The Pliocene Gastropoda (Mollusca) of Estepona, southern Spain. Part 18: Mangeliidae (Gastropoda, Conoidea)

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In this paper we review the Mangeliidae of the Lower Piacenzian, Upper Pliocene of Estepona, southern Spain. Forty species are recorded representing 14 genera, of which six species are described as new: *Agathotoma estherae* nov. sp., *Bela obesoiberica* nov. sp., *Bela olivoidea* nov. sp., *Mangelia pseudoceddaensis* nov. sp., *Sorgenfreispira planicostata* nov. sp., and *Vexiguraleus iberoangulatus* nov. sp.
Drillia hypoglypta Fontannes, 1880 and *Belidaphne brunettii* Della Bella, Naldi & Scarponi, 2015 are considered subjective junior synonyms of *Raphitoma semicostata* Bellardi, 1847.
The assemblages show a moderately high level of endemism (25%). Both shallow and deeper-water taxa are represented. The fauna is similar to that found in the tropical Mediterranean Pliocene of Italy (MPPMU1); we note the first record for the European Neogene of the genus *Bactrocythara* Woodring, 1928, which today occurs only further South along the tropical coasts of West Africa.

Key words: southern Spain, Upper Pliocene, Gastropoda, Mangeliidae, Conoidea, new species

Introduction

In this paper we continue to revise the gastropods found in the Pliocene assemblage of Estepona in south-western Spain (see Landau & Micali, 2021, p. 160 for summary of papers related to this series). Previous parts relating to families in Conoidea are: Clavatulidae (Landau & Harzhauser, 2022a); Borsoniidae, Clathurellidae, Mitromorphidae, Pseudomelatomidae (Landau & Harzhauser, 2022b); Raphitomidae (Landau *et al*., 2022), and Borsoniidae (part), Drilliidae, Fusiturridae, Horaiclavidae, Pseudomelatomidae (part), and Turridae (Landau & Harzhauser, 2023).
In this part we review the Mangeliidae. This work revises the monograph on the Turridae from Estepona by Vera-Peláez (2002). The limitations of that work were discussed by Landau & Harzhauser (2022b, p. 103), and will not be repeated here.

Age of the deposits

The Estepona assemblages are dated as earliest Piacenzian, early Late Pliocene, an age corroborated by the assemblage of Euthecosomata (A.W. Janssen, 2004). They form part of the Mediterranean ecostratigraphic unit MPPMU1 of Raffi & Monegatti (1993) and Monegatti & Raffi (2001), which includes the Zanclean and lowest Piacenzian (see Landau *et al*., 2011, text-fig. 9). For further discussion, see Landau & Micali (2021, p. 160).

Material and methods

The material described herein was collected from several localities around Estepona by the senior author (BL; 1997–2020) and by Henk Mulder between 2008–2021, to whom 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).
For further discussion on methodology see Landau & Harzhauser (2022a, 2022b).

Abbreviations:
CO: Velerín conglomerates; **PA**: Rio del Padrón; **VC**: Velerín carretera; **VA**: Velerín Antena; **PQ**: Parque Antena; **EL**: El Lobillo; see Landau *et al*. (2003, p. 4, text-fig. 1).
NHMW Natural History Museum Vienna (Austria)
MMPE Museo Municipal de Paleontología de Estepona (Málaga).

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

Systematic palaeontology

Family Mangeliidae P. Fischer, 1883b

For mangeliids the shells are categorised as small (<10 mm), medium (10-25 mm) large (>25-40 mm), very large (>40 mm); breadth is described as very broad (SL/MD <2.0), broad (SL/MD 2.0-2.5), moderately broad, (SL/MD = >2.5-2.7), moderately slender (SL/MD = >2.7-3.3), slender (SL/MD >3.3). SL = shell length, MD = shell width.

Genus *Agathotoma* Cossmann, 1899

Type species – *Mangelia angusta* Bellardi, 1847, by typification of replaced name, Pliocene, Italy.

1877 *Ditoma* Bellardi, p. 295. Type species (by monotypy): *Mangelia angusta* Bellardi, 1847, Pliocene, Italy (*non* Illiger, 1807, p. 320 [Coleoptera]).
1899 *Agathotoma* Cossmann, p. 45. *Nom. nov. pro Ditoma* Bellardi, 1877, *non* Illiger, 1807 [Coleoptera].

***Agathotoma angusta* (Bellardi, 1847)**
Plate 1, figs 1-4

1842 *Pleurotoma angusta* Jan in Sismonda, p. 34 (*nomen nudum*).
*1847 *Raphitoma angusta* Jan (*Pleurotoma*) Bellardi, p. 103, pl. 4, fig. 25.
1847 *Raphitoma angusta* Bell. – Sismonda, p. 35.
1877 *Mangelia angusta* Jan (*Pleurotoma*) – Bellardi, p. 295, pl. 8, fig. 40.
1896 *Mangelia* (*Ditoma*) *angusta* Jan – Cossmann, p. 125, pl. 7, figs 29, 30.
1907 *Pleurotoma* (*Mangelia*) *angusta* Jan. – Simroth, pl. 62, fig. 27.
1910 *Mangilia* (*Agathotoma*) *angusta* Jan – Cerulli-Irelli, p. 56 [248], pl. 5 [36], figs 20, 21.
1914 *Mangilia* (*Agathotoma*) *angusta* Jan – Cipolla, p. 148 [44], pl. 13 [2], fig. 19.
1937 *Mangelia costata* var. *angusta* (Jan) – Montanaro, p. 173, pl. 8, fig. 9.
1943 *Agathotoma angusta* (Jan) – Wenz, p. 1446, fig. 4092.
1960 *Mangelia* (*Agathotoma*) *angusta* Jan, 1842 – Glibert, p. 27, pl. 5, fig. 11.
1964 *Agathotoma angusta* Jan in Sismonda, 1842 – Brébion, p. 594.
1966 *Agathotoma angusta* (Jan in Bellardi, 1848 [*sic*]) – Powell, p. 99, pl. 15, fig. 15.
1974 *Agathotoma angusta* (Jan in Bellardi, 1848 [*sic*]) – Malatesta, p. 431, pl. 32, fig. 10.
1976 *Agathotoma angusta* (Jan) – Pavia, p. 113, pl. 8, fig. 21.
1992 *Mangelia angusta* (Jan, 1842) – Cavallo & Repetto, p. 142, fig. 385.
1996 *Agathotoma angusta* (Jan *in* Sismonda, 1842) – Vera-Peláez, p. 495, text-fig. 39, pl. 35, figs 11, 12.
1997 *Agathotoma angusta* (Jan in Sismonda, 1842) – Chirli, p. 58, pl. 16, figs 4-7.
2002 *Agathotoma angusta* (Jan in Sismonda, 1842) – Vera-Peláez, p. 206, pl. 4, figs I, J.
2010 *Agathotoma angusta* (Jan, 1842) – Sosso & Dell'Angelo, p. 47, unnumbered fig. p. 63, top row centre.
2010 *Agathotoma angusta* (Bellardi, 1847) – Scarponi & Della Bella, p. 81, figs 193-200.
2013 *Agathotoma angusta* (Bellardi, 1847) – Landau *et al*., p. 263, pl. 44, fig. 3.
2018 *Agathotoma angusta* (Bellardi, 1847) – Ceulemans *et al*., p. 99.
2018 *Agathotoma angusta* (Bellardi, 1847) – Brunetti & Cresti, p. 94, fig. 379.
2019 *Agathotoma angusta* (Bellardi, 1847) – Cárdenas *et al*., p. 213, fig. 8a.

Material and dimensions – Maximum height 8.4 mm, width 2.8 mm. **CO**: NHMW 2020/0171/0231 (2): **VC**: NHMW 2020/0171/0232-0235 (3), NHMW 2020/0171/0236 (5).

Description – Shell small, turriculate fusiform; spire angle about 25°. Protoconch conical, multispiral, composed of 4.2 strongly convex whorls with a small nucleus, apical angle 55° (dp = 910 μm, hp = 670 μm, dp/hp = 1.36, dn = 150 μm, dV1 = 220 μm). Last whorl bearing axial riblets. Junction with teleoconch sharply delimited by sinusigera. Teleoconch of four weakly shouldered, convex whorls, separated by impressed, weakly undulating suture. Axial sculpture of narrow, opisthocline, slightly sinuous, sharp ribs, 10-15 on penultimate whorl, about half width of their interspaces; ribs narrower and lamellar over subsutural ramp. Spiral sculpture visible without magnification of one or two subobsolete cords on subsutural ramp and cords over siphonal fasciole; under SEM magnification surface covered in fine irregular cordlets, surface covered with very fine micropustules of varying density (Pl. 1, fig. 4c). Last whorl 57-61% of total height, with narrow, poorly delimited subsutural ramp, roundly angled at high-placed shoulder, weakly convex below, moderately constricted at base. Aperture 36-40% of total height, narrow, subrectangular; outer lip strongly thickened by labial varix, smooth within; anal sinus deep, narrow U-shaped deeply incising and distorting

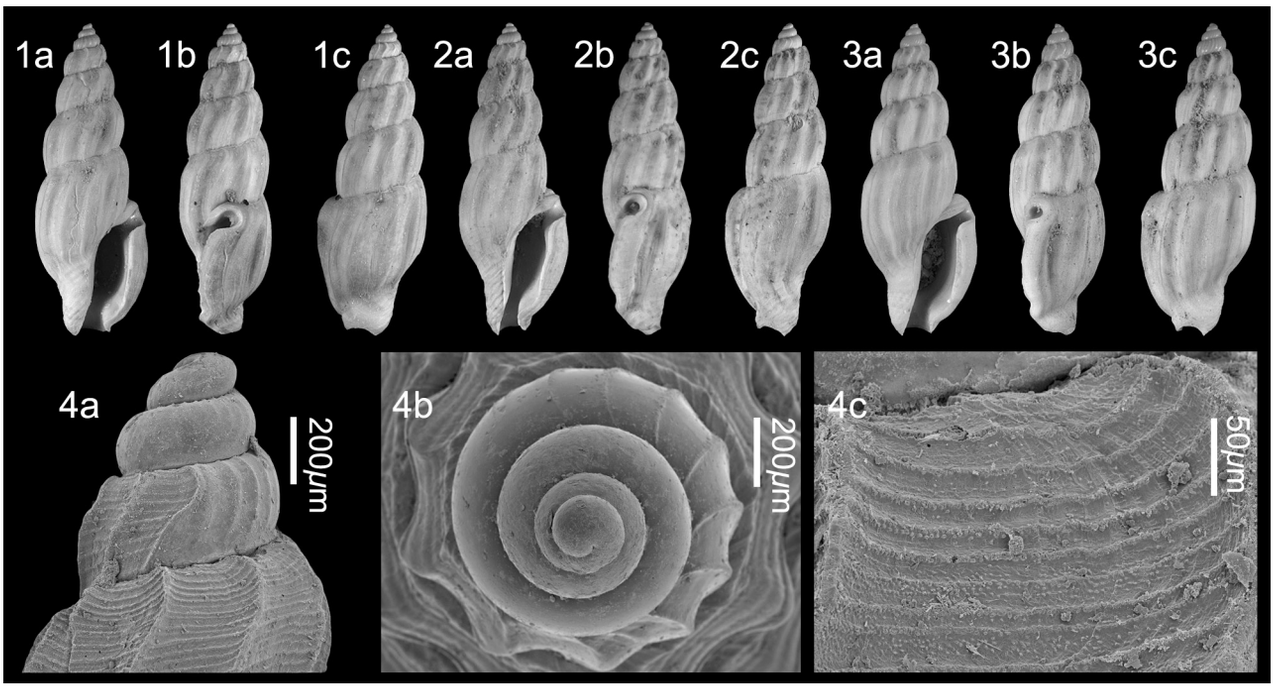

Plate 1. *Agathotoma angusta* (Bellardi, 1847); 1. NHMW 2020/0171/0232, height 7.2 mm, width 2.5 mm; 2. NHMW 2020/0171/0233, height 7.0 mm, width 2.4 mm; 3. NHMW 2020/0171/0234, height 7.4 mm, width 2.6 mm (digital images); 4. NHMW 2020/0171/0235, 4a-b, detail of protoconch, 4c, detail of teleoconch sculpture (SEM image). Velerín carretera, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

adapical portion of outer lip, well developed stromboid notch abapically; siphonal canal short, recurved, notched at tip. Columella straight, smooth. Columellar and parietal callus sharply delimited, weakly thickened, forming narrow callus rim.

Discussion –Agathotoma Cossmann, 1899 species differ from *Mangelia* Risso, 1826 in having a much heavier labial varix, a much deeper anal sinus, a well developed stromboid notch abapically on the outer lip, and a shorter siphonal canal. *Agathotoma angusta* (Bellardi, 1847) is a characteristic species that cannot be confused with other mangeliids. Apart from the generic characters, *A. angusta* has 10-15 sharp, narrow axial ribs that are elevated and lamellar at the suture, fine spiral sculpture; spiral cords are only developed over the siphonal fasciole. The protoconch illustrated by Scarponi & Della Bella (2010, fig. 193) is multispiral, of about four convex whorls, with sinuous axial riblets on the last two whorls, similar to that of the Estepona specimens. Vera-Peláez's description of "...*Protoconcha paucispiral cónica, de 2½, vueltas, lisas y convexas*...[…Conical paucispiral protoconch of 2½ smooth convex whorls…]" (2002, p. 206) is incorrect.

There is little to add to the discussion by Scarponi & Della Bella (2010, p. 82) on this very characteristic little turrid. *Raphitoma angusta* Jan in Sismonda, 1842 is a *nomen nudum* (Tucker, 2004).

Agathotoma pherousae (Glibert, 1960) from the Upper Miocene Assemblage I deposits of northwestern France differs in being smaller, with fewer, thicker, rounded instead of sharp-edged axial ribs (9-10 vs. 14-15), even finer spiral sculpture and a weaker stromboid notch on the outer lip. For further comparison with congeners see Landau *et al*. (2013, p. 264).

Scarponi & Della Bella (2010, p. 82) noted that in the Italian assemblages it occurred in circalittoral and upper bathyal assemblages. In Estepona we make the same observation as it occurs in the shallow and deeper water deposits, although never abundant. *Agathotoma angusta* is a remarkably long-lived and widely distributed mangeliid that did not, however, survive cooling SSTs (Sea Surface Temperature) at the end of the Early Pleistocene.

Distribution – Lower Miocene: Proto-Mediterranean (Burdigalian), Colli Torinesi, Italy (Bellardi, 1877; Wenz, 1943). Middle Miocene: eastern Proto-Mediterranean (Serravallian), Karaman Basin, Turkey (Landau *et al*., 2013). Upper Miocene: Atlantic (Tortonian): Algarve Basin (BL unpublished data; NHMW coll.), Seville, southwestern Spain (Cárdenas *et al*., 2019); Proto-Mediterranean (Tortonian), Italy (Montanaro, 1937). Lower Pliocene: Atlantic, NW France (Glibert, 1960); western Mediterranean, NE Spain (Gili & Martinell, 1994); central Mediterranean, Italy (Bellardi, 1877; Pavia, 1976; Chirli, 1997; Scarponi & Della Bella, 2010; Sosso & Dell'Angelo, 2010; Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (Vera-Peláez, 1996, 2002); central Mediterranean, Italy (Bellardi, 1847; Cipolla, 1914; Malatesta, 1974; Cavallo & Repetto, 1992; Scarponi & Della Bella, 2010). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1910).

***Agathotoma estherae* nov. sp.**
Plate 2, figs 1-3.

ZooBank registration – https://zoobank.org/NomenclaturalActs/9e8e8873-461d-4742-80ab-7efd6889e71d

Type material – Holotype NHMW 2020/0171/0564, height 4.1 mm, width 1.7 mm; paratype 1 NHMW 2020/0171/0619, height 3.2 mm, width 1.4 mm; paratype 2 NHMW 2020/0171/0620, height 2.4 mm, width 1.1 mm.

Other material – Known from type series only.

Type locality – El Lobillo, Estepona, Spain.

Type stratum – Lower Piacenzian, Upper Pliocene.

Etymology – Named after Esther Matias, goddaughter of the first author. *Agathotoma* gender feminine.

Diagnosis – Agathotoma species of small size, protoconch of three whorls, last bearing axial riblets, teleoconch of four whorls with coronate suture, 7-8 rounded axial ribs and spiral sculpture of wide-spaced primaries and crowded secondary threads in the interspaces.

Description – Shell small, turriculate fusiform; spire angle 39-42°. Protoconch conical, multispiral, composed of three convex whorls with a small nucleus, last whorl bearing arcuate axial riblets, apical angle 60° (dp = 490 μm, hp = 514 μm, dp/hp = 0.95, dn = 90 μm, dV1 = 190 μm). Junction with teleoconch sharply delimited by sinusigera. Teleoconch of 3.5 weakly convex, strongly shouldered whorls, the shoulder placed high at suture, separated by narrowly impressed, strongly undulating suture. Axial sculpture of relatively broad, slightly opisthocline and sinuous, rounded ribs, 7-8 on penultimate whorl, roughly equal in width to their interspaces; adapical end of ribs coronating suture. Spiral sculpture above the aperture of three equidistant narrow primary cords, interspaces filled by crowded secondary threads. Last whorl 66-67% of total height, shoulder placed at suture, weakly convex below, weakly constricted at base; siphonal fasciole short. Aperture 39-42% of total height, narrow, subrectangular; outer lip strongly thickened by labial varix, smooth within; anal sinus deep, narrow U-shaped deeply incising and distorting adapical portion of outer lip, moderately developed stromboid notch adapically; siphonal canal short, slightly recurved, unnotched. Columella straight, smooth. Columellar and parietal callus sharply delimited, weakly thickened, forming very narrow callus rim.

Discussion – Agathotoma estherae nov. sp. clearly differs from *A. angusta* (Bellardi, 1847) in its smaller size, smaller protoconch with a whorl less, shoulder placed at the suture giving the whorl a scalate profile, stronger ribs and spiral sculpture of primary and secondary ribs. It is more closely similar in profile to *A. pherousae* (Glibert, 1960) from the Atlantic Middle and Upper Miocene of NW France (see Landau *et al*., 2020, p. 23, pl. 19, figs 1-3) with which it shares a protoconch of about three whorls, the shoulder placed at the suture, broad ribs, and spirals of primary and secondary strength, but differs in its smaller size (maximum height 4.1 mm vs. 6.3 for *A. pherousae*), and having fewer axial ribs (7-8 vs. 9-10). They are, nevertheless, closely related species. *Agathotoma pseudola-*

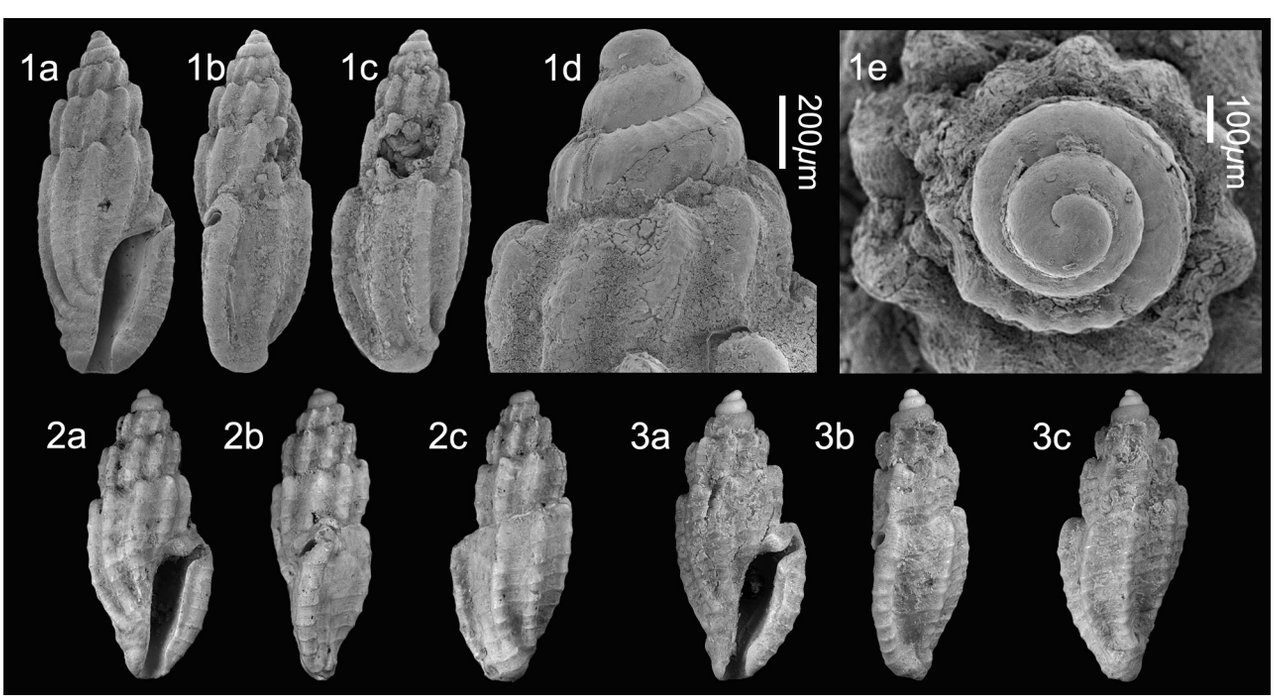

Plate 2. *Agathotoma estherae* nov. sp.; 1. **Holotype** NHMW 2020/0171/0564, height 4.1 mm, width 1.7 mm, 1d-e, detail of protoconch (SEM image); 2. **Paratype 1** NHMW 2020/0171/0619, height 3.2 mm, width 1.4 mm; 3. **Paratype 2** NHMW 2020/0171/0620, height 2.4 mm, width 1.1 mm (digital images). El Lobillo, Estepona, Lower Piacenzian, Upper Pliocene.

bratula Lozouet, 2015 from the Atlantic lower Oligocene of France also belongs within this group with a high set shoulder but has a protoconch of only 2.25 whorls that are more convex than in *A. estherae*, the axial ribs are narrower and slightly more numerous (8-9), and the spirals are all fine and of equal strength. *Agathotoma perforata* (Brusina, 1877) from the Paratethys Middle Miocene (= *Pleurotoma caerulans* in Hörnes, 1855, p. 377, pl. 40, fig. 19; *non* Philippi, 1844 = *Mangelia striolata* Risso, 1826) is larger (height 7 mm), the whorls are more evenly convex, the suture is not coronate, and the base is not constricted. Three further species were described from the Paratethys of Romania: *A. subfoliata* (Boettger, 1902) has a similar profile, but finer axial ribs, *A. paulae* (Boettger, 1902) and *A. detmersiana* (Boettger, 1902) do not have a coronate suture. The specimen from the Atlantic upper Oligocene of France illustrated by Lozouet (2017, pl. 22, figs 21-23) as *A.* cf. *subfoliata* again differs in having more numerous and finer ribs. The present-day representatives of the genus in the Caribbean were reviewed by Rolán *et al*. (2012). None of the species discussed by those authors are particularly similar to this European Neogene group.

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

Genus *Bactrocythara* Woodring, 1928

Type species – *Cythara obtusa* Guppy in Guppy & Dall, 1896, by original designation, Pliocene, Jamaica.

1928 *Bactrocythara* Woodring, p. 174.

***Bactrocythara labiosa* (E.A. Smith, 1872)**
Plate 3, figs 1-2

*1872 *Clathurella labiosa* E.A. Smith, p. 731, pl. 25, fig. 9.
1952 *Philbertia thiele* Knudsen, p. 174, pl. 3, figs 1, 2.
1994 *Bactrocythara labiosa* (Smith, 1870) [*sic*] – Rolán *et al*., p. 245, figs 2-4.
1999 *Bactrocythara labiosa* (Smith, 1870) [*sic*] – Rolán & Otero-Schmitt, p. 21, figs 68-72.
2005 *Bactrocythara labiosa* (Smith, 1870) [*sic*] – Rolán, p. 171, fig. 790.

Material and dimensions – Maximum height 4.1 mm, width 1.7 mm. **EL**: NHMW 2020/0171/0003-0004 (2), NHMW 2020/0171/0655 (1).

Description – Shell very small, solid, fusiform, pupoid; spire angle 38-40°. Protoconch multispiral, dome-shaped, of 3.25 convex whorls, last quarter whorl with comma-shaped axial riblets, apical angle 70°. Junction with teleoconch sharply delimited by sinusigera. Teleoconch of 2.5 convex whorls, subsutural ramp narrow, poorly delimited, convex below, separated by narrowly impressed, undulating suture. Axial sculpture of sinuous ribs, 14 on last whorl, roughly equal in width to their interspaces, overrun by very fine spiral treads, most evident in axial interspaces. Last whorl elongate, with very narrow subsutural ramp poorly delimited by weak, high-placed, rounded shoulder, very weakly convex below, hardly constricted at base; axials persist over base, stopping at siphonal fasciole, weak spirals continue over base and siphonal fasciole. Aperture elongate; outer lip strongly thickened by labial varix, smooth within; anal sinus relatively broad, moderate depth, U-shaped, weakly distorting adapical part of outer lip; siphonal canal short, wide, not notched. Columella straight, smooth. Columellar callus weakly thickened, parietal callus moderately thickened, sharply delimited, forming narrow callus rim, weak parietal tubercle.

Discussion – The shells from Estepona attributed to *Bactrocythara labiosa* (E.A. Smith, 1872) closely match the present-day specimens from Angola illustrated by Rolán *et al*. (1994, figs 2, 3) in size, profile and sculpture. The protoconch is also of the same planktotrophic type and of similar size, with axial riblets on the last quarter whorl. A second West African species, *Bactrocythara agachada* Rolán, Otero-Schmitt & Fernandes, 1994 differs in having a gradate spire and both the axial and spiral sculpture are coarser. The genus *Bactrocythara* Woodring, 1928 in the eastern Atlantic is now restricted to the tropical waters of West Africa. This is the first record of the genus in the Tropical Mediterranean Pliocene and reflects the 'West African' influence on the fauna discussed in previ-

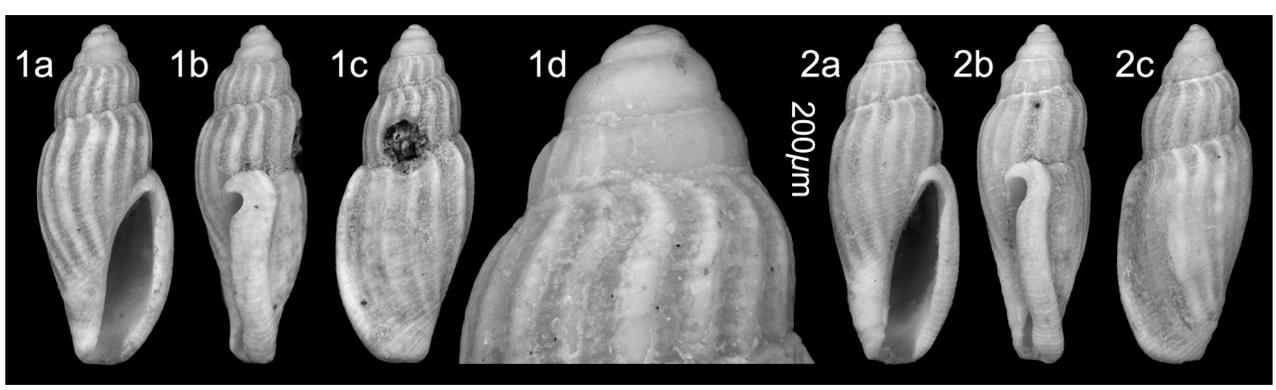

Plate 3. *Bactrocythara labiosa* (E.A. Smith, 1872); 1. NHMW 2020/0171/0003, height 4.1 mm, width 1.7 mm, 1c, detail of protoconch; 2. NHMW 2020/0171/0004, height 3.8 mm, width 1.5 mm. El Lobillo, Estepona, Lower Piacenzian, Upper Pliocene.

ous works (*e.g.*, Landau *et al*., 2006; Silva *et al*., 2011; Landau & Harzhauser, 2022a). In the Late Miocene its range extended even further North, to the latitude of NW France, represented by *B. pascaleae* Landau, Van Dingenen & Ceulemans, 2020, which differs in having a paucispiral protoconch, rather strangely shouldered whorls, and a shallower anal sinus.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (this paper). Present-day: West Africa, Sierra Leone, Ghana, Angola (E.A. Smith, 1870; Knudsen, 1952; Rolán *et al*., 1994; Rolán & Otero-Schmitt, 1999), Cape Verde Islands (Rolán, 2005).

Genus *Bela* Leach *in* Gray, 1847a [October]

Type species – *Murex nebula* Montagu, 1803, by subsequent designation (Gray, 1847b [November]), present-day, British Isles.

1847a *Bela* Leach *in* Gray, p. 270.
1847 *Ichnusa* Jeffreys, p. 312. Unavailable, name introduced in synonymy.
1884 *Ginnania* Monterosato, p. 127. Type species (by subsequent designation; Crosse, 1885): *Pleurotoma fuscata* Deshayes, 1835, present-day, Mediterranean.
1988a *Fehria* Van Aartsen, p. 30. Type species (by original designation): *Ginnania taprurensis* Pallary, 1904, present-day, eastern Mediterranean.

***Bela appeliusi* (Bellardi, 1877)**
Plate 4, figs 1-7

*1877 *Raphitoma Appeliusi* Bellardi, p. 314, pl. 9, fig. 28.
1910 *Raphitoma Appeliusi* Bell. – Cerulli-Irelli, p. 67 [259], pl. 6 [37], fig. 30.
1981 *Raphitoma Appeliusi* Bellardi, 1877 – Ferrero Mortara *et al*., p. 93, pl. 17, fig. 3.
2002 *Bela appeliusi* (Bellardi, 1877) – Vera-Peláez, p. 211, pl. 4, figs I', J'.
2013 *Bela appeliusi* (Bellardi, 1877) – Naldi *et al*., p. 73, pl. 1, figs 6-10, pl. 2, figs 10-18.

?*non* 1992 *Mangelia appeliusi* (Bellardi, 1877) – Cavallo & Repetto, p. 142, fig. 386.
non 1997 *Bela appeliusi* Bellardi, 1877 [*sic*] – Chirli, p. 62, pl. 17, fig. 12, pl. 18, figs 1, 2 [= *Bela pseudoappeliusi* Naldi, Della Bella & Scarponi, 2013].
non 2018 *Bela appeliusi* (Bellardi, 1877) – Brunetti & Cresti, p. 94, fig. 384.

Material and dimensions – Maximum height 8.8 mm, width 3.1 mm. **CO**: NHMW 2020/0171/0566-0567 (2), NHMW 2020/0171/0568 (15). **EL**: NHMW 2020/0171/0562 (40). **VC**: NHMW 2020/0171/0556-0560 (5), NHMW 2020/0171/0561 (6).

Description – Shell small, relatively squat biconic-turriculate, relatively solid; spire angle 32-37°. Protoconch dome shaped, of 3.5 whorls with small nucleus, last whorl bearing arcuate axial riblets crossed by five spiral cords forming small, pointed tubercles at intersections, apical angle 75° (dp = 805 μm, hp = 755 μm, dp/hp = 1.07, dn = 90 μm, dV1 = 195 μm). Junction with teleoconch delimited by sinusigera and beginning of adult sculpture. Teleoconch of up to four shouldered whorls, with medium width, concave subsutural ramp, angled at shoulder forming periphery, tapering to suture below, bearing 10-12 low, narrow ribs crossed by numerous fine spiral cords of alternating strength. Close-set growth lines interrupt cords to give surface granular appearance. Suture narrowly impressed, linear. Last whorl 59-65% of total height, subsutural ramp moderately broad, angled at shoulder, convex below, moderately constricted at base; base and siphonal fasciole not sharply delimited, axials weaken over base, spiral sculture continues over base and fasciole. Aperture 44-47% of total height, relatively broad, subrectangular; anal sinus broadly U-shaped occupying entire ramp, with apex near shoulder; siphonal canal short, broad, bent slightly to left, unnotched. Columella weakly excavated in upper third, straight below, slightly twisted at fasciole. Columellar and parietal callus forming narrow callus rim.

Discussion – Two closely similar species occur in the Italian Pliocene; *Bela appeliusi* (Bellardi, 1877) and *B. pseudoappeliusi* Naldi, Della Bella & Scarponi, 2013. According to Naldi *et al*. (2013, p. 73), their new species could not be separated from *B. appeliusi* based on shell size or teleoconch sculpture, and they both share a subrectangular aperture, short siphonal canal and rounded anal sinus. However, compared to *B. pseudoappeliusi*, *B. appeliusi* has broader and lower spire whorls, with a more strongly angulated shoulder, and thinner and more numerous axial ribs that are overrun by less dense spiral threads. The protoconch of *B. appeliusi* is on average larger (3.3 vs 3.1 whorls, diameter 750 μm vs 650 μm: although there is overlap between the two species; Naldi *et al*., 2013, tab. 1), and bears clearly reticulate sculpture.
The Estepona specimens show some variability in strength of the axial ribs and inflation of the last whorl. However, the rather squat profile, angular shoulder, and narrow ribs suggest they represent *B. appeliusi*. Moreover, the protoconch diameter is within the range of that species. Further differences not mentioned by previous authors are the suture, which is distinctly undulating in *B. pseudoappeliusi* and relatively straight in *B. appeliusi* and the last portion of the protoconch bears five spiral cords, whereas in *B. pseudoappeliusi* it bears 3-4.
Some records have been excluded from the chresonymy. Cavallo & Repetto (1992, fig. 386) may represent this species although the axial sculpture on the last whorl is subobsolete, and the profile somewhat unusual. It may represent a gerontic individual. Brunetti & Cresti (2018, fig. 384) illustrate a specimen with a different profile and a longer siphonal canal.

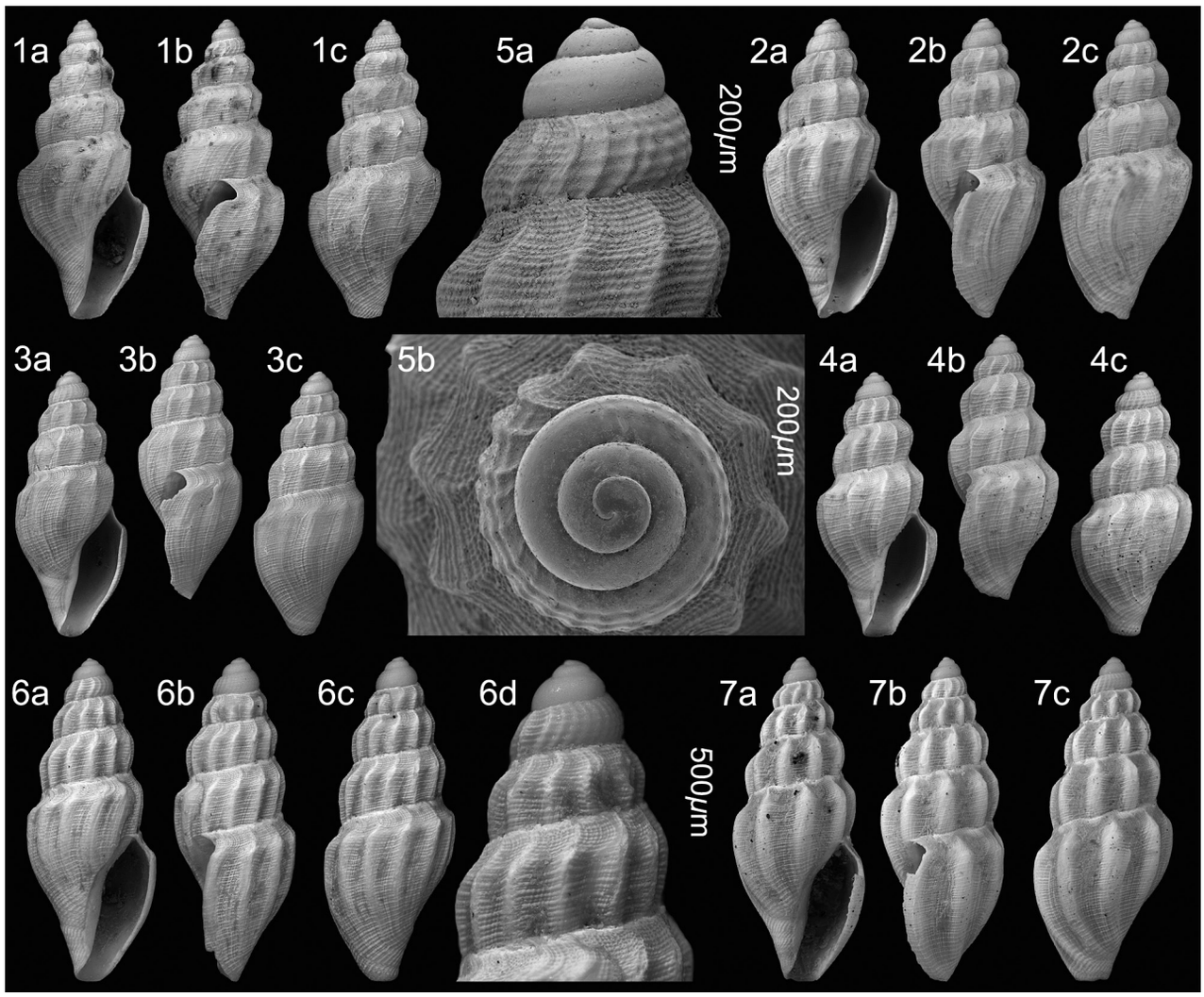

Plate 4. *Bela appeliusi* (Bellardi, 1877); 1. NHMW 2020/0171/0556, height 7.0 mm, width 2.8 mm; 2. NHMW 2020/0171/0557, height 6.3 mm, width 2.6 mm; 3. NHMW 2020/0171/0558, height 5.4 mm, width 2.2 mm; 4. NHMW 2020/0171/0559, height 5.1 mm, width 2.0 mm (digital images); 5. NHMW 2020/0171/0560, detail of protoconch (SEM image). Velerín carretera. 6. NHMW 2020/0171/0566, height 6.4 mm, width 2.6 mm, 6d, detail of protoconch; 7. NHMW 2020/0171/0567, height 6.3 mm, width 2.5 mm (digital images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

Distribution – Lower Pliocene: central Mediterranean, Italy (?Cavallo & Repetto, 1992). Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (Vera-Peláez, 2002); central Mediterranean, Italy (Bellardi, 1877; Naldi *et al*., 2013). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1910).

***Bela baetica* (Vera-Peláez, 2002)**
Plate 5, figs 1-3

*2002 *Fehria baetica* Vera-Peláez, p. 212, pl. 4, figs K', L', M', pl. 14, figs A, B, pl. 17, figs Ñ, O.

Material and dimensions – Maximum height 8.8 mm, width 3.1 mm. **CO**: NHMW 2020/0171/0176-0178 (3), NHMW 2020/0171/0179 (20). **EL**: NHMW 2020/0171/0656 (4)

Description – Shell small, medium-thickness, fusiform, with shouldered whorls; spire angle 40-45°. Protoconch paucispiral, of 1.5 smooth convex whorls with large nucleus, coloured deep orange/red (dp = 525 μm, hp = 465 μm, dp/hp = 1.13, dn = 290 μm, dV1 = 430 μm). Junction with teleoconch sharply delimited. Teleoconch of up to six sharply shouldered whorls, with broad, straight-sided subsutural ramp, sharply delimited by shoulder cord, convex below, separated by narrowly impressed, undulating suture. Axial sculpture strongly predominant, composed of elevated, rounded, orthocline ribs, 12-14 on last whorl, about half width of their interspaces, weaker over subsutural ramp, strongly developed at shoulder, extending to abapical suture. Spiral sculpture of 4-5 weaker cords on subsutural ramp, three primary cords below, adapical forming shoulder cord, with much weaker secondary and tertiary threads intercalated. Surface covered in dense micropustules (Pl. 5, fig. 3c). Last whorl 64-65%

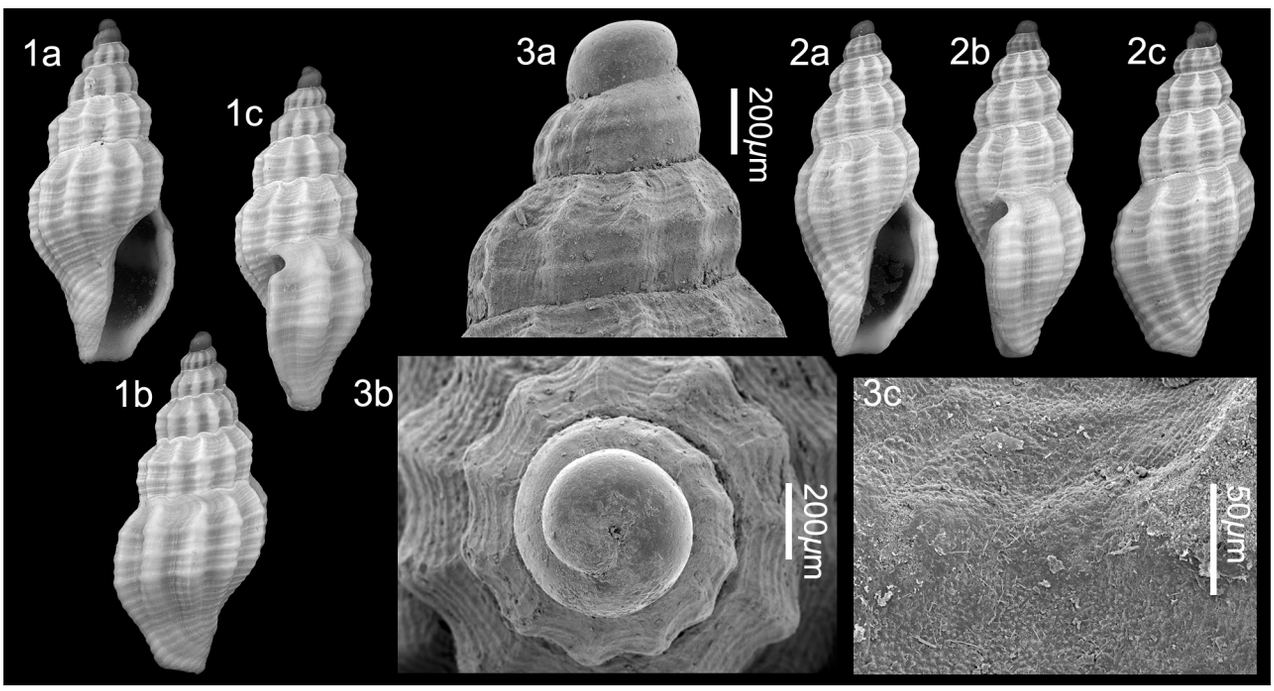

Plate 5. *Bela baetica* (Vera-Peláez, 2002); 1. NHMW 2020/0171/0176, height 6.4 mm, width 2.7 mm; 2. NHMW 2020/0171/0177, height 5.6 mm, width 2.2 mm (digital images); 3. NHMW 2020/0171/0179, 3a-b, detail of protoconch, 3c, detail of teleoconch microsculpture (SEM image). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

of total height, profile and sculpture as described above, angled at shoulder, convex below, moderately constricted at base; axials weakening over base, spirals of alternate strength persisting over base, slightly stronger cords over siphonal fasciole. Aperture 45% of total height, subrectangular; outer lip moderately thickened by labial varix, sharp edged, smooth within; anal sinus relatively narrow and deep, symmetrically U-shaped, occupying entire subsutural ramp, apex mid-ramp; siphonal canal moderately short, unnotched. Columella very weakly excavated, smooth. Columellar and parietal callus hardly thickened, forming narrow, indented callus rim.

Discussion – *Bela baetica* (Vera-Peláez, 2002) is immediately separated from all its Estepona congeners by having a paucispiral protoconch that is coloured deep orange/red. Colouring of the protoconch is preserved in almost all specimens. In this respect it is highly reminiscent of *Bela taprurensis* (Pallary, 1904), originally described from the Gulf of Gabès, Tunisia, which also has a usually, but not always, coloured paucispiral protoconch, but the lectotype figured on the MNHN website (MNHN-IM-2000-3269) is slenderer, with a taller spire comprising a greater number of teleoconch whorls, the subsutural ramp is narrower and less sharply delimited, and cords close-set and of subequal strength as opposed to *B. baetica*, in which the primary to tertiary cords are well differentiated.
Van Aartsen (1988a, p. 30) erected the genus *Fehria* (type species, by original designation, *Ginnania taprurensis* Pallary, 1904) for species with a paucispiral reddish protoconch. Mariottini *et al*. (2015, p. 438) synonymised *Fehria* with *Bela*. If subsequent genetic research were to justify the separation, the species from Estepona should be included in *Fehria* rather than *Bela*.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (Vera-Peláez, 2002). Present-day: eastern Mediterranean (Pallary, 1904).

Bela fuscata **(Deshayes, 1835)**
Plate 6, fig. 1

*1835	*Pleurotoma fuscata* Deshayes, p. 177.
1844	*Pleurotoma formicaria* Sowerby – Forbes, p. 139 (*non* G.B. Sowerby I, 1834).
1877	*Raphitoma nebula* (Mont.) – Bellardi, p. 322, pl. 9, fig. 38 [*non Bela nebula* (Montagu, 1803)].
1910	*Raphitoma nebula* Mtg. – Cerulli-Irelli, p. 68 [260], pl. 6 [37], figs 44-46 [*non Bela nebula* (Montagu, 1803)].
1910	*Raphitoma nebula abbreviata* Jeffr. – Cerulli-Irelli, p. 69 [261], pl. 6 [37], figs 47 (*non* Jeffreys, 1867).
1916	*Raphitoma fuscatum* (Desh.) – Milachewitch, p. 120, pl. 4, figs 1, 2.
1977a	*Bela nebula* (Montagu, 1803) – Nordsieck, p. 42 (*partim*), pl. 10, fig. 74.
1977a	*Bela ginnania* (Risso, 1826) – Nordsieck, p. 42, pl. 10, fig. 75 [*non Bela ginnania* (Risso, 1826)].
1977a	*Bela ginnania formicaria* Nordsieck, p. 42, pl. 10, fig. 76.
1977a	*Bela fuscata* (Deshayes, 1835) – Nordsieck, p. 42, pl. 10, fig. 77.

1977b *Bela ginnania formica* Nordsieck, p. 139, pl. 3, fig. 22 (*nom. nov. pro Bela ginnania formicaria* Nordsieck, 1977a, *non* G.B. Sowerby I, 1834).
1979 *Bela fuscata* (Deshayes, 1835) – Nordsieck & García-Talavera, p. 160, pl. 40, fig. 17 [*sic* for 18].
1980 *Bela fuscata* (Deshayes, 1835) – Bogi *et al*., p. 16, fig. 8.
1991 *Bela fuscata* (Deshayes, 1834 [*sic*]) – Poppe & Goto, p. 168, pl. 35, fig. 2.
1992 *Bela* (*Bela*) *nebula* (Montagu, 1803) – Cavallo & Repetto, p. 140, fig. 376 [*non Bela nebula* (Montagu, 1803)].
1997 *Bela nebula* (Montagu, 1803) – Chirli, p. 52, pl. 14, figs 10-12 [*non Bela nebula* (Montagu, 1803)].
2002 *Bela nebula* (Montagu, 1803) – Vera-Peláez, p. 210 (not figured) [*non Bela nebula* (Montagu, 1803)].
2006 *Bela fuscata* (Deshayes, 1835) - Kantor & Sisoev, p. 219, pl. 111 C-C' [lectotype figured].
2008 *Bela nebula* (Montagu, 1803) – Cecalupo *et al*., p. 31, pl. 67, figs 15-18 [*non Bela nebula* (Montagu, 1803)].
2011 *Bela nebula formicaria* – Cossignani & Ardovini, fig. p. 317.
2015 *Bela formica* Nordsieck, 1977 – Della Bella *et al*., p. 12, figs 1-8.
2015 *Bela* cf. *fuscata* (Deshayes, 1835) – Della Bella *et al*., p. 13, figs 13-20.

Material and dimensions – Height 6.9 mm, width 2.5 mm. **CO**: NHMW 2020/0171/0569 (1).

Description – Shell small, medium-thickness, fusiform, with tall spire; spire angle 30°. Protoconch probably multispiral (poorly preserved). Teleoconch of 5.5 convex whorls, subsutural area slightly depressed, but ramp not developed, separated by narrowly impressed, weakly undulating suture. Axial sculpture strongly predominant, composed of eight broad, weakly opisthocline to orthocline, rounded, ribs extending between sutures, roughly equal in width to their interspaces. Spiral sculpture of fine cords of alternating strength. Last whorl low, 57% of total height, profile and sculpture as described above, moderately constricted at base; axials persist over base, stopping abruptly at siphonal fasciole. Aperture small, 45% of total height, ovate; outer lip not thickened by labial varix, sharp edged, smooth within; anal sinus broad, moderate depth, symmetrically U-shaped; siphonal canal short, moderately wide, unnotched. Columella smooth, weakly excavated, twisted at fasciole. Columellar and parietal callus hardly thickened, forming narrow callus rim (description may be based on subadult shell as outer lip not thickened).

Discussion – Della Bella *et al*. (2015, p. 12) noted that Mediterranean specimens of what is usually called *Bela nebula* (Montagu, 1803) are smaller than Atlantic specimens from the British Isles (5-6 mm vs. up to 12 mm height) with more irregular spiral sculpture. The two populations cannot be separated on protoconch characters, profile, number of axial or shape of the anal sinus. Despite the possibility of the two forms being conspecific, they separated the Mediterranean forms under the name *Bela formica* Nordsieck, 1977. However, the holotype of *B. formica* from Saronicus, Greece, is undoubtedly a junior subjective synonym of *B. fuscata* (Deshayes, 1835) (Prkić & Giannuzzi-Savelli, 2023). *Bela nebula* in Mediterranean is limited to southern Spain. All present-day records of *B. nebula* in Mediterranean outside the area of southern Spain are to be referred at *Bela fuscata*, which differs in having finer spiral sculpture than *B. nebula*.
The species is extremely rare in Estepona. One specimen at hand is 6.9 mm in height and that reported, but not illustrated, by Vera-Peláez (2002, 210) is 7.8 mm height, closer to the size of Mediterranean fossil specimens. The spiral sculpture is far finer than that illustrated by Fretter & Graham (1984, fig. 358) for *B. nebula* from the British Isles. Specimens illustrated by Chirli (1997, pl. 14, figs 10-12) seem to be intermediate in size (7.5-9.8 mm height) but continue to have very fine spiral sculpture. Unfortunately, the Estepona material is too scarce and poorly preserved to add to the debate.

