y Maggiore, 1844) – Gofas & J.D. Oliver in Gofas *et al.*, p. 188, 2 unnumbered figures.
2011 *Alvania testae* (Aradas & Maggiore, 1844) – Tabanelli *et al.*, p. 45, fig. 23.
2011 *Alvania testae* (Aradas & Maggiore, 1884 [*sic*]) – Chirli & Linse, p. 83, pl. 24, figs 1a–1e.

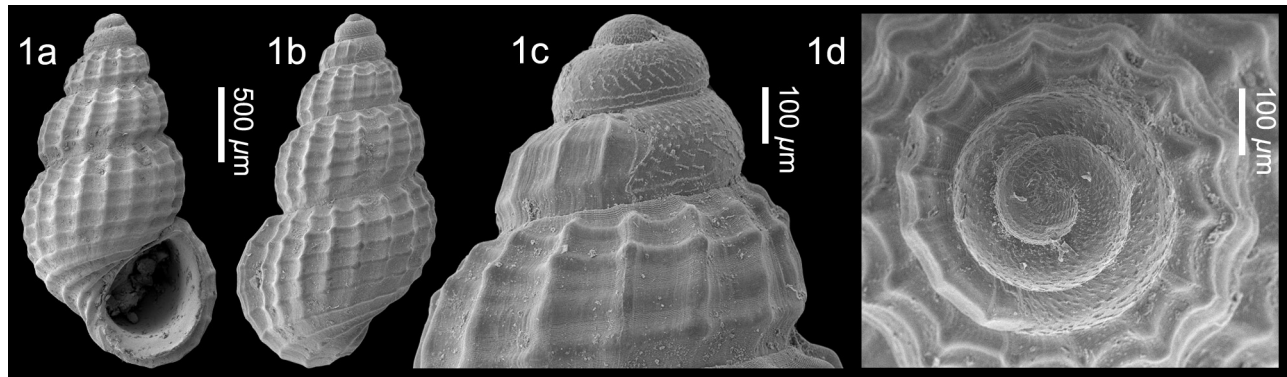


Plate 22. *Alvania testae* (Aradas & Maggiore, 1844); 1. NHMW 2024/0206/0032, height 2.4 mm, width 1.3 mm, c, d, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

- 2012 *Alvania testae* (Aradas & Maggiore, 1844) – Scaperrotta *et al.*, p. 58, 5 unnumbered figs.
 2014 *Alvinia? testae* (Aradas & Maggiore, 1844) – Garrilli & Parrinello, p. 381, 400, 404, figs 8A-B.
 2016 *Alvania testae* (Aradas & Maggiore, 1844) – Negri & Corselli, p. 61, pl. 13, figs j-l.
 2017 *Alvania testae* (Aradas & Maggiore, 1844) – Bitlis-Bakir & Öztürk, p. 404, figs 5K-L.
 2018 *Alvania testae* (Aradas & Maggiore, 1844) – Chimienti *et al.*, p. 198, fig. 1K.
 2019 *Alvania testae* (Aradas & Maggiore, 1844) – Scaperrotta *et al.*, p. 145, pl. 6M.
 2020 *Alvania testae* (Aradas & Maggiore, 1844) – Alf *et al.*, p. 117, pl. 97.
 2021 *Alvania testae* (Aradas & Maggiore, 1844) – Chirli & Forli, p. 180, pl. 144, figs C1-5, pl. 145, figs A1-18, pl. 146, figs A1-22, pl. 147, figs A1-7.
 2022 *Alvania testae* (Aradas & Maggiore, 1844) – J.D. Oliver *et al.*, p. 12, figs 5e-g.
 2024 *Alvania testae* (Aradas & Maggiore, 1844) – Amati *et al.*, p. 31, fig. 9B.

Material and dimensions – Average height 2.5 mm. **CO:** NHMW 2024/0206/0031 (1), **VC:** NHMW 2024/0206/0032 (1), NHMW 2024/0206/0033 (50+). **PQ:** NHMW 2024/0206/0034 (25).

Description – see Landau *et al.* (2004, p. 43). Protoconch measurements: dp = 375 µm, hp = 335 µm, dp/hp = 1.12, dn = 80 µm, dV1 = 160 µm [dp = 331 µm, dn = 47 µm, dV1 = 119 µm; Landau *et al.*, 2004, p. 44].

Discussion – The teleoconch of *Alvania testae* (Aradas & Maggiore, 1844) is similar to that of *Alvania subsoluta* (Aradas, 1847), although the latter is usually smaller, with finer sculpture, however the protoconchs are quite distinct. The larval shell of *A. testae* has 2.5 whorls with a strong sculpture, whereas that of *A. subsoluta* only has 1.5 smooth whorls. Bouchet & Warén (1993, p. 630) described the protoconch of *A. testae* as consisting of almost two whorls (although their figures 1386-1387 clearly show a protoconch of over two whorls), whereas ours have 2.5 whorls. This is a deeper water species, living at

100-200 m, rarely up to 2400 m depth (Bouchet & Warén, 1993, p. 629). In Estepona it is found almost exclusively in the deeper water deposits.

Ferrero Mortara *et al.* (1984, pl. 40, fig. 1) published a SEM photograph of *Flemingia scalaris* var. *taurinensis* Sacco, 1895. Both the protoconch and teleoconch characteristics are those of *A. testae*, of which we consider this a synonym.

Distribution – Middle Miocene: central Proto-Mediterranean, Italy (Sacco, 1895). Lower Pliocene: western Mediterranean, Estepona Basin, Spain (Landau *et al.*, 2004); central Mediterranean, Italy (Chirli, 2006). Upper Pliocene: central Mediterranean, Italy (Oliverio *et al.*, 1993; Bernasconi & Robba, 1994; Cavallo & Repetto, 1992; Tabanelli *et al.*, 2011). Lower Pleistocene: central Mediterranean, Italy (Mancini, 2003; Chirli, 2006; Chirli & Forli, 2021); eastern Mediterranean, Rhodes Island (Chirli & Linse, 2011). Plio-Pleistocene: Strait of Sicily, Italy (Amati *et al.*, 2024). Present-day: Atlantic, Norway, southwards to Morocco, 100-200 m depth (Bouchet & Warén, 1993; J.D. Oliver *et al.*, 2022), entire Mediterranean (Giribet & Peñas, 1997; Giannuzzi-Savelli *et al.*, 1997; Öztürk *et al.*, 2004; Gofas & J.D. Oliver in Gofas *et al.*, 2011; Scaperrotta *et al.*, 2012, 2019; Negri & Corselli, 2016; Bitlis-Bakir & Öztürk, 2017; Alf *et al.*, 2020). Throughout the Mediterranean, commonly in 100–800 m, more rarely in shallower (e.g., 36 m, in northern localities) or deeper (e.g., 2400 m). It is not known from the Faroes or Iceland (Bouchet & Warén, 1993, p. 629; Warén, 1996, p. 222).

***Alvania thalia* De Stefani & Pantanelli, 1878**

Pl. 23, figs 1-7; Plate 31, fig. 20

- *1878 *Alvania Thalia* De Stefani & Pantanelli, p. 172.
 1888 *Alvania Thalia* De St. et Pant. – De Stefani, p. 230, pl. 11, figs 36, 37.
 1895 *Alvania (Alvaniella) Thalia* (De Stef. e Pant.) – Sacco, p. 25.
 1895 *Alvania (Alvaniella) Thalia* var. *exbrevis* Sacco, p. 25, pl. 1, fig. 59.
 1895 *Alvania (Alvaniella) Thalia* var. *subaciculata*

Sacco, p. 26, pl. 1, fig. 59.
1994 *Alvania (Alvania) thalia* De Stefani & Pantanelli, 1880 [sic] – Bernasconi & Robba, p. 77 (*partim*), pl. 3, fig. 4 (only) (not figs 2-3).

2006 *Alvania thalia* De Stefani & Pantanelli, 1878 – Chirli, p. 36, pl. 18, figs 1-9.
2021 *Alvania thalia* De Stefani & Pantanelli, 1878 – Chirli & Forli, p. 181, pl. 147, figs B1-13.

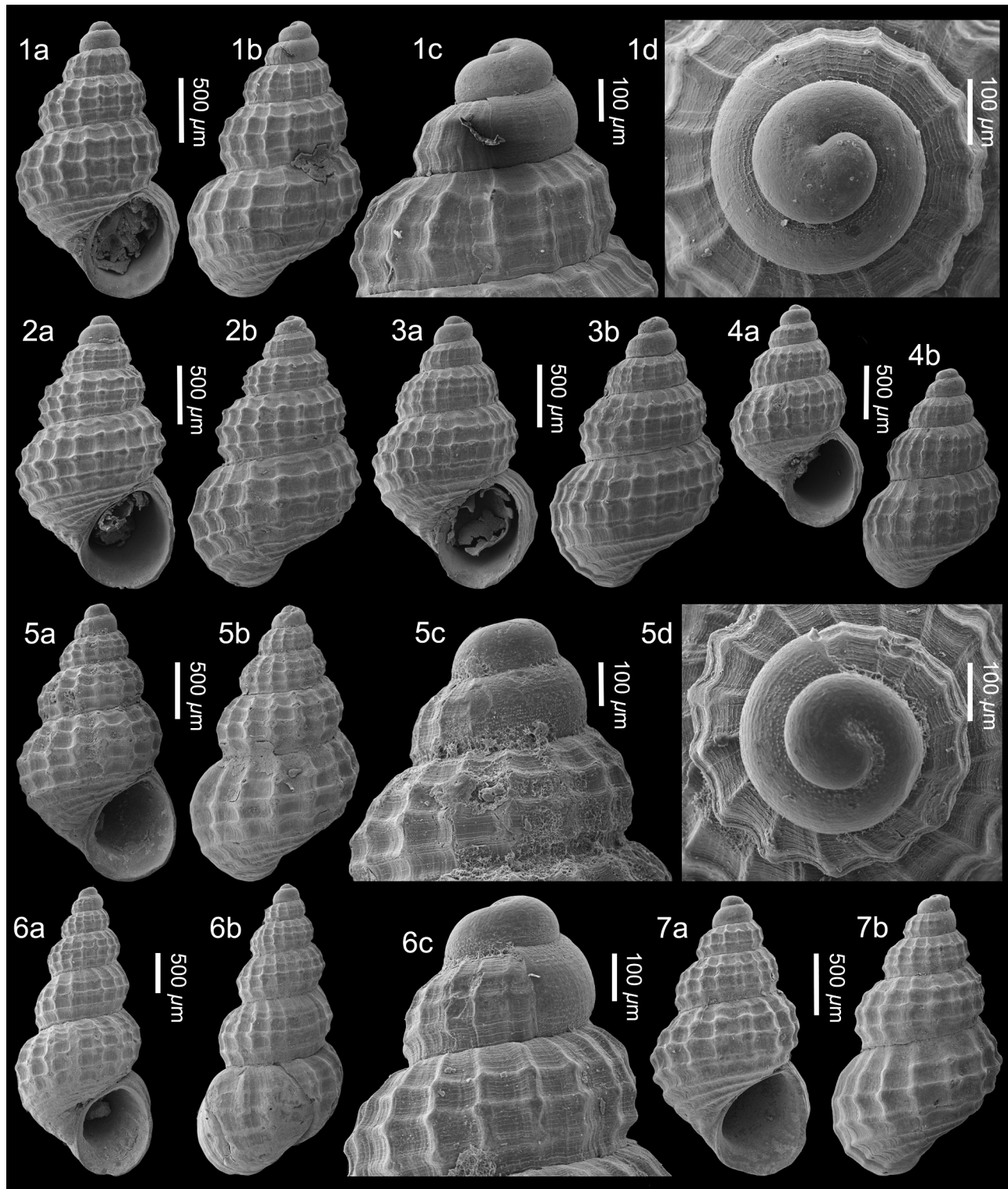


Plate 23. *Alvania thalia* De Stefani & Pantanelli, 1878; 1. NHMW 2024/0206/0098, height 2.1 mm, width 1.2 mm, c, d, detail of protoconch; 2. NHMW 2024/0206/0099, height 2.3 mm, width 1.3 mm; 3. NHMW 2024/0206/0100, height 2.2 mm, width 1.3 mm; 4. NHMW 2024/0206/0101, height 2.1 mm, width 1.2 mm; 5. NHMW 2024/0206/0102, height 2.5 mm, width 1.4 mm, c, d, detail of protoconch; 6. NHMW 2024/0206/0103, height 3.6 mm, width 1.8 mm, c, detail of protoconch; 7. NHMW 2024/0206/0104, height 2.3 mm, width 1.3 mm (SEM images). El Lobillo, Estepona, Upper Zanclean, Lower Pliocene.

Material and dimensions – Height 1.9 mm. **EL:** NHMW 2024/0206/0098-0101 (4), NHMW 2024/0206/0094 (50+). **CO:** NHMW 2024/0206/0102-0104 (3), NHMW 2024/0206/0097 (50+). **VQ:** NHMW 2024/0206/0134 (10). **VC:** NHMW 2024/0206/0035 (1).

Description – Shell small, medium-thickness, rissoi-form, imperforate, with relatively high spire. Protoconch paucispiral, two convex whorls, with large nucleus, microsculpture of close-set spiral rows of coalescent pustules ($dp = 345\text{--}430\ \mu\text{m}$, $hp = 305\text{--}380\ \mu\text{m}$, $dp/hp = 1.06\text{--}1.13$, $dn = 100\text{--}120\ \mu\text{m}$, $dV1 = 205\text{--}215\ \mu\text{m}$). Transition to teleoconch delimited by scar and beginning of adult sculpture. Teleoconch of three convex whorls separated by narrowly impressed suture. Spire whorls convex, sculptured by 13-14 narrow orthocline later weakly prosocline ribs, about one-third width of their interspaces, two spiral cords at P/T boundary, third cord appears above suture half whorl later, cords about half width of their interspaces, forming horizontally elongated reticulated sculpture with small, rounded tubercles formed at intersections, ribs slightly dominant. No microsculpture present. Last whorl 66% of total height, strongly convex bearing 16 weakly prosocline ribs, five cords at and above level insertion of outer lip, four further cords over base; ribs weaken rapidly over base. Aperture ovate, peristome complete, sharply delimited from base. Outer lip orthocline, thickened by broad labial varix, bearing about ten elongated denticles starting short distance behind peristome; anal sinus rounded, weakly developed.

Discussion – As noted by Chirli (2006), *Alvania thalia* De Stefani & Pantanelli, 1878 is a somewhat variable species, especially in regard to the number and strength of the spirals. The teleoconch of the specimens from Estepona fit within the variability illustrated by Chirli (2006, pl. 18, figs 1-9; especially figs 8, 9). The protoconch is 0.2 whorls larger than Chirli's specimen (2006, pl. 18, fig. 4), but the microsculpture is identical. We note that some of the specimens illustrated by Bernasconi & Robba (1994, pl. 3, figs 2, 3) are probably not this species.

Alvania thalia is extremely common in the Estepona assemblages.

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1895; Bernasconi & Robba, 1994; Chirli, 2006).

Alvania tiberiana (Coppi, 1876)

Plate 24, figs 1-3; Plate 31, fig. 21

- 1862 *Rissoa tuba* Doderlein, p. 17 (*nomen nudum*).
- *1876 *Rissoa Tiberiana* Coppi, p. 201.
- 1895 *Galeodinopsis tiberiana* (Coppi) – Sacco, p. 28, pl. 1, fig. 67.
- 1895 *Galeodinopsis tiberiana* var. *percrassica* Sacco, p. 28, pl. 1, fig. 68.

- 1921 *Galeodinopsis Tiberiana* Coppi – Cossmann, p. 23, pl. 1, figs 55, 56.
- 1938 *Galeodinopsis tiberiana* (Coppi) – Wenz, p. 616, fig. 1715.
- 1990 *Manzonella fariai* Rolán & Fernandes, p. 64, pl. 1, figs 4-6.
- 1994 *Alvania (Alvania) tiberiana* (Coppi, 1876) – Bernasconi & Robba, p. 77, pl. 4, figs 1, 2.
- 1999 *Alvania fariai* (Rolán & Fernandes, 1990) – Gofas, p. 88, figs 39-42.
- 2004 *Alvania fariai* (Rolán & Fernandes, 1990) – Landau *et al.*, p. 41, pl. 7, figs 3, 4.
- 2006 *Alvania tiberiana* (Coppi, 1876) – Chirli, p. 37, pl. 18, figs 10-12.
- 2008 *Galeodinopsis tiberiana* (Coppi, 1876) – Garilli, p. 43, figs 81-99.
- 2010 *Galeodinopsis tiberiana* (Coppi, 1876) – Sosso & Dell'Angelo, p. 21, p. 32 mid-row centre unnumbered fig.
- 2011 *Galeodinopsis tiberiana* (Coppi, 1876) – Tabanelli *et al.*, p. 49, fig. 35.
- 2014 *Galeodinopsis tiberiana* (Coppi, 1876) – Garilli & Parrinello, p. 396, figs 2A, B, 14A-C, F, G.
- 2014 *Galeodinopsis cf. tiberiana* (Coppi, 1876) – Garilli & Parrinello, p. 398, figs 14D, E, 15.
- 2018 *Alvania tiberiana* (Coppi, 1876) – Landau *et al.*, p. 271, pl. 99, fig. 1.
- 2021 *Galeodinopsis fariai* (Rolán & Fernandes, 1990) – Chirli & Forli, p. 195, 404, pl. 159, figs B1-9.
- 2021 *Galeodinopsis tiberiana* (Coppi, 1876) – Chirli & Forli, p. 195, 405, pl. 159, figs A1-18.

Material and dimensions – Average height, 2.8 mm. **EL:** NHMW 2024/0206/0036 (50+). **CO:** NHMW 2024/0206/0037 (26). **VQ:** NHMW 2024/0206/0088 (10). **VC:** NHMW 2024/0206/0038-0040 (3), NHMW 2024/0206/0041 (13). **PQ:** NHMW 2024/0206/0078 (1).

Description – see Landau *et al.* (2004, p. 41). Protoconch measurements: $dp = 385\text{--}445\ \mu\text{m}$, $hp = 330\text{--}375\ \mu\text{m}$, $dp/hp = 0.99\text{--}1.17$, $dn = 65\text{--}75\ \mu\text{m}$, $dV1 = 140\text{--}160\ \mu\text{m}$ [$dp = 380\ \mu\text{m}$, $dn = 78\ \mu\text{m}$, $dV1 = 166\ \mu\text{m}$; Landau *et al.*, 2004, p. 41].

