The Pliocene Gastropoda (Mollusca) of Estepona, southern Spain. Part 19: Chauvetiidae (Buccinoidea)

Bernard M. Landau[1*] & Pasquale Micali[2]

[1] *Naturalis Biodiversity Center, P.O. Box 9517, 2300 RA Leiden, The Netherlands; Instituto Dom Luiz da Universidade de Lisboa, Campo Grande, 1749-016 Lisboa, Portugal; and International Health Centres, Av. Infante de Henrique 7, Areias São João, P-8200 Albufeira, Portugal; email: bernardmlandau@gmail.com*
[2] *Via Papiria 17, 61032 Fano, Pesaro-Urbino, Italy; e-mail: lino.micali@virgilio.it*
[*] *Corresponding author*

ZooBank registration – urn:lsid:zoobank.org:pub:A1B973C0-C910-41B3-BB9E-AB92FA32B9E4

Received 12 September 2023, revised version accepted 25 October 2023.

In this paper we review the Chauvetiidae (Buccinoidea) of the Lower Piacenzian, Upper Pliocene of Estepona, southern Spain. Twenty species are described and discussed of which eleven are new: *Chauvetia brunettii* nov. sp., *C. fenestrata* nov. sp., *C. fortiornata* nov. sp., *C. hoffmani* nov. sp., *C. janseni* nov. sp., *C. obesa* nov. sp., *C. oliveri* nov. sp., *C. pseudopelorcei* nov. sp., *C. sinuosa* nov. sp., *C. solida* nov. sp., *C. spinosa* nov. sp. Three species are left in open nomenclature. The assemblage is highly endemic, with over half of the species known only from the Estepona assemblages. This level of endemicity is not surprising in a group that reproduces by direct development, as suggested by its paucispiral protoconch.
Today, the genus is found only along the eastern Atlantic frontage from the British Isles to West Africa. Fossil records are scarce, and this is the most diverse assemblage of fossil *Chauvetia* Monterosato, 1884 species described so far, and suggests that already in the Pliocene chauvetiid diversity was far greater in the westernmost Mediterranean than in the central or eastern part, a trend still seen today. The genus *Chauvetia* only appears in the European fossil record during the Late Miocene with just a couple of records known and was most likely transported to Europe from the Caribbean on a strengthening Gulf Stream. We suggest that the higher diversity in western Mediterranean may be due to the geographic proximity to its area of arrival in Europe/West Africa and its direct mode of development.

Key words: southern Spain, Upper Pliocene, Gastropoda, Chauvetiidae, Buccinoidea, new species

Introduction

Chauvetia Monterosato, 1884 encompasses a group of buccinid species with small shells (usually 4-12 mm in height), usually slender nassariform or broader fusiform in shape, with both axial and spiral sculpture, forming a reticulate pattern, often with small tubercles developed at the intersections. The protoconch in these gastropods is very characteristic, paucispiral with a large nucleus, and usually bearing microsculpture. Although traditionally placed within the Buccinidae, *Chauvetia* species are not particularly similar to any other buccinid genus. Based on molecular, anatomical and radula data, the *Chauvetia*-clade was found to be isolated and forms a sister-group to the Pisaniidae (Kantor *et al*., 2022 [2021]). Several family-group names have been proposed for *Chauvetia* species, such as Lachesinae Bellardi, 1877 and Donovaniidae T. L. Casey, 1904, none of which are nomenclaturally available (Gofas & Oliver, 2010, p. 28). Therefore, Kantor *et al*. (2022 [2021]) erected the family Chauvetiidae Kantor, Fedosov, Kosyan, Puillandre, Sorokin, Kano, R. Clark & Bouchet, 2021.

The genus comprises a fairly large number of extant species (approximately 44; see Figure 2) occurring along the eastern Atlantic from the southern North Sea, the English Channel, and along the Atlantic coasts of continental Europe (Graham, 1988; Rolán Mosquera, 1983) and West Africa, as far south as the Ivory Coast, the Macaronesian Islands, and also the Mediterranean (Oliver & Rolán, 2008, 2009; Gofas & Rolán, 2010; Hoffman *et al*., 2018). The most southwestern present-day record seems to be that for *Chauvetia helenae* (E.A. Smith, 1890), from the Island of Saint Helena in the eastern South Atlantic, although the validity of this taxon is unclear (MolluscaBase eds., 2023). However, the origins of *Chauvetia* are unexpected, and will be considered in the discussion.

Extant species inhabiting the Mediterranean were reviewed by Nordsieck (1976) and Micali (1999), those from the Canary Islands by Nordsieck & García-Talavera (1979) and Hernández *et al*. (2011), those from West Africa by Ardovini (2008), Oliver & Rolán (2008, 2009)

and Hoffman *et al*. (2018), and those from the Iberian-Moroccan area by Gofas & Oliver (2010). Fossil records are scarce and scattered. The most comprehensive work is by Brunetti *et al*. (2017) revising the Plio-Pleistocene Mediterranean species.

In this work we present an as yet unknown assemblage of *Chauvetia* species from the westernmost Mediterranean Pliocene including twenty species. This is by far the most diverse fossil chauvetiid assemblage yet described.

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) between 1997-2020 and by Henk Mulder between 2008-2023; to the latter we are extremely grateful for his tireless efforts and generosity in making his collection available to us. For a map of localities see Landau *et al*. (2003: 4, text-fig. 1). The material is housed in the Natural History Museum Vienna (NHMW) and Naturalis Biodiversity Center (RGM).
A comprehensive chresonymy and distribution is given for each species, in which only illustrated records are included. For extant species a selection of references is given representing the species' geographical and/or ecological extension.
A generic diagnosis for *Chauvetia* shells is given. The specific descriptions omit characters common to all congeners (*i.e*., solid shell, tall spire, undulating suture, thickened outer lip, ribs fading over base, ovate aperture, short siphonal canal), and highlight the species specific characters.
For *Chauvetia* species the shells are categorised as small (<7 mm), medium (7-10 mm) or large (>10 mm), shell length (SL) and maximum diameter (MD) measured, width is described as very broad (SL/MD <2.2), broad (SL/MD 2.2–2.49), slender (SL/MD = 2.5–2.69), very slender (SL/MD = >2.7). Last whorl is short (<=51%) of total height, tall (>= 58%) of total height. Aperture is low (<=31%) of total height, tall (> 38%) of total height. Denticles within the outer lip are given a number: D1 being the most adapical denticle, numbered sequentially towards base.

Protoconch measurements are taken using the same methods as in other parts of the series; that is, the nucleus counts as the first half whorl. This is in contrast to Oliver & Rolán (2008, 134, fig. 1) in which the nucleus is not counted. In effect, the measurement given herein as dV1 = 1/2V of Oliver & Rolán (see Pl. 1 comparing the two measuring methods). Oliver & Rolán (2008) also measured the height of the nucleus (LN), also adopted herein.

Protoconch measurements:
dp = diameter protoconch, **hp** = height protoconch, **dp/hp** = diameter/height protoconch, **dV1** = diameter first protoconch whorl, **n** = diameter nucleus, **Ln** = height of the nucleus.

Abbreviations:
CO: Velerín conglomerates; **PA**: Rio del Padrón; **VC**: Velerín carretera; **VS**: Velerín sands; **EL**: El Lobillo; see Landau *et al*. (2003, p. 4, text-fig. 1).
NHMW Natural History Museum Vienna (Austria)
RGM Naturalis Biodiversity Center, collection Cainozoic Mollusca (Leiden, The Netherlands).

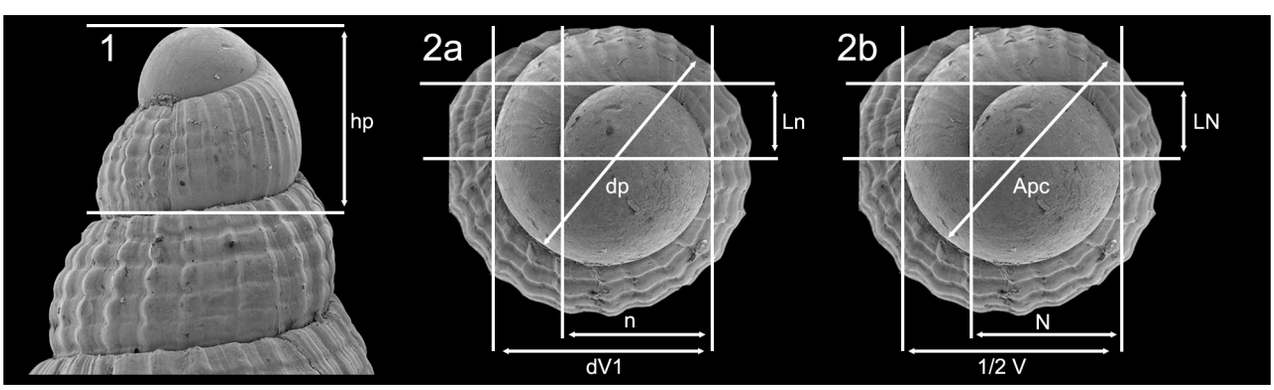


Plate 1. *Chauvetia* protoconch; 1. View showing protoconch/teleoconch boundary, 2. Apical view: 2a, measurements and terminology used in this paper; 2b, measurements and terminology used Oliver & Rolán (2008).

Systematics

Subclass Caenogastropoda
Order Neogastropoda
Superfamily Buccinoidea Rafinesque, 1815
Family Chauvetiidae Kantor, Fedosov, Kosyan, Puillandre, Sorokin, Kano, R. Clark & Bouchet, 2021
Genus *Chauvetia* Monterosato, 1884

Type species – *Nesaea mamillata* Risso, 1826 (type species (by typification of replaced name), present-day, Mediterranean.

1826 *Nesaea* Risso, p. 211. Type species (by subsequent designation, Bucquoy *et al*., 1883): *Nesaea mamillata* Risso, 1826, present-day, Mediterranean. Junior homonym of *Nesaea* Leach, 1814 [Crustacea].
1826 *Lachesis* Risso, p. 223. Type species (by monotypy): *Lachesis mamillata* Risso, 1826, present-day, Mediterranean. Junior homonym of *Lachesis* Daudin, 1803 [Reptilia].
1883 *Donovania* Bucquoy, Dautzenberg & Dollfus, p. 85, 112. Type species (by typification of replaced name): *Nesaea mamillata* Risso, 1826, present-day, Mediterranean. *Nom. nov. pro Lachesis* Risso, 1826, *non* Daudin, 1803 [Reptilia]; and *Nesaea* Risso, 1826, *non* Leach, 1814 [Crustacea]. Junior homonym of *Donovania* Leach, 1814 [Crustacea].
1884 *Folineaea* Monterosato, p. 136. Type species (by subsequent designation, Crosse, 1885): *Buccinum lefebvrii* Maravigna, 1840, present-day, Mediterranean.
1884 *Chauvetia* Monterosato, p. 137. Type species (by typification of replaced name): *Nesaea mamillata* Risso, 1826, present-day, Mediterranean. Established as a substitute name for *Nesaea* Risso, 1826, *non* Leach, 1814 [Crustacea].
1902 *Adansonia* Pallary, p. 13. Unnecessary *nom. nov. pro Folineaea* Monterosato, 1884, treated by Pallary as a junior homonym of *Folinia* Crosse, 1868.
1918 *Syntagma* Iredale, p. 28, 34. Type species (by typification of replaced name): *Nesaea mamillata* Risso, 1826, present-day, Mediterranean. *Nom. nov. pro Donovania* Bucquoy, Dautzenberg & Dollfus, 1883, *non* Leach, 1814 [Crustacea].
1968 *Donovaniella* Nordsieck, p. 136. Type species (by original designation): *Buccinum minimum* Montagu, 1803, present-day, British Isles.
1968 *Chauvetiella* Nordsieck, p. 137. Type species (by original designation): *Lachesis vulpecula* Monterosato, 1874, present-day, Mediterranean.

Diagnosis – Shell small (5-13 mm in adults, exceptionally up to 20 mm), solid, narrowly fusiform, with high spire and very short siphonal canal. Protoconch paucispiral, of 1.1-1.5 whorls, the nucleus about half the width of the protoconch, smooth or sculptured with spiral threads initially, last portion by axial ribs, sometimes with only prominent elevated ribs on post-nuclear whorl. Protoconch/teleoconch junction not clearly delimited in many species, is taken as the point at which the axial riblets on the last portion of the protoconch that often become slightly more close-set towards the junction, become broader and more widely spaced again, and any spiral microsculpture fades (in species with protoconch spiral sculpture) and the primary spiral cords appear. Teleoconch whorl outline convex, separated by undulating suture; shoulder not pronounced. Sculpture of strong axial ribs running along entire whorl height, 15-20 on last whorl, fading over base, and 3-5 distinct spiral cords, with tubercles formed at intersections in some species. Aperture ovate, low; outer lip thickened by labial varix, with or without denticles within.

Chauvetia affinis (Monterosato, 1889)

Plate 2, figs 1, 2; Plate 3, figs 1, 2; Plate 23, figs 4, 6

*1889 *Donovania affinis* Monterosato, p. 116.
1968 *Chauvetia turritellata* (Deshayes) – Ruggieri & Buccheri, p. 38, pl. 5, fig. 6 [*non* Deshayes, 1835].
1976 *Chauvetia turritellata* (Deshayes, 1832 [*sic*]) – Nordsieck, p. 6, fig. 23 [*non* Deshayes, 1835].
1976 *Chauvetia vulpecula attenuata* (Tiberi ms) Nordsieck, p. 7, fig. 32.
1999 *Chauvetia turritellata* (Deshayes, 1835) – Micali, p. 61, figs 15-18, 24-26, 30 [*non* Deshayes, 1835].
1999 *Chauvetia* cfr. *turritellata* (Deshayes, 1835) – Forli *et al*., p. 117, pl. 2, figs 10, 14.
2000 *Chauvetia turritellata* (Deshayes, 1835) – Chirli (*partim*), p. 59, pl. 23, figs 5-8.
2001 *Chauvetia minima* (Montagu, 1803) – Silva, p. 383, pl. 16, figs 5, 6 [*non Buccinum minimum* Montagu, 1803, *non* Berckenhout, 1795, *nec* Turton, 1802 = *Chauvetia brunnea* (Donovan, 1804)].
2003 *Chauvetia turritellata* (Deshayes, 1835) – Giannuzzi-Savelli *et al*., p. 15, 172, figs 342-347 [*non* Deshayes, 1835].
2008 *Chauvetia turritellata* (Deshayes, 1835) – Cecalupo *et al*., p. 99, pl. 52, figs 6a, b, 7-12, 15-16.
2009 *Chauvetia affinis* (Monterosato, 1889) – Oliver & Rolán, p. 116, figs 6-13, 68-76.
2011 *Chauvetia turritellata* (Deshayes, 1835) – Chirli & Linse, p. 144, pl. 48, fig. 7 [*non* Deshayes, 1835].
2017 *Chauvetia errata* Oliver & Rolán, 2009 – Brunetti *et al*., p. 12, figs 1A-C [*non* Oliver & Rolán, 2009].
2017 *Chauvetia turritellata* (Deshayes, 1835) – Brunetti *et al*., p. 17, figs 4C-F [*non* Deshayes, 1835].
?2018 *Chauvetia turritellata* (Deshayes, 1835) – Brunetti & Cresti, p. 74, fig. 274 (juvenile specimen of just one adult whorl).

non 1910 *Donovania affinis* Monterosato – Dautzenberg, p. 112 [= *Chauvetia errata* Oliver & Rolán, 2009].
non 2008 *Chauvetia affinis* (Monterosato, 1889) – Oliver & Rolán, p. 138, figs 13, 14, 68, 93-98, 181, 189 [= *Chauvetia errata* Oliver & Rolán, 2009].

non 2011 *Chauvetia turritellata* (Deshayes, 1835) – Landau *et al*., p. 25, pl. 12, fig. 6 [*Chauvetia* cf. *mamillata* (Risso, 1826)].

Material and dimensions – Maximum height 4.8 mm, width 2.0 mm. Typical form, **CO**: NHMW 2023/0284/0065-0066 (2), NHMW 2023/0284/0067 (50+), NHMW 2023/0284/0078 (1), RGM.1404354 (7). **EL**: NHMW 2023/0284/0086 (50+). Forma *arenaria* **CO**: NHMW 2023/0284/0068-0069 (2), NHMW 2023/0284/0070 (1). **EL**: NHMW 2023/0284/0087 (10). **VS**: NHMW 2023/0284/0097 (9).

Description – Shell small, broad (SL/MD = 2.40-2.47). Protoconch 1.3 whorls, bearing numerous crowded spiral cordlets separated by narrow grooves, 3-4 riblets on last quarter whorl (dp = 570-580 μm, hp = 575-610 μm, dp/hp = 0.93-1.01, dn = 300-315 μm, dV1 = 465-480 μm, Ln = 135-175 μm). Protoconch/teleoconch junction sharply delimited. Teleoconch of just over four convex whorls separated by moderately impressed undulating suture. Axial sculpture of narrow, weakly prosocline to opisthocline, rounded ribs, slightly narrower than their interspaces, 12 on last whorl. Spiral sculpture on first teleoconch whorl of four elevated rounded cords, wider than their interspaces. Fifth cord appears below suture on second whorl, sixth just visible above suture on penultimate whorl, mostly obscured by subsequent whorl: cords elevated, forming small, rounded tubercles at intersections. Last whorl 57% of total height, convex, moderately constricted at base, seven cords above insertion of outer lip, three over base, six over siphonal fasciole. Aperture 33-34% of total height, outer lip with seven elongated denticles within.

Discussion – The name to be used for this species was discussed at length by Micali (1999) and later Oliver & Rolán (2009, p. 120). We will not discuss this further and just summarise Oliver & Rolán to say that *Fusus turritellatus* Deshayes 1835 was established based on material from the eastern Mediterranean and the type material is lost. For Atlantic and western Mediterranean specimens usually referred to as *Chauvetia turritellata auct*. the name *Donovania affinis* Monterosato, 1889 is available, and we follow those authors in calling these specimens *Chauvetia affinis*. We note that specimens from Mauritania and Senegal identified as *C. affinis* by Oliver & Rolán (2008, p. 138) are not that species, and were subsequently described as *C. errata* Oliver & Rolán, 2009.

Micali noted that in the Monterosato collection (ZMR [*lapsus*] = MCZR) a form from the present-day Gulf of Gabès, Tunisia, was labelled *Lachesis arenaria* Monterosato (*in schedis*). This form differed in being "*più affusolati, con la scultura più delicata e il labbro esterno raramente varicoso* [slenderer, with more delicate sculpture, and the outer lip rarely varicose]" (1999, p. 61), and associated with lagoonal habitats. Nordsieck (1976) named this form *Chauvetia vulpecula attenuata*. Cecalupo *et al*. (2008) discussed this form and described the differences compared to the more typical *turritellata* [*affinis*] form. This form is also present in the Estepona assemblages (Pl. 3, figs 1-2).

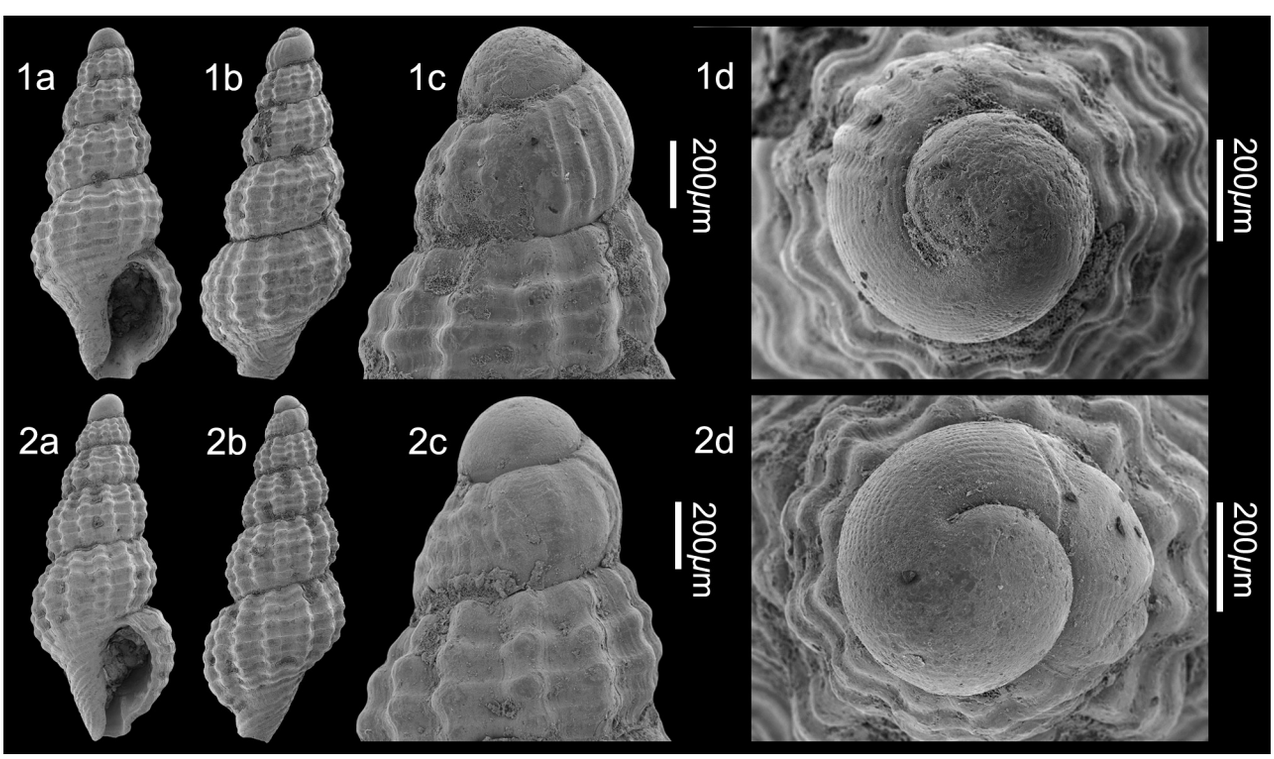


Plate 2. *Chauvetia affinis* (Monterosato, 1889); 1. NHMW 2023/0284/0065, height 4.2 mm, width 1.7 mm; 2. NHMW 2023/0284/0066, height 4.8 mm, width 2.0 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

As noted by other authors, it differs from the typical form in its slenderer shape (Estepona specimens: SL/MD = 2.67-2.89), smaller protoconch (Estepona specimens: dp = 515 μm, hp = 425 μm, dp/hp = 1.21, dn = 285 μm, dV1 = 415 μm, Ln = 110 μm), more oblique suture, finer sculpture, and more numerous axial ribs (Estepona: 14-16). Micali (1999) noted that in the Sfax material there were intermediates between the typical and elongated forms. In Estepona the *arenaria* form is uncommon and there are also intermediates. It may have been associated with a particular habitat as suggested by Micali (1999), although we do not exclude the possibility that they might represent a separate species.

The specimen illustrated by Brunetti *et al*. (2017, figs 1A-C) as *Chauvetia errata* Oliver & Rolán, 2009 from the Lower Pliocene of Italy is, in our opinion, also represents the *arenaria* form of *C. affinis*.

Distribution – Lower Pliocene: central Mediterranean, Italy (Forli *et al*., 1999; Chirli, 2000; Brunetti *et al*., 2017; ?Brunetti & Cresti, 2018). Upper Pliocene: Atlantic, Mondego Basin, Portugal (Silva, 2001); western Mediterranean, Estepona Basin, S. Spain (this paper). Lower Pleistocene: central Mediterranean, Italy (Ruggieri & Buccheri, 1968), eastern Mediterranean, Rhodes Island (Chirli & Linse, 2011). Present-day: Atlantic, Azores, Madeira, Canary Islands, Sahara to Mauritania and Senegal (Micali, 1999; Oliver & Rolán, 2009), entire Mediterranean (Micali, 1999; Giannuzzi-Savelli *et al*., 2003; Cecalupo *et al*., 2008; Oliver & Rolán, 2009).