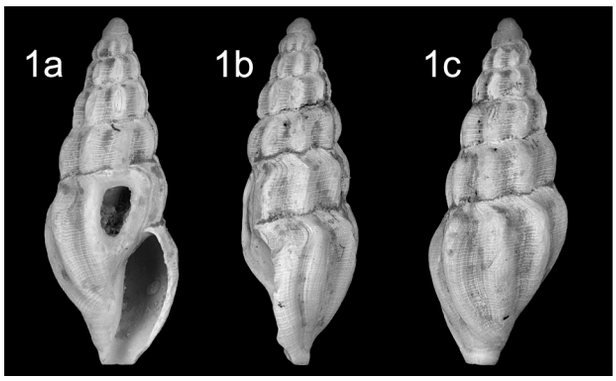

Plate 6. *Bela fuscata* (Deshayes, 1835); 1. NHMW 2020/0171/0569, height 6.9 mm, width 2.5 mm (digital images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

Distribution – Lower Pliocene: central Mediterranean, Italy (Cavallo & Repetto, 1992; Chirli, 1997; Della Bella *et al*., 2015). Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (Vera-Peláez, 2002); central Mediterranean, Italy (Bellardi, 1877; Della Bella *et al*., 2015). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1910; Della Bella *et al*., 2015). Present-day: Atlantic: Canary Islands (Nordsieck & García-Talavera, 1979), western Mediterranean (Nordsieck, 1977a; Cecalupo *et al*., 2008), central Mediterranean (Nordsieck, 1977a), Black Sea (Grossu & Cărăuşu, 1959).

***Bela megastoma* (Brugnone, 1862)**
Plate 7, figs 1-3

*1862 *Pleurotoma megastomum* Brugnone, p. 34, pl. 1, fig. 25.
1877 *Raphitoma megastoma* (Brugn.) – Bellardi, p. 311, pl. 9, fig. 23.

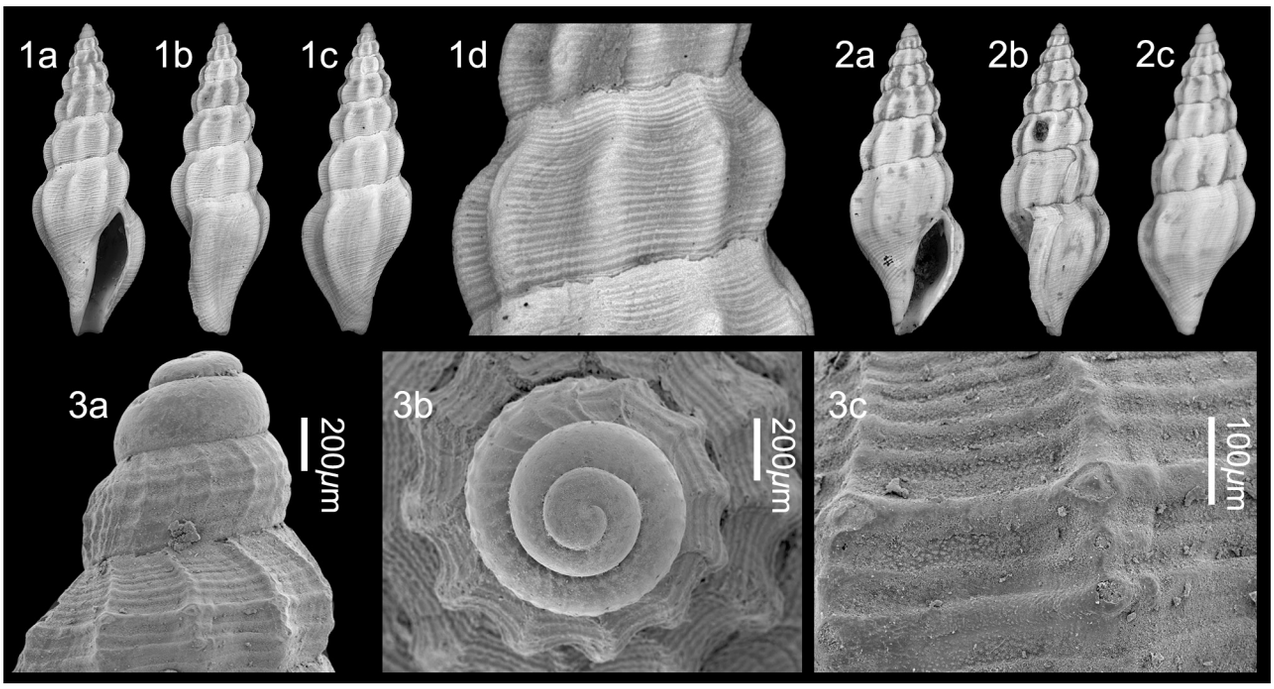

Plate 7. *Bela megastoma* (Brugnone, 1862); 1. NHMW 2020/0171/0522, height 12.7 mm, width 4.6 mm, 1d, detail of teleoconch sculpture; 2. NHMW 2020/0171/0523, height 11.4 mm, width 4.0 mm (digital images); 3. NHMW 2020/0171/0524, 3a-b, detail of protoconch, 3c, detail of teleoconch microsculpture (SEM image). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

1914 *Daphnella* (*Raphitoma*) *megastoma* Brugnone – Cipolla, p. 163 [59], pl. 14 [3], fig. 10.
1974 *Bela megastoma* (Brugnone, 1862) – Malatesta, p. 428, pl. 32, fig. 10.
1997 *Raphitoma megastoma* (Brugnone, 1862) – Chirli, p. 52, pl. 14, figs 6-9.
2007 *Bela megastoma* (Brugnone, 1862) – Della Bella & Scarponi, p. 47, figs 137-144.

non 1915 *Raphitoma megastoma* Brugnone – Harmer, p. 267, pl. 29, figs 36-37 [= *Bela beetsi* (Glibert, 1960).

Material and dimensions – Maximum height 14.5 mm, width 5.0 mm. **CO**: NHMW 2020/0171/0522-0524 (3), NHMW 2020/0171/0525 (4). **EL**: NHMW 2020/0171/0597 (1).

Description – Shell medium sized, solid, slender fusiform; spire angle 27-30°. Protoconch multispiral, of three convex whorls, last whorl bearing cordlets and weak riblets forming reticulated pattern with weak tubercles developed at intersections (dp = 770 μm, hp = 770 μm, dp/hp = 1.0, dn = 120 μm, dV1 = 205 μm). Junction with teleoconch delimited by sinusigera. Teleoconch of up to 6.5 roundly shouldered whorls, with poorly delimited, steeply inclined, concave subsutural ramp, rounded at shoulder, convex below, separated by narrowly impressed, weakly undulating suture. Axial sculpture strongly predominant, composed of weakly opisthocline to weakly prosocline, narrow, rounded ribs, 9-10 on last whorl, about half width of their interspaces, subobsolete over subsutural ramp, extending to abapical suture. Spiral sculpture of dense, fine, punctiform spiral threads of roughly alternating, but almost equal strength, covering entire surface. Surface covered in dense micropustules (Pl. 7, fig. 3c). Last whorl about 56% of total height, profile and sculpture as described above, broadly rounded at shoulder, convex below, moderately constricted at base; axials weakening over base, fine spirals persist over base and siphonal fasciole. Aperture about 39% of total height, elongate ovate; outer lip weakly thickened by labial varix, sharp edged, smooth within; anal sinus very broad and shallow, symmetrically U-shaped, occupying entire subsutural ramp, apex mid-ramp; siphonal canal moderate length, slightly recurved, shallowly notched at tip. Columella smooth, narrowly excavated in upper third, straight below, twisted slightly abapically. Columellar and parietal callus hardly thickened, moderately delimited, forming narrow callus rim.

Discussion – The Estepona specimens compare closely with the Italian Pliocene specimens illustrated by Della Bella *et al*. (2015, figs 137-144).
In the Italian Pliocene this species is found in littoral (Malatesta, 1974) and infra- and circalittoral deposits (Della Bella & Scarponi, 2007, p. 47). In Estepona it is also found in the shallower water assemblages of the Velerín conglomerates and El Lobillo.

Distribution – Lower Pliocene: central Mediterranean, Italy (Bellardi, 1877; Chirli, 1997; Della Bella & Scar-

poni, 2007); Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (this paper); central Mediterranean, Italy (Bellardi, 1877; Cipolla, 1914; Malatesta, 1974). Lower Pleistocene: central Mediterranean, Italy (Della Bella & Scarponi, 2007).

***Bela obesoiberica* nov. sp.**
Plate 8, figs 1-3

ZooBank registration – https://zoobank.org/NomenclaturalActs/31D6FCCD-7502-4913-A9BB-254188832B1C

Type material – Holotype NHMW 2020/0171/0627, height 6.4 mm, width 2.5 mm; paratype 1 NHMW 2020/0171/0628, height 6.0 mm, width 2.5 mm; paratype 2 NHMW 2020/0171/0629, height 5.7 mm, width 2.5 mm.

Other material – **VC**: NHMW 2020/0171/0630 (7).

Type locality – Velerín carretera, Estepona, Spain.

Type stratum – Lower Piacenzian, Upper Pliocene.

Etymology – Compound name reflecting area found, Iberian Peninsula, and the rather squat, rotund form. *Bela* gender feminine.

Diagnosis – *Bela* species of small size, squat, short spire and siphonal canal, protoconch of three whorls, teleoconch of 4-4.5 whorls with shoulder placed mid-whorl, 7-8 axial ribs forming tubercles at shoulder, fine punctiform spirals of alternating strength.

Description – Shell small, relatively solid, squat fusiform, with gradate spire; spire angle 36°. Protoconch multispiral, of 3.1 convex whorls, apical angle 55°, with small, flattened nucleus; nucleus bearing a few spiral lines, last half whorl with comma-shaped axial riblets (dp = 650 μm, hp = 705 μm, dp/hp = 0.92, dn = 105 μm, dV1 = 215 μm). Junction with teleoconch delimited by sinusigera. Teleoconch of 4-4.5 strongly shouldered whorls, with broad, concave subsutural ramp width of adapical half of whorl, narrowly rounded at shoulder forming periphery, weakly concave below, separated by deeply impressed shallowly undulating suture. Axial sculpture of broad, low, weakly opisthocline ribs, 7-8 on last whorl, weak to subobsolete over ramp, tubercular at shoulder, extending to abapical suture. Spiral sculpture of narrow crowded punctiform spiral cords of alternating strength covering entire surface. Last whorl profile and sculpture as described above, moderately convex below shoulder and constricted at base; axials fade a short distance below periphery, not extending onto base. Aperture subrectangular; outer lip not thickened by varix, smooth within; anal sinus broad, moderately deep, asymmetrically U-shaped, occupying entire ramp, with apex towards shoulder; siphonal fasciole moderately short, bent to left, unnotched. Columella excavated in upper third, straight below, twisted at fasciole. Columellar callus weakly thickened, parietal callus hardly developed, forming narrow callus rim.

Discussion – Placement in the genus *Bela* Leach *in* Gray, 1847a is provisional based on the protoconch and the teleoconch characters, although *Bela* species do not usually have sharp tubercles developed at the shoulder.
Bela obesoiberica nov. sp. is not particularly similar to

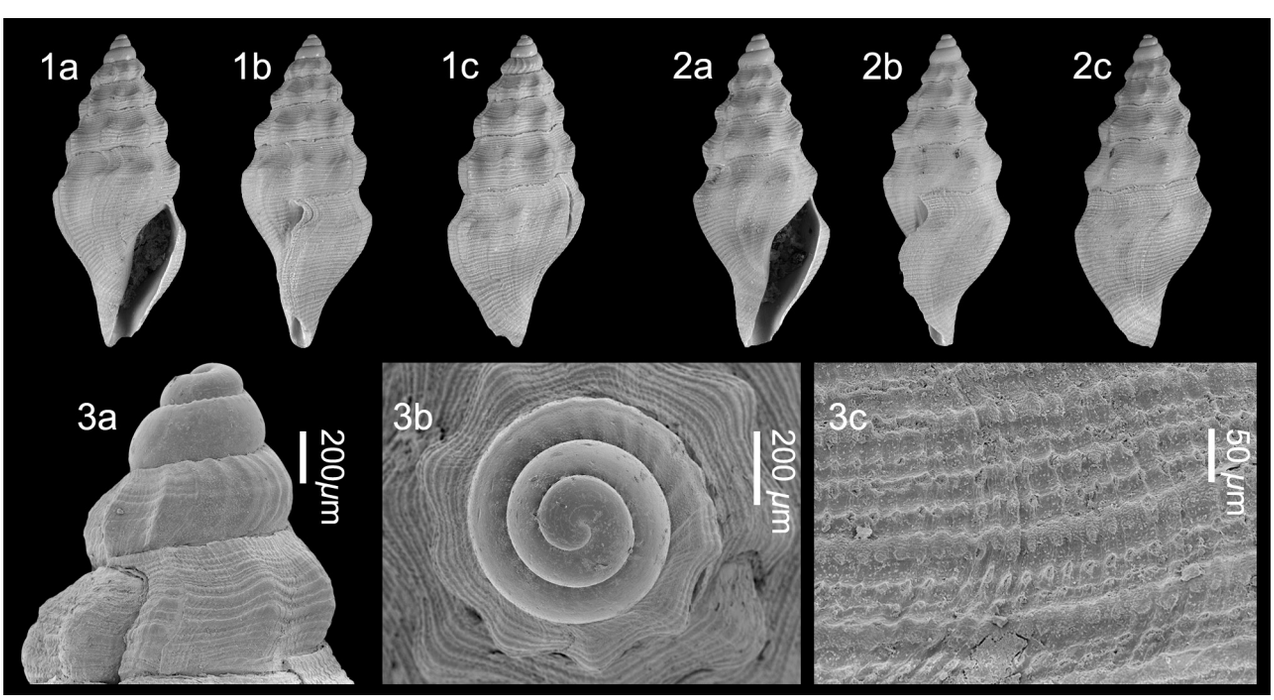

Plate 8. *Bela obesoiberica* nov. sp.; 1. **Holotype** NHMW 2020/0171/0627, height 6.4 mm, width 2.5 mm; 2. **Paratype 1** NHMW 2020/0171/0628, height 6.0 mm, width 2.5 mm (digital images); 3. **Paratype 2** NHMW 2020/0171/0629, height 5.7 mm, width 2.5 mm (SEM images). Velerín carretera, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

any of its Estepona congeners. *Bela trinacria* Mariottini & Smriglio, 2009 (in Mariottini *et al*., 2009), is similar in having a biconic profile and angled whorls, but the shoulder is not tubercular in that species.
Raphitoma calandrellii Bellardi, 1877 from the Upper Miocene of Italy is similar in profile and in having an angular shoulder but differs in having nine axial ribs that extend over the base (see also Montanaro, 1937, pl. 8 [11], fig. 31). We have not seen this species and no photographs are available.

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

***Bela olivoidea* nov. sp.**
Plate 9, figs 1-3

ZooBank registration – https://zoobank.org/NomenclaturalActs/85B29B91-7370-4AB2-8F20-2352DFDC6769

Type material – Holotype NHMW 2020/0171/0663, height 7.9 mm, width 3.6 mm; paratype 1 NHMW 2020/0171/0664, height 8.8 mm, width 4.2 mm; paratype 2 NHMW 2020/0171/0665, height 9.6 mm, width 4.7 mm.

Other material – Maximum height 9.6 mm, width 4.7 mm. **EL**: NHMW 2020/0171/0666 (2).

Type locality – El Lobillo, Estepona, Spain.

Type stratum – Lower Piacenzian, Upper Pliocene.

Etymology – Name reflecting the olive-like or almond-shaped profile of the species. *Bela* gender feminine.

Diagnosis – Solid, squat *Bela* species with low spire, relatively tall and inflated last whorl, sculpture of 11-12 broad ribs weakening towards aperture, fine crowded spirals, narrow aperture, outer lip bearing small tubercle adapically, siphonal canal short and broad.

Description – Shell medium sized, solid, squat biconic fusiform, low spired; spire angle 50-60°. Protoconch not preserved. Teleoconch of 4.5 low, roundly shouldered whorls, with relatively broad, concave subsutural ramp, rounded at shoulder, convex below, separated by narrowly impressed, undulating suture. Axial sculpture strongly predominant, composed of weakly opisthocline, rounded ribs, 11-12 on penultimate whorl, widths less than interspaces, weaker over subsutural ramp, strongly developed at shoulder, extending to abapical suture. Spiral sculpture of dense, fine spiral threads of alternating strength cover entire surface. Last whorl somewhat inflated, 69-73% of total height, profile and sculpture as described above, broadly rounded at high-placed shoulder, weakly convex below, hardly constricted at base; axials weakening over base and over last half whorl, fine spirals persist over base and siphonal fasciole. Aperture 50-55% of total height, elongate subrectangular; outer lip weakly to moderately thickened by labial varix, bearing low tubercle delimiting anal sinus laterally; anal sinus broad and shallow, symmetrically U-shaped, occupying entire subsutural ramp, apex mid-ramp; siphonal canal short, wide, bent slightly adaxially, shallowly notched at tip. Columella smooth, weakly excavated just above mid-height, slightly twisted at fasciole. Columellar and parietal callus weakly thickened, sharply delimited, forming moderate width callus rim.

Discussion – A small number of specimens from the El Lobillo locality represent an undescribed species of the *Bela menkhorsti* Van Aartsen, 1988 species group (of Mariottini *et al*., 2009). They are similar to *Bela trinacria* Mariottini & Smriglio, 2009 (in Mariottini *et al*., 2009), with which they occur in the El Lobillo assemblage, but differ in being squatter, with a proportionately lower spire

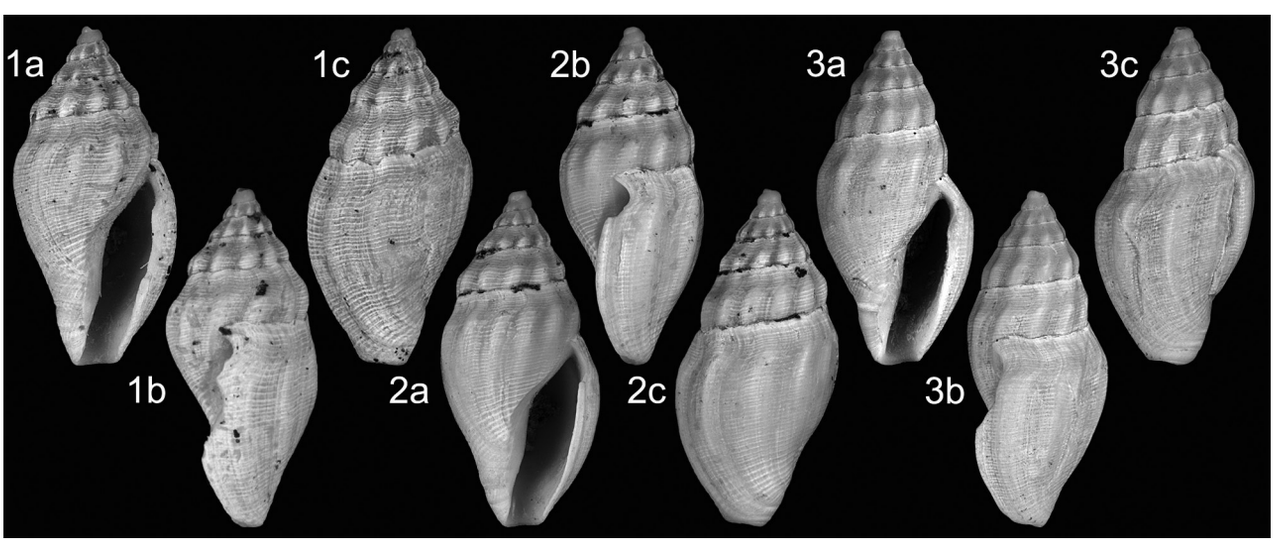

Plate 9. *Bela olivoidea* nov. sp.; 1. **Holotype** NHMW 2020/0171/0663, height 7.9 mm, width 3.6 mm; 2. **Paratype 1** NHMW 2020/0171/0664, height 8.8 mm, width 4.2 mm; 3. **Paratype 2** NHMW 2020/0171/0665, height 9.6 mm, width 4.7 mm (digital images). El Lobillo, Estepona, Lower Piacenzian, Upper Pliocene.

and taller last whorl (69-73% vs. 60-64%), taller aperture (50-55% vs. 42-46%), in having more numerous axial ribs (11-12 vs. 7-8), and in having a tubercle on the inside of the outer lip adapically delimiting the anal sinus laterally. The base is less constricted resulting in a wider siphonal fasciole, and the siphonal canal is shorter and wider. These differences result in a more regularly ovate olive-like profile. Unfortunately, the protoconch is abraded or missing in all specimens. However, it is small and there do not seem to be any riblets on the last part at the teleoconch junction, suggesting that it might be paucispiral.

Both paucispiral and multispiral species are known in the *B. menkhorsti* species group (see Mariottini *et al*., 2009), although none of the species revised by those authors has a similar oliviform profile. All specimens are from the shallow water deposit of El Lobillo. One of the specimens illustrated by Chirli (1997, pl. 15, fig. 11) as *Bela turgida* (Forbes in Reeve) (= *Bela trinacria* Mariottini & Smriglio, 2009; see discussion under that species) is similar in profile, but has fewer ribs, within the range of *B. trinacria*, and lacks the tubercle on the outer lip delimiting anal sinus laterally (not clearly seen on illustration but confirmed by Chirli to us RG-S; 28/12/2022).

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

***Bela submarginata* (Bellardi, 1847)**
Plate 10, fig. 1

*1847	*Raphitoma submarginata* Bon. (*Pleurotoma*)	Bellardi, p. 95, pl. 4, fig. 20.
1867	*Pleurotoma submarginata*? Bon.	Pereira da Costa, p. 241, pl. 28, fig. 3.
1877	*Raphitoma submarginata* (Bon.) [*sic*]	Bellardi, p. 309, pl. 9, fig. 21.
1879	*Raphitoma submarginata* Bonelli	Fontannes, p. 54, pl. 4, fig. 15.
1898	*Pleurotoma* (*Raphitoma*) *submarginata* Bon.	Almera & Bofill, p. 42, pl. 2, fig. 2.
1907	*Pleurotoma* (*Raphitoma*) *submarginata* Bon.	Almera, p. 153, pl. 6, fig. 11.
1910	*Raphitoma submarginata* Bon.	Cerulli-Irelli, p. 65 [257], pl. 6 [37], figs 18-24.
1974	*Bela submarginata* (Bonelli MS, Bellardi, 1847)	Malatesta, p. 429, pl. 31, fig. 7.
1981	*Raphitoma submarginata* Bellardi, 1847, Bonelli m.s.	Ferrero Mortara *et al*., p. 93, pl. 18, fig. 12.
1992	*Bela* (*Bela*) *submarginata* (Bellardi, 1847, Bonelli ms)	Cavallo & Repetto, p. 140, fig. 379.
1993	*Bela* cf. *submarginata* (Bonelli, 1847) [*sic*]	González Delgado, p. 41, pl. 4, figs 8-10.
1997	*Bela submarginata* (Bonelli MS, Bellardi, 1847)	Chirli (*partim*), p. 55, pl. 15, figs 5, 6, 8 (not fig. 9).
2002	*Bela submarginata* (Bellardi, 1847)	Vera-Peláez, p. 210, pl. 4, figs E', F'.
2010	*Bela submarginata* (Bellardi, 1847, Bonelli ms)	Sosso & Dell'Angelo, p. 47, unnumbered fig. p. 63, top row left.
2011	*Bela submarginata* (Bellardi, 1847)	Landau *et al*., p. 33, pl. 17, fig. 12.
non 1854	*Pleurotoma submarginata* (Bon.)	Hörnes, p. 375, pl. 40, fig. 9.
non 1912	*Raphitoma submarginata* Bon.	Friedberg, p. 228, pl. 14, fig. 16.
non 1954	*Raphitoma submarginata* Bon.	Strausz, p. 35, pl. 4, fig. 79.
non 1960	*Mangelia submarginata* Bon.	Kojumdgieva *in* Kojumdgieva & Strachimirov, p. 205, pl. 48, fig. 19.
non 1964	*Cythara* (*Mangelia*) *submarginata* Bonelli in Bellardi, 1877 [sic]	Brébion, p. 587, pl. 14, figs 16-18 [= *Bela pseudomegastoma* Landau, Van Dingenen & Ceulemans, 2020]
non 1968	*Mangelia submarginata* Bon.	Zelinskaya, p. 225, pl. 51, figs 1, 2.
non 1969	*Raphitoma submarginata* Bon.	Atanacković, p. 211, pl. 12, figs 9, 9a.
non 1985	*Raphitoma submarginata* Bon.	Atanacković, p. 174, pl. 38, figs 22, 23.
non 2018	*Brachycythara submarginata* (Bellardi, 1847)	Brunetti & Cresti, p. 96, fig. 399.

Material and dimensions – Height 13.0 mm, width 4.2 mm. **EL**: NHMW 2020/0171/0563 (1), NHMW 2020/0171/0568 (11).

Description – Shell of small to medium size, solid, slender fusiform; spire angle 35°. Protoconch tall, of three strongly convex whorls with small nucleus (dp = 655 μm, hp = 700 μm, dp/hp = 0.93, dn = 110 μm, dV1 = 245 μm) (surface abraded). Junction with teleoconch not clearly preserved. Teleoconch of five roundly shouldered whorls, with steeply inclined, concave subsutural ramp, rounded at shoulder, convex below, separated by narrowly impressed, weakly undulating suture. Axial sculpture strongly predominant, composed of weakly opisthocline, narrow ribs, 13 on last whorl, about one-third width of their interspaces, subobsolete over subsutural ramp, extending to abapical suture. Spiral sculpture of dense, fine spiral threads of alternating strength covers entire surface. Last whorl about 63% of total height, profile and sculpture as described above, broadly rounded at shoulder, convex below, moderately constricted at base; axials weakening over base, fine spirals persist over base and siphonal fasciole. Aperture about 56% of total height, elongate ovate; outer lip not thickened, sharp edged, smooth within; anal sinus very broad and shallow, symmetrically U-shaped, occupying entire subsutural ramp, apex below mid-ramp; siphonal canal moderately long, straight, unnotched. Columella smooth, weakly excavated, twisted slightly at fasciole. Columellar and parietal callus hardly thickened, moderately delimited, forming narrow callus rim.

Discussion – *Bela submarginata* is characterised by its slender profile, tall spire, and long siphonal canal. The specimen from Estepona is closely similar to the syntype from the Upper Pliocene of Italy illustrated by Ferrero

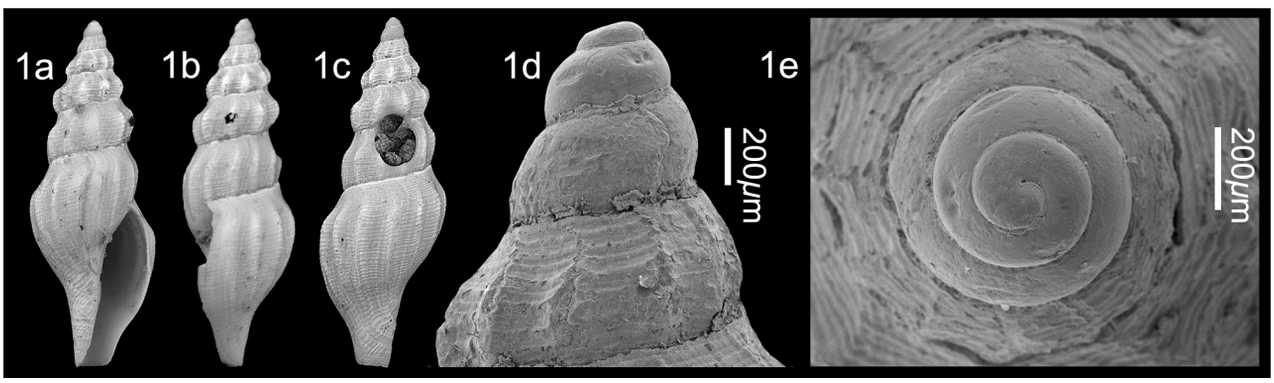

Plate 10. *Bela submarginata* (Bellardi, 1847); 1. NHMW 2020/0171/0563, height 9.2 mm, width 3.1 mm, 1a-c (digital image), 1d-e, detail of protoconch (SEM image). El Lobillo, Estepona, Lower Piacenzian, Upper Pliocene.

Mortara *et al*. (1981, pl. 18, fig. 12). Chirli (1997, pl. 15, figs 5-8) illustrated several specimens as *B. submarginata* of which figs 5, 6, 8 might represent that species, although the ribs are broader; fig. 7 represents a shell half the size of the others with angular whorls and may represent a separate species. The specimen illustrated by Brunetti & Cresti (2018, fig. 399) as *Brachycythara submarginata* is more solid, stockier, with a shorter spire and siphonal canal, and a sharper shoulder and is not this species. In having a slender fusiform profile, it is similar to *B. megastoma* (Brugnone, 1862), but differs in having a comparatively taller last whorl (63% vs. 56% of total height), a larger, wider aperture (45% vs. 39%), a less solid shell, the subsutural ramp is wider, and the outer lip is not thickened by varix.
This species was also described from the Badenian (Langhian, Serravallian) of the Central Paratethys Sea by various authors (Hörnes, 1854; Friedberg, 1912; Strausz, 1954; Kojumdgieva *in* Kojumdgieva & Strachimirov, 1960; *inter alia*). The illustrations, however, suggest that different species have been confused, which not all are conspecific with *B. submarginata*. For example, specimens described by Hörnes (1854) and Atanacković (1969, 1985) are comparatively stouter with a shorter last whorl and convex subsutural ramp. Kojumdgieva *in* Kojumdgieva & Strachimirov (1960) illustrated a specimen with fewer but more prominent axial ribs and longer siphonal canal and Strausz (1954) illustrated a specimen with a higher spire and a last whorl with a prominent shoulder. Therefore, we provisionally exclude these Paratethyan records until a revision of the material is available.

Distribution – Upper Miocene: Atlantic, Cacela, Portugal (Pereira da Costa, 1867). Lower Pliocene: Atlantic, Guadalquivir Basin, S. Spain (González Delgado, 1993; Landau *et al*., 2011); western Mediterranean, northeastern Spain (Almera & Bofill, 1898; Almera, 1907), Roussillon, France (Fontannes, 1879); central Mediterranean, Italy (Cavallo & Repetto, 1992; Chirli, 1997; Sosso & Dell'Angelo, 2010; Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (Vera-Peláez, 2002); central Mediterranean, Italy (Bellardi, 1877; Malatesta, 1974). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1910).

***Bela trinacria* Mariottini & Smriglio, *in* Mariottini *et al*., 2009**
Plate 11, figs 1-4

1877	*Raphitoma turgida* (Forb.) – Bellardi, p. 312, pl. 9, fig. 25 (*non* Reeve, 1844).
1898	*Pleurotoma* (*Raphitoma*) *turgidum* [*sic*] Forbes – Almera & Bofill, p. 42, pl. 11, fig. 8.
1904	*Raphitoma turgida* var. *pliospiralata* Sacc., Sacco, p. 56, pl. 14, figs 41-42.
1914	*Daphnella* (*Raphitoma*) *turgida* Forbes – Cipolla, p. 168, pl. 14, figs 17, 18 (*non* Reeve, 1844).
1937	*Daphnella* (*Raphitoma*) *turgida* (Forb.) – Montanaro, p. 189, pl. 8, fig. 71 (*non* Reeve, 1844).
1964	*Cythara* (*Mangelia*) *turgida* Forbes, 1843 [*sic*] – Brébion, p. 584, pl. 14, fig. 14 (*non* Reeve, 1844).
1964	*Cythara* (*Mangelia*) *turgida* var. *pliospiralata* Sacco, 1890 – Brébion, p. 584, pl. 14, fig. 15.
1992	*Bela* (*Ichnusa*?) *turgida* (Forbes in Reeve, 1844) – Cavallo & Repetto, p. 140, fig. 383 (*non* Reeve, 1844).
1993	*Bela turgida* (Forbes, 1843 [*sic*]) – González Delgado, p. 43, pl. 4, figs 11, 12 (*non* Reeve, 1844).
1997	*Bela turgida* (Forbes in Reeve, 1843 [*sic*]) – Chirli, p. 55, pl. 15, figs 9-12 (*non* Reeve, 1844).
1996	*Bela turgida* (Forbes, 1844) – Vera-Peláez, p. 546, text-fig. 48, pl. 36, figs 3-7, 9, 11, 13 (*non* Reeve, 1844).
2002	*Bela turgida* (Forbes, 1844) – Vera-Peláez, p. 208, pl. 4, figs X-Z, pl. 13, figs G, H (*non* Reeve, 1844).
*2009	*Bela trinacria* Mariottini & Smriglio *in* Mariottini *et al*., p. 10, figs 17-25.
2011	*Bela turgida* (Reeve, 1844) – Landau *et al*., p. 34, pl. 17, fig. 13 (*non* Reeve, 1844).
2013	*Bela trinacria* Mariottini & Smriglio, 2009 – Landau *et al*., p. 268, pl. 44, fig. 10, pl. 71, fig. 6, pl. 72, fig. 1.
2018	*Bela trinacria* Mariottini & Smriglio, 2009 – Ceulemans *et al*., p. 101, pl. 2, fig. 13, pl. 3, fig. 1.
2018	*Brachycythara trinacria* (Mariottini & Smriglio, 2009) – Brunetti & Cresti, p. 96, fig. 400.
2022	*Brachycythara trinacria* Mariottini, Smriglio, Di Giulio & Oliverio, 2009 [*sic*] – Brunetti, p. 72, fig. 158.

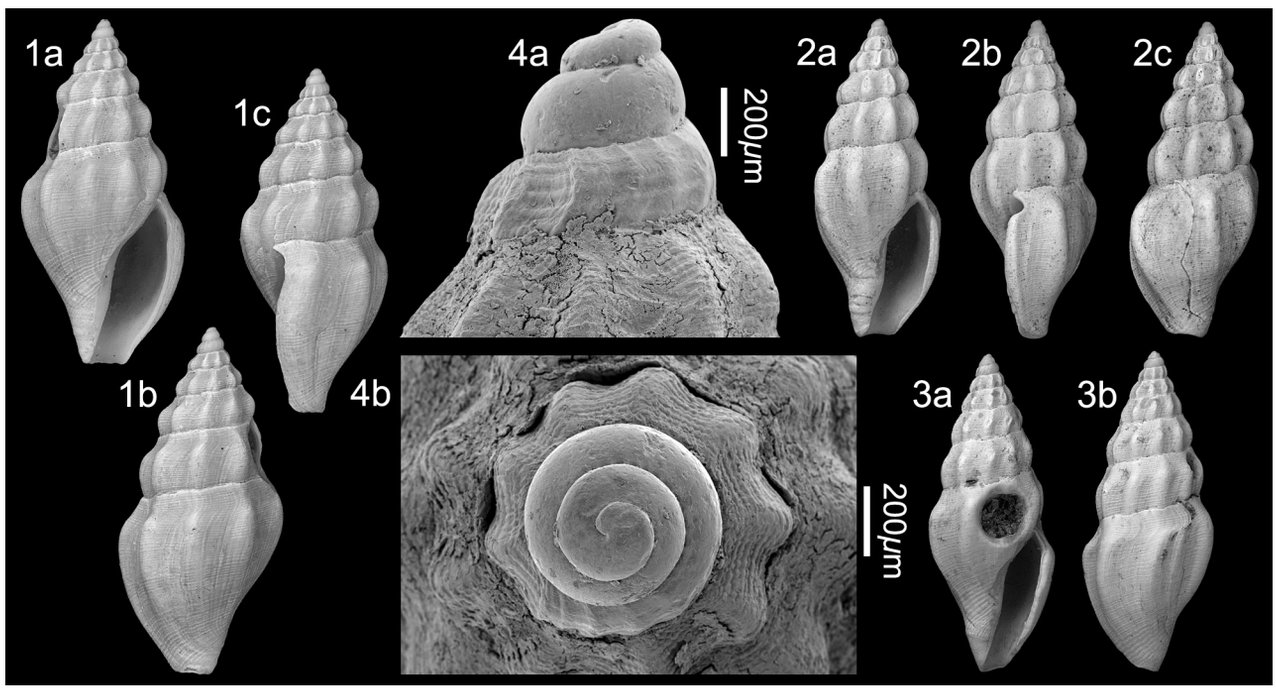

Plate 11. *Bela trinacria* Mariottini & Smriglio, 2009; 1. NHMW 2020/0171/0180, height 9.9 mm, width 4.8 mm; 2. NHMW 2020/0171/0181, height 11.3 mm, width 4.5 mm; 3. NHMW 2020/0171/0182, height 12.3 mm, width 4.7 mm (digital images); 4. NHMW 2020/0171/0184, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

Material and dimensions – Maximum height 12.3 mm, width 4.7 mm. **CO**: NHMW 2020/0171/0180-0183 (4), NHMW 2020/0171/0184 (50+). **VC**: NHMW 2020/0171/0662 (3). **EL**: NHMW 2020/0171/0185 (18).

Description – Shell medium sized, solid, biconic fusiform; spire angle 35-45°. Protoconch multispiral, of three convex whorls, last quarter whorl bearing cordlets and subobsolete riblets (dp = 650 μm, hp = 635 μm, dp/hp = 1.02, dn = 115 μm, dV1 = 240 μm). Junction with teleoconch delimited by sinusigera. Teleoconch of up to 5.5 shouldered whorls, with poorly delimited, steeply inclined, concave subsutural ramp, rounded at shoulder, convex below, separated by narrowly impressed, weakly undulating suture. Axial sculpture strongly predominant, composed of weakly opisthocline, rounded ribs, 7-9 on last whorl, about half width of their interspaces, subobsolete over subsutural ramp, strongly developed at shoulder, extending to abapical suture. Spiral sculpture of dense, fine spiral threads covers entire surface. Last whorl 60-64% of total height, profile and sculpture as described above, broadly rounded at shoulder, weakly convex below, weakly constricted at base; axials weakening over base, fine spirals persist over base and siphonal fasciole. Aperture 42-46% of total height subrectangular; outer lip weakly to moderately thickened by labial varix, sharp edged, smooth within; anal sinus broad and shallow, asymmetrically U-shaped, occupying entire subsutural ramp, apex towards shoulder; siphonal canal moderately short, wide, bent slightly adaxially, shallowly notched at tip. Columella smooth, weakly excavated just above mid-height, slightly twisted at fasciole. Columellar and parietal callus weakly thickened, sharply delimited, forming narrow callus rim.

Discussion – *Bela trinacria* Mariottini & Smriglio, 2009 belongs to the *Bela menkhorsti* species group of Mariottini *et al*. (2009). The name *Bela menkhorsti* Van Aartsen (1988a) was proposed to replace *Pleurotoma nana* Scacchi, 1836, *non* Deshayes, 1835. Members of this species group have often been reported in the literature as *Pleurotoma turgida* Reeve, 1844, which Van Aartsen (1988a, b) considered to be a *nomen dubium*.

The *Bela menkhorsti* group was revised recently by Mariottini *et al*. (2009), who recognised four species. All have very similar teleoconch morphology, but two have paucispiral protoconchs: *B. zenetouae* (Van Aartsen, 1988) and *B. taprurensis* (Pallary, 1904), and two have multispiral protoconchs: *B. menkhorsti* and *B. trinacria*. The difference between the multispiral species was based on protoconch characters, as the protoconch is larger in *B. trinacria* (0.6-0.7 mm *vs.* 0.53-0.54 mm) than in *B. menkhorsti*, with a greater number of whorls in *B. trinacria* (2.7-2.8 *vs.* 2.0-2.2). Mariottini *et al*. (2009) considered *B.trinacria* to be an extinct species present in the Italian Pliocene, whereas *B. menkhorsti* is the extant species. The protoconch in the Estepona material is within the range for size and number of whorls of *B. trinacria*.

Distribution – Middle Miocene: Proto-Mediterranean Sea (Serravallian): Karaman Basin, Turkey (Landau *et al*., 2013). Upper Miocene: Atlantic (Tortonian), NW France (Brébion, 1964); Proto-Mediterranean Sea (Tortonian): Po Basin, Italy (Montanaro, 1937). Lower Pliocene: Atlantic, NW France (Brébion, 1964; Ceulemans *et al*.,

2018), Guadalquivir Basin, S. Spain (González Delgado, 1993; Landau *et al*., 2011; Brunetti, 2022); western Mediterranean, NE Spain (Gili & Martinell, 1994); central Mediterranean, Italy (Chirli, 1997; Brunetti & Cresti, 2018). Upper Pliocene: northeastern Atlantic, Mondego Basin, Portugal (NHMW coll.); western Mediterranean, Estepona Basin (Vera Peláez, 1996, 2002); central Mediterranean, Italy (Bellardi, 1877; Sacco, 1904; Cipolla, 1914; Cavallo & Repetto, 1992).

***Bela vulpecula* (Brocchi, 1814)**
Plate 12, figs 1-3.

*1814 *Murex vulpeculus* Brocchi, p. 420, pl. 8, fig. 10.
1877 *Raphitoma vulpecula* (Brocch.) – Bellardi, p. 308, pl. 9, fig. 20.
1898 *Pleurotoma* (*Raphitoma*) *subvulpecula* Almera & Bofill, p. 41, pl. 2, fig. 7 [*non Pleurotoma subvulpecula* d'Orbigny, 1852].
1907 *Pleurotoma* (*Raphitoma*) *subvulpecula* Almera & Bofill – Almera, p. 152, pl. 6, fig. 7 [*non Pleurotoma subvulpecula* d'Orbigny, 1852].
1910 *Raphitoma vulpecula* Br. – Cerulli-Irelli, p. 65 [257], pl. 6 [37], figs 16, 17.
1914 *Daphnella* (*Raphitoma*) *vulpecula* Br. – Cipolla, 58 [162], pl. 3 [14], fig. 8.
1937 *Daphnella* (*Raphitoma*) *vulpecula* (Br.) – Montanaro, p. 154 [184], pl. 8 [11], fig. 51.
1955 *Cythara* (*Mangelia*) (*Mangelia*) *vulpecula* (Brocchi 1814) – Rossi Ronchetti, p. 301, fig. 161.
1963 *Cythara* (*Mangelia*) *vulpecula* (Brocchi, 1814) – Venzo & Pelosio, p. 129, pl. 41, fig. 28.
1974 *Bela vulpecula* (Brocchi, 1814) – Malatesta, p. 430, pl. 31, fig. 8.
1976 *Raphitoma* (*Raphitoma*) *vulpecula* (Brocchi) – Marasti & Raffi, p. 197, pl. 2, fig. 17.
1978 *Bela vulpecula* (Brocchi, 1814) – Cuscani Politi, p. 50, pl. 6, fig. 22.
1978 *Murex vulpeculus* Brocchi, 1814 – Pinna & Spezia, p. 155, pl. 40, fig. 4.
1982 *Bela vulpecula* (Brocchi, 1814) – Martinell, p. 106, pl. 1, figs 15, 16.
1992 *Neoguraleus vulpeculus* (Brocchi, 1814) – Cavallo & Repetto, p. 144, fig. 400.
1993 *Bela vulpecula* (Brocchi, 1814) – González Delgado, p. 41, pl. 4, figs 6, 7.
1996 *Bela vulpecula* (Brocchi, 1814) – Vera-Peláez, p. 530, text-fig. 45, pl. 37, figs 5-8.
1997 *Bela vulpecula* (Brocchi, 1814) – Chirli, p. 56, pl. 16, figs 1-3.
2001 *Bela vulpecula* (Brocchi, 1814) – Silva, p. 543, pl. 25, figs 4-5.
2002 *Bela vulpecula* (Brocchi, 1814) – Vera-Peláez, p. 207, pl. 4, figs Q, R.
2011 *Bela vulpecula* (Brocchi, 1814) – Landau *et al*., p. 33, pl. 17, fig. 14.
2022 *Bela vulpecula* (Brocchi, 1814) – Brunetti, p. 72, fig. 157.

non 1928 *Raphitoma vulpecula* Brocc. – Friedberg, p. 573, pl. 37, fig. 17 [? = *Bela polonica* Csepreghy-Meznerics, 1953].
non 1954 *Mangelia* (s.s.) *vulpecula* Brocchi, 1814 – Glibert, p. 49, pl. 6, fig. 9 [= *Bela pseudovulpecula* Landau, Van Dingenen & Ceulemans, 2020]

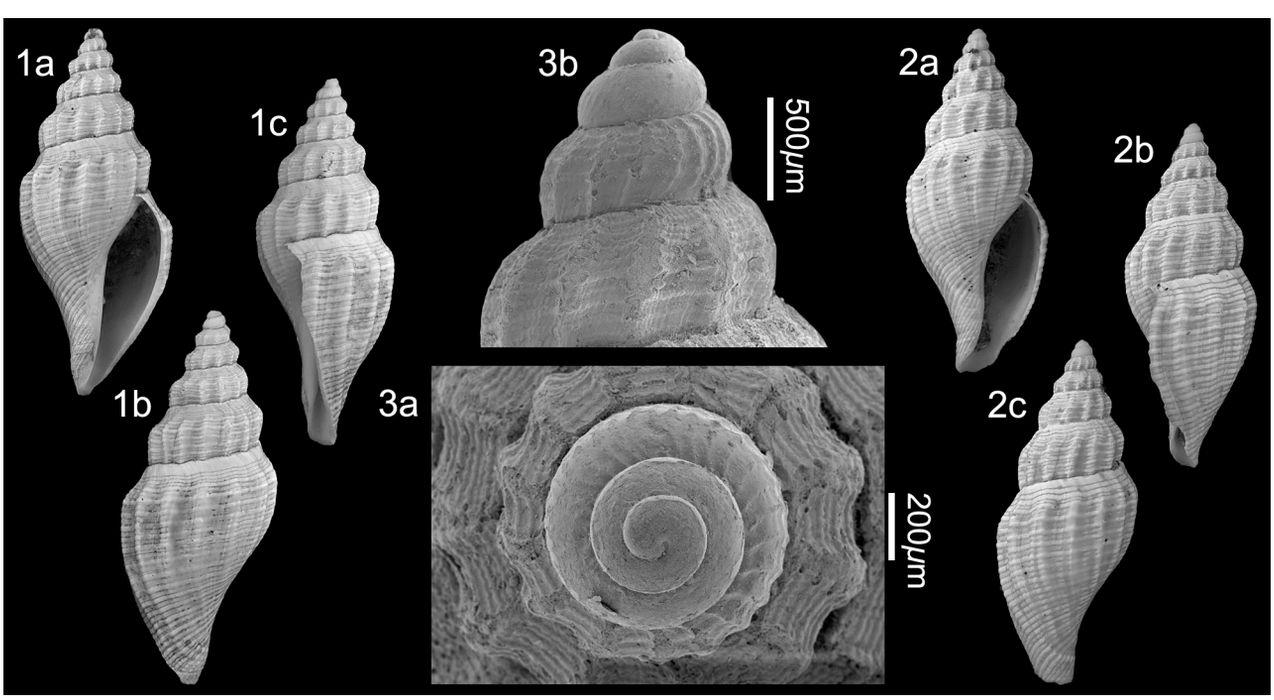

Plate 12. *Bela vulpecula* (Brocchi, 1814); 1. NHMW 2020/0171/0564, height 13.3 mm, width 5.5 mm; 2. NHMW 2020/0171/0565, height 11.8 mm, width 5.0 mm (digital images); 3. NHMW 2020/0171/0566, height 11.7 mm, width 4.8 mm, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

non 1954 *Raphitoma vulpecula* Jan. [*sic*] – Strausz, p. 34, pl. 5, fig. 109 [? = *Bela polonica* Csepreghy-Meznerics, 1953].

non 1966 *Mangelia vulpecula* Brocchi, 1814 – Strausz, p. 437, pl. 20, figs 18-21 [? = *Bela polonica* Csepreghy-Meznerics, 1953].

non 1998 *Bela vulpecula* (Brocchi, 1814) – Mikuž, p. 82, pl. 6, fig. 6 [? = *Bela polonica* Csepreghy-Meznerics, 1953].

non 2003 *Bela vulpecula* (Brocchi, 1814) – Bałuk, p. 63, pl. 24, figs 10-11 [? = *Bela polonica* Csepreghy-Meznerics, 1953].

Material and dimensions – Maximum height 13.3 mm, width 5.5 mm. **CO**: NHMW 2020/0171/0564-0566 (3), NHMW 2020/0171/0567 (7).

Description – Shell medium sized, medium-thickness, fusiform; spire angle 35°. Protoconch multispiral, of three convex whorls with small nucleus, last whorl bearing cordlets and subobsolete riblets, apical angle about 45° (dp = 750 μm, hp = 855 μm, dp/hp = 0.88, dn = 135 μm, dV1 = 255 μm). Junction with teleoconch delimited by sinusigera. Teleoconch of up to five weakly shouldered whorls, with moderate width, poorly delimited, weakly concave to straight subsutural ramp, rounded at shoulder, convex below, separated by narrowly impressed, weakly undulating suture. Axial sculpture strongly predominant, composed of slightly sinuous, weakly opisthocline, rounded ribs, 13-14 on last whorl, about half width of their interspaces, subobsolete over subsutural ramp, moderately developed at shoulder, extending to abapical suture. Spiral sculpture of narrow flattened cords of alternating strength covers entire surface. Last whorl 70-71% of total height, profile and sculpture as described above, weakly angled at high-placed shoulder, convex below, moderately constricted at base; axials weakening over base, narrow cords of alternating strength persist over base and siphonal fasciole. Aperture 49-53% of total height, elongate-ovate; outer lip not thickened by varix, sharp edged, smooth within; anal sinus broad, shallow, symmetrically U-shaped, occupying entire subsutural ramp, apex mid-ramp; siphonal canal moderately long, bent slightly adaxially, unnotched. Columella broadly excavated, smooth, slightly twisted at fasciole. Columellar and parietal callus weakly thickened, sharply delimited, forming narrow callus rim.

Discussion – Bela vulpecula (Brocchi, 1814) differs from *Bela plicatella* (Bellardi, 1847) in having more regularly convex spire whorls, with a less concave subsutural ramp and a weaker shoulder, the ribs are broad and straight, whereas in *B. plicatella* they are finer and more sinuous, the spirals are lower, and lacks the slightly strengthened shoulder cord delimiting the subsutural ramp.

Specimens from the Middle Miocene of the Central Paratethys Sea, described as this species by Friedberg (1928), Strausz (1954, 1966), Mikuž (1998, 2009) and Bałuk (2003) are generally smaller than the Pliocene species. Csepreghy-Meznerics (1953; 16) established the subspecies '*Cythara* (*Mangelia*) *vulpecula polonica'* for some of these specimens and we provisionally use this name for the Paratethyan specimens at full species rank, pending review.

Della Bella *et al*. (2015, p. 45) noted that in Italy *B. vulpecula* occurred in circalittoral assemblages. In Estepona it is also found only in the shallower water assemblage of Velerín conglomerates.

Distribution – Upper Miocene: Proto-Mediterranean, Italy (Bellardi, 1877; Montanaro, 1937; Venzo & Pelosio, 1963). Lower Pliocene: Atlantic, Guadalquivir Basin, S. Spain (Gonzalez Delgado, 1993; Landau *et al*., 2011; Brunetti, 2022); western Mediterranean, NE Spain (Almera & Bofill, 1898; Almera, 1907; Martinell, 1982; Gili & Martinell, 1994); central Mediterranean, Italy (Bellardi, 1877; Cavallo & Repetto, 1992; Chirli, 1997). Upper Pliocene: Atlantic, Mondego Basin, Portugal (Silva, 2001); western Mediterranean, Estepona Basin, southern Spain (Vera-Peláez, 1996, 2002); central Mediterranean, Italy (Bellardi, 1877; Cipolla, 1914; Malatesta, 1974; Marasti & Raffi, 1976). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1910).