Discussion – *Alvania tiberiana* (Coppi, 1876) is characterised by its strongly convex whorls, inflated last whorl, open cancellate sculpture, strong varix often present on the last whorl, and double rimmed outer lip. Unfortunately, the Estepona specimens are slightly abraded, and the fine protoconch microsculpture illustrated by Garilli (2008, figs 95-97) is not preserved in the specimens illustrated herein. The specimen illustrated by Landau *et al.* (2004, pl. 7, fig. 3e) does show remnants of microsculpture on the first protoconch whorl. The fine spiral teleoconch microsculpture between the cords illustrated by that author Garilli (2008, figs 96, 98) can be seen (Pl. 24, fig. 1c) and in Landau *et al.* (2004, pl. 7, fig. 3g).

Landau *et al.* (2004, p. 41) identified specimens from the Upper Pliocene of the Estepona Basin as *Alvania fariai*

(Rolán & Fernandes, 1990), which was synonymised with *A. tiberiana* by Garilli (2008) and Garilli & Parrinello (2014). Garilli (2008) used the genus *Galeodiniopsis* Sacco, 1895 for this species. Although we do not believe *Alvania* to be monophyletic, we await molecular genetic data before assigning genera. This and the record of Doderlein's material given by Garilli (2008) are the only Miocene records we can find.

This species is rather variable. Typical forms with a strong varix opposite the aperture on the last whorl occur (Landau *et al.*, 2004, pl. 7, fig. 4; Pl. 24, fig. 1, *hoc opus*) similar to that illustrated by Garilli & Parrinello (2014, figs 14A-C) together with what those authors called galeodinimorph forms (Pl. 24, figs 2-3), also figured by those authors (2014, Figs 14D, E).

In Estepona this species is found in most assemblages, although never common. The living *A. fariyai*, now con-

sidered a synonym, is found in depths of 40-250 m (Gofas, 1999, p. 88).

Distribution – Upper Miocene: Atlantic (Tortonian), NW France (Landau *et al.*, 2018); central Proto-Mediterranean (Tortonian), Italy (Garilli, 2008; Garilli & Parrinello, 2014). Lower Pliocene: western Mediterranean, Estepona Basin, southern Spain (Landau *et al.*, 2004), northeastern Spain (NHMW coll.); central Mediterranean, Italy (Sacco, 1895; Bernasconi & Robba, 1994; Chirli, 2006; Garilli, 2008; Sosso & Dell'Angelo, 2010; Tabanelli *et al.*, 2011; Garilli & Parrinello, 2014). Upper Pliocene: Atlantic, Mondego Basin, Portugal (Garilli & Parrinello, 2014); central Mediterranean, Italy (Garilli, 2008; Garilli & Parrinello, 2014). Present-day: Atlantic: Mauritania to northern Angola (Rolán & Fernandes, 1990; Gofas, 1999; Garilli, 2008).

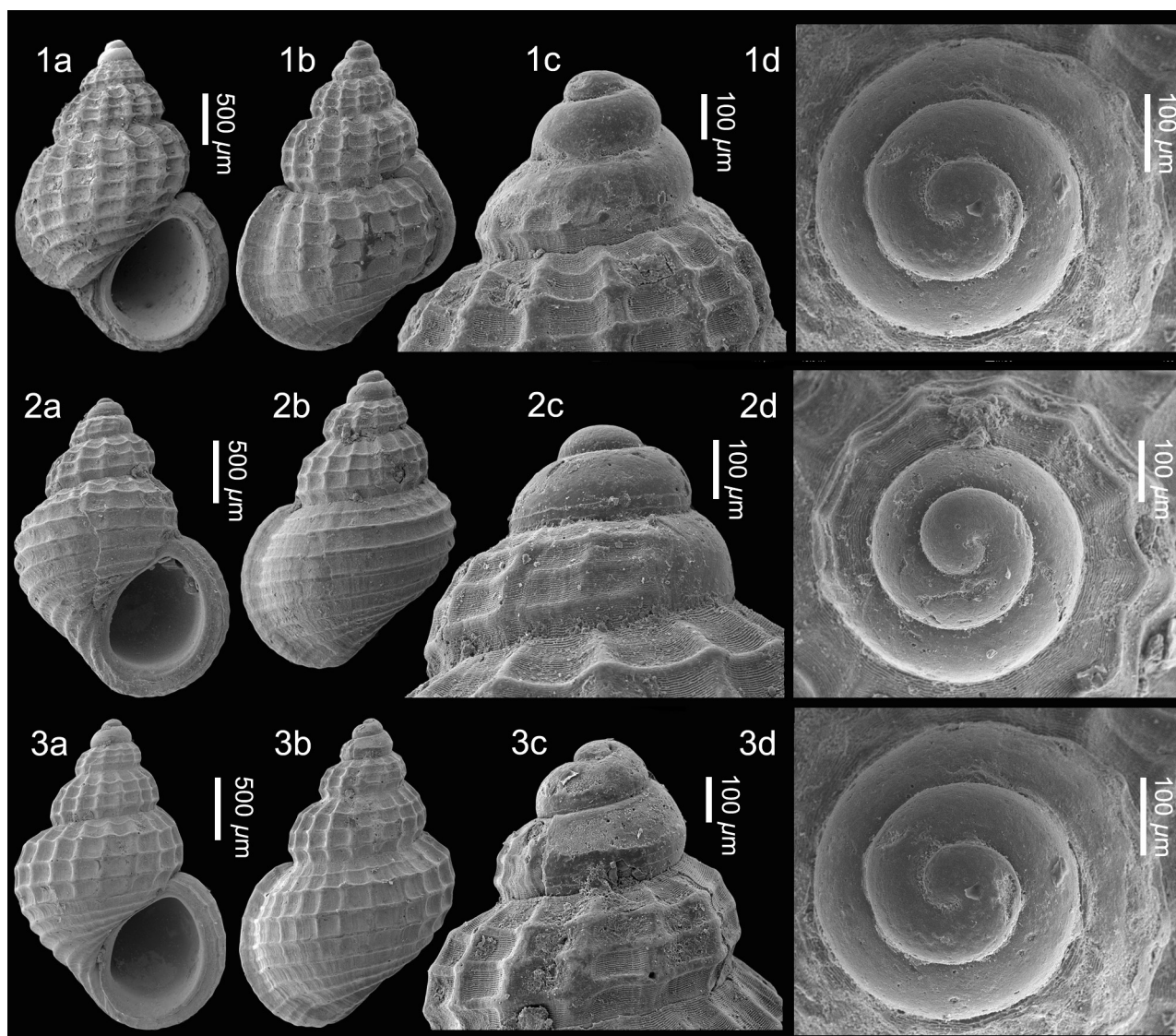


Plate 24. *Alvania tiberiana* (Coppi, 1876); 1. NHMW 2024/0206/0038, height 3.1 mm, width 2.1 mm, c, d, detail of protoconch; 2. NHMW 2024/0206/0039, height 2.4 mm, width 1.7 mm (subadult), c, d, detail of protoconch; 3. NHMW 2024/0206/0040, height 2.5 mm, width 1.6 mm (subadult), c, d, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

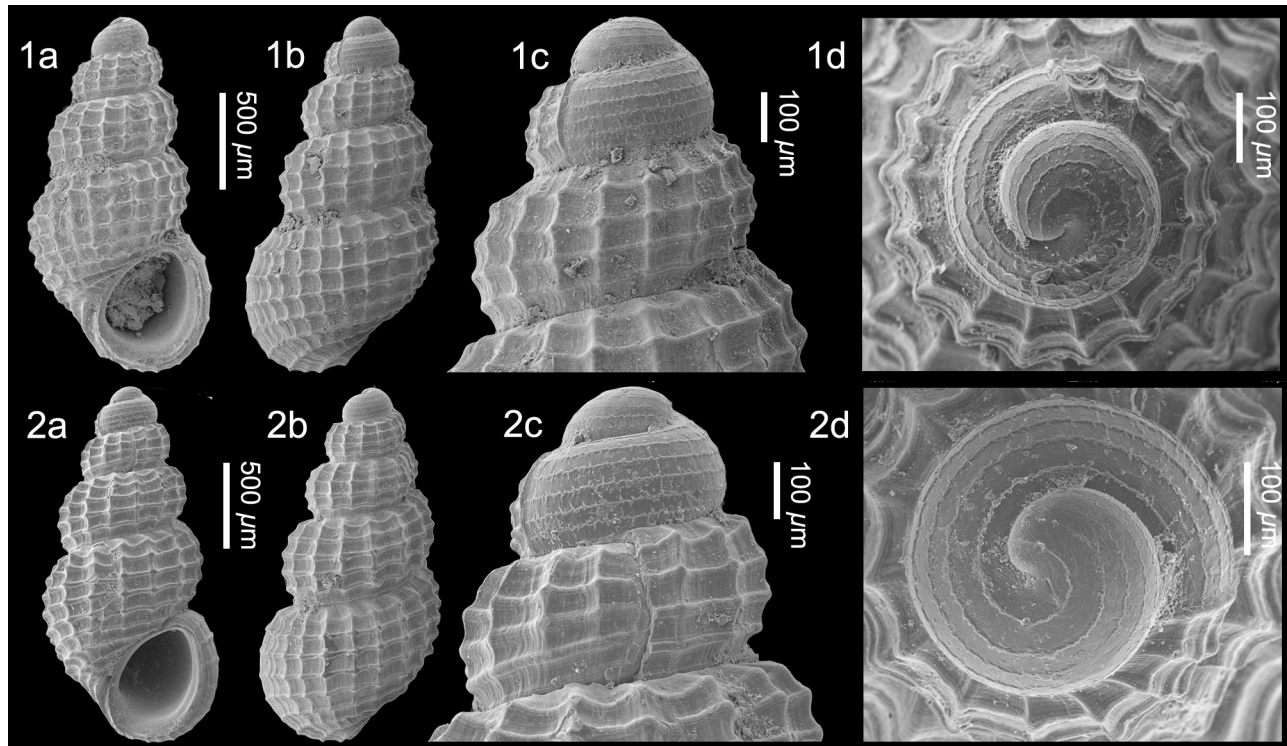


Plate 25. *Alvania tomentosa* (Pallary, 1920); 1. NHMW 2024/0206/0092, height 1.8 mm, width 1.0 mm, c, d, detail of protoconch (SEM images). Velerín conglomerates. 2. NHMW 2024/0206/0049, height 2.0 mm, width 1.0 mm, c, d, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

***Alvania tomentosa* (Pallary, 1920)**

Plate 25, figs 1-2; Plate 31, fig. 22

- 1902 *Rissoa tomentosa* Pallary, p. 18 (*nomen nudum*).
- *1920 *Rissoa (Alvania?) tomentosa* Pallary, p. 50, pl. 1 fig. 27.
- 1984 *Alvania altenai* Van Aartsen, Menkhurst & Gittenberger, p. 23, 24, 112, fig. 99.
- 1986 *Manzonina (Alvania) altenai* van Aartsen, Menkhurst & Gittenberger, 1984 – Oliverio *et al.*, p. 51, pl., fig. 3.
- 1993 *Alvania tomentosa* (Pallary, 1920) – Bouchet & Warén, p. 631, figs 1388-1389, 1406-1408.
- 2006 *Alvania tomentosa* (Pallary, 1920) – Peñas *et al.*, p. 87, figs 90-92.
- 2011 *Alvania tomentosa* (Pallary, 1920) – Gofas & J.D. Oliver in Gofas *et al.*, p. 186, 5 unnumbered figs.
- 2019 *Alvania tomentosa* (Pallary, 1920) – Scaperrotta *et al.*, p. 146, pl. 7D.
- 2021 *Alvania tomentosa* (Pallary, 1920) – Chirli & Forli, p. 182, pl. 148, figs A1-10.

Material and dimensions – Average height, 2.0 mm.
CO: NHMW 2024/0206/0092 (1). **VQ:** NHMW 2024/0206/0081 (1). **VC:** NHMW 2024/0206/0049 (1), NHMW 2024/0206/0050 (2).

Description – Shell very small, slender rissoiform, with elevated spire. Protoconch paucispiral, of just under 1.75 convex whorls, with large, elevated nucleus; surface bear-

ing six fine, irregularly cruciform spiral threads starting over nucleus ($dp = 360\text{--}390\ \mu\text{m}$, $hp = 280\text{--}345\ \mu\text{m}$, $dp/hp = 1.13\text{--}1.29$, $dn = 100\text{--}125\ \mu\text{m}$, $dV1 = 230\text{--}245\ \mu\text{m}$). Junction with teleoconch sharply delimited by elevated scar. Teleoconch of 3.5 convex whorls with periphery placed just below mid-whorl, separated by moderately deep linear suture. Horizontally elongate cancellate sculpture of four spiral cords at teleoconch junction overrunning narrow axial ribs; small, pointed tubercles formed at intersections. Five primary spirals on penultimate whorl overrunning 15 axial ribs. Last whorl 58% of total height, evenly convex, bearing six spirals above the level of the insertion of the outer lip, plus four further cords over base. Aperture ovate, peristome complete, outer lip slightly opisthocline, moderately thickened by varix, smooth within.

Discussion – These specimens undoubtedly represent *Alvania tomentosa* (Pallary, 1920). They are almost identical in both protoconch and teleoconch characters to present-day specimens illustrated by Bouchet & Warén (1999, figs 1388-1389, 1406-1408). It is very uncommon in the Estepona assemblages. Today, this is a deep water species found between 120-900 m depth (Bouchet & Warén, 1999, p. 631). This is the first fossil record for the species.

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (Landau *et al.*, 2004). Present-day: northwestern Spain to Ibero-Moroccan Gulf and northern Tyrrhenian Sea (Pallary, 1920; van Aartsen,

1984; Oliverio *et al.*, 1986; Bouchet & Warén, 1993; Peñas *et al.*, 2006; Gofas & J.D. Oliver in Gofas *et al.*, 2011; Scaperrotta *et al.*, 2019).

***Alvania vandervalki* nov. sp.**

Plate 26, figs 1-3; Plate 31, fig. 23

ZooBank registration – urn:lsid:zoobank.org:act:3045B6D0-ED02-4783-BAB7-F9880C1630B3

Type material – Holotype NHMW 2024/0206/0093, height 2.2 mm, width 0.9 mm. **Velerín quarry**. Paratype 1 NHMW 2024/0206/0095, height 2.0 mm, width 1.0 mm; paratype 2 NHMW 2024/0206/0056, height 2.4 mm, width 1.1 mm. **Velerín carretera**.

Other material – Known from type series only.

Type locality – Velerín quarry, Estepona, Spain.

Type stratum – Unnamed beds of uppermost Zanclean, Lower Pliocene.

Etymology – Named after Bert van der Valk (Deltares, Delft, The Netherlands) for his help with the geology of the Estepona deposits. *Alvania*, gender feminine.

Diagnosis – Small, slender, fragile *Alvania* species with protoconch of 1.5 convex whorls with fine micropustules, teleoconch of 3.25 convex whorls with extremely fine cancellate sculpture, 35 ribs crossed by seven cords on penultimate whorl, cords slight dominant.

Description – Shell very small, thin shelled, slender rissoiform, with elevated spire. Protoconch paucispiral, of just over 1.5 convex whorls, with large, elevated nucleus;

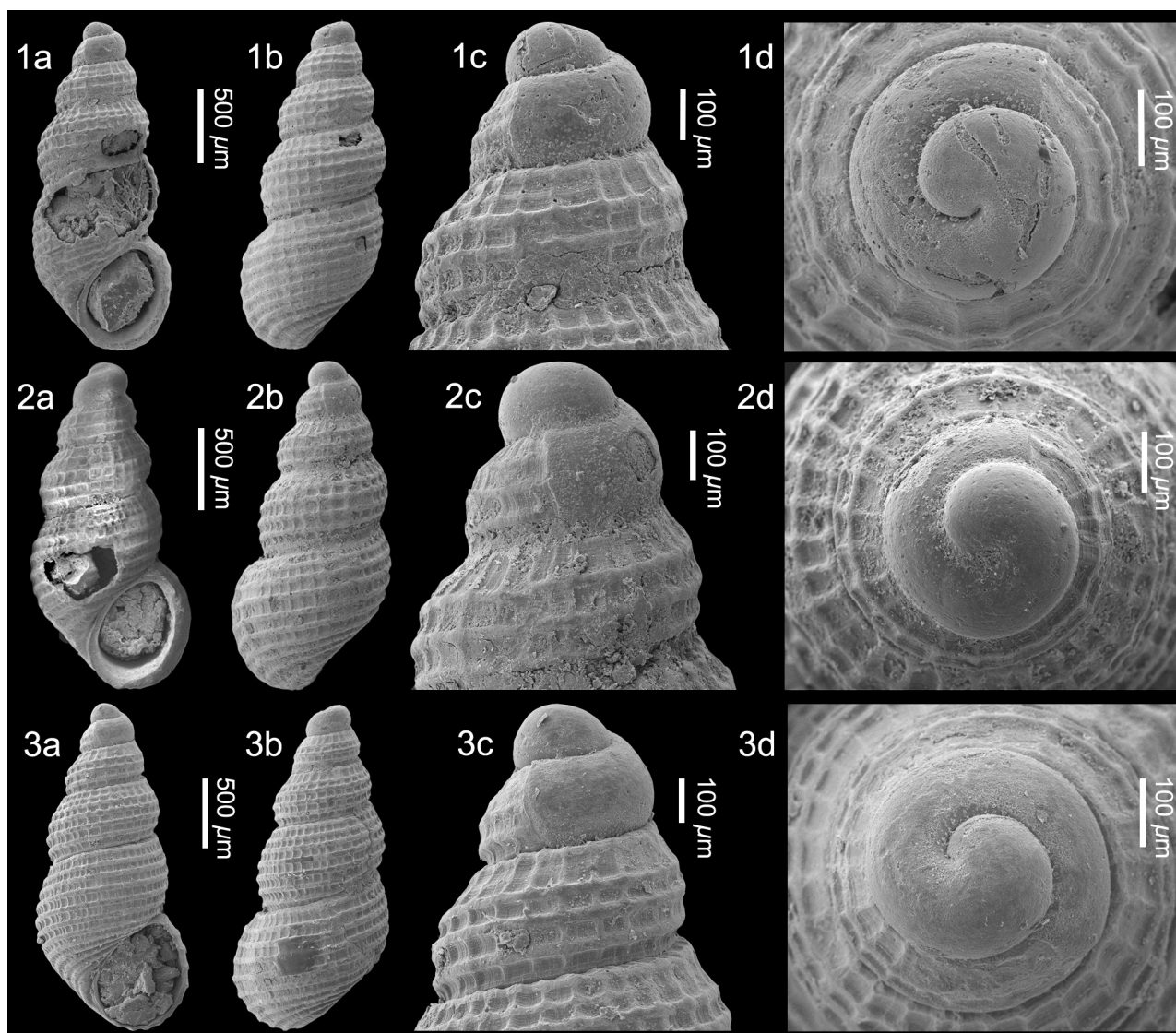


Plate 26. *Alvania vandervalki* nov. sp.; 1. **Holotype** NHMW 2024/0206/0093, height 2.2 mm, width 0.9 mm, c, d, detail of protoconch. Velerín quarry. 2. **Paratype 1** NHMW 2024/0206/0095, height 2.0 mm, width 1.0 mm, c, d, detail of protoconch; 3. **Paratype 2** NHMW 2024/0206/0056, height 2.4 mm, width 1.1 mm, c, d, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

surface abraded, but microsculpture of crowded pustules preserved close to suture (dp = 350-380 μm , hp = 290-360 μm , dp/hp = 1.01-1.21, dn = 110-160 μm , dV1 = 230-290 μm). Junction with teleoconch sharply delimited by elevated scar. Teleoconch of 3.25 convex whorls with periphery placed just below mid-whorl, separated by narrowly and rather weakly impressed linear suture. Sculpture of four spiral cords at teleoconch junction overrunning weaker, close-set axial ribs, visible only in spiral interspaces, not forming tubercles at intersections. Second teleoconch whorl further primary spiral appears just below and above suture. Penultimate whorl with seven spiral cords overrunning about 35 axial ribs forming finely reticulated surface sculpture. Teleoconch microsculpture of fine spiral threads in spiral interspaces. Last whorl 55% of total height, evenly convex, bearing seven spirals above the level of the insertion of the outer lip, plus five further cords over base. Aperture ovate, outer lip slightly opisthocline, thickened, without denticles.