***Chauvetia brunettii* nov. sp.**
Plate 4, figs 1, 2

2017 *Chauvetia maroccana* Gofas & Oliver, 2010 – Brunetti *et al*., p. 15, figs 4A-B [*non Chauvetia maroccana* Gofas & Oliver, 2010].

ZooBank registration – urn:lsid:zoobank.org:act:EE8EA2E8-12EC-4BA3-B1F7-92A1AA7358B8

Type material – Holotype NHMW 2023/0284/0049, height 6.3 mm, width 2.9 mm; paratype 1 NHMW 2023/0284/0050, height 6.5 mm, width 3.0 mm.

Other material – Maximum height 6.5 mm, width 3.0 mm. **CO**: NHMW 2023/0284/0051 (2).

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

Type stratum – unnamed beds of Lower Piacenzian age, Upper Pliocene.

Etymology – Named in honour of Mauro Brunetti of Rioveggio, Italy, for his contribution to the Chauvetiidae, as well as many other Pliocene mollusc groups. *Chauvetia,* gender feminine.

Diagnosis – Shell small, very broad nassariform, protoconch 1.25 whorls, teleoconch whorls moderately convex, 13 narrow, rounded orthocline ribs predominant, five

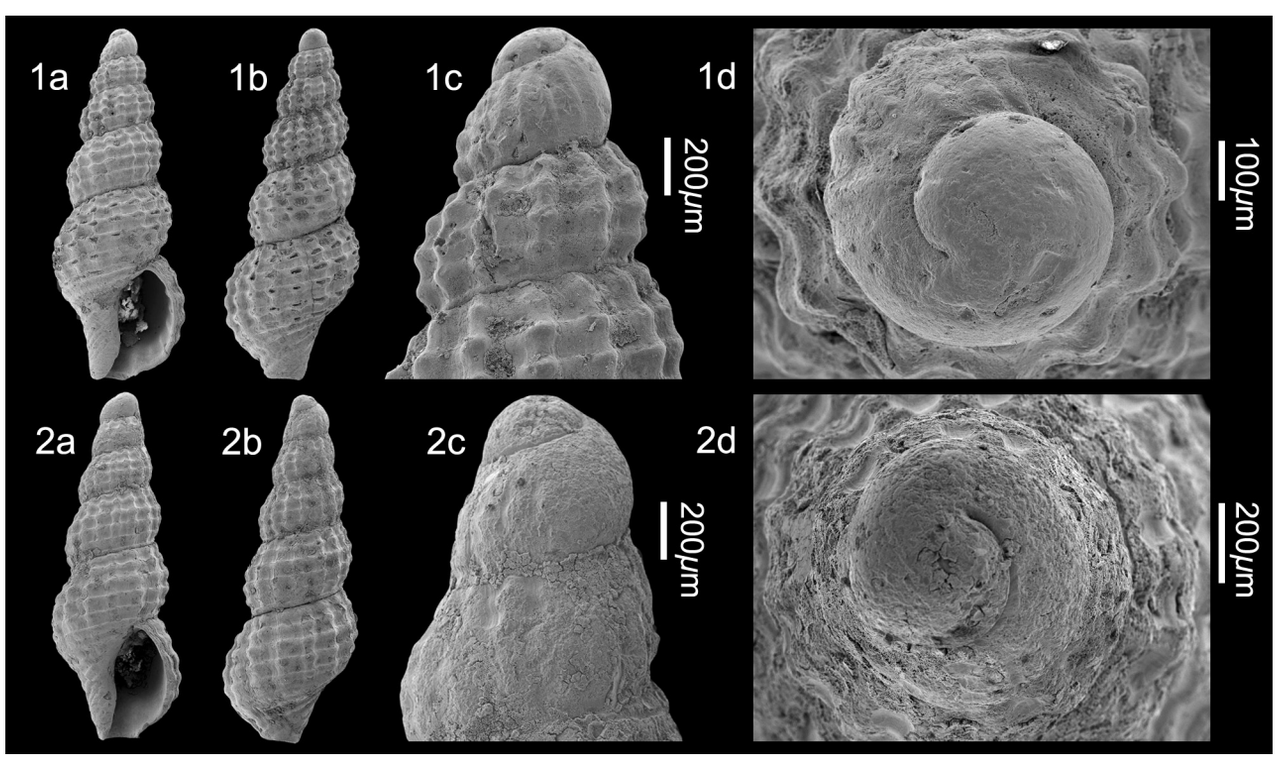


Plate 3. *Chauvetia affinis* (Monterosato, 1889), forma *arenaria*; 1. NHMW 2023/0284/0068, height 4.8 mm, width 1.8 mm; 2. NHMW 2023/0284/0069, height 5.2 mm, width 1.8 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

narrow spiral cords on spire whorls not forming small, rounded tubercles at intersections, 16-17 last whorl, six labial denticles, D1 strongest.

Description – Shell small, very broad (SL/MD = 2.17). Protoconch about 1.5 whorls, axial riblets on last half whorl, surface abraded (dp = 795 μm, hp = 665 μm, dp/hp = 1.19, dn = 560-580 μm, dV1 = 590-635 μm, Ln = 190 μm). Protoconch/teleoconch junction delimited by beginning of axial sculpture. Teleoconch of five moderately convex whorls separated by weakly impressed suture. Axial sculpture of narrow, elevated orthocline ribs, 13 on last whorl. Spiral sculpture of four cords on first teleoconch whorl, fifth appears soon after just above suture. Axials dominant forming fine, horizontally elongated reticulated surface sculpture, with small, rounded tubercles developed at intersections. Last whorl 58-59% of total height, moderately constricted at base, 5-6 cords above insertion of outer lip, three over base, about eight over siphonal fasciole. Aperture 36% total height, with six elongated denticles within, D1 slightly stronger.

Discussion – Although the protoconch appears smooth, the surface is abraded. No remnants of sculpture are seen. The protoconch/teleoconch junction is not sharply delimited. There are axial riblets on the last half whorl and we have interpreted the junction at about 1.5 whorls where the axials are suddenly stronger and wider spaced. This species seems to be the same as that illustrated by Brunetti *et al*. (2017, figs 4A-B) from the Lower Pliocene of Italy as *Chauvetia maroccana* Gofas & Oliver, 2010. However, *C. maroccana* has a smaller protoconch and a nucleus only about half as large (dp = 500-540 μm, dn = 260-300 μm; *fide* Gofas & Oliver, 2010, p. 36) and fewer, broader axial ribs (9-10 vs. 13). The base is also more strongly constricted than in *C. maroccana*.
Chauvetia edentula Oliver & Rolán, 2009 from present-day West Sahara, is also similar in profile. The protoconch is similar in diameter (dp = 720 μm; *fide* Oliver & Rolán, 2009, p. 146) and also has riblets following the nucleus, although in that species they are much more numerous. The teleoconch whorls are more convex in *C. edentula*, the base slightly more constricted, and the labial denticles are weaker.

Distribution – Lower Pliocene: central Mediterranean, Italy (Brunetti, *et al*., 2017). Upper Pliocene: western Mediterranean, Estepona Basin, S. Spain (this paper); central Mediterranean, Italy (Brunetti *et al*., 2017).

***Chauvetia decorata* Monterosato, 1889**
Plate 5, fig. 1; Plate 23, fig. 7

*1889	*Chauvetia decorata* Monterosato, p. 117.
2010	*Chauvetia decorata* Monterosato, 1889 – Gofas & Oliver, p. 53, figs 81-84, 91-94.

Material and dimensions – Height 5.3 mm, width 2.7 mm. **CO**: NHMW 2023/0284/0061 (1). **PA**: NHMW 2023/0284/0100 (1), NHMW 2023/0284/0101 (2).

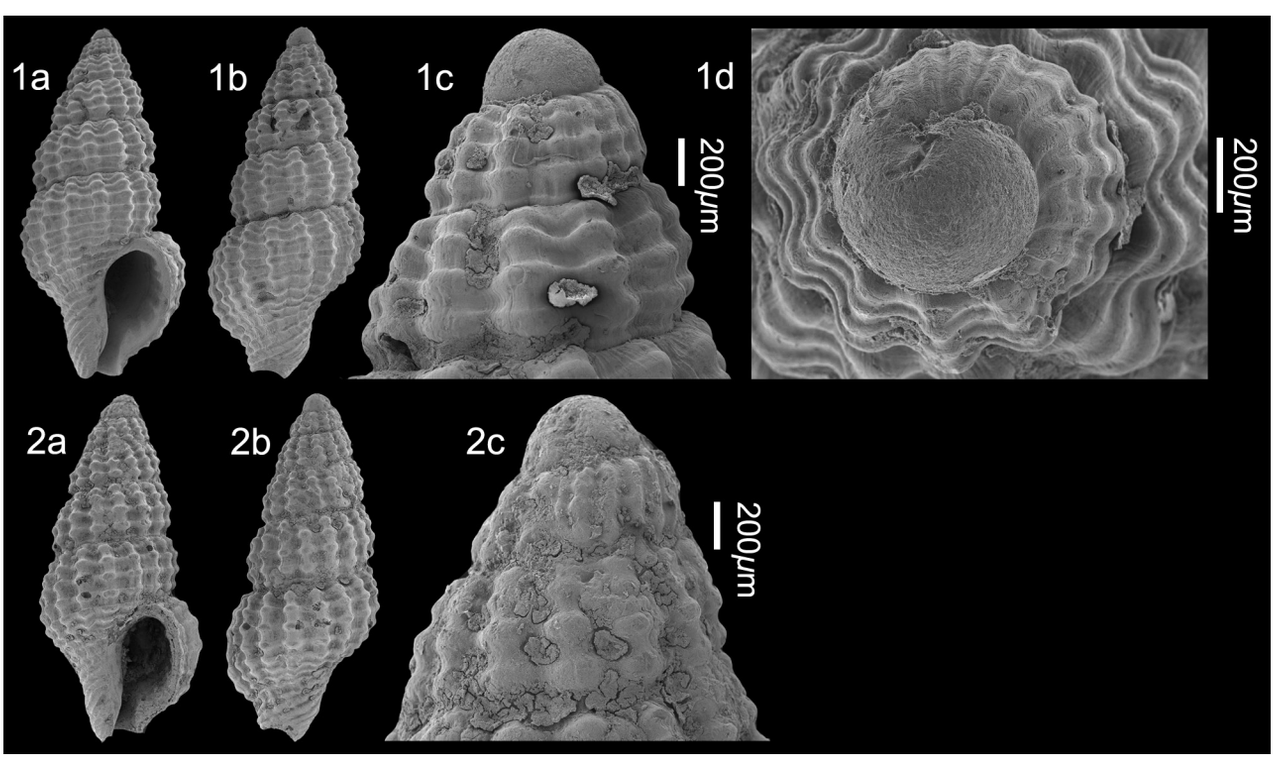


Plate 4. *Chauvetia brunettii* nov. sp.; 1. **Holotype** NHMW 2023/0284/0049, height 6.3 mm, width 2.9 mm; 2. **Paratype 1** NHMW 2023/0284/0050, height 6.5 mm, width 3.0 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

Description – Shell small, fusiform, very broad (SL/MD = 1.96). Protoconch approx. 1.3 whorls, surface abraded (hp ~ 700 μm). Protoconch/teleoconch junction marked by beginning of adult sculpture. Teleoconch of 3.25 weakly convex whorls with periphery at abapical suture, separated by weakly impressed, shallowly undulating suture. Axial sculpture of slightly prosocline rounded ribs, half to one-third width of their interspaces, 13 on last whorl. Spiral sculpture on first teleoconch whorl of four elevated rounded cords, slightly narrower than their interspaces. Fifth cord appears below suture on penultimate whorl. Last whorl tall, 69% of total height, broadly inflated and convex, weakly constricted at base, five cords above insertion of outer lip, about nine over base and siphonal fasciole, increasingly indistinct towards tip. Aperture 41% of total height, outer lip with five weak denticles, D5 strongest. Short, broad siphonal fasciole for genus.

Discussion – This species is represented by a few specimens, all with the protoconch incomplete or the surface abraded, making identification difficult. However, it seems to represent the squatter form of *Chauvetia decorata* Monterosato, 1889. We are unsure if this is actually the species Monterosato called *C. decorata*, as the type is not present in the Monterosato collection, and a central light colour band is seen in several *Chauvetia* species. The drawing by Pallary (1902, fig. 14) shows a much slenderer elongated shell than that figured here. This slender form was also recognised by Gofas & Oliver (2010, fig. 41) illustrating a specimen from Cádiz, Spain. Our specimens are like those illustrated by Gofas & Oliver (2010, figs 81-83).
In its broad fusiform shape, it is similar to *Chauvetia planicostata* nov. sp., but that species differs in its deeper suture, the character of the cords that become broad and flat, separated by narrow grooves, and the longer siphonal fasciole.

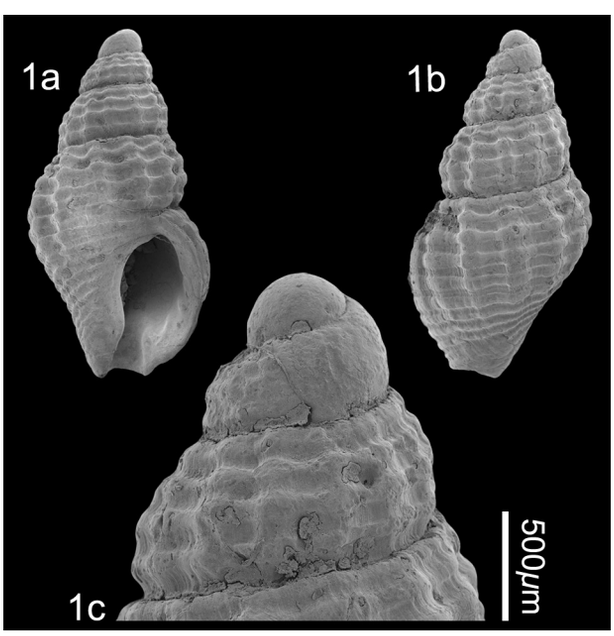


Plate 5. *Chauvetia decorata* Monterosato, 1889; 1. NHMW 2023/0284/0061, height 5.3 mm, width 2.7 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, S. Spain (this paper). Present-day: Atlantic southern Iberian from Gibraltar to Morocco (Gofas & Oliver, 2010).

***Chauvetia* cf. *errata* Oliver & Rolán, 2009**
Plate 6, fig. 1

cf. *2009	*Chauvetia errata* Oliver & Rolán, p. 132, figs 33-35, 104-108.
non 2017	*Chauvetia errata* Oliver & Rolán, 2009 – Brunetti *et al*., p. 12, figs 1A-C [= *Chauvetia affinis* (Monterosato, 1889) forma *arenaria*].

Material and dimensions – Height 6.3 mm, width 2.2 mm. **CO**: NHMW 2023/0284/0064 (1).

Description – Shell small, very slender (SL/MD = 2.86). Protoconch 1.25 whorls, surface abraded (dp = 770 μm, hp = 710 μm, dp/hp = 1.08, dn = 375 μm, dV1 = 570 μm, Ln = 1165 μm). Protoconch/teleoconch junction marked by beginning of adult sculpture. Teleoconch of 5.25 tall, weakly convex whorls, with periphery at about one-quarter whorl height, separated by shallow linear suture. Axial sculpture of narrow, poorly defined ribs, 22 on last whorl. Spiral sculpture dominant: on first teleoconch whorl of four rounded cords, roughly equal in width to their interspaces. Fifth cord appears below suture on penultimate whorl: small, rounded tubercles developed over intersections. Last whorl short, 47% of total height, convex, moderately strongly constricted at base, six cords above insertion of outer lip, one over base (abraded over siphonal fasciole). Aperture 27% of total height, outer lip without denticles.

Discussion – Unfortunately, the single specimen at hand is quite abraded. The protoconch is complete, but missing surface detail. It is quite distinctive in its extremely slender shell. Indeed, it is the slenderest *Chauvetia* we have seen. It bears some resemblance to *C. errata* Oliver & Rolán, 2009 from Mauritania and Senegal, but is even slenderer, the spire whorl profile is placed lower, and the base is more constricted, resulting in a different last whorl profile and apertural shape.
Brunetti *et al*. (2017, figs 1A-C) figured a single specimen from the Zanclean Lower Pliocene of Poggio alla Staffa (Siena, Italy) as *Chauvetia errata* Oliver & Rolán, 2009. The Italian fossil shell is very high spired, with a short last whorl, and remarkably similar to the specimen illustrated herein. Size is also comparable, a little smaller (5.8 mm vs. 6.3 mm). A difference from *C. errata* is the more inflated spire whorls in the Italian shell, the more oblique suture, the stronger adapical spiral cords and the more elongate aperture. The specimen figured by Brunetti *et al*. (2017,

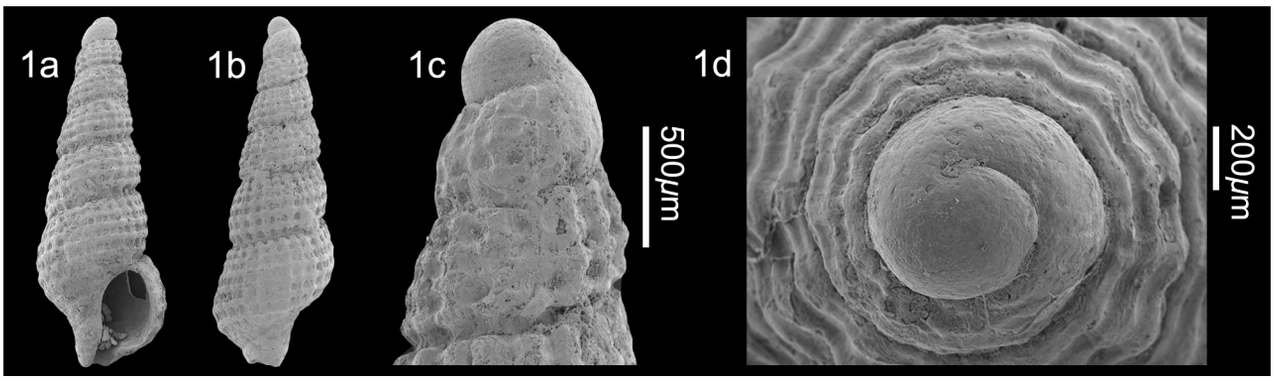


Plate 6. *Chauvetia* cf. *errata* Oliver & Rolán, 2009; 1. NHMW 2023/0284/0064, height 6.3 mm, width 2.2 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

figs 1A-C), seems to be the form *arenaria* of *C. affinis* (Monterosato, 1889), currently distributed in the Gulf of Gabes (see Cecalupo *et al*., 2008, pl. 52, figs 7-11, 15-16).

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

***Chauvetia fenestrata* nov. sp.**
Plate 7, figs 1, 2; Plate 23, fig. 8

ZooBank registration – urn:lsid:zoobank.org:act:A84B9D8D-F5A5-4B77-B99A-27A9CBB077E6

Type material – Holotype NHMW 2023/0284/0035, height 5.8 mm, width 2.4 mm; paratype 1 NHMW 2023/0284/0036, height 5.7 mm, width 2.4 mm; paratype 2 NHMW 2023/0284/0037, height 7.1 mm, width 2.6 mm; paratype 3 RGM.1404349, height 7.0 mm, width 2.7 mm; paratype 4 RGM.1404350, height 5.6 mm, width 2.4 mm; **Velerín conglomerates**. paratype 5 NHMW 2023/0284/0039, height 5.7 mm, width 2.4 mm; **El Lobillo**.

Other material – Maximum height 8.9 mm, width 3.8 mm. **CO**: NHMW 2023/0284/0038 (1). **EL**: NHMW 2023/0284/0040 (9).

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

Type stratum – unnamed beds of Lower Piacenzian age, Upper Pliocene.

Etymology – Latin '*fenestra*, *-ae*' feminine, meaning window, reflecting the coarse square reticulate sculpture resembling windows. *Chauvetia,* gender feminine.

Diagnosis – Small, broad, nassariform, protoconch of 1.2 whorls with sharp, elevated axial ribs on entire protoconch, teleoconch whorls weakly convex, 18-19 weakly prosocline ribs, 3-4 cords on spire whorls, sharp tubercles at intersections, forming deeply reticulated sculpture, 12 cords on last whorl, five labial denticles.

Description – Shell small, broad nassariform (SL/MD = 2.38-2.42). Protoconch about 1.2 whorls, bearing strong, elevated axial riblets along entire protoconch (dp = 600-715 μm, hp = 640-745 μm, dp/hp = 0.94-0.96, dn = 365-370 μm, dV1 = 560-615 μm, Ln = 200-225 μm). Protoconch/teleoconch junction well delimited by start of spiral cords. Teleoconch of 4.5-5 weakly convex whorls separated by moderately weakly impressed suture. Axial sculpture of narrow, elevated weakly prosocline ribs, 18-19 on last whorl. Spiral sculpture of three cords on first teleoconch whorl, adapical placed just below suture weaker, lower two cords stronger and elevated, fourth cord appears just above suture on second whorl. Axials and spirals of roughly equal strength forming coarse, horizontally elongated reticulated surface sculpture, with small, pointed tubercles developed at intersections. Last whorl 52-55% of total height, moderately constricted at base, five cords above insertion of outer lip, one over base, six over siphonal fasciole. Aperture 31-33% total height, with five elongated denticles within, D1 strongest.

Discussion – The protoconch sculpture consisting of elevated ribs and the open fenestrated teleoconch sculpture make *Chauvetia fenestrata* nov. sp. a very distinctive species. The protoconch strongly ribbed throughout is not common amongst chauvetiids: *C. tenuisculpta* (Dautzenberg, 1891) from the Atlantic southern coast of Spain to Senegal (Mediterranean records provisionally excluded by Oliver & Rolán, 2008, p. 144) (Oliver & Rolán, 2008, figs 101, 102) and *C. austera* Oliver & Rolán, 2009 from Western Sahara both have a similar protoconch (Oliver & Rolán, 2009, fig. 127), but they are both immediately separated by their teleoconch profile and sculpture.
Its fenestrated sculpture is reminiscent of *C. recondita* (Brugnone, 1873), present in the Atlantic from Cape St. Vincent, southern Portugal to Morocco and western half of the Mediterranean, but that species is immediately separated by its spirally sculptured protoconch (Gofas & Oliver, 2010, figs 46, 47).