***Bela* sp.**

Plate 13, figs 1-2.

?2015 *Bela* sp. 3 – Della Bella *et al*., p. 51, figs 153-156.

Material and dimensions – Maximum height 12.2 mm, width 5.4 mm. **VC**: NHMW 2020/0171/0587-0588 (2), NHMW 2020/0171/0589 (1).

Description – Shell of medium size and thickness, broad fusiform; spire angle 35°. Protoconch multispiral, of 2.5 convex whorls with small nucleus, last whorl bearing cordlets and weak riblets (dp = 550 μm, hp = 825 μm, dp/hp = 0.67, dn = 115 μm, dV1 = 235 μm). Junction with teleoconch delimited by sinusigera. Teleoconch of five initially sharply angled, later roundly shouldered whorls, with moderate width, weakly concave subsutural ramp not delimited by shoulder cord, rounded at shoulder, strongly convex below, separated by narrowly impressed, weakly undulating suture. Axial sculpture strongly predominant, composed of slightly sinuous, weakly opisthocline to orthocline, narrow ribs extending between sutures, 16 on last whorl, about one-third width of their interspaces. Spiral sculpture of fine crowded punctiform spiral threads of primary to tertiary strength covers entire surface. Last whorl 67% of total height, profile and sculpture as described above, rounded at high-placed shoulder, convex below, strongly constricted at base; axials weakening over base, fine spirals of primary to tertiary strength persist over base and siphonal fasciole. Aperture 50% of total height, subrectangular; outer lip not thickened by varix, sharp edged, smooth within; anal sinus very broad and shallow, symmetrically U-shaped, with apex at shoulder; siphonal canal moderately long, bent adaxially, unnotched. Columella smooth, weakly

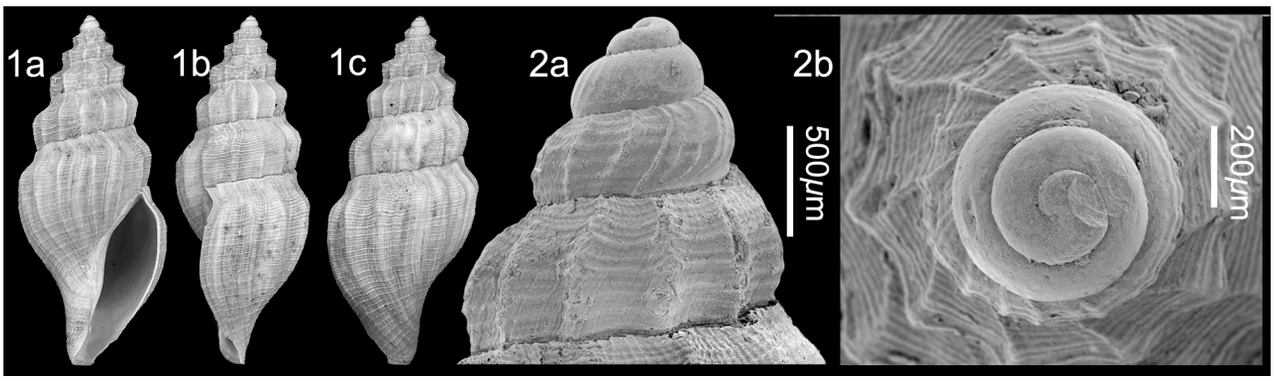

Plate 13. *Bela* sp.; 1. NHMW 2020/0171/0587, height 12.2 mm, width 5.4 mm (digital image); 2. NHMW 2020/0171/0588, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

excavated above mid-height, straight below, twisted at fasciole. Columellar and parietal callus weakly thickened, sharply delimited, forming narrow callus rim.

Discussion – This species is similar to *Bela plicatella* (Bellardi, 1847) and *B. vulpecula* (Brocchi, 1814) but is broader, has a smaller protoconch composed of fewer protoconch whorls, and the early teleoconch whorls are sharply angular at the shoulder, becoming rounded abapically, whereas in both of the other species they are more rounded from the early whorls. It might be the same species as that illustrated by Della Bella *et al*. (2015, figs 153-156) as *Bela* sp. 3 from the Upper Pliocene of Italy. Although the protoconch is illustrated on side view, no protoconch measurements are given, nor is the number of whorls specified.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (this paper); ?central Mediterranean, Italy (Della Bella *et al*., 2015).

Genus *Belidaphne* Vera-Peláez, 2002

Type species – Raphitoma semicostata Bellardi, 1847, by original designation, Pliocene, Spain.

2002 *Belidaphne* Vera-Peláez, p. 220.

Note – The genus *Belidaphne* Vera-Peláez, 2002 was introduced "*for species with characteristics intermediate between three genera* Comarmondia *Monterosato, 1884,* Bela *Gray, 1847 and* Rimosodaphnella *Cossmann, 1916, not fitting in any of these three genera* [translated from original Spanish]." (Vera-Peláez, 2002, p. 221), and placed in the Daphnellinae Hedley, 1922 (= Raphitomidae Bellardi, 1875). This comparison centres round a basic misunderstanding of the protoconch microsculpture, as all three genera belong within different families (Clathurellidae H. & A. Adams, 1853, Mangeliidae P. Fischer, 1883 and Raphitomidae Bellardi, 1875 respectively) with typical protoconch characters in species that have planktotrophic development. The species included in *Belidaphne* by Vera-Peláez have multispiral protoconchs with axial riblets and spiral cordlets on the last 1-2 whorls resulting in a reticulated pattern, typical of Mangeliidae and quite different to the fine diagonally reticulated mesh-like sculpture seen in Raphitomiidae or the usually keeled protoconch seen in Clathurellidae with riblets below the central keel.

Della Bella *et al*. (2015, p. 53) correctly placed *Belidaphne* in the family Mangeliidae, and any comparison should be made within this context. The most similar genus is *Bela* Leach *in* Gray, 1847 from which *Belidaphne* species differ not in protoconch characters, but in having a more regularly slender fusiform profile, the subsutural ramp occupying approximately one-third of the whorl height, concave, sharply delimited by a high-placed, rounded shoulder, and the base moderately to weakly constricted, resulting in a broader base and siphonal canal than is usual in *Bela*. These differences are small, and it may be that *Belidaphne* is a junior subjective synonym of *Bela*.

Vera-Peláez (2002) included three species in his genus *Belidaphne* and chose *Raphitoma semicostata* Bellardi, 1847 as the type species. However, Della Bella *et al.* (2015) highlighted a further complication; the Estepona material identified as that species by Vera-Peláez (p. 221, pl. 6, figs A, B, pl. 14, figs I, J) probably represents *Drillia hypoglypta* Fontannes, 1880 and not Bellardi's species, although doubt persisted as Della Bella *et al*. (2015, p. 53) were unable to locate the type of Fontannes' species. Further species included by Vera-Peláez in the genus were *Raphitoma desmoulinsi* Bellardi, 1847, which in our opinion represents a raphitomid (see under *Leufroyia desmoulinsi* Bellardi, 1847) and *B. saldubensis* Vera-Peláez, 2002. A further species was added to the genus from the Italian Pliocene: *B. brunettii* Della Bella, Naldi & Scarponi, 2015.

***Belidaphne semicostata* (Bellardi, 1847)**
Plate 14, figs 1-6

*1847 *Raphitoma semicostata* Bellardi, p. 94, pl. 4, fig. 19 (Upper Pliocene).
1877 *Homotoma semicostata* Bell. – Bellardi, p. 282, pl. 8, fig. 30.

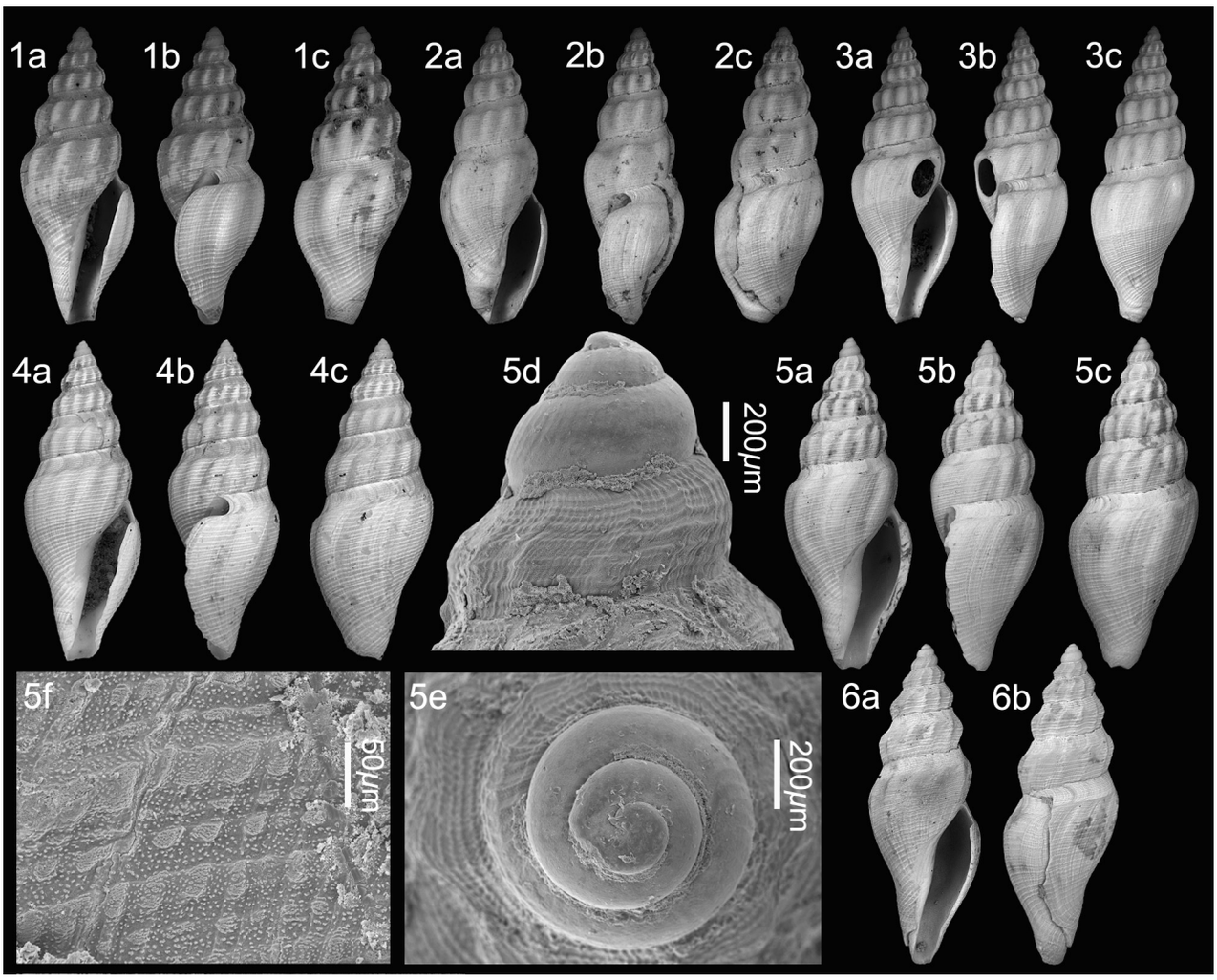

Plate 14. *Belidaphne semicostata* (Bellardi, 1847); 1. NHMW 2020/0171/0625, height 11.6 mm, width 4.3 mm; 2. NHMW 2020/0171/0626, height 13.4 mm, width 4.8 mm; 3. NHMW 2020/0171/0067, height 15.9 mm, width 5.7 mm; 4. NHMW 2020/0171/0426, height 13.1 mm, width 5.1 mm; 5. NHMW 2020/0171/0427, height 12.7 mm, width 4.7 mm, 5d-e, detail of protoconch, 5f, detail of microsculpture protoconch-teleoconch boundary (SEM image); 6. NHMW 2020/0171/0428, height 16.8 mm, width 5.7 mm (digital images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

1880 *Drillia hypoglypta* Fontannes, p. 255, pl. 12, fig. 29.
1904 *Peratotoma* (*Bellardiella*?) *semicostata* var. *pliostriata* Sacco, p. 53, pl. 14, figs 5, 6.
1914 *Daphnella* (*Bellardiella*) *semicostata* Bellardi – Cipolla, p. 48 [152], pl. 2 [13], fig. 24.
1981 *Raphitoma semicostata* Bellardi – Ferrero Mortara *et al*., p. 89, pl. 18, fig. 7.
2002 *Belidaphne semicostata* (Bellardi, 1847) – Vera-Peláez, p. 221, pl. 6, figs A, B, pl. 14, figs I, J.
2015 *Belidaphne hypoglypta* (Fontannes, 1880) – Della Bella *et al*., p. 54, figs 165-172.
2015 *Belidaphne brunettii* Della Bella, Naldi & Scarponi, p. 54, figs 181-192.

Material and dimensions – Maximum height 16.8 mm, width 5.7 mm. **CO**: NHMW 2020/0171/0426-0428 (3), NHMW 2020/0171/0429 (11), NHMW 2020/0171/0625-0626 (2), NHMW 2020/0171/0067 (1). **EL**: NHMW 2020/0171/0432 (1).

Description – Shell of medium sized and thickness, fusiform; spire angle 35-37°. Protoconch multispiral, of 3.1 convex whorls, last half whorl bearing cordlets and riblets forming reticulated pattern (dp = 750 μm, hp = 850 μm, dp/hp = 0.88, dn = 115 μm, dV1 = 235 μm). Junction with teleoconch sharply delimited by sinusigera. Teleoconch of up to six weakly shouldered whorls, with well-delimited, steeply inclined, weakly concave subsutural ramp occupying adapical third of whorl, rounded at shoulder, convex below, separated by narrowly impressed, linear suture. Axial sculpture strongly predominant, composed of broad, arched, opisthocline, rounded ribs, 9-10 on second whorl, 11-13 penultimate whorl, equal in width to slightly narrower than their interspaces, only developed below subsutural ramp. Spiral sculpture of dense, fine, punctiform spiral threads covering entire surface, of primary to tertiary order below ramp. Microsculpture of minute pustules covers entire surface (Pl. 14, fig. 5f). Last whorl 63-65% of total height, with narrow concave ramp,

sharply delimited at rounded shoulder, broadly convex below, weakly constricted at base; axials weakening to subobsolete on last whorl, reducing in number towards aperture, sometimes varicose, not extending below periphery, fine spirals of primary to tertiary strength persisting over base, slightly stronger subequal cords over siphonal fasciole; fasciole not sharply delimited. Aperture 46-49% total height, elongate subrectangular; outer lip weakly thickened by labial varix, sharp edged, smooth within; anal sinus of moderate width and depth, symmetrically U-shaped, occupying entire subsutural ramp, apex mid-ramp; siphonal canal moderate length, relatively wide, unnotched. Columella smooth, weakly excavated in upper third, straight below, weakly twisted at fasciole. Columellar and parietal callus hardly thickened, moderately delimited, forming callus rim expanded over venter abapically. Broad orange/brown colour band preserved over base in some specimens.

Discussion – Della Bella *et al*. (2015, p. 53) considered the Estepona specimens illustrated by Vera-Peláez (2002, pl. 6, figs A, B) as *Belidaphne semicostata* (Bellardi, 1847) to represent *Belidaphne hypoglypta* (Fontannes, 1880). Comparing the Estepona specimens with the lectotype of *B. semicostata* from the Upper Pliocene of Italy (Ferrero Mortara *et al*., 1981, pl. 18, fig. 7) Bellardi's species differs in having fewer axial ribs that weaken or become subobsolete on the last two teleoconch whorls, as opposed to just on the last whorl in *B. hypoglypta*. Having said this, the Estepona specimens are highly variable in apical angle, with relatively slender and broader specimens present. The axial sculpture on the spire whorls is constant, but on the last whorl the ribs may persist weakened, or more commonly become reduced in number and varicose, or disappear completely in a minority of specimens. This same variability is seen in the Italian Pliocene specimens illustrated by Della Bella *et al*. (2015, figs 165-172). The lectotype of *Raphitoma semicostata* figured by Bellardi and Ferrero Mortara *et al*. is a rather odd, elongated specimen. At 20 mm in height, it is probably a large gerontic specimen and similar to one of the specimens illustrated herein from Estepona (Pl. 14, fig. 2). It is not unusual in mangeliids as well as other turrids for the ribs to weaken in large specimens. We therefore consider *Drillia hypoglypta* Fontannes, 1880 to be a subjective junior synonym of *Raphitoma semicostata* Bellardi, 1847.
A further congener from the Italian Pliocene, *B. brunettii* Della Bella, Naldi & Scarponi, 2015 is very similar to *B. semicostata*, and was said to differ in having fewer spiral cordlets on the protoconch (6 vs 7-8), and more strongly developed axial ribs that persist onto the last whorl. In our opinion, this species was erected as result of a misunderstanding surrounding the variability of *B. semicostata*. We consider the holotype of *B. semicostata* to be an unusual gerontic form and the specimens illustrated by Della Bella *et al*. (2015, figs 181-192) as *B. brunettii* to fit well within the range of variability for *B. semicostata* as understood herein (Pl. 14, figs 1-6). The protoconch differences are minimal; said to be composed of 2.2-2.5 whorls (2015, p. 78, appendix 3; the first half whorl is not counted by those authors, so 2.7-3.0 whorls as counted herein) and is of similar size. The specimen illustrated herein has six cordlets on the last portion of the protoconch (Pl. 14, fig. 3a), which would place it in the range of *B. brunettii*. We therefore consider *Belidaphne brunettii* a subjective junior synonym of *Raphitoma semicostata* Bellardi, 1847.
Della Bella *et al*. (2015, p. 55) considered *Mangelia nysti* Glibert, 1960 from the Upper Pliocene North Sea Basin of Belgium to be closely related. The Glibert illustrations are small and unclear; the specimen does have a similar subsutural ramp but is slenderer than *B. semicostata*. We note that if the two are related, then Marquet's (1998a, p. 273, pl. 2, figs 3, 4; 1998b, p. 179, fig. 152) interpretation of Glibert's species, in which he considered it a junior subjective synonym of *Mangelia gracilior* (Bell, 1871), is incorrect.
In the Italian assemblages *B. semicostata* is found in circalittoral deposits (Della Bella *et al*., 2015, p. 55, reported as the synonymous *B. hypoglypta*). In Estepona it is also found in the shallower water deposits.
For further comparison, see below under *Belidaphne saldubensis*.

Distribution – Lower Miocene: Proto-Mediterranean, Italy (Bellardi, 1877). Lower Pliocene: western Mediterranean, NE Spain (Gili & Martinell, 1994); central Mediterranean, Italy (Bellardi, 1877; Sacco, 1904; Della Bella *et al*., 2015). Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (Vera-Peláez, 2002), France (Fontannes, 1880); central Mediterranean, Italy (Bellardi, 1877; Cipolla, 1914; Della Bella *et al*., 2015).

Belidaphne saldubensis **Vera-Peláez, 2002**
Plate 15, figs 1-3

*2002	*Belidaphne saldubensis* Vera-Peláez, p. 222, pl. 6, figs E, F, pl. 17, figs T, U.
2018	*Belidaphne saldubensis* Vera-Peláez, 2002 – Brunetti & Cresti, p. 96, fig. 391.

Material and dimensions – Maximum height 11.7 mm, width 4.3 mm. **VC**: NHMW 2020/0171/0430 (1), NHMW 2020/0171/0431 (6), NHMW 2020/0171/0624 (1).

Description – Shell of medium size and thickness, fusiform; spire angle 30-35°. Protoconch multispiral, of 2.9 convex whorls, last half whorl bearing cordlets and riblets forming reticulated pattern (dp = 775 μm, hp = 815 μm, dp/hp = 0.95, dn = 170 μm, dV1 = 315 μm). Junction with teleoconch sharply delimited by sinusigera. Teleoconch of up to five weakly shouldered whorls, with well-delimited, steeply inclined, weakly concave subsutural ramp occupying adapical third of whorl, rounded at shoulder, convex below, separated by narrowly impressed, linear suture. Axial sculpture strongly predominant, composed of narrow, opisthocline ribs, 11 on second whorl, 14 penultimate whorl, about half width of their interspaces, only developed below subsutural ramp. Spiral sculpture of fine, subequal cords covering entire surface. Microsculpture of

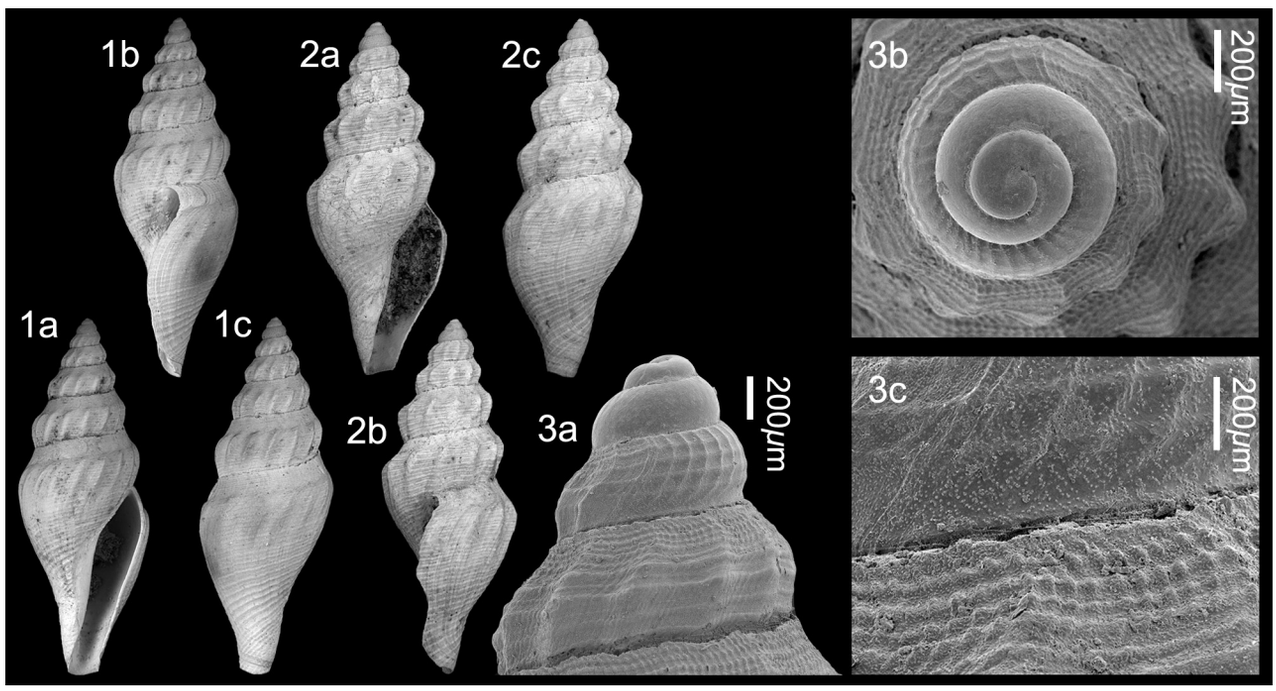

Plate 15. *Belidaphne saldubensis* Vera-Peláez, 2002; 1. NHMW 2020/0171/0624, height 11.6 mm, width 4.3 mm; 2. NHMW 2020/0171/0431, height 11.0 mm, width 4.2 mm (digital images); 3. NHMW 2020/0171/0430, 3a-b, detail of protoconch, 3c detail of microsculpture protoconch-teleoconch boundary (SEM image). Velerín carretera, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

minute pustules covers entire surface (Pl. 15, fig. 3c). Last whorl 64-67% of total height, with narrow almost straight ramp, sharply delimited at rounded shoulder, broadly convex below, weakly constricted at base; axials not extending below periphery, cords strengthening slightly over base and fasciole; fasciole not sharply delimited. Aperture 48-52% total height, elongate subrectangular; outer lip weakly thickened by labial varix, sharp edged, smooth within; anal sinus of moderate width and depth, symmetrically U-shaped, occupying entire subsutural ramp, apex mid-ramp; siphonal canal moderate length, relatively wide, unnotched. Columella smooth, weakly excavated in upper third, straight below, weakly twisted at fasciole. Columellar and parietal callus hardly thickened, moderately delimited, forming callus rim expanded over venter abapically. Broad orange/brown colour band preserved over base in some specimens.

Discussion – The original discussion compares *Belidaphne saldubensis* Vera-Peláez, 2002 with a couple of raphitomid species belonging to disparate genera that are all immediately separated on protoconch characters. Compared to *Belidaphne semicostata* (Fontannes, 1880), *B. saldubensis* is smaller (11.4 mm vs 17.1 mm), the shoulder is sharper, the axial ribs are slightly more numerous and narrower, the primary and secondary spirals are almost equal strength, whereas *B. semicostata* has more numerous, finer spirals of primary to tertiary strength. Moreover, the spirals are more strongly punctate (*i.e.*, more deeply cut by the close-set axial growth lines) in *B. semicostata*. The two species seem to have exploited different ecological niches; *B. semicostata* is found in the Estepona shallow water deposits, whereas *B. saldubensis* occurs in the deeper-water deposits of Velerín carretera. *Belidaphne saldubensis* has also been recognised in the Italian Pliocene (Della Bella *et al*., 2015, p. 55), accompanied by a similar ecological comment; *B. semicostata* was associated with circalittoral habitat and *B. saldubensis* was lower circalittoral to epibathyal.

Distribution – Lower Pliocene: central Mediterranean, Italy (Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (Vera-Peláez, 2002).

Genus *Benthomangelia* Thiele, 1925

Type species – Surcula trophonoidea Schepman, 1913, by original designation, present-day, Indonesia, deep water.

1925 *Benthomangelia* Thiele, p. 208.
1990 *Andersondrillia* Schnetler *in* Schnetler & Beyer, p. 66. Type species (by original designation): *Microdrillia grippi* Anderson, 1964, Miocene, Germany.

Note –This genus is characterised by rather small-shelled species with a tall spire, medially angulate whorls, long last whorl, slowly tapering to a moderately long, slightly twisted, unnotched siphonal canal, sculpture of narrow axials starting as small tubercles at the shoulder, oblique below, fading over the base, overrun by flat-topped spi-

rals separated by narrow grooves, and a shallow anal sinus (Powell, 1966, p. 99).

***Benthomangelia caterini* (Seguenza, 1875)**
Plate 16, figs 1-2

*1875	*Pleurotoma Caterini* Seguenza, p. 210.
1877	*Raphitoma Catherini* [*sic*] (Seg.) – Bellardi, p. 297, pl. 9, fig. 1 (spelt *Caterinii* on plate text).
1992	*Neoguraleus caterinii* [*sic*] (Seguenza, 1875) – Cavallo & Repetto, p. 144, fig. 397.
2002	*Benthomangelia catherini* [*sic*] (Seguenza, 1875) – Vera-Peláez, p. 218, pl. 5, figs Ñ, Q not Ñ, O (*lapsus*).
2018	?*Brachitoma caterinii* [*sic*] (Seguenza *in* Bellardi, 1877 [*sic*]) – Tabanelli, p. 6, fig. 3.

Material and dimensions – Maximum height 8.8 mm, width 3.1 mm. **VC**: NHMW 2020/0171/0149-0150 (2).

Description – Shell small, fragile, fusiform, with gradate spire, surface glossy; spire angle 40-45°. Protoconch multispiral, turbiniform, of five strongly convex whorls, with small highly raised nucleus, apical angle approximately 55°; last whorl with comma-shaped axial riblets (dp = 1067 μm, hp = 1340 μm, dp/hp = 0.80). Junction with teleoconch sharply delimited by sinusigera. Teleoconch of up to four strongly shouldered whorls, with broad, concave subsutural ramp delimited adapically by single weak subsutural cord, roundly angled at shoulder forming periphery, straight sided below, tapering inwards to deeply impressed linear suture. Axial sculpture of narrow, opisthocline, arcuate ribs, 16-22 on last whorl, forming small spinous tubercle on subsutural cord, narrow over ramp, tubercular at shoulder, weakening towards and fading before abapical suture. Spiral sculpture on spire whorls absent, except for subsutural cord. Last whorl 66-68% of total height, profile and sculpture as described above, moderately convex below and constricted at base; axials fade a short distance below periphery, not extending onto base, fine, weak spiral cords on base, strengthening slightly towards and on siphonal fasciole. Aperture 50-52% of total height, subrectangular; outer lip not thickened by varix (edge incomplete), smooth within; anal sinus broad, moderately deep, asymmetrically U-shaped, occupying entire ramp, with apex towards shoulder; siphonal fasciole moderately long, weakly recurved, not notched. Columella weakly excavated, slightly twisted at fasciole. Columellar and parietal callus weakly thickened, sharply delimited, forming narrow callus rim.

Discussion – *Benthomangelia caterini* (Seguenza, 1875) is a very characteristic species, with its highly polished, glossy surface, small, pointed tubercles developed just below the suture, stronger tubercles at the periphery, and spiral sculpture restricted to a few weak cords over the base and siphonal fasciole. Vera-Peláez (2002) in both the text (p. 218) and plate explanation (p. 244) refers to this species as figs N, O on plate 5. However, this must be a *lapsus* as plate 5 N, Q are photographs of the same specimen conspecific with those herein identified as *B. caterini*. Figures P, O must refer to his *Benthomangelia rafaelae* Vera-Peláez, 2002, and not figs P and Q as stated. *Benthomangelia* is widely distributed in bathyal and abyssal habitats (Bouchet & Warén, 1980, p. 45), and indeed in Estepona *B. caterini* is found only in the deeper water Velerín carretera assemblage. It differs from its extant eastern Atlantic congeners such as *B. antonia* (Dall, 1881), *B. macra* (Watson, 1881), *B. decapitata* Bouchet & Warén, 1980 in the absence of spiral sculpture on the spire whorls.

Distribution – Upper Miocene: Proto-Mediterranean, Italy (Bellardi, 1877). Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (Vera-Peláez, 2002); central Mediterranean, Italy (Tabanelli, 2018).

***Benthomangelia obtusangula* (Brocchi, 1814)**
Plate 17, figs 1-3

*1814	*Murex obtusangulus* Brocchi, p. 422, pl. 8, fig. 19.
1847	*Pleurotoma obtusangula* Brocchi (*Murex*) – Bellardi, p. 65, pl. 3, fig. 21.
1854	*Pleurotoma obtusangula* Brocc. – Hörnes, p. 365, pl. 40, figs 7, 8.

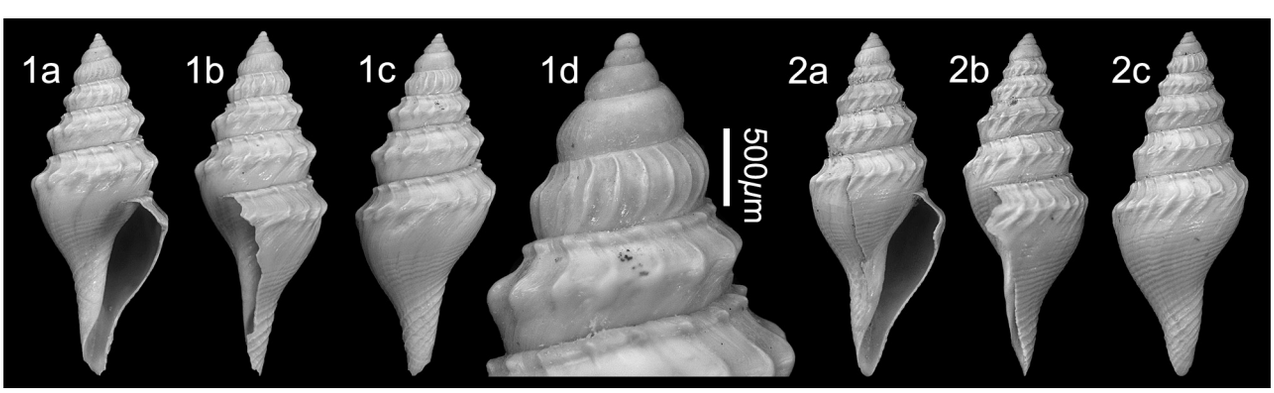

Plate 16. *Benthomangelia caterini* (Seguenza, 1875); 1. NHMW 2020/0171/0149, height 7.5 mm, width 3.0 mm, 1d, detail of protoconch; 2. NHMW 2020/0171/0150, height 8.8 mm, width 3.1 mm (digital images). Velerín carretera, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

1891 *Pleurotoma* (d. *Drillia*) *obtusangula* Brocc. – Hoernes & Auinger, p. 317, pl. 40, figs 13, 14.
1904 *Drillia obtusangula* (Br.) – Sacco, p. 45, pl. 12, figs 15, 16.
1904 *Drillia obtusangula* var. *obtusocarinata* Sacco, p. 45, pl. 12, fig. 17 (= var. A of Bellardi, 1877).
1904 *Drillia obtusangula* var. *dertocostata* Sacco, p. 45, pl. 12, fig. 18 (= var. B of Bellardi, 1877).
1914 *Drillia obtusangula* Brocchi – Cipolla, p. 116 [12], pl. 12 [1], fig. 4.
1937 *Drillia obtusangula* Br. – Montanaro, p. 150 [120], pl. 7 [10], figs 3, 4.
1937 *Drillia obtusangula* var. *dertocostata* Sacco – Montanaro, p. 151 [121], pl. 7 [10], figs 5, 6.
1953 *Drillia obtusangula* Brocchi – Csepreghy-Meznerics, p. 8, pl. 1, figs 11-14.
1954 *Clavus* (*Brachytoma*) *obtusangula* Brocchi, 1814 – Glibert, p. 25, pl. 4, fig. 4.
1955 *Drillia* (*Drillia*) *obtusangula* (Brocchi 1814) – Rossi Ronchetti, p. 325, fig. 175.
1956 *Brachytoma obtusangula* (Brocchi, 1814) – Rasmussen, p. 89, pl. 8, fig. 6.
1958 *Brachytoma obtusangula* (Brocchi, 1814) – Sorgenfei, p. 275, pl. 58, fig. 195.
1958 Drillia (Stenodrillia) *obtusangula* (Brocchi 1814) – Švagrovský, p. 25, pl. 8, fig. 1.
1960 *Drillia* (*Drillia*) *obtusangula* (Brocchi 1814) – Kojumdgieva *in* Kojumdgieva & Strachimirov, p. 200, pl. 48, fig. 5.
1964 *Brachytoma obtusangula* (Brocchi, 1814) – Anderson, p. 295, pl. 37, fig. 245.
1966 *Drillia obtusangulus* [*sic*] Brocchi, 1814 – Strausz, p. 424, pl. 19, figs 12, 14.
1967 *Clavus* (*Drillia*) *obtusangulus* (Brocchi) – Pelosio, p. 158 [58], pl. 45, figs 13-14.
1973 *Clavus* (*Drillia*) *obtusangulus* (Brocchi) 1814 – Caprotti & Vescovi, p. 178, pl. 2, fig. 20.
1974 *Brachitoma* [*sic*] *obtusangula* (Brocchi, 1814) – Malatesta, p. 422, pl. 31, fig. 4.
1976 *Clavus obtusangulus* (Brocchi) – Caprotti, p. 46, pl. 16, fig. 20.
1978 *Murex obtusangulus* Brocchi, 1814 – Pinna & Spezia, p. 152, pl. 38, fig. 4.
1978 *Clavus* (*Drillia*) *obtusangulus* (Brocchi) – Cuscani Politi, p. 50, pl. 6, fig. 23.
1981 *Brachytoma obtusangula* (Brocchi, 1814) – Martinell & Marquina, p. 126, pl. 1, figs 13, 14.
1984 *Asthenotoma obtusangula* (Brocchi, 1814) – A.W. Janssen, p. 290, pl. 12, fig. 4, pl. 49, figs 11, 12.
1992 *Stenodrillia obtusangulus* (Brocchi, 1814) – Cavallo & Repetto, p. 134, fig. 355.
1996 *Benthomangelia obtusangula* (Brocchi, 1814) – Vera-Peláez, p. 513, text-fig. 42, pl. 39, figs 1-4.
1997 *Clavus obtusangulus* (Brocchi, 1814) – Chirli, p. 41, pl. 11, figs 8-10.
2002 *Benthomangelia obtusangula* (Brocchi, 1814) – Vera-Peláez, p. 217, pl. 5, figs M, N.
2003 *Clavus* (*Drillia*) *obtusangulus* (Brocchi, 1814) – Bałuk, p. 44, pl. 14, figs 1, 2.
2007 *Benthomangelia* aff. *obtusangula* (Brocchi, 1814) – R. Janssen & Wienrich in Wienrich, p. 692, pl. 111, figs 1-2, pl. 143, figs 4-11.
2008 *Brachytoma obtusangula* (Brocchi, 1814) – Chirli & Richard, p. 71, pl. 14, figs 4, 5.
2010 *Benthomangelia obtusangula* (Brocchi, 1814) – Sosso & Dell'Angelo, p. 47, unnumbered fig. p. 62, bottom row centre.
2018 *Benthomangelia obtusangula* (Brocchi, 1814) – Brunetti & Cresti, p. 98, fig. 404.

Material and dimensions – Maximum height 12.3 mm, width 4.2 mm. **CO**: NHMW 2020/0171/0151 (3): **VC**: NHMW 2020/0171/0152-0154 (3), NHMW 2020/0171/0155 (35). **EL**: NHMW 2020/0171/0669 (3).

Description – Shell small, of medium-thickness, with tall gradate spire; spire angle 25-30°. Protoconch multispiral, tall turbiniform, apical angle approximately 60°, of three convex whorls, with small, elevated nucleus; last half whorl with comma-shaped axial riblets (dp = 530 μm, hp = 1095 μm, dp/hp = 0.48, dn = 110 μm, dV1 = 210 μm). Junction with teleoconch sharply delimited by sinusigera. Teleoconch of up to six sharply shouldered whorls, with moderately broad, concave subsutural ramp delimited adapically by thickened subsutural cord composed of two fused spirals, shoulder forming periphery, weakly convex below, separated by narrowly impressed suture. Axial sculpture predominant, rounded, opisthocline ribs developed at shoulder, 11-14 on last whorl, roughly equal in width to their interspaces, extending to abapical suture. Spiral sculpture of thickened subsutural cord, 3-4 further weaker cords over subsutural ramp, below shoulder of alternating strength, four primaries on spire whorls. Last whorl 60-62% of total height, profile and sculpture as described above, moderately convex below shoulder and constricted at base; axials subobsolete over base, narrow spirals of equal strength over base and siphonal fasciole. Aperture 47-48% of total height, subrectangular; outer lip not thickened by varix, sharp edged, smooth within; anal sinus broad, moderately deep, asymmetrically U-shaped, occupying entire ramp, with apex just above shoulder; siphonal fasciole moderately long, bent to left, unnotched. Columella weakly excavated in adapical half, slightly twisted at fasciole. Columellar and parietal callus weakly thickened, sharply delimited, forming narrow callus rim.

Discussion – *Benthomangelia obtusangula* (Brocchi, 1814) has been widely reported in the European fossil literature from the Middle Miocene to Upper Pliocene and from the North Sea Basin to the Mediterranean, including the Paratethys. In all assemblages the species is remarkably variable. This is well illustrated in the North Sea Basin assemblages by R. Janssen & Wienrich (in Wienrich, 2007, pl. 143, figs 4-11) and in the Paratethys by Bałuk (2003, pl. 14, figs 1-2). These records may well represent a species complex rather than a single taxon (*e.g.*, the Paratethyan specimens tend to have a narrower siphonal canal), but the protoconch seems to be similar in all specimens in which it has been illustrated (A.W. Jans-

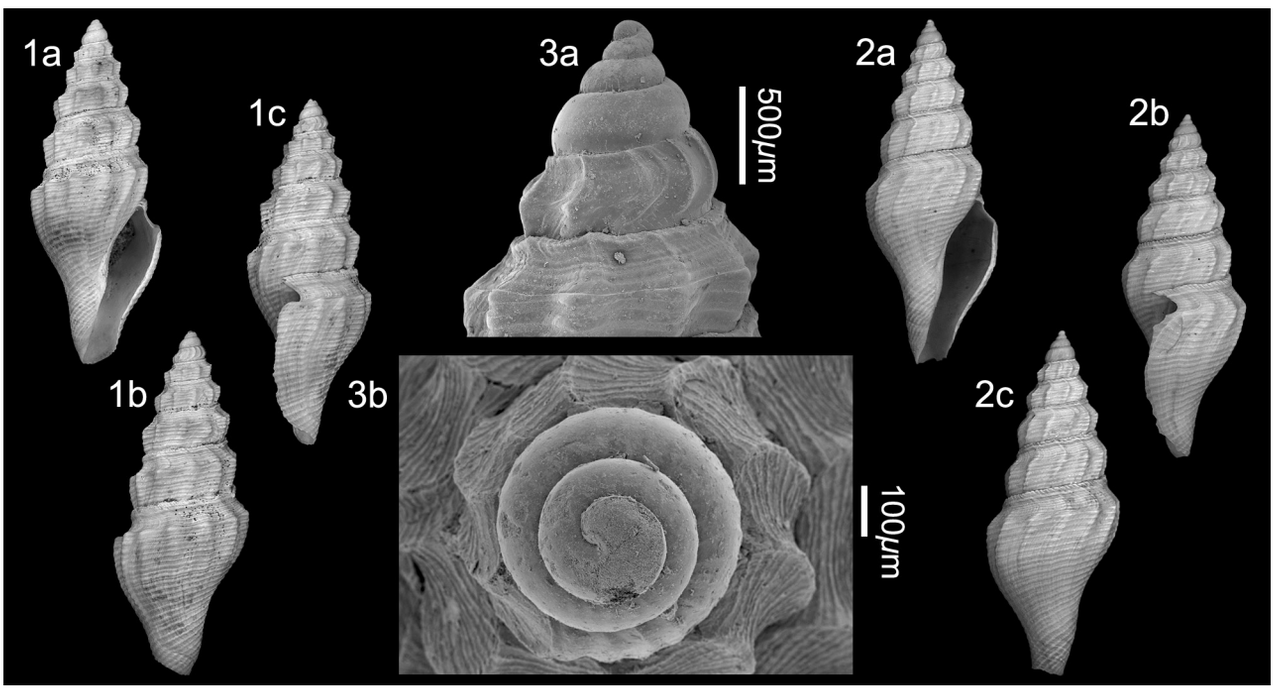

Plate 17. *Benthomangelia obtusangula* (Brocchi, 1814); 1. NHMW 2020/0171/0152, height 10.8 mm, width 4.0 mm; 2. NHMW 2020/0171/0153, height 9.3 mm, width 3.5 mm (digital images); 3. NHMW 2020/0171/0154, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

sen, 1984, pl. 12, fig. 4; R. Janssen & Wienrich, 2007, pl. 111, figs 1-2).

Distribution – Middle Miocene: North Sea Basin, Denmark (Rasmussen, 1956; Sorgenfrei, 1958), Germany (Anderson, 1964; R. Janssen & Wienrich, 2007), Netherlands (A.W. Janssen, 1984); Paratethys, Austria (Hörnes, 1854), Bulgaria (Kojumdgieva & Strachimirov, 1960), Hungary (Csepreghy-Meznerics, 1953; Strausz, 1966), Poland (Bałuk, 2003), Romania (Hoernes & Auinger, 1891), Slovakia (Švagrovský, 1958); Proto-Mediterranean, Italy (Bellardi, 1877; Sacco, 1904). Upper Miocene: North Sea Basin, Belgium (Glibert, 1954), Proto-Mediterranean, Italy (Bellardi, 1877; Sacco, 1904; Montanaro, 1937). Lower Pliocene: western Mediterranean, NE Spain (Gili & Martinell, 1994); central Mediterranean, Italy (Bellardi, 1877; Sacco, 1904; Pelosio, 1967; Cavallo & Repetto, 1992; Chirli, 1997; Sosso & Dell'Angelo, 2010; Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (Bellardi, 1877; Vera-Peláez, 1996, 2002), France (Chirli & Richard, 2008); central Mediterranean, Italy (Cipolla, 1914; Caprotti & Vescovi, 1973; Malatesta, 1974; Caprotti, 1976).

***Benthomangelia peridotitae* Vera-Peláez, 2002**
Plate 18, fig. 1

*2002 *Benthomangelia peridotitae* Vera-Peláez, p. 219, pl. 5, figs S, T, pl. 17, figs R, S.

Material and dimensions – Maximum height 9.5 mm, width 3.6 mm. **CO**: 1 specimen; **VC**: 3 specimens (Vera-Peláez, 2002, p. 220).

Original description – "*concha mediana-pequeña (H. máx. medida: 9.50 mm; A. máx. medida: 3.60 mm), turriculada-escalariforme, bicónica, de 6 vueltas de espira angulosas con fuertes cóstulas varicosas. Protoconcha sinosígera, multispiral cónica-turbiniforme, de 3 1/4 vueltas de espira convexas lisas y pulidas. Escultura de la teleoconcha con 7-9 fuertes cóstulas axiales varicosas, gruesas y oblicuas y 7-9 pares de microsurcos espirales regularmente espaciados. Sutura sinuosa. Líneas de crecimiento opistoclinas. Última vuelta bicónica alargada. Abertura angosta-fusiforme. Bordes columelar y parietal fusionados por un callo grueso, de forma sinusoidal. Canal sifonal recto y largo. Labro externo roto. Seno anal en U en la rampa sutural, bastante profundo y ancho. Desarrollo larvario planctotrófico. Protoconcha multispiral cónica-turbiniforme, sinosígera* [sic]*, de 3 1/4 vueltas convexas, pulidas y brillantes. Núcleo muy pequeño, centrado, esférico, algo oblicuo con respecto al eje axial. La protoconcha es lisa, la última 1/2 vuelta presenta finísimas cóstulas axiales filiformes opistocirtas que se engrosan en el último 1/4, que cruzados con cordoncillos forman un retículo. Sutura larvaria canaliculada. Teleoconcha turriculada-escalariforme, bicónica, de vueltas angulosas debido a 7-9 cóstulas axiales varicosas gruesas opistoclinas que cruzan las vueltas, más finas en la rampa sutural. Se diferencian una rampa sutural, algo cóncava, que ocupa la mitad de la altura de las vueltas y una región abapical a la rampa sutural, algo convexa*

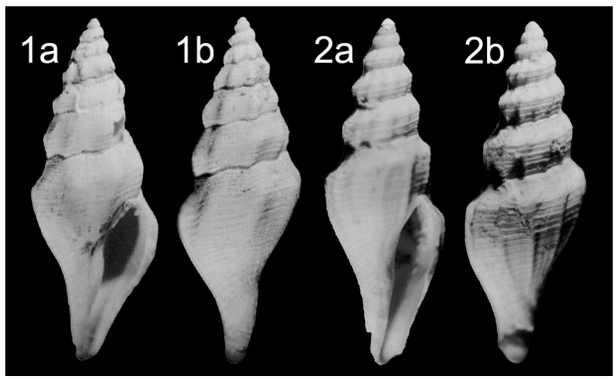

Plate 18. 1. *Benthomangelia peridotita* Vera-Peláez, 2002, holotype VL/G.671.001.001, height 9.5 mm, width 3.6 mm; Velerín conglomerates. 2. *Benthomangelia rafaelae* Vera-Peláez, 2002, holotype VLlG670.001.001, height 9.8 mm, width 3.6 mm. Velerín carretera, Velerín, Estepona, Lower Piacenzian, Upper Pliocene (original images from Vera-Peláez, 2002).

y más corta. La escultura espiral consiste en 7-9 pares de microsurcos espirales regularmente espaciados. Este patrón de escultura se mantiene en todas las vueltas. Sutura sinuosa. Líneas de crecimiento opistoclinas. La última vuelta es algo más alta de la mitad de la altura de la concha, bicónica, con una rampa sutural amplia, una región mayor convexa en el centro, un cuello fusiforme y un canal sifonal largo y recto. Abertura angosta-fusiforme. Bordes columelar y parietal fusionados por un callo grueso, de forma sinusoidal. Labro externo roto en parte. Seno anal en U, ocupando la altura de la rampa sutural, profundo y ancho" (Vera-Peláez, 2002, p. 220).

Discussion – According to the original discussion, *Benthomangelia peridotitae* Vera-Peláez, 2002 is characterised by having 7-9 broad, varicose, widely spaced axial ribs crossed by 7-9 pairs of widely spaced "microsulci", and a multispiral protoconch similar to that seen in other *Benthomangelia* species. It differs from *B. obtusangula* (Brocchi, 1814) in having fewer, wider ribs and less angular whorls. We have not recognised any specimens from Estepona attributable to this species.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (Vera-Peláez, 2002).

Benthomangelia rafaelae **Vera-Peláez, 2002**
Plate 18, fig. 2

*2002 *Benthomangelia rafaelae* Vera-Peláez, p. 218, pl. 5, figs P, O (not Q as stated; *lapsus*), R, pl. 17, figs P, Q.

Material and dimensions – Maximum height 11.3 mm, width 4.2 mm. **VC**: 3 specimens; **PQ**: 1 specimen (Vera-Peláez, 2002, p. 219).

Original description – "*Concha mediana (H. máx. medida: 11.25 mm; A. máx. medida: 4.10 mm), turricula-da-escalariforme, bicónica, de 6 vueltas de espira angulosas. Protoconcha multispiral, turbiniforme-cónica, sinosígera* [sic], *pequeña, de* $3^{1}/_{4}$-$3^{1}/_{2}$, *vueltas pulidas y globosas, la última vuelta larvaria con cóstulas filiformes opistocirtas. Las vueltas presentan una rampa sutural y una región abapical convexas. La escultura es doble: axial y espiral, la axial consta de 12-16 cóstulas filiformes opistoclinas. La espiral consiste en cordoncillos puntiformes próximos entre sí que cubren todas las vueltas. Líneas de crecimiento opistoclinas. Sutura sinuosa, superficial. Canal sifonal largo, recto. Abertura fusiforme, angosta, de borde paralelelos. Bordes columelar y parietal subrectos, cubiertos por un callo. Labro externo cortante. Seno anal en forma de U, moderadamente profundo, ocupando toda la altura de la rampa sutural. El labro externo contiene interiormente una variz axial. Desarrollo larvario planctotrófico. Protoconcha multispiral, turbiniforme-cónica, sinosígera* [sic], *pequeña, de* $3^{1}/_{4}$-$3^{1}/_{2}$ *vueltas pulidas, globosas. Se distinguen una protoconcha I, constituida por las* $1^{1}/_{2}$ *primeras vueltas, lisas y pulidas. Núcleo muy pequeño, desplazado abaxialmente, aplanado apicalmente. Protoconcha II: siguientes vueltas, con finísimas costulillas filiformes opistocirtas que cobran importancia en el desrrollo* [*sic*] *larvario, el último y. de vuelta consta de finos cordoncillos espirales. Sutura larvaria canaliculada. Teleoconcha turriculada-escalariforme, las vueltas presentan un perfil anguloso virtud a una rampa sutural que ocupa algo menos de la mitad de la altura de las vueltas y una región convexa abapicalmente a ésta. La escultura es doble: axial y espiral, la axial consite en 12-16 cóstulas filiformes opistoclinas, fuertemente comprimidas lateralmente y que se extienden de sutura a sutura. En la ontogenia se incrementa el n° de cóstulas, adelgazándose en la rampa sutural. La escultur espiral consiste en 6-12 cordoncillos puntiformes próximos entre sí en la rampa sutural y una cantidad equivalente en la región abapical a la rampa sutural, cubriendo toda la superficie de las vueltas. Líneas de crecimiento opistoclinas. Sutura sinuosa, superficial. La última vuelta ocupa ⅔ de la altura de la concha, bicónica-fusiforme, presenta una breve rampa sutural con la misma escultura descrita en las vueltas anteriores. Abapicalmente a la rampa sutural aparecen cordoncillos espirales puntiformes alternos más anchos con otros más finos hasta la base. Canal sifonal muy largo, recto, levemente torcido abaxialmente. Abertura fusiforme, angosta, de borde paralelelos. Bordes columelar y parietal subrectos cubiertos por un callo. Labro externo cortante. Seno anal en forma de U, poco profundo, ocupando la altura de la rampa sutural, con el ápice en la mediana. El labro externo en su parte interior presenta una variz axial*" (Vera-Peláez, 2002, p. 219).