Discussion – Although represented by few specimens, all of which are incomplete or damaged, this species is so distinctive that it warrants formal description. *Alvania vandervalki* nov. sp. is characterised by its slender rissoiform profile, protoconch of just over 1.5 whorls covered in micropustules still preserved close to the suture (Pl. 26, figs 1c-3c) and extremely fine reticulated sculpture. Of the myriad of Neogene to present-day European *Alvania* species described, we struggle to find any that can be usefully compared. *Alvania elegantissima* (Monterosato, 1875) from the Pliocene to present-day Mediterranean has similarly fine cancellate teleoconch sculpture but is squatter with extremely convex whorls separated by a deep suture. The protoconch is of similar size, the microsculpture composed of lines of micropustules. Unfortunately, the surface is abraded in the Estepona specimen, but the micropustules preserved close to the suture suggest they are randomly placed. *Alvania punctura* (Montagu, 1803) has similar sculpture but is immediately separated by its squatter form and multispiral protoconch. *Alvania tomentosa* (Pallary, 1920) that also occurs in the deeper water deposits of Estepona is similar in size and elongate, but coarser sculptured and has spiral cruciform sculpture on the protoconch.

Alvania vandervalki nov. sp. is extremely uncommon in the Estepona assemblages and found only in the deeper water facies of Velerín quarry and carretera.

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

Alvania veleriniana nov. sp.

Plate 27, figs 1-3; Plate 31, fig. 24

ZooBank registration – urn:lsid:zoobank.org:act:722A2B3F-C78D-4CCA-9726-D68AD5762376

Type material – Holotype NHMW 2024/0206/0114, height 2.6 mm, width 1.6 mm. **Velerín quarry**. Para-

type 1 NHMW 2024/0206/0115, height 3.1 mm, width 2.0 mm; paratype 2 NHMW 2024/0206/0116, height 3.1 mm, width 2.0 mm; paratype 3 NHMW 2024/0206/0117, height 3.4 mm, width 2.0 mm. **Velerín conglomerates**.

Other material – **CO**: NHMW 2024/0206/0138 (5). **VQ**: NHMW 2024/0206/0135 (3).

Type locality – Velerín quarry, Velerín, Estepona, Spain.

Type stratum – Unnamed beds of uppermost Zanclean, Lower Pliocene.

Etymology – Name after the type locality of Velerín. *Alvania*, gender feminine.

Diagnosis – *Alvania* species with small, solid, globose shell, paucispiral protoconch with weak spiral sculpture. Teleoconch of three convex whorls, with cancellate sculpture with fifteen axial ribs reaching base, of equal thickness to eight spiral cords. On last whorl four cords above insertion of outer lip, four below. Outer lip thickened by robust varix, bearing a few elongated denticles within.

Description – Shell small, solid, globose rissoiform. Protoconch paucispiral, dome shaped, composed of 1.8-1.9 whorls, weakly sculptured by approximately eight series of irregular, minute, closely spaced tubercles forming spirals, increasingly irregular towards junction with the teleoconch (dp = 365-375 μm , hp = 305-310 μm , dp/hp = 1.19, dn = 115-120 μm , dV1 = 215-220 μm). Transition to teleoconch clear, without thickening. Teleoconch consisting of slightly over three convex whorls with weakly incised suture. Axial sculpture consisting of sixteen narrow, prosocline ribs, about half width of their interspaces, reaching base. Spiral sculpture of two equidistant cords on first whorl, eight on the last whorl, of which four are above aperture. Subsutural (adapical) cord last to form and least developed, closer to next cord than other equidistant cords. Small, rounded tubercles developed at sculptural intersections. Microsculpture of very faint spiral threads thinner than the growth lines. Last whorl 68-72% of total height, globose and evenly convex, with four cords above insertion of outer lip, four over base. Umbilical chink absent. Aperture ovate, simple, rather large, peristome continuous, slightly prosocline, labial varix broad, outer lip orthocline, bearing elongated denticles that start at peristome.

Discussion – *Alvania veleriniana* nov. sp. is characterised by its solid, globose shell, paucispiral protoconch and cancellate teleoconch sculpture with medium strength nodules developed at the sculptural intersections.

The species most similar to *A. veleriniana* is *Alvania mamillata* Risso, 1826, from the present-day Mediterranean Sea, (no fossil specimens have been found) with which it shares, in addition to the globose outline, a paucispiral protoconch with weak microsculpture on the entire surface composed of spiral threads and scattered

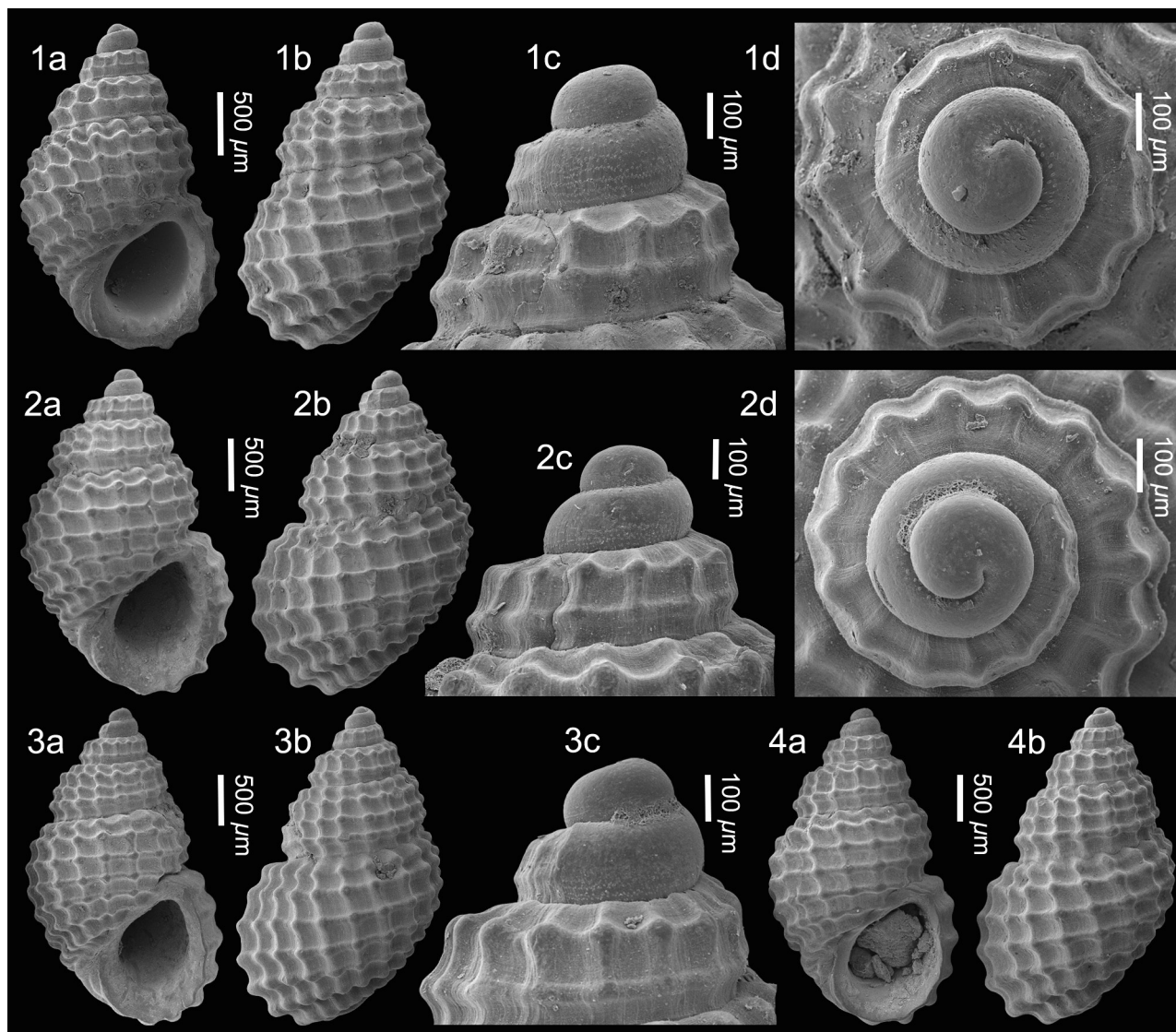


Plate 27. *Alvania veleriniana* nov. sp.; 1. **Holotype** NHMW 2024/0206/0114, height 2.6 mm, width 1.6 mm, c, d, detail of protoconch. Velerín quarry. 2. **Paratype 1** NHMW 2024/0206/0115, height 3.1 mm, width 2.0 mm, c, d, detail of protoconch; 3. **Paratype 2** NHMW 2024/0206/0116, height 3.1 mm, width 2.0 mm, c, detail of protoconch; 4. **Paratype 3** NHMW 2024/0206/0117, height 3.4 mm, width 2.0 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

micropustules in the spiral interspaces vs minute, spirally arranged tubercles that are more appressed on the last quarter of the whorl in *A. veleriniana* nov. sp. The teleoconch is thicker shelled in *A. mamillata* and the cancellate sculpture denser, with a greater number of spiral cords on the base 5 vs 4 in *A. veleriniana* nov. sp. In *A. mamillata* the four cords on the penultimate whorl above the aperture, are equidistant and of equal thickness vs the subsutural spiral cord is the last to form, and on the penultimate whorl it is always weaker and closer set to a second cord in *A. veleriniana*.

Alvania dimitrii Garilli & Parrinello, 2010 from the Upper Pliocene Piacenzian of Parma, Italy, also has a globose outline, but has a protoconch with sculpture more similar to that of *A. mamillata*, the labial varix is even thicker, and the labial denticles more robust. *Alvania dimitrii* has a teleoconch microsculpture of appressed and

spirally arranged microtubercles as opposed to growth striae crossed with weak spiral threads in *A. veleriniana*. *Alvania fiorentina* (Chirli, 2006) from the Lower Pliocene of Tuscany, Italy, has a protoconch initially sculpted by thin spiral threads that break up into more evident tubercles in the abapical half. Its last teleoconch whorl has a variable number of cords above the aperture 4–6 vs always four.

Alvania nestaresi Oliverio & Amati, 1990 from the present-day western Mediterranean has a protoconch sculpted by six spiral cords.

Alvania veleriniana is uncommon in the Estepona assemblages.

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

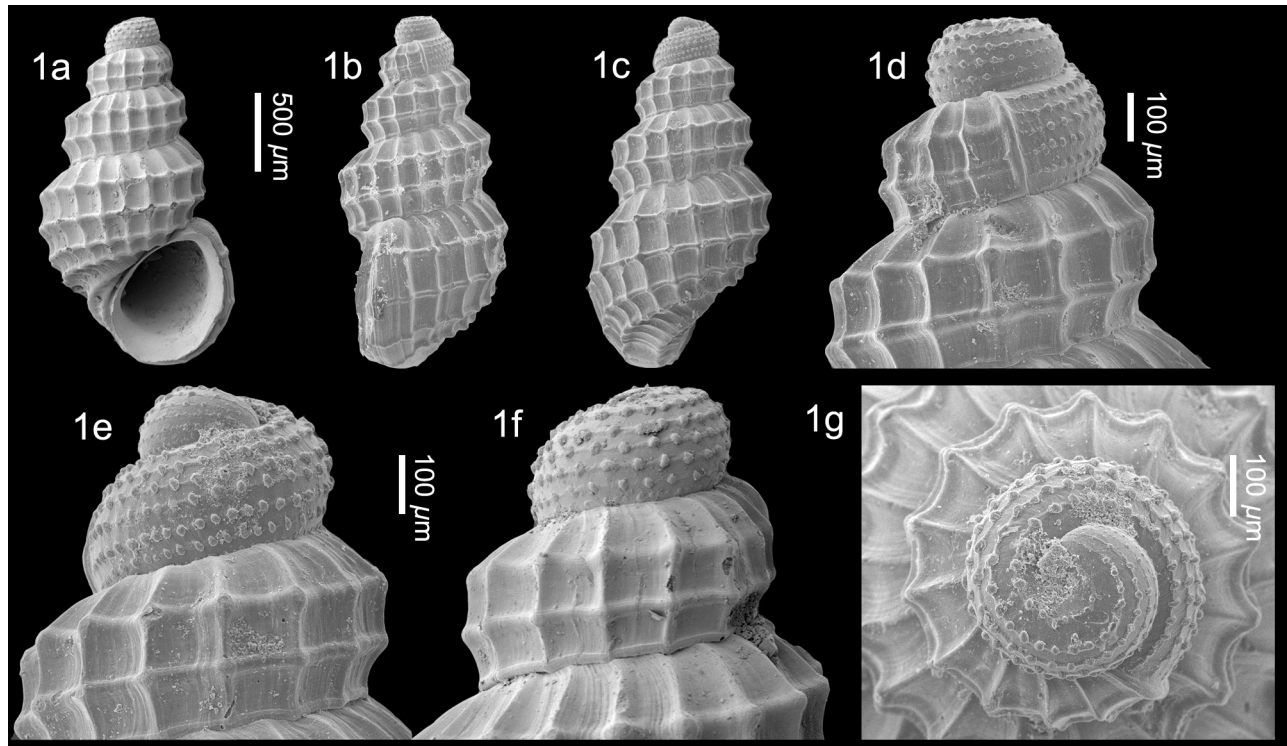


Plate 28. *Alvania weinkauffi* Schwartz von Mohrenstern in Weinkauff, 1868; 1. NHMW 2024/0206/0043, height 2.2 mm, width 1.2 mm, c, d, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, Upper Zanclean, Lower Pliocene.

***Alvania weinkauffi* Schwartz von Mohrenstern in Weinkauff, 1868**

Plate 28, fig. 1; Plate 31, fig. 25

- *1868 *Alvania Weinkauffi* Schwartz von Mohrenstern in Weinkauff, p. 312.
- 1984 *Alvania weinkauffi* (Schwartz in Weinkauff, 1868) – Van Aartsen *et al.*, p. 24, fig. 100a.
- 1986 *Manzonina (Alvinia) weinkauffi weinkauffi* (Weinkauff, 1868) – Oliverio *et al.*, p. 52, pl. 2, fig. 5.
- 1997 *Alvania (Alvania) weinkauffi weinkauffi* (Weinkauff, 1868 ex Schwartz ms.) – Giannuzzi-Savelli *et al.*, p. 114, figs 481-482, 493a.
- 2004 *Alvania weinkauffi* (Schwartz in Weinkauff, 1868) – Landau *et al.*, p. 44, pl. 9, fig. 2.
- 2006 *Alvania weinkauffi weinkauffi* Weinkauff, 1868 – Peñas *et al.*, p. 92, figs 207-210.
- 2014 *Alvinia weinkauffi* (Weinkauff, 1868 ex Schwartz von Mohrenstern ms) – Garilli & Parrinello, p. 381, 400, 403, 404, figs 4A, B, 5B.
- 2019 *Alvania weinkauffi weinkauffi* (Weinkauff, 1868) – Scaperrotta *et al.*, p. 146, pl. 7C.
- 2020 *Alvania weinkauffi* Schwartz, 1868 – Alf *et al.*, p. 117, pl. 97.
- 2021 *Alvania weinkauffi* Schwartz in Weinkauff, 1868 – Chirli & Forli, p. 190, pl. 152, figs B1-16, pl. 153, figs A1-17.

Material and dimensions – Average height 3.2 mm. **CO:** NHMW 2024/0206/0042 (50+). **EL:** NHMW 2024/0206/0070 (15). **VQ:** NHMW 2024/0206/0085 (13). **VC:**

NHMW 2024/0206/0043 (1), NHMW 2024/0206/0044 (2).

Description (revised description based on perfectly preserved specimen) – Shell very small, slender rissoiform, with elevated spire. Protoconch paucispiral, of 1.5 convex whorls, with large, elevated nucleus; surface bearing rows of large rounded micropustules starting over nucleus (dp = 410 µm, hp = 365 µm, dp/hp = 1.12, dn = 210 µm, dV1 = 340 µm). Junction with teleoconch sharply delimited by elevated smooth rim. Teleoconch of three convex whorls with periphery placed at second spiral cord, separated by moderate depth linear suture. Coarsely cancelate sculpture of two narrow spiral cords on spire whorls overrunning narrow axial ribs, forming small, pointed tubercles at intersections; 15 axial ribs on first whorl, 18 on penultimate whorl. Last whorl 61% of total height, convex, bearing two spirals above the level of the insertion of the outer lip, plus two over base separated by slightly wider interspace from two smooth, closer-set periumbilical cords. Aperture ovate, outer lip orthocone, moderately thickened by varix, protruding thin sharp margin, smooth within, somewhat flared abapically.

Discussion – A beautifully preserved specimen of *Alvania weinkauffi* (Schwartz von Mohrenstern in Weinkauff, 1868) from the deeper water Velerín carretera assemblage (Pl. 28, figs 1a-g) shows the same very characteristic protoconch as those illustrated by authors for extant specimens (e.g., Garilli & Parrinello, 2014, fig. 4B₂; *inter alia*), although we do not see the fine teleoconch microsculp-

ture illustrated by those authors (2014, fig. 5B₁, B₂), which might be abraded.