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

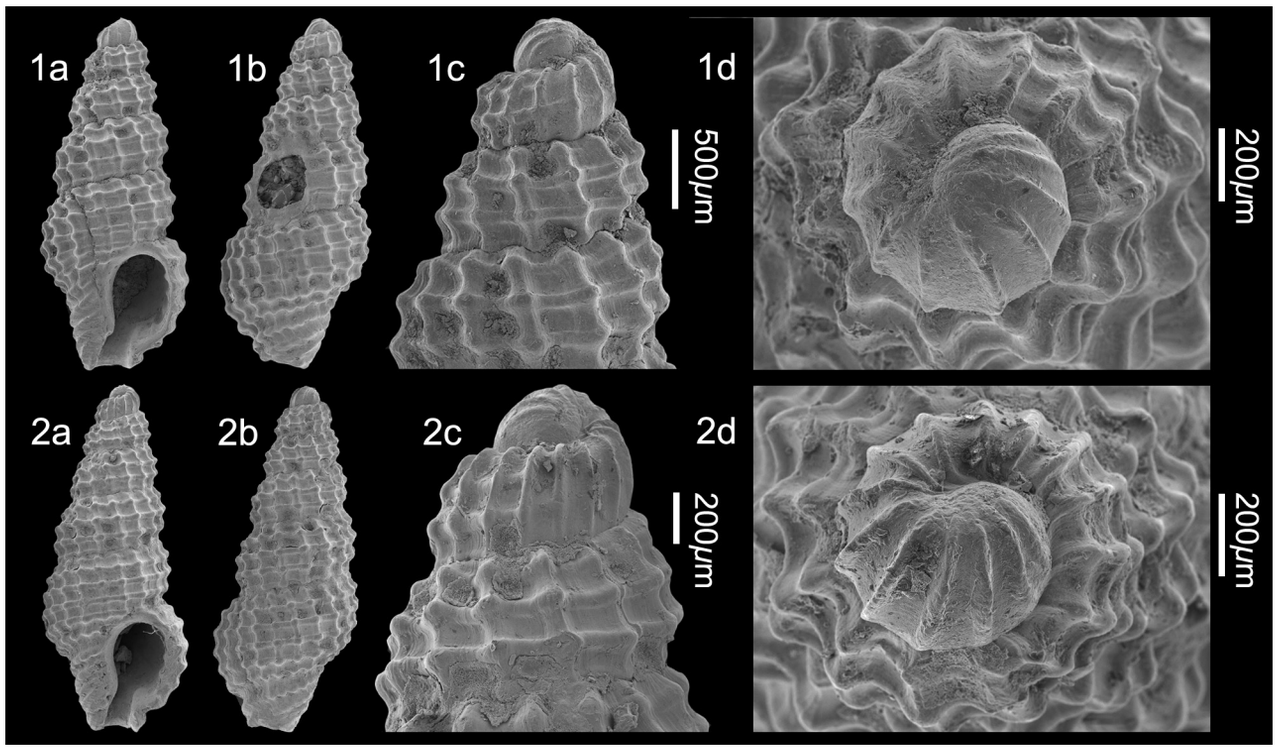


Plate 7. *Chauvetia fenestrata* nov. sp.; 1. **Holotype** NHMW 2023/0284/0035, height 5.8 mm, width 2.4 mm; 2. **Paratype 1** NHMW 2023/0284/0036, height 5.7 mm, width 2.4 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

***Chauvetia fortiornata* nov. sp.**
Plate 8, figs 1-3; Plate 23, fig. 9

ZooBank registration – urn:lsid:zoobank.org:act:7839FD60-992C-4BAD-A3AE-C075A35EE6FD

Type material – Holotype NHMW 2023/0284/0052, height 6.3 mm, width 2.7 mm; paratype 1 NHMW 2023/0284/0053, height 6.6 mm, width 2.9 mm; paratype 2 NHMW 2023/0284/0054, height 5.9 mm, width 2.3 mm; paratype 3 NHMW 2023/0284/0055, height 6.4 mm, width 2.4 mm; paratype 4 RGM.1404347, height 8.1 mm, width 3.3 mm.

Other material – Maximum height 6.6 mm, width 2.9 mm. **CO**: NHMW 2023/0284/0056 (10).

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

Type stratum – unnamed beds of Lower Piacenzian age, Upper Pliocene.

Etymology – Latin compound name of '*fortis*, *-e*, *-ior*', meaning strong and '*ornatus, -a*' ornate, reflecting strong sculpture. *Chauvetia,* gender feminine.

Diagnosis – Shell small, broad nassariform, protoconch 1.3-1.4 whorls bearing strong axial riblets overrun by weaker spiral cordlets forming reticulated sculpture, nucleus somewhat depressed, teleoconch whorls strongly convex, deep suture, 13 orthocline rounded ribs, 4-5 narrow spirals on spire whorls hardly swollen at intersections, 15 on last whorl, without labial denticles.

Description – Shell small, broad nassariform (SL/MD = 2.28-2.33). Protoconch 1.3-1.4 whorls, bearing strong axial riblets overrun by weaker spiral cordlets forming horizontally elongated reticulated protoconch sculpture, nucleus somewhat depressed (dp = 700-750 μm, hp = 545-670 μm, dp/hp = 1.04-1.38, dn = 360-390 μm, dV1 = 580-595 μm, Ln = 160-215 μm). Protoconch/teleoconch junction indistinct, marked by end of protoconch cordlets and beginning of adult spiral sculpture. Teleoconch of five convex whorls, with periphery just below mid-whorl, separated by deeply impressed suture. Axial sculpture of elevated slightly opisthocline ribs, 13 on last whorl. Spiral sculpture of four narrow elevated cords on spire whorls, fifth appears just above suture on last half of penultimate whorl. Axials dominant forming horizontally elongated reticulated surface sculpture: cords hardly swollen at intersections. Last whorl 54-55% of total height, strongly convex and strongly constricted at base, further cord appears just below suture making six cords above insertion of outer lip, three over base, about six over siphonal fasciole. Aperture 33-35% total height, outer lip without denticles. Siphonal canal relatively long for genus, weakly notched at tip.

Discussion – *Chauvetia fortiornata* nov. sp. is a very characteristic species, strongly sculptured both the pro-

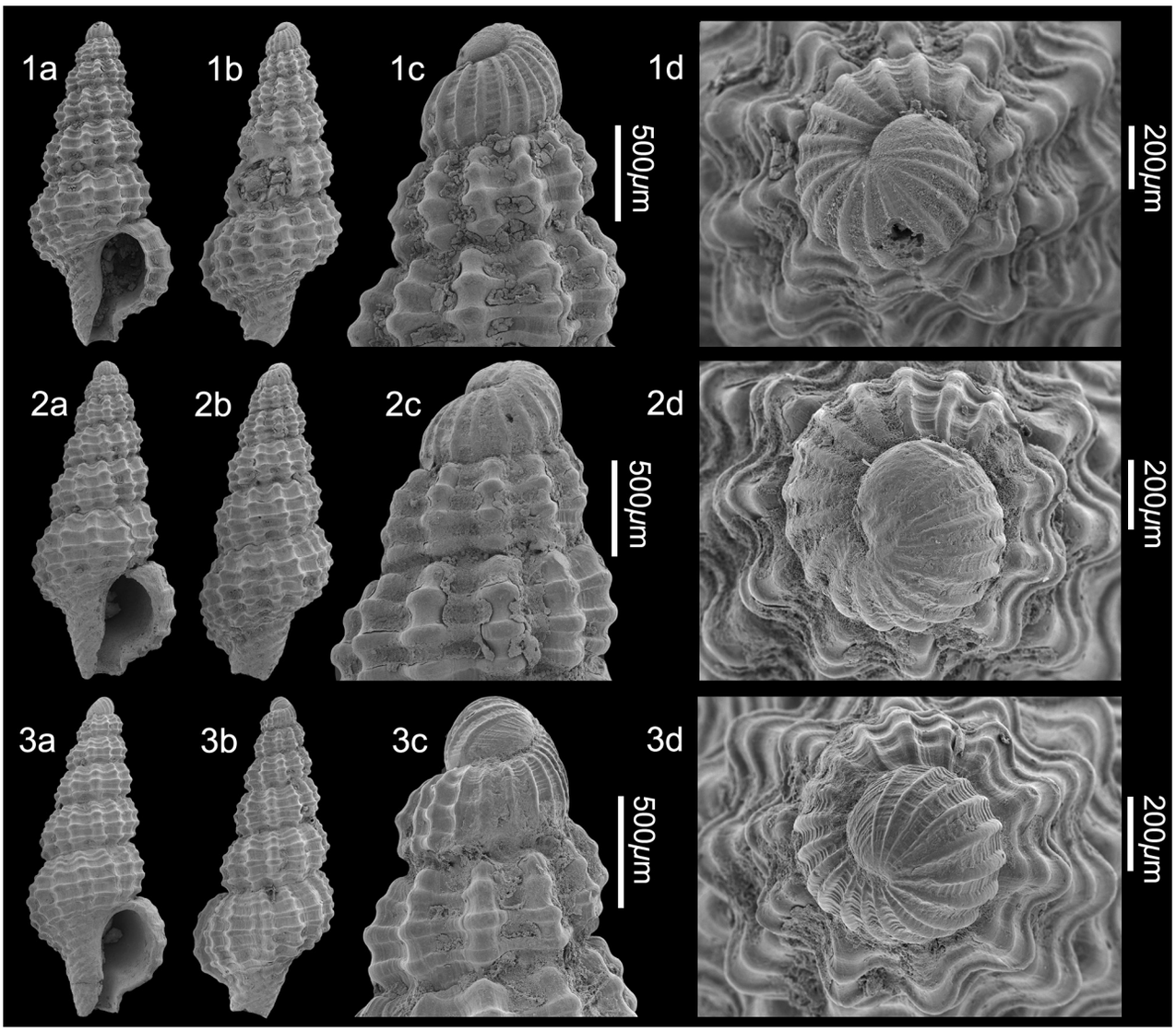


Plate 8. *Chauvetia fortiornata* nov. sp.; 1. **Holotype** NHMW 2023/0284/0052, height 6.3 mm, width 2.7 mm; 2. **Paratype 1** NHMW 2023/0284/0053, height 6.6 mm, width 2.9 mm; 3. NHMW 2023/0284/0063, height 6.8 mm, width 2.9 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

toconch on which the riblets start after a very narrow nucleus and the teleoconch with its elevated reticulated sculpture, the cords only slightly swollen at the intersections. In most *Chauvetia* species the axial riblets only start after one protoconch whorl. One specimen (Pl. 8, fig. 3) differs slightly in the nucleus being rounded and elevated as opposed to slightly flattened (dp = 625 μm, hp = 700 μm, dp/hp = 0.89, dn = 345 μm, dV1 = 505 μm, Ln = 150 μm), having twelve axial ribs on last whorl vs. 13, and a fifth spiral cord appears just below suture on second half of third whorl vs. just above suture on last half of penultimate whorl. However, the rest of the shell characters are similar, and we consider it to fit within the variability of *C. fortiornata*.

In a several extant West African species (*e.g.*, *C. javieri* Oliver & Rolan, 2008; *C. megastoma* Oliver & Rolán, 2009; *C. peculiaris* Oliver & Rolán, 2009; *C. edentula* Oliver & Rolán, 2009; *C. borgesi* Oliver & Rolán, 2009) and from the Canary Islands (*e.g.*, *C. elongata* Nordsieck & García-Talavera, 1979 = *C. retifera sensu* Gofas & Oliver, 2010, *non* Brugnone, 1880) the smooth nuclear portion is narrow and the riblets start after one-half whorl. Almost all of these can be separated immediately from *C. fortiornata* by their teleoconch morphology. Only *C. edentula* from present-day West Sahara is superficially similar, but the cordlets and spiral threads on the protoconch are denser, and the teleoconch is squatter with more numerous cords. *Chauvetia recondita* (Brugnone, 1873) from the present-day Mediterranean is similar to *C. fortiornata* in whorl profile and teleoconch sculpture but is immediately separated by its protoconch with close-set spirals and cordlets only starting after the first protoconch whorl (see Gofas & Oliver, 2010, figs 46-47).

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

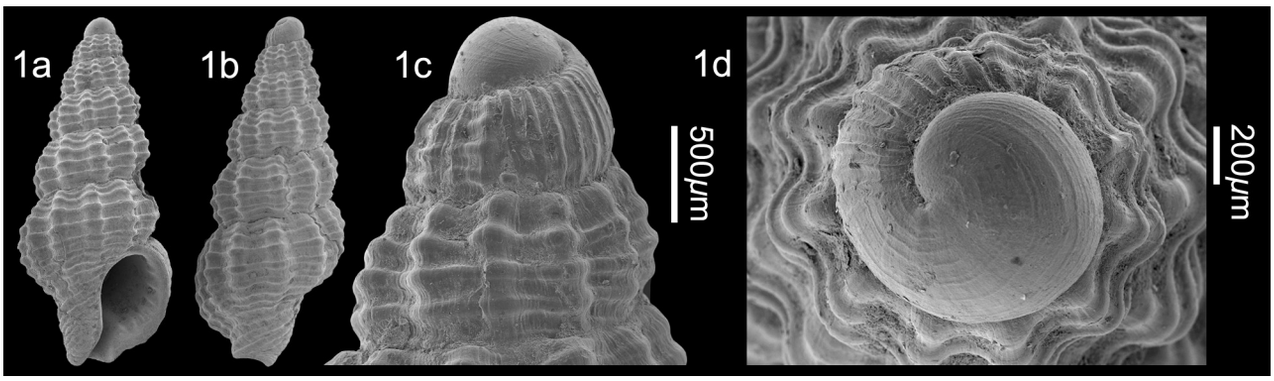


Plate 9. *Chauvetia hoffmani* nov. sp.; 1. NHMW 2023/0284/0047, height 8.7 mm, width 3.8 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

***Chauvetia hoffmani* nov. sp.**
Plate 9, fig. 1; Plate 23, fig. 10

ZooBank registration – urn:lsid:zoobank.org:act:5B922BDF-2A31-4E08-9234-0DA1825D87E7

Type material – Holotype NHMW 2023/0284/0047, height 8.7 mm, width 3.8 mm, **Velerín conglomerates**. paratype 1 NHMW 2023/0284/0102, height 7.2 mm, width 3.1 mm, **Velerín sands**.

Other material – Maximum height 8.7 mm, width 3.8 mm. **CO**: NHMW 2023/0284/0048 (5). **EL**: NHMW 2023/0284/0088 (2). **VS**: NHMW 2023/0284/0099 (1).

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

Type stratum – unnamed beds of Lower Piacenzian age, Upper Pliocene.

Etymology – Named in honour of Leon Hoffman, from Senckenberg am Meer, Germany, for his contribution to the Chauvetiidae. *Chauvetia,* gender feminine.

Diagnosis – Shell medium sized, broad nassariform, protoconch 1.25 whorls bearing wide spaced cordlets and a few riblets on last quarter whorl, teleoconch whorls convex, ten rounded orthocline ribs predominant, 4-5 narrow spiral cords on spire whorls not forming tubercles at intersections, 17 last whorl, seven labial denticles.

Description – Shell medium sized, broad nassariform (SL/MD = 2.29). Protoconch about 1.25 whorls, bearing widely spaced rounded spiral cordlets; a few riblets on last quarter whorl (dp = 985 μm, hp = 910 μm, dp/hp = 1.08, dn = 545 μm, dV1 = 840 μm, Ln = 240 μm). Protoconch/teleoconch junction well delimited by end of spiral cordlets and start of primary spiral cords. Teleoconch of 5.5 convex whorls separated by moderately impressed undulating suture. Axial sculpture of orthocline ribs, ten on last whorl. Spiral sculpture of four narrow cords on first two teleoconch whorls, fifth cord appears just below suture on third whorl. Spirals remain elevated and sharply delimited in axial interspaces. Axials predominant, the spirals overrunning, hardly swollen over the ribs. Last whorl 52% of total height, strongly convex and constricted at base, six cords above insertion of outer lip, three over base, about eight over siphonal fasciole. Aperture 32% total height, with seven moderate strength, elongated denticles within.

Discussion – Although we ascribe eight specimens at hand to this species, only two have the protoconch well preserved. *Chauvetia hoffmani* nov. sp. is superficially similar to *Chauvetia pelorcei* Oliver & Rolán, 2008 from present-day Senegal and *C. pseudopelorcei* nov. sp. from the Estepona assemblages but differs from both these species in that the spiral cordlets on the protoconch are widely spaced and not crowded, from the first teleoconch whorl having an extra spiral cord and an extra cord on all subsequent whorls. The spirals remain strong in the axial interspaces and are hardly swollen over the ribs, whereas in the other two species they weaken in the axial interspaces and are tubercular over the intersections. *Chauvetia edentula* Oliver & Rolán, 2009 from present-day West Sahara is similar in profile and teleoconch sculpture to *C. hoffmani*, but that species has axial sculpture on the protoconch and an extra spiral cord on the teleoconch whorls. It is also somewhat similar to *C. plioetrusca* Brunetti, Della Bella & Cresti, 2017, but that species is smaller, with weaker axial and spiral sculpture, the periphery is less inflated and the suture more inclined.

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

***Chauvetia janseni* nov. sp.**
Plate 10, figs 1, 2

ZooBank registration – urn:lsid:zoobank.org:act:A5EB38B1-E03E-4B94-9B90-6BBAE44194F9

Type material – Holotype NHMW 2023/0284/0030, height

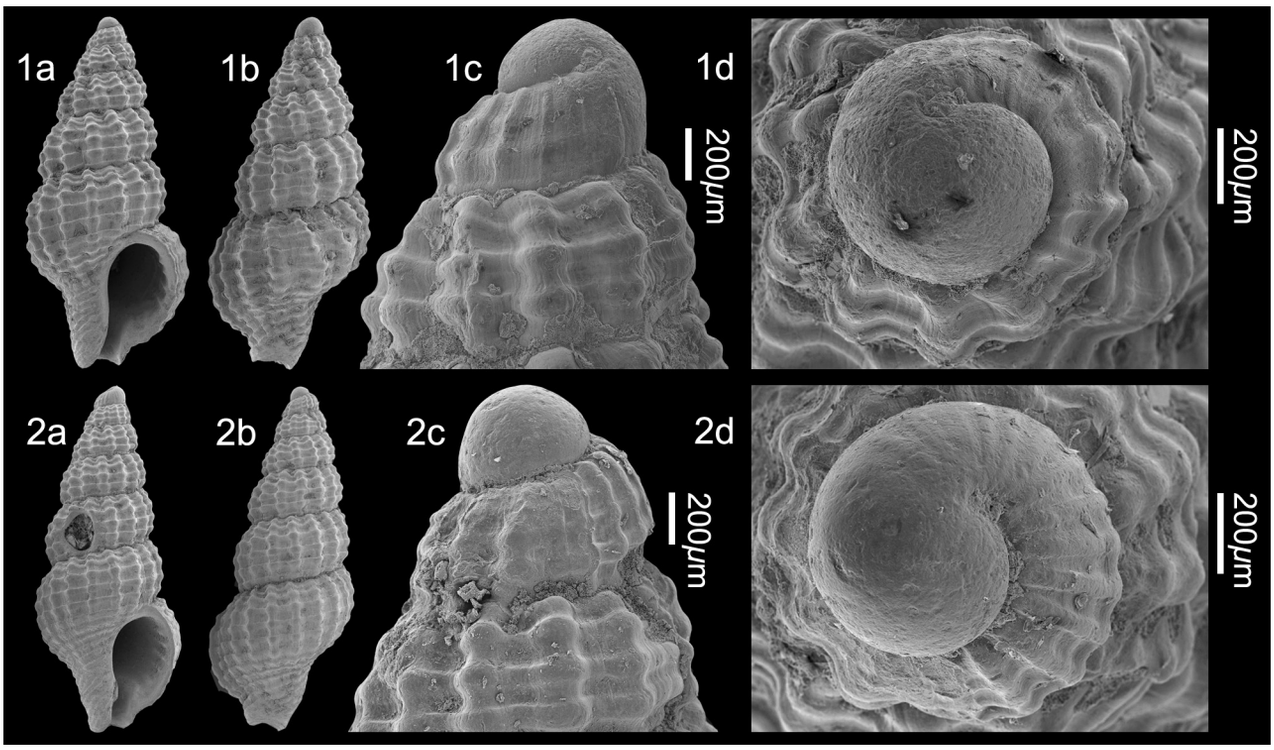


Plate 10. *Chauvetia janseni* nov. sp.; 1. **Holotype** NHMW 2023/0284/0030, height 7.7 mm, width 3.4 mm; 2. **Paratype 1** NHMW 2023/0284/0031, height 8.7 mm, width 3.5 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

7.7 mm, width 3.4 mm; paratype 1 NHMW 2023/0284/0031, height 8.7 mm, width 3.5 mm; paratype 2 NHMW 2023/0284/0032, height 8.8 mm, width 3.7 mm; paratype 3 NHMW 2023/0284/0033, height 8.9 mm, width 3.8 mm; paratype 4 RGM.1404347, height 8.1 mm, width 3.3 mm; paratype 5 RGM.1404348, height 8.3 mm, width 3.5 mm.

Other material – Maximum height 8.9 mm, width 3.8 mm. **CO**: NHMW 2023/0284/0034 (5). **EL**: NHMW 2023/0284/0094 (3).

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

Type stratum – unnamed beds of Lower Piacenzian age, Upper Pliocene.

Etymology – Named after Andre Jansen of Bovenkarspel (Noord-Holland, The Netherlands) citizen scientist and collector, interested in molluscan palaeontology, for his enormous help in almost all later parts of this series in sourcing digital literature. *Chauvetia,* gender feminine.

Diagnosis – Medium sized, broadly fusiform, nassariform, protoconch 1.2 whorls without microsculpture, few riblets on last quarter whorl, 16-18 narrow orthocline ribs, 4-6 narrow cords on spire whorls forming reticulated sculpture with tubercles at intersections, 21 on last whorl, 6 labial denticles.

Description – Shell medium sized, broad nassariform (SL/MD = 2.26-2.49). Protoconch about 1.2 whorls, surface appears smooth (abraded): few riblets seen on last part of whorl (dp = 685-710 μm, hp = 615 μm, dp/hp = 1.11, dn = 415-480 μm, dV1 = 665 μm, Ln = 180-235 μm). Protoconch/teleoconch junction moderately well delimited. Teleoconch of 6.5 convex whorls separated by moderately deeply impressed suture. Axial sculpture of narrow, elevated, orthocline ribs, 16-18 on last whorl. Spiral sculpture of four cords on first two teleoconch whorls, abapically further cords appear just below and above suture, six on penultimate whorl, cords much narrower than their interspaces, swollen over intersections without forming tubercles. Last whorl 53-58% of total height, strongly constricted at base, six cords above insertion of outer lip, three over base, about 12 over siphonal fasciole. Aperture 34-36% total height, with six weak elongated denticles within.

Discussion – *Chauvetia janseni* nov. sp. is closely similar to *Chauvetia oliveri* nov. sp., but differ in 1) smaller maximum size (8.9 mm vs. 12.9 mm), 2) smaller protoconch at similar number of whorls (1.25-1.2 whorls), 3) fewer axial ribs (16-18 vs. 20-21).
See discussion under *C. oliveri* for comparison with similar species, differences also apply to this species.

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

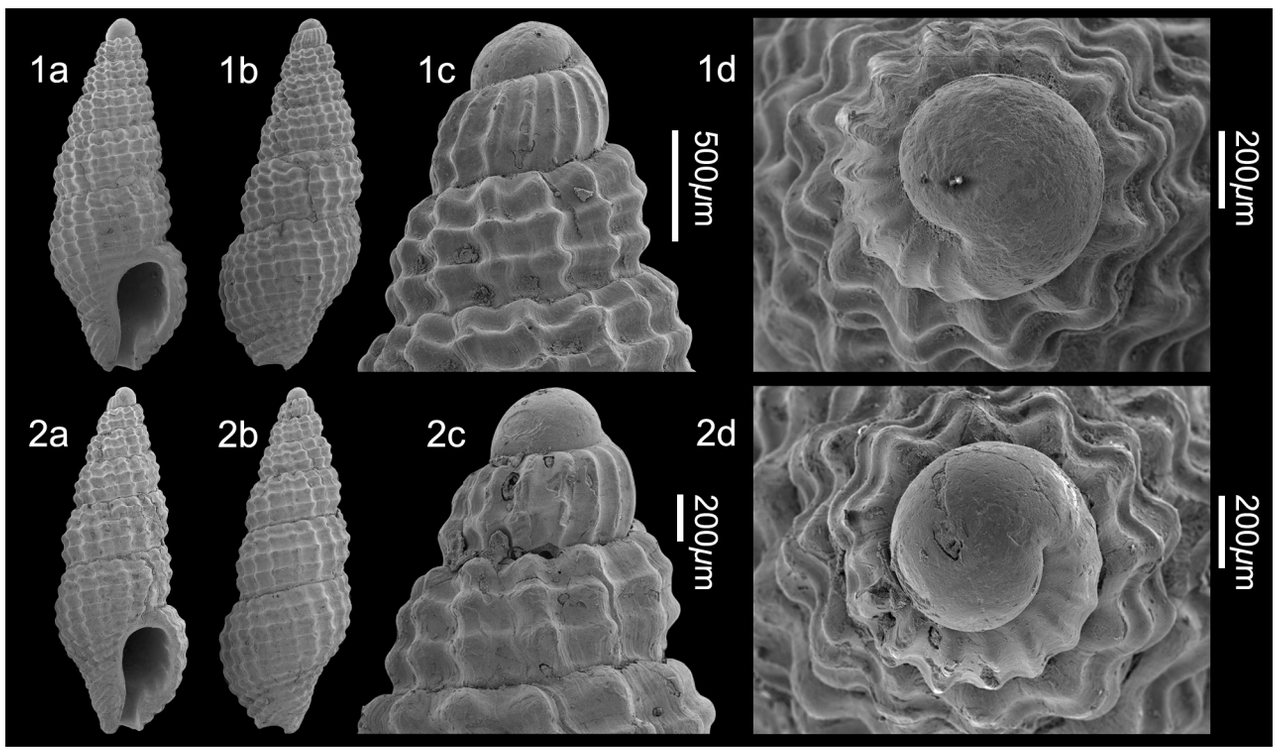


Plate 11. *Chauvetia luciacuestae* Oliver & Rolán, 2008; 1. NHMW 2023/0284/0016, height 7.4 mm, width 2.7 mm; 2. NHMW 2023/0284/0017, height 7.6 mm, width 2.9 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

***Chauvetia luciacuestae* Oliver & Rolán, 2008**
Plate 11, figs 1, 2; Plate 23, fig. 11

*2008 *Chauvetia luciacuestae* Oliver & Rolán, p. 166, figs 53-55, 76, 160-168, 183.