Discussion – Vera-Peláez (2002, p. 219) considered the present-day NE Atlantic *Benthomangelia decapitata* Bouchet-Warén, 1980 most similar to *B. rafaelae* Vera-Peláez, 2002, differing in having spiral sculpture covering the whole surface, lacking on the subsutural ramp of *B. decapitata*, in having a longer siphonal canal, and in hav-

ing fewer protoconch whorls. As with *Benthomangelia peridotitae* Vera-Peláez, 2002, we have not found any specimens that can be attributed to this species.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (Vera-Peláez, 2002).

***Benthomangelia spinifera* (Bellardi, 1847)**
Plate 19, figs 1-3

1841 *Pleurotoma spinulosa* Bellardi & Michelotti, p. 100, pl. 1, fig. 9 (*non* Risso, 1826).
*1847 *Pleurotoma spinifera* Bellardi, p. 66 (*nom. nov. pro Pleurotoma spinulosa* Bellardi & Michelotti, 1841, *non* Risso, 1826).
1862 *Pleurotoma acanthoplectum* Brugnone, p. 19, pl. 1, fig. 11.
1877 *Raphitoma spinifera* Bell. – Bellardi, p. 298, pl. 9, fig. 2.
1877 *Raphitoma acanthoplecta* (Brugn.) – Bellardi, p. 298, pl. 9, fig. 3.
1914 *Daphnella* (*Raphitoma*) *spinifera* Bellardi – Cipolla, p. 161 [57], pl. 14 [3], fig. 7.
1937 *Daphnella* (*Raphitoma*) *spinifera* Bell. – Montanaro, p. 179 [149], pl. 8 [11], fig. 34.
1937 *Daphnella* (*Raphitoma*) *spinifera* var. *acanthoplecta* (Brugn.) – Montanaro, p. 180 [150], pl. 8 [11], figs 35, 36.
1967 *Raphitoma* (*Raphitoma*) *spinifera* (Bellardi) – Pelosio, p. 165 [65], pl. 46, fig. 8.
1968 *Raphitoma* (*Raphitoma*) *spinifera* (Bellardi, 1847) – Robba, p. 606, pl. 46, fig. 4.
1981 *Raphitoma spinifera* (Bellardi, 1847) – Ferrero Mortara *et al*., p. 91, pl. 18, fig. 8.
1992 *Neoguraleus spiniferus* (Bellardi, 1847) – Cavallo & Repetto, p. 144, fig. 398.
1996 *Theta spinifera* (Bellardi, 1847) – Vera-Peláez, p. 656, text figs 34e, f, 35j, 65, pl. 50, figs 1-10.
1997 *Raphitoma spinifera* Bellardi, 1847 – Chirli, p. 88, pl. 25, figs 5-7.
2002 *Theta spinifera* (Bellardi, 1847) – Vera-Peláez, p. 227, pl. 6, figs T, U, V, pl. 16, figs J, K.
2008 *Neoguraleus spiniferus* (Bellardi, 1847) – Chirli & Richard, p. 68, pl. 13, fig. 8.
2010 *Benthomangelia spinifera* (Bellardi, 1847) – Sosso & Dell'Angelo, p. 47, unnumbered fig. p. 62, bottom row right.
2018 *Benthomangelia acanthoplecta* (Brugnone, 1862) – Brunetti & Cresti, p. 98, fig. 403.

Material and dimensions – Maximum height 17.5 mm, width 6.2 mm. **CO**: NHMW 2020/0171/0068 (3). **VC**: NHMW 2020/0171/0069-71 (3), NHMW 2020/0171/0072 (4). **VS**: NHMW 2020/0171/0073 (1).

Description – Shell medium size, relatively fragile, slender, with pagodiform, gradate spire; spire angle 30-35°. Protoconch tall, apical angle approximately 60°, multispiral, of 3.5 convex whorls, with small nucleus; nucleus with a few spiral lines, last whorl with comma-shaped axial riblets (dp = 775 μm, hp = 1045 μm, dp/hp = 0.74, dn = 120 μm, dV1 = 220 μm). Teleoconch of up to six carinate angular whorls, with broad, concave subsutural ramp width of adapical half of whorl, narrow, elevated shoulder cord, concave below, separated by

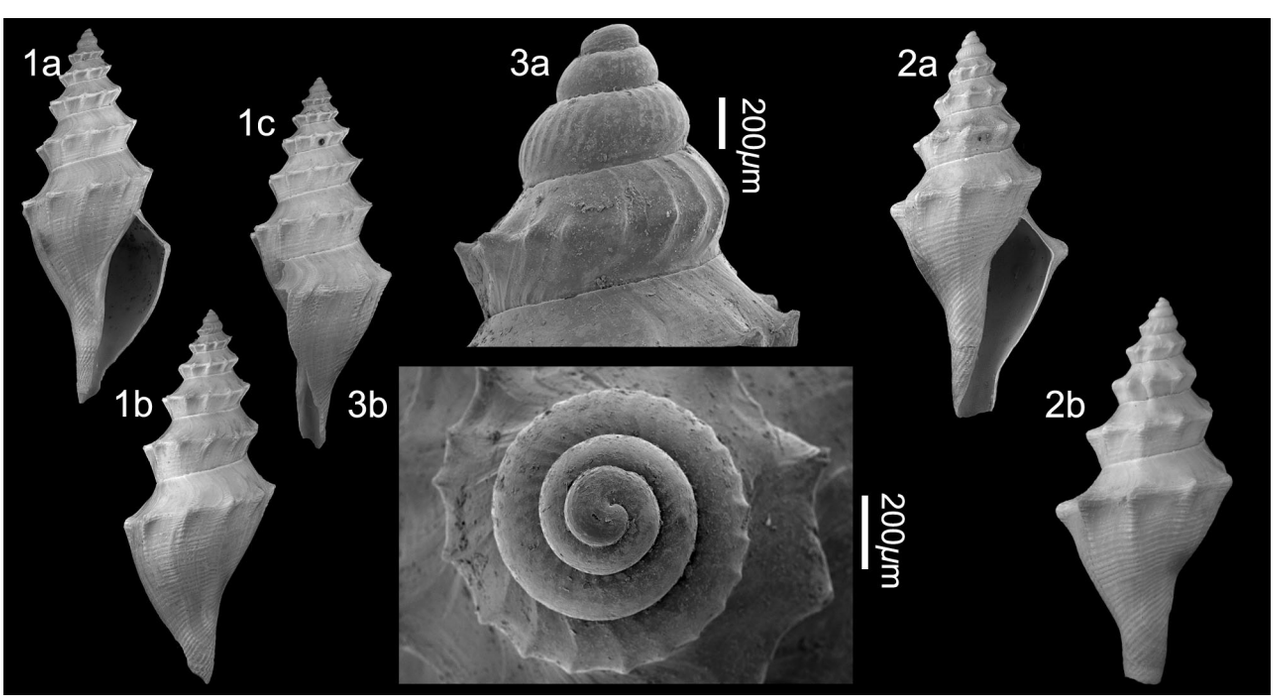

Plate 19. *Benthomangelia spinifera* (Bellardi, 1847); 1. NHMW 2020/0171/0069, height 13.3 mm, width 5.5 mm; 2. NHMW 2020/0171/0070, height 9.1 mm, width 4.0 mm (digital images); 3. NHMW 2020/0171/0071, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

superficial, linear suture. Axial sculpture of very narrow opisthocline ribs developed at shoulder where they form spinous tubercles, 10-12 on penultimate whorl, rapidly weakening towards and not reaching abapical suture on later adult whorls. Spiral sculpture only below shoulder, extremely weak. Last whorl 66-68% of total height, with broad, concave subsutural ramp, sharply angled at spinous shoulder cord, weakly convex below, moderately constricted at base; spirals slightly stronger over siphonal fasciole. Aperture 50-51% of total height, elongate, ovate; outer lip thin, sharp edged, without varix, smooth within; anal sinus broad, shallow, symmetrically U-shaped, occupying entire ramp, with apex placed mid-ramp; siphonal canal long, recurved, shallowly notched at tip. Columella smooth, weakly excavated, twisted at fasciole. Columellar and parietal callus not thickened, sharply delimited forming narrow callus rim.

Discussion – Vera-Peláez (1996, 2002) placed this species in the raphitomid genus *Theta* Clarke, 1959. Although members of that genus with multispiral protoconchs are unusual in not always having the typical diagonally reticulated protoconch sculpture seen in raphitomids (see Bouchet & Warén, 1980, figs 252-256), the protoconch of *Pleurotoma spinifera* Bellardi, 1847 is typically mangeliid. It is easily separated from all its congeners by the spinous shoulder.

Distribution – Upper Miocene: Proto-Mediterranean, Italy (Bellardi, 1877; Montanaro, 1937; Robba, 1968). Lower Pliocene: central Mediterranean, Italy (Bellardi, 1877; Pelosio, 1967; Cavallo & Repetto, 1992; Chirli, 1997; Sosso & Dell'Angelo, 2010). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (Vera-Peláez, 2002), France (Chirli & Richard, 2008); central Mediterranean, Italy (Bellardi, 1877; Cipolla, 1914).

Genus *Glabrocythara* Fargo, 1953

Type species – *Glabrocythara locklini* Fargo, 1953, by original designation, Pliocene, Florida, USA.

1953 *Glabrocythara* Fargo, p. 390.

Note – The genus is characterised by its multispiral protoconch of which the last whorl has cancellate sculpture and a subcarinate profile. For generic discussion see Scarponi & Della Bella (2010, p. 83).

***Glabrocythara multicostata* Scarponi & Della Bella, 2010**
Plate 20, fig. 1

*2010 *Glabrocythara multicostata* Scarponi & Della Bella, p. 83, figs 229-240.

Material and dimensions – Height 5.1 mm, width, 2.1 mm. CO: NHMW 2020/0171/0202 (1).

Description – Shell very small, solid, fusiform; spire angle approximately 30°. Protoconch incomplete (probably multispiral). Junction with teleoconch delimited by sinusigera. Teleoconch of four weakly shouldered, weakly convex whorls; subsutural ramp narrow, delimited by slightly stronger shoulder cord, weakly convex below, separated by narrowly impressed undulating suture. Axial sculpture of elevated, rounded, weakly opisthocline ribs, 14 on last whorl, slightly narrower than their interspaces; on last two whorls adapical end of ribs extend slightly above, coronating suture. Spiral sculpture of extremely fine, crowded threads on subsutural ramp, cords only slightly stronger below shoulder, of primary to tertiary strength. Last whorl 60% of total height, profile and sculpture as described above, hardly constricted at base; axials and spirals persist over base, seven stronger cords over siphonal fasciole cut by abapical ends of ribs, making cords slightly tubercular. Aperture narrow, ovate-elongate, 41% of total height; outer lip strongly thickened by broad labial varix, with small tubercle at lateral border of anal sinus; anal sinus narrow, deeply U-shaped, strongly distorting adapical part of outer lip; siphonal canal very short, unnotched. Columella shallowly excavated in upper half, straight below. Columellar callus weakly thickened, parietal callus moderately thickened, sharply delimited, forming narrow callus rim.

Discussion – We attribute one specimen from the Velerín conglomerates to *Glabrocythara multicostata* Scarponi & Della Bella, 2010. The size of the Estepona specimen is the same as holotype. Unfortunately, the protoconch is incomplete, but the last whorl appears subcarinate, and the sculpture is very similar, the last whorl with one rib more than the maximum for the Italian specimens (14 vs. 10-13 *fide* Scarponi & Della Bella, 2010, p. 122, appendix 3). In the Italian Pliocene it is found in infralittoral assemblages and in Estepona also in the shallower water deposits.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (this paper); central Mediterrannean (Scarponi & Della Bella, 2010).

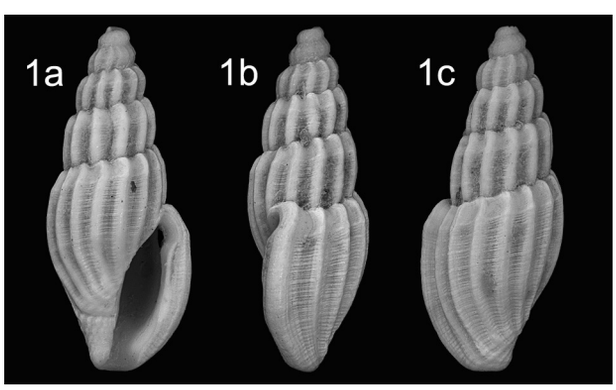

Plate 20. *Glabrocythara multicostata* Scarponi & Della Bella, 2010; 1. NHMW 2020/0171/0202, height 5.1 mm, width, 2.1 mm, (digital image). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

Genus *Mangelia* Risso, 1826

Type species – *Mangelia striolata* Risso, 1826, by subsequent designation (Gray, 1847b), present-day, Mediterranean.

1826 *Mangelia* Risso, p. 219.
1875 *Cytharella* Monterosato, p. 73. Type species (by subsequent designation; Woodring, 1928): *Murex costatus* Pennant, 1777, present-day, British-Isles.
1883b *Mangilia* P. Fischer, p. 593. Unjustified emendation of *Mangelia* Risso, 1826.
1883 *Mangiliella* Bucquoy, Dautzenberg & Dollfus, p. 85, 108. Type species (by original designation): *Pleurotoma multilineolata* Deshayes, 1835, present-day, Greece.
1917 *Rissomangelia* Monterosato, p. 24. Type species (by subsequent designation; Dall, 1918): *Pleurotoma bertrandii* Payraudeau, 1827, present-day, Mediterranean.
1977a *Cyrtocythara* Nordsieck, p. 34. Type species (by original designation): *Pleurotoma albida* Deshayes, 1835 [*non* Perry, 1811, *non* Risso, 1826; = *Mangelia unifasciata* (Deshayes, 1835)], present-day, Mediterranean.
1977a *Rugocythara* Nordsieck, p. 35. Type species (by original designation): *Pleurotoma rugulosum* Philippi, 1843b, Oligocene, Germany.

***Mangelia coarctata* (Forbes, 1840)**
Plate 21, figs 1-3

*1840 *Pleurotoma coarctata* Forbes, p. 107, pl. 2, fig. 15.
1851 *Mangelia costata* var. *coarctata* Forbes & Hanley, p. 485, pl. 114a, fig. 5, pl. RR, fig. 4.
1910 *Mangelia costata* var. *coarctata* Forbes et Hanley – Cerulli-Irelli, p. 54 [246], pl. 5 [36], fig. 12.
1914 *Mangelia costata* var. *coarctata* Forbes et Hanley – Cipolla, p. 142 [38], pl. 13 [2], fig. 11.
1968 *Cythara* (*Cytharella*) *costata coarctata* (Forbes) – Nordsieck, p. 165, pl. 28, fig. 92-41.
1974 *Cytharella costata* (Donovan, 1803) [*sic*] – Malatesta, p. 432, pl. 32, fig. 9 [*non Mangelia costata* (Pennant, 1777)].
1977a *Cythara* (*Cytharella*) *coarctata* (Forbes, 1840) – Nordsieck, p. 32, pl. 4, fig. 30.
1979 *Cythara costata* (Donovan, 1803) – Bogi *et al*., p. 8, fig. 6 (*non Mangelia costata* (Pennant, 1777).
1984 *Mangelia coarctata* (Forbes, 1844) – Van Aartsen *et al*., p. 43, fig. 208.
1984 *Cytharella coarctata* (Forbes, 1840) – Fretter & Graham, p. 529, fig. 365.
1988 *Cytharella coarctata* (Forbes, 1840) – Graham, p. 448, fig. 187.
1992 *Mangelia costata* (Donovan, 1804) [*sic*] – Cavallo & Repetto, p. 142, fig. 388 [*non Mangelia costata* (Pennant, 1777)].
1993 *Cythara* (*Cytharella*) *costata* (Donovan, 1803) – González Delgado, 37, pl. 3, figs 6-8 [*non Mangelia costata* (Pennant, 1777)].
1997 *Mangelia costata* (Donovan, 1804) [*sic*] – Chirli, p. 67, pl. 19, figs 8-10 [*non Mangelia costata* (Pennant, 1777)].
2001 *Mangelia costata* (Donovan, 1804) [*sic*] – Cachia *et al*., p. 53, pl. 7, fig. 11.
2008 *Mangelia coarctata* (Forbes, 1840) – Chirli & **Ri**chard, p. 67, pl. 13, fig. 6.
2010 *Mangelia coarctata* (Forbes, 1840) – Scarponi & Della Bella, p. 20, figs 25-32.
2011 *Mangelia coarctata* (Forbes, 1840) – Landau *et al*., p. 33, pl. 17, figs 4, 5.
2011 *Mangelia coarctata* (Forbes, 1840) – Hernández *et al*., p. 226, pl. 75, figs F-G.
2018 *Mangelia coarctata* Forbes, 1840 [*sic*] – Brunetti & Della Bella, p. 92, fig. 377.
2021 *Mangelia costata* (Pennant, 1777) – Öztürk, p. 246, fig. 5 (*non Mangelia costata* (Pennant, 1777).
2022 *Mangelia coarctata* (Forbes, 1840) – Brunetti, p. 70, fig. 149.
2023 *Mangelia coarctata* (Forbes, 1840) – Spada *et al*., p. 12, fig. 6.

Material and dimensions – Maximum height 9.1 mm, width 3.2 mm. **CO**: NHMW 2020/0171/0192-0194 (3), NHMW 2020/0171/0195 (50+). **VC**: NHMW 2020/0171/0196 (26). **EL**: NHMW 2020/0171/0197 (14).

Description – Shell small, solid, slender fusiform; spire angle approximately 30°. Protoconch multispiral, tall, conical of 3.1 convex whorls, apical angle 55°, with small, depressed nucleus; first three whorls smooth, last quarter whorl with comma-shaped axial riblets (dp = 695 μm, hp = 775 μm, dp/hp = 0.90, dn = 115 μm, dV1 = 230 μm). Junction with teleoconch sharply delimited by sinusigera. Teleoconch of up to five non-shouldered convex whorls; subsutural ramp not developed, separated by narrowly impressed, undulating suture. Axial sculpture of very narrow, opisthocline ribs, 6-7 on last whorl, much narrower than their interspaces, overrun by extremely fine cordlets of roughly alternating strength, spiral sculpture almost subobsolete. Last whorl 57-61% of total height, profile and sculpture as described above, broadly convex, weakly constricted at base; axials and spirals persist over base, spirals continue weakly over siphonal fasciole. Aperture 39-42% of total height, very narrow, elongate; outer lip extremely strongly thickened by broad labial varix, sharp edged, with low tubercle at lateral border of anal sinus; anal sinus moderately shallow U-shaped, not distorting outer lip; siphonal canal moderately short, unnotched. Columella smooth, weakly excavated in upper third, straight below, slightly twisted at fasciole. Columellar callus weakly thickened, parietal callus moderately thickened, sharply delimited, forming narrow callus rim.

Discussion – The relationship between *Mangelia costata* (Pennant, 1777) and *M. coarctata* (Forbes, 1840) is controversial with a variety of taxonomic opinions, from considering them conspecific (*e.g*., Fretter & Graham, 1984; Graham, 1988), or *M. coarctata* (Forbes, 1840) a

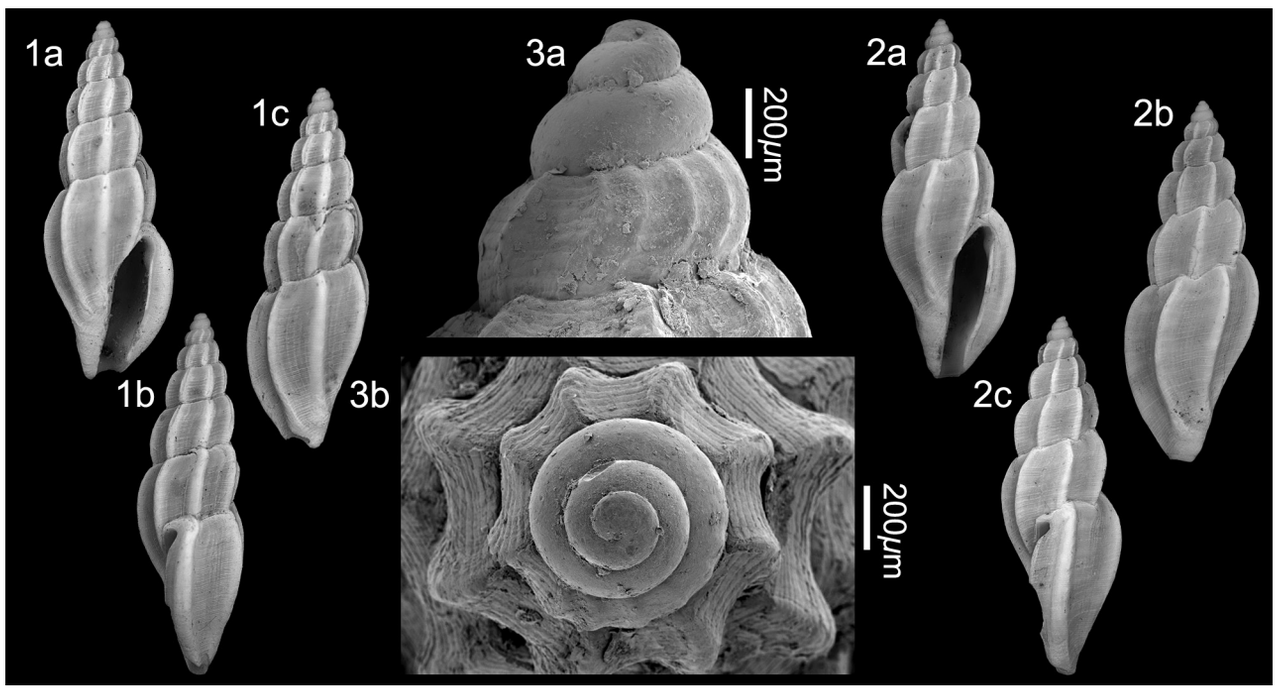

Plate 21. *Mangelia coarctata* (Forbes, 1840); 1. NHMW 2020/0171/0192, height 9.1 mm, width 3.2 mm; 2. NHMW 2020/0171/0193, height 8.5 mm, width 3.0 mm (digital images); 3. NHMW 2020/0171/0194, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

deeper water morphotype of *M. costata* (*e.g.*, Van Aartsen *et al*., 1984), to considering them separate species (*e.g.*, Scarponi & Della Bella, 2010).

According to Scarponi & Della Bella (2010) *M. coarctata*, today a circalittoral species, differed from *M. costata*, an infralittoral species, in having a more regularly conical spire and non-gradate as in *M. costata* due to a wider, but less well delimited and less concave subsutural ramp, and the spiral sculpture was finer. The two cannot be separated on protoconch characters (see Scarponi & Della Bella, 2010, p. 117-118, appendix 3). The specimens from Estepona compare closely with those from Italy illustrated by Scarponi & Della Bella (2010, figs 26-28.). For further discussion see below under *M. costata*. *Mangelia coarctata* differs from *Villiersiella attenuata* (Montagu, 1803) most markedly in apertural characters: a deeper anal sinus, thickened outer lip, and shorter siphonal canal.

Distribution – Lower Pliocene: Atlantic, Guadalquivir Basin, S. Spain (González Delgado, 1993; Landau *et al*., 2011; Brunetti, 2022); central Mediterranean, Italy (Cavallo & Repetto, 1992; Scarponi & Della Bella, 2010; Brunetti & Della Bella, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (Vera-Peláez, 2002), France (Chirli & Richard, 2008); central Mediterranean, Italy (Cipolla, 1914; Malatesta, 1974; Scarponi & Della Bella, 2010). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1910). Present-day: Atlantic Europe, British Isles (Fretter & Graham, 1984; Graham, 1988), Sweden (Spada *et al.,* 2023), Canary Islands (Hernández *et al*., 2011), western Mediterranean, Italy (Van Aartsen *et al*., 1984), central Mediterranean, Italy (Nordsieck, 1977; Bogi *et al*., 1979; Cachia *et al*., 2001), eastern Mediterranean (Öztürk, 2021), entire Mediterranean (Spada *et al*., 2023).

***Mangelia costata* (Pennant, 1777)**

Plate 22, figs 1-2; Plate 23, figs 1-3

*1777	*Murex costatus* Pennant, p. 125, pl. 79, fig. 1.
1848	*Clavatula costata* Da Costa [*sic*] – S.V. Wood, p. 58, pl. 7, fig. 6.
1910	*Mangelia costata* Pennt. – Cerulli-Irelli, p. 54 [246], pl. 5 [36], fig. 10.
1915	*Mangilia* [*sic*] *costata* (Donovan) – Harmer, p. 244, pl. 29, fig. 13.
1966	*Cytharella costata* (Donovan, 1803) – Powell, p. 100, pl. 15, fig. 21.
1968	*Cythara* (*Cytharella*) *costata* (Donovan) – Nordsieck, p. 165, pl. 28, fig. 92-40.
1977a	*Cythara* (*Cytharella*) *costata* (Donovan, 1803) – Nordsieck, p. 32, pl. 4, fig. 28.
2023	*Mangelia costata* (Pennant, 1777) – Spada *et al*., p. 14, fig. 7.
non 1878	*Pleurotoma costata* Da Costa [*sic*] – Nyst (*partim*), pl. 3, fig. 17 [= *Mangelia substriolata* (Harmer, 1918)].
non 1882	*Pleurotoma costata* Da Costa [*sic*] – Nyst (*partim*), p. 52 [= *Mangelia substriolata* (Harmer, 1918)].
?*non* 1937	*Mangelia costata* Penn. – Montanaro, p. 140 [170], pl. 8 [11], figs 1, 2.

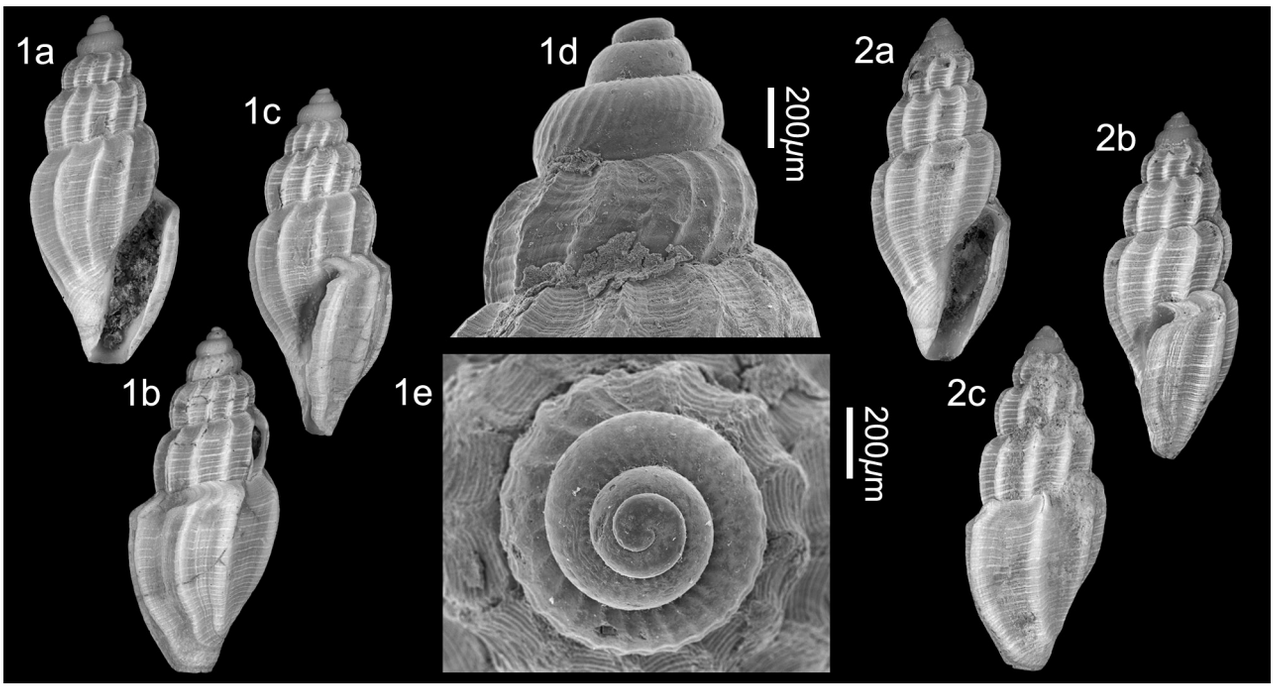

Plate 22. *Mangelia costata* (Pennant, 1777); 1. NHMW 2020/0171/0641, height 5.2 mm, width 2.3 mm, 1d, e, detail of protoconch; 2. NHMW 2020/0171/0642, height 5.2 mm, width 2.1 mm (digital images, except 1d, e, SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

non 1974	*Cytharella costata* (Donovan, 1803) [*sic*] – Malatesta, p. 432, pl. 32, fig. 9 [= *Mangelia coarctata* (Forbes, 1840)].
non 1992	*Mangelia costata* (Donovan, 1804) [*sic*] – Cavallo & Repetto, p. 142, fig. 388 [= *Mangelia coarctata* (Forbes, 1840)].

Material and dimensions – Maximum height 6.2 mm, width 2.3 mm. **CO**: NHMW 2020/0171/0641-0643 (3), NHMW 2020/0171/0644 (40). **VC**: NHMW 2020/0171/0637-0639 (3), NHMW 2020/0171/0640 (1). **EL**: NHMW 2020/0171/0680 (15).

Description – Shell small of medium thickness, slender fusiform; spire angle approximately 30°. Protoconch multispiral, tall conical of 3.75 convex whorls, apical angle approximately 55°, with small slightly raised nucleus: first three whorls smooth, last half whorl with comma-shaped axial riblets (dp = 780-810 μm, hp = 870-1025 μm, dp/hp = 0.79-0.90, dn = 85-115 μm, dV1 = 185-230 μm). Junction with teleoconch delimited by sinusigera. Teleoconch of 3-3.5 weakly shouldered whorls, subsutural ramp convex, poorly delimited, convex below, separated by narrowly impressed, undulating suture. Axial sculpture of 8-9 very narrow, sinuous, opisthocline ribs, much narrower than their interspaces, overrun by numerous, extremely fine subequal threads. Last whorl about 64% total height, profile and sculpture as described above, weakly shouldered a short distance below suture, weakly convex below, moderately constricted at base; axials and spirals persist over base, spirals slightly stronger over siphonal fasciole; fasciole not delimited. Aperture 44% of total height, narrow, elongate; outer lip weakly to modertely thickened by narrow labial varix, smooth within; anal sinus of moderate breadth and depth, U-shaped, occupying entire subsutural ramp; siphonal canal of moderate length and width, bent slightly adaxially, unnotched. Columella very weakly excavated in upper third, straight and slightly oblique below. Columellar and parietal callus weakly thickened, sharply delimited, forming narrow rim.

Discussion – Like many authors before us, we are unsure of the species boundaries for *M. coarctata* (Forbes, 1840) and *M. costata* (Pennant, 1777). We have separated the larger more fusiform shells as the former (see above), and the lower squatter forms with weakly shouldered whorls as the latter. They have the same number of ribs, the spiral sculpture is similar, and their protoconchs are indistinguishable. *Mangelia coarctata* was considered by some authors to represent a deeper water morphotype of *M. costata*. To complicate matters further, in the Estepona assemblages, the squatter *M. costata* form is found in both deep (Pl. 23, figs 1-3) and shallower water (Pl. 22, figs 1-2) assemblages. Specimens from the deeper water deposits are thinner shelled and have finer ribs than usually seen in that species, but then most specimens found in the deeper water Velerín carretera assemblages are thinner shelled than conspecific specimens from the shallower water Velerín conglomerates or El Lobillo deposits. We interpret these differences as representing a deeper water morph. Öztürk (2021, p. 243, table 1, p. 247, figs 5A-F) reported quite a wide bathymetric range for the species (10-260 m depth) and illustrated its variability in the present-day eastern Mediterranean.

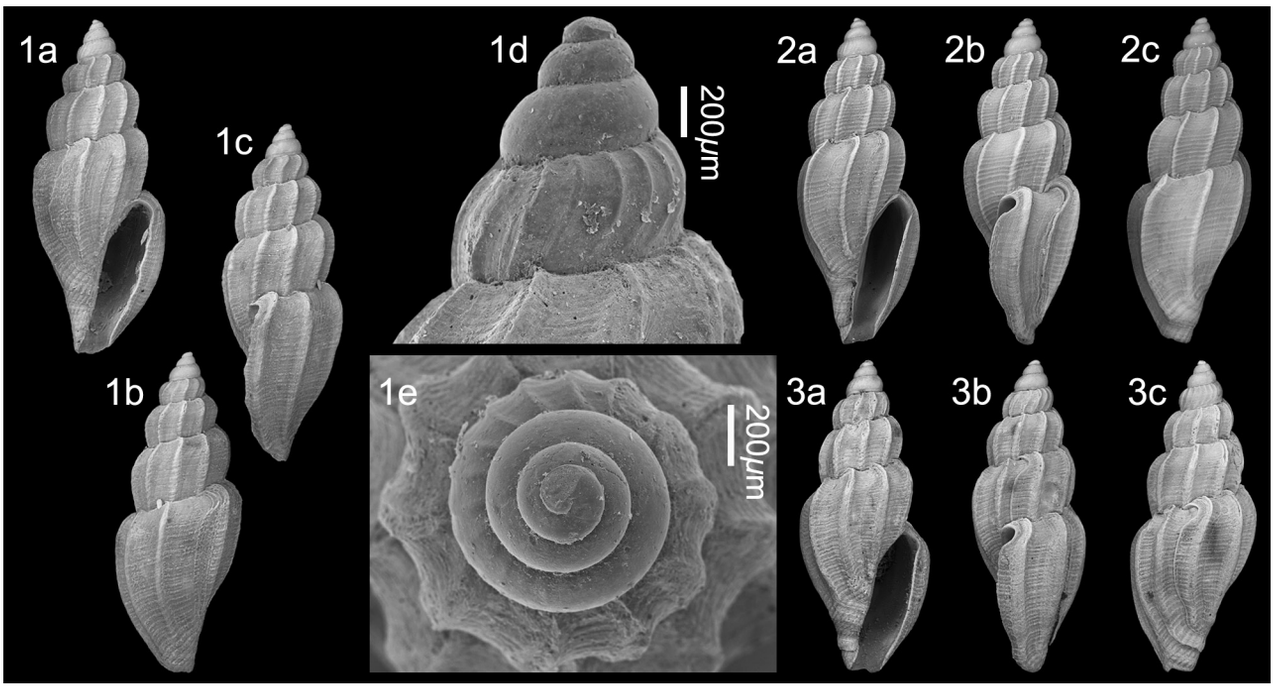

Plate 23. *Mangelia costata* (Pennant, 1777); 1. NHMW 2020/0171/0637, height 6.2 mm, width 2.3 mm; 2. NHMW 2020/0171/0638, height 5.7 mm, width 2.0 mm; 3. NHMW 2020/0171/0639, height 5.9 mm, width 2.3 mm. Velerín carretera, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

Distribution – Lower Pliocene: North Sea Basin, Coralline Crag, England (S.V. Wood, 1848; Harmer, 1915), Atlantic, Mondego Basin, Portugal (NHMW coll.). Upper Pliocene: North Sea Basin, Red Crag, England (S.V. Wood, 1848; Harmer, 1915); western Mediterranean, Estepona Basin, southern Spain (this paper). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1910). Pleistocene (indet.): Atlantic, Ireland, Scotland (Harmer, 1915; Nordsieck, 1977a). Present-day: Atlantic from southwestern England to Morocco (Spada *et al.,* 2023), western Mediterranean (Spada *et al.,* 2023).

***Mangelia frumentum* (Bellardi, 1875)**
Plate 24, figs 1-2

1862 *Pleurotoma rugulosa* var. C Brugnone, p. 38, pl. 1, fig. 29.
*1875 *Mangelia frumentum* Brugnone, Bellardi, p. 23 (*nom. nov. pro Pleurotoma rugulosa* var. C Brugnone, 1862, *non Pleurotoma rugulosa* Philippi, 1843).
1877 *Mangelia frumentum* (Brugn.) [*sic*] – Bellardi, p. 291, pl. 8, fig. 35.
1904 *Mangilia frumentum* (Brugn.) [*sic*] – Sacco, p. 55, pl. 14, figs 29, 30.
1914 *Mangilia frumentum* Brugnone [*sic*] – Cipolla, p. 36[140], pl. 2 [13], fig. 8.
1940 *Mangilia frumentum* Brug. [*sic*] – Roman, p. 360, pl. 1, fig. 12.
1982 *Cythara* (*Cytharella*) *frumentum* Brug. [*sic*] – Martinell, p. 101, pl. 1, figs 7, 8.
1997 *Mangelia frumentum* (Brugnone, 1874) [*sic*] – Chirli, p. 68, pl. 20, figs 1-3.
2002 *Mangelia frumentum* (Brugnone, 1874) [*sic*] – Vera Peláez, p. 205; pl. 4, figs C, D, pl. 13, figs C, D.
2010 *Mangelia frumentum* (Bellardi, 1874) – Scarponi & Della Bella, p. 25, figs 45-52.

Material and dimensions – Maximum height 7.0 mm, width 2.7 mm. **CO**: NHMW 2020/0171/0544 (10). **EL**: NHMW 2020/0171/0541-542 (2), NHMW 2020/0171/0543 (25).

Description – Shell small, squat, solid, fusiform; spire angle 50-55°. Protoconch multispiral, tall, conical of 3.5 convex whorls, with small nucleus; first three whorls smooth, last half whorl with comma-shaped axial riblets. Junction with teleoconch sharply delimited by sinusigera. Teleoconch of up to four weakly shouldered, convex whorls; subsutural ramp narrow, delimited by slightly stronger shoulder cord, convex below, separated by narrowly impressed, undulating suture. Axial sculpture of narrow, rounded, elevated, opisthocline ribs, 9-10 on last whorl, half width of their interspaces, coronating suture adapically, 1-2 ribs varicose on later whorls, overrun by very fine cordlets of primary to tertiary strength. Last whorl about 67% of total height, with shoulder placed high, evenly convex below, hardly constricted at base; axials and spirals persist over base, axials stopping abruptly at siphonal fasciole, about ten slightly stronger cords over siphonal fasciole. Aperture about 46% of total height, narrow, elongate; outer lip

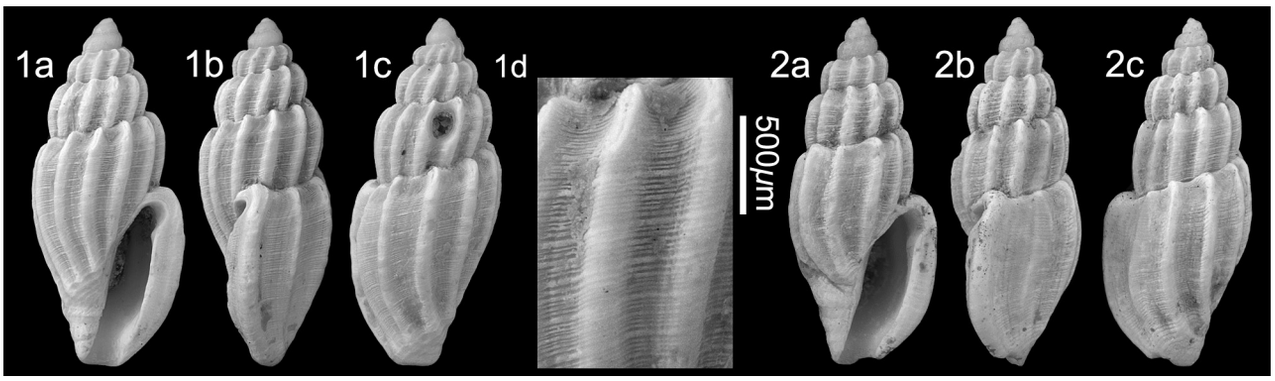

Plate 24. *Mangelia frumentum* (Bellardi, 1875); 1. NHMW 2020/0171/0541, height 6.7 mm, width 2.5 mm; 2. NHMW 2020/0171/0542, height 6.5 mm, width 2.4 mm (digital images). El Lobillo, Estepona, Lower Piacenzian, Upper Pliocene.

strongly thickened by broad labial varix, sharp edged, with well-developed tubercle at lateral border of anal sinus; anal sinus narrow, deeply U-shaped, strongly distorting adapical part of outer lip; siphonal canal broad, very short, unnotched. Columella weakly excavated in upper third, straight and slightly oblique below. Columellar callus weakly thickened, parietal callus moderately thickened, sharply delimited, forming narrow callus rim.

Discussion – This species is characterised by its very solid shell, axial ribs that coronate the suture and anal sinus that strongly distorts the adapical portion of the outer lip. *Mangelia unifasciata* (Deshayes, 1835) differs in having fewer, narrower, wider-spaced ribs, and in having axial riblets covering less of the protoconch (Scarponi & Della Bella, 2010). *Mangelia imitatrix* Scarponi & Della Bella, 2010 from the Italian Pliocene differs again in having less of the protoconch cover in riblets, the teleoconch has narrower ribs and the subsutural ramp is slightly more strongly delimited.

Distribution – Lower Pliocene: western Mediterranean, NE Spain (Martinell, 1982; Gili & Martinell, 1994); central Mediterranean, Italy (Scarponi & Della Bella, 2010). Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (Vera-Peláez, 2002); central Mediterranean, Italy (Cipolla, 1914; Bellardi, 1875, 1877; Sacco, 1904).

Mangelia melpomene Chirli & Linse, 2011

Plate 25, fig. 1

*1997 *Mangelia melpomene* Chirli & Linse, p. 182, pl. 65, fig. 2.

Material and dimensions – Height 8.5 mm, width 3.4 mm. **CO**: NHMW 2020/0171/0551 (1), NHMW 2020/0171/0681 (1).

Description – Shell small, solid, pupoid; spire angle 47°. Protoconch of 2.5 convex whorls, with small nucleus; last half whorl with comma-shaped axial riblets and three cordlets (dp = 530 μm, hp = 585 μm, dp/hp = 0.91, dn = 105 μm, dV1 = 215 μm). Junction with teleoconch delimited by sinusigera. Teleoconch of five strongly convex whorls, subsutural area very slightly flattened, ramp not delimited, spire whorls somewhat swollen abapically, separated by narrowly impressed, undulating suture. Axial sculpture of straight, broad, elevated, rounded, opisthocline ribs, ten on last whorl, slightly narrower than their interspac-

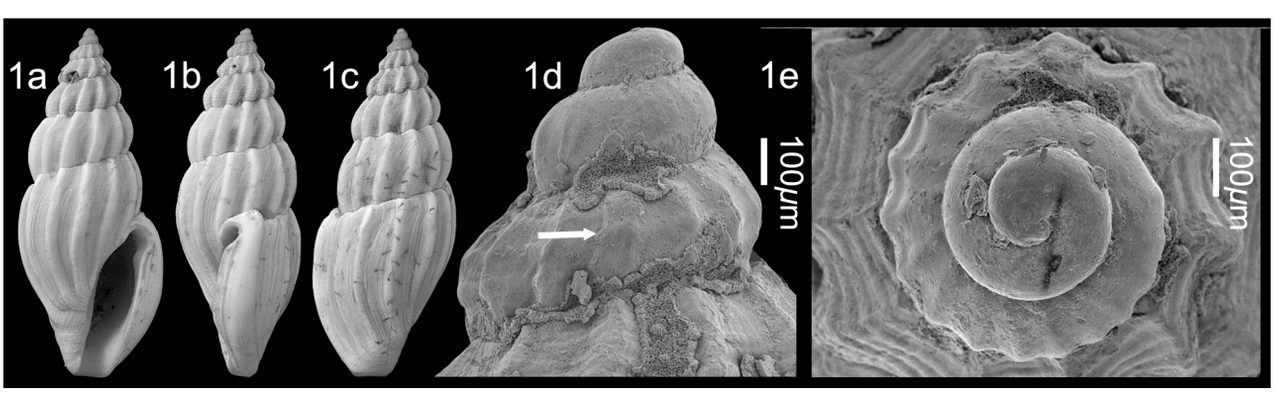

Plate 25. *Mangelia melpomene* Chirli & Linse, 2011; 1. NHMW 2020/0171/0551, height 8.5 mm, width 3.4 mm (digital image), 1d-e, detail of protoconch, arrow denotes protoconch/teleoconch boundary (SEM image). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

es. Spiral sculpture subobsolete. Last whorl 61% of total height, evenly convex, hardly constricted at base; axials persist over base and siphonal fasciole, very faint narrow cords over fasciole. Aperture narrow, elongate; outer lip strongly thickened by broad labial varix, with stout tubercle at lateral border of anal sinus; anal sinus narrow, deeply U-shaped, strongly distorting adapical part of outer lip; siphonal canal short, wide, unnotched. Columella weakly excavated in upper third, straight below. Columellar callus weakly thickened, parietal callus moderately thickened, sharply delimited, forming very narrow callus rim.

Discussion – *Mangelia melpomene* Chirli & Linse, 2011 is a very characteristic species that differs from its congeners, in having unshouldered whorls and having the spiral sculpture so weak that it seems absent even at low magnification. The outer lip is strongly thickened by a varix and a stout tubercle delimits the anal sinus laterally.
The specimens from Estepona are slightly smaller than the holotype from Rhodes (height 8.5 mm vs. 10.2 mm; no indication is given of the size of the paratypes), but the H/W ratio is similar. The protoconch has slightly more whorls (2.7 vs. 2.3) and is not quite as elevated. However, the teleoconch profile and sculpture are so similar that we consider them conspecific. This is only the second record for the species but suggests that it will probably occur in other Mediterranean Plio/Pleistocene assemblages.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (this paper). Lower Pleistocene: eastern Mediterranean, Rhodes Island (Chirli & Linse, 2011).

***Mangelia paciniana* (Calcara, 1839)**
Plate 26, fig. 1

*1839	*Pleurotoma pacinianum* Calcara, p. 7, fig. 2.
1883	*Mangilia* [*sic*] *paciniana* Calcara – Bucquoy *et al*., p. 105, pl. 15, figs 7-9.
1977a	*Cythara grisea* Nordsieck, p. 34, pl. 5, fig. 38.
1977a	*Cythara* (*Lyromangelia*) *paciniana* (Calcara, 1839) – Nordsieck, p. 37, pl. 6, fig. 49.
1979	*Cythara* (*Lyromangelia*) *paciniana* (Calcara, 1839) – Bogi *et al*., p. 8, fig. 11, p. 18.
2001	*Mangelia paciniana* (Calcara, 1839) – Cachia *et al*., p. 54, pl. 8, fig. 4.
2008	*Mangelia paciniana* (Calcara, 1839) – Cecalupo *et al*., p. 31, pl. 68, figs 2, 21a-22a, b [not fig. 21b = *Lyromangelia taeniata* (Deshayes, 1835)].
2010	*Mangelia paciniana* (Calcara, 1839) – Scarponi & Della Bella, p. 44, figs 93-100.
2011	*Mangelia taeniata* (Deshayes, 1835) – Hernández *et al*., p. 228, pl. 76, fig. C [*non Lyromangelia taeniata* (Deshayes, 1835)].
2021	*Mangelia paciniana* (Calcara, 1839) – Öztürk, p. 248, fig. 7.
2023	*Mangelia paciniana* (Calcara, 1839) – Spada *et al*., p. 17, fig. 9.

Material and dimensions – Height 4.8 mm, width 2.0 mm. **CO**: NHMW 2020/0171/0599 (1).

Description – Shell small, solid, fusiform; spire angle approximately 35°. Protoconch multispiral (about three whorls, nucleus missing, and surface abraded, spire angle approximately 45°, sinusigera not clearly preserved, but dp = ~500 μm). Teleoconch of 3.5 roundly shouldered whorls, subsutural area slightly flattened, ramp poorly delimited, weakly convex below, separated by narrowly impressed, undulating suture. Axial sculpture of elevated, rounded, opisthocline ribs, ten on last whorl, half width of their interspaces. Spiral very fine, crowded cords and threads of primary to tertiary strength. Last whorl 67% of total height, profile and sculpture as described above, rounded at shoulder, convex below, hardly constricted at base; axials persist over base stopping at siphonal fasciole, weak narrow cords over siphonal fasciole. Aperture narrow, elongate; outer lip strongly thickened by broad labial varix, with stout tubercle at lateral border of anal sinus; anal sinus narrow, deeply U-shaped, strongly distorting adapical part of outer lip; siphonal canal moderately short, wide, unnotched. Columella broadly and shallowly excavated, slightly twisted at fasciole. Columellar callus weakly thickened, parietal callus moderately thickened, sharply delimited, forming very narrow callus rim. Col-

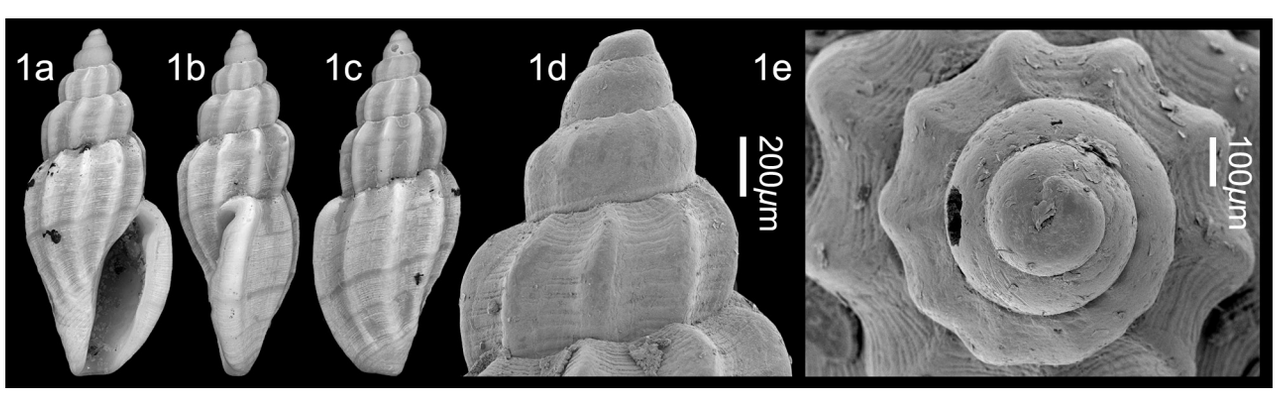

Plate 26. *Mangelia paciniana* (Calcara, 1839); 1. NHMW 2020/0171/0599, height 4.8 mm, width 2.0 mm (digital image), 1d-e detail of teleoconch (SEM image). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

our pattern preserved of narrow, orange/brown spiral stripes, slightly thicker stripe delimiting base.