Alvania weinkauffi is very similar to *Alvania fischeri* (Jeffreys, 1884), which also has a pustular protoconch, but differs in having only two spiral cords on the spire whorls and three above the aperture on the last whorl, whereas the latter has three cords on the spire whorls and four above the aperture on the last whorl. The taxon *Alvania weinkauffi jacobusi* Oliverio, Amati & Nofroni, 1986 differs in having a more prominent spiral sculpture, making the whorls carinate instead of regularly cancellate. It however occurs sympatrically with *Alvania weinkauffi weinkauffi*, so that a subspecies status is improbable (La Perna, 2003, pers. comm.); the specimens collected in Estepona in any case belong to the *weinkauffi weinkauffi* type. Romani *et al.* (2018), reporting the presence of the subspecies *jacobusi* in the Adriatic, stated: “This taxon, well separable from the nominate subspecies, probably requires specific rank (Bruno Amati, pers. comm.)”. Other species with similar teleoconch characteristics are *Alvania clathrella* Monterosato in L. Seguenza, 1903, *Alvania dictyophora* (Philippi, 1844), *Alvania subareolata* Monterosato, 1869 and *Alvania sororcula* (Granata Grillo, 1877), but their protoconchs bear much smaller pustules. *Alvania zetlandica* (Montagu, 1816) also has a similar teleoconch, but the protoconch sculpture is quite different (see Giannuzzi-Savelli *et al.*, 1997, figs 480, 493). In Estepona this species is found predominantly in the shallower water assemblages. Today its habitat is intertidal to mid subtidal (Alf *et al.*, 2020, p. 117).

Distribution – Lower Pliocene: western Mediterranean, Estepona Basin, Spain (Landau *et al.*, 2004). Present-day: North African coast of the western Mediterranean (Giannuzzi-Savelli *et al.*, 1997; Arduino & Arduino, 2001; Peñas *et al.*, 2006; Garilli & Parrinello, 2014; Scaperrotta *et al.*, 2019; Alf *et al.*, 2020).

***Alvania zetlandica* (Montagu, 1816)**

Plate 29, fig. 1; Plate 31, fig. 26

- *1816 *Turbo zetlandicus* Montagu, p. 194, pl. 13, fig. 3.
- 1843 *Rissoa cyclostomata* Récluz, p. 104.
- 1844 *Rissoa canaliculata* Philippi, p. 223, pl. 28, fig. 19 (*fide* Jeffreys, 1884, p. 116).
- 1844 *Rissoa Scalariformis* Metcalfe, in Thorpe, p. xlii (i), viii, fig. 89 as *Cingula scalariformis* (contrary to the description, the figure probably represents an *A. subsoluta*).
- 1847 *Rissoa carinata* Aradas, p. 74 (*fide* Monterosato, 1878, p. 85).
- 1848 *Rissoa Zetlandica* Mont. – S.V. Wood, p. 101, pl. 11, fig. 7.
- 1878 *Alvania zetlandica* Mont. – O.G. Sars, p. 177, pl. 10, figs 7a, 7b.
- 1914 *Rissoia (Flemingia) zetlandica* Mtg. – Cerulli-Irelli, p. 194, pl. 15, figs 48-49.
- 1920 *Manzonina zetlandica* (Montagu) – Harmer, p. 622, pl. 50, figs 51, 52.
- 1964 *Alvania (Taramellia) zetlandica* Montagu, 1811 [*sic*] – Brébion, p. 167, pl. 4, figs 24, 25.
- 1978 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Fretter & Graham, p. 180, figs 154-155.
- 1984a *Alvania (Taramellia) zetlandica* (Montagu, 1811 [*sic*]) – Bogi *et al.*, p. 19, 1 unnumbered figure.
- 1985 *Manzonina (Alvinia) zetlandica* (Montagu) – Ponder, p. 148, fig. 99G (only protoconch).
- 1987a *Manzonina (Flemellia) zetlandica* (Montagu) – Moolenbeek & Faber, p. 179, pl. 3, figs 49-51.
- 1991 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Poppe & Goto, p. 102, pl. 12, fig. 31.
- 1993 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Bouchet & Warén, p. 655, figs 1494-1496, 1502.
- 1996 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Warén, p. 225, fig. 17A.
- 1997 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Di Geronimo & La Perna, p. 399, pl. 2, fig. 2.
- 1997 *Alvania (Alvania) zetlandica* (Montagu, 1815 [*sic*]) – Giannuzzi-Savelli *et al.*, p. 112, figs 476-479, 480d.
- 2000 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Arduvini & Cossignani, p. 38, 1 unnumbered figure.
- 2004 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Landau *et al.*, p. 45, pl. 9, fig. 4.
- 2005 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Rolán, p. 299, pl. 16, fig. 246.
- 2006 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Marquet & Landau, p. 26, fig. 6/1a-d.
- 2006 *Alvania zetlandica* (Montagu, 1803 [*sic*]) – Peñas *et al.*, p. 89, figs 198-200.
- 2006 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Chirli, p. 39, pl. 19, figs 9-16.
- 2010 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Scaperrotta *et al.*, p. 60, 5 unnumbered figures.
- 2011 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Gofas & Moreno in Gofas *et al.*, p. 179, 3 unnumbered figures.
- 2011 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Hoffman *et al.*, p. 51, figs 64-66.
- 2011 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Tabanelli *et al.*, p. 48, fig. 24.
- 2012 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Brunetti & Vecchi, p. 114, pl. 6, figs c, d.
- 2013 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Raad *et al.*, p. 47, figs 3, 4.
- 2014 *Alvinia zetlandica* (Montagu, 1815 [*sic*]) – Garilli & Parrinello, p. 404, figs 4C, D, 5A,
- 2016 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Van Dingenen *et al.*, p. 138, pl. 8, fig. 6, pl. 9, fig. 4.
- 2018 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Landau *et al.*, p. 272, pl. 101, fig. 1.
- 2018 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Chimentiet *et al.*, p. 198, fig. 1L.
- 2019 *Alvania zetlandica* – Scaperrotta *et al.*, p. 146, 146, pl. 7, fig. I.
- 2020 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Tabanelli *et al.*, p. 37, pl. 2, fig. 26.
- 2020 *Alvania zetlandica* (Montagu, 1815 [*sic*]) – Alf *et al.*, p. 117, pl. 97.

- 2021 *Alvania zetlandica* (Montagu, 1816) – Chirli & Forli, p. 191, pl. 154, figs B1-14, pl. 155, figs A1-19, pl. 156, figs A1-10.
- 2022 *Alvania zetlandica* (Montagu, 1816) – J.D. Oliver *et al.*, p. 15, figs 7a-g.
- 2024 *Alvania zetlandica* (Montagu, 1816) – Amati *et al.*, p. 31, figs 9M, N.
- non 1856 *Rissoa Zetlandica* Mont. – Hörnes, p. 566, pl. 48, fig. 11 [= *Manzonina miocrassica* (Sacco, 1895)].
- non 1933 *Manzonina (Taramellia) zetlandica* Montagu – Meznerics, p. 332 [= *Manzonina miocrassica* (Sacco, 1895)].

Material and dimensions – Average height 3.2 mm. **EL:** NHMW 2024/0206/0044 (1), NHMW 2024/0206/0045 (21). **CO:** NHMW 2024/0206/0046 (7). **VQ:** NHMW 2024/0206/0091 (2). **VC:** NHMW 2024/0206/0047 (3). **PQ:** NHMW 2024/0206/0048 (3).

Description – see Landau *et al.* (2004, p. 45). Protoconch measurements: dp = 365 μ m, hp = 315 μ m, dp/hp = 1.16, dn ~ 80 μ m (damaged), dV1 = 145 μ m [dp = 284 μ m, dn = 104 μ m, dV1 = 169 μ m; Landau *et al.*, 2004, p. 45].

Discussion – *Alvania zetlandica* (Montagu, 1816) is a very characteristic species with coarse sculpture, in which axial and spiral elements are almost of equal strength, and with a double-rimmed inner lip. Unfortunately, the protoconch and teleoconch sculpture in our specimens is eroded.

Alvania zetlandica is another of the taxa discussed by Gofas (1999) with a sibling species in the present-day West African fauna. *Alvania gofasi* (Rolán & Fernandes, 1990) found from Senegal and northern Angola is a smaller squatter, less elongated shell, seldom larger than 2 mm, whereas present-day shells of *A. zetlandica* are usually 4-5 mm high. The protoconch consists of two whorls, with a smaller nucleus (*vide* Rolán & Fernandes, 1990, no measurement is given by the authors). This species was originally described under the genus *Manzonina* Brusina 1870; however, it does not have the pitted spiral microsculpture characteristic to the genus (Moolenbeek & Faber, 1987a-c).

Interestingly the Estepona specimens have a shell size intermediate between extant *A. gofasi* and the living *A. zetlandica*. The protoconch in our shells a quarter whorl less than usually seen in recent *A. zetlandica*, but larger than that of *A. gofasi* and the protoconch dimensions less than those described by Fretter & Graham (1978) (diameter of protoconch 285 μ m, diameter first whorl 130 μ m). The Pliocene specimens from Estepona may represent a distinct species, predecessor of both the Recent *A. zetlandica* and *A. gofasi*, but the differences are too small to warrant a new taxon.

In Estepona this species is found predominantly in the shallower water assemblages, with a few specimens found in the deeper water facies. Today it is shallow water to mid subtidal (Alf *et al.*, 2020).

Distribution – Upper Miocene: Atlantic (Tortonian), NW France (Brébion, 1964; Landau *et al.*, 2018). Lower Pliocene: Atlantic, NW France (Calas, 1949; Brébion, 1964; Van Dingenen *et al.*, 2016); North Sea Basin, Coralline Crag, England (S.V. Wood, 1848; Harmer, 1920), Luchtbal Formation, Belgium (Marquet & Landau, 2006); western Mediterranean, Estepona (Landau *et al.*, 2004); central Mediterranean, Italy (Chirli, 2006). Upper Pliocene: North Sea Basin, Red Crag, England (Harmer, 1920); central Mediterranean, Italy (Anfossi *et al.*, 1983; Tabanelli *et al.*, 2011, 2020; Brunetti & Vecchi, 2012). Pliocene (indeterminate): North Sea Basin, The Netherlands (Beets, 1946; Van Regteren Altena *et al.*, 1954; Raad *et al.*, 2013). Upper Pliocene-Pleistocene: Atlantic, NW France (Brébion, 1964). Plio-Pleistocene: Strait of Sicily, Italy (Amati *et al.*, 2024). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1914; Di Geronimo & La Perna, 1997; Garilli & Parrinello, 2014). Pleistocene (indeterminate): Atlantic, British Isles (Harmer, 1920); Present-day: Atlantic, Norway, British Isles (Fretter & Graham, 1978; Hoffman *et al.*, 2011), southwards to Morocco, Macaronesia (Moolenbeek & Faber, 1987a; Bouchet & Warén, 1993; J.D. Oliver *et al.*, 2020), Cape Verde Islands (Rolán, 2005), entire Mediterranean (Bogi *et al.*, 1984a; Poppe & Goto, 1991; Ardovini & Cossignani, 2000; Peñas *et al.*, 2006; Scaperrotta *et al.*, 2010, 2019; Gofas & Moreno *in* Gofas *et al.*, 2011). Not Iceland, The Faroes or the Azores (Bouchet & Warén, 1993, p. 657).

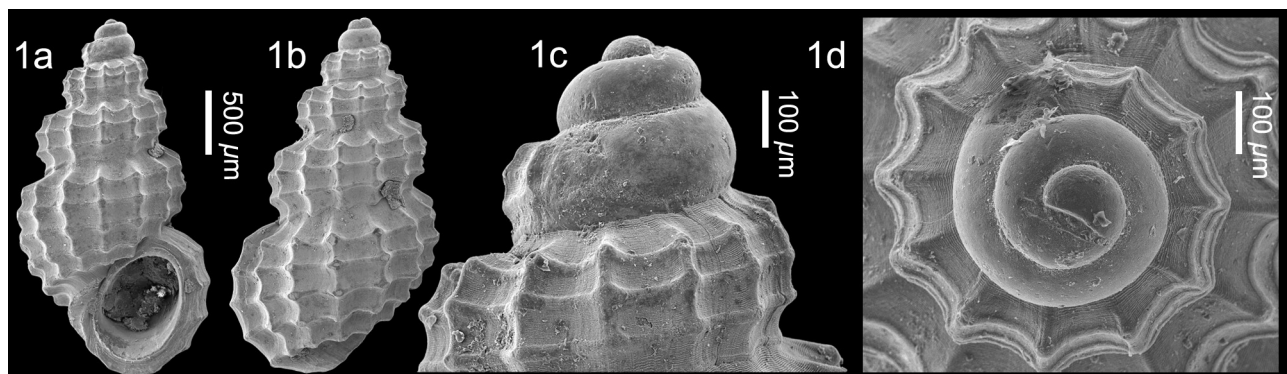


Plate 29. *Alvania zetlandica* (Montagu, 1816); 1. NHMW 2024/0206/0044, height 2.8 mm, width 1.5 mm, c, d, detail of protoconch (SEM images). El Lobillo, Estepona, Upper Zanclean, Lower Pliocene.

Genus and subgenus *Manzonina* Brusina, 1870

***Manzonina crassa* (Kanmacher, 1798)**

Plate 30, figs 1-5; Plate 31, fig. 27

- *1798 *Turbo crassus* Kanmacher, p. 638, fig. 20.
- 1914 *Rissoia* (*Manzonina*) *costata* Adams – Cerulli-Irelli, p. 193, pl. 15, figs 43-47.
- 1915 *Rissoia* (*Manzonina*) *falunica* de Morgan, p. 234, fig. 17.
- 1918 *Manzonina costata* (Adams) – Harmer, p. 624, pl. 50, fig. 48.
- 1921 *Manzonina costata minuta* Cossmann, p. 380, pl. 16, fig. 22.
- 1923 *Manzonina costata* Adams var. – Friedberg, p. 385, pl. 23, fig. 5.
- 1938 *Manzonina costata* (J. Adams) – Wenz, p. 614, fig. 1707.
- 1949 *Alvania* (*Manzonina*) *costata falunica* de Morgan, 1915 – Glibert, p. 102, pl. 5, fig. 22.
- 1954 *Alvania* (*Manzonina*) *crassa* (Kanmacher, 1798) – Van Regteren Altena *et al.*, p. 62, fig. 36.
- 1964 *Folinia* (*Manzonina*) *costata* Adams, 1796 – Brébion, p. 149, pl. 4, figs 9, 10.
- 1966 *Folinia* (*Manzonina*) *costata* (Adams) – Iljina, p. 91, pl. 4, fig. 2.
- 1974 *Manzonina* (*Manzonina*) *crassa* (Kanmacher, 1798) – Malatesta, p. 171, pl. 13, fig. 13.
- 1975 *Manzonina crassa* (Kanmacher) – Fekih, p. 69, pl. 24, fig. 12.
- 1975 *Folinia* (*Manzonina*) *costata* (Adams) – Bałuk, p. 74, pl. 8, fig. 12.
- 1978 *Manzonina crassa* (Kanmacher, 1798) – Fretter & Graham, p. 170 (*partim*).
- 1985 *Manzonina* (*Manzonina*) *crassa* (Kanmacher in J. Adams) – Ponder, figs 99A-F.
- 1987a *Manzonina* (*Manzonina*) *crassa* (Kanmacher in J. Adams, 1798) – Moolenbeek & Faber, p. 4, figs 3-5.
- 1987b *Manzonina* (*Manzonina*) *crassa exigua* (Michaud, 1830) – Moolenbeek & Faber, p. 6.
- 1991 *Manzonina crassa* (Kanmacher, 1798) – Poppe & Goto, p. 104, pl. 13, fig. 5.
- 1992 *Manzonina* (*Manzonina*) *crassa* (Kanmacher, 1798) – Cavallo & Repetto, p. 52, fig. 080.
- 1996 *Manzonina crassa* (Kanmacher, 1798) – Warén, p. 226, fig. 17B.
- 1997 *Manzonina* (*Manzonina*) *crassa* (Kanmacher, 1798) – Giannuzzi-Savelli *et al.*, p. 116, figs. 504-506.
- 2001 *Manzonina* (*Manzonina*) *crassa* (Kanmacher, 1798) – Silva, p. 150, pl. 5, figs. 17-18.
- 2004 *Manzonina crassa* (Kanmacher, 1798) – Landau *et al.*, p. 47, pl. 10, fig. 1.
- 2004 *Manzonina* (*Manzonina*) *crassa* (Kanmacher & J. Adams, 1798) – Kowalke & Harzhauser, p. 122, fig. 8c.
- 2008 *Manzonina crassa* (Kanmacher, 1798) – Garilli, p. 46, figs 105-107.
- 2011 *Manzonina crassa* (Kanmacher, 1798) – Tabanelli *et al.*, p. 50, fig. 36.

- 2011 *Manzonina crassa* (Kanmacher, 1798) – Chirli & Linse, p. 84, pl. 24, figs 4a-4d.
- 2013 *Manzonina crassa* (Kanmacher, 1798) – Landau *et al.*, p. 74, pl. 58, fig. 5.
- 2013 *Manzonina crassa* (Kanmacher, 1798) – Raad *et al.*, p. 51, fig. 16.
- 2014 *Manzonina crassa* (Kanmacher in Adams, 1798) – Garilli & Parrinello, p. 404, figs 3F, G.
- 2016 *Manzonina crassa* (Kanmacher, 1798) – Van Dingenen *et al.*, p. 140, pl. 10, fig. 2.
- 2018 *Manzonina crassa* (Kanmacher, 1798) – Landau *et al.*, p. 274, pl. 103, fig. 1.
- 2020 *Manzonina crassa* (Kanmacher, 1798) – Alf *et al.*, p. 119, pl. 98.
- 2021 *Manzonina crassa* (Kanmacher, 1798) – Chirli & Forli, p. 214, pl. 170, figs C1-14, pl. 171, figs A1-24, pl. 172, figs A1-12.
- 2024 *Manzonina crassa* (Kanmacher, 1798) – Amati *et al.*, p. 27, fig. 6C.

Material and dimensions – Average height 2.4 mm. **EL:** NHMW 2024/0206/0051 (33), NHMW 2024/0206/0105-0108 (4). **CO:** NHMW 2024/0206/0052 (1), NHMW 2024/0206/0053 (20). **PA:** NHMW 2024/0206/0054 (13). **VQ:** NHMW 2024/0206/0082 (5). **VC:** NHMW 2024/0206/0055 (2).