Material and dimensions – Maximum height 8.3 mm, width 2.8 mm. **CO**: NHMW 2023/0284/0016-0018 (3), NHMW 2023/0284/0019 (48), RGM.1404342 (3). **EL**: NHMW 2023/0284/0089 (1). **VS**: NHMW 2023/0284/0098 (1).

Description – Shell medium sized, slender fusiform (SL/MD = 2.62-2.70). Protoconch 1.25 whorls, surface slightly abraded in all specimens, but appears smooth; a few strong riblets seen on the last portion (dp = 660-700 μm, hp = 655-695 μm, dp/hp = 1.01, dn = 375-430 μm, dV1 = 575-610 μm, Ln = 180-260 μm). Protoconch/teleoconch junction relatively well delimited. Teleoconch of 5.5 weakly convex whorls. Axial sculpture of low, narrow, weakly prosocline ribs, 19-21 on last whorl. Spiral sculpture of three cords on first teleoconch whorl, fourth cord appears below suture on third whorl, fifth appears just above suture on fourth whorl, cords slightly narrower than their interspaces; small, rounded tubercles formed at intersections. Last whorl 51-53% of total height, weakly constricted at base, total of 15-16 cords over last whorl and siphonal fasciole. Aperture low, 31% total height, with five elongated denticles within, D1 and D5 more strongly developed, D2 weak.

Discussion – We consider the specimens from Estepona conspecific with *Chauvetia luciacuestae* Oliver & Rolán, 2008, described from present-day Senegal. There are small differences in the species description given by those authors. The maximum height of the extant species is slightly greater at 9.0 mm (holotype 8.8 mm height). The protoconch is 1.3 whorls (0.8 + 0.5 whorl nucleus), dimensions for the extant species are (dp = 675 μm, hp = 650 μm, dn = 237 μm, dV1 = 595 μm). These measurements all fit within the range of our fossil specimens, except the nuclear measurement. However, if the nucleus is measured from Oliver & Rolán (2008, fig. 162) using the scale given in their photograph, dn = 365 μm, which is just below the range of the fossil specimens. The fourth spiral cord on the teleoconch is described as appearing only from the fourth whorl. However, in figs 163 and 164 (Oliver & Rolán, 2008, p. 167) a subobsolete fourth cord can be seen already on the second whorl, just as in the fossil specimens from Estepona. The character and number of ribs and cords on the last whorl is similar, with small tubercles developed at the intersections, and the dentition within the outer lip is identical. The only possibly important difference between the extant and fossil shells is the extremely fine spiral microsculpture illustrated (figs 162, 166; Oliver & Rolán, 2008). However, the surface is slightly abraded in the fossil material, and may have been lost. In view of the close shell shape, sculpture and morphometrics, we consider then conspecific.
This species is similar to *C. lefebvrii* (Maravigna, 1840). Oliver & Rolán (2008, p. 168) noted that this was a vari-

able species and listed certain differences between the Atlantic form and the Mediterranean form from the coast of Algeria. Nevertheless, the Atlantic form of *C. lefebvrii* differs in being broader, more solid, with wider and closer spaced ribs, and the tubercles developed at the intersections flatter and squarish (see Oliver & Rolán, 2009, figs 77-80). The protoconch is also larger at the same number of whorls (dp = 850 μm, hp = 700 μm, dn = 500 μm, dV1 = 680 μm; *fide* Oliver & Rolán, 2009, p. 124). *Chauvetia austera* Oliver & Rolán, 2009 from present-day West Sahara shares similar teleoconch characters, but is immediately separated by its post-nuclear protoconch that bears sharp axial ribs.

Chauvetia luciacuestae is known only from the bay of Dakar, living at depths of about 30 m.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, S. Spain (this paper). Present-day: Atlantic, Senegal (Oliver & Rolán, 2008).

***Chauvetia mamillata* (Risso, 1826)**

Plate 12, figs 1-4; Plate 23, fig. 2; Plate 24, fig. 1

1826	*Lachesis mamillata* Risso, p. 211, pl. 5, fig. 65.
*1826	*Nesaea mamillata* Risso, p. 223, pl. 5, fig. 69.
1826	*Nesaea granulata* Risso, p. 223, pl. 5, fig. 67.
1836	*Buccinum mínimum* Philippi, p. 222.
1882	*Donovania minima* var. *submamillata* Bucquoy, Dautzenberg & Dollfus, p. 113, pl. 15, fig. 30.
1882	*Donovania minima* var. *attenuata* Bucquoy, Dautzenberg & Dollfus, p. 113.
1882	*Donovania minima* var. *insignis* Bucquoy, Dautzenberg & Dollfus, p. 114.
1999	*Chauvetia mamillata* (Risso, 1826) – Micali, p. 63, figs 19, 20.
2003	*Chauvetia mamillata* (Risso, 1822 [*sic*]) – Giannuzzi-Savelli *et al*., p. 15, 168, figs 334-335.
2010	*Chauvetia mamillata* Risso, 1826 [*sic*] – Gofas & Rolán, p. 29, figs 2-14, 23-26, 97-98.
?2011	*Chauvetia turritellata* (Deshayes, 1835) – Landau *et al*., p. 25, pl. 12, fig. 6 (*non C. affinis* (Monterosato, 1889)].

Material and dimensions – Maximum height 9.2 mm, width 3.6 mm. **CO**: NHMW 2023/0284/0076-0081 (6), NHMW 2023/0284/0080 (4), NHMW 2023/0284/0103, RGM.1404355-1404356 (2). **EL**: NHMW 2023/0284/0085 (44).

Description – Shell medium sized, tall spired, slender nassariform (2.51-2.78). Protoconch about 1.25 whorls (surface abraded in all specimens) (approx.: dp = 625-655 μm, hp = 615 μm, dp/hp = 1.02-1.07, dn = 414-440 μm, dV1 = 590 μm, Ln = 190 μm). Protoconch/teleoconch junction not well preserved. Teleoconch of 6.5-7 convex whorls with lower half of whorl slightly swollen forming periphery, separated by moderately impressed suture. Axial sculpture dominant; elevated, weakly prosocline ribs, 10-12 on last whorl. Spiral sculpture of four broad, flattened, subequal cords separated by narrow interspaces on first preserved teleoconch whorl (third whorl), fifth cord appears just below suture on fourth whorl, sixth cord appears just above suture on penultimate whorl, with rounded tubercles developed at intersections. Last whorl short, 48-52% of total height, slightly concave just below suture, strongly convex and inflated mid-whorl, moderately constricted at base, six cords above insertion of outer lip, two over base, about eight over siphonal fasciole. Aperture low, 28-30% of total height, widened adapically below subsutural ramp, with six elongated denticles variably developed within, D1 strongest.

Discussion – Although several specimens are available, all are abraded, making detailed characterisation difficult. We consider this species to represent *Chauvetia mamillata* (Risso, 1826), although the maximum size is slightly greater than that seen today (9.2 mm vs. maximum of 7.7 mm, normally less than 7.5 mm; *fide* Gofas & Rolán, 2010, p. 30). The protoconch is about the same size (625-655 μm vs. 600-650 μm; *fide* Gofas & Rolán, 2010, p. 30). *Chauvetia brunnea* (Donovan, 1804), distributed along the eastern Atlantic frontage from the British Isles to Gibraltar and into the Mediterranean, is easily separated by its much smaller size (maximum 5.7 mm, usually less than 5 mm; *fide* Gofas & Rolán, 2010; p. 35), and fewer axial ribs on the last whorl (9-10 vs. 11-13). *Chauvetia affinis* (Monterosato, 1889) from the present-day Atlantic Canary Islands, Sahara and into the Mediterranean is considerably smaller (maximum height 5.8 mm; *fide* Oliver & Rolán, 2009, p. 120), the spire is not as tall as in *C. mamillata* from Estepona and the base is less constricted. Moreover, the mid-portion of the last whorl in *C. mamillata* is narrowly swollen, not seen in *C. affinis*. *Chauvetia joani* Oliver & Rolán, 2008 from Mauritania, Senegal and the Cape Verde Islands is similar in profile but smaller (maximum size 7.9 mm; fide Oliver & Rolán, 2008, p. 152), the spiral cords are narrower, and the aperture is regularly ovate. In *C. mamillata* the central portion of the last whorl is inflated, making the subsutural ramp more concave. At the aperture this caused the outer lip to come out further, widening the aperture adapically. This feature is constant in all specimens. *Chauvetia pardacuta* Oliver & Rolán, 2008 from Senegal is also tall spired and the spire whorls are slightly inflated in their lower half. However, like in the last species compared, the profile of the last whorl is quite different.

Distribution – ?Lower Pliocene: Guadalquivir Basin, S. Spain (Landau *et al*., 2011). Upper Pliocene: western Mediterranean, Estepona Basin, S. Spain (this paper). Atlantic southern Iberian coast from Cape St. Vincent to Gibraltar (Oliver & Rolán, 2009), Morocco (Micali, 1999), Canary Islands (Oliver & Rolán, 2009), western Mediterranean (Micali, 1999; Giannuzzi-Savelli *et al*., 2003), central Mediterranean (Micali, 1999; Giannuzzi-Savelli *et al*., 2003).

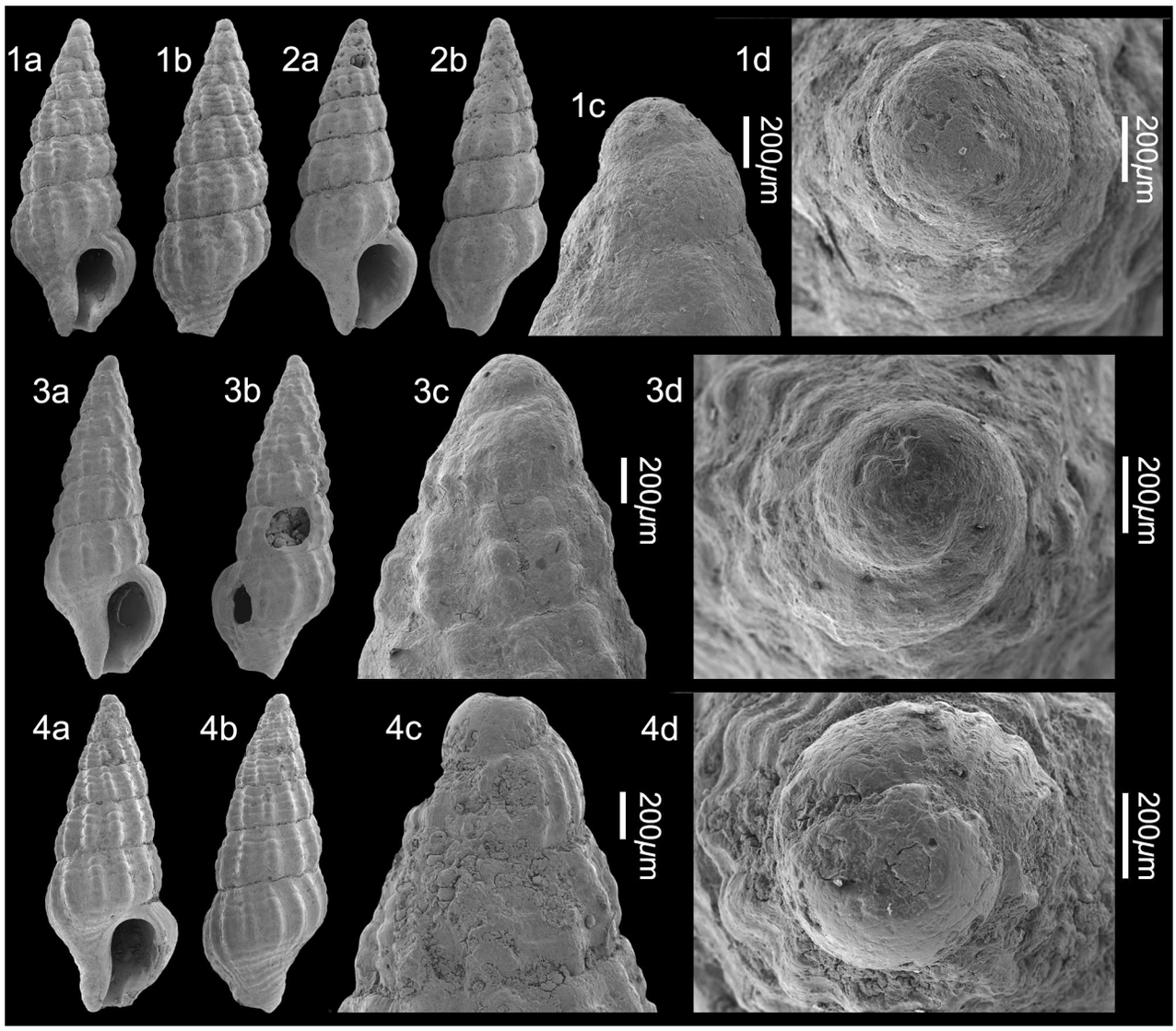


Plate 12. *Chauvetia mamillata* (Risso, 1826); 1. NHMW 2023/0284/0076, height 9.0 mm, width 3.5 mm; 2. NHMW 2023/0284/0077, height 9.2 mm, width 3.6 mm; 3. NHMW 2023/0284/0079, height 7.8 mm, width 3.1 mm; 4. NHMW 2023/0284/0081, height 8.9 mm, width 3.2 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

***Chauvetia obesa* nov. sp.**
Plate 13, figs 1-3; Plate 24, fig. 2

ZooBank registration – urn:lsid:zoobank.org:act:B132D90E-9797-4DED-8AAB-4B688D65E9E5

Type material – Holotype NHMW 2023/0284/0020, height 9.0 mm, width 3.5 mm; paratype 1 NHMW 2023/0284/0021, height 8.7 mm, width 3.4 mm; paratype 2 NHMW 2023/0284/0022, height 8.6 mm, width 3.4 mm; paratype 3 NHMW 2023/0284/0023, height 9.7 mm, width 3.0 mm; paratype 4 RGM.1404343, height 7.9 mm, width 3.3 mm; paratype 5 RGM.1404344, height 8.3 mm, width 3.1 mm.

Other material – Maximum height 8.6 mm, width 3.4 mm. **CO**: NHMW 2023/0284/0024 (9), NHMW 2023/0284/0041 (1). **EL**: NHMW 2023/0284/0090 (4).

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

Type stratum – unnamed beds of Lower Piacenzian age, Upper Pliocene.

Etymology – Name reflecting the broader than usual profile of this species for the genus. *Chauvetia,* gender feminine.

Diagnosis – Medium sized, slender fusiform, protoconch large, about 1.5 whorls without microsculpture, about ten riblets on last quarter whorl, 18-20 narrow orthocline ribs, five narrow cords on spire whorls forming finely reticulated sculpture with small tubercles at intersections, 19 on last whorl, seven denticles within outer lip.

Description – Shell medium sized, slender fusiform (SL/

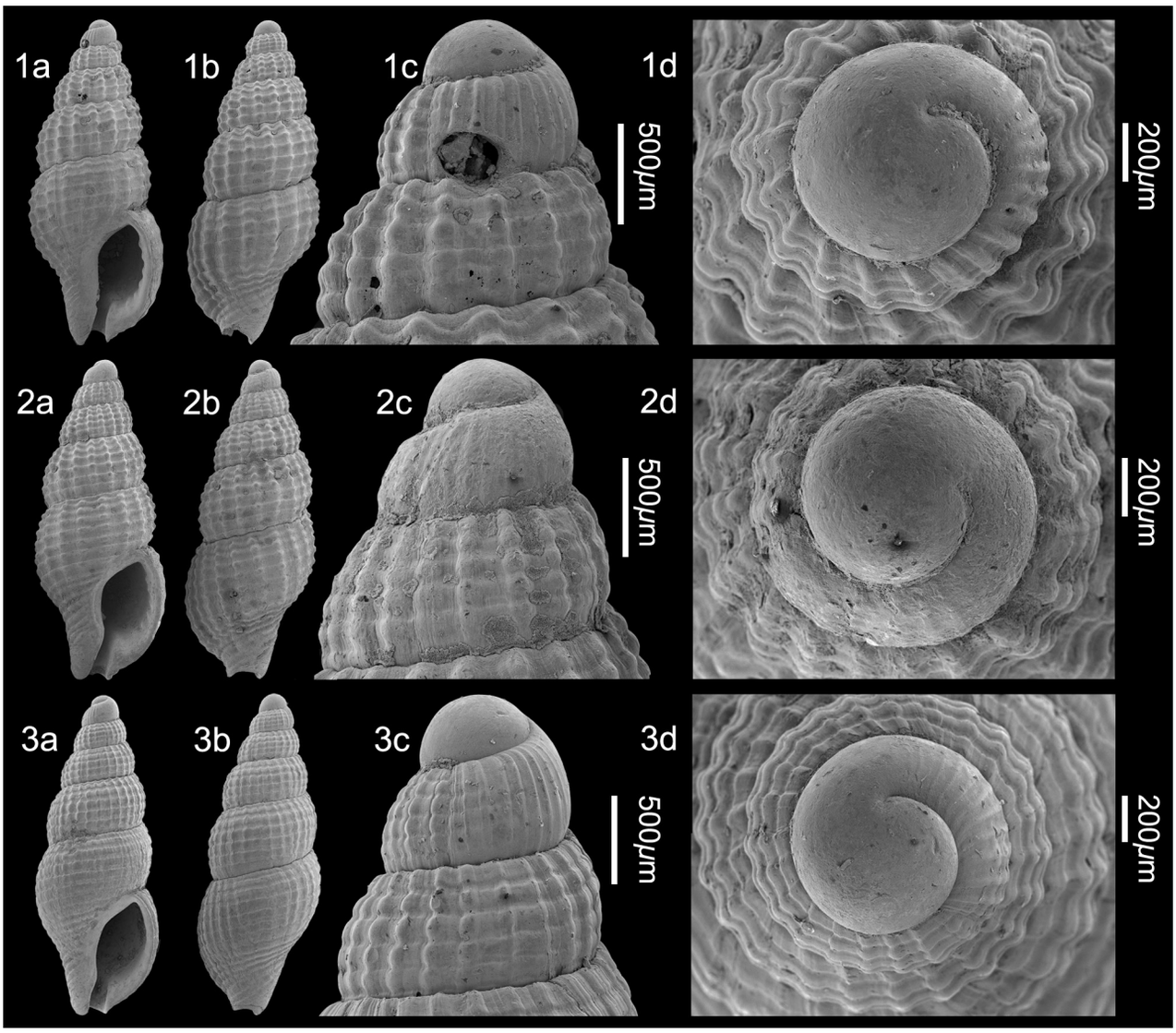


Plate 13. *Chauvetia obesa* nov. sp.; 1. **Holotype** NHMW 2023/0284/0020, height 9.0 mm, width 3.5 mm; 2. **Paratype 1** NHMW 2023/0284/0021, height 8.7 mm, width 3.4 mm. 3. NHMW 2023/0284/0041, height 8.3 mm, width 3.1 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

MD = 2.56-2.65). Protoconch 1.3-1.5 whorls, surface appears smooth: about ten riblets seen on the last half whorl (dp = 870-1000 μm, hp = 765-980 μm, dp/hp = 1.03-1.23, dn = 440-635 μm, dV1 = 740-900 μm, Ln = 215-300 μm). Protoconch/teleoconch junction well delimited. Teleoconch of 4.5 convex whorls separated by moderately impressed suture. Axial sculpture of low, narrow, orthocline ribs, 18-20 on last whorl. Spiral sculpture of five cords on first teleoconch whorl, fifth appears just above suture on penultimate whorl, cords narrower than their interspaces; small, rounded tubercles formed at intersections. Last whorl tall, 58% of total height, moderately constricted at base, six cords above insertion of outer lip, three over base, about ten over siphonal fasciole, coalescent towards tip. Aperture 36-37% total height, with seven short denticles within, D1 and D7 slightly stronger.

Discussion – *Chauvetia obesa* nov. sp. is a very distinctive species with its very large protoconch, rather obese form and fine sculpture. One of the specimens (Pl. 13, fig. 3) is somewhat different in having a more cyrtoconoid profile, finer reticulate sculpture and a slightly wider siphonal canal. Its protoconch is identical to that of *C. obesa*, and the protoconch dimensions fall within the range for that species (dp = 975 μm, hp = 950 μm, dp/hp = 1.02, dV1 = 870 μm, dn = 590 μm). This form is represented by a single specimen that we think is an extreme morph, but we cannot exclude it being a further species. It is therefore not included in the type series. This finely sculptured specimen is superficially similar to *C. lefebvrii* (Maravigna, 1840) in having fine cancellate sculpture, but that species is more solid, less globose, with a much smaller aperture and quite a different protoconch (see Gofas & Oliver, 2010, figs 65-67).

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

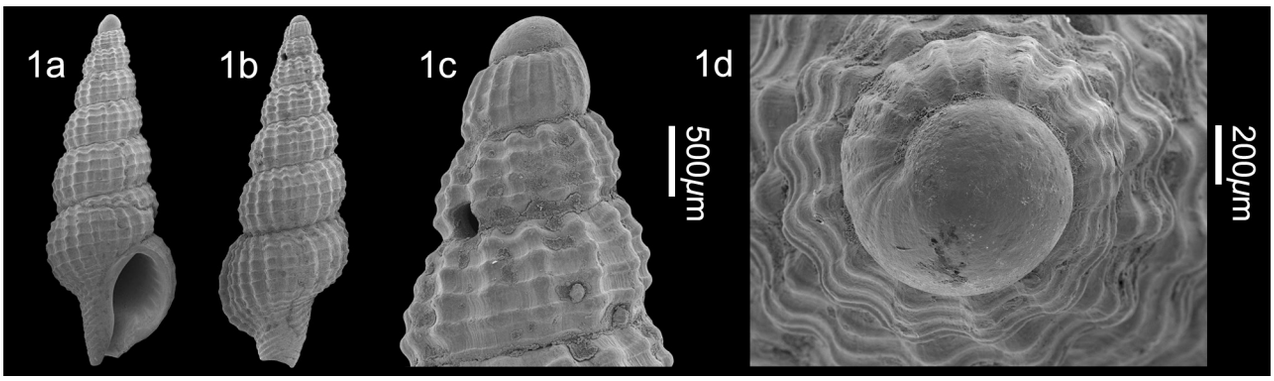


Plate 14. *Chauvetia oliveri* nov. sp.; 1. **Holotype** NHMW 2023/0284/0025, height 11.6 mm, width 4.3 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

***Chauvetia oliveri* nov. sp.**
Plate 14, fig. 1; Plate 24, fig. 3

ZooBank registration – urn:lsid:zoobank.org:act:7E06C878-64BC-44E3-B64F-E3BC7283456D

Type material – Holotype NHMW 2023/0284/0025, height 11.6 mm, width 4.3 mm; paratype 1 NHMW 2023/0284/0026, height 11.4 mm, width 4.7 mm; paratype 2 NHMW 2023/0284/0027, height 11.7 mm, width 4.8 mm; paratype 3 NHMW 2023/0284/0028, height 12.1 mm, width 5.0 mm; paratype 4 RGM.1404345, height 10.5 mm, width 4.4 mm; paratype 5 RGM.1404346, height 10.2 mm, width 4.4 mm.