Discussion – The specimen from the Velerín conglomerates is very similar to the Italian Lower Pleistocene specimen illustrated by Scarponi & Della Bella (2010, figs 93-100). Unfortunately, the protoconch in the Spanish shell is not well preserved, but the diameter is similar to that reported by those authors (2010, p. 120, appendix 3), and shows the same distinctive colour pattern of narrow stripes typical for *Mangelia paciniana* (Calcara, 1839). The species is superficially similar to *Lyromangelia taeniata* (Deshayes, 1835) in having fine coloured stripes, but that species differs in having a paucispiral protoconch and being more sharply shouldered.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (this paper). Lower Plesitocene: central Mediterranean, Italy (Scarponi & Della Bella, 2010). Present-day: Atlantic, Canary Islands (Hernández *et al*., 2011), western Mediterranean (Bucquoy *et al*., 1883; Nordsieck, 1977a; Cecalupo *et al*., 2008), central Mediterranean (Bogi *et al*., 1979; Cachia *et al*., 2001), eastern Mediterranean (Öztürk, 2021), entire Mediterranen (Spada *et al*., 2023).

***Mangelia pseudoceddaensis* nov. sp.**
Plate 27, figs 1-7

ZooBank registration – https://zoobank.org/NomenclaturalActs/35D5DFE3-915F-4FFC-8BF5-B6CADDA2D4BF

Type material – Holotype NHMW 2020/0171/0204, height 4.8 mm, width 2.3 mm; paratype 1 NHMW 2020/0171/0205, height 4.7 mm, width 2.3 mm; paratype 2 NHMW 2020/0171/0206, height 4.5 mm, width 2.1 mm; **Velerín carretera**. Paratype 3 NHMW 2020/0171/0198, height 5.7 mm, width 2.3 mm; paratype 4 NHMW 2020/0171/0199, height 5.1 mm, width 2.1 mm; paratype 5 NHMW 2020/0171/0201. **Velerín conglomerates**.

Other material – Maximum height 5.7 mm, width 2.4 mm. **CO**: NHMW 2020/0171/0200 (1), NHMW 2020/0171/0203 (12). **VC**: NHMW 2020/0171/0207 (32). **EL**: NHMW 2020/0171/0208 (35).

Type locality – Velerín carretera, Estepona, Spain.

Type stratum – Lower Piacenzian, Upper Pliocene.

Etymology – Name reflecting the similarity to *Mangelia ceddaensis* (Della Bella, 2010). *Mangelia* gender feminine.

Diagnosis – *Mangelia* species of small size, squat, protoconch of 3.75 whorls, last bearing riblets and cords, teleoconch of four strongly convex spire whorls, ten narrow axial ribs, three narrow primaries with much weaker secondary and tertiary cords in interspaces, outer lip hardly thickened, aperture broad, relatively short siphonal canal.

Description – Shell small, medium thickness, squat fusiform, with gradate spire; spire angle approximately 35°. Protoconch multispiral, apical angle approximately 75°, conical of 3.75 convex whorls, with small, elevated yet spightly depressed nucleus: early whorls smooth, last whorl with comma-shaped axial riblets and 5-6 spiral cords (dp = 780-785 μm, hp = 780-825 μm, dp/hp = 0.95, dn = 80-90 μm, dV1 = 170-180 μm). Junction with teleoconch sharply delimited by sinusigera. Teleoconch of up to four whorls, spire whorls strongly convex; subsutural ramp convex, moderately broad, shallowly inclined, delimited by shoulder cord, convex below, separated by narrowly impressed, undulating suture. Axial sculpture of narrow, elevated, sharp, arcuate, opisthocline ribs, ten on last whorl, one-quarter width of their interspaces. Spiral sculpture of very narrow, widely spaced, raised cords, one weaker near periphery of subsutural ramp, three below, adapical delimiting shoulder; cords forming small tubercles where they overrun ribs. Much weaker cords of secondary and tertiary strength intercalated. Surface covered in micropustules (Pl. 27, fig. 3c). Last whorl about 62% of total height, relatively broad, with profile and sculpture as described above, roundly angled at prominent shoulder, convex below, weakly constricted at base; axials and spirals persist over base, axials stopping at siphonal fasciole, about six fine closer-set cords over siphonal fasciole. Aperture 41-43% of total height, subrectangular; outer lip hardly thickened by labial varix, sharp edged, smooth within; anal sinus broad, moderate depth, asymmetrically U-shaped, occupying entire ramp, apex towards shoulder; siphonal canal moderately short, straight, unnotched. Columella moderately excavated in upper third, straight and slightly oblique below. Columellar and parietal callus weakly thickened, sharply delimited, forming narrow callus rim.

Discussion – As can be seen from the series illustrated, *Mangelia pseudoceddaensis* nov. sp. is most variable in the angulation of the last whorl. One of the specimens illustrated (Pl. 27, fig. 7) is somewhat different in not having the primary cords as well developed, but probably represents the same species.
This species is extremely similar to *Mangelia ceddaensis* (Della Bella *in* Scarponi & Della Bella, 2010) and shares the same profile and sculpture, but differs in being larger shelled (maximum height 5.6 mm vs. 4.5 mm), the protoconch is larger (dp = 785 μm, hp = 825 μm vs. max. dp = 520 μm, hp = 530 μm), with more numerous whorls (npw = 3.75, vs. max. 2.8). The two would be difficult to separate reliably based on teleoconch characters, although in the Estepona species the last whorl is slightly lower (62% vs. 70%) and the aperture shorter (42% vs. 47%) and broader, and the outer lip is not as strongly thickened.

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

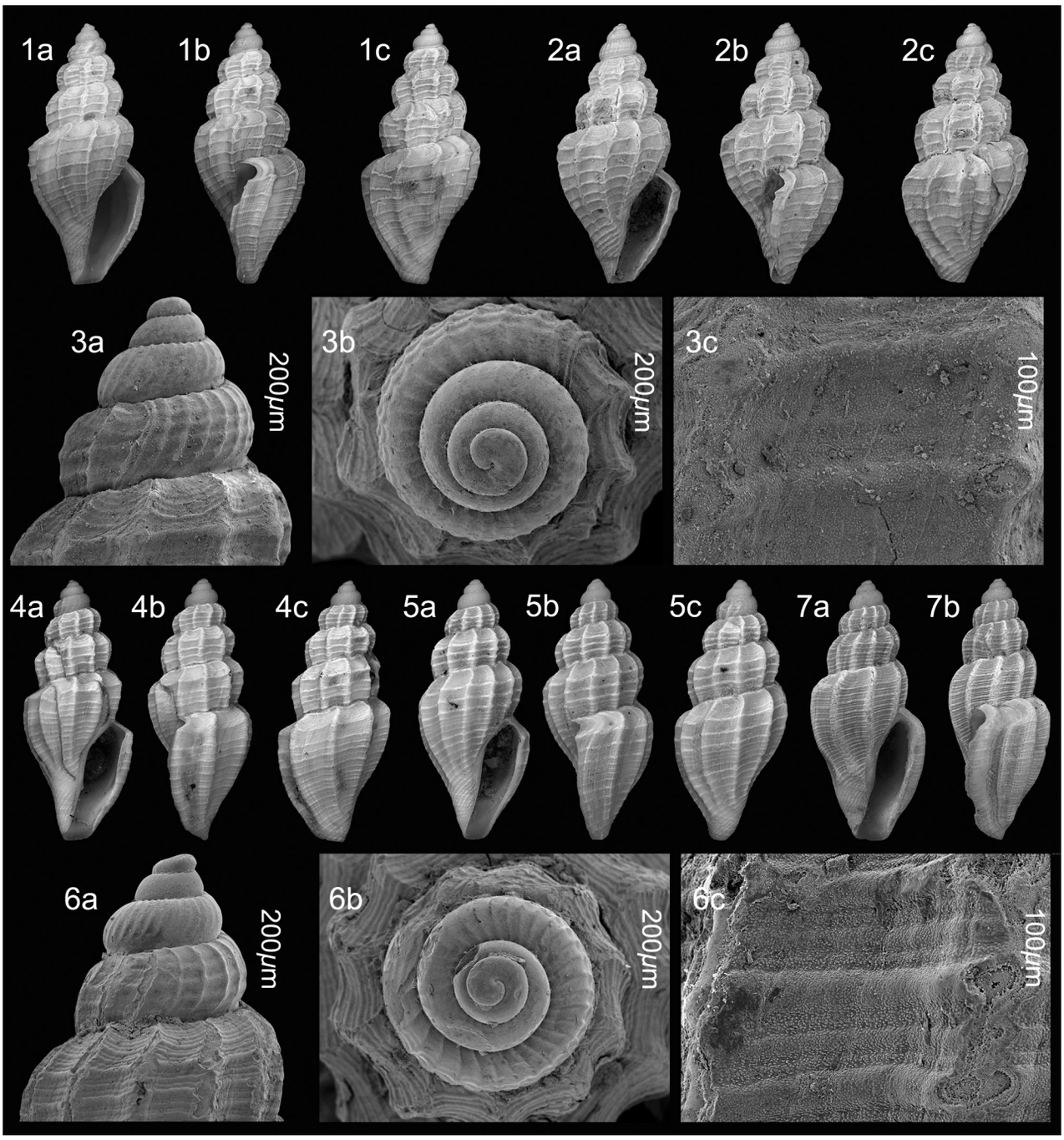

Plate 27. *Mangelia pseudoceddaensis* nov. sp.; 1. **Holotype** NHMW 2020/0171/0204, height 4.8 mm, width 2.3 mm; 2. **Paratype 1** NHMW 2020/0171/0205, height 4.7 mm, width 2.3 mm (digital images); 3. **Paratype 2** NHMW 2020/0171/0206, 3a-b, detail of protoconch, 3c, detail of teleoconch microsculpture (SEM image). Velerín carretera. 4. **Paratype 3** NHMW 2020/0171/0198, height 5.7 mm, width 2.3 mm; 5. **Paratype 4** NHMW 2020/0171/0199, height 5.1 mm, width 2.1 mm; 6. **Paratype 5** NHMW 2020/0171/0201, detail of protoconch (SEM image); 7. NHMW 2020/0171/0200, height 5.3 mm, width 2.3 mm (digital images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

***Mangelia scabriuscula* (Brugnone, 1862)**
Plate 28, figs 1-3

*1862 *Pleurotoma scabriusculum* Brugnone, p. 39, pl. 1, fig. 30.
1904 *Mangilia scabriuscula* (Brugn.) – Sacco, p. 55, pl. 14, figs 18-19.
1910 *Mangilia scabriuscula* Brugn. – Cerulli-Irelli, p. 55 [247], pl. 5 [36], fig. 18.
1914 *Mangilia scabriuscula* Brugnone – Cipolla, p. 34 [138], pl. 3 [13], fig. 6.
?1937 *Mangelia scabriuscula* (Brugn.) – Montanaro, p. 143 [173], pl. 8 [11], figs 10, 11.
1963 *Cythara* (*Mangelia*) *scabriuscula* (Brugnone, 1862)

– Venzo & Pelosio, p. 128, pl. 41, fig. 23.
1964 *Cythara* (*Mangelia*) *scabriuscula* Brugnone, 1862 – Brébion, p. 583, pl. 14, fig. 13 [*non Mangelia scabriuscula* (Brugnone, 1862)].
1974 *Cytharella scabriuscula* (Brugnone, 1862) – Malatesta, p. 434, pl. 32, fig. 12.
1976 *Cythara* (*Cytharella*) *scabriuscula* (Brugnone) – Pavia, p. 148, pl. 8, figs 6, 7.
1992 *Mangelia scabriuscula* (Brugnone, 1862) – Cavallo & Repetto, p. 142, fig. 390.
2010 *Mangelia scabriuscula* (Brugnone, 1862) – Scarponi & Della Bella, p. 49, figs 133-140).
2018 *Mangelia scabriuscula* (Brugnone, 1862) – Brunetti & Cresti, p. 92, fig. 378.
2020 *Mangelia scabriuscula* (Brugnone, 1862) – Landau *et al*., p. 40, pl. 35, figs 1-2.

Material and dimensions – Maximum height 7.8 mm, width 2.2 mm. **CO**: NHMW 2020/0171/0553-0554 (2), NHMW 2020/0171/0555 (4), NHMW 2020/0171/0598 (1).

Description – Shell small, medium thickness, fusiform, with tall gradate spire; spire angle approximately 30°. Protoconch multispiral, tall, apical angle approximately 50-55°, conical of three convex whorls, with small, elevated nucleus; early whorls smooth, last quarter whorl with comma-shaped axial riblets and four spiral cords (dp = 610 μm, hp = 740 μm, dp/hp = 0.82, dn = 110 μm, dV1 = 200 μm). Junction with teleoconch sharply delimited by sinusigera. Teleoconch of up to five shouldered whorls; subsutural ramp convex, moderately broad, sharply delimited by shoulder cord, convex below, separated by narrowly impressed, undulating suture. Axial sculpture of narrow, elevated, sharp, orthocline ribs, 8-10 on last whorl, one-third to half width of their interspaces. Spiral sculpture of three very narrow, widely spaced, primary cords, with crowded secondary and tertiary threads in the interspaces. Last whorl 58-59% of total height, relatively slender, with profile and sculpture as described above, sharply angled shoulder, broadly convex below, moderately constricted at base; axials and spirals persist over base, axials stopping at siphonal fasciole, about six fine closer-set cords over siphonal fasciole. Aperture 35-39% of total height, narrow; outer lip strongly thickened by labial varix, sharp edged, smooth within; anal sinus broad, moderately shallow, symmetrically U-shaped, occupying entire ramp; siphonal canal moderate length, straight, unnotched. Columella weakly excavated in upper half, straight below. Columellar and parietal callus weakly thickened, sharply delimited, forming narrow callus rim.

Discussion – Specimens from Estepona are similar to those illustrated by Scarponi & Della Bella (2010, figs 133-140), although larger (max. height 7.8 mm vs. 6.4 mm) and possibly a little slenderer. The number of protoconch whorls and the dimensions are also similar (*cf.* 2010, p. 120, appendix 3). *Mangelia scabrida* Monterosato, 1890 from the present-day Mediterranean and possibly Lower Pleistocene of Italy (Scarponi & Della Bella, 2010) has similar sculpture, but is squatter and has a smaller protoconch of only 2.1-2.5 whorls. *Mangelia ceddaensis* Della Bella *in* Scarponi & Della Bella 2010 from the Pliocene of Italy again has sculpture, but is squatter,

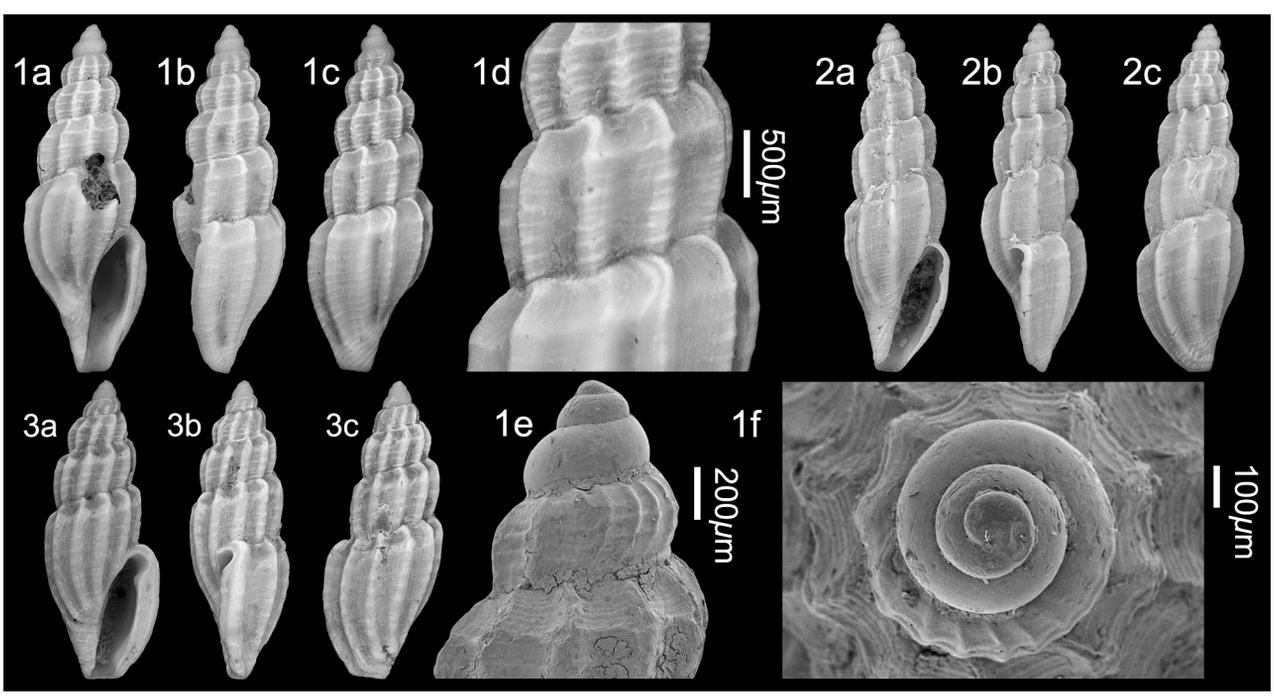

Plate 28. *Mangelia scabriuscula* (Brugnone, 1862); 1. NHMW 2020/0171/0553, height 6.3 mm, width 2.1 mm, 1d, detail of teleoconch sculpture, 1e-f, detail of protoconch; 2. NHMW 2020/0171/0554, height 7.8 mm, width 2.2 mm; 3. NHMW 2020/0171/0598, height 5.9 mm, width 2.2 mm (all digital images, except 1e-f, SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

smaller shelled (maximum height 4.5 mm), and again has a smaller protoconch (npw = 2.5-2.8, average dp = 500 μm, hp = 500 μm; Scarponi & Della Bella 2010, 2010, p. 117, appendix 3). *Mangelia unifasciata* (Deshayes, 1835) from the Upper Pliocene to present-day Mediterranean has less shouldered whorls, and a smaller protoconch with half a whorl less.

Distribution – Upper Miocene: Atlantic (Tortonian): NW France (Landau *et al*., 2020); ?central Proto-Mediterranean, Italy (Montanaro, 1937; Venzo & Pelosio, 1963). Lower Pliocene: central Mediterranean, Italy (Pavia, 1976; Scarponi & Della Bella, 2010). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Brugnone, 1862; Bellardi, 1877; Sacco, 1904; Malatesta, 1974; Cavallo & Repetto, 1992; Scarponi & Della Bella, 2010; Brunetti & Cresti, 2018). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1910).

***Mangelia* sp.**
Plate 29, fig. 1

Material and dimensions – Height 6.8 mm, width 2.5 mm. **CO**: NHMW 2020/0171/0552.

Description – Shell small, moderately solid, fusiform, with tall gradate spire; spire angle 40°. Protoconch multispiral, 3.5 convex whorls, with small nucleus; first three whorls smooth, last whorl with comma-shaped riblets crossed by 5 narrow cordlets forming reticulated pattern (dp = 645 μm, hp = 755 μm, dp/hp = 0.85, dn = 60 μm, dV1 = 190 μm). Junction with teleoconch delimited by sinusigera. Teleoconch of 4.25 weakly shouldered whorls, with moderate width, convex subsutural ramp delimited by shoulder cord, obtusely angled at shoulder, convex below, periphery mid-whorl, separated by narrowly impressed undulating suture. Axial sculpture predominant, composed of nine rounded, orthocline ribs, about half width of their interspaces, narrowed and arcuate over subsutural ramp. Spiral sculpture of three primary cords, adapical delimiting shoulder, with secondary and tertiary threads intercalated abapically, spirals weakly punctiform. Last whorl 56% of total height, with convex subsutural ramp, sharply delimited by shoulder cord, convex below, hardly constricted at base; axials persist strongly over base, eight narrow primary cords with secondaries and tertiaries intercalated below shoulder, 5-6 further slightly stronger cords over siphonal fasciole. Aperture small, about 37% of total height; outer lip thin, not thickened by varix, sharp edged, smooth within; anal sinus moderate depth and width, symmetrically U-shaped, occupying entire ramp, apex mid ramp; siphonal canal moderately short, bent to left, unnotched. Columella broadly and weakly excavated in upper half, twisted at fasciole. Columellar and parietal callus not thickened, forming narrow indented callus rim.

Discussion – This species is problematic. The teleoconch profile and sculpture strongly suggests placement in the genus *Sorgenfreispira* Moroni, 1979. However, the protoconch sculpture on the last half whorl is reticulate but does not form the tubercles at the sculptural intersections, characteristic to that genus (see below). Moreover, the spirals are not punctiform, or much less so than in most members of the genus *Sorgenfreispira*, and no micropustules are seen under SEM imaging, which are present in the three species of *Sorgenfreispira* present in the Estepona assemblages. The anal sinus is also deeper that that seen in *Sorgenfreispira*. As the species is represented by a single specimen, we are uncertain if this is an abberant individual and provisionally keep it in the genus *Mangelia* Risso, 1826.
Della Bella *et al*. (2015) described several similar species from the Italian Pliocene of Tuscany. Those authors did not recognise the genus *Sorgenfreispira* Moroni, 1979 and placed them all in *Bela* Leach, 1847. *Bela fiorentina* Della Bella, Naldi & Scarponi, 2015 has a smaller protoconch of only 2.3-2.9 whorls (Della Bella *et al*., 2015, p. 77, appendix 3). Tubercles are formed at the sculptural intersections on the last protoconch whorl (protoconch somewhat abraded; 2015, figs 61, 69, but described p. 23) and would be placed in the genus *Sorgenfreispira* herein. The teleoconch sculpture differs in having five primary spirals on the second whorl as opposed to three. *Bela plagiosculpta* Della Bella, Naldi & Scarponi, 2015 has a protoconch of 3.2-3.5 whorls, with 3-4 cordlets on the

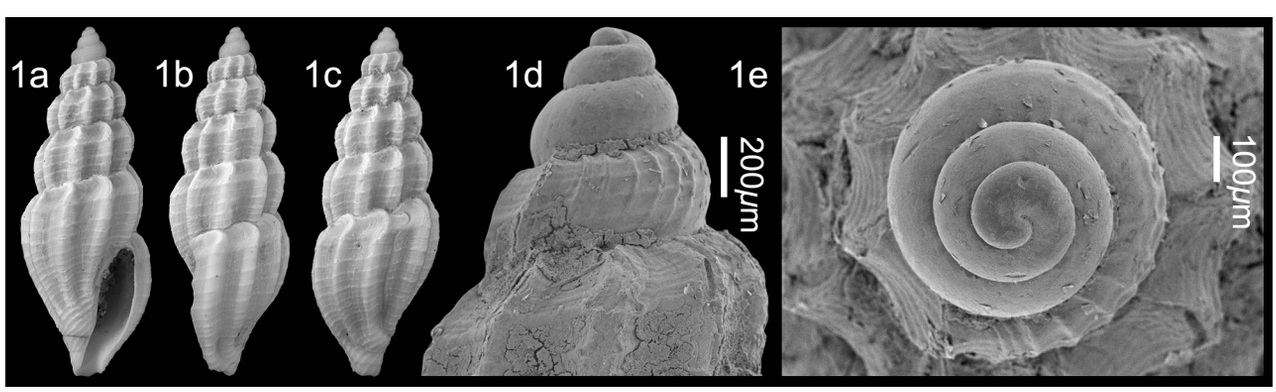

Plate 29. *Mangelia* sp.; 1. NHMW 2020/0171/0552, height 6.8 mm, width 2.5 mm (digital image), 1d-e, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

final portion, but again forms tubercles at the sculptural intersections, and again is considered to belong within the genus *Sorgenfreispira*. The teleoconch differs from the Estepona specimen in having more strongly shouldered whorls. *Bela pseudoexilis* Della Bella, Naldi & Scarponi, 2015 has a protoconch of 2.8-3.2 whorls and again a tuberculate protoconch and therefore also a *Sorgenfreispira*. The teleoconch differs from the Estepona species in sculpture and in having a shallower anal sinus.

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

Genus *Pseudomangelia* Sabelli & Spada, 2023 (*in* Spada *et al*., 2023)

Type species – *Pleurotoma vaquelini* Payraudeau, 1827, by original designation, Present-day, Mediterranean.

2023 *Pseudomangelia* Sabelli & Spada *in* Spada *et al*., p. 38.

Note – *Pseudomangelia* Sabelli & Spada (*in* Spada *et al*., 2023) was erected as a monotypic genus for *Pleurotoma vaquelini* Payraudeau, 1827 separating it from other mangeliids on both shell and soft tissue characters. Shell characters considered peculiar to the genus were flat spiral bands separated by narrow spiral grooves. For differences in soft tissue and radula, see Spada *et al*. (2023, p. 38).

***Pseudomangelia vauquelini* (Payraudeau, 1827)**
Plate 30, figs 1-3

*1827 *Pleurotoma Vauquelini* Payraudeau, p. 145, pl. 7, figs 14-15.
1836 *Pleurotoma vauquelini* Payr. – Philippi, p. 198-199, pl. 11, figs 19, 19a.
1846 *Mangelia cavernosa* Reeve, pl. 2, species 8.
1883 *Mangilia* [*sic*] *Vauquelini* Payraudeau – Bucquoy *et al*., p. 103, pl. 15, figs 1-3.
1884 *Mangilia Vauquelini* Payraudeau – Tryon, p. 243, pl. 21, fig. 17.
1905 *Pleurotoma vauquelini* Payraudeau – Kobelt, p. 336, pl. 93, figs 12, 13.
1910 *Mangilia* [*sic*] *Vauquelini* Payr. – Cerulli-Irelli, p. 51 [243], pl. 5 [36], fig. 2.
1941 *Mangilia* [*sic*] *Vauquelini* Payraudeau – Paulus & Mars, p. 245, fig. 16.
1968 *Cythara* (*Lyromangelia*) *vauquelini* (Payraudeau, 1826) – Nordsieck, p. 167, pl. 28, fig. 92.71.
1977a *Cythara* (*Lyromangelia*) *vauquelini* (Payraudeau, 1826) – Nordsieck, p. 37, pl. 6, fig. 50.
1979 *Cythara vauquelini* (Payraudeau, 1826) – Bogi *et al*., p. 8, unnumbered figure.
1979 *Cythara vauquelini* (Payraudeau, 1826) – Nordsieck & García-Talavera, p. 158, pl. 39, fig. 10.
1985 *Cythara vauquelini* (Payraudeau, 1826) – Orlando & Palazzi, p. 44, pl. 8, figs 134-136.
1990 *Mangelia vauquelini* (Payraudeau, 1826) – Bouchet, p. 71, fig. 1c.
1991 *Mangelia vauquelini* (Payraudeau, 1826) – Poppe & Goto, p. 171, pl. 35, fig. 16.
1997 *Mangelia vauquelini* (Payraudeau, 1826) – Chirli, p. 72, pl. 21, figs 3, 4.
2001 *Mangelia vauquelini* (Payraudeau, 1826) – Cachia *et al*., p. 57, pl. 8, fig. 11.
2001 *Mangelia vauquelini* (Payraudeau, 1826) – Delamotte & Vardala-Theodorou, p. 236, Turridae fig. 2.
2005 *Mangelia vauquelini* (Payraudeau, 1826) – Repetto *et al*., p. 210, fig. 852.
2008 *Mangelia vauquelini* (Payraudeau, 1826) – Cecalupo *et al*., pl. 68, figs 3a-b.
2011 *Mangelia vauquelini* (Payraudeau, 1826) – Chirli & Linse, p. 185, pl. 67, fig.1.
2011 *Mangelia vauquelini* (Payraudeau, 1826) – Hernández *et al*., p. 228, figs 67A-B.
2021 *Mangelia vauquelini* (Payraudeau, 1826) – Öztürk, p. 257, fig. 18A-E.
2023 *Pseudomangelia vauquelini* (Payraudeau, 1827) – Spada *et al*., p. 38, fig. 20.

non 1854 *Pleurotoma Vauquelini* Pay. – Hörnes, p. 378, pl. 40, fig. 18 [= *nom. nov. Mangelia pumilio* Brusina, 1871].
non 1867 *Pleurotoma Vauquelini*? Pay. – Pereira da Costa, p. 235, pl. 28, fig. 5.

Material and dimensions – Maximum height 5.3 mm, width 2.4 mm. **EL**: NHMW 2020/0171/0671-0673 (3), NHMW 2020/0171/0674 (2). **PA**: NHMW 2020/0171/0670 (1).

Description – Shell small, medium thickness, fusiform, with gradate spire; spire angle approximately 45°. Protoconch of 2.75 convex whorls, with small nucleus; early whorls smooth, last quarter whorl with comma-shaped axial riblets (dp = 580 μm, hp = 545 μm, dp/hp = 1.06, dn = 95 μm, dV1 = 205 μm). Junction with teleoconch sharply delimited by sinusigera. Teleoconch of up to four strongly shouldered whorls; subsutural ramp flattened, moderately broad, well delimited, almost straight sided below tapering inwards, separated by narrowly impressed, undulating suture. Axial sculpture of narrow, elevated, opisthocline ribs, 11-12 on last whorl, one-third to half width of their interspaces. Spiral sculpture of very narrow, widely spaced cords, without secondaries. Last whorl 63-70% of total height, relatively broad, with profile and sculpture as described above, strongly angled at shoulder, convex below, moderately constricted at base; axials and spirals persist over base, axials interrupted over siphonal fasciole by about ten stronger spiral cords. Aperture 43-47% of total height, ovate; outer lip weakly thickened by labial varix (all specimens subadult), sharp edged, smooth within; anal sinus broad, moderately shallow, symmetrically U-shaped, occupying entire ramp; siphonal canal moderate length, bent slightly abaxially, unnotched. Columella weakly excavated in upper half, straight below. Columellar and parietal callus weakly de-

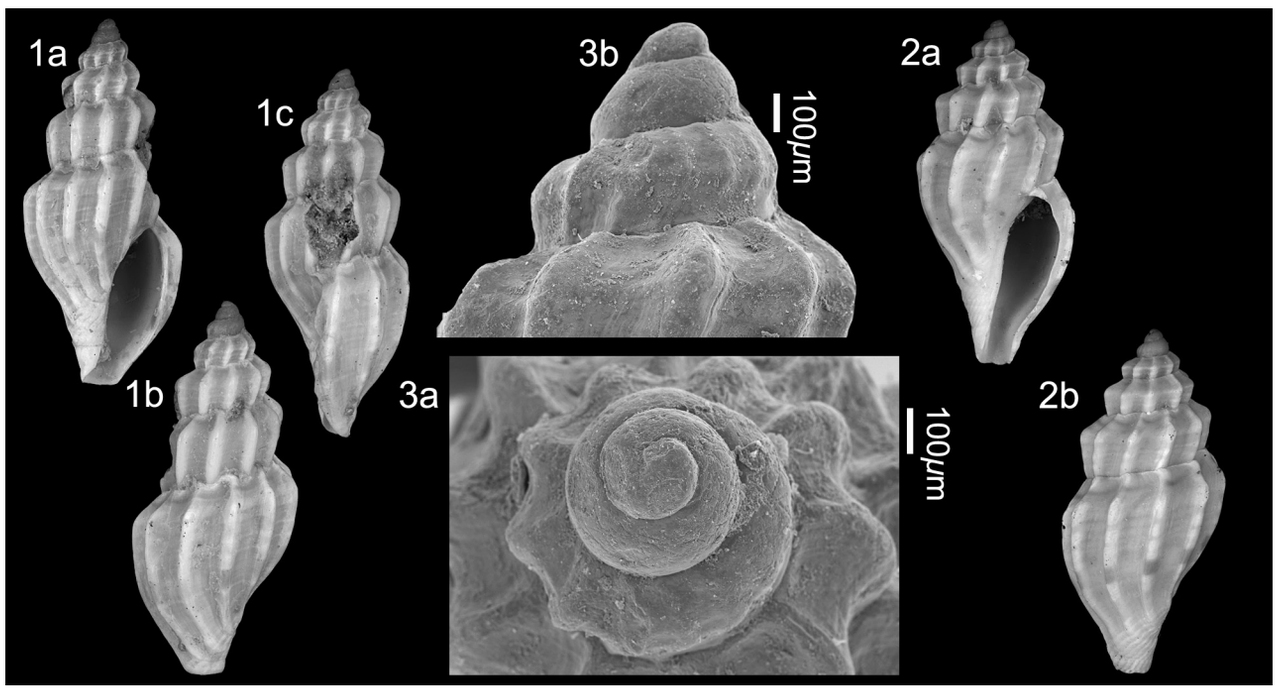

Plate 30. *Pseudomangelia vauquelini* (Payraudeau, 1827); 1. NHMW 2020/0171/0671, height 5.3 mm, width 2.4 mm; 2. NHMW 2020/0171/0672, height 5.3 mm, width 2.4 mm (digital images); 3. NHMW 2020/0171/0673, height 5.1 mm, width 2.1 mm, detail of protoconch (SEM image). El Lobillo, Estepona, Lower Piacenzian, Upper Pliocene.

veloped, forming narrow callus rim. Colour pattern preserved consisting of darker colouration of the protoconch a dark band over subsutural ramp and broader band over base, with narrower interrupted horizonal stripes between.

Discussion – None of the specimens at hand from Estepona is fully adult and they do not show the strongly thickened labial varix, characteristic to the species. However, the coloured protoconch is similar to that illustrated by Öztürk (2021, fig. 18E), as is the characteristic teleoconch colour pattern of a darker band on the subsutural ramp and over the base (latter not always present). Chirli (1997, p. 73) recorded it from the Upper Miocene Tortonian of Montegibbio (Italy). This and other unillustrated records from the Miocene (*e.g.*, Doderlein, 1864; Bardin, 1882) are excluded pending confirmation.

Distribution – Lower Pliocene: Atlantic, Santa Maria Island (Mayer, 1864); central Mediterranean, Italy (Chirli, 1997; Scarponi & Della Bella, 2010). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Brugnone, 1862; Bellardi, 1877; Sacco, 1904; Malatesta, 1974; Cavallo & Repetto, 1992; Scarponi & Della Bella, 2010; Brunetti & Cresti, 2018). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1910). Present-day: Canary Islands (Nordsieck & García-Talavera, 1979), Morocco (Spada *et al.,* 2023) western Mediterranean (Bucquoy *et al*., 1883), central Mediterranean (Bogi *et al*., 1979, Cachia *et al*., 2001), eastern Mediterranean (Öztürk, 2021), entire Mediterranean (Spada *et al.,* 2023).

Genus *Pyrgocythara* Woodring, 1928

Type species – *Pyrgocythara eminula* Woodring, 1928, by original designation, Pliocene, Jamaica.

1928 *Pyrgocythara* Woodring, p. 171.

***Pyrgocythara rugosissima* (Seguenza, 1875)**
Plate 31, figs 1-3

1862 *Pleurotoma rugusolum* Phil. var. B – Brugnone, p. 38, pl. 1, fig. 28 [*non* Philippi, 1844 = *Mangelia unifasciata* (Deshayes, 1835)].
*1875 *Mangelia rugosissima* Seguenza, p. 210.
1877 *Mangelia rugosissima* (Brugn.) – Bellardi, p. 292, pl. 8, fig. 36.
1877 *Mangelia contracta* Bellardi, p. 295.
1904 *Mangilia contracta* Bell. – Sacco, p. 55, pl. 14, figs 35, 36.
1914 *Mangilia rugosissima* Brugnone [*sic*] – Cipolla, p. 139, pl. 13, fig. 7.
1976 *Cythara* (*Cytharella*) *rugosissima* (Bellardi) – Pavia, pl. 8, fig. 5.
1981 *Mangelia contracta* Bellardi, 1877 – Ferrero Mortara *et al*., p. 91, pl. 17, figs 6, 7.
1992 *Mangelia contracta* Bellardi, 1877 – Cavallo & Repetto, p. 144, fig. 392.
1992 *Mangelia rugosissima* (Brugnone, 1862) [*sic*] – Cavallo & Repetto, p. 144, fig. 393.
1996 *Pyrgocythara* (*Glabrocythara*) *rugosissima* (Brugnone, 1862) [*sic*] – Vera-Peláez, p. 506, text-fig.

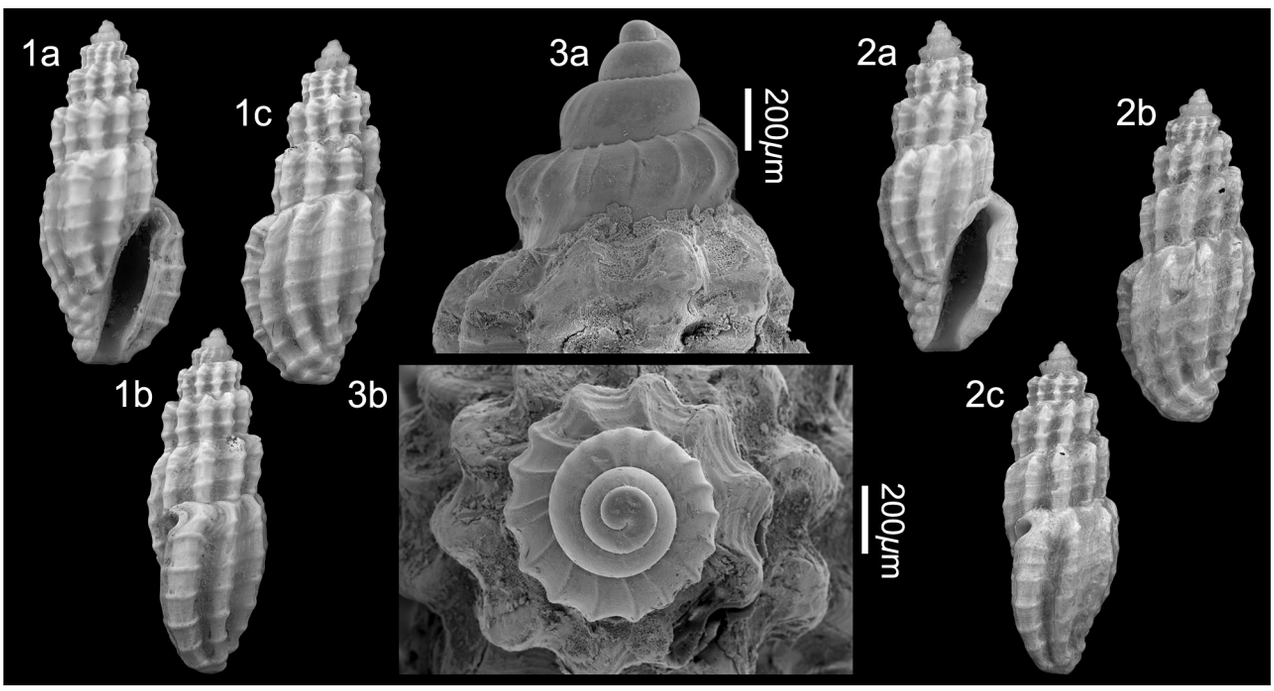

Plate 31. *Pyrgocythara rugosissima* (Seguenza, 1875); 1. NHMW 2020/0171/0107, height 6.8 mm, width 2.6 mm; 2. NHMW 2020/0171/0108, height 5.8 mm, width 2.3 mm (digital images); 3. NHMW 2020/0171/0109, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

41, pl. 35, figs 9, 10.

1997 *Mangelia contracta* Bellardi, 1877 – Chirli, p. 66, pl. 19, figs 4-7.

1999 *Pyrgocythara* (*Glabrocythara*) *rugosissima* (Brugnone, 1862) [*sic*] – Vera-Peláez *et al*., p. 12.

2001 *Pyrgocythara* (*Glabrocythara*) cf. *rugosissima* (Brugnone, 1862) [*sic*] – Silva, p. 545, pl. 25, figs 11-15.

2002 *Mangelia rugosissima* (Brugnone, 1862) [*sic*] – Vera-Peláez, p. 205, pl. 4, figs G, H.

2010 *Pyrgocythara rugosissima*? (Seguenza, 1875) – Scarponi & Della Bella, p. 95, figs 201-208.

2018 *Pyrgocythara rugosissima* (Seguenza, 1875) – Ceulemans *et al*., p. 103, pl. 3, fig. 3.

2018 *Pyrgocythara rugosissima* (Seguenza, 1875) – Brunetti & Cresti, p. 94, fig. 380.

Material and dimensions – Maximum height 7.9 mm, width 3.2 mm. **CO**: NHMW 2020/0171/0107-0109 (3), NHMW 2020/0171/0110 (8). **VS**: NHMW 2020/0171/0111 (4). **EL**: NHMW 2020/0171/0112 (18).

Description – Shell small, solid, elongate fusiform, with gradate spire; spire angle approximately 20-25°. Protoconch, tall, apical angle approximately 50-60°, conical, multispiral, of 3.7 whorls, with small, elevated nucleus; first two whorls convex, last two whorls shouldered bearing axial riblets (dp = 664 μm, hp = 740 μm, dp/hp = 0.90, dn = 95 μm, dV1 = 180 μm). Junction with teleoconch marked by sinusigera. Teleoconch of 3.5-4 strongly shouldered whorls, shoulder placed just below suture, almost straight sided below, separated by superficial undulating suture. Axial sculpture of strongly elevated, weakly opisthocline, rounded ribs, 9-11 on penultimate whorl, equal in width to their interspaces, that are somewhat coronate at shoulder, crossed by narrow, widely spaced spirals, three on first teleoconch whorl, four on penultimate whorl, slightly thickened over ribs. Last whorl about 62% of total height, with narrow subsutural ramp, obtusely, roundly angled at shoulder placed short distance below suture, weakly convex below, hardly constricted at base; ribs strongly elevated, occasionally varicose, extending over base and siphonal fasciole; six primary spirals below shoulder, spirals over fasciole stronger, cut by axials, forming coarse beading. Aperture 42-44% of total height, elongate, narrow. Outer lip very strongly thickened by labial varix, sharp edged; anal sinus broad, relatively deep U-shaped, occupying entire ramp and distorting adapical portion of outer lip, stout tubercle formed at lateral of anal canal within outer lip; siphonal canal short, unnotched. Columella smooth, very weakly excavated. Columellar and parietal callus weakly thickened, sharply delimited, forming very narrow callus rim; small parietal pad formed adapically.

Discussion – Vera-Peláez *et al*. (1999) placed this species in the genus *Pyrgocythara* Woodring, 1928, a position followed by all subsequent authors except for Vera-Peláez (2002), who returned to its more traditional placement in the genus *Mangelia* Risso, 1826. *Pyrgocythara* is a western Atlantic Caribbean genus and although this species certainly fits within the genus description, especially in relation to the multispiral protoconch with sinuous riblets

on the last two whorls, deep U-shaped sinus with a denticle placed immediately below on the outer lip (Powell, 1966, p. 117), these features are also present in other European Pliocene *Mangelia* species (see Scarponi & Della Bella, 2010) and may be convergent. The actual relationships of *Pyrgocythara eminula* (type species of *Pyrgocythara*) and all the other species currently included in this genus should be clarified by a phylogenetic assessment. Moreover, Faber (2004), considered Miocene fossil *Pyrgocythara eminula* to be "probably" conspecific with the extant *Pleurotoma trilineata* C. B. Adams, 1845, which is in turn currently included in the genus *Tenaturris* Woodring, 1928.
Scarponi & Della Bella (2010) stressed the absence of type material for *P. rugosissima* and expressed doubt over what specimen was referred to by the original description, but in our opinion, all subsequent authors have attributed this name to the same species. The strong sculpture is characteristic of *P. rugosissima* (Seguenza, 1875) and separates it from all other mangeliids.

Distribution – Lower Pliocene: Atlantic, NW France (Ceulemans *et al*., 2018); western Mediterranean, NE Spain (Gili & Martinell, 1994); central Mediterranean, Italy (Bellardi, 1877; Sacco, 1904; Pavia, 1976; Chirli, 1997; Scarponi & Della Bella, 2010; Brunetti & Cresti, 2018). Upper Pliocene: Atlantic, Mondego Basin, Portugal (Silva, 2001); western Mediterranean, Estepona Basin (Vera-Peláez, 1996, 2002); central Mediterranean, Italy (Seguenza, 1875; Bellardi, 1877; Cipolla, 1914; Cavallo & Repetto, 1992; Scarponi & Della Bella, 2010).

Genus *Smithiella* Monterosato, 1890

Type species – *Pleurotoma smithii* Forbes, 1840, by typification of replaced name, Present-day, British-Isles.

1884 *Smithia* Monterosato, 1884, p. 128. Type species (by monotypy): *Pleurotoma smithii* Forbes, 1840, present-day, British-Isles. Junior homonym of *Smithia* Milne-Edwards & Haime, 1851 [Cnidaria] and several others.
1890 *Smithiella* Monterosato, p. 186. *Nom. nov. pro Smithia* Monterosato, 1884, *non* Milne-Edwards & Haime, 1851.

Note – This genus was recently resurrected by Spada *et al*. (2023, p. 44). It differs from *Mangelia* Risso, 1826 in the colouring of the animal. The shell characters are a thin outer lip margin, and it does not have a C-shaped indentation around the anal canal. The genus seems monotypic as those authors did not list any further congeners.

***Smithiella costulata* (Risso, 1826)**
Plate 32, figs 1-4

*1826 *Mangelia costulata* Risso, p. 219.
1840 *Pleurotoma smithii* Forbes, p. 107, pl. 23, fig. 14.
1845 *Pleurotoma farrani* Thompson, p. 316, pl. 19, fig. 3.
1845 *Pleurotoma loeviana* Reeve, pl. 32, sp. 290.
1884 *Smithia striolata* Monterosato, p. 128.
1886 *Raphitoma rissoi* Locard, p. 126.
1891 *Raphitoma ornata* Locard, p. 57.
1891 *Raphitoma strictum* Locard, p. 59.
1910 *Raphitoma exstriolata* Cerulli-Irelli, p. 67 [259], pl. 6 [37], figs 31-34.
1938 *Cythara* (*Mangelia*) *altenai* Brakman, p. 47.
1968 *Bela* (*Smithiella*) *costulata* (Blainville) [*sic*] – Nordsieck, p. 172, pl. 29, fig. 93.40.
1972 *Bela costulata scacchii* Nordsieck, p. 242.
1977a *Smithiella costulata* (Blainville, 1825) [*sic*] – Nordsieck, p. 46 (*partim*), pl. 13, fig. 101.
1979 *Smithiella costulata* (Blainville) [*sic*] – Nordsieck & García-Talavera, p. 161, pl. 40, fig. 19.
1980 *Smithiella costulata* (Blainville, 1825) [*sic*] – Bogi *et al*., p. 16, unnumbered fig.
1980 *Mangelia wareni* Piani, p. 155.
2011 *Mangelia* cf. *costulata* (Blainville, 1829) [*sic*] – Chirli & Linse, p. 180, pl. 64, fig. 2.
2011 *Mangelia costulata* (Risso, 1826) [*sic*] – Hernández *et al*., p. 226, pl. 75, figs D-E.
2021 *Mangelia costulata* Risso, 1826 – Öztürk, p. 248, fig. 6.
2023 *Smithiella costulata* (Risso, 1826) – Spada *et al*., p. 44, fig. 23.

Material and dimensions – Maximum height 9.2 mm, width 3.7 mm. **CO**: NHMW 2020/0171/0553 (1), NHMW 2020/0171/0554 (7), NHMW 2020/0171/0594-0596 (3). **EL**: NHMW 2020/0171/0555 (1)

Description – Shell small, solid, fusiform; spire angle approximately 30°. Protoconch multispiral, tall, conical of 3.0-3.1 convex whorls, apical angle 55°, with small elevated, yet slightly depressed nucleus; first three whorls smooth, last whorl with comma-shaped axial riblets and four cordlets (dp = 650-690 μm, hp = 670-685 μm, dp/hp = 0.97-1.0, dn = 115-140 μm, dV1 = 225-250 μm). Junction with teleoconch sharply delimited by sinusigera. Teleoconch of up to 4.5 weakly shouldered convex whorls; subsutural ramp weakly delimited, separated by narrowly impressed, undulating suture. Axial sculpture of narrow, rounded, weakly opisthocline ribs, 9-10 on last whorl, half width of their interspaces, overrun by very fine subequal cordlets, 25-28 on penultimate whorl. Last whorl 59% of total height, profile and sculpture as described above, broadly convex, weakly constricted at base; axials and spirals persist over base, even weaker spirals over siphonal fasciole. Aperture 40% of total height, narrow, elongate; outer lip strongly thickened by broad labial varix, sharp edged, smooth within; anal sinus narrow, U-shaped, distorting adapical part of outer lip; siphonal canal short, wide, bent slightly adaxially, unnotched. Columella very weakly excavated just above mid-height, straight and oblique below, slightly twisted at fasciole. Columellar and parietal callus weakly thickened, sharply delimited, forming narrow callus rim.