Description – see Landau *et al.* (2004, p. 47).

Discussion – The Mediterranean shells differ slightly from the Atlantic ones in being somewhat squatter, composed of more globose whorls with a more pronounced shoulder, giving the spire a scalate appearance and slightly fewer axial ribs (15-18 vs 17-20). Moolenbeek & Faber (1987a, p. 2) considered the Mediterranean form a subspecies, *Manzonina* (*Manzonina*) *crassa exigua* (Michaud, 1830), however, there are no differences in the protoconch, and subsequent authors have not recognised this separation.

In the Estepona populations we note a great variability in adult size, some at least double the size of others, especially amongst the El Lobillo specimens. In rissoid species size range is quite variable. A subspecies has been erected in the literature for the small form (*Manzonina costata minuta* Dollfus & Dautzenberg, 1886 from the Burdigalian of SW France). Unfortunately, most of the surface protoconch sculpture in our specimen is eroded, but a small area showing micropustules is preserved at the edge of the first protoconch whorl (Landau *et al.*, 2004, pl. 10, fig. 1c), similar to the sculpture seen in modern specimens: Protoconch I has a delicate reticulate pattern, whereas Protoconch II is smooth (Fretter & Graham, 1978). The dimensions of the protoconch in our shells are somewhat greater than those reported by the authors (total diameter 265 µm vs 200 µm). As pointed out by Van Aartsen (1983, p. 7) and Moolenbeek & Faber (1987a, p. 9), the description given by Fretter & Graham (1978), which corresponds with *Manzonina crassa* (Kanmacher, 1798), does not coincide with figure 146, a specimen from Madeira, with a protoconch bearing prominent

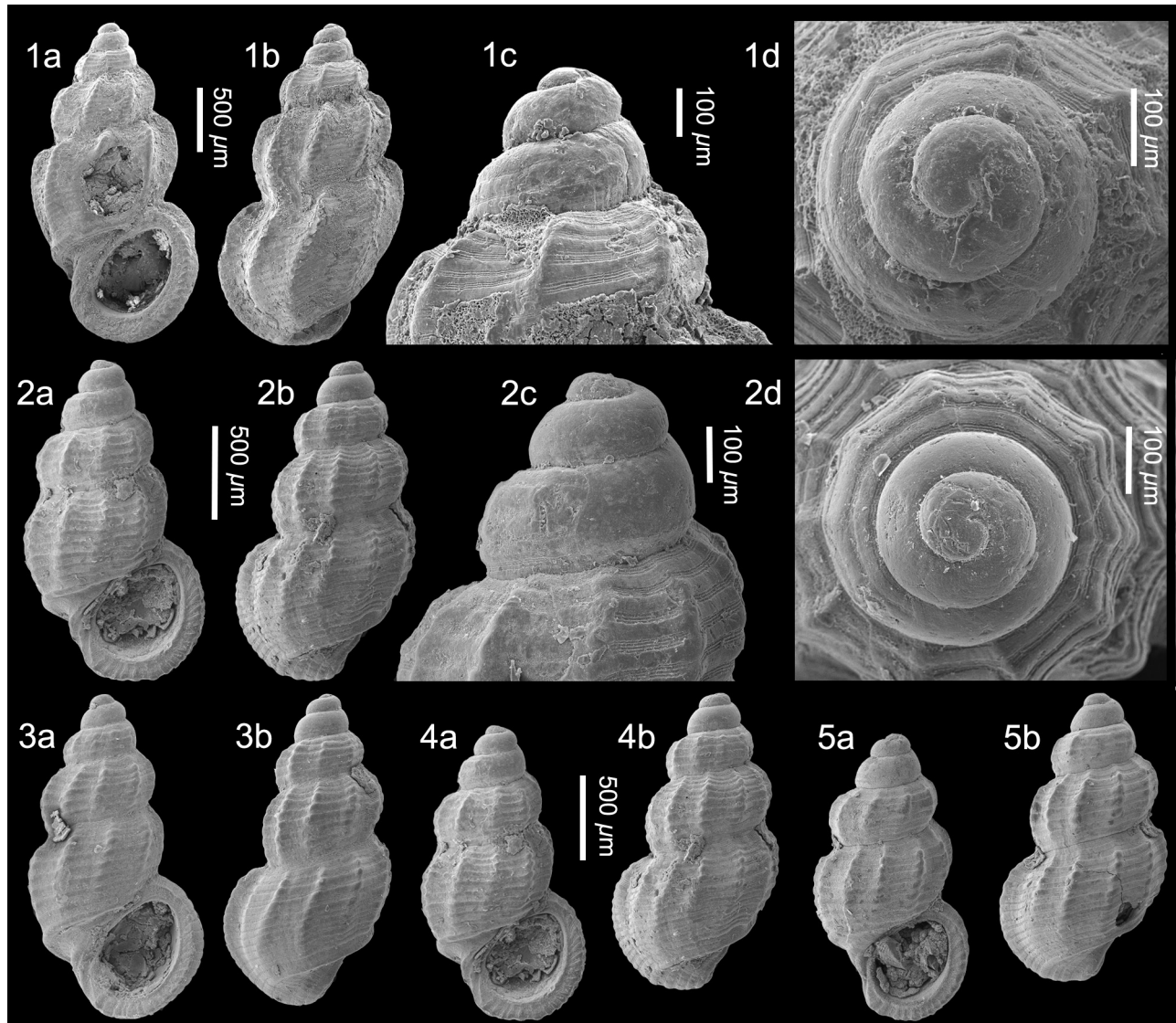


Plate 30. *Manzonella crassa* (Kanmacher, 1798); 1. NHMW 2024/0206/0052, height 2.6 mm, width 1.3 mm, c, d, detail of protoconch (SEM images). Velerín conglomerates, Velerín. 2. NHMW 2024/0206/0105, height 1.7 mm, width 0.9 mm, c, d, detail of protoconch; 3. NHMW 2024/0206/0106, height 1.9 mm, width 1.0 mm; 4. NHMW 2024/0206/0107, height 1.8 mm, width 1.0 mm; 5. NHMW 2024/0206/0108, height 1.7 mm, width 0.9 mm (SEM images). El Lobillo, Estepona, upper Zanclean, Lower Pliocene. Estepona.

spiral cords that represents *M. overdiepi* Van Aartsen, 1983. Indeed, the genus has a high degree of speciation in the Macaronesian area but is represented by a single species in the European Atlantic coasts and Mediterranean (Moolenbeek & Faber, 1987a, b & c) and one in the Atlantic coast of Morocco in the area of the Strait of Gibraltar (Gofas, 2010, p. 93, figs 1-7).

Manzonella miocristata Sacco, 1895 from the Late Miocene, Tortonian of Italy has similar teleoconch characteristics and a similar microsculpture, but a different mammillate protoconch, much more elevated, consisting of at least 2.5-3 whorls (Ferrero Mortara *et al.* 1984, p. 218, pl. 39, fig. 8).

Manzonella costata falunica (de Morgan, 1915) from the Atlantic Middle Miocene of France (Glibert, 1949, p. 102, pl. 5, fig. 22) is smaller than usual for the Pliocene to present-day *M. crassa* and has slightly less elevated

whorls, giving the shell a squatter, less elongated appearance. The size, even in present-day populations, is variable, the north Atlantic specimens being larger than the Mediterranean ones (Van Aartsen, *et al.*, 1984). The French Miocene shells have the same sculpture as the recent species. Based on material from the Upper Miocene (Van Dingenen *et al.*, 2016, p. 140) and Lower Pliocene (Landau *et al.*, 2018, p. 274) of France, those authors considered the subspecies to fit within the variability of the nominate species.

Baluk (1975, p. 74, fig. 12) reported this species from the Middle Miocene, Paratethys of Poland. The protoconch is somewhat more elevated and larger, consisting of 2.5 whorls, diameter about 350 µm (measurements taken from Moolenbeek & Faber, 1987c, pl. 3, fig. 66A). The first protoconch whorl appears smooth, although the mi-

crossculpture may be eroded. We consider these small differences to be within the variability of this long lived and widely distributed taxon.

Manzonina pontileviensis (de Morgan, 1915), also found in the Atlantic Middle Miocene of France is a separate species, much smaller, with a less scalate spire, weaker axial ribs, less numerous spiral cords and a much thinner outer lip. It should probably be included in *Alvania*.

Manzonina schmidtii Amati, Taviani & Oliverio, 2024 from likely Plio-Pleistocene of Strait of Sicily (Amati *et al.*, 2024: 26-28, figs 5A-D, 6A, B, 7A-C; Pliocene of Emilia-Romagna, Italy (Tabanelli *et al.*, 2020: 28, 37, pl. 2, fig. 29, as *Manzonina crassa*, differs from *Manzonina crassa*, in having on the teleoconch whorls a smaller number of axial ribs and spiral cords. Small rather protruding tubercles at the intersections vs flat, very little protruding in *M. crassa*; also, the microsculptures are different.

Distribution – Middle Miocene: Atlantic, Loire Basin (de Morgan, 1915; Cossmann, 1918; Glibert, 1949); Paratethys (Langhian-Serravallian), Vienna Basin, Austria (Kowalke & Harzhauser, 2004), Hungary (Strausz, 1966), Poland (Friedberg, 1923; Bałuk, 1975), Romania (Kowalke & Harzhauser, 2004); Proto-Mediterranean Sea (Serravallian), Karaman Basin, Turkey (Landau *et al.*, 2013).

Upper Miocene: Atlantic (Tortonian and Messinian), NW France (Calas, 1949; Brébion, 1964; Landau *et al.*, 2018); Proto-Mediterranean Sea (Tortonian and Messinian), Po Basin, Italy (Sacco, 1895b; Venzo & Pelosio, 1963). Lower Pliocene: Atlantic, NW France (Van Dingenen *et al.*, 2016); western Mediterranean, Estepona Basin, Spain (Landau *et al.*, 2004); central Mediterranean, Italy (Chirli, 2006); Tunisia (Fekih, 1975). Upper Pliocene: north-eastern Atlantic, Mondego Basin, Portugal (Silva, 2001); central Mediterranean, Italy (Sacco, 1895b; Malatesta, 1974; Cavallo & Repetto, 1992; Sosso & Dell'Angelo, 2010; Tabanelli *et al.*, 2011). Lower Pleistocene: North Sea Basin, British Isles (Harmer, 1918); western Mediterranean, France (Glibert, 1962); central Mediterranean, Italy (Cerulli-Irelli, 1914; Bucchieri, 1970); eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Upper Pleistocene: North Sea Basin, The Netherlands (Van Regteren Altena *et al.*, 1954; Raad *et al.*, 2013); eastern Mediterranean, Greece (Garilli & Parrinello, 2014). Present-day: northeastern Atlantic, Norway (Warén, 1996), British Isles (Fretter & Graham, 1978), southwards to Morocco, entire Mediterranean (Giannuzzi-Savelli *et al.*, 1997; Alf *et al.*, 2020; Amati *et al.*, 2024). From extreme low tide line to 50 m depth, often on sandy bottoms, but also under stones and in weeds (Poppe & Goto, 1991).

Plate 31. *Alvania* species from Estepona, side views.

1. *Alvania acutissimispira* nov. sp., **Paratype 1** NHMW 2024/0206/0126, height 2.5 mm, width 1.3 mm (SEM images). El Lobillo.
2. *Alvania bicingulina* nov. sp., **Holotype** NHMW 2024/0206/0109, height 2.3 mm, width 1.3 mm, c, d, detail of protoconch. Velerín conglomerates.
3. *Alvania cancellata* (da Costa, 1778), NHMW 2024/0206/0001, height 4.6 mm, width 2.6 mm, Velerín conglomerates.
4. *Alvania cathyae* Landau, Marquet & Grigis, 2004, NHMW 2024/0206/0007, height 3.0 mm, width 1.7 mm, Velerín carretera.
5. *Alvania cimex* (Linnaeus, 1758), NHMW 2024/0206/0009, height 3.3 mm, width 2.0 mm, Velerín conglomerates.
6. *Alvania cimicoides* (Forbes, 1844), NHMW 2024/0206/0011, height 3.2 mm, width 1.9 mm, Velerín carretera.
7. *Alvania cimicoiberica* nov. sp., **Holotype** NHMW 2024/0206/0127, height 3.5 mm, width 2.0 mm, Velerín conglomerates.
8. *Alvania diadema* (De Stefani, 1875), NHMW 2024/0206/0015, height 2.8 mm, width 1.9 mm, Velerín carretera.
9. *Alvania granosa* Tabanelli, Bongiardino & Perugia, 2011, NHMW 2024/0206/0057, height 2.9 mm, width 1.8 mm, Velerín carretera.
10. *Alvania hispanica* nov. sp., **Paratype 1** NHMW 2019/0167/0007, height 2.2 mm, width 1.1 mm, Velerín conglomerates.
11. *Alvania iberopliocenica* nov. sp., **Holotype** NHMW 2024/0206/0118, height 2.8 mm, width 1.0 mm, Velerín quarry.
12. *Alvania lachrymiformis* nov. sp., **Holotype** NHMW 2024/0206/0063, height 2.6 mm, width 1.5 mm, Velerín carretera.
13. *Alvania lactea* (Michaud, 1830), NHMW 2024/0206/0019, height 3.9 mm, width 2.4 mm, Velerín conglomerates.
14. *Alvania* sp. '*Alvania lineata* complex', NHMW 2024/0206/0021, height 3.4 mm, width 2.0 mm, Velerín carretera.
15. *Alvania lobilloensis* nov. sp., **Holotype** NHMW 2024/0206/0121, height 1.8 mm, width 1.2 mm, El Lobillo.
16. *Alvania magistra* Chirli, 2006, NHMW 2024/0206/0025, height 3.3 mm, width 1.8 mm, Velerín carretera.
17. *Alvania punctura* (Montagu, 1803), NHMW 2024/0206/0027, height 1.6 mm, width 1.0 mm, Velerín conglomerates.
18. *Alvania seanlandaui* Landau, Marquet & Grigis, 2004, NHMW 2024/0206/0072, height 2.6 mm, width 1.5 mm, Velerín carretera.
19. *Alvania testae* (Aradas & Maggiore, 1844), NHMW 2024/0206/0032, height 2.4 mm, width 1.3 mm, Velerín carretera.
20. *Alvania thalia* De Stefani & Pantanelli, 1878, NHMW 2024/0206/0098, height 2.1 mm, width 1.2 mm, El Lobillo.
21. *Alvania tiberiana* (Coppi, 1876), NHMW 2024/0206/0038, height 3.1 mm, width 2.1 mm, Velerín carretera.
22. *Alvania tomentosa* (Pallary, 1920), NHMW 2024/0206/0049, height 2.0 mm, width 1.0 mm, Velerín carretera.
23. *Alvania vandervalki* nov. sp., **Paratype 2** NHMW 2024/0206/0056, height 2.4 mm, width 1.1 mm, Velerín carretera.
24. *Alvania veleriniana* nov. sp., **Holotype** NHMW 2024/0206/0114, height 2.6 mm, width 1.6 mm, Velerín quarry.
25. *Alvania weinkauffi* Schwartz von Mohrenstern in Weinkauff, 1868, NHMW 2024/0206/0043, height 2.2 mm, width 1.2 mm, Velerín carretera.
26. *Alvania zetlandica* (Montagu, 1816), NHMW 2024/0206/0044, height 2.8 mm, width 1.5 mm, El Lobillo.
27. *Manzonina crassa* (Kanmacher, 1798), NHMW 2024/0206/0052, height 2.6 mm, width 1.3 mm, El Lobillo.

ALL: Estepona, upper Zanclean, Lower Pliocene.

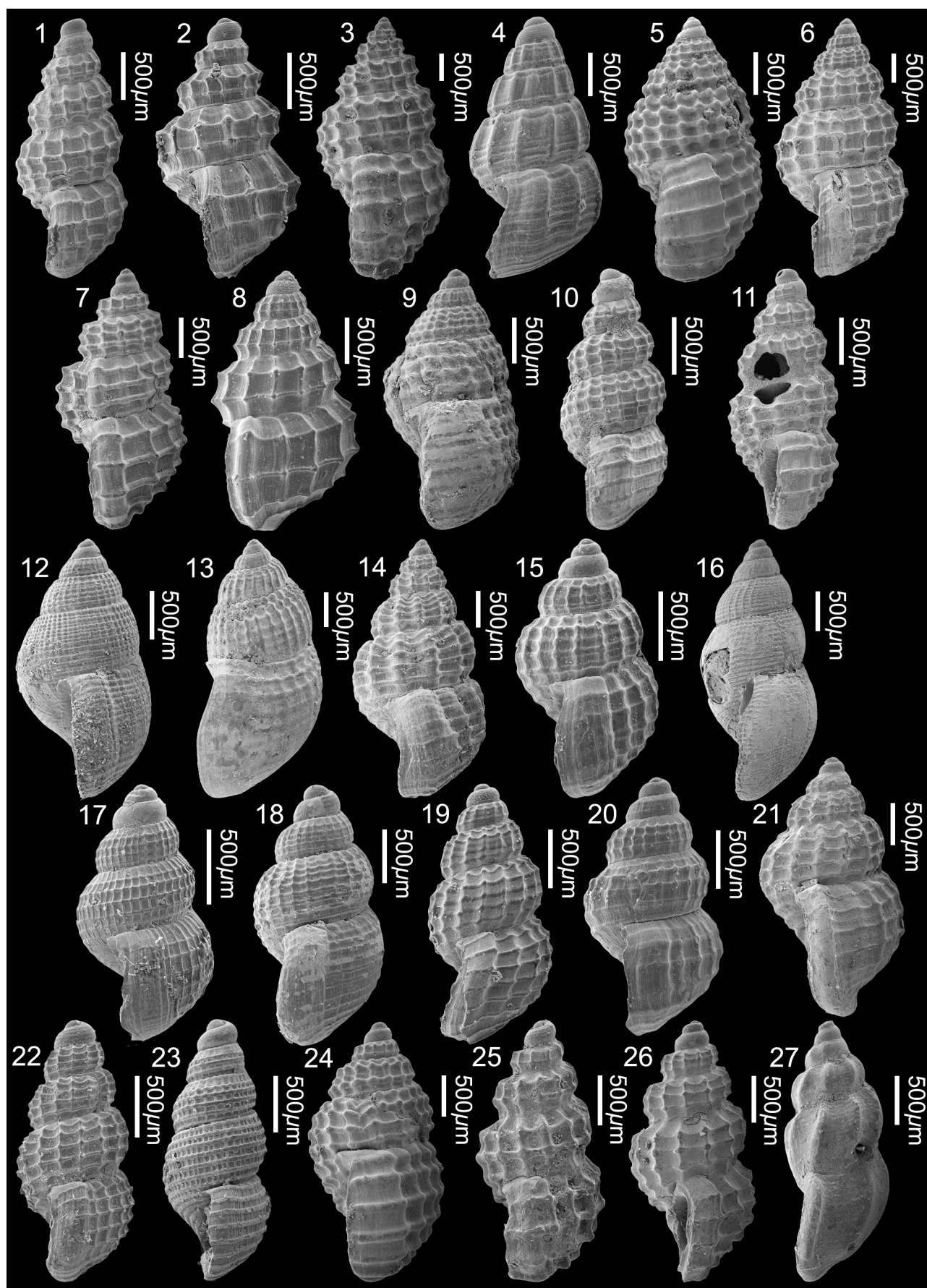


Plate 31.