Other material – Maximum height 12.9 mm, width 5.0 mm. **CO**: NHMW 2023/0284/0029 (12).

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

Type stratum – unnamed beds of Lower Piacenzian age, Upper Pliocene.

Etymology – Named after Joan Daniel Oliver of Madrid (Spain) in recognition of his enormous contribution to the knowledge of Chauvetiidae. *Chauvetia,* gender feminine.

Diagnosis – Large, medium width, nassariform, protoconch 1.25 whorls without microsculpture, few riblets on last quarter whorl, 20-21 narrow orthocline ribs, 4-6 narrow cords on spire whorls forming finely reticulated sculpture, 21 on last whorl, labial denticles in some specimens, relatively long siphonal canal.

Description – Shell large, medium width, nassariform (SL/MD = 2.43-2.70). Protoconch about 1.25 whorls, surface appears smooth (slightly abraded): few riblets seen on last quarter whorl (dp = 880-885 μm, hp = 770-795 μm, dp/hp = 1.11-1.14, dn = 565-605 μm, dV1 = 760-765 μm, Ln = 255-275 μm). Protoconch/teleoconch junction not sharply delimited. Teleoconch of 6-6.5 convex whorls separated by moderately impressed suture. Axial sculpture of low, narrow, orthocline ribs, 20-21 on last whorl. Spiral sculpture of four cords on first teleoconch whorl, abapically further cords appear just below and above suture, six on penultimate whorl, cords much narrower than their interspaces, slightly swollen over intersections without forming tubercles. Last whorl short, 49-52% of total height, strongly constricted at base, six cords above insertion of outer lip, three over base, about 12 over siphonal fasciole. Aperture 32-33% total height, with six weak elongated denticles within, absent in some specimens, relatively long siphonal canal for genus.

Discussion – Several congeners need to be compared. In the Estepona assemblages *Chauvetia oliveri* nov. sp. is most similar to *C. janseni* nov. sp. (for comparison see under that species). *Chauvetia affinis* Monterosato, 1889, an extant species from Mauritania and Senegal, extending into the Mediterranean, is smaller (up to 6 mm height; *fide* Oliver & Rolán, 2008, p. 138), with a protoconch only about half the size (dp = 430 μm, hp = 480 μm), the spiral cords are broader with small, but more strongly developed tubercles at the intersections, the base is less constricted, and the siphonal canal is shorter. *Chauvetia lamyi* Knudsen, 1956, a West African species found from Mauritania to Ivory Coast is very similar in having narrow spiral cords, has a comparable number of axials and spirals, and a strongly constricted base, but is much smaller (up to 6 mm height; *fide* Oliver & Rolán, 2008, p. 144), and has a smaller protoconch, with a much smaller nucleus (dp = 540 μm, hp = 540 μm, dn = 290 μm). *Chauvetia procerula* (Monterosato, 1889) found in the Atlantic from Cape St Vincent, south Portugal to the Canary Islands and into the Mediterranean is superficially similar in having narrow cords, but has a maximum size of 9.7 mm, smaller protoconch (dp = 600-650 μm, dn = 350-400 μm), and has only half the number of axial ribs (9-19) that are stronger (Gofas & Oliver, 2010, p. 40).

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

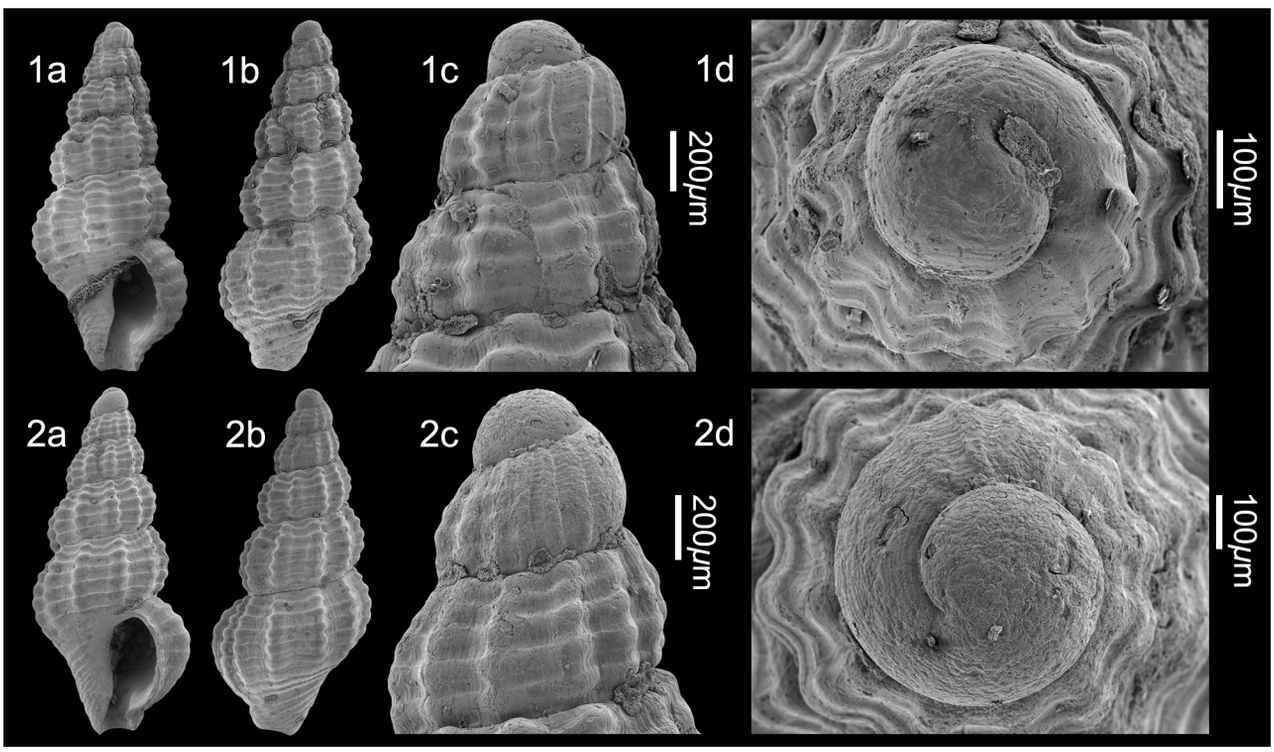


Plate 15. *Chauvetia plioetrusca* Brunetti, Della Bella & Cresti, 2017; 1. NHMW 2023/0284/0082, height 5.0 mm, width 2.2 mm; 2. NHMW 2023/0284/0083, height 5.0 mm, width 2.2 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

***Chauvetia plioetrusca* Brunetti, Della Bella & Cresti, 2017**
Plate 15, figs 1, 2

2000 *Chauvetia brunnea* for. A (Donovan, 1804) – Chirli, p. 59, pl. 23, figs 1-4 (*non* Donovan, 1804).
*2017 *Chauvetia plioetrusca* Brunetti, Della Bella & Cresti, p. 20, figs 5G-I.

Material and dimensions – Maximum height 5.0 mm, width 2.2 mm. **CO**: NHMW 2023/0284/000082-0083 (1), NHMW 2023/0284/000084 (5).

Description – Shell small, broad nassariform (SL/MD = 2.27). Protoconch 1.4 whorls, bearing close-set spiral cordlets and 2-3 axial riblets on the last portion (dp = 395-560 μm, hp = 525-530 μm, dp/hp = 0.75-1.06, dn = 190-275 μm, dV1 = 295-440 μm, Ln = 90-120 μm). Protoconch/teleoconch junction marked by beginning of adult sculpture. Teleoconch of 4.5 convex whorls separated by deeply impressed, weakly undulating suture. Axial sculpture predominant; broad, rounded slightly opisthocline to orthocline ribs, 9-10 on last whorl. Spiral sculpture on first teleoconch whorl of four rounded cords, wider than their interspaces. Fifth cord appears below suture on second whorl; cords hardly swollen over intersections. Last whorl short, 56% of total height, convex, moderately constricted at base, six cords above insertion of outer lip, tow over base, about ten over siphonal fasciole. Aperture 34% of total height, six labial denticles, D6 strongest.

Discussion – The specimens from Estepona seem to be conspecific with *Chauvetia plioetrusca* Brunetti, Della Bella & Cresti, 2017 from the Lower Pliocene of Italy. The Estepona specimens are slightly larger (max. height 5.0 mm vs. 4.2; *fide* Brunetti *et al*., 2017, p. 20), but they coincide in profile, protoconch type (cannot be certain as that publication does not include SEM images, and most of the protoconchs seems to have a slightly worn surface), the number and form of the axial ribs, and in the number of cords. The original description mentions two cords on the first teleoconch whorl, but in the magnified apical image (2017, fig. 5I) three cords are visible at the protoconch/teleoconch junction and four on the second teleoconch whorl.
Chauvetia plioetrusca is similar to *C. procercula* (Monterosato, 1889) but differs in being smaller (max. height 5.0 mm vs. at least 7-8 mm), slightly slenderer and having one spiral cord less on the spire whorls. Note that the two specimens illustrated herein seem to have similar teleoconch characters and are of the same height, but their protoconchs vary significantly in size.

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli, 2000; Brunetti *et al*., 2017). Upper Pliocene: western Mediterranean, Estepona Basin, S. Spain (this paper).

***Chauvetia procercula* (Monterosato, 1889)**
Plate 16, figs 1-3

*1889 *Donovania procercula* Monterosato, p. 116.

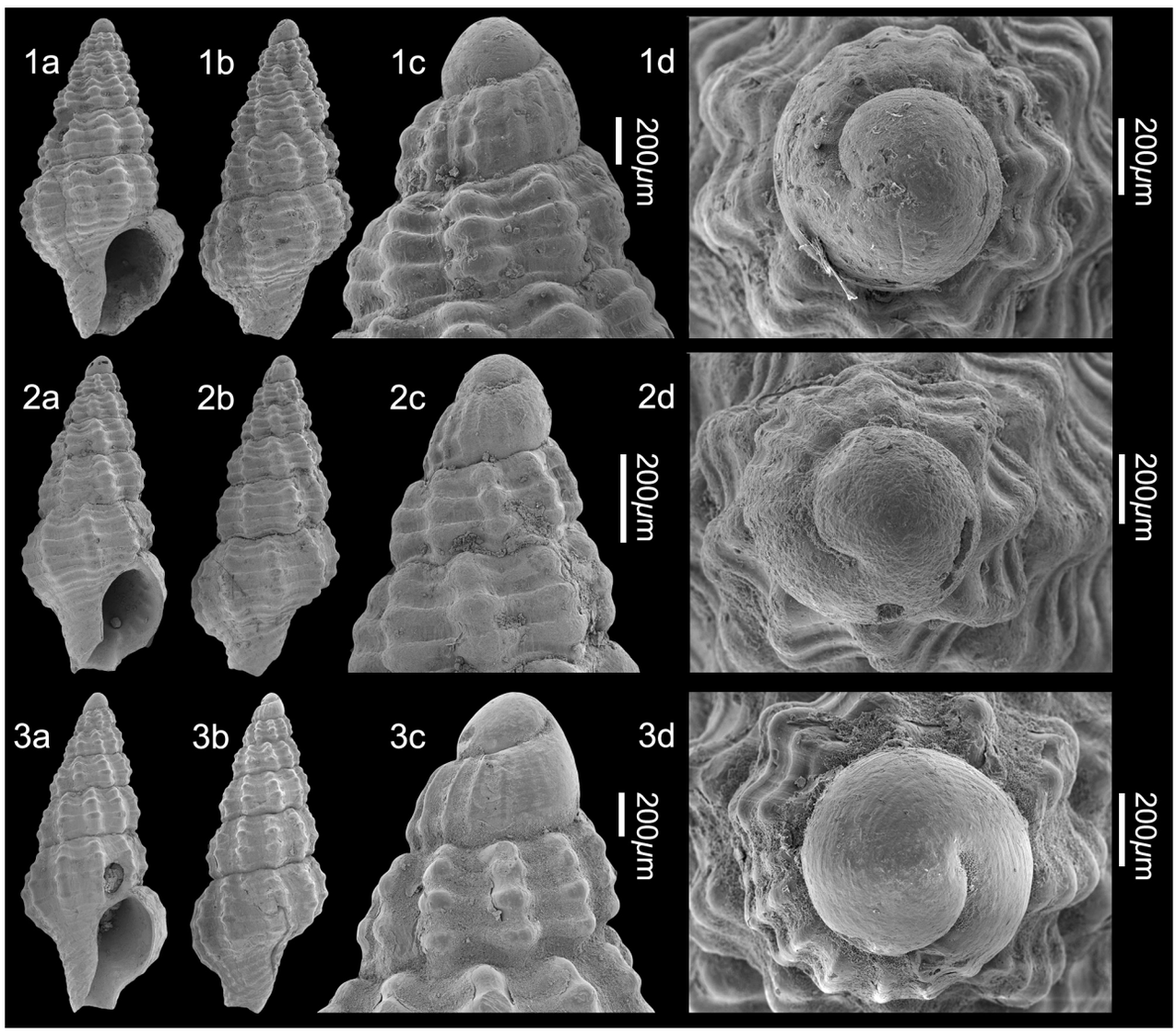


Plate 16. *Chauvetia procercula* (Monterosato, 1889); 1. NHMW 2023/0284/0072, height 6.5 mm, width 3.2 mm; 2. NHMW 2023/0284/0073, height 6.4 mm, width 3.0 mm (SEM images). Velerín conglomerates. 3. NHMW 2023/0284/0075, height 8.1 mm, width 3.6 mm. Velerín sands, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

1999 *Chauvetia procercula* (Monterosato, 1889) – Micali, p. 64, figs 21, 22, 27.
2003 *Chauvetia procercula* (Monterosato, 1889) – Giannuzzi-Savelli *et al*., p. 15, 170, figs 336-340.
2009 *Chauvetia procercula* (Monterosato, 1889) – Oliver & Rolán, p. 124, figs 17, 18, 81-85.
2010 *Chauvetia procercula* (Monterosato, 1889) – Gofas & Rolán, p. 38, figs 35-41, 42-45.
2011 *Chauvetia procercula* (Monterosato, 1889) – Hernández *et al*., p. 206, pl. 64N-O.

Material and dimensions – Maximum height 8.1 mm, width 3.6 mm. **CO**: NHMW 2023/0284/0072-0073 (2), NHMW 2023/0284/0074 (17), RGM.1404353 (2). VS: NHMW 2023/0284/0075 (1). **EL**: NHMW 2023/0284/0091 (6). **VS**: NHMW 2023/0284/0095 (17).

Description – Shell medium sized, very broad to broad (SL/MD = 2.03-2.25). Protoconch 1.25 whorls, surface abraded (dp = 650-695 μm, hp = 580-710 μm, dp/hp = 0.94-1.20, dn = 360-430 μm, dV1 = 565-630 μm, Ln = 160-220 μm). Protoconch/teleoconch junction marked by beginning of adult sculpture. Teleoconch of five convex whorls with periphery just below mid-whorl, separated by moderately impressed undulating suture. Axial sculpture of strong, weakly prosocline to opisthocline rounded ribs, narrower than their interspaces, 10-13 on last whorl: ribs roughly aligned axially. Spiral sculpture on first teleoconch whorl of three elevated rounded cords, roughly equal in width to their interspaces. On second or third whorl one cord appears just below and just above suture; fifth mostly obscured by subsequent whorl: cords elevated, slightly swollen horizontally over intersections. Last whorl 53-54% of total height, strongly convex, strongly constricted at base, five cords above insertion of outer lip, three over base, about eight over siphonal fasciole. Aper-

ture 33-35% of total height, outer lip with six elongated denticles within.

Discussion – *Chauvetia procercula* (Monterosato, 1889) is characterised by its strong axial sculpture, the ribs roughly aligned axially. The protoconch in all the Estepona specimens is poorly preserved and the surface abraded, but it is spirally striate with a few axial riblets on the last portion (see Oliver & Rolán, 2009, figs 83, 84; Gofas & Rolán, figs 42-45). This is the first fossil record for the species.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, S. Spain (this paper). Present-day: Atlantic southern Iberian coast from Cape St. Vincent to Canary Islands (Oliver & Rolán, 2009; Hernández *et al*., 2011), Senegal (Micali, 1999), western Mediterranean (Micali, 1999; Giannuzzi-Savelli *et al*., 2003), rarely central Mediterranean (Giannuzzi-Savelli *et al*., 2003).

***Chauvetia pseudopelorcei* nov. sp.**
Plate 17, figs 1, 2

ZooBank registration – urn:lsid:zoobank.org:act:E1B26C59-8345-4E0A-BB2E-00409B9FD372

Type material – Holotype NHMW 2023/0284/0042, height 6.1 mm, width 2.8 mm; paratype 1 NHMW 2023/0284/0043, height 6.5 mm, width 3.1 mm, width 4.7 mm; paratype 2 NHMW 2023/0284/0044, height 7.5 mm, width 3.2 mm; paratype 3 NHMW 2023/0284/0045, height 6.3 mm, width 2.8 mm; paratype 4 RGM.1404351, height 7.6 mm, width 3.5 mm.

Other material – Maximum height 7.6 mm, width 3.5 mm. **CO**: NHMW 2023/0284/0046 (1).

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

Type stratum – unnamed beds of Lower Piacenzian age, Upper Pliocene.

Etymology – Named reflecting the close similarity to *Chauvetia pelorcei* Oliver & Rolán, 2008. *Chauvetia,* gender feminine.

Diagnosis – Small, very broad nassariform, protoconch 1.25 whorls, bearing spiral cordlets and a few riblets on last quarter whorl, teleoconch whorls moderately convex, 12 orthocline ribs predominant, 3-4 cords on spire whorls, tubercles at intersections, 16 on last whorl, six labial denticles.

Description – Shell small, very broad nassariform (SL/MD = 2.10-2.18). Protoconch about 1.25 whorls, bearing spiral cordlets; a few riblets on last quarter whorl (dp = 715-780 μm, hp = 655-680 μm, dp/hp = 1.05-1.19, dn = 415-460 μm, dV1 = 590-635 μm, Ln = 225-235 μm). Protoconch/teleoconch junction well delimited by

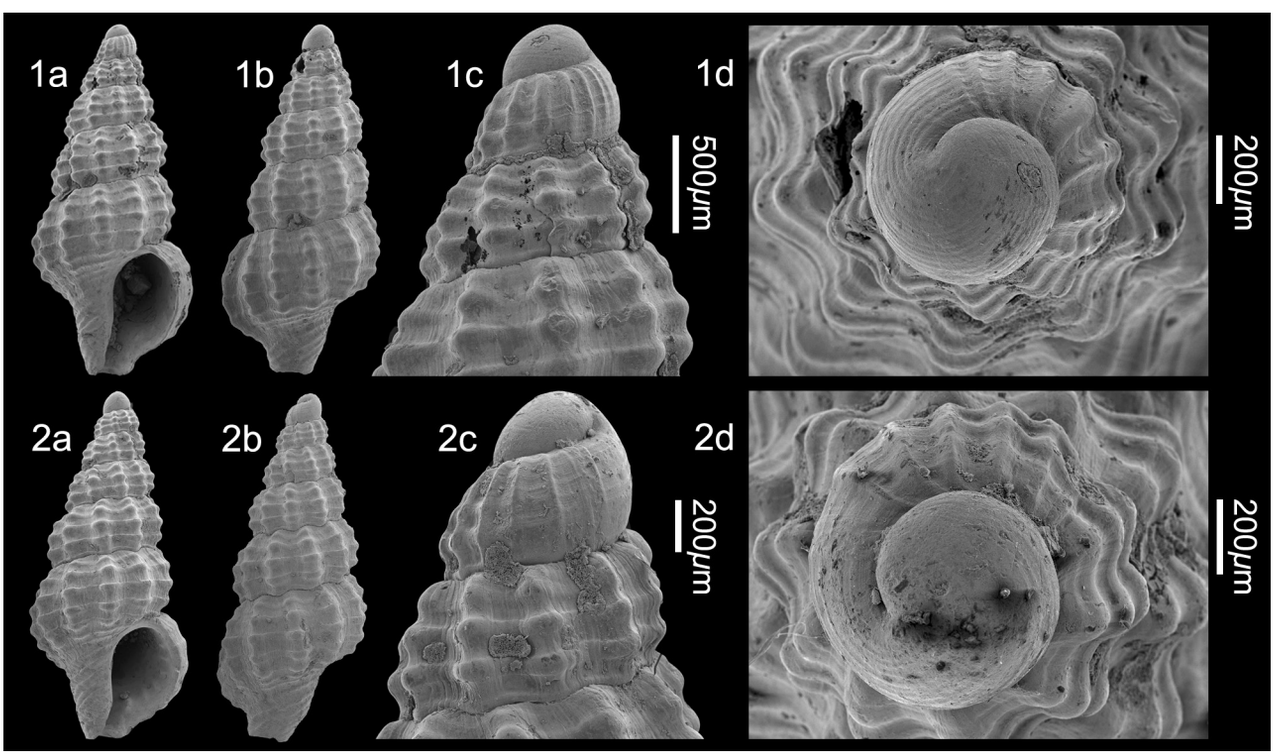


Plate 17. *Chauvetia pseudopelorcei* nov. sp.; 1. **Holotype** NHMW 2023/0284/0042, height 6.1 mm, width 2.8 mm; 2. **Paratype 1** NHMW 2023/0284/0043, height 6.5 mm, width 3.1 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

end of spiral cordlets and start of primary spiral cords. Teleoconch of 5-5.5 convex whorls separated by moderately impressed suture. Axial sculpture of orthocline ribs, 12 on last whorl. Spiral sculpture of three narrow cords on first two teleoconch whorls, fourth cord appears just below suture on third whorl. Spirals tend to fade in axial interspaces. Axials predominant, spirals overrunning and swollen over the ribs, tubercular at intersections. Last whorl 54-56% of total height, strongly convex and constricted at base, five cords above insertion of outer lip, three over base, about eight over siphonal fasciole. Aperture 32-35% total height, with six weak elongated denticles within.

Discussion – *Chauvetia pelorcei* Oliver & Rolán, 2008 from present-day Senegal has a similar profile, similar number of protoconch whorls (0.8 *fide* Oliver & Rolán, 2008 = 1.3 as counted herein) with similar sculpture. However, the protoconch in the living species is considerably smaller (dp = 475 μm, hp = 525 μm, dn = 200 μm, dV1 = 370 μm), the profile of the last whorl is somewhat different; more narrowly inflated mid-whorl with the base more constricted in the Estepona species resulting in a narrower siphonal fasciole. Moreover, the roughened teleoconch microsculpture seen between the cords in *C. pelorcei* (Oliver & Rolán, 2008, figs 132-133) is not seen in the Estepona species. *Chauvetia procercula* (Monterosato, 1889), present in the Atlantic of the Canary Islands and extending into the Mediterranean, has a similarly sculptured protoconch, somewhat smaller (dp = 580 μm, hp = 600 μm, dn = 220 μm, dV1 = 320 μm), and similar teleoconch sculpture, but composed of fewer, broader, more elevated ribs (9-10 vs. 12 on last whorl). *Chauvetia tenebrosa* Oliver & Rolán, 2008 from Senegal and Mauritania is also similar in protoconch and teleoconch sculpture, but smaller (max. height 4.0 mm) with a smaller protoconch, the cords are broader, forming larger tubercles over the intersections.