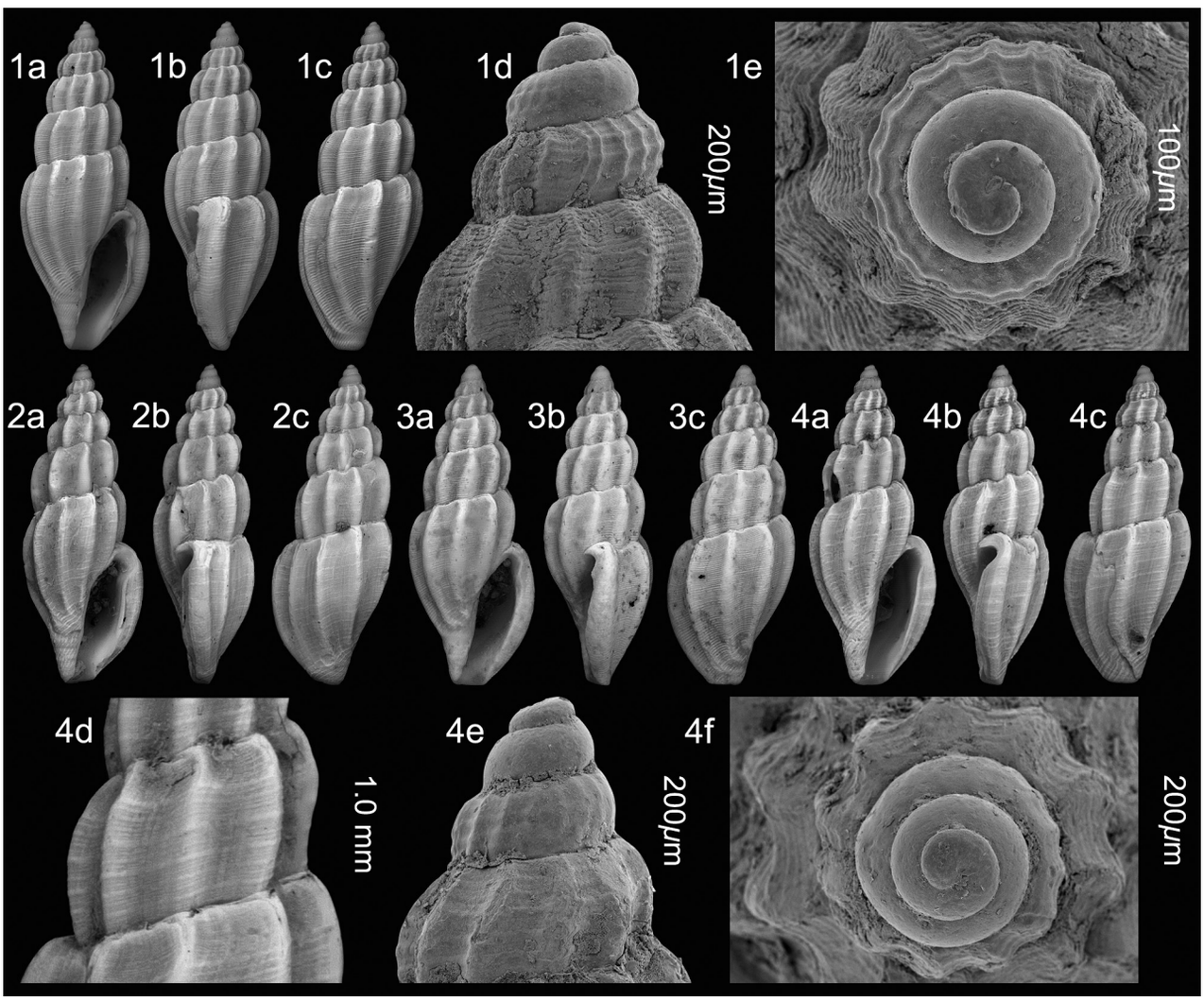

Plate 32. *Smithiella costulata* (Risso, 1826); 1. NHMW 2020/0171/0553, height 7.7 mm, width 2.8 mm (digital images), 1d-e, detail of protoconch (SEM images); 2. NHMW 2020/0171/0594, height 7.8 mm, width 2.9 mm; 3. NHMW 2020/0171/0595, height 7.3 mm, width 2.6 mm; 4. NHMW 2020/0171/0596, height 7.1 mm, width 2.6 mm, 4d detail of teleoconch sculpture (digital images), 4e-f, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

Discussion – *Smithiella costulata* (Risso, 1826) is characterised by its regularly fusiform profile, unshouldered or very weakly shouldered whorls, straight narrow axial ribs and very fine spiral sculpture. *Mangelia coarctata* (Forbes, 1840) has a similar fusiform profile, but fewer (6-7 vs. 9-10) more arcuate ribs. In Estepona *S. costulata* is found only in the shallower water deposits, although in the present day eastern Mediterranean it seems to have quite a wide bathymetric range (3-200 m depth: Öztürk, 2021, p. 243, table 1). It occurs throughout the Mediterranean (Spada *et al.,* 2023).

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (Vera-Peláez, 2002). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1910); eastern Mediterranean, Rhodes Island (Chirli & Linse, 2011). Present-day: Atlantic, Canary Islands (Nordsieck & García-Talavera, 1979; Hernández *et al*., 2011), central Mediterranean (Bogi *et al*., 1980; Spada *et al*., 2023), eastern Mediterranean (Öztürk, 2021), entire Mediterranean (Spada *et al*., 2023).

Genus *Sorgenfreispira* Moroni, 1979

Type species – *Cythara moronii* Venzo & Pelosio, 1964, by original designation, Miocene, Italy.

1979 *Sorgenfreispira* Moroni, p. 2.

Note – Mariottini *et al*. (2015) ascribed species within the *Bela brachystoma*-complex to the genus *Sorgenfreispira* Moroni, 1979. They differ from *Bela* Leach *in* Gray, 1847 in having a protoconch microsculpture of granulose spiral cordlets, granulose spirals also on adult whorls, a short siphonal canal, and the entire teleoconch surface covered in micropustules.

***Sorgenfreispira brachystoma* (Philippi, 1844)**
Plate 33, figs 1-4

*1844 *Pleurotoma brachystomum* Philippi, p. 169, pl. 26, fig. 10.
1847 *Raphitoma cancellina* Bellardi, p. 94, pl. 4, fig. 23.
?1878 *Clavatula brachystoma* Phil. – S.V. Wood, 1848, p. 60, pl. 7, fig. 8.
1862 *Pleurotoma granuliferum* Brugnone, p. 21, pl. 1, fig. 13.
1877 *Raphitoma brachystoma* (Phil.) – Bellardi, p. 318, pl. 9, fig. 34.
1898 *Pleurotoma* (*Raphitoma*) *brachystoma* Philippi – Almera & Bofill, p. 43, pl. 2, fig. 16.
1907 *Pleurotoma* (*Raphitoma*) *brachystoma* Philippi – Almera, p. 154, pl. 6, fig. 16.
1910 *Raphitoma brachystoma* Phil. – Cerulli-Irelli, p. 68 [260], pl. 6 [37], figs. 35-43.
1914 *Daphnella* (*Raphitoma*) *brachystoma* Philippi – Cipolla, p. 65 [169], pl. 3 [14], fig. 19.
?1915 *Raphitoma brachystoma* (Philippi) – Harmer, p. 261, pl. 30, figs 30, 31.
1937 *Daphnella (Raphitoma*) *harpula* var. *brachystoma* (Phil.) – Montanaro, p. 158 [188], pl. 8 [11], figs 66, 67 [*non Turriclavus harpula* (Brocchi, 1814)].
1956 *Mangilia* [*sic*] *brachystoma* Philippi – Moroni, p. 122, pl. 7, fig. 38.
1963 *Cythara* (*Mangelia*) *moronii* Venzo & Pelosio, p. 128, pl. 41, fig. 27.
1968 *Bela brachystoma* (Philippi, 1844) – Nordsieck, p. 171, pl. 29, fig. 93.24.
1974 *Bela brachystoma* (Philippi, 1844) – Malatesta, p. 425, pl. 32, fig. 11.
1977a *Bela brachystoma* (Philippi, 1844) – Nordsieck, p. 44, pl. 11, fig. 85.
?1977a *Bela brachystoma apicalis* Nordsieck, p. 44, pl. 11, fig. 86.
1980 *Bela brachistoma* [*sic*] (Philippi, 1844) – Bogi *et al*., p. 16, fig. 9.
1982 *Bela brachystoma* (Philippi, 1844) – Martinell, p. 104, pl. 1, figs 13, 14.
1984 *Mangelia brachystoma* (Philippi, 1844) – Fretter & Graham, p. 552, figs 359, 360.
1984 *Bela brachystoma* (Philippi) – Martinell & Domenèch, p. 9, pl. 1, fig. 16.
1985 *Bela brachystoma* (Philippi) – Martinell & Domenèch, p. 32, 34, 38, 40, pl. 1, fig. 14.
1988 *Mangelia brachystoma* (Philippi, 1844) – Graham, p. 440, fig. 183.
1992 *Bela* (*Bela*) *brachystoma* (Philippi, 1844) – Cavallo & Repetto (*partim*), p. 138, fig. 374 right figure only [left figure = *Compsodrillia matheroni* (Bellardi, 1877)].
1993 *Bela brachystoma* (Philippi, 1844) – González Delgado, p. 39, pl. 4, figs 1-3.
1995 *Mangelia brachystoma* (Philippi) – Hayward *et al*., p. 538, fig. 10.16.
1996 *Bela brachystoma* (Philippi, 1844) – Vera Peláez, p. 552, pl. 40, figs 4-12.
2001 *Bela brachystoma* (Philippi, 1844) – Cachia *et al*., p. 47, pl. 7, fig. 2.
2002 *Bela brachystoma* (Philippi, 1844) – Vera Peláez, p. 209; pl. 4, figs K, L, pl. 13, figs L, M.
2009 *Bela brachystoma* (Philippi, 1844) – Mariottini *et al*., p. 4, figs 1-77, 127-140, 151-161.
2008 *Bela brachystoma* (Philippi, 1844) – Chirli & Richard, p. 65, pl. 12, fig. 11.
2008 *Bela brachystoma* (Philippi, 1844) – Cossignani & Ardovini, p. 30, 317, figs a, b-d.
2011 *Bela brachystoma* (Philippi, 1844) – Landau *et al*., p. 33, pl. 17, fig. 9.
2011 *Bela brachystoma* (Philippi, 1844) – Hernández *et al*., p. 224, pl. 74, figs A-B.
2015 *Bela brachystoma* (Philippi, 1844) – Della Bella *et al*., p. 17, figs 37-44.
2015 *Sorgenfreispira brachystoma* (Philippi, 1844) – Mariottini *et al*., p. 434, figs 14-17.
2018 *Sorgenfreispira brachystoma* (Philippi, 1844) – Brunetti & Cresti, p. 94, fig. 381.
2022 *Sorgenfreispira brachystoma* (Philippi, 1844) – Brunetti, p. 72, fig. 152.

non 1878 *Pleurotoma brachystoma* Phil. – Nyst, pl. 3, fig. 18 [= *Sorgenfreispira antwerpiensis* (Marquet, 1997).
non 1882 *Pleurotoma brachystoma* Phil. – Nyst (*partim*), p. 53 [= *Sorgenfreispira antwerpiensis* (Marquet, 1997).
non 1997 *Bela brachystoma* (Philippi, 1844) – Chirli, p. 50, pl. 14, figs 1-2, pl. 13, figs 11-12 [= *Sorgenfreispira pseudoexilis* (Della Bella, Naldi & Scarponi, 2015).

Material and dimensions – Maximum height 7.0 mm, width 2.5 mm. **CO**: NHMW 2020/0171/0209 (23). **VC**: NHMW 2020/0171/0210-0213 (4), NHMW 2020/0171/0214 (6). **EL**: NHMW 2020/0171/0215 (25).

Description – Shell very small, solid, turriculate, with gradate spire; spire angle 20-25°. Protoconch multispiral dome-shaped, 2.75-3.25 convex whorls, with small nucleus; first two whorls smooth, second two with close-set, comma-shaped riblets crossed by 4-7 cordlets, with small tubercles developed at intersections (dp = 560 μm, hp = 630 μm, dp/hp = 0.89, dn = 65 μm, dV1 = 175 μm). Junction with teleoconch delimited by sinusigera. Teleoconch of up to four shouldered whorls, with moderate width convex subsutural ramp, roundly angled at strengthened shoulder cord, convex below, periphery mid-whorl, separated by deeply impressed undulating suture. Axial sculpture predominant, composed of narrow, orthocline to weakly prosocline ribs, 9-12 on last whorl, one-third to one-quarter width of their interspaces, weakened over subsutural ramp. Spiral sculpture of five narrow primary spiral cords, with single secondary thread intercalated from penultimate whorl, 2-3 weaker spirals over subsutural ramp, all spirals finely punctiform. Fine, close-set scabrous growth lines present in spiral interspaces, together with punctiform cords give surface roughened appearance. Surface covered in micropustules (Pl. 33, fig. 4c). Last whorl 53-54% of total height, short, with con-

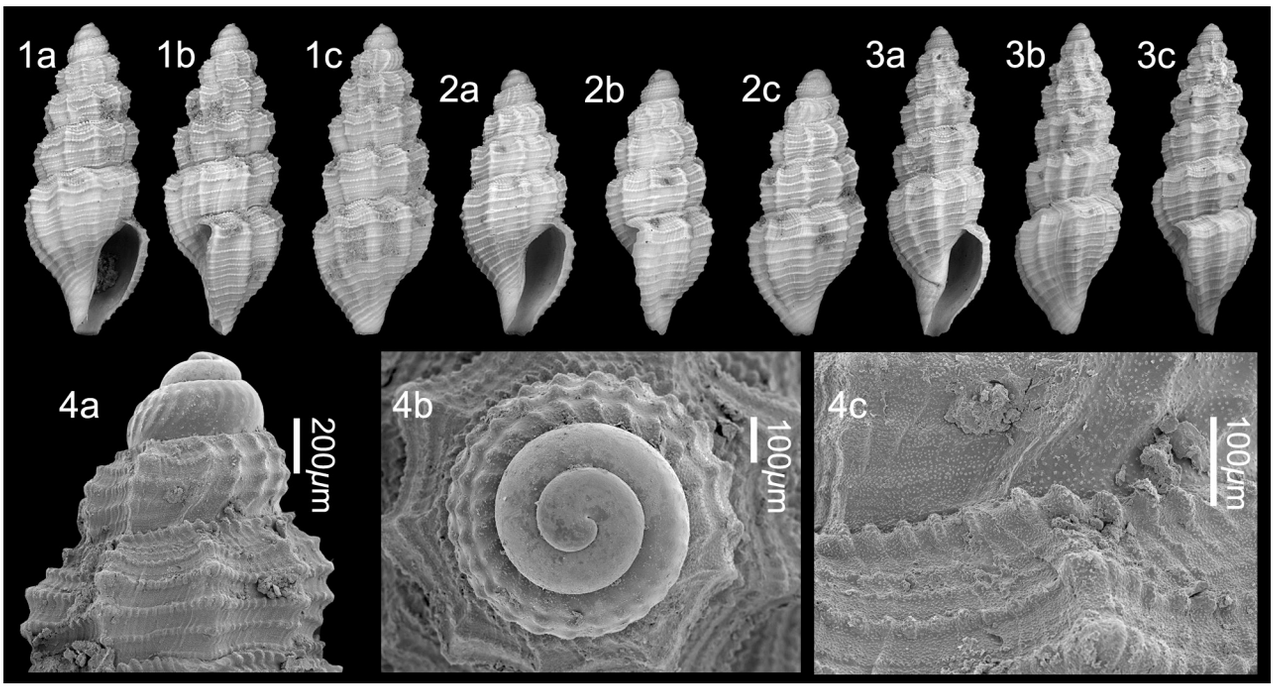

Plate 33. *Sorgenfreispira brachystoma* (Philippi, 1844); 1. NHMW 2020/0171/0210, height 5.3 mm, width 2.0 mm; 2. NHMW 2020/0171/0211, height 5.2 mm, width 2.0 mm; 3. NHMW 2020/0171/0212, height 6.6 mm, width 2.5 mm (digital images); 4. NHMW 2020/0171/0213, 4a-b, detail of protoconch, 4c, detail of teleoconch microsculpture (SEM image). Velerín carretera, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

vex subsutural ramp, sharply delimited by strengthened shoulder cord, convex below, moderately constricted at base; axials persist weakened over base, 8-10 narrow primary cords with secondaries intercalated below shoulder, 5-6 further cords over siphonal fasciole. Aperture 33-36% of total height, small; outer lip thin, not thickened by varix, sharp edged, smooth within; anal sinus broad, moderately deep and symmetrically U-shaped, occupying entire ramp, apex at shoulder; siphonal canal short, bent to left, unnotched. Columella weakly excavated in upper third, straight below, twisted at fasciole. Columellar and parietal callus not thickened, forming narrow indented callus rim.

Discussion – For discussion see *Sorgenfreispira nitida* (Pavia, 1976) and *S. scalariforme* (Brugnone, 1862).

Distribution – Upper Miocene: Proto-Mediterranean, Italy (Montanaro, 1937; Della Bella *et al*., 2015). Lower Pliocene: Atlantic, Guadalquivir Basin, S. Spain (González Delgado, 1993; Landau *et al*., 2011; Brunetti, 2022); western Mediterranean, NE Spain (Martinell, 1982; Gili & Martinell, 1994); central Mediterranean, Italy (Bellardi, 1877; Cavallo & Repetto, 1992; Della Bella *et al*., 2015; Brunetti & Cresti, 2018). Upper Pliocene: ?North Sea Basin, Red Crag, England (S.V. Wood, 1848; Harmer, 1915); western Mediterranean, Estepona Basin, southern Spain (Vera-Peláez, 1996, 2002), NE Spain (Almera & Bofill, 1898; Almera, 1907; Martinell & Domenèch, 1984), France (Chirli & Richard, 2008); central Mediterranean, Italy (Bellardi, 1877; Cipolla, 1914; Malatesta, 1974; Della Bella *et al*., 2015). Lower Pleistocene: ?North Sea Basin, St Erth, England (Harmer, 1915); central Mediterranean, Italy (Cerulli-Irelli, 1910). Present-day: Atlantic, Scandinavia, Norway, British Isles (Fretter & Graham, 1984; Graham, 1988; Hayward *et al*., 1995) to southern Morocco (Mariottini *et al*., 2015), Canary Islands (Hernández *et al*., 2011), central Mediterranean (Nordsieck, 1977a; Bogi *et al*., 1980; Cachia *et al*., 2001), eastern Mediterranean (Nordsieck, 1977a).

Sorgenfreispira nitida (Pavia, 1976)

Plate 34, figs 1-4

*1976	*Bela* (*B.*) *nitida* Pavia, p. 148, pl. 8, figs 17-20.
1992	*Bela* (*Bela*) *nitida* Pavia, 1976 – Cavallo & Repetto, p. 140, fig. 377.
1996	*Bela nitida* Pavia, 1975 [*sic*] – Vera Peláez, p. 558; text-fig. 50, pl. 40, figs 1-3.
1997	*Bela nitida* Pavia, 1975 [*sic*] – Chirli, p. 53, tav. 15, fig. 1
2002	*Bela nitida* Pavia, 1975 [*sic*] – Vera Peláez, p. 209; pl. 4, figs M, N, Ñ.
2008	*Bela nitida* Pavia, 1975 [*sic*] – Chirli & Richard, p. 66, pl. 13, fig. 3.
2015	*Bela nitida* Pavia, 1976 – Della Bella *et al*., p. 19, figs 45-52.
2018	*Sorgenfreispira nitida* (Pavia, 1976) – Brunetti & Cresti, p. 94, fig. 383.

Material and dimensions – Maximum height 6.1 mm, width 2.3 mm. **CO**: NHMW 2020/0171/0216 (14). **VC**:

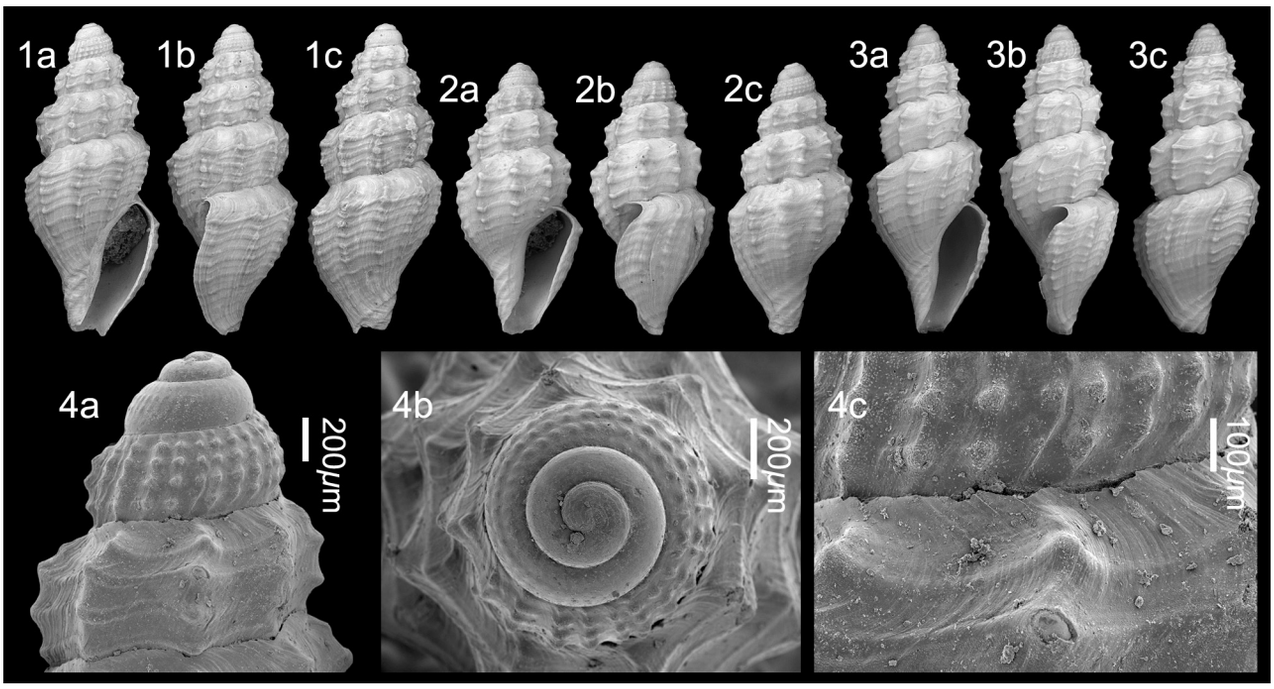

Plate 34. *Sorgenfreispira nitida* (Pavia, 1976); 1. NHMW 2020/0171/0217, height 6.1 mm, width 2.3 mm; 2. NHMW 2020/0171/0218, height 4.6 mm, width 2.0 mm; 3. NHMW 2020/0171/0219, height 5.7 mm, width 2.3 mm (digital images); 4. NHMW 2020/0171/0220, 4a-b, detail of protoconch, 4c, detail of teleoconch microsculpture (SEM image). Velerín carretera, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

NHMW 2020/0171/0217-0220 (4), NHMW 2020/0171/0221 (6).

Description – Shell small, fragile, squat turriculate, with gradate spire; spire angle approximately 30°. Protoconch multispiral dome-shaped, 2.75-3.5 convex whorls, with small nucleus; first whorl with fine spiral lines, post nuclear whorl smooth, last whorl with close-set, comma-shaped riblets crossed by 4-7 cordlets, with small tubercles developed at intersections (dp = 860 μm, hp = 770 μm, dp/hp = 1.12, dn = 105 μm, dV1 = 220 μm). Junction with teleoconch delimited by sinusigera. Teleoconch of up to 3.5 shouldered whorls, with broad convex subsutural ramp, inclination diminishing abapically, roundly angled at shoulder, convex below, periphery mid-whorl, separated by narrowly impressed undulating suture. Axial sculpture predominant, composed of narrow, arched, opisthocline ribs, 9-12 on last whorl, much narrower than their interspaces, weakened over subsutural ramp. Spiral sculpture of narrow spiral cords, three on first teleoconch whorl, four on second, five on penultimate whorl, forming small, rounded tubercles at axial intersections. Surface covered in very small and sparce micropustules (Pl. 34, fig. 4c). Last whorl 59-62% of total height, with broad, convex, weakly inclined subsutural ramp, one weak cord placed close to periphery, delimited and sharply angled at shoulder cord that is not strengthened, convex below, moderately constricted at base: axials fading over base, 9-10 narrow cords, irregular in strength and position to alternating in strength, below shoulder, 5-6 further slightly stronger cords over siphonal fasciole. Aperture about 42% of total height, pyriform; outer lip thin, not thickened by varix, sharp edged, smooth within; anal sinus deeply and symmetrically U-shaped, occupying entire ramp, apex mid-ramp; siphonal canal moderate length, bent to left, unnotched. Columella broadly and weakly excavated in upper half, twisted at fasciole. Columellar and parietal callus slightly thickened, sharply delimited, forming narrow callus rim.

Discussion – As noted by Pavia (1976, p. 150), the profile and sculpture change with ontogeny and the strength of the primary cords and presence and strength of secondary spiral sculpture. It differs from *Sorgenfreispira brachystoma* (Philippi, 1844) and *S. scalariforme* (Brugnone, 1862), with which it co-occurs in the Estepona assemblages in being more fragile, in having a broader profile, more inflated whorls, a broader subsutural ramp not delimited by a markedly stronger shoulder cord, and broader, non-granular spirals.
Della Bella *et al*. (2015, p. 19) note that *S. nitida* is typically, but not exclusively circalittoral. In the Estepona assemblage it almost exclusively found in the deeper water Velerín carretera deposits, which we consider to be lower circalittoral to upper bathyal, whereas all the other *Sorgenfreispira* species occur in the shallower-water facies.

Distribution – Upper Miocene: Proto-Mediterranean, Italy (Pavia, 1976). Lower Pliocene: central Mediterranean, Italy (Pavia, 1976; Cavallo & Repetto, 1992; Chirli, 1997; Della Bella *et al*., 2015; Brunetti & Cresti, 2018).

Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (Vera-Peláez, 1996, 2002), France (Chirli & Richard, 2008); central Mediterranean, Italy (Della Bella *et al*., 2015). Lower Pleistocene: central Mediterranean, Italy (Della Bella *et al*., 2015).

***Sorgenfreispira scalariforme* (Brugnone, 1862)**
Plate 35, figs 1-4

*1862 *Pleurotoma scalariforme* Brugnone, p. 23, pl. 1, fig. 16.
1877 *Raphitoma scalariformis* (Brugn.) – Bellardi, p. 319, pl. 9, fig. 33.
1898 *Pleurotoma* (*Raphitoma*) *scalariforme* Brugnone – Almera & Bofill, p. 44, pl. 3, fig. 2.
1902 *Rhaphitoma* [*sic*] *subcylindrata* Boettger, p. 75, no. 243.
1906 *Rhaphitoma* [*sic*] *subcylindrata* Bttgr – Boettger, p. 83, no. 308.
1907 *Pleurotoma* (*Raphitoma*) *scalariforme* Brugnone – Almera, p. 154, pl. 7, fig. 2.
1914 *Daphnella* (*Raphitoma*) *scalariformis* Brugnone – Cipolla, p. 67 [170], pl. 3 [14], fig. 21.
1928 *Raphitoma plicatella* Jan – Friedberg, p. 572, pl. 37, figs 14-16 [*non Bela plicatella* (Bellardi, 1847)].
1934 *Cythara* (*Mangelia*) *subcylindrata* (Boettger) – Zilch, p. 267, pl. 19, fig. 31.
1938 *Daphnella* sp. an n. sp. – Friedberg, p. 153, text-fig. 49.
1958 *Mangelia* (*Mangelia*) *subcylindrata* Boettger – Švagrovský, p. 28, pl. 8, figs 8, 9.
1963 *Cythara* (*M*.) *scalariformis* (Brugn.) – Venzo & Pelosio, p. 128, pl. 11, fig. 23.
1976 *Bela* (*B*.) *scalariformis* (Brugnone) – Pavia, p. 113, pl. 8, fig. 16.
1992 *Bela* (*Bela*) *scalariformis* (Brugnone, 1862) – Cavallo & Repetto, p. 140, fig. 378.
1997 *Bela scalariformis* (Brugnone, 1862) – Chirli, p. 54, pl. 15, figs 2-4.
2001 *Bela scalariformis* (Brugnone, 1862) – Silva, p. 541, pl. 25, figs 6-10.
2002 *Bela scalariformis* (Brugnone, 1862) – Vera-Peláez, p. 210; pl. 4, figs C', D'.
2003 *Cythara* (*Mangelia*) *subcylindrata* (Boettger, 1901 [sic]) – Bałuk, p. 60, pl. 22, figs 1-4.
2011 *Bela scalariforme* (Brugnone, 1862) – Landau *et al*., p. 34, pl. 17, fig. 11.
2013 *Bela scalariformis* (Brugnone, 1862) – Landau *et al*., p. 267, pl. 44, figs 8, 9, pl. 71, fig. 5.
2015 *Bela scalariforme* (Brugnone, 1862) – Della Bella *et al*., p. 20, figs 53-60.

Material and dimensions – Maximum height 8.1 mm, width 2.8 mm. **CO**: NHMW 2020/0171/0222-0225 (4), NHMW 2020/0171/0226 (10). **EL**: NHMW 2020/0171/0682 (10).

Description – Shell small, moderately solid, turriculate, with tall gradate spire; spire angle approximately 25°. Protoconch multispiral dome-shaped, 3.0-3.5 convex whorls, with small nucleus; first two whorls smooth, second two with close-set, comma-shaped riblets crossed by 5-7 cordlets, with small tubercles developed at inter-

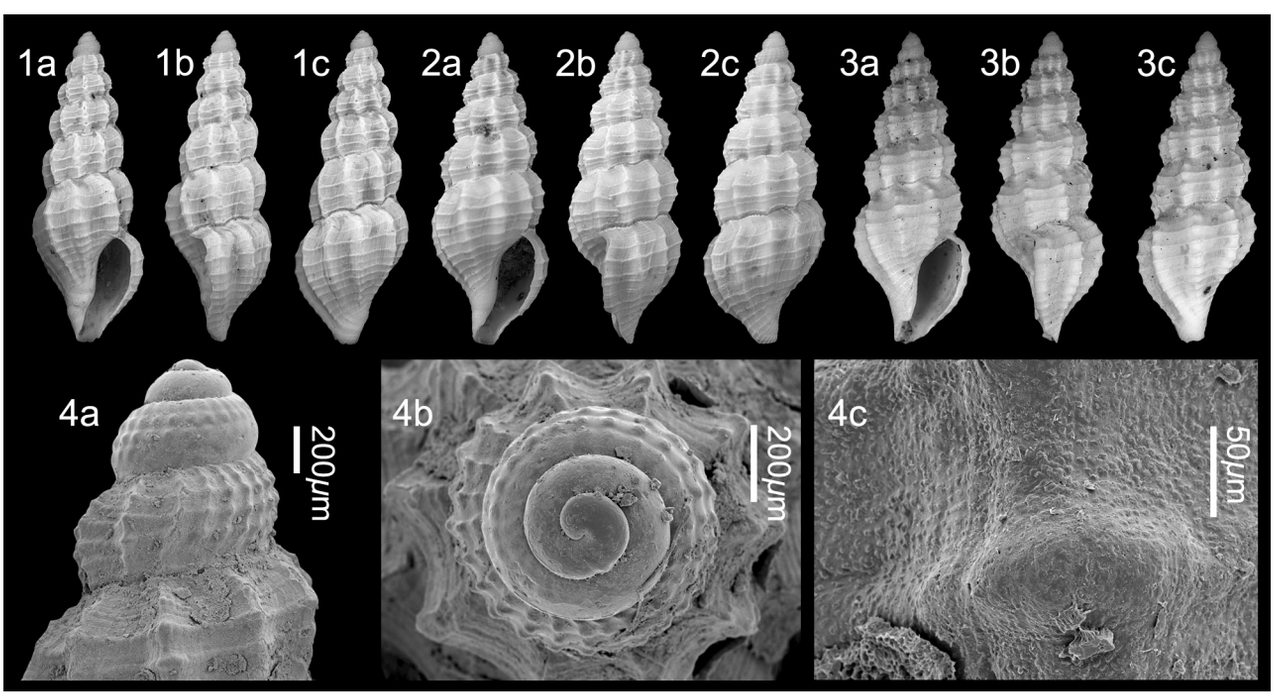

Plate 35. *Sorgenfreispira scalariforme* (Brugnone, 1862); 1. NHMW 2020/0171/0222, height 8.1 mm, width 2.8 mm; 2. NHMW 2020/0171/0223, height 7.5 mm, width 2.8 mm; 3. NHMW 2020/0171/0224, height 5.7 mm, width 2.3 mm (digital images); 4. NHMW 2020/0171/0225, 4a-b, detail of protoconch, 4c, detail of teleoconch microsculpture (SEM image). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

sections (dp = 725 μm, hp = 915 μm, dp/hp = 0.79, dn = 85 μm, dV1 = 215 μm). Junction with teleoconch sharply delimited by sinusigera. Teleoconch of up to 5.5 convex whorls, with moderate width convex, poorly delimited subsutural ramp, roundly angled at slightly strengthened shoulder cord, weakly convex below, periphery at shoulder, separated by narrowly impressed undulating suture. Axial sculpture predominant, composed of rounded, orthocline ribs, 9-12 on last whorl, about half to one-third width of their interspaces, only slightly weakened over subsutural ramp. Spiral sculpture of four primary cords, second cord delimiting shoulder, with secondary thread intercalated from third teleoconch whorl, 2-3 weaker spirals above first primary over subsutural ramp, all spirals finely punctiform. Fine, close-set scabrous growth lines present in spiral interspaces, together with weakly punctiform cords give surface slightly roughened appearance. Surface covered in dense micropustules (Pl. 35, fig. 4c). Last whorl short, 52-54% of total height, with convex subsutural ramp, sharply delimited by slightly strengthened shoulder cord, convex below, moderately constricted at base; axials persist weakened over base, 6-7 narrow primary cords with secondaries intercalated below shoulder, 5-6 further cords over siphonal fasciole. Aperture small, about 34% of total height; outer lip thin, not thickened by varix, sharp edged, smooth within; anal sinus shallow, symmetrically U-shaped, occupying entire ramp, apex mid ramp; siphonal canal moderately short, bent to left, unnotched. Columella broadly and weakly excavated in upper half, twisted at fasciole. Columellar and parietal callus not thickened, forming narrow indented callus rim.

Discussion – *Sorgenfreispira scalariforme* (Brugnone, 1862) differs from *S. brachystoma* (Philippi, 1844) in being taller, with a more gradate spire, with a greater number of teleoconch whorls, and in having a shallower anal sinus. The spiral cords are not smooth as stated by Vera-Peláez (2002, p. 211), but the tubercles are finer than in *S. brachystoma* and the axial growth lines less scabrous, resulting in a less roughened appearance. *Sorgenfreispira nitida* (Pavia, 1976) is much squatter, thinner shelled, with fewer whorls that are more strongly shouldered and a comparatively larger aperture. The protoconch is also lower dome-shaped (dp/hp = 0.79 vs. dp/hp = 1.12).

Distribution – Middle Miocene: Paratethys (Langhian-Serravallian): Poland (Friedberg, 1928, 1938; Bałuk, 2003), Slovakia (Švagrovský, 1958), Romania (Boettger, 1902, 1906; Zilch, 1934); Proto-Mediterranean (Serravallian): Karaman Basin, Turkey (Landau *et al*., 2013). Upper Miocene: Proto-Mediterranean (Messinian): Po Basin, Italy (Venzo & Pelosio, 1963). Lower Pliocene: northeastern Atlantic, Guadalquivir Basin, S. Spain (Landau *et al*., 2011); western Mediterranean, NE Spain (Almera & Bofill, 1898; Almera, 1907); central Mediterranean, Italy (Pavia, 1976; Cavallo & Repetto, 1992; Chirli, 1997; Della Bella *et al*., 2015). Upper Pliocene: Atlantic, Mondego Basin, Portugal (Silva, 2001); western Mediterranean, Estepona Basin, Spain (Vera-Peláez, 2002); central Mediterranean, Italy (Bellardi, 1877; Cipolla, 1914; Della Bella *et al*., 2015). Lower Pleistocene: central Mediterranean, Italy (Della Bella *et al*., 2015).

***Sorgenfreispira planicostata* nov. sp.**
Plate 36, figs 1-3

ZooBank registration – https://zoobank.org/NomenclaturalActs/15085E4C-3C20-4637-94B6-31FB71DAAB14

Type material – Holotype NHMW 2020/0171/0227, height 5.7 mm, width 2.2 mm; paratype 1 NHMW 2020/0171/0228, height 5.9 mm, width 2.3 mm; paratype 2 NHMW 2020/0171/0229, height 5.5 mm, width 2.1 mm.

Other material – Maximum height 5.9 mm, width 2.3 mm**. CO**: NHMW 2020/0171/0230 (4).

Type locality – Velerín conglomerates, Estepona, Spain.

Type stratum – Lower Piacenzian, Upper Pliocene.

Etymology – Name reflecting the flattened cords characteristic to this species. *Sorgenfreispira* gender feminine.

Diagnosis – *Sorgenfreispira* species of small size, 4.5 convex, weakly shouldered teleoconch whorls, 13 rounded axial ribs, flattened spiral cords not swollen or forming tubercles at intersections, punctiform secondary spiral sculpture absent.

Description – Shell small, moderately solid, elevated, turriculate, with gradate spire; spire angle approximately 25°. Protoconch multispiral dome-shaped, 3.5 convex whorls, with small nucleus; first 2.5 whorls smooth, last whorl with close-set, comma-shaped riblets crossed by four cordlets, with small tubercles developed at intersections (dp = 790 μm, hp = 780 μm, dp/hp = 1.01, dn = 100 μm, dV1 = 210 μm). Junction with teleoconch delimited by sinusigera. Teleoconch of up to 4.5 shouldered whorls, with moderate width convex subsutural ramp, rounded at shoulder cord, convex below, periphery above mid-whorl, separated by narrowly impressed weakly undulating suture. Axial sculpture composed of weakly opisthocline ribs, 13 on last whorl, slightly narrower than their interspaces, weakened over subsutural ramp. Spiral sculpture of four primary suprasutural cords, second cord delimiting shoulder; cords initially rounded, flattened abapically, not swollen over ribs. No secondary sculpture. Interspaces between cords bearing extremely fine crowded micropustules (Pl. 36, fig. 1f). Last whorl about 62% of total height, with flattened subsutural ramp, obtusely angled at shoulder cord, convex below, moderately constricted at base; axials persist weakened over base, 7-8 flattened cords or irregular width below shoulder, 5-6 further cords over siphonal fasciole; single secondary cord intercalated on second half of last

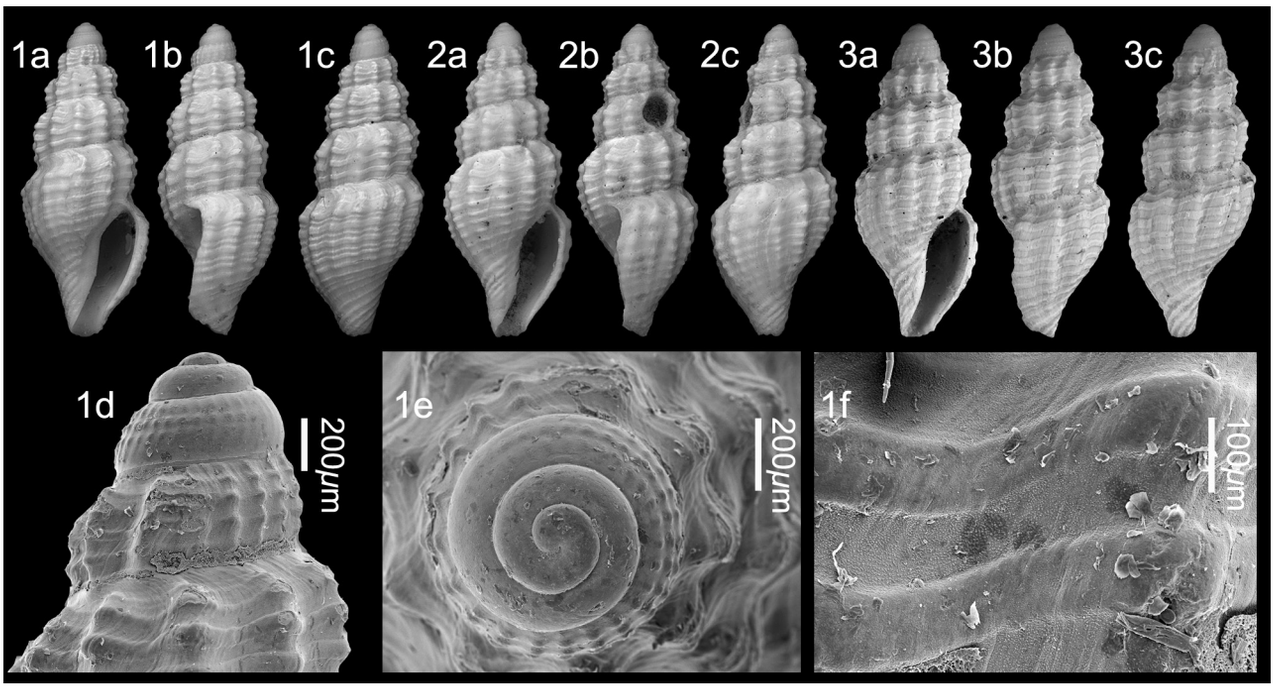

Plate 36. *Sorgenfreispira planicostata* nov. sp.; 1. **Holotype** NHMW 2020/0171/0227, height 5.7 mm, width 2.2 mm, 1d-e, detail of protoconch, 1f, detail of teleoconch sculpture; 2. **Paratype 1** NHMW 2020/0171/0228, height 5.9 mm, width 2.3 mm; 3. **Paratype 2** NHMW 2020/0171/0229, height 5.5 mm, width 2.1 mm. (digital images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

whorl in some specimens. Aperture narrow, pyriform, about 41% of total height; outer lip thin, not thickened by varix, sharp edged, smooth within; anal sinus moderate breadth and depth, symmetrically U-shaped, occupying entire ramp; siphonal canal moderately short, bent to left, unnotched. Columella excavated in upper third, straight below, twisted at fasciole. Columellar and parietal callus not thickened, forming poorly delimited, narrow callus rim.

Discussion – *Sorgenfreispira planicostata* nov. sp. differs from *S. brachystoma* (Philippi, 1844) and *S. scalariforme* (Brugnone, 1862) in having smooth, flattened ribs without any secondary sculpture, except on the last half whorl in some specimens, and lacking the granules over the spirals and coarse axials growth lines that give those two species a roughened surface appearance. In *S. planicostata* the spiral interspaces are smooth, extremely fine micropustules are present in the interspaces between the ribs. The most similar is *S. nitida* (Pavia, 1976), but that species is more fragile, with tubercles developed at the sculptural intersections and it has secondary spirals, both absent in *S. planicostata*. This species is found only in the shallower water assemblage of Velerín conglomerates.

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

Genus *Vexiguraleus* Powell, 1942

Type species – *Vexiguraleus clifdenensis* Powell, 1942, by original designation, New Zealand, Miocene.

1942 *Vexiguraleus* Powell, p. 145.

Note – Generic placement of this group of European fossil mangeliids has been problematic. They are characterised by having multispiral protoconchs of 3.5-4.0 convex whorls with a very small nucleus, the last two whorls bearing cordlets and riblets forming reticulated pattern, and the surface covered in scattered micropustules. They have often been assigned to the genus *Bela* Leach *in* Gray, 1847a, but species in that genus with multispiral protoconch are characterised by having smooth whorls, except for the last, where low, curved axial riblets are overrun by a few rows of obsolete spiral elements forming swollen tubercles at the intersection (Scarponi *et al*., 2014, p. 50).
We have assigned this group to the Antipodean genus *Vexiguraleus* Powell, 1942 (RG-S). That genus is characterised by its ovate-fusiform profile, weakly shouldered whorls, multispiral protoconch with first 1.5 whorls smooth, later whorls bearing acuate riblets and four narrow spirals on last ¼-½ protoconch whorl, adult sculpture of moderately strong flexuous axial ribs, overridden by weaker distant spiral threads, outer lip thin, broad, very shallow subsutural sinus, aperture elongate-pyriform terminating in a short, only slightly twisted, unnotched siphonal canal (Powell, 1966, p. 106). However, it is possible that this group needs a separate genus.

***Vexiguraleus hispidulus* (Bellardi, 1847)**
Plate 37, figs 1-10

1844 *Pleurotoma decussatum* Philippi, p. 174, pl. 26, fig. 23 (*non* Couthouy, 1839).
*1847 *Raphitoma hispidula* Jan (*Pleurotoma*) Bellardi, p. 92, pl. 4, fig. 17.
1855 *Pleurotoma nuperrimum* Tiberi, p. 14, pl. 2, figs 7-9.
1877 *Raphitoma hispidula* Jan – Bellardi, p. 304, pl. 9, figs 17-18.
1891 *Raphitoma reconditum* Locard, p. 59.
1897 *Raphitoma peregrinator* Locard, p. 229, pl. 10, figs 28-31.
1904 *Raphitoma hispidula* var. *pliocostatissima* Sacco, p. 55.
1904 *Raphitoma hispidula* var. *pliosubcancellata* Sacco, p. 55, pl. 14, fig. 37.
1904 *Raphitoma hispidula* var. *convexiuscula* Sacco, p. 56, pl. 14, fig. 38.
?1904 *Raphitoma hispidula* var. *pliocostulatissima* Sacco, p. 56, pl. 14, fig. 39.
1910 *Raphitoma hispidula* Jan – Cerulli-Irelli, p. 64 [256], pl. 6 [37], fig. 13.
1910 *Raphitoma hispidula* var. *pliocostatissima* Sacco – Cerulli-Irelli, p. 64 [256], pl. 6 [37], fig. 14.
1914 *Daphnella* (*Raphitoma*) *hispidula* Jan – Cipolla, p. 164, pl. 14, fig. 2.
1930 *Raphitoma hispidula* Jen [*sic*] – Patrini, p. 37, pl. 3, fig. 18.
?1937 *Daphnella* (*Raphitoma*) *hispidula* (Jan) *in* Bell. – Montanaro, p. 182, pl. 8, fig. 42.
1955 *Raphitoma hispidula* Jan – Malaroda, p. 54, pl. 1, fig. 5.
1968 *Raphitoma* (*Amblyacrum*) *nuperrima* (Tiberi) – Nordsieck, p. 178, pl. 30, fig. 94.40.
1976 *Raphitoma* (*Raphitoma*) *hispidula* (Jan) – Marasti & Raffi, p. 197, pl. 2, figs 14, 15.
1980 *Mangelia nuperrima* (Tiberi, 1855) – Bouchet & Warén, p. 30, figs 81, 215.
1992 *Neoguraleus hispidulus* (Jan in Bellardi, 1847) – Cavallo & Repetto, p. 144, fig. 399.
1993 *Bela hispidula* (Jan, 1847) – González Delgado, p. 39, pl. 4, figs 4, 5.
1996 *Bela hispidula* (Bellardi, 1847) – Vera-Peláez, p. 540, text-fig. 47, pl. 39, figs 5-12.
1997 *Raphitoma hispidula* Jan *in* Bellardi, 1847 – Chirli, p. 80, pl. 23, figs 1-4.
1997 *Mangelia nuperrima* (Tiberi, 1855) – Giribet & Peñas, p. 52, figs 52-53.
1998 *Neoguraleus hispidulus* (Jan *in* Bellardi, 1847) – Bogi & Cauli, p. 130, fig. 5.
1999 *Bela hispidula* (Bellardi, 1847) – Vera-Peláez *et al*., p. 5, figs 5A-C.
1999 *Bela nuperrima* (Tiberi) – Ardovini & Cossignani, p. 18, 69, fig. 5.
2001 *Mangelia nuperrima* (Tiberi, 1855) – Cachia *et al*., p. 54, pl. 8, fig. 3.
2002 *Bela hispidula* (Bellardi, 1847) – Vera-Peláez, p. 208, pl. 4, figs V, W, pl. 13, fig. K.
2008 *Neoguraleus hispidulus* (Jan in Bellardi, 1847) – Chirli & Richard, p. 67, pl. 13, fig. 7.
2011 *Bela hispidula* (Bellardi, 1847) – Landau *et al*., p. 34, pl. 17, fig. 8 (not 10 as stated: *lapsus*).
2011 *Mangelia nuperrima* (Tiberi, 1855) – Hernández *et al*., p. 227, pl. 75, figs M-P.
2013 *Bela hispidula* (Bellardi, 1847) – Landau *et al*., p. 265, pl. 44, figs 5-6.
2015 *Bela hispidula* (Bellardi, 1847) – Della Bella *et al*., p. 36, figs 97-100.
2015 *Bela nuperrima* (Tiberi, 1855) – Della Bella *et al*., p. 41, figs 109-112.
2018 *Bela hispidula* (Bellardi, 1847) – Brunetti & Cresti, p. 94, fig. 387.

non 1872 *Pleurotoma hispidula* Monterosato, p. 52 (*nomen nudum* = *Raphitoma histrix* Bellardi, 1847).
non 1872 *Pleurotoma hispidula* Jan. – S.V. Wood, p. 42, pl. 3, fig. 3 [= *Bela belgica* (Van Regteren Altena, 1959)].
non 1915 *Raphitoma hispidula* Bellardi – Harmer, p. 260, pl. 29, fig. 27 [= *Bela belgica* (Van Regteren Altena, 1959)].
non 1918 *Raphitoma nuperrima* (Tiberi) – Harmer, p. 386, pl. 39, fig. 5.
non 1928 *Raphitoma hispidula* Jan – Friedberg, p. 572, pl. 37, figs 12. 13 [= *Bela zejszneri* Friedberg, 1912)].
non 1960 *Mangelia hispidula* (Jan) – Bàldi, p. 86, pl. 2, fig. 14.
non 1960 *Mangelia hispidula* (Jan *in* Bellardi 1847) – Kojumdgieva *in* Kojumdgieva & Strachimirov, p. 206, pl. 48, fig. 21.
non 1962 *Bela hispidula* (Jan) – Hölzl, p. 291, pl. 1, figs 5, 9.
non 1964 *Brachytoma hispidula* (Bellardi 1848) – Anderson, p. 296, pl. 37, fig. 246.
non 1969 *Raphitoma hispidula* (Jan) – Atanacković, p. 212, pl. 12, fig. 12.
non 1970 *Bela hispidula* (Jan) – Greco, p. 291, pl. 1, figs 5, 9.
non 1974 *Raphitoma* (*Raphitoma*) *hispidula* (Jan in Bell.) 1847 – Caprotti, p. 33, pl. 4, fig. 5.

Material and dimensions – Maximum 13.1 mm, width 5.2 mm. **CO**: NHMW 2020/0171/0516 (26), NHMW 2020/0171/0623 (1), NHMW 2020/0171/0657 (1). **VC**: NHMW 2020/0171/0517-0520 (4), NHMW 2020/0171/0521 (50+), NHMW 2020/0171/0539-0540 (2), NHMW 2020/0171/0622 (4). **EL**: NHMW 2020/0171/0634 (12), NHMW 2020/0171/0658 (1), NHMW 2020/0171/0659 (1).