Discussion

This revision of the rissoid genera *Alvania* Risso, 1826 and *Manzonina* Brusina 1870 from the uppermost Zanclean, Lower Pliocene of Estepona, southern Spain almost doubles the number of species reported by Landau *et al.* (2004) from 15 to 29 (Fig. 1). Twenty-eight species of *Alvania* are recorded, of which two are left in open nomenclature and nine are described as new. One species of the genus *Manzonina* is recorded.

Alvania is highly endemic in the Estepona assemblages, with 11 of the 28 species found only in these deposits. Fifteen of the *Alvania* species found in Estepona are extinct; *Alvania diadema* (De Stefani, 1875), *A. granosa* Tabanelli, Bongiardino & Perugia, 2011, *A. magistra* Chirli, 2006, and *A. thalia* De Stefani & Pantanelli, 1878 are also found in the Pliocene central Mediterranean of Italy. Eleven of the *Alvania* species found in Estepona are still extant in the Mediterranean.

The genus *Manzonina* is represented by a single species *Manzonina crassa* (Kanmacher, 1798), a species that is widely distributed stratigraphically and geographically, and displays considerable variability in size within populations. This variability is well illustrated in the Estepona Pliocene populations.

Acknowledgements

The authors wish to thank Massimo Appolloni (MCZR, Rome, Italy) for assistance with the Monterosato malacological collection. To Carlos Marques da Silva of the University of Lisbon, Portugal, for his advice and help with graphics. To Leon Hoffman, of the Taxonomy Mollusca, Marine Research Department, Senckenberg Forschungsinstitut Sektion Malakologie for his careful review. I have not done so before, and this is an oversight by the first author, but I would like to give an enormous thanks to Bertie Joan van Heuven and Rob Langelaan in Naturalis (Leiden, The Netherlands) for their endless patience and help with the Scanning Electron Microscope, and enormous skill in shewing off the gremlins that occasionally creep into the machine.

References

Alf, A., Brenzinger, B., Haszprunar, G., Schrödl M. & Schwabe, E. 2020. *A guide to marine molluscs of Europe*. ConchBooks, Harxheim, 1-803.

Amati, B. 2012. *Alvania consociella* Monterosato, 1884 junior synonym of *Alvania lanciae* (Calcare, 1845) (Prosobranchia, Rissoidae). *Bollettino Malacologico* 48(2): 116-121.

Amati, B., Appolloni, M., Giulio, A.D., Scuderi, D., Smriglio,

C., Oliverio, M. 2020a. Revision of the Recent *Alvania scabra* (Philippi, 1844) complex (Mollusca, Gastropoda, Rissoidae) from the Mediterranean Sea with the description of a new species. *Zootaxa* 4767(3): 415-458.

Amati, B., Appolloni, M., Quaggiotto, E., Smriglio, C. & Oliverio, M. 2019. Notes on some taxa of the *Alvania lineata*-complex and descriptions of three new species of the genus *Alvania* Risso, 1826 from the Mediterranean Sea (Gastropoda: Rissoidae). *Iberus* 37(1): 81-112.

Amati, B., Appolloni, M. & Smriglio, C. 2017. Taxonomic notes on the *Alvania cimex*-complex in the Mediterranean Sea. *Alvania cingulata* (Philippi, 1836) junior synonym of *Alvania mamillata* Risso, 1826 (Gastropoda, Rissoidae). *Iberus* 35: 123-141.

Amati, B. & Chiarelli, S. 2017. Description of *Alvania oetyliaca* n. sp. (Mollusca Gastropoda Rissoidae) from the Mediterranean Sea. *Biodiversity Journal* 8(3): 839-850.

Amati, B., Nofroni, I. & Oliverio, M. 1990. Nuove specie e riscoperte nell'*Alvania*-group dal 1980 ad oggi per il Mediterraneo (Prosobranchia; Truncatelloidea). *La Conchiglia* 22 (253-255): 47-49.

Amati, B. & Oliverio, M. 1985. *Alvania (Alvaniella) hallgassii* sp. n. (Gastropoda, Prosobranchia). *Notiziario del C.I.S.Ma* 6(1-2): 28-34.

Amati, B., Taviani, M. & Oliverio, M. 2024. Rissoidae (Mollusca, Gastropoda, Rissoidae) from taphocoenotic assemblages of the Strait of Sicily (Mediterranean Sea) with the description of two new species. *Zootaxa* 5432(1): 019-037.

Amati, B., Trono, D. & Oliverio, M. 2020b. Description of *Alvania rominae* n. sp. from the Mediterranean Sea (Mollusca Gastropoda Rissoidae). *Biodiversity Journal* 11(2): 533-543.

Anfossi, G., Brambilla, G. & Mosna, S. 1983. La fauna del Pliocene di Taino (Varese). *Atti dell'Istituto di Geologia dell'Università di Pavia* 30: 83-102.

Antit, M. & Azzouna, A. 2012. Mollusques des milieux littoraux de la baie de Tunis. *Iberus* 30(2): 107-133.

Appolloni, M., Smriglio, C., Amati, B., Lugliè, L., Nofroni, I., Tringali, L.P., Mariottini, P. & Oliverio, M. 2018. Catalogue of the primary types of marine molluscan taxa described by Tommaso Allery di Maria, Marquis of Monterosato, deposited in the Museo Civico di Zoologia, Roma. *Zootaxa* 4477 (1): 1-138.

Aradas, A. 1847. Descrizione delle conchiglie fossili di Gravelli presso Messina. *Atti dell'Accademia Gioenia di Scienze Naturali* (2)4: 57-88.

Aradas, A. & Maggiore, G. 1840-1844. Catalogo ragionato delle conchiglie viventi e fossili di Sicilia. *Atti dell'Accademia Gioenia di Scienze Naturali* 15(2): 187-217, 349-366 [1840]; 16(1): 49-87 [?1841]; 17(1): 53-106 [?1841]; 17(2): 163-205 [?1842]; 20: 101-142, 343-360 [1844].

Ardovini, R. & Carone, G. 2022. Gasteropodi di Profondità dell'Area di Capo Vaticano (Vibo Valentia). *Alleryana* 40 (1): 1-11.

Figure 1. Geography, stratigraphy and distribution of species found in the Lower Pliocene Upper Zanclean of the Estepona Basin, southern Spain. For present-day geographic distribution designated by biogeographical province: 1 = Boreal-Celtic Province, 2 = French-Iberian Province, 3 = Mediterranean-Moroccan Province, 4 = Mauritanian-Senegalese Province (see Landau *et al.*, 2011, p. 49, text-fig. 8). For stratigraphic distribution black signifies Atlantic distribution (A), grey Mediterranean distribution (M).

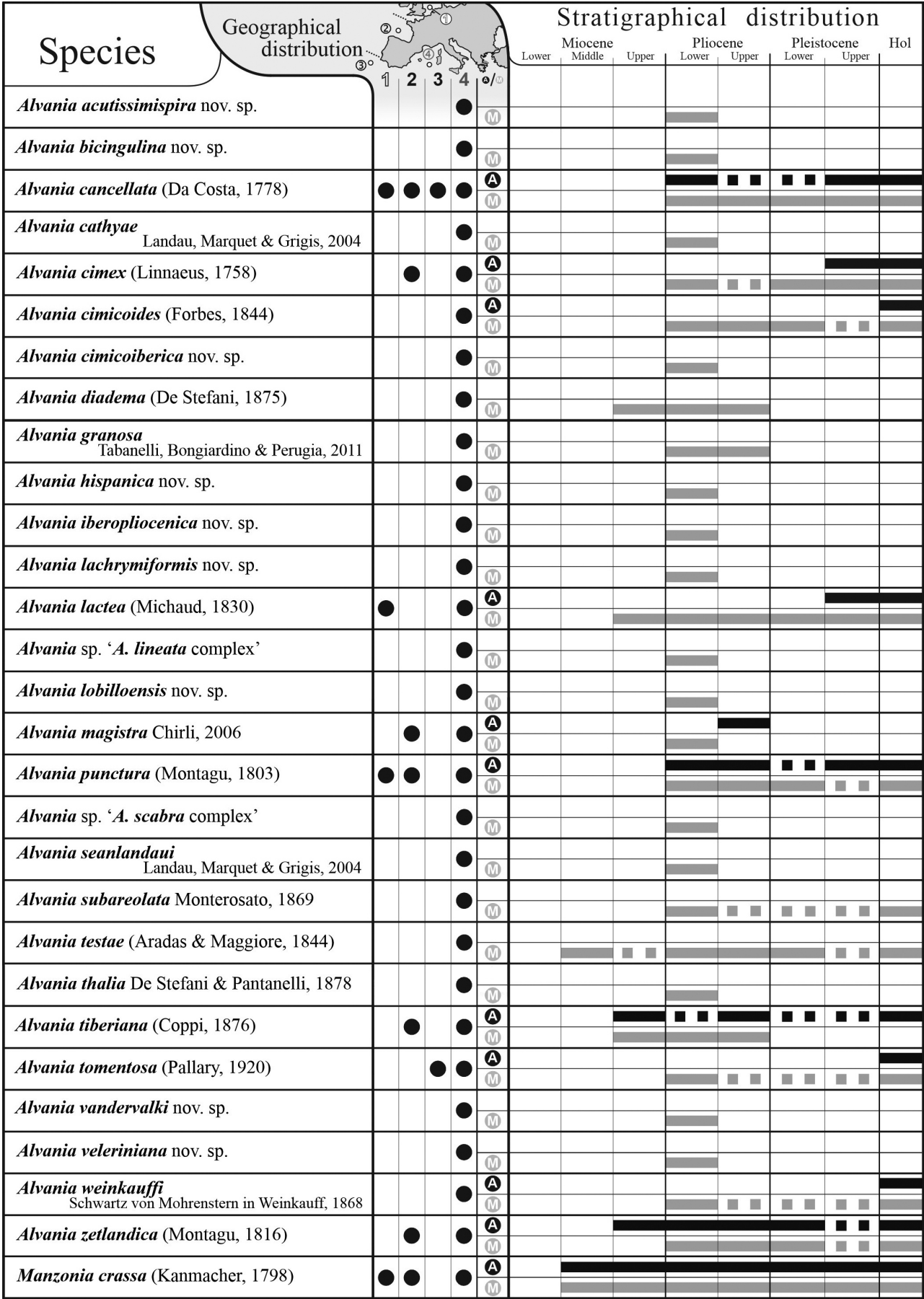


Figure 1.

- Ardevini, R. & Cossignani, T. 2000. *Atlante delle conchiglie di profondità del Mediterraneo*. L'Informatore Piceno Ed., 109 pp.
- Arduino, G. & Arduino, M. 2001. *Catalogo illustrato: Rissoidae del Mediterraneo*. Edizione Naturama, Palermo, 1-50.
- Arnaud, P.M. 1978 [1977]. Révision des taxa malacologiques méditerranéens introduits par Antoine Risso. *Annales du Muséum d'Histoire Naturelle de Nice* 5: 101-150.
- Ávila, C.M.S.P. 2005. Processos e padrões de dispersão e colonização nos Rissoidae (Mollusca: Gastropoda) dos Açores. Tese de Doutorado, universidade dos Açores, Ponta da Gada. 329 pp. (unpublished).
- Ávila, S.P., Amen, R., Azevedo, J.M.N., Cachão, M. & Garcia-Talavera, F. 2002. Checklist of the Pleistocene Marine Molluscs of Práinha and Lagoínhas (Santa Maria Island, Azores). *Açoreana* 9(4): 343-370.
- Ávila, S.P., Goud, J. & Frias Martins, A.M. de 2012. Patterns of diversity of the Rissoidae (Mollusca: Gastropoda) in the Atlantic and the Mediterranean Region. *The Scientific World Journal* 2012: 1-30.
- Ávila, S.P., Rebelo, A.C., Medeiros, A., Melo, C., Gomes, C., Bagaço, L., Madeira, P., Borges, P.A., Monteiro, P., Cordeiro, R., Meireles, R. & Ramalho, R. 2010. *Os fósseis de Santa Maria (Açores). I. A jazida da Práinha*. Nova Gráfica Lda, Observatório Vulcanológico e Geotérmico dos Açores, Lagoa, 103 pp.
- Bałuk, W. 1975. Lower Tortonian gastropods from Korytnica, Poland. *Palaeontologia Polonica* 32: 1-186.
- Beets, C. 1946. The Pliocene and Lower Pleistocene gastropods in the collections of the Geological Foundation in The Netherlands (with some remarks on other Dutch collections). *Mededeelingen van de Geologische Stichting (C-IV-I)* 6: 1-166.
- Bernasconi, M.P. & Robba, E. 1994. Notes on some Pliocene gastropods from Rio Torsero, Western Liguria, Italy. *Rivista Italiana di Paleontologia e Stratigrafia* 100: 71-102.
- Bitlis Bakýr, B. & Öztürk, B. 2016. Rissoidae Species distributed along the Turkish Levantine Coast. *Turkish Journal of Fisheries and Aquatic Sciences* 16: 443-454.
- Bitlis Bakýr, B. & Öztürk, B. 2017. The genus *Alvania* (Gastropoda: Rissoidae) along the Turkish Aegean coast with the description of a new species. *Scientia Marina* 81(3): 395-411.
- Bogi, C., Coppini, M. & Margelli, A. 1984a. Contributo alla conoscenza della malacofauna dell'Alto Tirreno. Il genere *Alvania* Risso. *La Conchiglia* 16(178-179): 18-19.
- Bogi, C., Coppini, M. & Margelli, A. 1984b. Contributo alla conoscenza della malacofauna dell'Alto Tirreno. Il genere *Alvania* Risso. *La Conchiglia* 16(180-181): 10-12 [reported year 15 in error].
- Bouchet, P. & Warén, A. 1993. Revision of the northeast Atlantic bathyal and abyssal Mesogastropoda. *Bollettino Malacologico* suppl. 3: 579-840.
- Brébion, P. 1964. Les gastéropodes du Redonien et leur signification, 1-2. Thèse de doctorat dès-Sciences. Paris (Faculté des Sciences de l'Université de Paris: 775 pp., 15 pls (27 June 1964, unpublished).
- Brunetti, M.M. & Cresti, M. 2018. *I fossili di Orciano Pisano [The fossils of Orciano Pisano]*. Atlante iconografico [An Iconographic Atlas]. Palermo (Edizioni Danaus): 232 pp.
- Brunetti, M.M. & Vecchi, G. 2012 [2010-2011]. La malacofauna Plio-Pleistocenica del Torrente Stirone (Parma) VII. Rissoidae (II). *Parva Naturalia* 9: 65-119.
- Brusina, S. 1870. *Ipsa Chiereghinii Conchylia, ovvero contribuzione pella Malacologia Adriatica desunta dal manoscritto descrizione de' Crostacei, de' Testacei, e de' Pesci che abitano le Lagune e Golfo Veneto, rappresentati in figure, a chiaro-scuro ed a colori dall'Abate S. Chiereghini ... illustrata da S. Brusina*. Pisa, Biblioteca Malacologica: 280 pp.
- Bucquoy, F., Dautzenberg, P. & Dollfus, G. 1882-1886. *Les mollusques marins du Roussillon, I. Gastropodes, avec atlas de 66 planches photographées d'après nature*. Paris (J.B. Baillière & Dautzenberg): 570 p., 66 pl. [pp. 1-40, pl. 1-5, February 1882; pp. 41-84, pl. 6-10, August 1882; pp. 85-135, pl. 11-15, February 1883; pp. 136-196, pl. 16-20, August 1883; pp. 197-222, pl. 21-25, January 1884; pp. 223-258, pl. 26-30, February 1884; pp. 259-298, pl. 31-35, August 1884; pp. 299-342, pl. 36-40, September 1884; p. 343-386, pl. 41-45, February 1885; p. 387-418, pl. 46-50, August 1885; pp. 419-454, pl. 51-60, January 1886; p. 455-486, pl. 56-60, April 1886; p. 487-570, pl. 61-66, October 1886].
- Calas, P. 1949. Note préliminaire à une revision des Rissoidae du Redonien. *Bulletins du Musée National d'Histoire Naturelle de Paris* (2)21: 164-168.
- Calcare, P. 1845. *Cenno sui molluschi viventi e fossili della Sicilia da servire da supplimento ed insieme di critiche osservazioni all'opera di R.A. Philippi*. Stamperia Reale, Palermo: 65 pp., pls 1-4.
- Cavallo, O. & Repetto, G. 1992. Conchiglie fossili del Roero. Atlante iconografico. *Associazione Naturalistica Piemontese Memorie (Associazione Amici del Museo 'Federico Eusebio')* 2: 1-251.
- Cerulli-Irelli, S. 1914. Fauna malacologica mariana, 7. Melaniidae, Fossaridae, Solariidae, Rissoidae, Capulidae, Calyptraeidae, Xenophoridae, Lamellariidae, Naticidae, Scalidae, Aclisidae, Eulimidae, Pyramidellidae. *Paleontographia Italica* 20: 357-451.
- Chimienti, G., Montesanto, F., Grieco, F., Santacroce, D., Mastrototaro, F. & Panetta, P. 2018. The Genus *Alvania* (Mollusca: Gastropoda: Rissoidae). In: A Coastal Detritic Thanatocoenosis [Il Genere *Alvania* (Mollusca: Gastropoda: Rissoidae) In Una Tanatocenosi Del Detritico Costiero]. 49° Congresso della Società Italiana di Biologia Marina Cosenatico (FC): 197-198, 4-8 June 2018.
- Chirli, C. 2006. *Malacofauna Pliocenica Toscana, 5. Caenogastropoda*. Firenze (C. Chirli): 144 pp.
- Chirli, C. & Forli, M. 2021. *The Family Rissoidae Gray, 1847 from Miocene to Present-day, in the Mediterranean Basin*. Edizioni Danaus, Palermo, 466 pp.
- Chirli, C. & Linse, U. 2011. *The Pleistocene marine Gastropods of Rhodes Island (Greece)*. Grafiche PDB, Tavarnelle V.P., Firenze, 262 pp., 90 pls.
- Coppi, F. 1876. Frammenti di paleontologia modenese. *Bollettino del Reale Comitato Geologico d'Italia* 7(5-6): 190-209.
- Cossmann, M. 1921. *Essais de paléoconchologie comparée* 12. Paris (Cossmann); 1-348, pls 1-10.
- Costa, E.M. Da 1778. *Historia naturalis testaceorum Britanniae*. London (Millan, White, Elmsley & Robson): xii + 254 + viii pp.
- Cox, L.R. 1960. Thoughts on the classification of the Gastro-