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

***Chauvetia sinuosa* nov. sp.**
Plate 18, figs 1, 2

ZooBank registration – urn:lsid:zoobank.org:act:6E8022E3-A732-4893-97DE-9180331DCCBB

Type material – Holotype NHMW 2023/0284/0001, height 8.0 mm, width 3.3 mm; paratype 1 NHMW 2023/0284/0002, height 7.5 mm, width 3.2 mm; paratype 2 NHMW 2023/0284/0003, height 8.8 mm, width 3.3 mm; paratype 3 NHMW 2023/0284/0004, height 9.2 mm, width 3.5 mm; paratype 4 RGM.1404336, height 9.6 mm, width 3.8 mm; paratype 5 RGM.1404337, height 8.0 mm, width 3.4 mm.

Other material – Maximum height 9.3 mm, width 3.5 mm. **CO**: NHMW 2023/0284/0005 (23). **EL**: NHMW 2023/0284/0092 (2).

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

Type stratum – unnamed beds of Lower Piacenzian age, Upper Pliocene.

Etymology – Name reflecting the sinuous axial ribs. *Chauvetia,* gender feminine.

Diagnosis – Medium sized, broadly fusiform, protoconch just over one whorl with riblets on last portion, last two whorls inflated, 11 broad, sinuous axial ribs, five broad flattened cords separated by narrow grooves on penultimate whorl, 15 on last whorl.

Description – Shell medium sized, broadly fusiform (SL/MD = 2.34-2.42). Protoconch 1.1-1.2 whorls, surface abraded in all specimens; a few riblets seen on the last portion (dp = 600 μm, hp = 615 μm, dp/hp = 0.98, dn = 370 μm, dV1 = 565 μm, Ln = 175 μm). Protoconch/teleoconch junction not clearly delimited. Teleoconch of 5.5 strongly convex whorls; last two spire whorls somewhat inflated in abapical half. Axial sculpture of strong, broad, opisthocline ribs, 11 sinuous on last whorl. Spiral sculp-

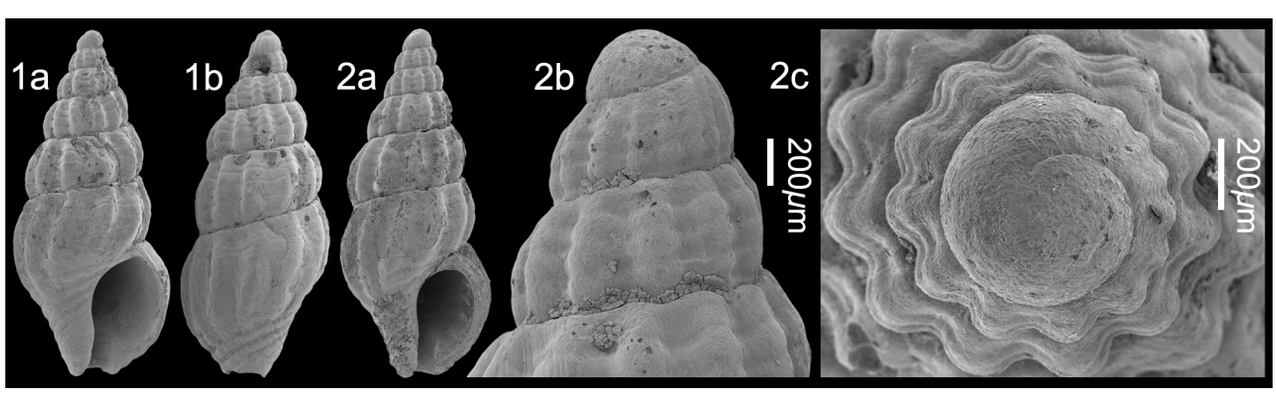


Plate 18. *Chauvetia sinuosa* nov. sp.; 1. **Holotype** NHMW 2023/0284/0001, height 8.0 mm, width 3.3 mm; 2. **Paratype 1** NHMW 2023/0284/0002, height 7.5 mm, width 3.2 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

ture of four cords on first teleoconch whorl, abapically cords broaden and flatten, five on penultimate whorl, separated by narrow, shallow grooves; no tubercles formed at intersections. Last whorl 53-55% of total height, moderately constricted at base; six weak cords above insertion of outer lip, three over base, about six over siphonal fasciole. Aperture 31-35% total height, with five elongated denticles within some specimens.

Discussion – Somewhat similar in profile to *Chauvetia megastoma* Oliver & Rolán, 2009 from present-day Mauritania, but that species is immediately separated by its more numerous and narrower spiral cords that remain narrow on later whorls, separated by wide interspaces, whereas in *Chauvetia sinuosa* nov. sp. the cords flatten and broaden abapically and are separated by narrow grooves. In the character of the flattened cords, it is reminiscent of *C. borgesi* Oliver & Rolán, 2009 from the Canary Islands, but that species is immediately separated by its strongly axially sculptured protoconch, and a greater number of spiral cords on the teleoconch whorls. *Chauvetia dentifera* Gofas & Oliver, 2010 from the present-day Alborán Sea and Strait of Gibraltar has a similar number of flattened cords on the teleoconch whorls but differs strongly in whorl profile; *C. dentifera* has far less convex whorls, separated by a shallower suture giving the spire a more regularly conical aspect, and the base is less constricted. *Chauvetia taeniata* Gofas & Oliver, 2010 described from southern Portugal to the Strait of Gibraltar also has flattened cords, but has a spirally striate protoconch, the teleoconch whorls are not as convex as they are in *C. sinuosa*, and the spirals are more numerous, especially on the last whorl (25-30), and the ribs are not sinuous on the last whorl.

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

***Chauvetia solida* nov. sp.**
Plate 19, figs 1, 2; Plate 24, fig. 4

ZooBank registration – urn:lsid:zoobank.org:act:B655A92E-08FE-448A-B393-BEEA60EE528B

Type material – Holotype NHMW 2023/0284/0006, height 9.7 mm, width 3.6 mm; paratype 1 NHMW 2023/0284/0007, height 8.1 mm, width 3.3 mm; paratype 2 NHMW 2023/0284/0008, height 9.7 mm, width 3.7 mm; paratype 3 NHMW 2023/0284/0009, height 8.0 mm, width 3.3 mm; paratype 4 RGM.1404338, height 8.7 mm, width 3.6 mm; paratype 5 RGM.1404339, height 7.3 mm, width 3.1 mm.

Other material – Maximum height 9.7 mm, width 3.6 mm. **CO**: NHMW 2023/0284/0010 (21). **EL**: NHMW 2023/0284/0093 (1).

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

Type stratum – unnamed beds of Lower Piacenzian age, Upper Pliocene.

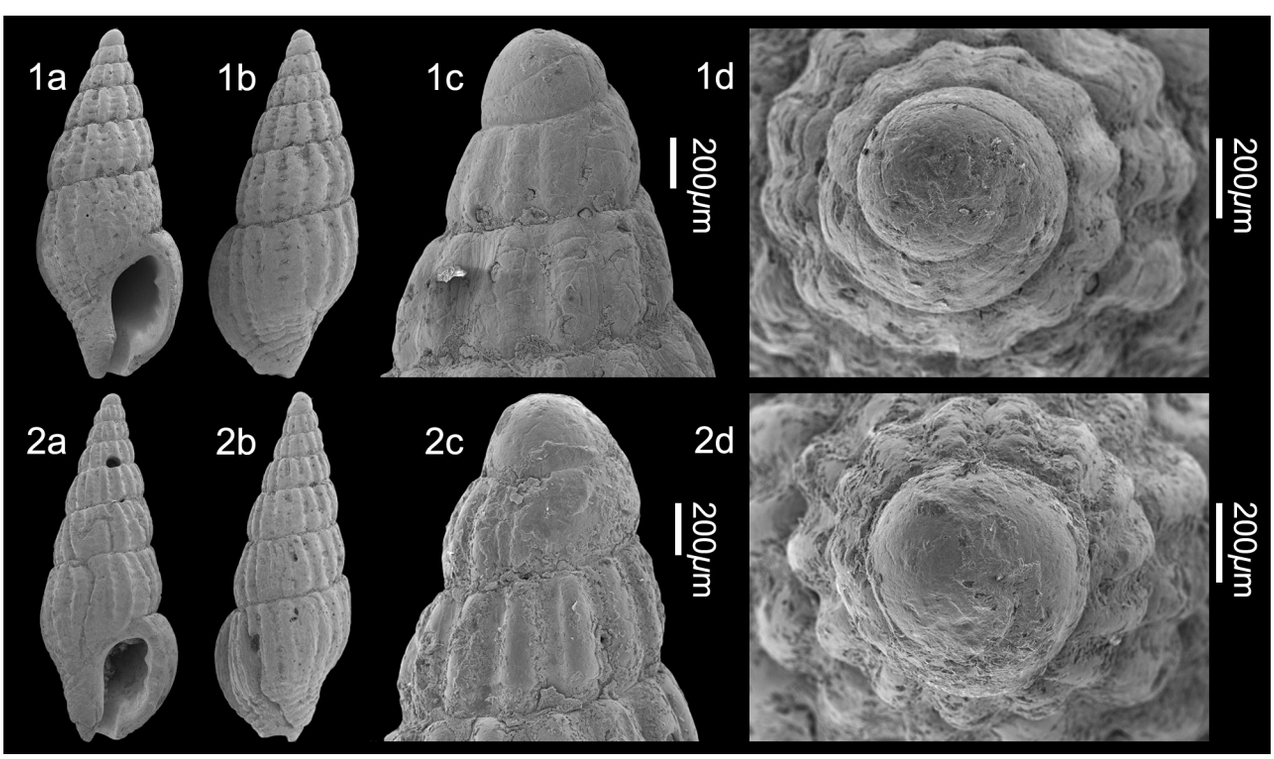


Plate 19. *Chauvetia solida* nov. sp.; 1. Holotype NHMW 2023/0284/0006, height 9.7 mm, width 3.6 mm; 2. Paratype 1 NHMW 2023/0284/0007, height 8.1 mm, width 3.3 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

Etymology – Name reflecting the solid shell of this species. *Chauvetia,* gender feminine.

Diagnosis – Medium sized, solid, nassariform, with regularly conical spire, protoconch 1.3 whorls, teleoconch whorls weakly convex, suture superficial, 15-18 orthocline ribs, 4-5 flattened cords on spire whorls, 15-17 on last whorl, 4-5 strong labial denticles.

Description – Shell medium sized, medium width (SL/MD = 2.45-2.69), nassariform, with regularly conical spire. Protoconch approx. 1.3 whorls, surface abraded in all specimens (dp = 610-650 μm, hp = 665-755 μm, dp/hp = 0.86-0.92, dn = 405 μm, dV1 = 555 μm, Ln = 200 μm). Protoconch/teleoconch junction not clearly delimited. Teleoconch of up to 6.5 weakly convex whorls, separated by relatively shallow suture, resulting in regularly conical spire. Axial sculpture of straight, opisthocline to orthocline ribs, 15-18 on last whorl, separated by interspaces roughly equal in width to ribs. Spiral sculpture weak; cords not clearly seen on first two teleoconch whorls, four flattened cords on third whorl, 5-6 on penultimate whorl separated by narrow grooves; low tubercles developed at intersections. Last whorl 54-57% of total height, weakly constricted at base, 15-17 low spiral cords. Aperture 30-35% total height, with 4-5 strong, elongated denticles within, D1 strongest.

Discussion – This species is characterised with some difficulty. Although it is one of the more abundant *Chauvetia* species in the Velerín conglomerates, the specimens are invariably abraded. There is no sign of protoconch microsculpture, although we cannot be sure of its absence, and the protoconch/teleoconch boundary is unclear. The spiral cords on the first two teleoconch whorls are very faint (Pl. 19, figs 1c, 2c). Several specimens show signs of predation (drill hole and probably crab attack) and repair (Pl. 19, figs 2a, b).
Chauvetia solida nov. sp. is not particularly similar to any of its congeners and has a distinctly nassariform profile. *Chauvetia lefebvrii* (Maravigna, 1840) found today along the Atlantic Iberian coast southwards to Sahara and into the Mediterranean is vaguely similar in profile, but the last quarter protoconch whorl is strongly axially sculptured, the cords on the early teleoconch whorls are much more strongly developed, and the axial ribs are weaker and more numerous, cutting the ribs so they appear as a row of tubercles.

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

***Chauvetia spinosa* nov. sp.**
Plate 20, fig. 1; Plate 24, fig. 5

ZooBank registration – urn:lsid:zoobank.org:act:39B734C1-30FF-4E86-9488-992888EA6D09

Type material – Holotype NHMW 2023/0284/0011, height 5.1 mm, width 2.5 mm; paratype 1 NHMW 2023/0284/0012, height 5.2 mm, width 2.5 mm; paratype 2 NHMW 2023/0284/0013, height 5.7 mm, width 2.6 mm; paratype 3 NHMW 2023/0284/0014, height 5.7 mm, width 2.7 mm; paratype 4 RGM.1404340, height 5.1 mm, width 2.5 mm; paratype 5 RGM.1404341, height 5.1 mm, width 2.5 mm.

Other material – Maximum height 6.5 mm, width 2.8 mm. **CO**: NHMW 2023/0284/0015 (31).

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

Type stratum – unnamed beds of Lower Piacenzian age, Upper Pliocene.

Etymology – Name reflecting the slightly spinous sculpture of this species, unusual in Chauvetiidae. *Chauvetia,* gender feminine.

Diagnosis – Small, solid, very broadly fusiform, protoconch 1.5 whorls bearing regular spiral cordlets and a few riblets on last quarter whorl, teleoconch whorls with widely spaced ribs, eight on last whorl, three spiral cords on spire whorls, abapical two stronger and tubercular at intersections, last whorl with 18 cords, two peripheral cords strongest.

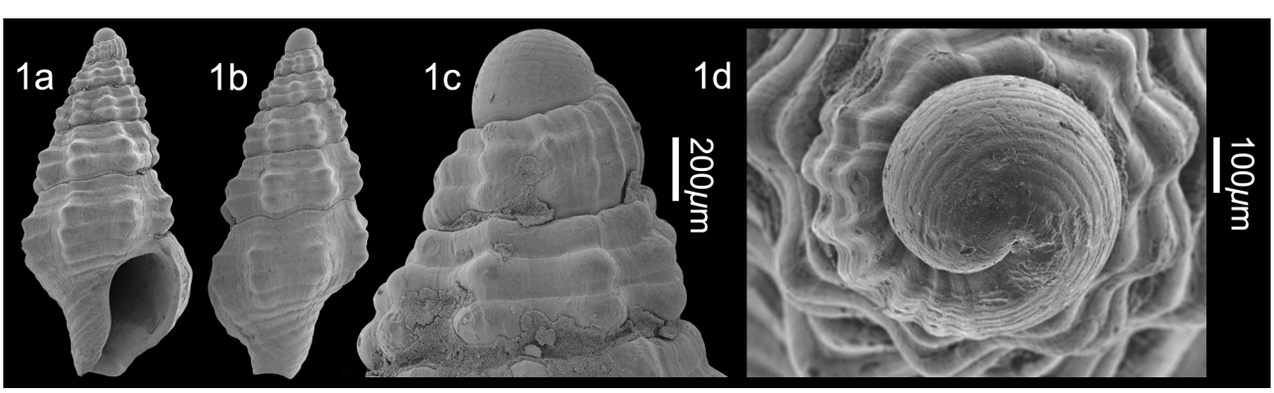


Plate 20. *Chauvetia spinosa* nov. sp.; 1. **Holotype** NHMW 2023/0284/0011, height 5.1 mm, width 2.5 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

Description – Shell small, solid, very broadly fusiform (SL/MD = 1.8-2.04). Protoconch just under 1.5 whorls, bearing broad spiral cordlets; five riblets seen on the last quarter (dp = 560 μm, hp = 595 μm, dp/hp = 0.94, dn = 280 μm, dV1 = 440 μm, Ln = 130 μm). Protoconch/teleoconch junction sharply delimited. Teleoconch of five weakly convex whorls separated by shallow suture. Axial sculpture of widely spaced orthocline ribs, eight on last whorl. Spiral sculpture of three cords on first teleoconch whorl, adapical cord weaker. Abapically, adapical cord weakens further, lower two cords strengthen with pointed tubercles developed at intersections. Last whorl tall, 58-60% of total height, base moderately strongly constricted, six cords above level of insertion of outer lip, adapical cord placed on shoulder weak, next two cords strongest forming periphery, three further below, two over base, about nine over siphonal fasciole. Aperture 35-38% total height, without denticles.

Discussion – The holotype is perfectly preserved and represents a species with very distinctive protoconch and teleoconch sculpture. The only species that can be compared is *Chauvetia pelorcei* Oliver & Rolán, 2008 from Senegal, which has a very similar profile, similar number of protoconch whorls (0.8 *fide* Oliver & Rolán, which equals 1.3 as counted herein) with similar sculpture, and a weaker adapical cord on the teleoconch whorls. However, the protoconch in the living species is smaller (dp = 475 μm, hp = 525 μm, dn = 200 μm, dV1 = 370 μm), there are four primary cords on the first two teleoconch whorls, the adapical two weaker, with a fifth appearing just above the suture on the penultimate whorl, whereas in *Chauvetia spinosa* nov. sp. all spire whorls have only three cords. Moreover, the roughened teleoconch microsculpture seen between the cords in *C. pelorcei* (Oliver & Rolán, 2008, figs 132-133) is not seen in the Estepona species. *Chauvetia distans* Oliver & Rolán, 2009 from present-day West Africa, Mauritania to Sahara, has a similar profile, but is taller spired with more convex whorls. The protoconch is slightly larger with a larger nucleus (dp = 610 μm, dn = 310 μm; *fide* Oliver & Rolán, 2009, p. 142), and the microsculpture consists of spiral rows of pits (Oliver & Rolán, 2009, figs 123-124) rather than broad cordlets separated by narrow grooves as seen in *C. spinosa*.

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

***Chauvetia* cf. *taeniata* Gofas & Oliver, 2010**
Plate 21, fig. 1, Plate 24, fig. 6

Material and dimensions – Height 6.5 mm, width 3.0 mm. **CO**: NHMW 2023/0284/0057 (1).

Description – Shell small, very broad fusiform (SL/MD = 2.17). Protoconch 1.5 whorls, bearing numerous crowded spiral cordlets separated by narrow grooves, five riblets on last quarter whorl (dp = 720 μm, hp = 735 μm, dp/hp = 0.98, dn = 315 μm, dV1 = 510 μm, Ln = 120 μm). Protoconch/teleoconch junction sharply delimited. Teleoconch of just over four whorls increasing in convexity abapically, separated by deeply impressed shallowly undulating suture. Whorl periphery at abapical suture on first two whorls, abapical portion swollen on second half of second whorl and penultimate whorl so that periphery migrates to about one-quarter whorl height. Axial sculpture of broad sinuous ribs slightly narrower than their interspaces, ten on last whorl. Spiral sculpture on first teleoconch whorl of four elevated rounded cords, roughly equal in width to their interspaces. Abapically cords broaden and flatten, five cords on second whorl, six on penultimate whorl separated by narrow grooves, three abapical cords wider than three above. Last whorl tall, 63% of total height, strongly inflated and convex midwhorl, moderately constricted at base, seven cords above insertion of outer lip, about eight over base and siphonal fasciole, increasingly indistinct towards tip. Aperture 40% of total height, outer lip with seven short, weak denticles. Relatively long siphonal fasciole for genus.

Discussion – This single specimen probably represents a subadult specimen of *Chauvetia taeniata* Gofas & Oliver, 2010, today found from southern Portugal to Gibraltar. The difference in the number of spiral cords is due to the type specimen having one more whorl.
Chauvetia tenebrosa Oliver & Rolán, 2008 from present-day Senegal also has similar protoconch sculpture and flattened spiral cords but differs in having somewhat an-

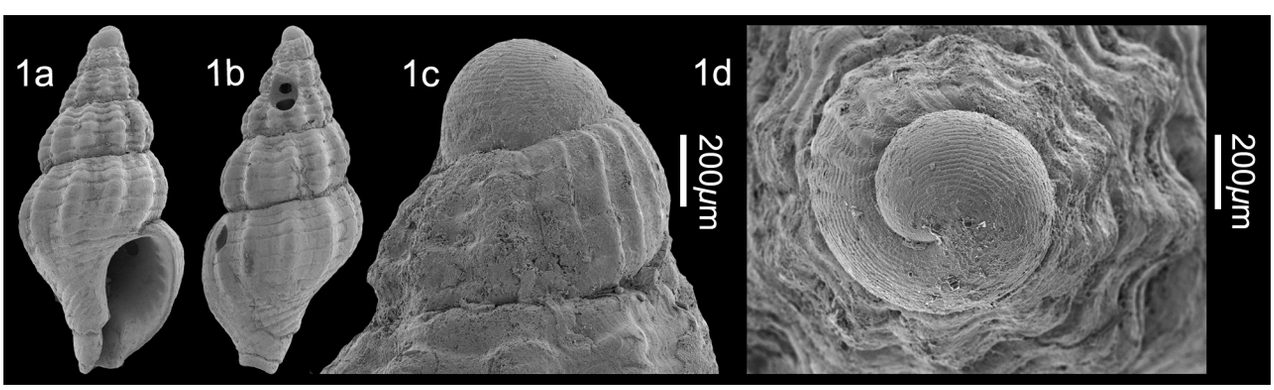


Plate 21. *Chauvetia* cf. *taeniata* Gofas & Oliver, 2010; 1. NHMW 2023/0284/0057, height 6.5 mm, width 3.0 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

gular whorls, the periphery placed higher, and slightly tubercular at the intersections with the ribs. *Chauvetia affinis* (Monterosato, 1889) from the Canary Islands, Sahara and occasionally western Mediterranean also has similar protoconch characters (see Oliver & Rolán, 2009, figs 73-76), but is slenderer, the cords are less flattened and tubercular at the intersections with the ribs. *Chauvetia crassior* (Odhner, 1932) from present-day southern Iberian coast to Mauritania and the Canary Islands also has flattened cords, but the spiral threads on the protoconch are rather irregular and widely spaced, and the ribs on the teleoconch are distinctly prosocline and straight on the last whorl as opposed to sinuous.

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

***Chauvetia* sp.**
Plate 22, figs 1, 2

Material and dimensions – Height 7.7 mm, width 3.3 mm. **CO**: NHMW 2023/0284/0071 (1).

Description – Shell small, broad nassariform (SL/MD = 2.33). Protoconch about 1.25 whorls, bearing spiral cordlets and seven riblets on last quarter whorl (dp = 960 μm, hp = 390 μm, dp/hp = 2.46, dn = 540 μm, dV1 = 810 μm, Ln = 235 μm). Protoconch/teleoconch junction well delimited by end of spiral cordlets and start of primary spiral cords. Teleoconch of five convex whorls separated by moderately impressed undulating suture. Axial sculpture of strong, slightly opisthocline, rounded ribs, nine on last whorl. Spiral sculpture of three very narrow cords on first teleoconch whorl, fourth cord just visible at abapical suture. Axials strongly predominant, spirals not swollen at intersections. Last whorl 57% of total height, strongly convex and constricted at base, five cords above insertion of outer lip, three over base, about seven over siphonal fasciole. Aperture 34% total height, with six elongated denticles within, D6 strongest. Siphonal fasciole well developed, bent adaxially.