Description – Shell of medium size and thickness, broad fusiform, with scalate spire; spire angle 35-40°. Protoconch multispiral, elevated dome-shaped, 3.5 convex whorls with very small nucleus, last two whorls bearing cordlets and riblets forming reticulated pattern, surface covered in scattered micropustules (dp = 930 μm, hp = 925 μm, dp/hp = 1.01, dn = 80 μm, dV1 = 210 μm). Junction with teleoconch sharply delimited by sinusigera. Teleoconch of up to 4.5 strongly shouldered whorls, with broad, straight subsutural ramp, obtusely angled at shoulder, convex be-

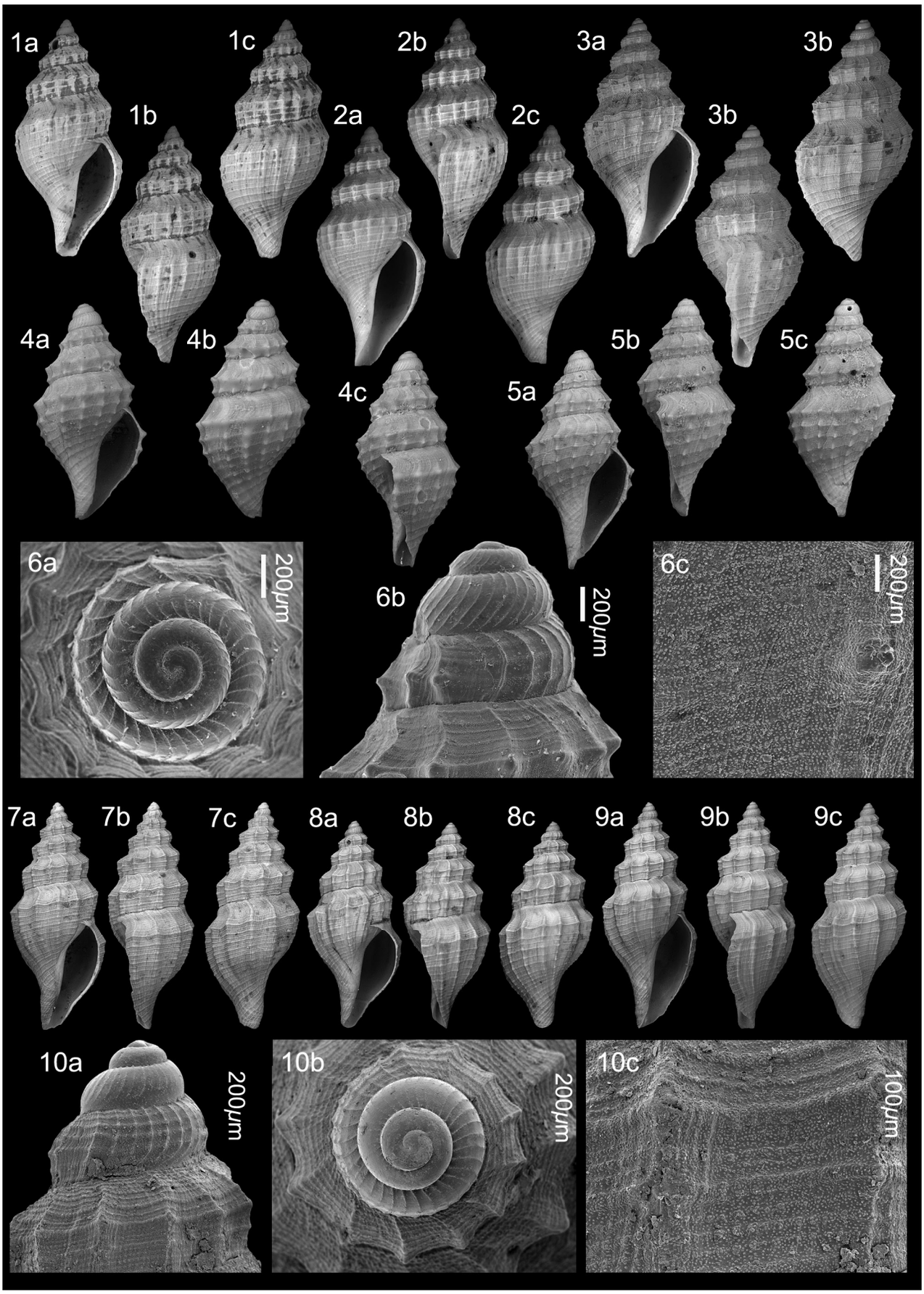
1a
1b
1c
2a
2b
2c
3a
3b
3b
4a
4b
4c
5a
5b
5c
6a
200µm
6b
200µm
6c
200µm
7a
7b
7c
8a
8b
8c
9a
9b
9c
10a
200µm
10b
200µm
10c
100µm

Plate 37

low, separated by narrowly impressed, weakly undulating suture. Axial sculpture strongly predominant, composed of sharp, narrow, weakly prosocline ribs, 15-20 on last whorl, much narrower their interspaces, weaker and arcuate over subsutural ramp, extending to abapical suture. Spiral sculpture of very fine punctiform cords, on second teleoconch whorl 2-3 weaker cords on subsutural ramp, usually three primary cords below (two in some specimens), adapical of which forms shoulder cord, extremely fine spirals of secondary and tertiary strength intercalated from second whorl; small tubercles developed on primary cords at intersections, all spirals minutely punctiform. Surface covered in dense micropustules (Pl. 37, fig. 6c). Last whorl 68-71% of total height, profile and sculpture as described above, convex below shoulder, moderately constricted at base; axials weakening over base, fine spirals persist over base, slightly stronger subequal cords over siphonal fasciole. Aperture 48-53% of total height, subrectangular; outer lip not thickened by varix, sharp edged, smooth within; anal sinus very broad and shallow, symmetrically U-shaped, occupying entire subsutural ramp, apex mid-ramp; siphonal canal medium length, bent to left, unnotched. Columella smooth, weakly excavated in upper third, straight below, slightly twisted at fasciole. Columellar and parietal callus hardly thickened, sharply delimited, forming narrow, indented callus rim.

Discussion – Della Bella *et al.* (2015, p. 36) considered there to be confusion in the literature on fossils between *Bela hispidula* (Bellardi, 1847) and *Bela nuperrima* (Tiberi, 1855), and concluded that *B. hispidula* differed in having a variable, but always greater number of axial ribs (*B. hispidula* 15-20; *fide* Bellardi, 1877, p. 304 vs. *B. nuperrima* 12-15, Estepona specimens), coarser cancellate sculpture with small spinous tubercles developed at the intersections, three tuberculose spiral cords on the second teleoconch whorl as opposed to two in *B. nuperrima*, and the protoconch was proportionately smaller. In their chresonymy they corrected some of the historical records for these two species. Unfortunately, discussion in that work is extremely brief and no descriptions are given. There is no indication of the rib counts for each species and protoconch measurements are not given and almost impossible to calculate based on their illustrations, as apical views are not given for these two species, and in the case of *B. hispidula* the side view does not catch the protoconch/teleoconch boundary. There is also a *lapsus* in the chresonymy, as the Estepona record of *B. hispidula* by Vera-Peláez (2002) is placed in the chresonymy of both species, but in the text of *B. hispidula* by Della Bella *et al.* (2015, p. 37) it states that Vera-Peláez's record is a misidentification.
Based on the Estepona material, this distinction seems rather artificial. It is not always easy to distinguish between the two forms and a continuum can be seen with only a small number of specimens having more than 16 ribs. Moreover, some of the specimens with more ribs (i.e., *B. hispidula*) have three primary cords on the second teleoconch whorl (Pl. 37, fig. 1). We also note that the extant specimen of *B. nuperrima* illustrated by Bouchet & Warén (1980, fig. 80) probably has about 16 ribs on the last whorl. The protoconch figured for *B. hispidula* is larger and not smaller than that of *B. nuperrima* (dp = 930 μm, hp = 925 μm vs. dp = 780 μm, hp = 805 μm) as suggested by Della Bella *et al.* In Estepona, '*nuperrima*' form is found primarily in the shallower water deposits and '*hispidula*' form in the deeper-water assemblages. We are unconvinced by the distinction between the two species given Della Bella *et al.* (2015) and consider them synonyms, and place it in the genus *Vexiguraleus* Powell, 1942.
The specimens from the Serravallian Middle Miocene of the Karaman Basin, Turkey identified as *B. hispidula* by Landau *et al*. (2013, pl. 44, figs 5-6) are probably not this species. The number of ribs is similar, but shell is slenderer fusiform, and the sculpture is smoother.
Bela hispida (Bellardi, 1877) (syntype illustrated by Ferrero Mortara *et al*., 1981, pl. 18, fig. 9) from the Tortonian Upper Pliocene of Italy is very similar to *V. hispidulus*. Bellardi (1877, p. 299) said it differed from *B. hispidula* in "*La spira più breve, l'ultimo anfratto più lungo, l'angolo spirale più aperto, e specialmente la coda comparativamente lunga e diritta e la columella depressa posteriormente*" [shorter, spire, taller last whorl, wider apical angle, and especially the comparatively long siphonal canal, and the columella depressed posteriorly]. The spire looks more gradate than in *V. hispidulus* and the siphonal canal does indeed appear longer and straighter, however, we have not seen this Tortonian species.

Distribution – Upper Miocene: Proto-Mediterranean, Italy (Bellardi, 1877; Montanaro, 1937). Lower Pliocene: Atlantic, Guadalquivir Basin, S. Spain (Gonzàlez Delgado, 1993; Landau *et al*., 2011); central Mediterranean, Italy (Bellardi, 1877; Sacco, 1904; Cavallo & Repetto, 1992; Chirli, 1997; Della Bella *et al*., 2015; Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (Vera-Peláez *et al*., 1999, Vera-Peláez, 2002); central Mediterranean, Italy (Bellardi, 1877; Sacco, 1904; Cipolla, 1914; Harmer, 1915; Patrini, 1930; Malaroda, 1955; Marasti & Raffi, 1976; Cavallo & Repet-

Plate 37. *Vexiguraleus hispidulus* (Bellardi, 1847); 1. NHMW 2020/0171/0623, height 11.8 mm, width 5.3 mm; 2. NHMW 2020/0171/0657, height 10.6 mm, width 5.0 mm. Velerín conglomerates, Velerín. 3. NHMW 2020/0171/0658, height 9.5 mm, width 4.4 mm. El Lobillo. 4. NHMW 2020/0171/0539 (subadult), height 6.5 mm, width 3.1 mm; 5. NHMW 2020/0171/0540 (subadult), height 5.9 mm, width 3.2 mm (SEM images); 6. NHMW 2020/0171/0660, height 5.8 mm, width 2.8 mm, 6a-b, detail of protoconch, 6c, detail of teleoconch microsculpture; 7. NHMW 2020/0171/0517, height 11.8 mm, width 4.8 mm; 8. NHMW 2020/0171/0518, height 10.0 mm, width 4.6 mm; 9. NHMW 2020/0171/0519, height 11.5 mm, width 4.5 mm (digital images); 10. NHMW 2020/0171/0520, 10a-b, detail of protoconch, 10c, detail of teleoconch microsculpture (SEM image). Velerín carretera, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

to, 1992; Della Bella *et al*., 2015). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1910). Present-day Atlantic Lusitanian region (Bouchet & Warén, 1980), Canary Islands (Hernández *et al*., 2011), and Mediterranean (Bouchet & Warén, 1980; Giribet & Peñas, 1997; Ardovini & Cossignani, 1999; Cachia *et al*., 2001).

***Vexiguraleus iberoangulatus* nov. sp.**
Plate 38, fig. 1

ZooBank registration – https://zoobank.org/NomenclaturalActs/0890798A-7DF7-4632-9DB7-1F5ADCA0BF99

Type material – Holotype NHMW 2020/0171/0571, height 8.1 mm, width 3.7 mm; paratype 1 NHMW 2020/0171/0661, height 8.5 mm, width 3.9 mm (incomplete).

Other material – Known from type series only.

Type locality – El Lobillo, Estepona, Spain.

Type stratum – Lower Piacenzian, Upper Pliocene.

Etymology – Compound name combining the Iberian Peninsula and the angular profile of the whorls. *Vexiguraleus* gender masculine.

Diagnosis – *Vexiguraleus* species of small size, biconic, protoconch multispiral, teleoconch of four angular whorls with very broad and flat subsutural ramp, nine rounded ribs, tubercular at shoulder, and narrow elevated cords, two below shoulder on spire whorls, secondaries intercalated on last whorl.

Description – Small shell of medium thickness, squat biconic; spire angle 40°. Protoconch multispiral, elevated, of at least three convex whorls (nucleus missing and surface abraded). Junction with teleoconch marked by sinusigera. Teleoconch of 4.25 angular whorls, with very broad, flat subsutural ramp, sharply delimited at angular shoulder by cord, weakly convex below, separated by narrowly impressed, weakly undulating suture. Axial sculpture of elevated, rounded ribs extending between sutures, nine on last whorl, roughly half width of their interspaces. Spiral sculpture of two cords on first teleoconch whorl, upper placed mid-whorl becomes shoulder cord. Two weaker cords develop over suprasutural ramp on second teleoconch whorl. Third primary cord appears just above suture on second half of penultimate whorl. No secondary sculpture developed on spire whorls. Last whorl 68% of total height, subsutural ramp very broad and flat, bearing undulating subsutural cord plus three further cords of subequal strength. Shoulder sharply delimited by slightly strengthened cord, profile almost straight below, tapering inwards to fasciole; fasciole of medium length; axials weaken over base; spiral sculpture of five primary cords (including shoulder cord) over base, with single secondary intercalated in interspaces, ten thicker cords of equal strength over fasciole, becoming more crowded abapically. Aperture 50% of total height, ovate-subrectangular; outer lip not thickened by varix (edge broken), smooth within; anal sinus very broad and shallow, asymmetrically U-shaped, occupying entire subsutural ramp, apex on adapical half of ramp; siphonal canal medium length, broad, bent slightly to left (tip damaged). Columella smooth, weakly excavated in upper half, twisted at fasciole. Columellar and parietal callus hardly thickened, moderately delimited, forming narrow callus rim.

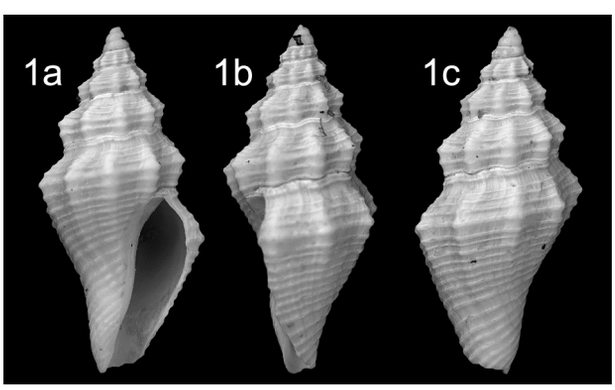

Plate 38. *Vexiguraleus iberoangulatus* nov. sp.; 1. **Holotype** NHMW 2020/0171/0571, height 8.1 mm, width 3.7 mm (digital image). El Lobillo, Estepona, Lower Piacenzian, Upper Pliocene.

Discussion – Although represented by only two specimen, *Vexiguraleus iberoangulatus* nov. sp. is quite distinctive and quite unlike any other Mediterranean mangeliid. We provisionally place it in the genus *Vexiguraleus* Powell, 1942, as it is most similar to *Vexiguraleus hispidulus* (Bellardi, 1847) (see above), but differs in more strongly angular whorls, fewer stronger axial ribs and spiral cords, and less constricted base.

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

***Vexiguraleus plicatellus* (Bellardi, 1847)**
Plate 39, figs 1-4

*1847	*Raphitoma plicatella* Jan (*Pleurotoma*) Bellardi, p. 92, pl. 4, fig. 18.
?1854	*Pleurotoma plicatella* Jan – Hörnes, p. 374, pl. 40, fig. 5 (not fig. 6) [*non Bela plicatella* (Bellardi, 1847)].
1867	*Pleurotoma plicatella*? Jan – Pereira da Costa, p. 233, pl. 28, fig. 1.
1877	*Raphitoma plicatella* (Jan) [*sic*] – Bellardi, p. 307, pl. 9, fig. 19.
1910	*Raphitoma plicatella* Jan – Cerulli-Irelli, p. 65 [257], pl. 6 [37], fig. 15.
1976	*Raphitoma* (*Raphitoma*) *plicatella* (Jan) – Marasti & Raffi, p. 197, pl. 2, figs 11, 12.
1996	*Bela plicatella* (Bellardi, 1847) – Vera-Peláez, p. 535, text-fig. 46, pl. 37, figs 1-4, 9, 10, pl. 38, figs 1-8.

1997 *Raphitoma plicatella* Jan in Bellardi, 1847 – Chirli, p. 85, pl. 24, fig. 8.
2002 *Bela plicatella* (Bellardi, 1847) – Vera-Peláez, p. 208, pl. 4, figs S, T, U, pl. 13, figs I, J.
?2003 *Raphitoma plicatella* Jan in Bellardi, 1847 – Bałuk, p. 69, pl. 21, figs 1-3.
2018 *Bela plicatella* (Jan in Bellardi, 1847) – Brunetti & Cresti, p. 94, fig. 390.

non 1915 *Bela plicatella* (Bellardi, 1847) – Harmer, p. 258, pl. 30, fig. 7.
non 1928 *Raphitoma plicatella* Jan – Friedberg, p. 572, pl. 37, figs 14-16.
non 1966 *Raphitoma plicatella* Jan – Kókay, p. 65, pl. 10, fig. 7 (fragment illustrated with shorter last whorl).

Material and dimensions – Maximum height 20.7 mm, width 7.6 mm. **CO**: NHMW 2020/0171/0417 (1), NHMW 2020/0171/0418 (10). **VC**: NHMW 2020/0171/0419-0421 (3), NHMW 2020/0171/0422 (2). **EL**: NHMW 2020/0171/0423 (2).

Description – Shell medium sized, medium-thickness, fusiform; spire angle approximately 35°. Protoconch multispiral, elevated, of 3.25 convex whorls with small, depressed nucleus, apical angle approximately 50°, last whorl bearing cordlets and subobsolete riblets (dp = 710 μm, hp = 930 μm, dp/hp = 0.76, dn = 160 μm, dV1 = 265 μm). Junction with teleoconch delimited by sinusigera. Teleoconch of up to six weakly shouldered whorls, with moderate width, weakly concave subsutural ramp delimited by slightly strenghtened shoulder cord, rounded at shoulder, convex below, separated by narrowly impressed, weakly undulating suture. Axial sculpture strongly predominant, composed of slightly sinuous, weakly opisthocline, narrow ribs, 10-16 on last whorl, much narrower than their interspaces, subobsolete over subsutural ramp, strongly developed at shoulder, extending to abapical suture. Spiral sculpture of fine crowded spiral threads of primary to tertiary strength covers entire surface. Last whorl 67-68% of total height, profile and sculpture as described above, broadly rounded at high-placed shoulder, convex below, moderately constricted at base; axials weakening over base, fine spirals of primary to tertiary strength persist over base and siphonal fasciole. Aperture 50-53% of total height, subrectangular; outer lip not thickened by varix, sharp edged, smooth within; anal sinus broad, shallow, symmetrically U-shaped, occupying entire subsutural ramp, apex mid-ramp; siphonal canal moderately long, bent slightly adaxially, unnotched. Columella very weakly and broadly excavated, smooth, twisted at fasciole. Columellar and parietal callus weakly thickened, sharply delimited, forming narrow callus rim.

Discussion – This species has usually been placed in the genus *Bela* Leach *in* Gray, 1847a, but species in that genus with multispiral protoconch are characterised by having smooth whorls, except for the last, where low, curved axial riblets are overrun by a few rows of obsolete spiral elements forming swollen tubercles at the intersection (Scarponi *et al*., p. 50). We provisionally place it in the genus *Vexiguraleus* Powell, 1942 (see generic note). *Vexiguraleus plicatellus* (Bellardi, 1847) is most similar to *Bela vulpecula* (Brocchi, 1814), but the latter has more

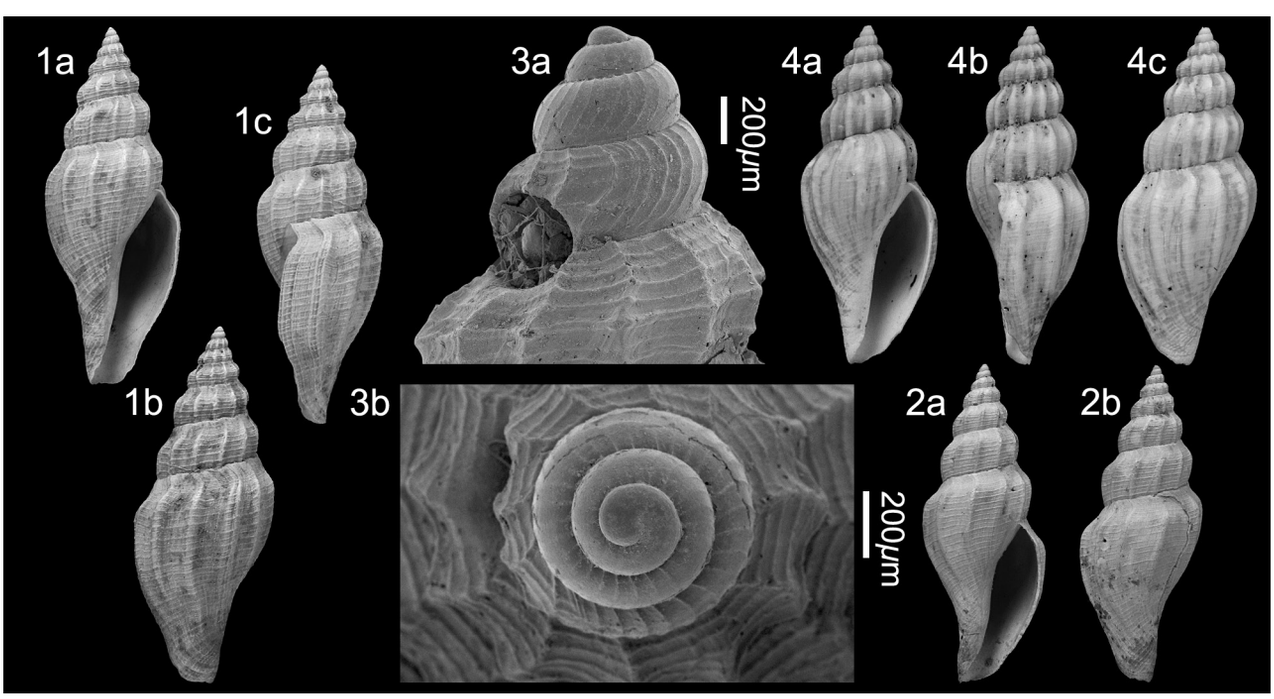

Plate 39. *Vexiguraleus plicatellus* (Bellardi, 1847); 1. NHMW 2020/0171/0419, height 20.7 mm, width 7.6 mm; 2. NHMW 2020/0171/0420, height 18.4 mm, width 6.8 mm (digital images); 3. NHMW 2020/0171/0421, detail of protoconch (SEM image). Velerín carretera. 4. NHMW 2020/0171/0417, height 16.4 mm, width 6.3 mm (digital image). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

regularly convex spire whorls, with a less concave subsutural ramp and a weaker shoulder, the ribs are broad and straight, whereas in *V. plicatellus* they are finer and more sinuous, the spirals are lower, and lacks the slightly strengthened shoulder cord delimiting the subsutural ramp. Moreover, only the last protoconch whorl in B. *vulpecula* has axial riblets.
Another similar Pliocene Mediterranean species *Bela nevropleura* (Brugnone, 1862) differs in having less convex whorls, the ribs terminate at the adapical suture, the aperture is slightly narrower, the outer lip more evenly convex, the base is hardly constricted, and the columella is straight and not twisted at the fasciole (Bellardi, 1877, p. 310).
Della Bella *et al*. (2015) reported a wide bathymetric range for this species, from circalittoral to epibathyal. In Estepona the species is not common, but widespread.

Distribution – ?Middle Miocene: Paratethys, Austria (Hörnes, 1854), Poland (Friedberg, 1954; Bałuk, 2003). Upper Miocene: Atlantic, Cacela Basin, Portugal (Periera da Costa, 1867). Proto-Mediterranean, Italy (Bellardi, 1877). Lower Pliocene: central Mediterranean, Italy (Bellardi, 1877; Chirli, 1997; Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (Vera-Peláez, 1996, 2002); central Mediterranean, Italy (Marasti & Raffi, 1976). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1910).

Genus *Villiersiella* Monterosato, 1890

Type species – *Murex attenuatus* Montagu, 1803, by typification of replaced name, present-day, Mediterranean.

1884 *Villiersia* Monterosato, p. 128. Type species (by monotypy): *Murex attenuatus* Montagu, 1803, present-day, Mediterranean. Junior homonym of *Villiersia* d'Orbigny, 1837 [Nudibranchia]. *Vielliersia* incorrect original spelling.
1890 *Villiersiella* Monterosato, p. 191. *Nom. nov. pro Villiersia* Monterosato, 1884, *non* d'Orbigny, 1837.

Note – This genus was recently resurrected by Spada *et al*. (2023, p. 46), and characterises species with very slender and polished shells, sculptured with weakly undulating axial ribs, not superiorly bent near the suture, and absence of spiral sculpture in the interspaces between the axial ribs. Apart from the type species, the genus includes another extinct species from the Plio-Pleistocene of Italy, *V. tenuicosta* (Brugnone, 1862), and the extant West African *V. adansoni* (Knudsen, 1952).

***Villiersiella attenuata* (Montagu, 1803)**
Plate 40, figs 1-4

*1803 *Murex attenuatus* Montagu, p. 266, pl. 9, fig. 6.
1829 *Pleurotoma Villiersii* Michaud, p. 262, pl. (unnumbered), figs 4, 5.
1836 *Pleurotoma gracile* Philippi, p. 198, pl. 11, fig. 23 (*non* Conrad, 1830, *nec* Scacchi, 1836).
1836 *Pleurotoma gracilis* Scacchi, p. 13, note 21, fig. 21 (*non* Conrad, 1830, *nec* Scacchi, 1836).
1838 *Pleurotoma vulpina* Bivona-Bernardi, p. 223, fig. 10.
1840 *Pleurotoma Bivonae* Maravigna, p. 326.
1851 *Mangelia attenuata* Mont. – Forbes & Hanley, p. 488, pl. 113, figs 8, 9, pl. RR, fig. 5.
1884 *Vielliersia attenuata* Mtg. – Monterosato, p. 128.
1904 *Raphitoma* (*Villiersiella*) *attenuata* (Montg.) – Sacco, p. 56, pl. 14, figs 43, 44.
1910 *Raphitoma attenuata* Mtg. – Cerulli-Irelli, p. 70 [262], pl. 6 [37], figs 52-58.
1914 *Daphnella* (*Raphitoma*) *attenuata* Montagu – Cipolla, p. 165, pl. 14, figs 14, 15.
1915 *Raphitoma attenuata* (Montagu) – Harmer, p. 256, pl. 30, figs 8, 9.
1944 *Cythara* (*Mangelia*) *attenuata* (Montagu) – Wenz, p. 1435, fig. 4058.
1954 *Mangelia striolata* Risso, 1826 – Glibert, p. 48, pl. 6, fig. 7 [*non Mangelia striolata* (Risso, 1826)].
1960 *Mangelia* (*Mangelia*) *attenuata* (Montagu, 1803) – Malatesta, p. 192, pl. 9, fig. 12.
1964 *Cythara* (*Mangelia*) *attenuata* Montagu, 1803 – Brébion, p. 577.
1966 *Mangelia attenuata* (Montagu, 1803) – Powell, p. 97, pl. 15, fig. 7.
1974 *Mangelia attenuata* (Montagu, 1803) – Malatesta, p. 423, pl. 32, fig. 7.
1976 *Cythara* (*Mangelia*) *attenuata* Montagu, 1803 – Pavia, p. 113, pl. 8, fig. 13.
1977a *Mangelia attenuata* (Montagu, 1803) – Nordsieck, p. 39, pl. 8, figs 62-64.
1980 *Mangelia attenuata* (Montagu, 1803) – Bogi *et al*., p. 15, unnumbered fig.
1982 *Cythara* (*Mangelia*) *attenuata* (Montagu, 1804 [*sic*]) – Martinell, p. 102, pl. 1, figs 9-10.
1984 *Mangelia attenuata* (Montagu, 1803) – Fretter & Graham, p. 525, fig. 362.
1987 *Mangelia* (*Mangelia*) *attenuata* (Montagu, 1803) – Cuerda Barceló, p. 318, pl. 29, fig. 16.
1988 *Mangelia attenuata* (Montagu, 1803) – Graham, p. 444, fig. 185.
1992 *Mangelia attenuata* (Montagu, 1803) – Cavallo & Repetto, p. 142, fig. 387.
1993 *Cythara* (*Mangelia*) *attenuata* (Montagu, 1803) – González Delgado, p. 39, pl. 3, figs 9-11.
1996 *Mangelia attenuata* (Montagu, 1803) – Vera-Peláez, p. 483, text-fig. 37, pl. 34, figs 1-4, 11, 13, 15.
1997 *Mangelia attenuata* (Montagu, 1803) – Chirli, p. 63, pl. 18, figs 3-5.
2001 *Mangelia attenuata* (Montagu, 1803) – Silva, p. 539, pl. 25, figs 16-20.
2001 *Mangelia attenuata* (Montagu, 1803) – Cachia *et al*., p. 52, pl. 7, fig. 9.
2002 *Mangelia attenuata* (Montagu, 1803) – Vera-Peláez, p. 205, pl. 4, figs A, B, pl. 13, figs A, B.
2008 *Mangelia attenuata* (Montagu, 1803) – Chirli & Richard, p. 66, pl. 13, fig. 5.

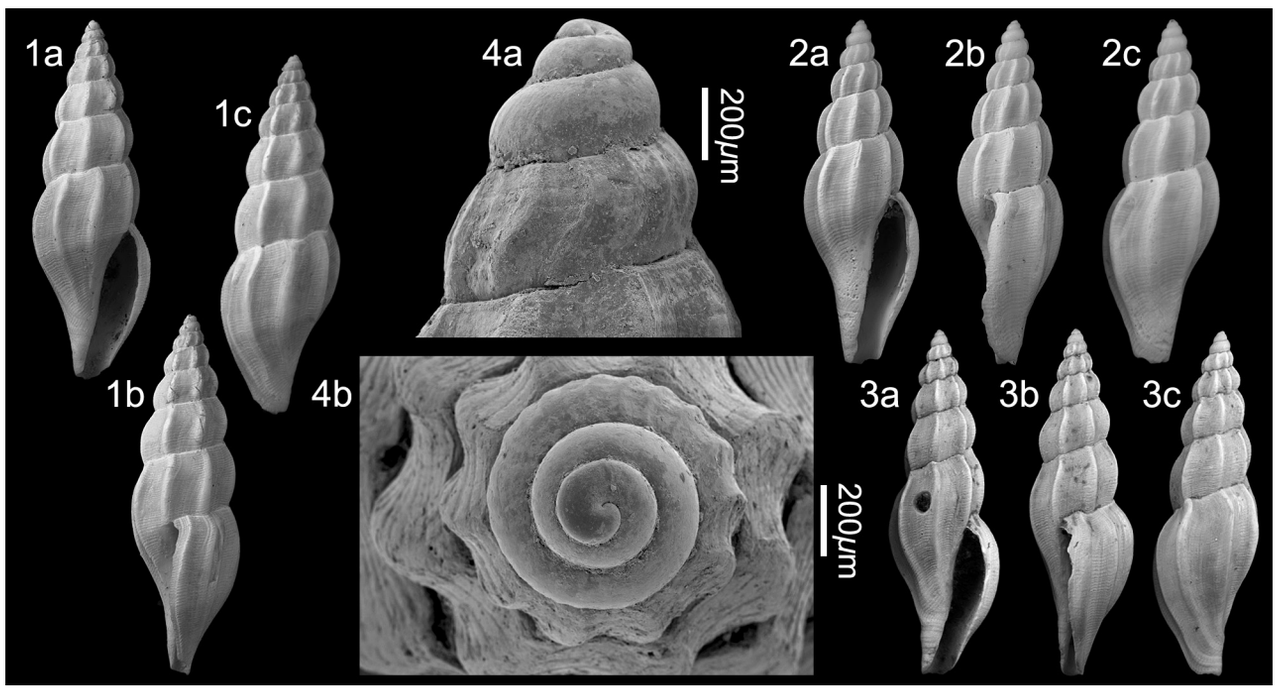

Plate 40. *Villiersiella attenuata* (Montagu, 1803); 1. NHMW 2020/0171/0261, height 10.9 mm, width 3.5 mm; 2. NHMW 2020/0171/0262, height 10.1 mm, width 3.2 mm; 3. NHMW 2020/0171/0263, height 10.9 mm, width 2.9 mm (digital images); 4. NHMW 2020/0171/0264, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

2011 *Mangelia coarctata* (Forbes, 1840) – Landau *et al*., p. 33, pl. 17, fig. 7 [*non Mangelia coarctata* (Forbes, 1840)].
2011 *Mangelia attenuata* (Montagu, 1803) – Hernández *et al*., p. 226, pl. 75, figs A-C.
2018 *Mangelia attenuata* (Montagu, 1803) – Ceulemans *et al*., p. 103, pl. 3, fig. 2.
2020 *Mangelia attenuata* (Montagu, 1803) – Landau *et al*., p. 38, pl. 33, figs 1-2.
2021 *Mangelia attenuata* (Montagu, 1803) – Öztürk, p. 244, fig. 1.
2022 *Villiersiella attenuata* (Montagu, 1803) – Brunetti, p. 70, fig. 151.
2023 *Villiersiella attenuata* (Montagu, 1803) – Spada *et al*., p. 46, fig. 24.

Material and dimensions – Maximum height 12.7 mm, width 4.0 mm. **CO**: NHMW 2020/0171/0261-0264 (4), NHMW 2020/0171/0265 (19). **EL**: NHMW 2020/0171/0266 (40).

Description – Shell small of medium thickness, very slender fusiform; spire angle about 25°. Protoconch multispiral, tall conical of 3.5 convex whorls, with small, depressed nucleus, apical angle approximately 45°; first three whorls smooth, last half whorl with comma-shaped axial riblets crossed by broad spiral cords with narrow interspaces (dp = 710 μm, hp = 730 μm, dp/hp = 0.97, dn = 95 μm, dV1 = 220 μm). Junction with teleoconch delimited by sinusigera. Teleoconch of up to five whorls tall, non-shouldered whorls, slightly concave below suture, subsutural ramp poorly delimited, convex below, separated by superficial, undulating suture. Axial sculpture of 8-9 narrow, slightly sinuous, opisthocline ribs, about one-third width of their interspaces, overrun by very fine subequal cordlets, 20-25 on penultimate whorl. Last whorl 59-65% of total height, slender, profile and sculpture as described above, evenly rounded, moderately constricted at base; axials and spirals persist over base, even weaker spirals over siphonal fasciole; fasciole not delimited. Aperture 41-49% of total height, narrow, elongate; outer lip weakly to moderately thickened by narrow labial varix, smooth within; anal sinus very broad and very shallow U-shaped, occupying entire subsutural ramp; siphonal canal moderate length, wide, bent slightly adaxially, unnotched. Columella weakly excavated, oblique to spire axis, slightly flexuous towards parietal area. Columellar and parietal callus hardly developed, not thickened, moderately delimited, forming poorly delimited, narrow rim, indented in some specimens.

Discussion – *Villiersiella attenuata* (Montagu, 1803) is characterised by its slender elongated shell. The shape and sculpture is rather constant, although in some specimens there are fewer ribs on the last whorl that become elevated and varicose. The number of protoconch whorls and size is a little variable. For extant specimens (npw = 3-3.5, hp = 500 μm, dp = 500 μm; Fretter & Graham, 1985, p. 525) for specimens from the Lower Pliocene of northwestern France (npw = 4, hp = 1020 μm, dp = 760 μm; Ceulemans *et al*., 2018, p. 103). The Estepona specimens fall exactly in between these records (npw = 3.5, hp = 730 μm, dp = 710 μm; *hoc opus*). These differences in protoconch size

were discussed by Ceulemans *et al*. (2018, p. 103).
Villiersiella tenuicosta (Brugnone, 1862) from the Plio-Pleistocene of Italy has a more fragile shell, the shoulder is more angular and higher placed, the axial ribs are narrower and more flexuous, and the base is more excavated.

Distribution – Middle Miocene: Atlantic, Loire Basin (Glibert, 1954). Upper Miocene: Atlantic (Tortonian), NW France (Glibert, 1954; Brébion, 1964; Landau *et al*., 2020). Lower Pliocene: Atlantic, NW France (Glibert, 1954; Brébion, 1964; Ceulemans *et al*., 2018), Guadalquivir Basin, S. Spain (González Delgado, 1993; Landau *et al*., 2011; Brunetti, 2022); North Sea Basin, Coralline Crag, England (Harmer, 1915); western Mediterranean, NE Spain (Martinell, 1982; Gili & Martinell, 1994); central Mediterranean, Italy (Pavia, 1976; Chirli, 1997). Upper Pliocene: Atlantic, Mondego Basin, Portugal (Silva, 2001); North Sea Basin, Red Crag, England (Harmer, 1915); western Mediterranean, Estepona Basin (Vera Peláez, 1996, 2002), France (Chirli & Richard, 2008); central Mediterranean, Italy (Bellardi, 1877; Sacco, 1904; Cipolla, 1914; Cavallo & Repetto, 1992). Upper Pliocene-Pleistocene: Atlantic, NW France (Brébion, 1964). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1910). Upper Pleistocene: western Mediterranean, Balearic Islands (Cuerda Barceló, 1987). Pleistocene (indeterminate): Atlantic, Ireland (Harmer, 1915); central Mediterranean, Italy (Malatesta, 1960). Present-day: Atlantic, north Atlantic Frontage to Norway (Bogi *et al*., 1980; Fretter & Graham, 1984; Graham, 1988), Canary Islands (Hernández *et al*., 2011), central Mediterranean (Cachia *et al*., 2001; Spada *et al*., 2023), eastern Mediterranean (Öztürk, 2021).

Discussion

In this paper forty species of Mangeliidae are described and reviewed from the Lower Piacenzian assemblages of Estepona (Fig. 1). Six species are described as new. The total number includes two endemic species described by Vera-Peláez (2002), but not present in the material at hand (*Benthomangelia peridotitae* Vera-Peláez, 2002 and *B. rafaelae* Vera-Peláez, 2002), but excludes two records included by Vera-Peláez (2002) that are not confirmed herein and may be based on misidentifications [*Bela unifasciata* (Deshayes, 1835) and *Mangelia biondii* (Bellardi, 1877)].
The assemblage is closely similar to that found in other parts of the Tropical Pliocene Mediterranean-West African Palaeobiogeographical Province, such as the Italian assemblages, during MPPMU1. Endemism is moderately high, with 10 (25%) of the species found only in Estepona, and the same number 10 (25%) surviving to the present day. Only a small number of species [6 (15%)] are also found in the neighbouring northern Pliocene Subtropical French Iberian Province and two or possibly three species (5-8%) in the more northern warm temperate Pliocene Boreal-Celtic Province.
Of interest is the presence of the genus *Bactrocythara* Woodring, 1928, which today occurs only further south along the tropical coasts of West Africa. This genus forms part of a cohort of genera that today are typically West African and during MPPMU1 extended their range into the Mediterranean adjacent to the Strait of Gibraltar but did not extend further into the Mediterranean (for further discussion on this see Landau *et al*., 2006; Silva *et al*., 2011; Landau & Harzhauser, 2022a).
In all, 154 species of turrids are recognised in the Estepona assemblages, of which 52 (34%) are endemic (Landau & Micali, 2021; Landau & Harzhauser, 2022a, 2022b; Landau *et al*., 2022; Landau & Harzhauser, 2023; *hoc opus*).
A full synthesis of the Estepona assemblages will be prepared at the end of the series.

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References

Aartsen, J.J. van 1988a. European Mollusca: notes on less well-known species. 12. *Bela menkhorsti* nom. nov. = *Pleurotoma nana* Scacchi, 1836 not Deshayes, 1835 and *Fehria* (nov. gen.) *zenetouae* nov. spec. *La Conchiglia* 20(232-233): 30-31.

Aartsen, J.J. van 1988b. Nomenclatural notes, 7. Forbes' Aegean Turridae. *Bollettino Malacologico* 24: 141-144.

Aartsen, J.J. van, Menkhorst, H.P.M.G. & Gittenberger, E. 1984. The marine Mollusca of the Bay of Algeciras, Spain, with general notes on *Mitrella*, Marginellidae and Turridae. *Basteria* Suppl. 2: 1-135.

Adams, H. & Adams, A. 1853-1858. *The genera of recent Mollusca; arranged according to their organization*. London (John van Voorst), 1:1-256, pls. 1-32, 1853; 257-484, 1854; 2:1-284, pls. 33-96, 1855; 285-412, pls. 97-112, 1856; 413-540, pls. 113-128, 1857; 541-660, pls. 129-138, 1858.

Adams, C.B. 1845. Specierum novarum conchyliorum, in Jamaica repertorum, synopsis. *Proceedings of the Boston Society of Natural History* 2: 1-17.

Almera, J. 1907. Descripción de los depósitos pliocénicos de la cuenca del Bajo Llobregat y Llano de Barcelona. Segunda parte (paleontología): catálogo de las fauna y flora fósiles contenidas en estos depósitos y determinación de la edad de cada uno de sus tramos. *Memorias de la Real Academia de Ciencias y Artes de Barcelona* 3: 109-355, 28 pls.

Almera, J. & Bofill, A. 1898. Moluscos fósiles recogidos en los terrenos pliocenos de Cataluña. Descripciones y figuras de las nuevas formas y enumeración de todas las encontradas en dichos yacimientos. *Boletín de la Comisión del Mapa Geológico de España* (2)4: i-xii, 1-223, pls 1-14, 1 map.

Anderson, H.J. 1964. Die miocäne Reinbek-Stufe in Nord- und Westdeutschland und ihre Mollusken-Fauna. *Fortschritte in der Geologie von Rheinland und Westfalen* 14: 31-368.

Ardovini, R. & Cossignani, T. 1999. *Atlante delle Conchiglie di Profondità del Mediterraneo*. L'Informatore Piceno, Ancona, Italy: 111 pp.

Atanacković, M.A. 1969. Paleontoloska i biostratigrafska analiza tortonske faune severouistocnog Potkozarja (Okolina sela Turjaka i Miljevica). *Acta Geologica Zagreb* 6: 149- 222.

Atanacković, M.A. 1985. *Mekušci Morskog Miocena Bosne*. Geoinženjering, Sarajevo, 305 pp.

Bàldi, T. 1960. Tortonische Molluskenfauna von "Badener Tegelfazies" aus Szokolya, Nordungarn. *Annales Historico-Naturales Musei Nationalis Hungarici Pars Mineralogica et Palaeontologica* 52: 51-99.

Bałuk, W. 2003. Middle Miocene (Badenian) gastropods from Korytnica, Poland, 4. Turridae. *Acta Geologica Polonica* 53: 29-78.

Bardin, A. 1882. Études paléontologiques sur les terrains tertiaires miocènes du département de Maine-et-Loire. *Mémoires de la Société d'agriculture, sciences et arts d'Angers* 23: 1-115.

Bell, A. 1871. Contributions to the Crag-Fauna. *Annals and Magazine of Natural History* series 4, 7: 351-362.

Bellardi, L. 1847. Monografia delle pleurotome fossili del Piemonte. *Memorie della Reale Accademia delle Scienze di Torino* (2)9: 531-650 [R. Janssen, 1993, stated that the journal issue was published in 1848, but that a separate was distributed in 1847; the title and pagination for the separate are: *Monografia delle pleurotome fossili del Piemonte*. Torino: 119 pp.].

Bellardi, L. 1874. Bemerkungen über die in der Umgebung Wiens vorkommenden und von M. Hoernes (foss. Moll. d. T. B. v. Wien) beschrieben Pleurotomen. *Verhandlungen der Kaiserlich-Königlichen Geologischen Reichsanstalt* 7: 155-157.

Bellardi, L. 1875. Novae pleurotomidarum Pedimonti et Liguriae fossilium: dispositionis prodromus. *Bullettino della Società Malacologica Italiana* 1: 16-24.

Bellardi, L. 1877. I molluschi dei terreni terziarii del Piemonte e della Liguria, 2. Gasteropoda (Pleurotomidae). *Memorie della Reale Accademia delle Scienze di Torino* (2)29 (1878): 1-264 (reprint 264 pp.) (June 30, 1877).

Bellardi, L. & Michelotti, G. 1841. *Saggio orittographico sulla classe dei gasteropodi fossili dei terreni terziarii del Piemonte*. 82 pp., 8 pls. Also published in 1841 as: *Memorie della Reale Accademia delle Scienze di Torino*, ser. 2, 3: 93-174, pls 2-9.

Bivona-Bernardi And. 1838. Generi e specie di molluschi descritti dal Barone Antonio Bivona e Bernardi. Lavori postumi pubblicati dal figlio Andrea dottore in medicina con note ed aggiunte. *Giornale di Scienze Lettere e Arti per la Sicilia* 61: 211-227 [stated date march 1838] 63: 319-324 [stated date September 1838] [also as reprint, 16 pp, 1 pl., tipografia del Giornale Letterario, Palermo].

Boettger, O. 1902. Zur Kenntnis der Fauna der mittelmiocänen Schichten von Kostej im Krassó-Szörényer Komitat.Mit einem Situationsplan der Fundpunkte, 2. *Verhandlungen und Mitteilungen des Siebenbürgischen Vereins für Naturwissenschaften zu Hermannstadt* 51 (1901): 1-200.

Boettger, O. 1906-1907. Zur Kenntnis der Fauna der mittelmiocänen Schichten von Kostej im Krassó-Szörényer Komitat. Gasteropoden und Anneliden, 3. *Verhandlungen und Mitteilungen des Siebenbürgischen Vereins für Naturwissenschaften zu Hermannstadt* 54/55: i-viii, 1-99 (1906); 101-244 (1907).

Bogi, C. & Cauli, L. 1998. La malacofauna circalitorale del Pliocene medio di Casa Pagliana (Fauglia-Pisa). *Bollettino Malacologico* 33: 127-134.

Bogi, C., Coppini, M. & Margelli, A. 1979. Molluscan fauna of the central Tyrrhenian Sea. Turridae (First part). *La Conchiglia,* 11(124/125): 6-8, 18.

Bogi, C., Coppini, M. & Margelli, A. 1980. Molluscan fauna of the central Tyrrhenian Sea. Turridae: part II (1). *La Conchiglia,* 12(132/133): 15-17.

Bouchet, P. 1990. Turrid genera and mode of development: the use and abuse of protoconch morphology. *Malacologia* 32: 69-77.

Bouchet, P. & Warén, A. 1980. Revision of the North-East Atlantic bathyal and abyssal Turridae (Mollusca: Gastropoda). *Journal of Molluscan Studies* Suppl. 8: 1-119.

Brakman, C. 1938. *Cythara* (*Mangelia*) *altenai*, nov. sp. *Basteria* 3: 47-48, unnumbered fig.

Brébion, P. 1964. Les gastéropodes du Redonien et leur signification, 1-2. Thèse de doctorat ès-Sciences. Paris (Faculté des Sciences de l'Université de Paris: 775 pp., 15 pls (27 June 1964, unpublished).

Brocchi, G. 1814. *Conchiologia fossile subapennina, con osservazioni geologiche sugli Apennini e sul suolo adiacente*, 1-2. Milano (Stamperia Reale): 1-240 (1); 241-712 (2), 16 pls.

Brugnone, G.A. 1862. *Memoria sopra alcuni pleurotomi fossili dei dintorni di Palermo*. Palermo (F. Lao): 41 pp, 1 pl.

Brunetti, M.M. 2022. *Malacofaune plioceniche della Valle del Guadalquivir, Spagna.* Privately published, Edizione Danaus: 147 pp.

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.

Brusina, S. 1871 [1870]. [Untitled]. *Viestnik Narodnoga Zemaljskog Muzeja u Zagrebu.* 1: 212-214.

Brusina, S. 1877. Fragmenta Vindobonensia. *Journal de Conchyliologie* 25: 368-391.

Bucquoy, F., Dautzenberg, P. & Dollfus, G. 1882-1886. *Les mollusques marins du Rousillon*, 1. *Gastropodes, avec atlas de 66 planches photographées d'apres nature*. Paris (J.B. Baillière & Dautzenberg): 1-84 (1882), 85-196 (1883), 197-342 (1884), 343-418 (1885), 419-570 (1886).

Cachia, C., Mifsud, C. & Sammut, P.M. 2001. *The Marine Mollusca of the Maltese Islands Part Three Sub-Class Prosobranchia to Sub-Class Pulmonata, Order Basommatophora.* Backhuys Publishers, Leiden, 266 pp.

Calcara, P. 1839. *Esposizione di alcune nuove specie di conchiglie appartenenti al genere* Pleurotoma *del Sig. De Lamarck, fatta del Dr. Pietro Calcara, coll'aggiunta di tutte le altre fossili e viventi, che rinvengonsi nei dintorni di Palermo*. L'Oreteo, Palermo: 16 pp., 1 pl.

Caprotti, E. 1974. Molluschi del Tabianiano (Pliocene inferiore) della Val d'Arda. Loro connessioni temporali e spaziali. *Conchiglie* 10: 1-47.