- poda. *Proceedings of the Malacological Society of London* 33(6): 239-261.
- Cuerda Barceló, J. 1987. *Molluscos marinos y salobres del Pleistoceno Balear*. Palma de Mallorca (Publ. Caja de Baleares 'Sa Nostra'): 421 pp.
- Dautzenberg, P. & Fischer, H. 1896. Dragages effectués par l'Hirondelle et par la Princesse Alice 1888-1895. 1. Mollusques Gastéropodes. *Mémoires de la Société Zoologique de France* 9: 395-498, pls 15-22.
- Della Bella, G. & Scarponi, D. 2000. Una nuova specie di *Alvania* (Rissoidae) nel Pliocene del Mediterraneo. *Giornale di Geologia* (ser. 3) 62: 63-68.
- De Stefani, C. 1875 [1874]. Fosili pliocenici dei dintorni di S. Miniato (Toscana). *Bullettino Malacologico italiano* 7: 5-88.
- De Stefani, C. 1888. Iconografia dei nuovi molluschi pliocenici d'intorno Siena. *Bullettino della Società malacologica italiana* 13: 181-235.
- De Stefani, C. & Pantanelli, D. 1878-1880. Molluschi pliocenici dei dintorni di Siena. *Bullettino della Società Malacologica italiana* 4: 1-48 [14 October 1878]; 49-112 [18 February 1879]; 113-160 [October 1879]; 161-216 [11 January 1880].
- Di Geronimo, I. 1979. Il Pleistocene in facies batiale di Valle Palione (Grammichele, Catania). *Bollettino Malacologico* 15(5-6): 85-156.
- Di Geronimo, I. & La Perna, R. 1997. Pleistocene bathyal molluscan assemblages from Southern Italy. *Rivista Italiana di Paleontologia e Stratigrafia* 103: 389-426.
- Di Geronimo, I. & Panetta, P. 1973. La malacofauna batiale del Golfo di Taranto. *Conchiglie* 9 (5-6): 69-121.
- Doderlein, P. 1862. Cenni geologici intorno la giacitura dei terreni miocenici superiori dell'Italia centrale. Estratto dagli *Atti del X° Congresso degli Scienziati Italiani*, 1862, Siena: 25 pp. Also published as: 1864, *Atti del Decimo Congresso degli Scienziati Italiani*: 83-107, 223 (errata).
- Dollfus, G. & Dautzenberg, Ph. 1886-1887. Etude préliminaire des coquilles fossiles des faluns de la Touraine. *La Feuille des Jeunes Naturalistes* 16 (1886): 77-80, 92-96, 101-105, 138-143; 17 (1887): 21-25, 33-36.
- Fekih, M. 1975. Paleocologie du Pliocène marin au nord de la Tunisie. *Annales des Mines et de la Géologie* 27: 1-195.
- Fernandes, F. & Rolán, R. 1993. Molluscos marinos de São Tomé. *Iberus* 2: 31-47.
- Ferrero Mortara, E.L., Montefameglio, L., Novelli, M., Opresso, G., Pavia, G. & Tampieri, R. 1984. Catalogo dei tipi e degli esemplari figurati della collezione Bellardi e Sacco, 2. *Museo Regionale di Scienze Naturali Cataloghi* 7: 1-484.
- Forbes, E. 1844. Report on the Mollusca and Radiata of the Aegean Sea, and on their distribution, considered as bearing on geology. *Reports of the British Association for the Advancement of Science* (1843): 130-193.
- Forbes, E. & Hanley, S. 1848-53. A history of British Mollusca and their shells 1-4. London (van Voorst) [published in parts; for publication dates see Fisher & Tomlin 1935, *Journal of Conchology* 20: 150-151].
- Forli, M., Dell'Angelo, B. & Taviani, M. 1999. Molluschi del Pliocene inferiore toscano: la sezione Montenero (Grosseto). *Bollettino Malacologico* 34: 109-122.
- Fretter, V. & Graham, A. 1978. The prosobranch molluscs of Britain and Denmark, 4. Marine Rissoacea. *The Journal of Molluscan Studies* suppl. 6: 153-241.
- Friedberg, W. 1911-28. *Mięczaki miocenne ziem Polskich (Mollusca Miocaenica Poloniae)*, 1. *Ślimaki i lódkonogi, 1. Gastropoda et Scaphopoda*. Lwow (Muzeum Imienia Dzieduszyckich): 631 pp. (issued in parts: 1, 1-112, pls 1-5 (1911); 2, 113-240, pls 6-14 (1912); 3, 241-360, pls 15-20 (1914); 4, 361-440, pls 21-26 (1923); 5, 441-631, pls 27-38 (1928). Reprinted 1951-55 with slightly different title and pagination, Warszawa (Wydawnictwa Geologiczne).
- Gardella, F., Bertaccini, E., Bertamini, R., Bongiardino, C., Petracci, P. & Tabanelli, C. 2021. La malacofauna dello "spungone". *Alvania cerreti* n. sp. (Mollusca: Gastropoda: Caenogastropoda: Rissoidae). *Quaderno di Studi e Notizie di Storia Naturale della Romagna* 53: 19-25.
- Garilli, V. 2008. On some Neogene to Recent species related to *Galeodina* Monterosato, 1884, *Galeodinopsis* Sacco, 1895, and *Massotia* B., D. & D., 1884 (Caenogastropoda: Rissoidae) with the description of two new *Alvania* species from the Mediterranean Pleistocene. *The Nautilus* 122: 19-51.
- Garilli, V. & Parrinello, D. 2010. Two similar new species of *Alvania* Risso, 1826 (Caenogastropoda: Rissoidae) from the late Cenozoic of Italy. *Molluscan Research* 30(3): 165-175.
- Garilli, V. & Parrinello, D. 2014. Taxonomy and palaeobiogeography of the Cenozoic Euro-Mediterranean rissoid gastropod *Galeodinopsis* and its relationship with close genera. *Acta Palaeontologica Polonica* 59: 379-406.
- Giannuzzi-Savelli, R., Pusateri, F., Palmeri, A. & Ebreo, C. 1997. *Atlante delle conchiglie marine del Mediterraneo, 2 (Caenogastropoda 1. Discopoda-Heteropoda)*. Roma ('La Conchiglia'): 258 pp.
- Gili, C. & Martinell, J. 1994. Relationships between species longevity and larval ecology in nassariid gastropods. *Lethaia* 27: 291-299.
- Giribet, G. & Peñas, A. 1997. Malacological marine fauna from Garraf coast (NE Iberian Peninsula). *Iberus* 15(1): 41-93.
- Glibert, M. 1949. Gastropodes du Miocène moyen du Bassin de la Loire. Première partie. *Institut Royal des Sciences naturelles de Belgique, Mémoires* ser. 2, 30: 1-240.
- Gofas, S. 1999. The West African Rissoidae (Gastropoda: Rissoidea) and their similarities to some European species. *The Nautilus* 113: 78-101.
- Gofas, S. 2007. Rissoidae (Mollusca: Gastropoda) from northeast Atlantic seamounts. *Journal of Natural History* 41(13-16), 779-885.
- Gofas, S. & Oliver, J.D. 2011. Familia Rissoidae. In: Gofas S., Moreno D. & Salas C. (eds): *Molluscos marinos de Andalucía. Vol. 1*. Servicio de Publicaciones e Intercambio Científico, Universidad de Málaga, pp. 167-194.
- Gofas, S. & Warén, A. 1982. Taxonomie de quelques especes du genre *Alvania* (Mollusca, Gastropoda) des côtes Iberiques et Marocaines. *Bollettino Malacologico* 18(1-4), 1-16.
- Granata Grillo, G. 1876-1877. Contribuzione pella fauna dei molluschi del Mediterraneo. Catalogo delle conchiglie di Messina e dintorni. *Il Barth, Giornale di Medicina e Scienze Naturali, Malta* 4(1): 73-78 [1876]; 4(2): 143-147, 5(1): 17-20 [1877].
- Gray, J.E. 1847. On the classification of the British Mollusca by W.E. Leach, M.D. *Annals and Magazine of Natural History* (1)20: 267-273 [October].
- Gunert, P., Ćorić, S., Landau, B.M., van der Valk, B., Lirer, F. & Harzhauser, M. 2025. Biostratigraphy of the Estepona

- assemblages (southern Spain), based on calcareous nannofossils and planktonic foraminifera. *Cainozoic Research* 25(1): 17-23.
- Harmer, F.W. 1914-1925. The Pliocene Mollusca of Great Britain, being supplementary to S.V. Wood's monograph of the Crag Mollusca, 1. *Monographs of the Palaeontographical Society* 1(1): 1-200 (1914); 1(2): 201-302 (1915), 1(3): 303-461 (1918), 1(4): 463-483 (1919), 2(1): 485-652 (1920), 2(2): 653-704 (1921), 2(3): 705-856 (1923), 2(4): 857-900 (1925).
- Hernández, J.M., Rolán, E., Swinnen, F., Gómez, R. & Pérez, J.M. 2011. *Moluscos y Conchas Marinas de Canarias. Solenogastres, Caudofoveata, Polyplacophora, Gastropoda, Bivalvia, Cephalopoda y Scaphopoda*. ConchBooks, Hackenheim, 716 pp.
- Hoffman, L., Van Heugten, B. & Lavaleye, M.S.S. 2011. Gastropoda (Mollusca) from the Rockall and Hatton Banks, northeastern Atlantic Ocean. 3. *Miscellanea Malacologica* 5(2): 23-52.
- Hoenselaar, H.J. & Goud, J. 1998. The Rissoidae of the CANCAP expeditions, I: the genus *Alvania* Risso, 1826 (Gastropoda, Prosobranchia). *Basteria* 62(1-2): 69-115.
- Hörnes, M. 1851-1870. Die fossilen Mollusken des Tertiär-Beckens von Wien. *Abhandlungen der Kaiserlich-Königlichen Geologischen Reichsanstalt* 3-4: 1-42, pl. 1-5 (1851), 43-208, pl. 6-20 (1852), 209-296, pl. 21-32 (1853), 297-382, pl. 33-40 (1854), 383-460, pl. 41-45 (1855), 461-736, pl. 46-52 (1856) (3); 1-479, pls 1-85 (1870) (4).
- Hubendick, B. & Warén, A. 1969. Småsnäckor vid svenska västkusten. 1. Släkte *Alvania*. *Göteborgs Naturhistoriska Museum Årstryck* 1969: 55-61.
- Ilijina [Il'ina], L.B. 1966. The history of Gastropods of the Black Sea [in Russian]. *Trudy paleontologičeskogo Instituta* 110: 1-228.
- Jablonski, D. & Lutz, R.A. 1980. Molluscan larval shell morphology, ecological and paleontological applications, pp 323-377. In: D. C. Rhoads, & R. A. Lutz (eds.): *Skeletal Growth of Aquatic Organisms, Biological Records of Environmental Change*. Plenum Press, New York.
- Janssen, A.W. 2004. Holoplanktonic molluscan assemblages (Gastropoda, Heteropoda, Thecosomata) from the Pliocene of Estepona (Spain, Malaga). *Palaeontos* 5: 103-131.
- Jeffreys, J.G. 1862-1869. *British conchology*. Vol. 1: pp. cxiv + 341 [1862]. Vol. 2: pp. 479 [1864]. Vol. 3: pp. 394 [1865]. Vol. 4: pp. 487 [1867]. Vol. 5: pp. 259 [1869]. London, van Voorst.
- Jeffreys, J.G. 1870. Mediterranean Mollusca. *Annals and Magazine of Natural History* ser. 4, 6: 65-86.
- Jeffreys, J.G. 1884. On the Mollusca procured during the 'Lightning' and 'Porcupine' expeditions 1868-70 (Part VII). *Proceedings of the Zoological Society of London* 1884: 111-149, pls 9-10.
- Kanmacher, F. 1798. *Essays on the microscope. The Second Edition, with considerable additions and improvements*. Dillon & Keating, London. xvii + [7 unnumbered] + 724 pp., 32 pls.
- Kowalke, T. & Harzhauser, M. 2004. Early ontogeny and palaeoecology of the Mid-Miocene rissoid gastropods of the Central Paratethys. *Acta Palaeontologica Polonica* 49: 111-134.
- Landau, B.M., Ceulemans, L. & Van Dingenen, F. 2018. The upper Miocene gastropods of northwestern France, 2. Caenogastropoda. *Cainozoic Research* 18: 177-368.
- Landau, B.M., Marquet, R. & Grigis, M. 2003. The early Pliocene Gastropoda (Mollusca) of Estepona, southern Spain. Part 1: Vetigastropoda. *Palaeontos* 3: 1-87, pls 1-19.
- Landau, B.M., Marquet, R. & Grigis, M. 2004. The early Pliocene Gastropoda (Mollusca) of Estepona, southern Spain, 2. Orthogastropoda, Neotaenioglossa. *Palaeontos* 4: 1-108.
- Landau, B.M. & Micali, P. 2021. The Pliocene Gastropoda (Mollusca) of Estepona, southern Spain. Part 13: Murchisonelloidea and Pyramidelloidea. *Cainozoic Research* 21(2): 159-351.
- Landau, B.M., Silva, C.M. da & Mayoral, E. 2011. The lower Pliocene gastropods of the Huelva Sands Formation, Guadalquivir Basin, southwestern Spain. *Palaeofocus* 4: 1-90.
- Leach, W.E. 1852. *Molluscorum Britanniae Synopsis. A synopsis of the Mollusca of Great Britain arranged according to their natural affinities and anatomical structure*. Van Voorst, London, viii + 376 pp. (edited posthumously by J. E. Gray).
- Linnaeus, C. 1758. *Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis, 1. Editio decima, reformata*. Holmiae (Laurentii Salvii): 824 pp. [facsimile reprint, British Museum (Natural History), 1956].
- Locard, A. 1886. *Prodrome de malacologie française. Catalogue général des mollusques vivants de France. Mollusques marins*. Lyon: H. Georg & Paris: Baillière: x + 778 pp.
- Locard, A. 1891. Les coquilles marines des côtes de France. *Annales de la Société Linnéenne de Lyon* 37: 1-385 [Published 31 October 1891; also published by Baillière as a book in 1892].
- Lozouet, P., Lesport, J.F., & Renard, P. 2001. Révision des Gastropoda (Mollusca) du stratotype de l'Aquitainien (Miocène inf.): site de Saucats 'Larrey', Gironde, France. *Cossmanniana* (hors série 3): 1-189.
- MacGillivray, W. 1843. *A history of the molluscous animals of the counties of Aberdeen, Kincardine and Banff, to which is appended an account of the cirripedal animals of the same district*. Cunningham & Mortimer, London. xxiv + 372 pp.
- Malatesta, A. 1960. Malacofauna pleistocenica di Grammichele (Sicilia). *Memorie per Servire alla Carta Geologica d'Italia* 12: 1-196.
- Malatesta, A. 1974. Malacofauna pliocenica Umbra. *Memorie per Servire alla Carta Geologica d'Italia* 13: 1-498.
- Mancini, A. 2003. Nota malacologica di aggiornamento sulle specie rinvenute alla cava di Formello (Guidonia). *Annali dell'Associazione Nomentana di Storia ed Archeologia* 4: 7-21.
- Marquet, R. & Landau, B.M. 2006 [2005]. The gastropod fauna of the Luchtbal Sand Member (Lillo Formation, Zanclean, early Pliocene) of the Antwerp region (Belgium). *Cainozoic Research* 5: 13-50.
- Martins, A.M.F. de, Borges, J.P., Ávila, S.P., Costa, A.C., Madeira, P. & Morton, B. 2009. Illustrated checklist of the infralittoral molluscs off Vila Franca do Campo. *Açoreana* 6: 15-103.
- Melone, G. & Sabelli, B. 1980. Ritrovamento di *Alvania subaeolata* Monterosato, 1869. *Bollettino Malacologico* 16(9-10): 361-366.
- Meznerics, I. 1933. Die Minutien der tortonischen Ablagerungen von Steinabrunn in Niederösterreich. *Annalen des*