Discussion – A single specimen is present similar to *Chauvetia recondita* (Brugnone, 1873), but differing in its larger size (7.7 mm vs. maximum 6.5 mm; *fide* Gofas & Oliver, 2010, p. 42), the slightly slenderer profile, and the less regularly convex whorls. The protoconch is similar to that illustrated for present-day specimens of *C. recondita* (Micali, 1999; fig. 28; Gofas & Rolán, 2009, figs 46-47), but also larger (dp = 960 μm vs. 620-650 μm; *fide* Gofas & Oliver, 2010, p. 42).

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

Discussion

In this paper twenty species are described and discussed from the Lower Piacenzian, Upper Pliocene of Estepona, southern Spain (Figure 1). *Chauvetia brunettii* nov. sp., *C. fenestrata* nov. sp., *C. fortiornata* nov. sp., *C. hoffmani* nov. sp., *C. janseni* nov. sp., *C. obesa* nov. sp., *C. oliveri* nov. sp., *C. pseudopelorcei* nov. sp., *C. sinuosa* nov. sp., *C. solida* nov. sp., *C. spinosa* nov. sp. are described as new. Three species are left in open nomenclature. The assemblage is highly endemic, with over half of the species known only from the Estepona assemblages. This level of endemicity is not surprising in a group that reproduces by direct development, as suggested by their paucispiral protoconchs.

Origins of Chauvetia

The oldest occurrence of the genus *Chauvetia* in the eastern Atlantic fossil record is from the Atlantic Tortonian Upper Miocene Cacela locality, southern Portugal, with one species which seems to be *C. pliorobusta* Brunetti, Della Bella & Cresti, 2017 (Pl. 23, fig. 1) (NHMW coll; ex BL coll.). Teleoconch characters agree, although the protoconch surface is abraded and does not show the sculpture typical of the species. Brunetti *et al*. (2017, p. 10) noted that Sacco (1904, p. 47, pl. 12, figs 55, 56) had recorded and illustrated a *Chauvetia* species as *Donovania minima* (Montg.) from the Tortonian central Proto-Mediterranean of Stazzano, Italy. Therefore, *Chauvetia* seems to have ap-

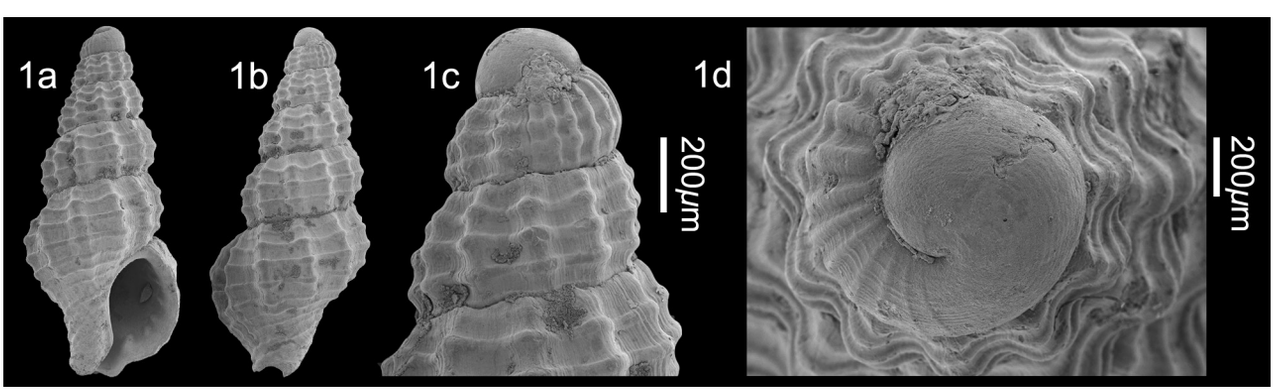


Plate 22. *Chauvetia* sp.; 1. NHMW 2023/0284/0071, height 7.7 mm, width 3.3 mm (SEM images). Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

peared in Old World, at the earliest, the beginning of the Late Miocene, and was represented by very few species.
Until recently its Pliocene record was scarce. In the Atlantic Lower Pliocene of the Guadalquivir Basin Landau *et al*. (2011) illustrated two species: *C. turritellata* (Deshayes, 1835) [= *C. affinis* (Monterosato, 1889)] herein identified as *C.* cf. *mamillata* (Risso, 1826) (Pl. 23, fig. 2), and *C. candidissima* (Philippi, 1836) (Pl. 23, fig. 3) herein corrected to *C. tenuisculpta* (Dautzenberg, 1891). Unfortunately, the apices of the Guadalquivir Basin material are abraded making definitive identification difficult.
Silva (2001) also illustrated two species for the lowermost Upper Pliocene of the Mondego Basin of central-west Portugal: *C. minima* (Montagu, 1803) [here identified to *C. affinis*] (Pl. 23, fig. 4) and *Chauvetia* aff. *candidissima* (Philippi, 1836) [here identified as *Chauvetia lineolata* (Tiberi, 1868)] (Pl. 23, fig. 5).
Plio-Pleistocene Mediterranean records were recently revised by Brunetti *et al*. (2017). During the Lower Pliocene diversity was relatively low, with only seven species recorded by Brunetti *et al.* (2017). Therefore, this assemblage from Estepona suggests a much greater diversity in the Pliocene western Mediterranean than in the central area. The genus does not seem to have expanded its range further north in the Pliocene. There are no *Chauvetia* species in the rich Lower Pliocene Assemblage III (*sensu* Van Dingenen *et al*., 2015) of NW France. A few species were recorded from Lower Pleistocene deposits of southern England (Harmer, 1918), mostly from St. Erth in Cornwall. These deposits were considered to be of Late Pliocene age and dated at about 2 Ma by Roe *et al*. (1999), which is Gelasian, and now considered Early Pleistocene (Cohen *et al*., 2023). This was a warmer period during the Pleistocene, which may explain their presence further north.
The origin of the genus was unclear until Landau *et al*. (2015) described a species from the Lower-Middle Miocene Cantaure Formation of Venezuela. They suggested that this pre-late Tortonian (pre-8.12–7.42 Ma) dispersal of the tropical Gatunian West Atlantic *Chauvetia* into the tropical East Atlantic European-West African Province most probably happened during the 10.71–9.36 Ma interval (early-mid Tortonian) during which the Circum-Tropical Current weakened, and the northward Intra-Caribbean Current had started, enhancing the Gulf Stream and the North Atlantic Current. They suggested dispersal by rafting as the most likely mechanism of transport. Other genera in the Estepona assemblages that seem to have the same history are the marginellid genera *Prunum* and *Persicula* (for further discussion see Silva *et al*., 2011 and Landau *et al*., 2015).

Palaeobiogeography of Chauvetia

Today, the genus *Chauvetia* has an eastern Atlantic and Mediterranean distribution (Figure 2). It spans several biogeographical provinces from the cool temperate southern part of the Boreal-Celtic Province in the North to the tropical Mauritanian-Senegalese molluscan province of Raffi *et al.* (1985) in the South.
However, species richness increases sharply from temperate to sub/tropical waters. Only one species is recorded from the cool-temperate Boreal-Celtic Province (British Isles; Graham, 1988), two from the warm temperate French-Iberian Province (northern Spain; Rolán Mosquera, 1983; note: Rolán Mosquera reported three species, but his record of *C. lefebvrii* is a misidentification corrected to *C. retifera*; see Gofas & Rolán, 2010,

Plate 23

1. *Chauvetia pliorobusta* Brunetti, Della Bella & Cresti, 2017, height 5.0 mm, width 4.3 mm, Cacela Velha, Algarve, Portugal, Tortonian, Upper Miocene.
2. *Chauvetia* cf. *mamillata* (Risso, 1826), height 6.3 mm, Santa Catalina, Lucena del Puerto, Huelva, Spain, Arenas de Huelva Formation, Zanclean, Lower Pliocene.
3. *Chauvetia tenuisculpta* (Dautzenberg, 1891), NHMW 2010/0054/0112, height 8.7 mm, Santa Catalina, Lucena del Puerto, Huelva, Spain, Arenas de Huelva Formation, Zanclean, Lower Pliocene.
4. *Chauvetia affinis* (Monterosato, 1889), NHMW 2018/0331/0208, height 6.3 mm, width 2.8 mm, Vale de Freixo, Pombal, Central-West Portugal, Lower Piacenzian, Upper Pliocene.
5. *Chauvetia lineolata* (Tiberi, 1868), NHMW 2018/0331/0210, height 8.1 mm, width 3.0 mm, Vale de Freixo, Pombal, Central-West Portugal, Lower Piacenzian, Upper Pliocene.
6. *Chauvetia affinis* (Monterosato, 1889), NHMW 2023/0284/0078, height 5.1 mm, width 2.1 mm, Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.
7. *Chauvetia decorata* Monterosato, 1889, NHMW 2023/0284/0100, height 5.5 mm, width 2.8 mm, Rio del Padron, Estepona, Lower Piacenzian, Upper Pliocene.
8. *Chauvetia fenestrata* nov. sp., **Paratype 2** NHMW 2023/0284/0037, height 7.1 mm, width 2.6 mm, Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.
9. *Chauvetia fortiornata* nov. sp., **Paratype 1** NHMW 2023/0284/0053, height 6.6 mm, width 2.9 mm, Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.
10. *Chauvetia hoffmani* nov. sp., **Paratype 1** NHMW 2023/0284/0099, height 7.2 mm, width 3.1 mm, Velerín sands, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.
11. *Chauvetia luciacuestae* Oliver & Rolán, 2008, NHMW 2023/0284/0098, height 8.2 mm, width 2.9 mm, Velerín sands, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

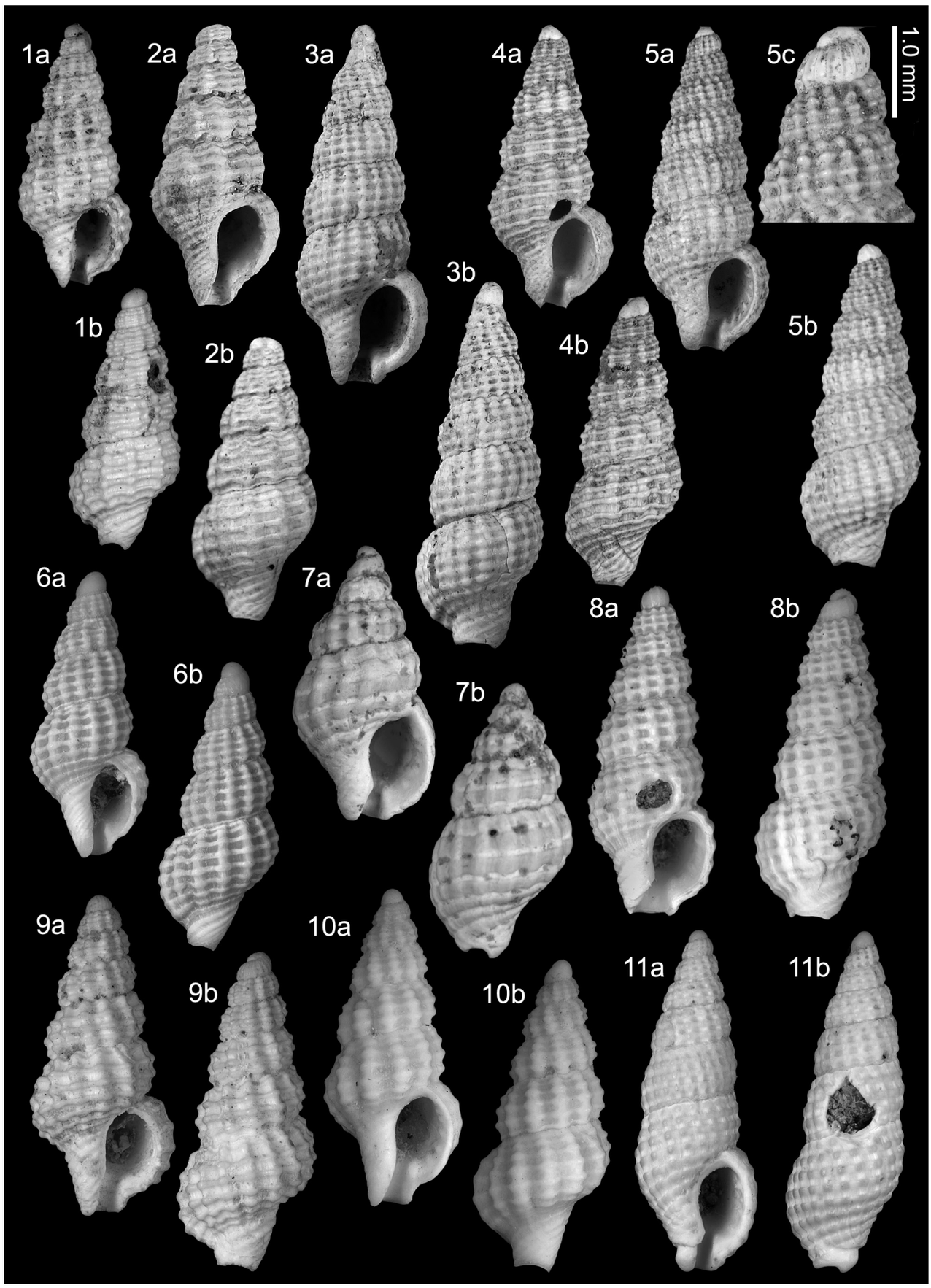

1a
2a
3a
4a
5a
5c
1.0 mm
3b
1b
2b
4b
5b
6a
7a
8a
8b
6b
7b
9a
10a
11a
11b
9b
10b

Plate 23

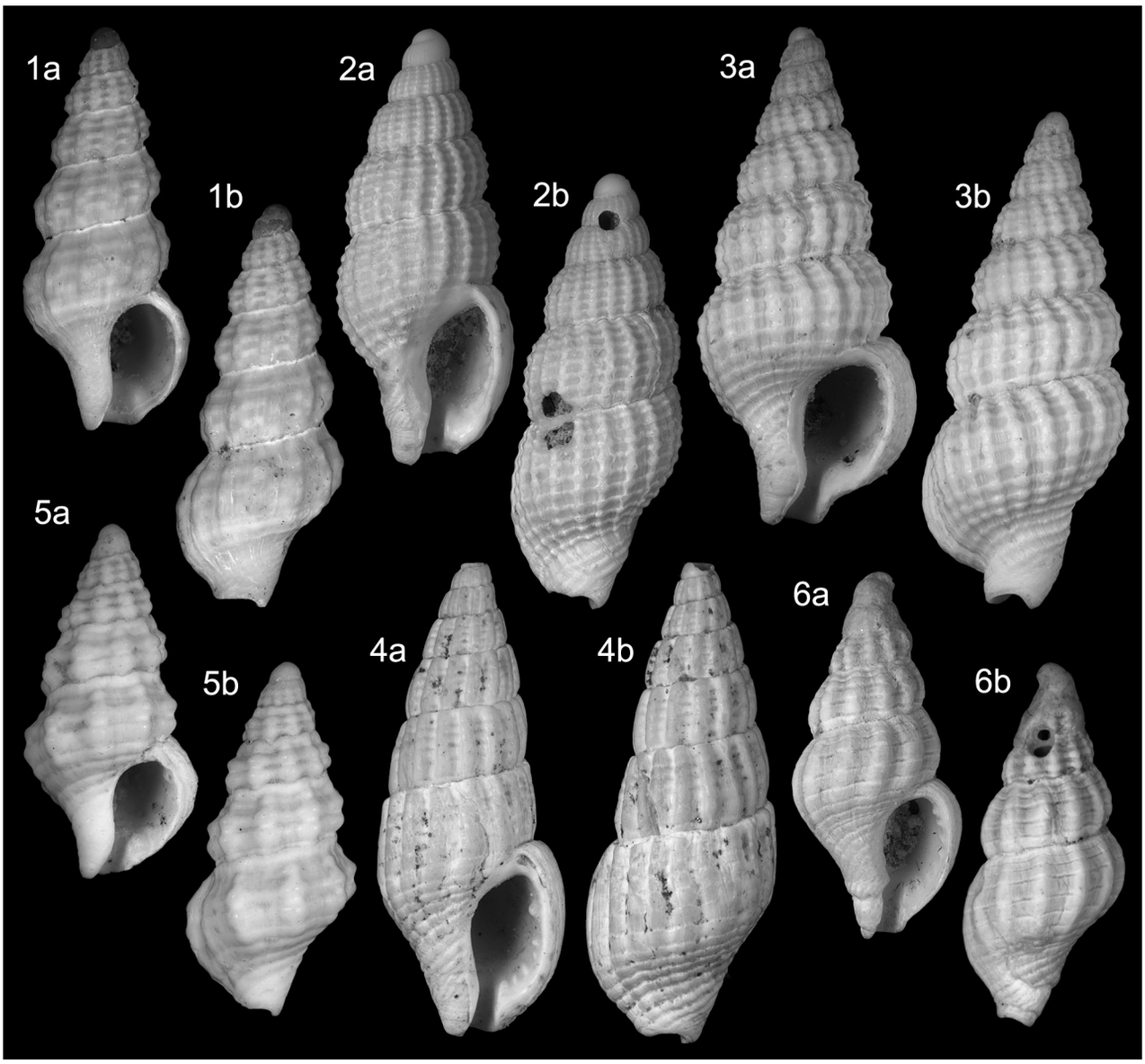


Plate 24

1. *Chauvetia mamillata* Risso, 1826, NHMW 2023/0284/0103, height 7.0 mm, width 2.9 mm, Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.
2. *Chauvetia obesa* nov. sp., **Paratype 4** NHMW 2023/0284/0041, height 8.2 mm, width 3.1 mm, Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.
3. *Chauvetia oliveri* nov. sp., **Paratype 2** NHMW 2023/0284/0027, height 11.7 mm, width 4.8 mm, Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.
4. *Chauvetia solida* nov. sp., **Paratype 2** NHMW 2023/0284/0008, height 9.7 mm, width 3.7 mm, Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.
5. *Chauvetia spinosa* nov. sp., **Paratype 2** NHMW 2023/0284/0013, height 5.7 mm, width 2.6 mm, Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.
6. *Chauvetia* cf. *taeniata* Gofas & Oliver, 2010, NHMW 2023/0284/0057, height 6.5 mm, width 3.0 mm, Velerín conglomerates, Velerín, Estepona, Lower Piacenzian, Upper Pliocene.

p. 46), whereas a similar number of species are recorded from the subtropical Mediterranean-Moroccan Province (28) and the tropical Mauritanian-Senegalese (27). In the present-day Mediterranean there is also an increased diversity in the western Mediterranean compared to the eastern Mediterranean.

Until now, the most complete chauvetiid European fossil record was given by Brunetti *et al*. (2017) for the Mediterranean Plio-Pleistocene. Those authors recorded the following species in the Pliocene of Italy (Zanclean): *C. errata* Oliver & Rolán, 2009 [herein identified as form *arenaria* of *C. affinis* (Monterosato, 1889)], *C. maroccana*

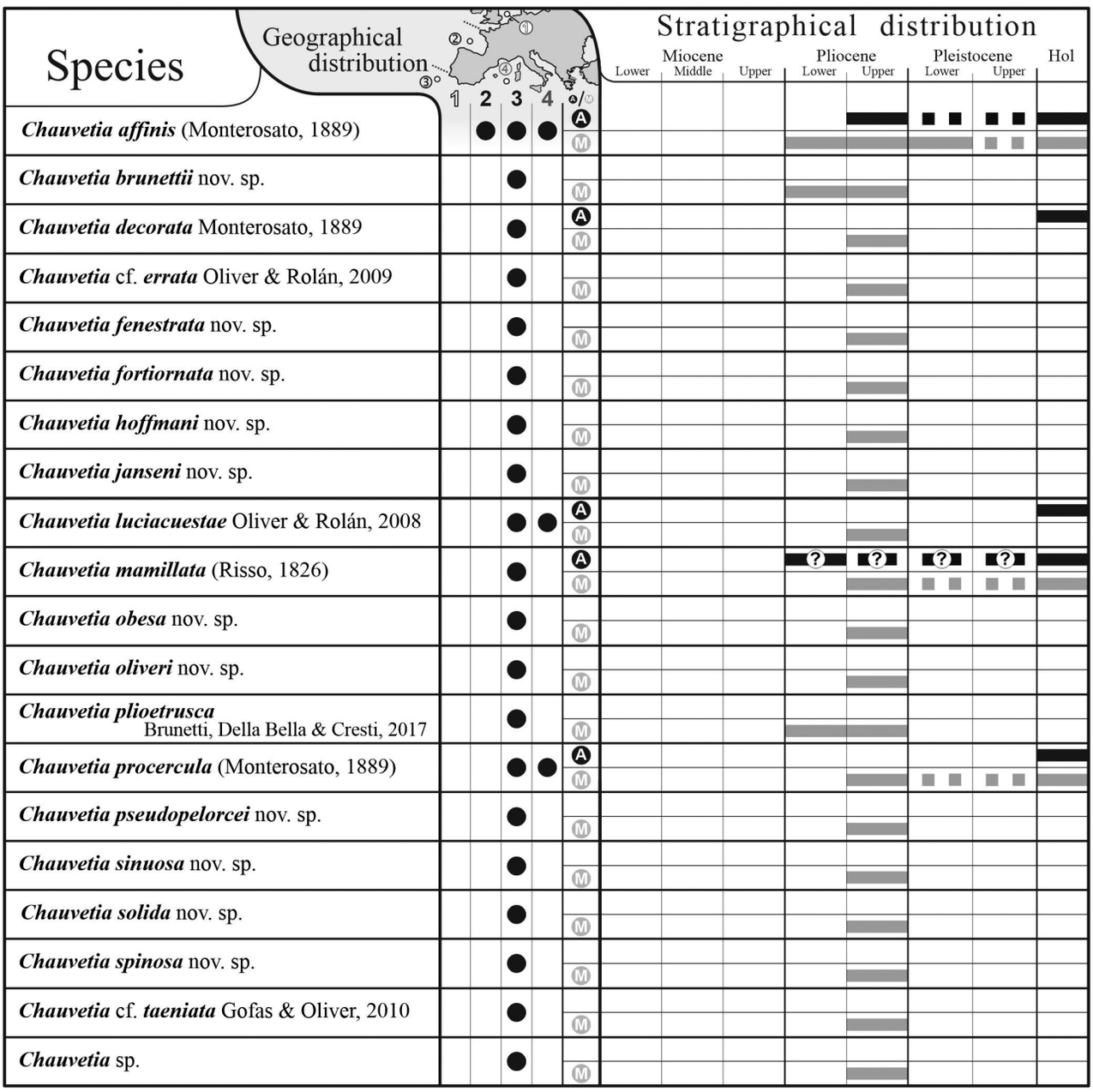


Figure 1. Geography, stratigraphy and distribution of species found in the Upper Pliocene Lower Piacenzian of the Estepona Basin, southern Spain. For present-day geographic distribution designated by biogeographical province: 1 = Boreal-Celtic Province, 2 = French-Iberian Province, 3 = Mediterranean-Moroccan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

Gofas & Oliver, 2010 [herein described as *C. brunettii* nov. sp.], *C. turritellata* (Deshayes, 1835) [herein referred to as *C. affinis*], *C. pliorobusta* Brunetti, Della Bella & Cresti, 2017, *C. chirlii* Brunetti, Della Bella & Cresti, 2017, *C. plioetrusca* Brunetti, Della Bella & Cresti, 2017, and *C. sossoi* Brunetti, Della Bella & Cresti, 2017. Three of these extend their range to the Late Pliocene (Piacenzian): *C. errata* [= *C. affinis* forma *arenaria*], *C. maroccana* [= *C. brunettii* nov. sp.], and *C. turritellata* [= *C. affinis*]. In the same work the following species were recorded in the Italian Pleistocene: *C. giunchiorum* Micali, 1999, *C. lineolata* (Tiberi, 1868) [herein determined as *C. recondita* (Brugnone, 1873)], *C. mamillata* (Risso, 1826), and *C. turritellata* [= *C. affinis*]. The Early Pleistocene specimen from Italy ascribed to *C. lineolata* (Tiberi, 1868) by Brunetti *et al*., (2017, p. 14, figs 2C-D) is not that species but *C. recondita*. *Chauvetia lineolata* is almost double maximum size (about 11.5 mm vs. 5.5 mm; *fide* Micali, 1999), with a broader shell profile, more numerous axial ribs (17 vs. 15), greater number of cords on the penultimate whorl (6 vs. 4).