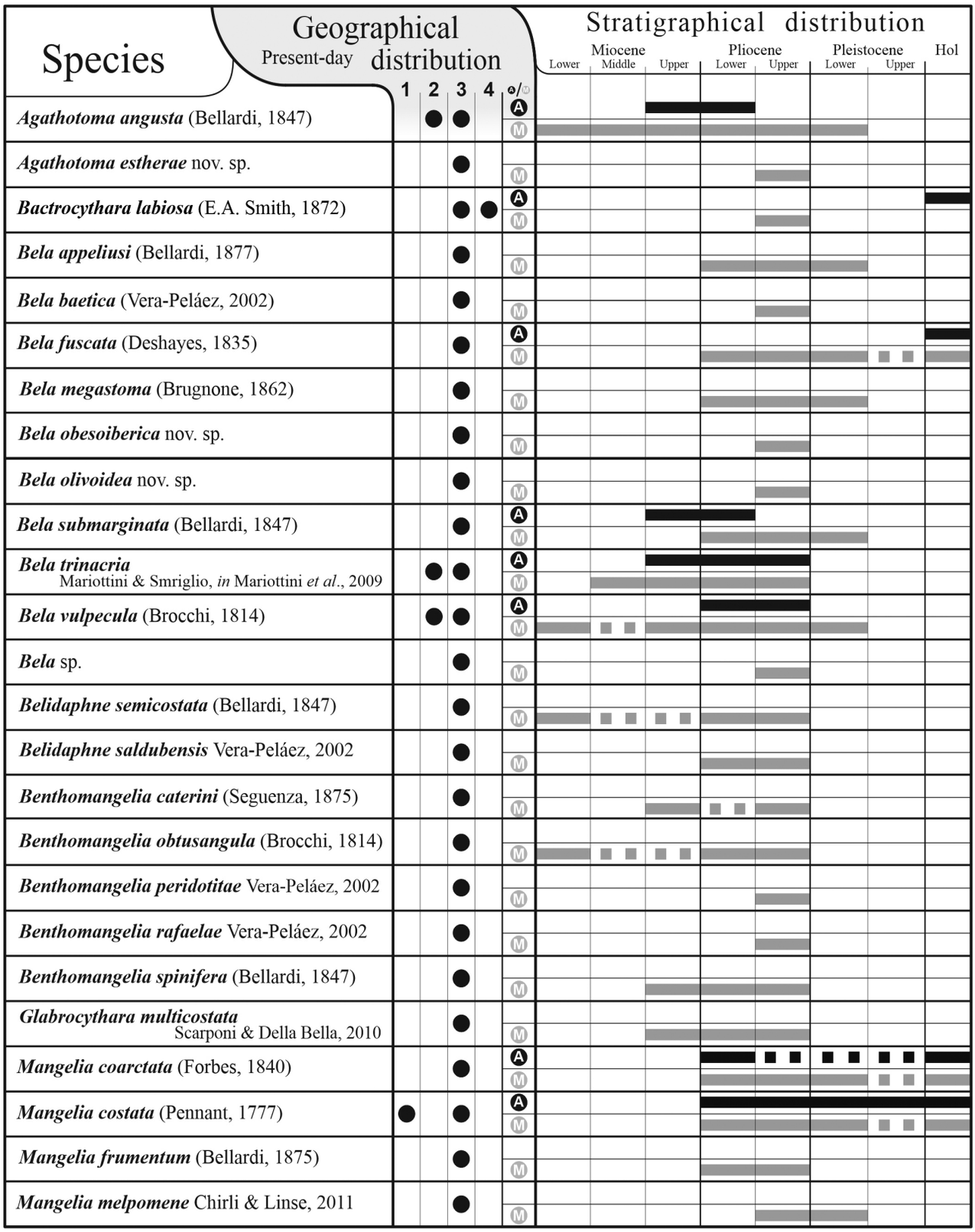
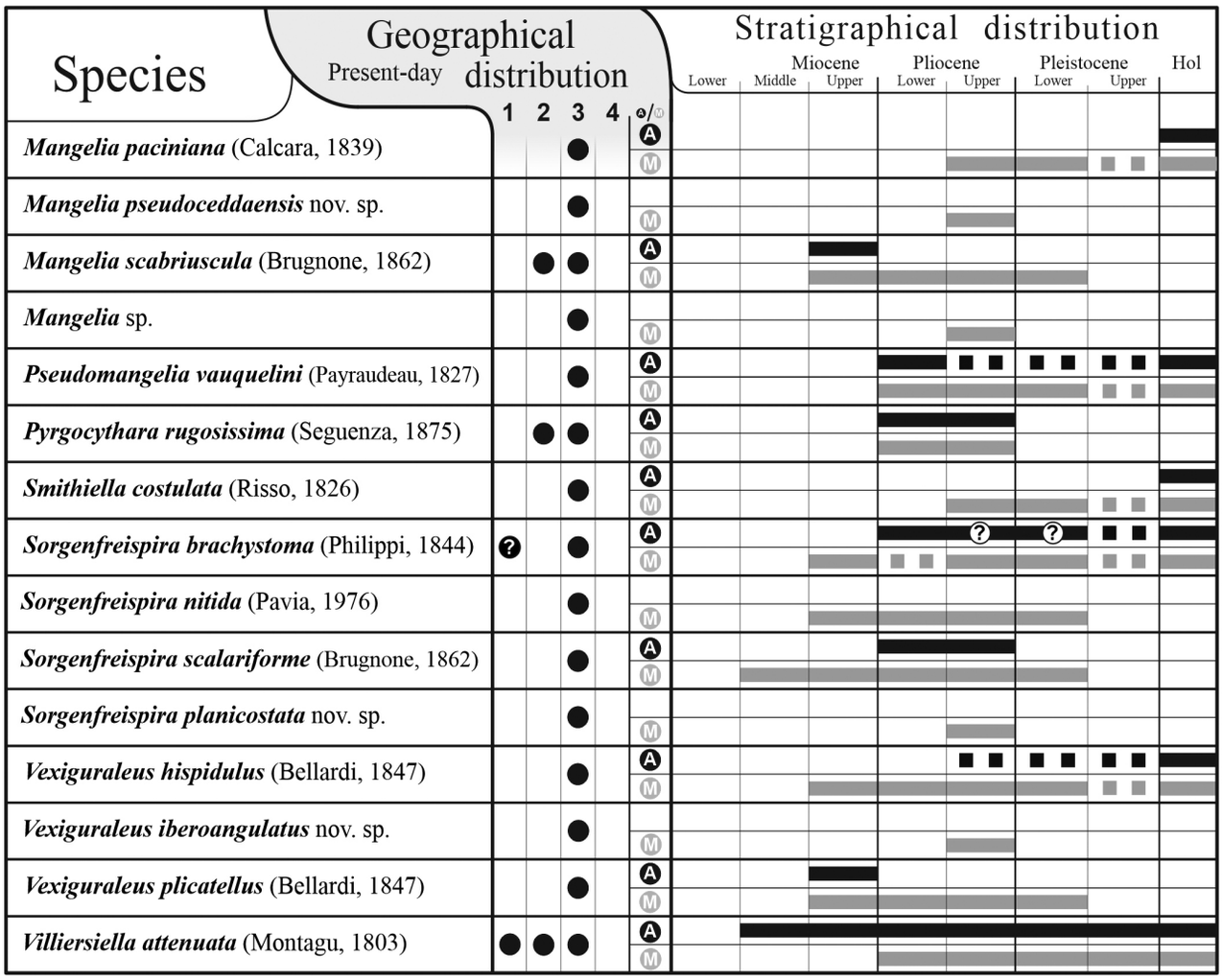


Figure 1. Geography, stratigraphy and distribution of species found in the Upper Pliocene Lower Piacenzian of the Estepona Basin, southern Spain. For Pliocene-recent geographic distribution designated by biogeographical province: 1 = Boreal-Celtic Province, 2 = French-Iberian Province, 3 = Mediterranean-Moroccan 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).



Caprotti, E. 1976. Malacofauna dello stratotipo piacenziano (Pliocene de Castell'Arquato). *Conchiglie* 12: 1-56.

Caprotti, E. & Vescovi, M. 1973. Neogastropoda ed Euthyneura dello stratotipo piacenziano (Castell'Arquato, Piacenza). *Natura, Atti della Società Italiana di Scienze Naturali e del Museo Civico di Storia Naturale di Milano* 64: 156-193.

Cárdenas, J., Bajo, I. & Maestre, M.V. 2019. Estudio paleontológico de los gasterópodos y escafópodos (Mollusca) del Tortoniense superior de Arroyo Trujillo, Cantillana (Sevilla). [Palaeontological study of the gastropods and scaphopods (Mollusca) of the late Tortonian of Arroyo Trujillo, Cantillana (Sevilla)]. *Spanish Journal of Palaeontology* 34(2): 205-228.

Cavallo, O. & Repetto, G. 1992. Conchiglie fossili del Roero. Atlante iconografico. *Associazione Naturalistica Piemontese Memorie* (Associazione Amici del Museo 'Federico Eusebio') 2: 1-251.

Cecalupo, A., Buzzurro, G. & Mariani, M. 2008. Contributo alla conoscenza della macrofauna del Golfo di Gabès (Tunisia). *Quaderni della Civica Stazione Idrobiologica di Milano* 31: 1-173, pls 1-92.

Cerulli-Irelli, S. 1910. Fauna malacologica mariana, 4. (Dentalidae), Stenogyridae, Gadiniidae, Actaeonidae, Tornatinidae, Scaphandridae, Bullidae, Ringiculidae, Philinidae, Umbrellidae, Conidae, Pleurotomidae. *Paleontographia Italica* 16: 215-262.

Ceulemans, L., Van Dingenen, F. & Landau, B.M. 2018. The lower Pliocene gastropods of Le Pigeon Blanc (northwest France). Part 5 - Neogastropoda (Conoidea) and Heterobranchia (*fine*). *Cainozoic Research* 18: 85-172.

Chirli, C. 1997. *Malacofauna Pliocenica Toscana* 1. *Superfamiglia Conoidea*. Firenze (C. Chirli): 129 pp.

Chirli, C. & Linse, U. 2011. *The Pleistocene marine Gastropods of Rhodes Island (Greece).* Firenze (C. Chirli): 448 pp., 90 pls.

Chirli, C. & Richard, C. 2008. *Les mollusques plaisanciens de la Côte d'Azur*. Tavarnelle (C. Chirli): 128 pp.

Cipolla, F. 1914. Le pleurotomidi del Pliocene di Altavilla (Palermo). *Palaeontographia Italica* 20: 105-181.

Clarke, A.H., Jr 1959. New abyssal molluscs from off Bermuda collected by the Lamont Geological Observatory. *Proceedings of the Malacological Society of London* 33: 231-238, pl. 13.

Conrad, T.A. 1830. On the geology and organic remains of a part of the peninsula of Maryland; with appendix; containing descriptions of twenty-nine new species of fossil shells, noticed in the preceding paper. *Journal of the Academy of Natural Sciences of Philadelphia* series 1, 6: 205-230, pls 9-10.

Cossignani, T. & Ardovini, R. 2011. *Malacologia Mediterranea*. Ancona, L'Informatore Piceno: 536 pp.

Cossmann, M. 1896. *Essais de paléoconchologie comparée. Deuxième livraison*. Paris (The author and Société d'Éditions Scientifiques): 180 pp., 8 pls.

Cossmann, M. 1899. Rectifications de nomenclature. *Revue Critique de Paléozoologie* 3(1): 45-46.

Couthouy, J.P. 1839. Art. VII.-Monograph of the family Osteodesmacea of Deshayes, with remarks on two species of Patelloidea, and descriptions of new species of marine shells, a species of *Anculotus*, and one of *Eolis*. *Boston Journal of Natural History* 2: 127-189, pl. 4.

Crosse, H. 1885. Nomenclatura generica e specifica par le marquis de Monterosato. *Journal de Conchyliologie* 33: 139-142.

Csepreghy-Meznerics, I. 1953. Mittelmiozäne Pleurotomen aus Ungarn. *Annales Historico-Naturales Musei Nationalis Hungarici* (s.n.) 4: 5-22.

Cuerda Barceló, J. 1987. *Molluscos marinos y salobres del Pleistoceno Balear.* Palma de Mallorca (Publicaciones de la Caja de Baleares 'Sa Nostra'): 421 pp.

Cuscani Politi, P. 1978. Aggiunta alla malacofauna delle argille plioceniche a *Rhinoceros* (*Dicerorhinus*) *etruscus* di Castelnuovo Berardenga Scalo nei pressi di Siena (Toscana). *Atti dell'Accademia delle Scienze di Siena detta de' Fisiocritici*, ser. 14, 10: 33-59.

Dall, W.H. 1881. Reports on the results of dredging, under the supervision of Alexander Agassiz, in the Gulf of Mexico and in the Caribbean Sea (1877-78), by the United States Coast Survey Steamer "Blake", Lieutenant-Commander C.D. Sigsbee, U.S.N., and Commander J.R. Bartlett, U.S.N., commanding. XV. Preliminary report on the Mollusca. *Bulletin of the Museum of Comparative Zoology at Harvard College* 9(2): 33-144.

Dall, W.H. 1918. Notes on the nomenclature of the mollusks of the family Turritidae. *Proceedings of the United States National Museum* 54: 313-333.

Delamotte, M. & Vardala-Theodorou, E. 2001. *Shells from the Greek Seas.* The Goulandris Natural History Museum, Kifissia: 323 pp.

Della Bella, G., Naldi, F. & Scarponi, D. 2015. *Molluschi marini del Plio-Pleistocene dell'Emilia-Romagna e della Toscana. Superfamiglia Conoidea*. *Vol. 4-Mangeliidae II*. Ancona (Museo Geologico Giovanni Capellini): 80 pp.

Della Bella, G. & Scarponi, D. 2007. *Molluschi marini del Plio-Pleistocene dell'Emilia-Romagna e della Toscana. Superfamiglia Conoidea*. *Vol. 2-Conidae 1*. Ancona (Museo Geologico Giovanni Capellini): 93 pp.

Deshayes, G.P. 1835. Mollusques. Pp. 81-203, pl. 18-26, *in* Bory de Saint-Vincent J.B.G.M. (ed.), *Expédition scientifique de Morée. Section des Sciences Physiques. Tome III. 1ere Partie. Zoologie. Première Section. Animaux vertébrés, Mollusques et Polypiers*. Paris (Levrault).

Doderlein, P. 1864. Cenni geologici intorno la giacitura dei terreni miocenici superiori dell'Italia centrale. *Atti del X Congresso degli Scienziati Italiani*, Siena: 83-107.

Donovan, E. 1799-1804. *The natural history of British shells: including figures and descriptions of all the species hitherto discovered in Great Britain, systematically arranged in the Linnean manner, with scientific and general observations on each*. 5 volumes, London, printed fro the Author, and for F. and C. Rivington, 180 plates with unpaginated text. Vol. 1: introduction 3 pp; pl. 1-18 [1799]; pl. 19-36; index 10 pp. [1800] . Vol. 2: pl. 37-54 [1800]; pl. 55-72, index 10 pp. [1801]. Vol. 3: pl. 73-90 [1801]; pl. 91-108, index 8 pp. [1802]; Vol. 4: pl. 109-126 [1802]; pl. 127-144, index 8 pp [1803]. Vol. 5: pl. 145-162 [1803]; pl.163-180, index 7 pp. [1804].

Faber, M.J. 2004. Marine gastropods from Cuba described by Louis Pfeiffer: type specimens and identifications with the introduction of *Gibberula pfeifferi* new name (Mollusca: Gastropoda). *Miscellanea Malacologica* 1(3): 49-71.

Fargo, W.G. 1953. Part II. The Pliocene Turridae of Saint Petersburg, Florida. *Academy of Natural Sciences of Philadelphia,* Monograph 8: 361-409, pls. 16-24.

Ferrero Mortara, E.L., Montefameglio, L., Pavia, G. & Tampieri, R. 1981. Catalogo dei tipi e degli esemplari figurati della collezione Bellardi e Sacco, 1. *Museo Regionale di Scienze Naturali di Torino,* Cataloghi 6: 1-327.

Fischer, P. 1880-1887. *Manuel de Conchyliologie et de Paléontologie Conchyliologique*. Paris, Savy pp. XXIV + 1369 + pl. 23. Fasc. 1: pp. 1-112 [September 1880]. Fasc. 2: pp. 113-192 [March 1881]. Fasc. 3: pp. 193-304 [July 1881]. Fasc. 4: pp. 305-416 [May 1882]. Fasc. 5: pp. 417-512 [February 1883a]. Fasc. 6: pp. 513-608 [December 1883b]. Fasc. 7: pp. 609-688 [June 1884]. Fasc. 8: pp. 689-784 [January 1885]. Fasc. 9: pp. 785-896 [August 1885]. Fasc. 10: pp. 897-1008 [April 1886]. Fasc. 11: pp. 1009-1369 [June 1887].

Fontannes, F. 1879-1880. *Les invertébrés du bassin tertiaire du Sud-Est de la France. Les mollusques pliocènes de la Vallée du Rhône et du Roussillon*, 1. *Gastéropodes des formations marines et saumatres.* Paris (Georg, Lyon & F. Savy): viii + 276 pp., 12 pls (pp. 1-76 published in 1879, remainder in 1880).

Forbes, E. 1840. On some new and rare British mollusca. *Annals and Magazine of Natural History* 5(29): 102-108, pl. 2.

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 for 1843*: 130-193.

Forbes, E. & Hanley, S.C. 1848-1853. *A history of British Mollusca and their shells*. Vol. 1: i-lxxx [1853], 1-486 [1848], pl. A-W, AA-ZZ, AAA-ZZZ [dates uncertain]; Vol. 2: 1-480 [1 dec. 1849], 481-557 [1850]; Vol. 3: 1-320 [1850], 321-616 [1851]; Vol. 4: 1-300 [1852], pl. 1-114F [dates uncertain]. London, van Voorst. London, van Voorst. 1:1-486 [for dates see N. Fisher & J. R. le B. Tomlin, 1935. The dates of publication of Forbes and Hanley's Hist. Brit. Moll. *Journal of Conchology* 20(5): 150-151].

Fretter, V. & Graham, A. 1984. The Prosobranch Molluscs of Britain and Denmark. Part 8 - Neogastropoda. *Journal of Molluscan Studies* Suppl. 15: 435-556.

Friedberg, W. 1911-28. *Mięczaki mioceńskie ziem Polskich (Mollusca Miocaenica Poloniae)*, 1. *Ślimaki i łódkonogi*, 1. *Gastropoda et Scaphopoda*. Lwów (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).

Gili, C. & Martinell, J. 1994. Paleobiogeography of turrid gastropods in the Pliocene of Catalonia. *Acta Geologica Polonica* 38: 349-358.

Giribet, G. & Peñas, A. 1997. Fauna Malacológica del litoral del Garraf (NE de la Península Ibérica). *Iberus* 15: 41-93.

Glibert, M. 1954. Pleurotomes du Miocène de la Belgique et du Bassin de la Loire. *Mémoires de l'Institut Royal des Sciences Naturelles de Belgique* 129: 1-75.

Glibert, M. 1960. Gastropodes du Diestien, du Scaldisien et du Merxémien de la Belgique, 4(fin). Annexe. Additions aux pleurotomes du Neogène du Bassin de la Loire. *Bulletin de l'Institut royal des Sciences naturelles de Belgique* 36: 1-44.

González-Delgado, J.A. 1993. Estudio sistemático de los gasterópodos del Plioceno de Huelva (SW de España), 5. Neogastropoda (Volutacea, Connacea [*sic*]). *Studia Geologica Salmanticensia* 28: 7-69.

Graham, A. 1988. *Molluscs: Prosobranch and pyramidellids gastropods. Synopses of the British Fauna* (new series). In: Kermack, D.M. & Barnes, R.S.K (eds); second edition, published for The Linnaean Society of London and The Estuarine and Brackish-Water Sciences Association. Leiden (E.J. Brill/Dr. W. Backhuys): 662 pp.

Gray, J.E. 1847a. The classification of the British Mollusca, by W.E. Leach, M. D. *Annals and Magazine of Natural History* 20: 267-273 [October].

Gray, J.E. 1847b. A list of the genera of Recent Mollusca, their synonyma and types. *Proceedings of the Zoological Society of London* (1847): 129-219 [November].

Greco, A. 1970. La malacofauna pliocenica di contrada Cerausi presso Serradifalco (Caltanissetta). *Geologica Romana* 9: 275-314.

Guppy, R.J.L. & Dall, W.H. 1896. Descriptions of Tertiary fossils from the Antillean region. *Proceedings of the United States National Museum* 19: 303-331, pl. 27-30.

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).

Hayward, P.J., Wigham, G.D. & Yonow, N. 1995. Molluscs (Phylum Mollusca). In Hayward, P.J. & Ryland, J.S. (Eds.) *Handbook of the Marine Fauna of North-West Europe*. Oxford University Press, Oxford: 484-628.

Hedley, C. 1922. A revision of the Australian Turridae. *Records of the Australian Museum* 13(6): 213-359.

Hernández, J.M., Rolán, E. & Swinnen, F. 2011. *Moluscos y conchas marinas de Canarias*. Conchbooks, Hackenheim & Emilio Rolán, Vigo: 716 pp., 130 pls.

Hoernes, R. & Auinger, M. 1879-91. Die Gasteropoden der Meeres-Ablagerungen der ersten und zweiten Miocänen Mediterran-Stufe in der Österreichisch-Ungarischen Monarchie. *Abhandlungen der Kaiserlich-Königlichen Geologischen Reichsanstalt*, 12: 1-382, 50 pls. Published in parts: 1-52, pls 1-6 (1879); 53-112, pls 7-12 (1880); 113-152, pls 13-16 (1882); 153-192, pls 17-22 (1884); 193-232, pls 23-28 (1885); 233-282, pls 29-36 (1890); 283-330, pls 37-42 (1891); 331-382, pls 43-50 (1891).

Hölzl, O. 1962. Die Molluskenfauna aus dem Grenzbereich Burdigal-Helvet im Kaltenbach-Gernergraben, Landkreis Miesbach/Oberbayern (vorläufige Mitteilung). *Geologica Bavarica* 50: 258-289.

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).

Hornung, A. 1920. Gastéropodes fossiles du Rio Torsero (Cériale). Pliocène inférieur de la Ligurie. *Annali del Museo Civico di Storia Naturale Giacomo Doria* 49 [ser. 3, 9]: 70-92, pl. 2.

Illiger, K. 1807. Vorschlag zur Aufnahme im Fabricischen Systeme fehlender Käfer-Gattungen. *Magazin für Insektenkunde* (Braunschweig) 6: 318-349.

Janssen, A.W. 1984. *Mollusken uit het Mioceen van Winterswijk-Miste. Een inventarisatie, met beschrijvingen en afbeeldingen van alle aangetroffen soorten.* Amsterdam (Koninklijke Nederlandse Natuurhistorische Vereniging, Nederlandse Geologische Vereniging & Rijkmuseum van Geologie en Mineralogie): 451 pp.

Janssen, A.W. 2004. Holoplanktonic molluscan assemblages (Gastropoda, Heteropoda, Thecosomata) from the Pliocene of Estepona (Spain, Malaga). *Palaeontos* 5: 103-131.

Jeffreys, J.G. 1847. Descriptions and notices of British shells. *Annals and Magazine of Natural History* 19: 309-314.

Jeffreys, J.G. 1862-1869. *British conchology*. Vol. 1: pp. cxiv + 341 [1862]. Vol. 2: pp. 479 [1864]. Vol. 3: pp. 394 [1865a]. Vol. 4: pp. 487 [1867]. Vol. 5: pp. 259 [1869]. London (van Voorst).

Kantor, Y.I. & Sysoev, A.V. 2006. *Marine and brackish water Gastropoda of Russia and adjacent countries: an illustated catalogue*. Moscow, KMK Scientific Press Ltd., pp. 371 + 140 color pls.

Knudsen, J. 1952. Marine prosobranchs of tropical West Africa collected by the Atlantide Expedition, 1945–46. *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening i Kjobenhavn* 114: 129-185, 3 pls.

Kobelt, W. 1887-1908. Iconographie der schalentragende europäischen Meeresconchylien. Fischer, Cassel. Part 1: 1-171 pl. 1-28 [1887]. Part 2: 1-16 pl. 29-32 [1888] 17-40 pl. 33-38 [1889] 41-104 pl. 39-50 [1900] 105-139 pl. 51-58 [1901]. Part 3: 1-24 pl. 59-62 [1902] 25-200 pl. 63-78 [1903] 201-272 pl. 79-84, 86-87 [1904] 273-406 [1905]. Part 4: 1-80 pl. 99-114 [1906] 81-172 pl. 115-126 [1908].

Kojumdgieva, E.M. & Strachimirov, B. 1960. Les fossiles de Bulgarie, 7. Tortonien. Sofia (Académie des Sciences de Bulgarie): 317 pp.

Kókay, J. 1966. Márkói Barnakõszénterület földtani és Õslénytani Vizsgálata. *Geologica Hungarica, series Palaeontologica* 36 1-149.

Landau, B.M. & Harzhauser, M. 2022a. The Pliocene Gastropoda (Mollusca) of Estepona, southern Spain. Part 14: Clavatulidae. *Cainozoic Research* 22(1): 45-72

Landau, B.M. & Harzhauser, M. 2022b. The Pliocene Gastropoda (Mollusca) of Estepona, southern Spain. Part 15: Borsoniidae, Clathurellidae, Mitromorphidae, Pseudomelatomidae. *Cainozoic Research* 22: 103-156.

Landau, B.M. & Harzhauser, M. 2023. The Pliocene Gastropoda (Mollusca) of Estepona, southern Spain. Part 17: Borsoniidae (part), Drilliidae, Fusiturridae, Horaiclavidae, Pseudomelatomidae (part), and Turridae *Cainozoic Research* 23: 5-46.

Landau, B.M. & Harzhauser, M. & Giannuzzi-Savelli, R. 2022. The Pliocene Gastropoda (Mollusca) of Estepona, southern Spain. Part 16: Raphitomidae. *Cainozoic Research* 22: 157-240.

Landau, B.M., Harzhauser, M., İslamoğlu, Y. & Silva, C.M. da 2013. Systematics and palaeobiogeography of the gastropods of the middle Miocene (Serravallian) Karaman Basin, Turkey. *Cainozoic Research* 11-13: 3-584.

Landau, B.M., La Perna, R. & Silva, C.M. da 2006. The Early Pliocene Gastropoda (Mollusca) of Estepona, southern Spain. Part 10 Marginelliidae, Cysticidae. *Palaeontos* 9: 22-60, 12 pls.

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. & Micali, P. 2021. The Pliocene Gastropoda (Mollusca) of Estepona, southern Spain. Part 13: Murchisonelloidea and Pyramidelloidea. *Cainozoic Research* 21(2): 159-351.

Landau, B., Silva, C.M. da & Mayoral, E. 2011. The lower Pliocene gastropods of the Huelva Sands Formation, Guadalquivir Basin, southwestern Spain. *Palaeofocus* 4: 1-90.

Landau, B.M., Van Dingenen, F. & Ceulemans, L. 2020. The upper Miocene gastropods of northwestern France, 5. Conoidea. *Cainozoic Research* 20: 3-107.

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].

Locard, A. 1897-1898. Expéditions scientifiques du Travailleur et du Talisman pendant les années 1880, 1881, 1882 et 1883. *Mollusques testacés. Paris, Masson.* vol. 1 [1897]: 1-516, pls 1-22; vol. 2 [1898]: 1-515, pls 1-18.

Lozouet, P. 2015. Nouvelles espèces de gastéropodes (Mollusca: Gastropoda) de l'Oligocène et du Miocène inférieur d'Aquitaine (Sud-Ouest de la France). Partie 5. *Cossmanniana* 17: 15-84.

Lozouet, P. 2017. Les Conoidea de l'Oligocène supérieur (Chattien) du bassin de l'Adour (Sud-Ouest de la France). *Cossmanniana* 19: 3-180.

Malaroda, R. 1955. Contributo alle conoscenze paleontologiche del Pliocene dei dintorni di Strongoli, nel Crotonese (Catanzaro). *Accademia dei Lincei, Rendiconti del Classe di Scienze Fisiche Matematiche e Naturali* 19: 50-58.

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.

Marasti, R. & Raffi, S. 1976. Osservazioni biostratigrafiche e paleoecologiche sulla malacofauna del Piacenziano di Maiatico (Parma, Emilia Occidentale). *Bollettino della Società Paleontologica Italiana* 15: 189-214.

Maravigna, C. 1840. Description de plusieurs coquilles nouvelles. Revue Zoologique, par la Société Cuvierienne; *Association universelle pour l'advancement de la zoologie, de l'anatomie comparée et de la Palaeontologie* 3: 325-326.

Mariottini, P., Di Giulio, A., Smriglio, C. & Oliverio, M. 2015. Additional notes on the systematics and new records of East Atlantic species of the genus *Sorgenfreispira* Moroni, 1979 (Gastropoda Mangeliidae). *Biodiversity Journal* 6(1): 431-440.

Mariottini, P., Smriglio, C., Di Giulio, A. & Oliverio, M. 2009. A new fossil conoidean from the Pliocene of Italy, with comments on the *Bela menkhorsti* complex (Gastropoda: Conidae). *Journal of Conchology* 40: 5-14.

Marquet, R. 1997. The Pliocene turrid gastropods of Belgium, 1. Drilliidae, Turridae, Conidae (genus *Bela*). *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Sciences de la Terre* 67: 119-151.

Marquet, R. 1998a. The Pliocene turrid gastropods of Belgium, 2. Conidae (genera *Asthenotoma, Comarmondia, Cytharella, Mangelia, Lusitanops, Raphitoma* and *Philbertia*). *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Sciences de la Terre* 68: 263-287.

Marquet, R. 1998b. *De Pliocene gastropodenfauna van Kallo (Oost-Vlaanderen, België).* Antwerpen (Belgische Vereniging voor Paleontologie v.z.w.): 1-246.

Martinell, J. 1982. Estudio de los Conacea (Neogastropoda, Gastropoda) del Plioceno de l'Empordà (Catalunya). Descriptiva y sistemàtica. *Iberus* 2: 95-119.

Martinell, J. & Domènech, R. 1984. Malacofauna del Plioceno de Sant Onofre (Baix Ebre; Tarragona). *Iberus* 4: 1-17.

Martinell, J. & Domènech, R. 1985. Característiques tafonómiques i paleoecológiques del Pliocè Marí de l'Empordá. *Centre d'Investigaciones Arqueològiques, sèrie monogràfica* 4: 5-69.

Martinell, J. & Marquina, M.A. 1981. Malacofauna Pliocenica de St. Vicenç dels Horts (Baix Llobregat, Barcelona). *Iberus* 1: 9-22.

Mayer, K. 1864. *Die Tertiar-fauna der Azoren und Madeiren.* Zurich, published by the author: vi + 107 pp.

Michaud, A.L.G. 1829. Description de plusieurs espèces nouvelles de coquilles vivantes. *Bulletin d'Histoire Naturelle de la Société Linnéenne de Bordeaux* 3: 260-276, 1 pl. (unnumbered).

Mikuž, V. 1998. Turridae (Neogastropoda) iz srednjemiocenskih badenijskih plasti Slovenije. *Geologija (Ljubljana)* 40: 65-101.

Mikuž, V. 2009. Miocene gastropods from the vicinity of Šentjernej and from other localities in the Krka Basin, Slovenia. *Folia Biologica et Geologica* 50: 5-69

Milachevitch, K.O. 1916. *Fauna Rossii i Sopredeljnykh stran Preimushchestvenno po Kollektzijam Zoologicheskago Muzeja Imperatorskoj Akademii Nauk. Molljuski Russkikh Morei. Tome 1.* Zoologicheskago Muzeja, Petrograd, xii + 312 pp., 11 pls.

Milne-Edwards, H. & Haime, J. 1851. A monograph of the British fossil corals. Corals from the oolitic formations. *Monographs of the Palaeontographical Society* 5: 73-146, pls 12-30.

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.

Montanaro, E. 1937. Studi monografici sulla malacologia Miocenica Modenese, 1. I molluschi Tortoniani di Montegibbio. *Palaeontographia Italica* 37 (nuova serie 5): 115-191.

Monterosato, T.A. di 1872. *Notizie intorno alle conchiglie fossili di Monte Pellegrino e Ficarazzi*. Palermo (Ufficio Tipografico Michele Amenta): 44 pp.

Monterosato, T.A. di 1875. Note intorno ad alcuni articoli di Conchiologia Mediterranea pubblicati nel Jahrbucher der deutschen Malakozoologische Gesellschaft dal Sig. H.C. Weinkauff e dal Dott. Kobelt. *Bullettino della Società Malacologica Italiana* 1: 68-73.

Monterosato, T.A. di 1884. *Nomenclatura generica e specifica di alcune conchiglie mediterranee.* Palermo (Virzi): 152 pp.

Monterosato, T.A. di 1890. Conchiglie della profondità del mare di Palermo. *Naturalista Siciliano* 9(6): 140-151 [1 March]; 9(7): 157-166 [1 April]; 9(8): 181-191 [1 May].

Monterosato, T.A. di 1917. Molluschi viventi e quaternari raccolti lungo le coste della Tripolitania dall'Ing. Camillo Crema. *Bollettino della Società Zoologica Italiana* (3)4: 1-28.

Moroni, M.A. 1956. La macrofauna saheliana del Messiniano inferiore della Repubblica di S. Marino. *Giornale di Geologia* (2)25: 81-162.

Moroni, M.A. 1979. *Sorgenfreispira*, nuovo genere di Turridae (Gastropoda, Prosobranchia) del Miocene europeo. *Lavori Dell'Istituto di Geologia della Università di Palermo* 16: 1-11.

Naldi, F., Della Bella, G., Scarponi, D. 2013. *Bela pseudoappeliusi* n. sp. (Neogastropoda: Mangeliidae) from the Plio-Pleistocene of Italy. *Bollettino della Società Paleontologica italiana* 52(3): 1-9.

Nordsieck, F. 1968. *Die europäischen Meeres-Gehäuseschnecken (Prosobranchia). Vom Eismeer bis Kapverden und Mittelmeer*. Stuttgart (Gustav Fischer): viii + 273 pp.

Nordsieck, F. 1972. Marine Gastropoden aus der Shiqmona-Bucht in Israël. *Archiv für Molluskenkunde* 102(4-6): 227-245.

Nordsieck, F. 1977a. *The Turridae of the European seas*. Roma (Ed. la Piramide): 131 pp.

Nordsieck, F. 1977b. Edward Forbes (1814–1854) redivivus: revision der Gastropoden seiner Agäis-Expedition von 1841–1842. *Annales Musei Goulandris* 3: 131-172.

Nordsieck, F. & Garcia-Talavera, F. 1979. *Moluscos Marinos de Canarias y Madeira (Gastropoda).* Aula de Cultura, Tenerife, 208 pp., 46 pls.

Nyst, P.H. 1878. Conchyliologie des terrains tertiaires de la Belgique, 1 Terrain Pliocène Scaldisien. *Annales du Musée Royal d'Histoire Naturelle de Belgique, série Paléontologique* 3: atlas, 28 pls.

Nyst, P.H. 1882. Conchyliologie des terrains tertiaires de la Belgique, 1. Terrain Pliocène Scaldisien. *Annales du Musée Royal d'Histoire Naturelle de Belgique, série Paléontologique* 3: text, 1-263.

Orbigny, A. d' 1837. Mémoire sur des espèces et sur des genres nouveaux de l'ordre des nudibranches observés sur les côtes de France. *Magasin de Zoologie* 7, classe 5: 1-16, pls 102-109.

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.

Orlando, V.E. & Palazzi, F. 1985. Malacofauna del Golfo di Castellamare (Sicilia). *Il Naturalista Siciliano* serie 4, 9: 29-77.

Öztürk, B. 2021. *Mangelia* (Gastropoda, Conoidea) species of the Turkish coasts with description of *Mangelia vanaartseni* sp. nov. *Zootaxa* 4933(2): 241–262.

Pallary, P. 1904-1906. Addition à la faune malacologique du Golfe de Gabès. *Journal de Conchyliologie* 52: 212-248, pl. 7 (1904); 54: 77-124, pl. 4 (1906).

Patrini, P. 1930. La fauna nana pliocenica del colle di S. Colombano al Lambro. *Rivista Italiana di Paleontologia* 36: 33-44.

Paulus, M. & Mars, P. 1941. Guide malacologique des environs de Marseille. Deuxième partie. Catalogue des principaux mollusques marins du Golfe de Marseille. Solenogastres, polyplacophores, gastéropodes. *Bulletin du Muséum d'Histoire Naturelle de Marseille* 1: 227-247.

Pavia, G. 1976. I molluschi del Pliocene inferiore di Monteu Roero (Alba, Italia NW). *Bollettino della Società Paleontologica Italiana* 14: 99-175.

Payraudeau, B.C. 1827. *Catalogue descriptif et méthodique des annelides et des mollusques de l'Ile de Corse; avec huit planches représentant quatre-vingt-huit espèces, dont soixante-huit nouvelles*. 218 pp. Paris.

Pelosio, G. 1967. La malacofauna dello stratotipo del Tabianiano (Pliocene inferiore) de Tabiano Bagni (Parma). *Bollettino della Società Paleontologica Italiana* 5: 101-183.

Pennant, T. 1777. *The British zoology*, 4. *Crustacea, Mollusca, Testacea.* London (Benjamin White): xviii + 156 pp.

Pereira da Costa, F.A. 1866-1867. Molluscos fosseis. Gasteropodes dos depositos terciarios de Portugal. *Memória Commissão Geologica de Portugal* 4(1): 1-116 (1866); (2): 117-252 (1867).

Perry, G. 1811. *Conchology or the Natural History of Shells, Containing a New Arrangement of the Genera and Species, Illustrated by Coloured Engravings Executed from the Natural Specimens, and Including the Latest Discoveries*. W. Bulmer & Co., London: 4 pp., 61 pls.

Philippi, R.A. 1836. *Enumeratio Molluscorum Siciliae cum Viventium tum in Tellure Tertiaria Fossilium quae in Itinere suo Observavit Auctor*. Berolini, Berlin, xiv + 268 pp., 12 pls.

Philippi, R.A. 1842-1850. *Abbildungen und Beschreibungen neuer oder wenig gekannter Conchylien unter mithufte meherer deutscher Conchyliologen*, 1-3. Cassel (T. Fischer): 1: 1-20 (1842), 21-76 (1843a), 77-186 (1844), 187-204 (1845); 2: 1-64 (1845), 65-152 (1846), 153-232 (1847); 3: 1-50 (1847), 51-82 (1848), 1-88 (1849), 89-138 (1850); 144 pls.

Philippi, R.A. 1843b. *Beiträge zur Kenntniss der Tertiärversteinerungen des Nordwestlichen Deutschlands.* Theodor Fischer, Cassel: iii + 85 pp., 4 pls.

Piani, P. 1980. Catalogo dei Molluschi conchiferi viventi nel Mediterraneo. *Bollettino Malacologico* 16(5-6): 113-224.

Pinna, G. & Spezia, L. 1978. Catalogo dei tipi del Museo Civico di Storia Naturale di Milano, 5. I tipi dei Gasteropodi fossili. *Atti della Società Italiana di Scienze naturali Museo Civico di Storia naturale* 119: 125-180.

Poppe, G.T. & Goto, Y. 1991. *European Seashells. Volume 1 (Polyplacophora, Caudofoveata, Solenogastra, Gastropoda).* Verlag Christa Hemmen, Wiesbaden, Germany: 352 pp.

Powell, A.W.B. 1942. The New Zealand Recent and fossil Mollusca of the family Turridae with general notes on turrid nomenclature and systematics. *Bulletin of the Auckland Institute and Museum* 2: 1-188.

Powell, A.W.B. 1966. The molluscan families Speightiidae and Turridae. An evaluation of the valid taxa both Recent and fossil, with lists of characteristic species. *Bulletin of the Auckland Institute and Museum* 5: 1-184.

Prkić, J. & Giannuzzi-Savelli, R. 2023. A new species of *Bela* Leach in J.E. Gray, 1847 (Conoidea Mangeliidae) from Croatia. *Biodiversity Journal* 13 (4): 841-852.

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.

Rasmussen, L.B. 1956. The marine Upper Miocene of South Jutland and its molluscan fauna. *Danmarks Geologiske Undersøgelse* 2(81): 1-166.

Reeve, L.A. 1843-1846. *Monograph of the Genus* Pleurotoma. In: *Conchologia Iconica, or Illustrations of the Shells of Molluscous Animals*, 1. London (Reeve Brothers): 40 pls. + index and errata. Published in parts; 1843: pls. 1-18 (January-December 1843); 1844: pl. 19 (January 1844b); 1845: pls. 20-33 (October-December 1845); 1846: pls. 34-40, index and errata (January-April 1846).

Regteren Altena, C.O. van 1959. Notes on Turridae from the Plio-Pleistocene of the Netherlands. *Basteria* 23: 31-32.

Repetto, G., Orlando, F. & Arduino, G. 2005. *Conchiglie del Mediterraneo*. Alba (Amici del Museo "Federico Eusebio"): 391 pp.

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): vii + 439 pp.

Robba, E. 1968. Molluschi del Tortoniano-tipo (Piemonte). *Rivista Italiana di Paleontologia e Stratigrafia* 74: 457-646.

Rolán, E. 2005. *Malacological Fauna from the Cape Verde Archipelago*. ConchBooks, Hackenheim, 455 p.

Rolán, E., Fernández-Garcés, E. & Redfern, C. 2012. New records and description of four new species of the genus *Agathotoma* (Gastropoda, Mangeliidae) in the Caribbean. *Novapex* 13(2): 45-62 .

Rolán, E. & Otero-Schmitt, J. 1999. The family Turridae s. l. (Molluscs, Neogastropoda) in Angola. 2. Subfamily Mangeliinae Fischer, 1883. *Argonauta* 13(1): 5-26.

Rolán, E., Otero-Schmitt, J. & Fernandes, F. 1994. El genero *Bactrocythara* (Gastropoda: Mangeliinae) en Africa Occidental, con la descripcion de una nueva especie. *Bollettino Malacologico* 29(9-12): 243-248.

Roman, F. 1940. Listes raisonnées des faunes du Pliocène et de Miocène de Syrie et du Liban. In Dubertret, L. (Ed.) Études Paléontologiques. *Notes et Mémoires Haut-Commissariat de la République Française en Syrie et au Liban Service des Travaux Publics-Section d'Études Géologiques*. Tome III. Victor-Cousin, Paris: 353-399, 5 pls.

Rossi-Ronchetti, C. 1955. I tipi della 'Conchiologia Fossile Subapennina' di G. Brocchi, 2. Gastropodi, Scafopodi. *Rivista Italiana di Paleontologia e Stratigrafia, Memorie* 5: 91-343.

Sacco, F. 1904. I molluschi dei terreni terziari del Piemonte e della Liguria, 30. Aggiunte e correzioni (con 1400 figure). Considerazioni generali. Indice generale dell'opera. Torino (C. Clausen): 203 + xxxvi pp., 31 pls.

Scacchi, A. 1836. *Catalogus conchyliorum regni neapolitani quae usque reperit.* Neapoli (Typis Filiatre-Sebetii): 18 pp.

Scarponi, D. & Della Bella, G. 2010. *Molluschi marini del Plio-Pleistocene dell'Emilia-Romagna e della Toscana. Conoidea,* 4. *Conidae*, 2. *(Sottofamiglia Mangeliinae*, 1*)*. Bologna (Museo Geologico Giovanni Capellini): 128 pp.

Scarponi, D., Landau, B., Janssen, R., Morgenroth, H. & Della Bella, G. 2014. Lectotype designation for *Murex nebula* Montagu 1803 (Mangeliidae) and its implications for *Bela* Leach in Gray 1847. *Zootaxa* 3884 (1): 045-054.

Schepman, M.M. 1913. The Prosobranchia of the Siboga Expedition. Part V. Toxoglossa, with a supplement. *Siboga-Expeditie* 49e: 365-452, pls 25-34. Leiden, E.J. Brill.

Schnetler, K.I. & Beyer, L. 1990. A late Oligocene (Chattian B) molluscan fauna from the coastal cliff at Mogenstrup, north of Skive, Jutland, Denmark. *Mededelingen van de Werkgroep voor Tertiaire en Kwartaire Geologie* 27, 39-81.

Seguenza, G. 1875. Studii stratigrafici sulla formazione pliocenica dell'Italia meridionale (*partim*). *Bullettino del Reale Comitato Geologico d'Italia* (1875), 18-31 (1-2); 82-89 (3-4); 145-153 (5-6); 204-211 (7-8); 276-283 (9-10); 340-345 (11-12).

Silva, C.M. da 2001. Gastrópodes pliocénicos marinhos de Portugal: sistemática, paleoecologia, paleobiologia, paleogeografia. Dissertação de doutoramento. Lisboa (Faculdade de Ciências da Universidade de Lisboa): 747 pp. (unpublished).

Silva, C.M. da, Landau, B.M. & La Perna, R. 2011. Biogeography of Iberian Atlantic Neogene marginelliform gastropods (Marginellidae, Cystiscidae): Global change and transatlantic colonization. *Journal of Paleontology* 85(6): 1052-1066.

Simroth, H. 1907. *Dr. H. G. Bronn's Klassen und Ordnungen des Tier-Reichs Wissenschaftlich Dargestellt in Wort und Bild. Dritter Band, Mollusca. II. Abteilung: Gastropoda Prosobranchia*. Vol. 3. 1056 pp., 63 pls.

Sismonda, E. 1842. *Synopsis Methododica Animalium Invertebratorum Pedemontii Fossilium*. Augustae Taurinorum, Torino: 44 pp.

Sismonda, E. 1847. *Synopsis Methododica Animalium Invertebratorum Pedemontii Fossilium (exceptis speciebus ineditis).* 2nd edition. *Augustae Taurinorum, Torino:* VIII + 62 pp.

Smith, E.A. 1872. A list of species of shells from West Africa, with descriptions of those hitherto undescribed. *Proceedings of the Zoological Society of London* 1871: 727-739, pl. 75.

Sorgenfrei, T. 1958. Molluscan assemblages from the marine middle Miocene of South Jutland and their environments, 1-2. *Danmarks Geologiske Undersøgelse* (2)79: 1-503.

Sosso, M. & Dell'Angelo, B. 2010. *I fossili del Rio Torsero*. Prato (Editing Marginalia, Cartotectonica Beusi srl): 95 pp.

Sowerby, G.B. I. 1833-1834. [Characters of new species of shells from the collection formed by Mr. Cuming on the western coast of South America and among the islands of

the South Pacific Ocean]. *Proceedings of the Zoological Society of London* 1833: 16-22, 34-38 [17 May]; 52-56 [24 May]; 70-74 [20 September]; 82–85 [8 September]; 134-139. [16 April 1834].

Spada, G., Sabelli, B. & Giannuzzi-Savelli, R. 2023. *Mangelia* Risso, 1826 and allied genera in the Mediterranean with the description of a new genus and three new species (Gastropoda, Mangeliidae). *Bollettino Malacologico* 59: 1-53.

Strausz, L. 1954. Várpalotai Felsö-Mediterrán Csigák (Les gastropods du Mediterranéen Supérieur (Tortonien) de Varpalota). *Geologica Hungarica* 25: 1-150.

Strausz, L. 1966. *Die Miozän-Mediterranen Gastropoden Ungarns*. Budapest (Akadémiai Kiadó): 692 pp.

Švagrovský, J. 1958. Miocénne Pleurotomidae západnokarpatských panví. *Acta Geologica et Geographica Universitatis Comenianae* 1: 5-56.

Tabanelli, C. 2018. Una specie fossile di grande profondità: *Gymnobela santorsolae* n. sp. (Mollusca: Gastropoda: Raphitomidae). *Quaderno di Studi e Notizie di Storia Naturale della Romagna* 47:1-7.

Thiele, J. 1925. Gastropoden der Deutschen Tiefsee-Expedition. II Teil. *Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition auf dem Dampfer "Valdivia" 1898-1899* 17(2): 35-382, pls 13-46 [reprints paginated 1–348, pls 1–34].

Thompson, W. 1845. Additions to the fauna of Ireland, including descriptions of some apparently new species of Invertebrata. *Annals and Magazine of Natural History* (1)15: 308-321, pl. 19.

Tiberi, N. 1855. *Descrizione di alcuni nuovi testacei viventi nel Mediterraneo.* Napoli (G. Nobile): 16 pp.

Tryon, G.W., Jr 1884. *Conidae, Pleurotomidae. Manual of Conchology, Structural and Systematic, with Illustrations of the Species. Vol. 6*. Tryon, Philadelphia: 413 pp., 34 pls.

Tucker, J.K. 2004. Catalog of Recent and fossil turrids (Mollusca: Gastropoda). *Zootaxa* 682: 1-1295.

Venzo, S. & Pelosio, G. 1963. La malacofauna Tortoniana del Colle di Vigoleno (Preappenino Piacentino). *Palaeontographia Italica* 58: 43-213.

Vera-Peláez, J.L. 1996 [1997?]. Turridae (Mollusca, Gastropoda) del Plioceno malacitano. Tesis doctoral (2 vols). Departamento de Ecología y Geología. Facultad de Ciencias. Universidad de Málaga: 864 pp, 39 figs, 59 pls (unpubished) [work dated in text by Vera-Peláez, J.L. 2002 variably as 1996 or 1997, but in references as 1996. Copy of thesis available dated 1996 on front page. The figure numbers quoted under each species do not match the figure captions].

Vera-Peláez, J.L. 2002. Revisión de la familia Turridae, excepto Clavatulinae (Gastropoda, Prosobranchia) en el Plioceno de las cuencas de Málaga y Vélez Málaga (Málaga, S España) con la descripción de 26 especies nuevas. *Pliocénica, Publicaciones del Museo Municipal Paleontológico de Estepona* 2: 176-262.

Vera-Peláez, J.L. & Batllori Aguilá, J. 1996. La subfamilia Crassispirinae Morrison, 1966 (Turridae, Gastropoda) del Neógeno de la Península Iberica. *Malakos* 5: 32-52.

Vera-Peláez, J.L., Martinell, J. & Lozano-Francisco, M.C. 1999. Turridae (Gastropoda, Prosobranchia) del Plioceno inferior de Málaga (España). *Iberus* 17: 1-19.

Watson, R.B. 1879-1883. Mollusca of H.M.S. 'Challenger' Expedition. *Journal of the Linnean Society of London.* 14: 506-529, 586-605, 692-716 [1879]; 15: 87-126, 217-230 [1880], 245-274, 388-412, 413-455, 457-475 [1881]; 16: 247-254, 324-343, 358-372, 373-392 [1882], 594-611 [1883]; 17: 26-40, 112-130, 284-293, 319-340, 341-346 [1883].

Wenz, W. 1938-1944. Gastropoda. Teil 1: Allgemeiner Teil und Prosobranchia. xii + 1639 pp. In: Schindewolf, O.H. (Ed.) *Handbuch der Paläozoologie*, Band 6. Bornträger, Berlin. Lief. 1, 1-240 [March 1938]; 3, 241-480 [October 1938]; 4, 481-720 [July 1939]; 6, 721-960 [August 1940]; 7, 961-1200 [October 1941]; 8, 1201-1506 [October 1943]; 9, 1507-1639, i-xii [November 1944].

Wienrich, G. 2007. *Die Fauna des marinen Miozäns von Kevelaer (Niederrhein), 4. Gastropoda ab Mitridae.* (Turridae by Janssen, R. & Wienrich, G.). Leiden (Backhuys Publishers BV): 640-954.

Wood, S.V. 1848. A Monograph of the Crag Mollusca or, descriptions of shells from the middle and upper tertiaries of the east of England. Part 1. Univalves. *Monograph of the Palaeontographical Society of London* 1: xii + 1-208, 21 pls.

Wood, S.V. 1872-1874. Supplement to the monograph of the Crag Mollusca, with descriptions of shells from the upper Tertiaries of the east of England, 3. Univalves and bivalves, with an introductory outline of the geology of the same district, and map. *Monographs of the Paleontographical Society*: i-xxxi + 1-99 (1872), 100-231 (1874).

Woodring, W.P. 1928. *Miocene mollusks from Bowden, Jamaica*, 2. *Gastropods and discussion of results*. Washington (Carnegie Institution of Washington, DC): 564 pp.

Zelinskaya, V.A., Kulichenko, V.G., Makarenko, D.E. & Sorochan, E.A. 1968. *Paleontologicheskiy Spravochnik, 2. Bruyukhonogiye 'lopatonogiye mollyuski paleogena' miotsena Ykranini*. (*Paleontological Reference Book, 2. Gastropoda and scaphopod mollusks of the Paleogene and Miocene of Ukraine*). Kiev (Academy of Sciences, Ukrainian SSR, Institute of Geological Sciences): 281 pp.

Zilch, A. 1934. Zur Fauna des Mittel-Miocäns von Kostej (Banat). Typus-Bestimmung und Tafeln zu O. Boettger's Bearbeitungen. *Senckenbergiana* 16:193-302, 22 pls.