- Naturhistorischen Museums in Wien* 46: 319-359.
- Michaud, A.L.G. 1830. *Description de plusieurs espèces de coquilles du genre Rissoa*. Lyon: Perrin. 19 pp., 1 pl.
- Monegatti, P. & Raffi, S. 2001. Taxonomic diversity and stratigraphic distribution of Mediterranean Pliocene bivalves. *Palaeogeography Palaeoclimatology Palaeoecology* 165: 171-193.
- Montagu, G. 1803. *Testacea Britannica, or natural history of British shells, marine, land and the fresh-water, including the most minute: systematically arranged and embellished with figures*. London (Romsey): xxxvii + 606 pp.
- Montagu, G. 1808. *Supplement to Testacea Britannica with Additional Plates*. Woolmer, Exeter. v + 183 pp., pl. 17-30.
- Montagu, G. 1816 [1815]. An account of some new and rare marine British shells and animals. *Transactions of the Linnean Society of London* 11(2): 179-204, pls 12-14 [24 January 1816].
- Monterosato, T.A. di 1869. *Testacei nuovi dei mari di Sicilia*. Tipografia di Ignazio Mirto, printed for the Author, Palermo, 18 pp.; 1 pl.
- Monterosato, T.A. di 1875. Nuova rivista delle Conchiglie Mediterranee. *Atti dell'Accademia di Scienze, Lettere ed Arti di Palermo, New Series* 5(1): 1-50.
- Monterosato, T.A. di 1878. Enumerazione e sinonimia delle conchiglie mediterranee. *Giornale di Scienze Naturali ed Economiche pubblicato per cura della Società di Scienze Naturali ed Economiche di Palermo* 13: 61-115.
- Monterosato, T.A. di 1883-1885. Conchiglie littorali mediterranee. *Naturalista Siciliano*, 3(3): 87-91 (1883); 3(4): 102-111; 3(5): 137-140; 3(6): 159-163; 3(8): 227-231; 3(10): 277-281; 4(1-2): 21-25; 4(3): 60-63 (1884); 4(4): 80-84; 4(8): 200-204 (1885).
- Monterosato, T.A. di 1889. Coquilles marines marocaines. *Journal de Conchyliologie* 37(1): 20-40 [2 May 1889]; 37(2): 112-121 [20 September 1889].
- Moolenbeek, R.G. & Faber, M.G. 1987a. The Macaronesian species of the genus *Manzonina* (Gastropoda: Rissoidae), Part 1. *De Kreukel* 23(1): 1-16.
- Moolenbeek, R.G. & Faber, M.G. 1987b. The Macaronesian species of the genus *Manzonina* (Gastropoda: Rissoidae), Part 2. *De Kreukel* 23(2-3): 23-31.
- Moolenbeek, R.G. & Faber, M.G. 1987c. The Macaronesian species of the genus *Manzonina* (Gastropoda: Rissoidae), Part 3. *De Kreukel* 23(10): 166-179.
- Moolenbeek, R.G. & Hoenselaar, H.J. 1989. The genus *Alvania* on the Canary Islands and Madeira (Mollusca, Gastropoda). Part 1. *Bulletin, Zoölogisch Museum, Universiteit van Amsterdam* 11(27): 215-228.
- Moolenbeek, R.G., Hoenselaar, H.J. & Oliverio, M. 1991. The Rissoid species described by J.J. Oberling. *Bollettino Malacologico* 27:107-120.
- Morgan, J. de 1916. Observations sur la stratigraphie et la paléontologie du Falunien de la Touraine. *Bulletin de la Société Géologique de France, quatrième série* 15: 217-241.
- Nardo, G.D. 1847. *Sinonimia Moderna delle Specie Registrate nell'Opera Intitolata: Descrizione de' Crostacei, de' Testacei e de' Pesci che Abitano le Lagune e Golfo Veneto Rappresentati in Figure, a Chiaro-scuro ed a Colori dall'Abate Stefano Chiereghini Ven. Clodiense*. Antonelli: Venezia.
- Negri, M.P. & Corselli, C. 2016. Bathyal Mollusca from the cold-water coral biotope of Santa Maria di Leuca (Apulian margin, southern Italy). *Zootaxa* 4186(1): 1-97.
- Nekhaev, I.O. 2013. The first record of *Alvania punctura* from Russian waters (Gastropoda: Rissoidae). *Marine Biodiversity Records* 6(2): 1-3.
- Nevill, G. 1885. *Hand list of Mollusca in the Indian Museum, Calcutta, 2. Gastropoda. Prosobranchia-Neurobranchia (contd.)*. London (J. White): x + 306 pp.
- Nordsieck, F. 1972. *Die europäischen Meeresschnecken (Opisthobranchia mit Pyramidellidae; Rissoacea)*. Vom Eismeer bis Kapverden, Mittelmeer und Schwarzes Meer. I-XIII, Stuttgart: 1-327.
- Nordsieck, F. 1974. Molluschi dei fondali della platea continentale fra la Corsica e la Sardegna. *La Conchiglia* 61: 11-14.
- Oberling, J.-J. 1970. Quelques espèces nouvelles de Gastropodes du bassin Méditerranéen. *Naturhistorisches Museum Bern. Kleine Mitteilungen* 1: 1-7.
- Oliver, J.D., Calvo, M., Guallart, J., Sancheztocino, L. & Templado, J. 2015. Marine gastropods of the Chafarinas island (southwestern Mediterranean). *Iberus* 33(1): 97-150.
- Oliver, J.D., Gofas, S., Urgorri, V., Díaz-Agras, G. & Templado, J. 2022. Rissoidae gastropods of the outer continental shelf and slope off Galicia (NW Spain). *Zootaxa* 5196(1): 001-045.
- Oliver, P.G., Morgenroth, H., Salvador, A. 2017. Type specimens of Mollusca described by Col. George Montagu in the Royal Albert Memorial Museum & Art Gallery, Exeter and The Natural History Museum, London. *Zoosystema Evolution* 93(2): 363-412.
- Oliverio, M. & Amati, B. 1990. Una nuova specie del gruppo di *Alvania subcrenulata* (Gastropoda: Rissoidae). *Bollettino Malacologico* 26(5-9): 83-90.
- Oliverio, M., Amati, B. & Nofroni, I. 1986 [1985-1986]. Proposta di adeguamento sistematico dei Rissoidae (sensu Ponder) del Mar Mediterraneo. Parte I: famiglia Rissoidae Gray, 1847 (Gastropoda: Prosobranchia). *Notiziario del CISM* 7-8(8-9): 35-52.
- Oliverio, M., Amati, B. & Nofroni, I. 1993. Revision of the *Alvania testae* group of species (Gastropoda, Prosobranchia, Truncatelloidea = Rissoidea). *Lavori S.I.M.* 24: 249-259.
- Orbigny, A. d' 1852. *Prodrome de paléontologie stratigraphique universelle des animaux mollusques et rayonnés, faisant suite au cours élémentaire de paléontologie et de géologie stratigraphique*, 3. Paris (Victor Masson): 1-196, index 1-189.
- Öztürk, B., Buzzurro, G. & Avni Benli, H. 2004 [2003]. Marine molluscs from Cyprus: new data and checklist. *Bollettino Malacologico* 39(5-8): 49-78.
- Pallary, P. 1902. Liste des mollusques testacés de la baie de Tanger. *Journal de Conchyliologie* 50: 1-39, pl. 1.
- Pallary, P. 1920. Malacologie. In: *Exploration Scientifique du Maroc, Organisée par la Société de Géographie de Paris et Continué par la Société des Sciences Naturelles du Maroc. Vol. 2. L'Institut Scientifique Chérifien, Rabat & É. Larose Éditeur, Paris*, 108 pp., 1 pl., 1 map.
- Pavia, G. 1980. Molluschi del Tabianiano del Basso Monferrato (Alba, Italia NW). *Bollettino della Società Paleontologica Italiana* 19: 205-226.
- Peñas, A., Rolán, E., Luque, A., Templado, J., Moreno, D., Rubio, F., Salas, C., Sierra, A. & Gofas, S. 2006. Moluscos Marinos de la Isla de Alborán. *Iberus* 24 (1): 23-151.

- Petersen, K.J. 2004. Late Quaternary environmental changes recorded in the Danish marine molluscan faunas. *Geological Survey of Denmark and Greenland Bulletin* 3: 268 pp.
- Petracci, P. & Bertamini, R. 2013. Segnalazione di *Alvania cimex* (Linné, 1758) (Gastropoda, Caenogastropoda, Rissoidae) in una malacofauna del Miocene superiore. *Quaderno di Studi e Notizie di Storia Naturale della Romagna* 38: 1-6.
- Philippi, R.A. 1836. *Enumeratio molluscorum siciliae cum ventium tum in tellure tertiaria fossilium quae in itinere suo observavit auctor*. Berolini (Schropp): xiv + 268 pp.
- Philippi, R.A. 1844. *Enumeratio molluscorum siciliae cum ventium tum in tellure tertiaria fossilium quae in itinere suo observavit auctor, 2. Continens addenda et emendanda, nec non comparisonem faunae recentis siciliae cum faunis aliarum terrarum et cum fauna periodi tertiariae*. Halis Saxonium (E. Anton): iv + 303 pp.
- Ponder, W.F. 1985. A review of the genera of the Rissoidae (Mollusca: Mesogastropoda: Rissoacea). *Records of the Australian Museum Suppl.* 4: 1-221.
- Poppe, G.T. & Goto, Y. 1991. *European seashells, 1. Polyplacophora, Caudofoveata, Solenogastrea, Gastropoda*. Wiesbaden (Verlag Christa Hemmen): 352 pp.
- Raad, H.J., Simons, G. & Wesselingh, F.P. 2013. De fossiele schelpen van de Nederlandse kust, 2. Rissoidae (deel 4). *Spirula* 391: 46-59.
- Raffi, S. & Monegatti, P. 1993. Bivalve taxonomic diversity throughout the Italian Pliocene as a tool for climatic-oceanographic and stratigraphic inferences. *Ciências da Terra* 12: 45-50.
- Recluz, C.A. 1843. Catalogue descriptif de plusieurs nouvelles espèces de coquilles de France suivi d'observations sur quelques autres. *Revue zoologique, par la Société Cuvierienne* 6: 5-12, 104-112, 228-238, 257-261.
- Regteren Altena, C.O. van, Bloklander, A. & Pouderoyen, L.P. 1954-1956. De fossiele schelpen van de Nederlandse stranden en zeegaten, 1-3. *Basteria* 18: 54-64, pls 1-4 (1, 1954); 19: 27-34, pls 5-8 (2, 1955); 20: 81-90, pls 9-12 (3, 1956).
- Risso, A. 1826. *Histoire naturelle des principales productions de l'Europe méridionale et principalement de celles des environs de Nice et des Alpes-Maritimes, 4. Mollusques*. Paris (Levrault): i-vii, 1-439.
- Rolán, E. 2005. *Malacological fauna from the Cape Verde Archipelago. Part 1 Polyplacophora and Gastropoda*. Conch Books, 455 pp.
- Rolán, E. & Fernandes, F. 1990. Tres nuevas especies del género *Manzonina* (Mollusca, Gastropoda) para la costa occidental de Africa. *Publicações Ocasionais de la Sociedade Portuguesa de Malacologia* 15: 63-68.
- Romani, R., Raveggi A., Scaperrotta, M. & Bartolini, S. 2018. Contributo alla conoscenza della malacofauna marina delle isole adriatiche. 1. Nota sui micromolluschi marini conchiferi rinvenuti sulla costa settentrionale dell'isola di Lastovo [Lagosta] (Croazia, Mar Adriatico Sud-Orientale). *Alleryana* 36(1): 1-22.
- Rueda, J., Salas, C. & Gofas, S. 2000. A molluscan community from coastal bioclastic bottoms in the Strait of Gibraltar area. *Iberus* 18(1): 95-123.
- Ruggieri, G. 1950. Contribuzione alla conoscenza della malacofauna e della stratigrafia del Pliocene e del Quaternario. *Giornale di Geologia. Annali del Museo Geologico di Bologna serie seconda* 21: 65-89, pl. 2.
- Ruggieri, G. 1981. *Alvania heraelaciniae* ed il sottogenere *Profundialvania* Taviani, 1975. *Bollettino Malacologico* 17: 205-210.
- Sabelli, B., Giannuzzi-Savelli, R. & Bedulli, D. 1990-1992. *Catalogo annotato dei Molluschi marini del Mediterraneo*. Edizioni Libreria Naturalistica Bolognese, Bologna. vol. 1 (1990), pp. i-xiv, 1-348; vol. 2 (1992), pp. 349-498; vol. 3 (1992), pp. 501-781.
- Sacchetti, C., Landau, B. & Ávila, S.P. 2023. The Lower Pliocene marine gastropods of Santa Maria Island, Azores: Taxonomy and palaeobiogeographic implications. *Zootaxa* 5295(1): 1-150.
- Sacco, F. 1895. I molluschi dei terreni terziarii del Piemonte e della Liguria, 18. (Melaniidae, Littorinidae, Fossaridae, Rissoidae, Hydrobiidae, Paludinidae e Valvatidae). *Bollettino dei Musei di Zoologia ed Anatomia comparata della Reale Università di Torino* 10 (206): 75-78 (May 30, 1895).
- Sars, O.G. 1878. *Bitrag til Kundskaben om Norges Arktiske Fauna. 1. Mollusca Regionis Arcticae Norvegiae. Oversigt over de i Norges Arktiske Region Forekommende Bløddyr*. Christiania [= Oslo], xiii + 466 pp., 34 + 18 [anatomical] pls., 1 map.
- Scaperrotta, M., Bartolini, S. & Bogi, C. 2009. *Accrescimenti: stadi di accrescimento dei molluschi marini del Mediterraneo. Vol. 1*. L'Informatore Piceno, Ancona, 167 pp.
- Scaperrotta, M., Bartolini, S. & Bogi, C. 2010. *Accrescimenti: stadi di accrescimento dei molluschi marini del Mediterraneo. Vol. 2*. L'Informatore Piceno, Ancona, 176 pp.
- Scaperrotta, M., Bartolini, S. & Bogi, C. 2011. *Accrescimenti: stadi di accrescimento dei molluschi marini del Mediterraneo. Vol. 3*. L'Informatore Piceno, Ancona, 184 pp.
- Scaperrotta, M., Bartolini, S. & Bogi, C. 2012. *Accrescimenti: stadi di accrescimento dei molluschi marini del Mediterraneo. Vol. 4*. L'Informatore Piceno, Ancona, 184 pp.
- Scaperrotta, M., Bartolini, S. & Bogi, C. 2019. *Accrescimenti: stadi di accrescimento dei molluschi marini del Mediterraneo. Vol. 10*. L'Informatore Piceno, Ancona, 212 pp.
- Seguenza, G. 1876. Di alcuni molluschi del mare di Messina. *Bullettino della Società Malacologica Italiana* 2(1): 62-65.
- Seguenza, L. 1903. Rissoidi neogenici della provincia di Messina. *Paleontographica Italica* 9: 35-60, pl. 11.
- Silva, C.M. da 2001. *Gastropodes pliocénicos marinhos de Portugal: sistemática, paleoecologia, paleobiologia, paleogeografia*. Dissertação de doutoramento. Faculdade de Ciências da Universidade de Lisboa, Lisboa: 747 pp. (unpublished).
- Sosso, M. & Dell'Angelo, B. 2010. *I fossili del Rio Torsero*. Prato (Editing Marginalia, Cartotecnica Beusi srl): 95 pp.
- Sowerby, I. G.B. 1821-1834. *The genera of recent and fossil shells, for the use of students, in conchology and geology*. Published in 42 parts. Vol. 1, pls 1-126 [1821-1825]; vol. 2, pls 127-262 + text (unpaginated) [1825-1834]. London: G. B. Sowerby.
- Tabanelli, C. 1988. Presenza e variabilità di *Alvania diadema* (Doderlein in de Stefani, 1874) (Gastropoda: Prosobranchia) nella serie marina plio-pleistocenica della Romagna. *Bollettino Malacologico* 24: 49-60.
- Tabanelli, C. 2008. Associazioni di paleocomunità batiali a

- molluschi bentonici nel Pliocene della Romagna. Metodologie ed indicazioni per nuove tematiche. *Quaderno di Studi e Notizie di Storia naturale della Romagna* 26: 1-80.
- Tabanelli, C., Bongiardino, C. & Perugia, I. 2011. Cingulopsidae e Rissoidae provenienti dallo 'spungone' (Pedeappennino romagnolo) e loro eventuale significato paleoambientale. *Quaderno di Studi e Notizie di Storia Naturale della Romagna* 32: 27-76.
- Tabanelli, C., Bertaccini, E., Bertamini, R., Bongiardino, C., Gardella, F. & Petracci, P. 2020. La malacofauna dello "spungone" Le famiglie Rissoidae e Rissoidinae: addenda et corrigenda. *Quaderno di Studi e Notizie di Storia Naturale della Romagna* 51: 19-40.
- Thivaoui, D., Harzhauser, M. & Koskeridou, E. 2019. Early Miocene gastropods from the Felli section (Proto-Mediterranean Sea, NW Greece). *Geodiversitas* 41(8): 323-366.
- Thorpe, C. 1844. *British marine conchology: Being a descriptive catalogue, arranged according to the Lamarckian system, of the salt water shells of Great Britain*. London: Edward Lumley: 1 + 267 pp.
- Tisselli, M. & Micali, P. 2023. *Alvania skylla* n. sp. from the Mediterranean Sea (Gastropoda: Rissoidae). *Bollettino Malacologico* 59(2): 156-165.
- Van Aartsen, J.J. 1982. Tavole sinottiche di conchiologia Mediterranea ed Europea Genere *Alvania* (Sottogeneri: *Arsenia* e *Alvaniella*). *La Conchiglia* 14(164-165): 4-6.
- Van Aartsen, J.J. 1983. *Manzonina overdiepi*, a new marine gastropod (Rissoidae) from Canary and Madeira is. *La Conchiglia* 15(168-169): 6-7.
- Van Aartsen, J.J., Menkhorst, H.P.M.G. & Gittenberger, E. 1984. The Marine Mollusca of Algeciras, Spain, with notes on *Mitrella*, Marginellidae and Turridae. *Basteria* 2 (Supplement), 1-135.
- Van Dingenen, F., Ceulemans, L. & Landau, B.M. 2016. The lower Pliocene gastropods of Le Pigeon Blanc (Loire Atlantique, Northwest France). Part 2, Caenogastropoda. *Cainozoic Research* 16: 109-219.
- Verduin, A. 1984. On the taxonomy of some recent European marine species of the genus *Cingula* s.l.. *Basteria* 48(1-3): 37-87.
- Verduin, A. 1986. *Alvania cimex* (l.) s.l. (Gastropoda, Prosobranchia) and aggregate species. *Basteria* 50(1-3): 25-32.
- Warén, A. 1980. Marine Mollusca described by John Gwyn Jeffreys, with the location of the type material. *The Conchological Society of Great Britain and Ireland Special Publications* 1: 1-60, 8 pls.
- Warén, A. 1996. Mollusca from Iceland and Scandinavia. Part 3. *Sarsia* 81: 197-245.
- Weinkauff, H.C. 1867-1868. Die Conchylien des Mittelmeeres, ihre geographische und geologische Verbreitung. T. Fischer, Cassel Vol. 1: pp. XIX + 307 [1867], Vol. 2: pp. VI + 512 [1868].
- Wenz, W. 1938-1944. Gastropoda. Prosobranchia. In: Schindewolf, O.H. (ed.) *Handbuch der Paläozoologie*, 6. Berlin (Gebrüder Borntraeger): 1201-1505. [Pagination from H.-J. Anderson, 1964, for Wenz's contribution to the entire work is: 1-240, figs 1-471, March 1938 (1); 241-480, figs 472-1235, October 1938 (2); 481-720, figs 1236-2083, July 1939 (3); 721-960, figs 2084-2787, August 1940 (4); 961-1200, figs 2788-3416, October 1941 (5); 1201-1505, figs 3417-4211, October 1943 (6); xii + 1507-1639, November 1944 (7).]
- Wood, S.V. 1848. A monograph of the Crag Mollusca, or description of shells from the middle and upper Tertiaries of the east of England, 1. Univalves. *Monographs of the Paleontographical Society*: i-xii, 1-208.