That is a total of six species in the Pliocene and four in the Pleistocene. Although chauvetiids are small, this paucity of fossil species is likely to be a true reflection

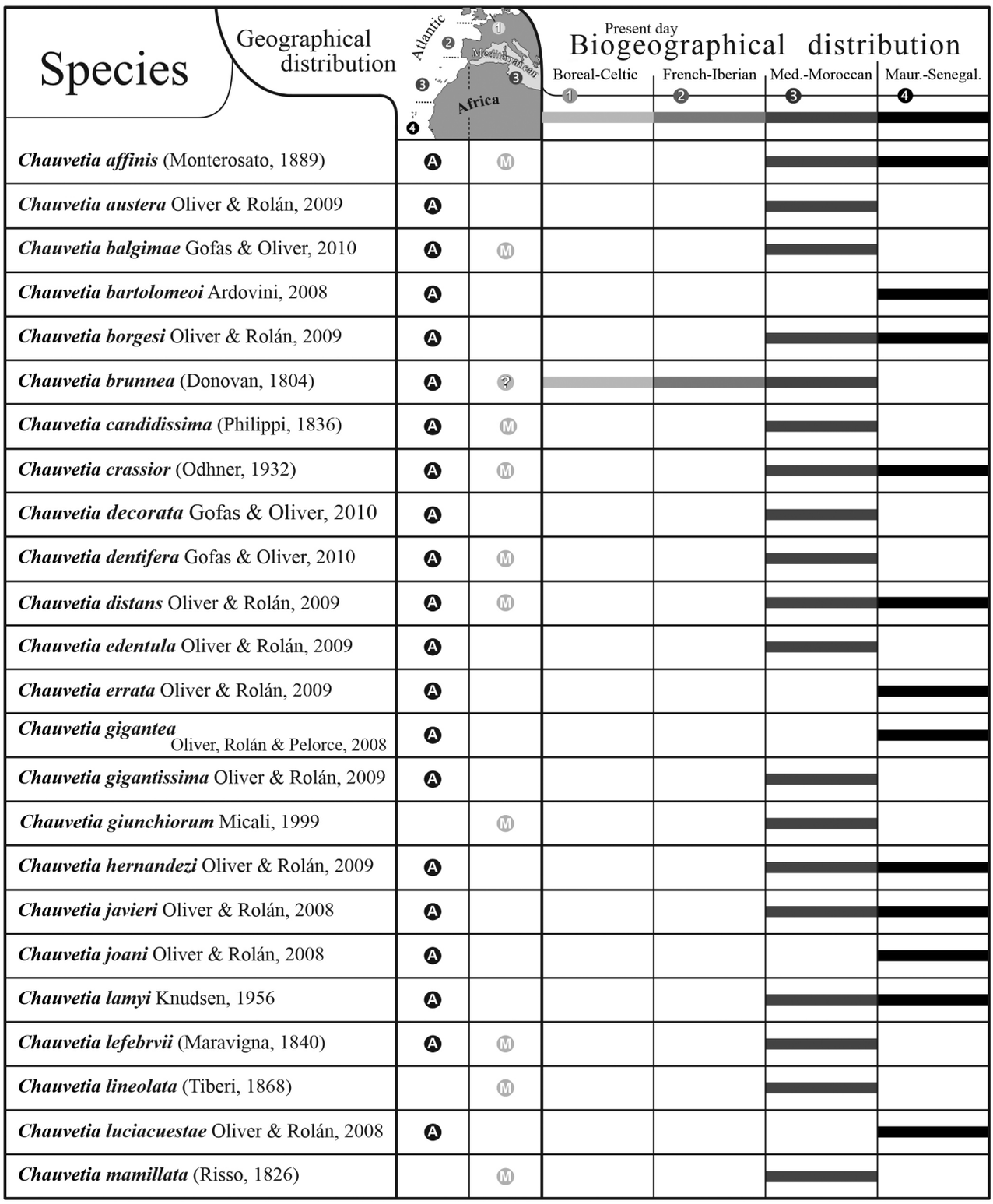
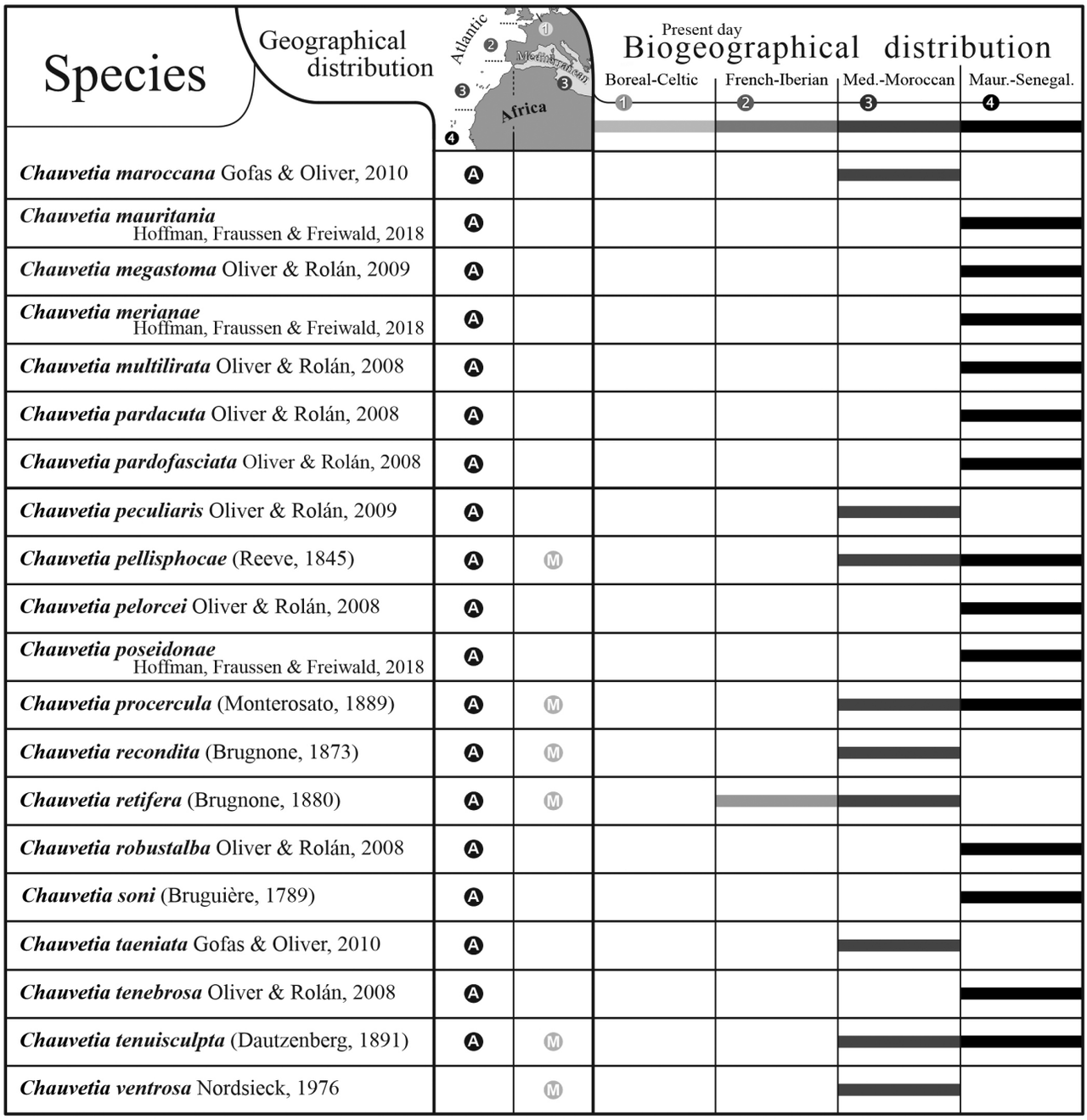


Figure 2. Extant species of *Chauvetia* and their biogeographic distribution (from Micali, 1999; Ardovini, 2008; Oliver & Rolán, 2008, 2009; Gofas & Oliver, 2010; Hoffman *et al*., 2018).

of Plio-Pleistocene Mediterranean diversity considering the amount of research done in the central Mediterranean area. It suggests not only a low species richness compared to the present-day Mediterranean, but also that they were not abundant, judging from the small number of specimens recorded by Brunetti *et al*. (2017) for each species, with the exceptions of *C. errata* and *C. affinis*. We note that the number of specimens recorded here is an underestimate of the abundance, especially at the Velerín conglomerates, from where we have a couple of hundred



specimens too worn to be certain of their identification. A further observation is that all the Pliocene Italian species are small, less than 5.0 mm in height, whereas the Estepona endemic species are relatively large, surpassing double that size. There seems to have been a strong Plio/Pleistocene turnover of species, with only three species surviving in the Mediterranean today (*C. affinis*, *C. mamillata*, *C. procercula*), one found along the Atlantic southern Iberian coast from Gibraltar to Morocco (*C. decorata*), and only one species found today further south along the coasts of Senegal (*C. luciacuestae*).

The Estepona chauvetiid assemblage is far more diverse with twenty species recorded, of which eleven are described as new. Only three species are found in common with the Pliocene Mediterranean *C. affinis*, *C. brunettii* nov. sp., and *C. plioetrusca* Brunetti, Della Bella & Cresti, 2017. This diversity suggests that the drop in species richness seen today between the western and central Mediterranean was already in place during the palaeobiogeographic unit MPPMU1, and, if anything, even more marked than it is today.

This could be explained if *Chauvetia* only arrived in Europe towards the end of the Miocene, and during the Early Pliocene was still a relatively recent arrival in the Old World. One would expect maximum species diversity close to the area of arrival from the Caribbean to the Old World; *i.e*, close to the Atlantic. *Chauvetia* species all reproduce by direct development. Therefore, its slow post-Late Miocene colonisation of the Mediterranean from the

West, its rapid turnover of species, and high endemicity are all features of this type of development.
Lastly, we note that in contrast with the Italian Pliocene, most of the Estepona species are larger than 6.0 mm in height, with a few species greater than 10 mm, large for a *Chauvetia*. Quite a few of the West African species reach this large size, whereas only a few of the extant Mediterranean species do. Having said this, the Estepona assemblage shares very few species with the present-day West African fauna, although it is possible that some of these Estepona species will be found living along the West African coasts as that fauna becomes better known.

Acknowledgements

Our thanks to Carlos Marques da Silva of the University of Lisbon, Portugal, for his advice and help with graphics. Thanks also to Leon Hoffman, of the Taxonomy Mollusca, Marine Research Department, Senckenberg Forschungsinstitut Sektion Malakologie for his review. Although not acknowledged in every one of our papers published in Cainozoic Research, our deep thanks to the managing editor Han Raven and the production editor Ronald Pouwer, both of the Naturalis Biodiversity Center, Leiden. They both dedicate a huge amount of time and work to each and every issue.

References

Ardovini, R. 2008, Description of a new species belonging to Genus *Chauvetia* Monterosato, 1884, (Gastropoda: Buccinidae), from West Africa (Senegal). *Malacologia Mostra Mondiale* 60: 3-5.

Bellardi, L. 1877. I molluschi dei terreni terziarii del Piemonte e della Liguria. Parte II (Pleurotomidae). Stamperia Reale, Torino, 364 pp., 9 pl.

Berkenhout, J. 1795. *Synopsis of the natural history of Great-Britain and Ireland. Ed. 3, vol. 2*. T. Cadell, London. 466 pp.

Brugnone, G.A. 1873. *Miscellanea malachologica*. Pars prima. Palermo, Michele Amenta: 15 pp. + 1 pl.

Brugnone, G.A. 1880. Le conchiglie plioceniche delle vicinanze di Caltanisetta. *Bullettino della Società Malacologica Italiana* 6: 85-158, 1 pl.

Brunetti, M.M. & Cresti, M. 2018. *I fossili di Orciano Pisano* [The fossils of Orciano Pisano]. Atlante iconografico [An Iconographic Atlas]: 1-232. Edizioni Danaus, Palermo.

Brunetti, M.M., Della Bella, G. & Cresti, M. 2017. La familia Buccinidae Rafinesque, 1815, nel Plio-Pleistocene del Bacino mediterráneo: i genere *Chauvetia* Monterosato, 1884, *Buccinum* Linnaeus, 1758, *Neptunea* Röding, 1798 (Gastropoda) con descrizione di cinque nuove specie. *Bollettino Malacologico* 53: 9-29.

Bucquoy, E., Dautzenberg, P. & Dollfus, G. 1882-1886. *Les mollusques marins du Roussillon*. Vol. 1 Gastropodes. Paris: Baillière & fils. 570 pp., 66 pls. [pp. 1-84, pls 1-10, 1882; pp. 85-196, pls 11-20, 1883; pp. 197-342, pls 21-40, 1884; pp. 343-418, pls 41-50, 1885; pp. 419-570, pls 51-66, 1886].

Casey, T.L. 1904. Notes on the Pleurotomidae with description of some new genera and species. *Transactions of the Academy of Science of St. Louis* 14: 123-170.

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

Chirli, C. 2000. *Malacofauna Pliocenica Toscana, 2 Superfamiglia Muricoidea*. Firenze (C. Chirli): 143 pp

Chirli, C. & Linse, U. 2011. *The Pleistocene marine Gastropods of Rhodes Island (Greece).* Grafiche PDB, Tavarnelle V.P. Firenze: 262 pp, 90 pls.

Cohen, K.M., Finney, S.C., Gibbard, P.L. & Fan, J.-X. 2023 (2013; updated). The ICS International Chronostratigraphic Chart. *Episodes* 36: 199-204.

Crosse, H. 1868. Les méléagrinicoles. Espèces nouvelles, par L. de Folin (1) [Review]. *Journal de Conchyliologie* 16: 217-219.

Crosse, H. 1885. Nomenclatura generica e specifica di alcune Conchiglie Mediterranee, pel marchese di (Nomenclature générique et spécifique de quelques Coquilles méditerranéennes, par le marquis de) Monterosato. *Journal de Conchyliologie* 33(2): 139-142.

Daudin, F.M. 1803. *Histoire Naturelle, Générale et Particulière des Reptiles*. Vol. 8. F. Dufart, Paris: 439 pp.

Dautzenberg, P. 1891. Voyage de la goëlette Melita aux Canaries et au Sénégal, 1889-1890: Mollusques Testacés. *Mémoires de la Société Zoologique de France* 4: 16-65, pl. 3.

Dautzenberg, P. 1910. Contribution à la faune malacologique de l'Afrique occidentale. *Actes de la Société Linnéenne de Bordeaux* 64: 47-228, pls 1-4 [reprints paginated 1-174].

Deshayes, G.P. 1835. Mollusques. pp. 81-203, iii, pls. 18-28, 1 text fig. In: J.-B.-G.-M. Bory de Saint-Vincent (ed.), *Expédition scientifique de Morée. Section des sciences physiques. Tome III (1.re Partie). Zoologie*. Paris, F.G. Levrault.

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 for 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].

Forli, M., Dell'Angelo, B. & Taviani, M. 1999. Molluschi del Pliocene inferiore toscano: la sezione Montenero (Grosseto). *Bollettino Malacologico* 34: 109-122.

Giannuzzi-Savelli, R., Pusateri, F., Palmeri, A. & Ebreo, C. 2003. *Atlante delle conchiglie marine del Mediterraneo, vol. 4 (Neogastropoda: Muricoidea).* Evolver, Roma: 298 pp.

Gofas, S. & Oliver, J.D. 2010. Las especies del género *Chauvetia* (Gastropoda, Neogastropoda, Buccinidae) del área ibero-marroquí, con descripción de cuatro especies nuevas. *Iberus* 28: 23-60.

Graham, A. 1988, *Molluscs: Prosobranch and pyramidellid gastropods. Synopses of the British Fauna* (new series). *In*; Kermack, D.M., and 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.

Harmer, F.W. 1914-1925. The Pliocene Mollusca of Great Britain, being supplementary to S.V. Wood's monograph of the Crag Mollusca, 1. *Monographs of the Palaeontographical Society*, 1(1): 1-200 (1914); 1(2): 201-302 (1915), 1(3): 303-461 (1918), 1(4): 463-483 (1919), 2(1): 485-652 (1920), 2(2): 653-704 (1921), 2(3): 705-856 (1923), 2(4): 857-900 (1925).

Hernández, J.M., Rolán, E. & Swinnen, F. 2011. Parte 3: Gastropoda: Prosobranchia. *In*: *Moluscos y conchas marinas de Canarias* (E. Rolán, ed.), pp. 54-269. ConchBooks, Hackenheim. 716 pp., 130 pls.

Hoffman, L., Fraussen, K. & Freiwald, A. 2018. The genus *Chauvetia* (Gastropoda, Buccinoidea) in deep-water coral habitats on the continental slope of Mauritania. *Miscellanea Malacologica* 7(6): 127-138.

Iredale, T. 1918. Molluscan nomenclatural problems and solutions.- No. 1. *Proceedings of the Malacological Society of London* 13(1-2): 28-40.

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

Kantor, Y.I., Fedosov, A.E., Kosyan, A.R., Puillandre, N., Sorokin, P.A., Kano, Y., Clark, R. N. & Bouchet, P. 2022 [nomenclatural availability: 2021]. Molecular phylogeny and revised classification of the Buccinoidea (Neogastropoda). *Zoological Journal of the Linnean Society* 194: 789-857.

Knudsen, J. 1956. Marine prosobranchs of Tropical West Africa. *Atlantide Report* 4: 7-110.

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

Landau, B., Silva C.M. da & Vermeij G.J. 2015. First record of buccinid genus *Chauvetia* (Mollusca: Gastropoda) from the fossil record of the New World (Miocene, Venezuela) and its paleobiogeographic implications. *Journal of Paleontology* 89(3): 487-493.

Leach, W.E. 1813-1815. Crustaceology. In: Brewster, D. (ed.), *The Edinburgh Encyclopaedia*. Balfour, Edinburgh, vol. 7(1): 383-384 [1813], 7(2): 385-437, 765-766 [1814], 9(1): pl. CCXXI [1815].

Maravigna, C. 1840. Description de plusieurs coquilles nouvelles. *Revue Zoologique de la Société Cuvierienne* 1840: 325-326.

Micali, P. 1999. Note sulle specie di *Chauvetia* dell'Atlantico nord-orientale. *Bollettino Malacologico* 34(5-8): 53-68.

MolluscaBase eds. 2023. MolluscaBase. *Lachesis helenae* E. A. Smith, 1890. Accessed through: World Register of Marine Species at: https://www.marinespecies.org/aphia.php?p=taxdetails&id=716287 on 2023-07-23.

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 fresh-water, including the most minute: Systematically arranged and embellished with figures*. J. White, London, Vol. 1, xxxvii + 291 pp; Vol. 2, pp. 293-606, pl. 1-16.

Monterosato, T.A. di 1874. Recherches conchyliologiques, effectuées au Cap Santo Vito, en Sicile. *Journal de Conchyliologie* 22(3): 243-282.

Monterosato, T.A. di 1884. *Nomenclatura generica e specifica di alcune conchiglie mediterranee*. Virzi, printed for the author, Palermo: 152 pp.

Monterosato, T.A. di 1889. Coquilles marines marocaines. *Journal de Conchyliologie* 37(1): 20-40 [2 May 1889]; 37(2): 112-121 [20 September 1889].

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

Nordsieck, F. 1976. Famiglia Buccinidae. Il genere *Chauvetia* Monterosato, 1884 nei mari d'Europa. *La Conchiglia* 89-90: 3-7.

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

Odhner, N.H. 1932. Beitrage zur Malakozoologie der Kanarischen Inseln. Lamellibranchien, Cephalopoden, Gastropoden. *Arkiv för Zoologi* 23A (14): 1-116, pls 1-2.

Oliver, J.D. & Rolán, E. 2008. Las especies del género *Chauvetia* (Gastropoda, Neogastropoda) del área de Dakar, Senegal, África occidental, con la descripción de diez especies nuevas. *Iberus* 26: 133-175.

Oliver, J.D. & Rolán, E. 2009. Las especies de *Chauvetia* Monterosato, 1884 (Mollusca, Neogastropoda) de Canarias y el área oeste africana de Mauritania y Sahara. *Iberus* 27: 113-154.

Pallary, P. 1902. Liste des mollusques testacés de la baie de Tanger. *Journal de Conchyliologie* 50: 1-39, pl. 1.

Philippi, R.A. 1836. *Enumeratio molluscorum Siciliae cum viventium tum in tellure tertiaria fossilium quae in itinere suo observavit*. Sumptibus Simonis Schroppii et Sociorum. Berolini [Berlin]: Vol. 1. xiv + 267 p., pls. 1-12.

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.

Raffi, S., Stanley, S. & Marasti, R. 1985. Biogeographic patterns and Plio-Pleistocene extinction of Bivalvia in the Mediterranean and southern North Sea: *Paleobiology* 11: 368-388.

Rafinesque, C.S. 1815. *Analyse de la nature ou tableau de l'univers et des corps organisés.* Palermo (Rafinesque): 223 pp.

Risso, A. 1826. *Histoire naturelle des principales productions de l'Europe Méridionale et particulièrement de celles des environs de Nice et des Alpes Maritimes. Vol. 4 Mollusques. Annélides*. Paris, F.G. Levrault: iv+439 pp., 12 pls.

Roe, L., Hart, M.B., Taylor, G.K & Marks, A. 1999. The St. Erth Formation: History of the Clay workings, geological setting and stratigraphy. *Geoscience in south-west England* 9: 304-309.

Rolán Mosquera, E. 1983. Moluscos de la ria de Vigo 1. Gasteropodes. *Thalassas* 1(1) Anexo 1: 1-383 [also published as book].

Ruggieri, G. & Buccheri, G. 1969. Una Malacofauna tirreniana dell'isola di Ustica (Sicilia). *Geologica Romana* 7: 27-58.

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.

Silva, C.M. da 2001. *Gastrópodes pliocénicos marinhos de Portugal: sistemática, paleoecologia, paleobiologia, paleogeografia*. Dissertação de doutoramento. Faculdade de Ciências da Universidade de Lisboa, 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: 1052-1066.

Smith, E.A. 1890. Report on the marine molluscan fauna of the island of St. Helena: *Proceedings of the Zoological Society of London* 1890: 247-317.

Tiberi, N. 1868. Des testacés de la Méditerranée qui doivent ètre compris dans les genres *Lachesis* et *Nesaea* de Risso. *Journal de Conchyliologie* 16: 68-81, pl. 5.

Turton, W. 1802. *A General System of Nature, through the three grand Kingdoms of Animals, Vegetables, and Minerals; systematically divided into their several classes, orders, genera, species, and varieties, with their habitations, manners, economy, structure, and peculiarities. Translated from Gmelin's last edition of the celebrated Systema Natura, by Sir Charles Linné : Amended and enlarged by the improvements and discoveries of later naturalists and societies, with appropriate copper-pla*. Lackington and co. 4 vol.

Van Dingenen, F., Ceulemans, L., Landau, B.M. & Silva, C.M. da 2015. The family Nassariidae (Gastropoda: Buccinoidea) from the late Neogene of northwestern France. *Cainozoic Research* 15: 75-122.